REPORT OF THE

ROBUST REDHORSE CONSERVATION COMMITTEE ANNUAL MEETING

Webb Wildlife Management Area
Garnett, South Carolina
September 7 – 9, 2010

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U.S. Fish & Wildlife Service

TABLE OF CONTENTS

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

EXECUTIVE SUMMARY

The robust redhorse recovery effort, in its 16th 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 sixteenth annual meeting of the RRCC was held September 7 – 9, 2010 at Webb Wildlife Management Area, South 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, Progress Energy (formerly Carolina Power and Light Company), Duke Power Company, South Carolina Electric and Gas Company, U.S. Fish and Wildlife Service, U.S. Geological Survey (Biological Resources Division), 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 2010 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 and in a short upper Coastal Plain section of the Ocmulgee River. 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's Falls Dam in North Carolina. Robust redhorse populations have also been reintroduced within their historic range into the Broad and Ocmulgee 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 – Forrest Sessions

Forrest Sessions opened the 2010 Annual Meeting by welcoming the participants to the Webb Center. Forrest gave a brief history of the Webb Center.

Memorandum of Understanding Renewal – Ross Self

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. Because of the organizational structure of the signatories, it was important that revisions and/or updates to the MOU were discussed at the 2009 RRCC meeting. Ross has received some comments from signatory representatives since that meeting. At this time, any additional changes will be made and re-sent to the representatives. Once Ross receives signed copies, he will forward them to Ryan Heise, incoming RRCC Chair.

Installation of Incoming RRCC Chairperson – Forrest Sessions

Ryan Heise was installed as the new RRCC Chairperson. He indicated to the members that he was very excited to be the new chair and was thankful for all of our dedication over the years to the robust redhorse recovery effort.

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

Georgia 2010 Update

The following research is being conducted on stocked populations in Georgia, 1.) population demographics and reproduction and recruitment success in the stocked population in the Ocmulgee River (GA Coop Unit), 2.) movement, habitat use, spawning success, population demographics, recruitment in the stocked population in the Broad River, GA (UGA Institute of Ecology), 3.) movement, habitat use, spawning success, population demographics, recruitment in the stocked population in Ogeechee River (beginning fall 2010) (GA Coop Unit). One research project is currently being conducted on wild populations in Georgia: Movement and habitat use in the Oconee River population (GA Coop unit). In summary, funded research is being conducted on all the stocked populations and one wild population in Georgia. Currently, this leaves only the Savannah population with no funded studies.

Oconee River Status Survey 2010 – Jimmy Evans

The Oconee River robust redhorse population was sampled on 05/03/10 – 05/04/10. Five sampling reaches were distributed in the area between Sinclair Dam tailrace to the end of a long meander section about nine miles above the Country Club ramp in Dublin. This protocol differed from standardized robust redhorse sampling conducted in recent years that did not include the sampling exclusion zone from Sinclair Dam to the Central of GA railroad trestle. Sampling was organized by the GADNR and conducted by the GADNR (assisted by the Fish and Wildlife Service), Georgia Power Company, and the Georgia Coop Unit. A total of 10.5 hrs of sampling effort was expended and no robust redhorse were collected (one observed). It should be noted that lower releases (600 cfs) at Sinclair Dam were requested to provide suitable sampling conditions downriver, however rain immediately prior to sampling resulted in higher flows and turbidities. These conditions probably reduced sampling efficiency and contributed to the poor results. Robust redhorse have been collected under similar conditions in the past, however, suggesting that abundance in spring 2010 was probably low in this reach and similar to levels found in the same sampled areas in the last several years.

Ogeechee River Recruitment Monitoring 2010 – Jimmy Evans

Spring recruitment monitoring was not conducted on the Ogeechee by the GADNR in 2010, as was done in 2009. This was due to staff reductions and work on the new Go-Fish-Georgia Center that required curtailment of all but the most critical field activities. In July 2010, GADNR Region 7 staff made 5 – 6 seine hauls at each of two locations on the upper Ogeechee to search for robust redhorse young-of-the-year and juveniles. This was one component of a larger sampling effort to monitor American shad and striped bass recruitment that focused on the lower river. No robust redhorse were collected. Fall standardized sportfish sampling on the Ogeechee is scheduled for later this month by the

GADNR Demeries Creek office. Sampling will be conducted at fixed stations from the lower river to the Louisville area. Last year 15 robust redhorse were collected in fall sampling on the Ogeechee and similar results may be expected this year. Also, funded recruitment monitoring studies on Ogeechee conducted by the GA Coop Unit are scheduled to begin this fall and continue into 2011. Four robust redhorse were collected in June 2010 from the Ogeechee in the Louisville area in about one hour of targeted sampling in an attempt to provide fish for the Go-Fish-Georgia display. Catch rates were similar to those from the area in previous years and provide additional evidence that adult robust redhorse can be collected with relatively little effort from the Ogeechee. These fish were all mature and showed typical post-spawning injuries. Unfortunately, all fish died within three weeks after transport to the Go-Fish-Georgia Center. These specimens are currently in the freezer at our Fort Valley office. In summary, significant sampling effort is scheduled for the Ogeechee in fall 2010 and 2011 that may hopefully provide some of the answers to questions on spawning site selection as well as reproduction and recruitment success. To date, a total of 138 stocked robust redhorse have been collected from the Ogeechee, but as yet there is no substantive evidence of successful recruitment. Results of recruitment monitoring efforts on the Broad and Ocmulgee rivers are presented in separate presentations by Carrie Straight of the UGA institute of Ecology and Will Pruitt of the Georgia Coop Unit, respectively.

Ocmulgee River Recruitment Monitoring – Joey Slaughter

The robust redhorse conservation activities pursuant to the Candidate Conservation Agreement with Assurances (CCAA) between Georgia Power Company (GPC) and the U.S. Fish and Wildlife Service (FWS) in 2010 are included in Will Pruitt's summary (see RESEARCH UPDATES section).

Plant Washington Environmental Review – Jimmy Evans

Since the last annual RRCC meeting in September 2009, the Georgia EPD issued the required water withdrawal and NPDES discharge permits for Plant Washington, a proposed 850-megawatt coal fired power plant located in Sandersville, Washington County, GA. These permits contained some, but not all, of the issuing conditions recommended by the Fisheries Management Section of the GAWRD after an extensive environmental review process. The issuance of these permit constituted a major step toward final permitting for the facility which proposes to withdraw 13.5 MGD from the Oconee River near the Avant Mine site, the only known robust redhorse spawning site in the Oconee River. As anticipated, environmental groups challenged the permits and the petitioners were the Altamaha River keeper, Fall-Line Alliance for a Clean Environment, and the Georgia Chapter of the Sierra Club. Greenlaw and the Southern Environmental Law Center represented the groups. An administrative law judge of the Office of State Administrative Hearings heard the case. The Petitioners set forth six grounds on which they contended the permits should be invalidated. Four were denied and two granted. The two counts that were granted concerned: 1.) the permit condition that required

pollutants in the discharge to be monitored and regulated at the plant site rather than at the discharge point and, 2.) the contention that GAEPD had failed to follow proper procedures for permitting interbasin water transfer. The robust redhorse was not an issue in any of the six counts presented by the petitioners. The GAEPD will revise the permits as needed to address the points raised and a new press release and public notice will be issued, followed by a meeting in Sandersville. Public comments will be addressed in an official response and the permits will be reissued. The new permits could be contested as well and the ultimate outcome of future legal battles is unclear.

Applications for a new hydropower project at New Savannah River Bluff Lock and Dam – Jimmy Evans

There are two recent applicants for preliminary permits to install hydropower facilities at the New Savannah River Bluff Lock and Dam at Augusta, GA. Since one of the three known wild robust redhorse populations is found both above and below this dam, the species would obviously become an issue in any future permitting for this facility.

Update on the new Go-Fish-Georgia Center – Jimmy Evans

The Go-Fish-Georgia Educational Center in Perry, GA is the centerpiece of larger statewide economic development and tourism project for Georgia. The primary goal is to improve and promote fishing and boating tourism as a means of enhancing economic development. The vision for the Go-Fish-Georgia project is to create a world-class fishery statewide that will attract all levels of anglers. The two major components are the Georgia Bass Trail and the Go-Fish-Georgia Educational Center.

The Go-Fish-Georgia Center is 45,000 sq ft facility built on the Georgia National Fairgrounds in Perry, GA. The Center will include an educational facility, fish and wildlife exhibits, state-of-the-art theaters, nature trails, fishing ponds, and a fish hatchery. The fish and wildlife exhibits will feature both interactive and live elements that depict natural habitats found in and around Georgia's waterways.

The centerpiece of the exhibits will be a series of aquaria totaling 180,000 gallons and featuring several of Georgia's important aquatic ecosystems, including piedmont, coastal plain blackwater, and mountain stream systems. Current full time staff at the Center includes a head aquarist, hatchery manager, technician, interpretive specialist, and AOC. Plans include a staff of up to 12 people when the facility is fully operational.

Aquarium exhibits will include a robust redhorse display requiring three separate size classes. Required size classes are ten 3 – 6 inch fingerlings for a 20- 30 gal "jewel" tank, ten 6-8 inch juveniles for a 1,000 gal display tank (with some other species), and up to 12 adults to be included with other species in a larger Piedmont river display. Six of the smaller fish will be picked up from the South Carolina Aquarium in Charleston after the meeting and transported to the Center in Perry, GA. Adults for the display will be

collected from the Ogeechee later in the fall when water temperatures are cooler. The robust redhorse displays are accompanied by interpretive panels that describe the discovery of the species and some of the natural history in much the same language as seen at the display at the Georgia Aquarium. Robust redhorse are now found in exhibits at the Georgia, South Carolina, and Tennessee Aquariums as well as at the Go-Fish-Georgia Center and all of these facilities will require small juveniles for their exhibits in the future. Since smaller size classes are not collected from the wild, a potential problem exists with supplying smaller fish when all hatchery programs are terminated in fall 2010. Adult robust redhorse for aquarium displays can more easily be collected from stocked rivers, primarily the Ogeechee River in Georgia.

Oconee River Gravel Augmentation – Jimmy Evans

The objective of Phase II of the Oconee River gravel augmentation project was to improve habitat quality and provide suitable spawning areas for robust redhorse at four existing sites that had previously provided only marginal habitat. The Southeast Aquatic Resources Partnership (SARP) provided funding for the project; personnel from the GADNR Fort Valley Fisheries Management office conducted planning, coordination, and implementation. During the period June 23, 2009 - March 24, 2010, approximately 1,019 tons of gravel (mixture of three sizes) was placed in the Oconee River channel at four previously selected locations in Washington, Wilkinson, Johnson, and Laurens counties. Gravel was trucked from a stockpile site located 1.5 miles north of Oconee, GA to access points at Balls Ferry ramp, Beaverdam WMA ramp, and the Johnson County Landing. A pontoon barge was launched at each of the access points and loaded with gravel using a 40 ft. portable conveyor. The barge then traveled to the deposition sites located 0.2 to 2.5 miles from the access points where gravel was washed off the barge and onto augmentation sites using a high-pressure water pump. Gravel was placed in areas with depths and velocities documented from previous observations to provide optimal robust redhorse spawning habitat.

The estimated combined total of 1,019 tons of gravel deposited at the four augmentation sites covered approximately 107,800 sq. ft. (2.47 ac). Preliminary post-project field observations and photo documentation indicate that suitable robust redhorse spawning habitat was created at all four augmentation sites, with quality varying from fair to excellent. Gravel has persisted and maintained suitable characteristics through at least the spring of 2010. Additional monitoring will be conducted at lower lows during early fall 2010.

South Carolina 2010 Update – Scott Lamprecht

South Carolina Santee Basin Robust Redhorse (RRH) restoration efforts continued with the fall 2009 stocking of 9,000 phase I fingerlings evenly divided between the two restoration sites on the Broad River (SC) and the Wateree River. This brought the total number of unique parental crossings, used to produce the stocked progeny, to 95. A total

50,500 phase I fingerlings have been stocked in the two Broad River sites. The Wateree River site has received 12,601 phase I fingerlings, 2,400 phase II juveniles (age 1+), and 400 phase III juveniles (age 2+). The Santee River Basin stocking history is presented in Table 1. All fish stocked have been tagged with either coded wire (CW) or pit tags (P).

Table 1. RRH Stocking History in South Carolina

Year (Fall)	**River**	**Locations**	**Fingerlings**	**Phase 2**	**Phase 3**
2004	Broad	Sandy River	9,540 (CW)	-	-
	Broad	Below Parr Dam	9,380 (CW)	-	-
	Wateree	Below Wateree Dam	-	-	-
2005	Broad	Sandy River	9,000 (CW)	-	-
	Broad	Below Parr Dam	9,000 (CW)	-	-
	Wateree	Below Wateree Dam	5,107 (CW)	1,010 (CW) 1,000 (P)	-
2006	Broad	Sandy River	332 (CW)	-	-
	Broad	Below Parr Dam	400 (CW)	-	-
	Wateree	Below Wateree Dam	196 (P)	400 (CW,P)	400 (P)
2007	Broad	Sandy River	3000 (CW)	-	-
	Broad	Below Parr Dam	3000 (CW)	-	-
	Wateree	Below Wateree Dam	3800 (CW)	-	-
2008	Broad	Sandy River	444 (CW)	-	-
	Broad	Below Parr Dam	441 (CW)	-	-
	Wateree	Below Wateree Dam	498 (CW)	-	-
2009	Broad	Sandy River	3000 (CW)	-	-
	Broad	Below Parr Dam	3000 (CW)	-	-
	Wateree	Below Wateree Dam	3000 (CW)	-	-

Our 7th annual spawning collection trip to the Savannah River gravel bar, located below Augusta at RK 173.3 (~14.5 Km below Augusta Shoals Lock and Dam), took place on May 13th. Twenty five adults were collected; six females and 19 males. Seventeen parental crosses were made. Seven of the fish had been previously tagged, with two males having been initially tagged in 2004. These two males were previously recaptured at this site during one of our annual one day spawning efforts. Approximately 25,000 fry were stocked out in production ponds that will be harvested in November 2010. Provided survival to harvest is adequate, a total of 112 unique parental crosses will have been used to stock fingerlings out in the Santee Drainage restoration sites.

Table 2. Savannah River RRH Spring Spawning Summary.

Year	Eggs Produced	Males Spawned	Females Spawned
2004	35,000	16	6
2005	35,000	16	6
2006	25,000	16	7
2007	20,000	15	7
2008	40,000	18	6
2009	25,000	9	3
2010	30,000	15	6

Tracking of two mature sonic transmittered RRH, collected immediately below Wateree Dam during the spring of 2009, showed an intriguing pattern of seasonal movement. Both transmittered fish departed the Wateree Dam tailwaters in early June and moved down the Wateree River to its confluence with the Congaree River and ascended the Congaree to the fall line area in the City of Columbia. One fish summered in the lower Saluda River and the other in the vicinity of Rosewood landing (Congaree R.), just below the confluence of the Saluda and the Broad Rivers. This is significant because the cold water release from Lake Murray, about 10 km upstream of Saluda River's confluence with the Broad River, influences summer temperatures of the Saluda River and to a lesser degree, the Congaree River. The two transmittered RRH moved downstream in late September and early October and over wintered in the lower portions of the Wateree River (located in the Coastal Plain). Both returned to the Wateree Dam tailrace in 2010; March 26 and April 15th. Following spawning season both departed the Wateree River and again ascended the Congaree River within weeks of each other; May 26th and June 6th. There is no indication that these fish utilized any portion of Lake Marion, located just downstream of the Congaree and Wateree River confluence.

While some mature RRH were utilizing the Wateree Dam Tailrace in a manner that would suggest spawning behavior, 13 individuals were observed moving upstream through the Columbia Fishway into the Broad River. Tuberculation was visible on several individuals and several were of a mature size. Rough expansion of the observations made during the Klienschmidt sampling schedule yields an estimate of 92 individuals passed during the fish ladder operation.

Table 3. Broad River RRH Recapture Summary, 2010.

LENGTH	RADIO ID	SONIC ID	PIT TAG	Year Class
473	R48.051		470D744942	2005
514	R48.O11		47065C6918	2004
500	R48.151		470E061B1F	2005
503	R48.111		470B385452	2004
513		47409	4708054974	2004
474			470E131E52	2005
394			4709257631	2006
508			470801764E	2004
519			4707783843	2004
464			4821317800	2005
526			470638641D	2004
493			4708183115	2004
512			4709055128	2004
413			470D73743F	2006
517			470D681017	2005

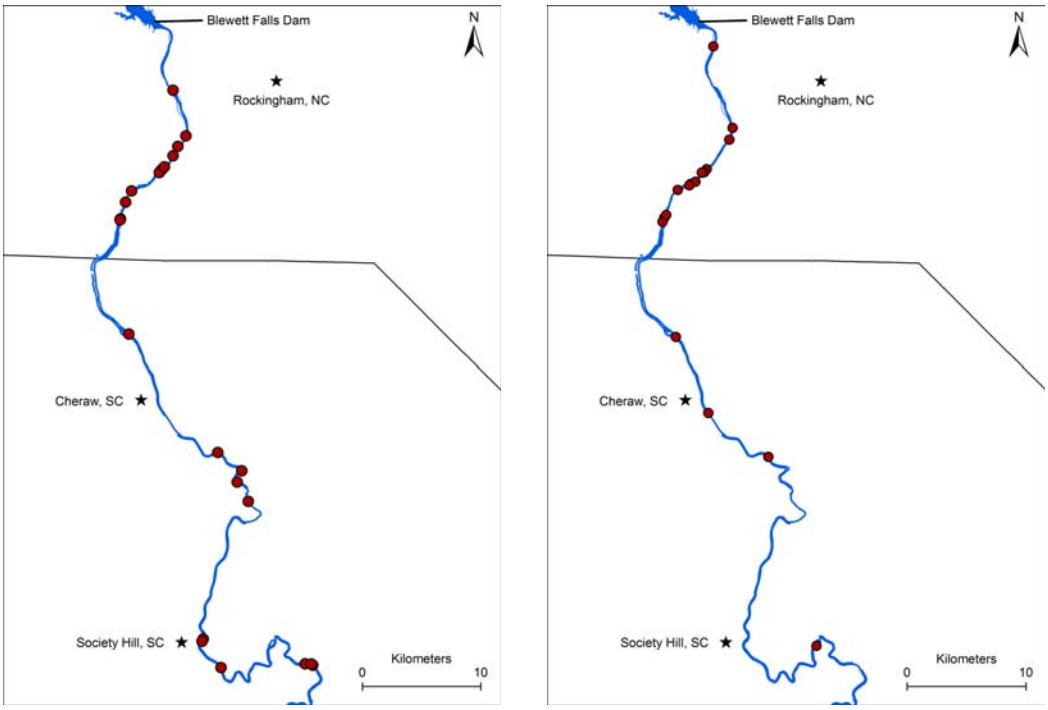
North Carolina 2010 Update – Ryan Heise

NC Wildlife Resources Commission (WRC) personnel conducted limited electrofishing surveys near Blewett Falls dam (Big Island to Hwy 74) to determine if the higher than normal rainfall this winter and spring may have caused robust redhorse to spawn further

upstream. The TWG will resume population monitoring (electrofishing surveys) in 4 to 5 years after the minimum flows from Blewett Falls dam have been in place and robust redhorse populations have had an opportunity to respond to the improved conditions in the Pee Dee River.

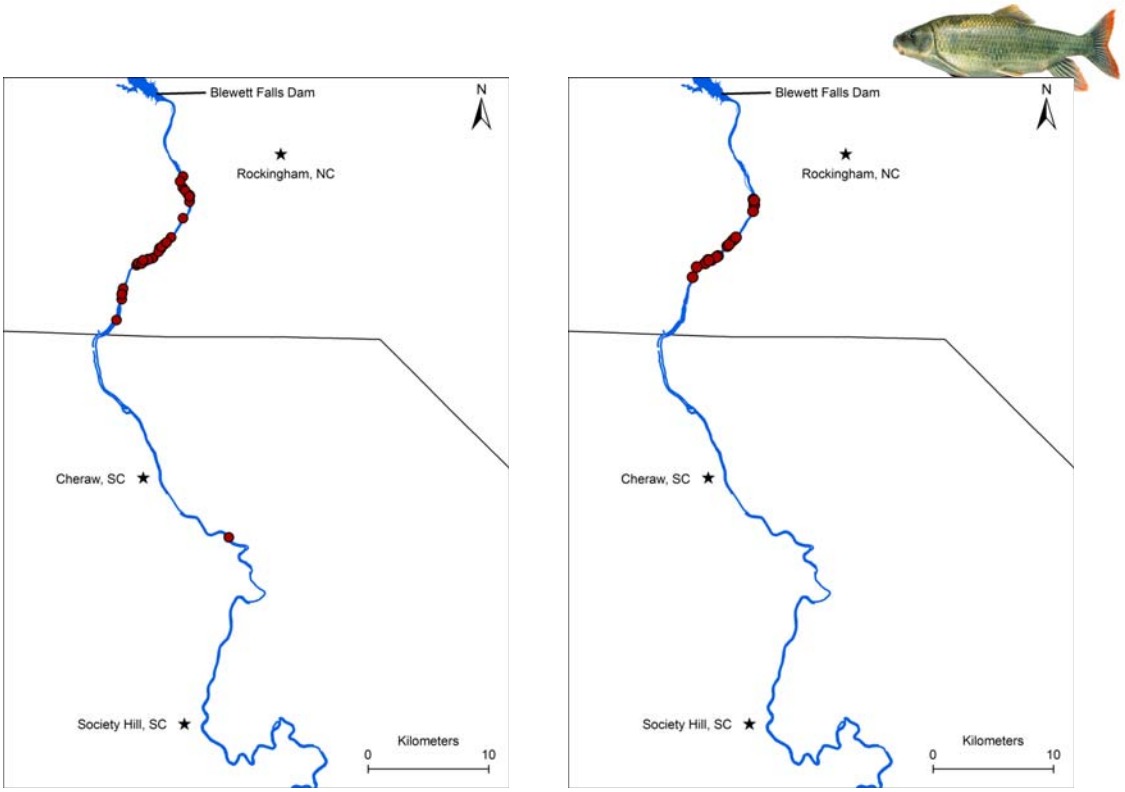
Robust redhorse were radio-tracked by South Carolina Department of Natural Resources (SCDNR) on March 24, 25 and April 2, 8, 16, 23. North Carolina WRC and/or Progress Energy radio-tracked on April 9, 15, 16, 22, 27, 28, May 5, and July 6. In South Carolina, five individuals were relocated from Great Island (upstream of Cheraw) to near Tom Blue landing (downstream from Society Hill; Figures 1 and 2). Four of these individuals migrated upstream to the Jones Creek shoal and the fifth migrated upstream to the Hitchcock Creek shoal (near the RR trestle). Twenty-two radio tagged robust redhorse were relocated in North Carolina (Figures 1 and 2). The majority of the relocations occurred in or near Jones Creek and Hitchcock Creek shoals. One individual migrated from the Hitchcock Creek shoal upstream to Walls landing (near Blewett Falls dam), then downstream to Jones Creek shoal, and then back upstream to Hitchcock Creek shoal. Our radio telemetry data indicated that spawning robust redhorse continue to utilize these two shoals each spring. The higher flows this winter and spring did not shift the spawning locations of the radio-tagged robust redhorse.

Progress Energy and the NC WRC electrofished from Blewett Falls Dam downstream to Hwy 74 on April 8 and May 4 for a total effort of 6.15 hours of pedal time. No robust redhorse were captured. May 2005 is the only occasion when robust redhorse were collected in the side channel at Big Island (just downstream from Blewett Falls dam).



Late-March and early-April Mid-April

Figure 1. Maps showing the spring 2010 robust redhorse telemetry locations.



Late-April May

Figure 2. Map showing the spring 2010 robust redhorse telemetry locations.

Wateree River Collections – Dave Coughlin

Since first introduced into the Wateree River, SC, in 2005, collections of robust redhorse have steadily increased each spring. Electrofishing efforts for diadromous fish below the Wateree Dam each spring have noted increasing numbers and sizes of robust redhorse. The maximum size of robust redhorse, the number of fish, and the number of sexually mature fish have increased each spring. The collections indicate that the SCDNR's relocation effort has been initially very successfully. While triads of mature adults have been collected during spring in the Wateree River, at this time, no wild juveniles have been collected.

RESEARCH UPDATES

A Summary and Preliminary Evaluation of Stocking as a Recovery Strategy for the Imperiled Robust Redhorse – Jimmy Evans and Forrest Sessions

The robust redhorse was described from the Yadkin R., NC in 1869 and later disappeared from the scientific record until individuals were discovered in the Savannah and Pee Dee rivers in the 1980s and a population was found in the Oconee R., GA in 1991. Adults feed on mollusks and can reach weights to 19 lbs. Clean gravel is preferred spawning habitat and major threats are sedimentation, dams and impoundments, and introduced predators. The historic range is the Altamaha Basin, GA to the Pee Dee, NC/SC. In 1991 the only known population was in the Oconee R. in the Altamaha Basin of Georgia. Populations were later discovered in the Savannah R., GA/SC and in the Pee Dee R., NC/SC. These populations are managed as distinct Evolutionary Significant Units.

Range-wide concerns include limited geographic range, small populations, and low recruitment rates. The Robust Redhorse Conservation Committee (RRCC) serves as the primary recovery vehicle and short-term goals are to establish refugial populations, locate other wild populations, determine population status, and maintain existing populations. The long-term goal is to establish or maintain six self-sustaining populations.

Sampling in the Oconee in the early 1990s indicated limited recruitment and a demographic decline within 10–15 years were considered possible. Population estimate and catch rate trends have since shown declines. Stocking efforts in Georgia began in 1992 and ended in 2008. Rationales were limited recruitment in the Oconee and the need to conserve the gene pool, and to augment the population if declines occurred. Broodfish were collected from the Oconee and fingerlings reared on hatcheries in Georgia and South Carolina. A range of sizes was stocked and all received coded wire tags. Larger fish were also PIT tagged. The stocking program in South Carolina began in 2004 and will end in 2010. Rationales included discovery of the species in the Savannah R., GA/SC and the RRCC goal of establishing six populations. Broodfish are collected from the Savannah using electric grids and fingerlings are reared on state hatcheries. Hatchery production in Georgia and South Carolina has met all major stocking objectives.

Results of the hatchery program include the establishment of stocked populations in the Ocmulgee, Ogeechee, and Broad rivers in Georgia and the Broad and Wateree rivers in South Carolina. Most suitable rivers in both states have been stocked, significant populations are found in all stocked rivers, and the target number of crosses has been produced. Monitoring indicates mature fish now exist in all stocked rivers, spawning has been observed in three rivers, and tentative evidence exists of recruitment in two rivers.

In summary, in 1991 there was one known population with limited recruitment. At present, three wild populations have been discovered and five stocked populations established. Progress toward recovery has been made using a cooperative stakeholder process, without the need for a federal listing, and the effort may be on target to reach the

RRCC's goal of six self-sustaining populations. Major tasks remaining are to improve the status of the Oconee population and conclusively document recruitment in stocked rivers.

Seasonal Movements of Robust Redhorse in Oconee River, GA – Patrick Ely

We used radio telemetry to assess seasonal habitat use and movement patterns of adult robust redhorse stocked in the Oconee River downstream of Milledgeville, GA. Thirty three hatchery-produced robust redhorse from Oconee River broodstock were captured in the Ogeechee River, transported to the Oconee River, anesthetized, implanted with radio transmitters, and released. Within two weeks of release, 79% of robust redhorse traveled upstream of the release site; some even traveling ~40 km upstream near the historic Avant mine spawning site. After spawning season, the tagged fish generally moved downstream to varying degrees. Movement was limited to about 9 km during the summer (July – August 2008-09) and winter (December – February 2008-10) periods. During fall 2008 (Sept – Nov), fish movement increased to ~52 km and movement was generally in a downstream directions with some intermittent upstream movements. This was probably a delayed exploratory response related to an increase in water level and a decrease in water temperature following summer drought conditions. In contrast, during fall 2009 (Sept – Nov), movement was only about 15 km. In late-October 2009, three fish were tracked over a 24-hr period and relocated at 2-hr intervals. Movement averaged 0.15 km (± 0.07 SE) at night and 0.44 km (± 0.19 SE) during the day but without obvious directionality.

In the winter of 2008-09, following a minor flooding event, an individual who had been last located the previous fall went undetected in the Oconee River. Tracking for this individual was extended downstream the entire length of the Altamaha River without success. During the pre-spawning period of 2009, tracking continued into the Ocmulgee River where the fish was relocated on 05 March 2009 approximately 65 km upstream of the confluence. That individual later re-entered the Oconee River and was detected on 25 March 2009 just south of Dublin, GA, an approximate absolute distance of 143 km from its previous location.

During the 2009 & 2010 spring/pre-spawn period (March – April), 100% of the fish migrated upstream toward the Avant mine area. In mid-April 2009 during this migration, four fish were tracked over a 24-hour period and relocated at 2-hr intervals. Movement averaged 1.34 km (± 0.65 SE) at night and 6.07 km (± 1.95 SE) during the day in an upstream direction. During the 2009 & 2010 spawning periods, robust redhorse were located near the Avant mine site, but none were located on the historic gravel bar. However, in 2009, an aggregate of tagged fish was located about 1.4 km upstream of the Avant mine site at an oxbow "cut through" that contained gravel substrates. Within a 0.2 km radius of the "cut through", seven individuals (50% of remaining tagged fish) were located at least once, and three were located multiple times. During the 2010 spawning season, none of the remaining tagged fish were relocated in the "cut through" area, and gravel substrates were not detected at the site. During the 2009 spawning season, another aggregate of tagged fish was located in a 1-km stretch of river containing gravel

substrates. This section of river was located ~2 km downstream of the Avant mine site. Six different individuals (43% of remaining tagged fish) were located here at least once and three were located multiple times. During the 2010 spawning season, two individuals (67% of remaining tagged fish) were located in this same stretch of river and gravel substrates were still present.

Robust redhorse were consistently found in the main channel associated with fast current (0.47 m/s ± 0.01 SE), relatively deep water (2.26 m ± 0.04 SE), sandy substrates, and woody debris. Annual linear home range estimates for robust redhorse averaged 43.2 km and ranged from 26.6 km to 77.0 km. Annual kernel density core area home range estimates averaged 9.5 km (range: 2.3 km – 28.6 km) and indicated that a majority of our radio-tagged robust redhorse primarily occupied the ~ 25 km section of river between the Avant mine site and the Oconee trestle throughout the year.

Reproductive Ecology and Habitat Relations of the Robust Redhorse – Michael Fisk

The robust redhorse, *Moxostoma robustum* is a potamodromous, imperiled riverine species rediscovered in the Pee Dee River of North Carolina and South Carolina. Due to anthropogenic processes, including habitat fragmentation and alteration from dams, the robust redhorse persists as a small remnant population in the Pee Dee River. Blewett Falls Hydro-facility, the terminating hydroelectric dam on the Pee Dee River is implementing a new minimum flow regime to create more stable habitats during critical periods for aquatic organisms including diadromous and resident fishes. The objectives of this study were to describe robust redhorse habitat suitability, quantify suitable habitat before and after the implementation of a new minimum flow regime, describe how robust redhorse use this habitat and assess egg and larval survival associated with flow augmentation.

Adult robust redhorse were implanted with radio-transmitters and relocated fish from February 2008 to July 2009. Robust redhorse were found in moderate to deep waters associated with bedrock or sandy substrates with coarse woody debris or boulders for cover. Deviations in microhabitat use came when robust redhorse moved into shoal habitats during the spawning period. Spawning habitat consisted of shallow waters with moderate to high velocities and gravel substrates. Except for spawning and post-spawning migrations, robust redhorse were generally sedentary making only localized movements. After spawning, a group of telemetered fish migrated downstream into the Coastal Plain, while other fish stayed in close proximity to spawning grounds, identifying two behavioral subgroups. Habitat suitability indices were developed based on field microhabitat measurements and applied to model weighted usable area (suitable habitat quantity) for proposed minimum flows. Weighted usable area increased for each seasonal minimum flow for both spawning and non-spawning periods.

A laboratory experiment was conducted to understand the effects of redd dewatering on robust redhorse eggs and larvae. Eggs and larvae were subjected to different dewatering treatments, mimicking different hydropeaking regimes. Eggs were able to withstand

some degree of dewatering, but once larvae hatched and were free-swimming and dependent on gills for respiration, dewatering was fatal.

The results will contribute to understanding the ecology of a rare, imperiled fish and help conserve and manage this elusive species in regulated rivers. Hydroelectric facilities can use this data to manage discharge more effectively and create and maintain important aquatic habitats (shoals) during critical time periods for species of concern.

Current Robust Redhorse Research Georgia Coop Unit – Will Pruitt

A multi-stakeholder Candidate Conservation Agreement with Assurances (CCAA) was implemented in 2002 to establish a refugial population of robust redhorse within the upper reaches of the Ocmulgee River, GA. As part of the conservation actions outlined in the CCAA, captive reared robust redhorse of Oconee brood stock have been released the project site between Lloyd Shoals Dam (LSD) and a low head mill dam in Juliette, GA (JMD). These stocked robust redhorse must be monitored to determine the current status of the Ocmulgee population. Previous studies on the Ocmulgee River population revealed detection probability is very low (0.031; Grabowski et al 2009) and robust redhorse may occupy different habitats in the upper reaches of the Ocmulgee seasonally than their Oconee River counterparts. Often robust redhorse sampling efforts target spawning aggregations in spring at the expense of other habitats in other seasons. The current study samples robust redhorse in all habitat types between LSD and JMD during the Spring, Summer and Fall months to determine seasonal habitat use. To account for imperfect detection, our current study employs hierarchical occupancy models to estimate site occupancy, seasonal habitat use and estimate abundance of the Ocmulgee River population. Using this new approach, we hope to more accurately predict the current population status of stocked robust redhorse within the project site.

Broad River, Georgia Research Update 2010 – Bud Freeman and Carrie Straight

Between 1995 and 1998 over 39,000 Phase I fingerlings were stocked in various locations throughout the Broad River system. Since robust redhorse were stocked in the Broad River system of Georgia, monitoring of stocked populations has been limited. In 2009, we obtained funding through a State Wildlife Grant to document robust redhorse movements within the Broad River and Clark's Hill Reservoir, assess the population structure, document spawning, and assess potential of recruitment in this stocked population.

Movements within the Broad River system. On 19 March 2010, we collected and implanted sonic transmitters into six robust redhorse captured at Anthony Shoals in the Broad River system of Georgia. Two individuals were identified as females, four were identified as males. All of the fish were from the 1997 year class (13 years old) and ranged from 452-515 mm SL and weighed between 2442-3434g.

To track migratory movements within the Broad River system we placed passive receivers at road crossings or access points to detect tagged fish moving in the vicinity of the receivers. Each receiver was checked 1-4 times a month from 19 March until mid-June. One receiver was also placed at a spawning locality to document tagged fish using the area during the spawning season.

All six tagged fish moved upstream from the vicinity of the surgery location by early May and were in the vicinity of known spawning localities from 20 April - 23 May. The spawning localities were approximately 81-88 river km upstream from the surgery site. During upstream migratory movements, robust redhorse were detected passing receivers at night as well as during the day.

Post spawning movements of robust redhorse began 21 - 26 May. Travel downstream of the spawning sites also occurred at all hours of the night / day. Due to lower water levels, detections of downstream movements in the lower Broad River system was sporadic. We currently have three passive receivers located within the reservoir, downstream of the surgery location. One additional receiver will be placed within the reservoir in mid-September 2010 (Figure 3). The passive receivers are attached to existing channel or warning buoys that have been installed and are maintained by the U.S. Army Corps of Engineers. These receivers will detect fish passing within range of the receivers and indicate which areas of the reservoir over-wintering fish might be using. As of 1 September 2010, three of the six fish were located within the reservoir (Figure 4).

Figure 3. Locations of three passive receivers placed within Clark's Hill Reservoir on 20 August 2010 and one additional receiver (S 144) placed in mid-September 2010.

Figure 4. Detection locations of three fish located in Clark's Hill Reservoir between 4 August and 30 August 2010.

Spawning Documentation. In 2007, our group found evidence of three spawning aggregations of robust redhorse in the Broad River system. In 2008, we re-visited two of these three locations and documented spawning at both localities. Poor conditions prevented documentation in 2009.

In spring of 2010, we visited known past spawning localities and one additional possible location for potential spawning fish starting in mid-April. We first detected fish at a known spawning locality on 9 May 2010. Of four sites monitored this season, robust redhorse used three for spawning in the spring of 2010. Two sites (Sites 2 and 3) were sites previously used for spawning by robust redhorse and one site (Site 1) was not known to be used until this season. Within each site there were multiple spawning groups that had little interaction with other groups at the site during times when observations were made.

Table 4. Summary of robust redhorse spawning site information for spring 2010.

	Spawning groups (minimum #)*	Peak spawning date	Max # individuals present **	Spawning temperature range (C)
Site 1	2	5/16	31+	16.5-21.5
Site 2	2	5/13-5/14	26+	~20
Site 3	4	5/14	29+	16-22

* Spawning groups refer to distinct groups of holding males and corresponding females that appeared to have little, if any, mixing during times when we made observations.
** This number represents the maximum number of individuals counted, and represents a minimum number of individuals present.

The spawning period lasted approximately 14 days at Site 3 and had at least two tagged fish (one male and one female) present during part of that spawning period.

Acoustics. During the spawning season, a two-day period of rain and increased flow/turbidity prevented direct observation of spawning individuals. Additionally, fish spawning areas with higher water depths (≥ 1 m) prevented direct observations. We used an acoustic system to "listen" to spawning activities of robust redhorse to verify activity in poor visibility situations. A hydrophone was connected to an amplifier and into an mp3 recorder to document spawning sounds and frequency of spawning events. The sound caused by gravel movement of spawning robust redhorse (frequency (kHz) / duration (s)) is distinctive relative to ambient stream sounds (Figure 5). This method has potential use in other areas where conditions prevent direct observation of spawning individuals at potential spawning sites without disruption of spawning events.

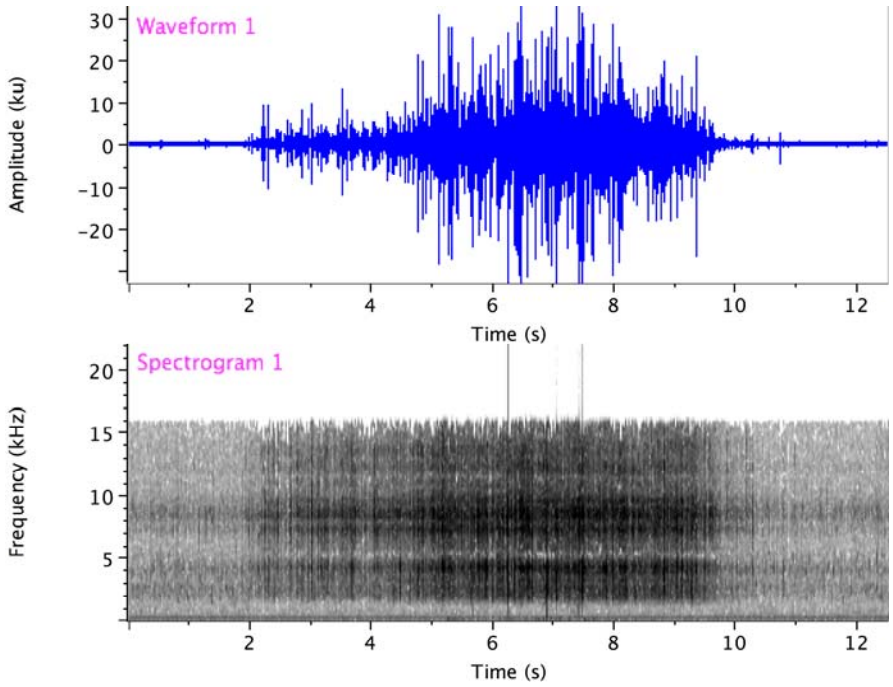


Figure 5. Oscillogram (waveform) and spectrogram of a robust redhorse spawning event at Site 2. The oscillogram begins with ambient stream sounds. The spawning event starts at 2 seconds and ends just before 10 seconds after which is ambient stream sounds. This spawning event corresponded with a visual observation of a trio of fish and a visible sediment plume documenting the disturbance of gravel.

Recruitment. We began sampling for young-of-year robust redhorse in fall of 2009. Twenty-one randomly selected locations were chosen for young-of-year sampling. Within each locality "patches" were defined by areas with similar flows, depth, and substrate. All available habitat types within a randomly selected location were sampled. Each patch was collected with a method that is most appropriate to the flow, depth, and bottom substrate. Within each patch, we collected five depth measurements, classified the bottom substrate and flow. We sampled a total of 157 patches within the 21 localities.

Methodologies used for sampling for young-of-year suckers corresponding to general habitat types.

Habitat patch type	Typical sampling procedures
No flow, sand/sediment bottom	Seine hauls (either upstream or downstream)
No-little flow; boulder/bedrock, gravel bottom	Seining, dipnetting along with backpack electrofishing
Little-high flow; sand/sediment bottom	Seining along with backpack electrofishing
Little-high flow; boulder/bedrock, gravel bottom	Kick-seining with backpack electrofishing
Areas with large woody materials, root masses (obstructing objects in the water column)	Backpack electrofishing / dipnetting

In total, 22 *Minytrema melanops*, 14 *Moxostoma* sp. (brassy jumprocks), 9 *Moxostoma collapsum* were collected. However, no M. robustum were collected during this sampling. Once a subset of localities are resampled in 2010, we will use patch occupancy modeling to attempt to estimate a probability of detection for the three species listed above (and *M. robustum*, if they are collected) and each species' associated flow, depth, and substrates.

TECHNICAL WORKING GROUP REPORTS

Oconee River Technical Working Group – Alice Lawrence

During the last year, the Oconee Technical Working Group re-analyzed Georgia DNR electrofishing data to finalize two figures in the Management Plan for the Oconee River Robust Redhorse Population. These two figures in the Plan depict 1) electrofishing catch rates by year for robust redhorse in the Oconee River between the mouth of Black Creek and Dublin, Georgia since 1994 and 2) mark-recapture population estimates for robust redhorse in the Oconee River between the mouth of Black Creek and Dublin, Georgia from 1995 to 2004. After much discussion, the Oconee TWG feels that these figures most accurately convey the trends in the data. Reanalyzing these data addresses two management objectives and specific sub-tasks listed in the Management Plan. Relevant sub-tasks fall under the management objectives to 1) continue and refine the standardized electrofishing program and 2) develop a consistent population estimate methodology.

The final draft of the Oconee River robust redhorse management plan was completed in August 2010 and sent to RRCC members. A few minor revisions were suggested by reviewers and the final plan should be available for posting on the RRCC website soon.

Yadkin-Pee Dee Technical Work Group Activities – Ryan Heise

The short-term goals of the Yadkin-Pee Dee technical working group (TWG) are to consistently collect robust redhorse in the Pee Dee River and to determine its distribution and life history requirements so that informed conservation decisions can be made. The 2010 objectives of the Yadkin-Pee Dee technical working group (TWG) were to search for new spawning shoals by tracking radio-tagged robust redhorse in March, April, and May. These individuals were radio-tagged in 2009 as part of a Wildlife Resources Commission and Progress Energy funded graduate research project at North Carolina State University (NCSU). Data for the collections and electro-fishing efforts can be found in the North Carolina update section in Management Activities.

Internet Technology Technical Working Group – Jaci Zelko

The status of the annual reports, website, and database was relayed to the meeting participants. 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 writing and submitting an abstract has greatly streamlined the annual report process. As of this meeting she has completed the 2003, 2004, 2005 reports and is drafting the 2009 report. These documents need to be uploaded to the RRCC as well as many other pictures and documents. Jaci will work with Ryan to get this accomplished by the next annual meeting.

Habitat Technical Working Group

The Habitat TWG did not give a report to the Committee during the 2010 Annual Meeting.

B U S I N E S S

Research Topics and Resource Needs

A general discussion was held concerning research needs. The following list includes these topics.

- A larval source may be needed in the future for the following projects:
    - Determining bottlenecks in certain populations
    - Fish cage experiments concerning inter-sex fish
    - Larval research concerning Plant Washington
    - Fingerlings to replenish Aquarium stocks
    - Preserved series for Georgia and North Carolina Museums.
- Genetic markers for other species in South Carolina.
- Evaluate upper Pee Dee River for additional spawning sites.
- Savannah River sampling to determine population size.
- Stocking of other sites in Georgia.

Questions and Answers Concerning the 404 Species Petition

The Center for Biological Diversity filed a scientific petition with the U.S. Fish and Wildlife Service to list 404 Southeast aquatic, riparian, and wetland species as threatened or endangered under the Endangered Species Act in April 2010. Robust redhorse is included in their petition. Several of the RRCC members have been in contact with staff from the Center but have been unable to convince them to take robust redhorse off their list. After much discussion, it was decided that the RRCC would not take any action at this time. However, the members agreed that they would sends letter to the Center to urge them to take the robust redhorse off their petition list. They also agreed that the RRCC could send letters to Directors/Managers of each signatory to the Committee as a show of support.

A T T A C H M E N T S

Attendees of the 2010 Meeting:

Abney, Michael
Bowles, Tom
Brosius, Cory
Coughlan, Dave
Dodd, Tony
Ely, Patrick
Evans, Jimmy
Farnau, Nathan
Fisk, Michael
Freeman, Bud
Heise, Ryan
Kwak, Rom
Lamprecht, Scott
Lawrence, Alice
Moyer, Greg
Osier, Liz
Peterson, Rebecca
Pruitt, Will
Quattro, Lynn
Raley, Morgan
Self, Ross
Sessions, Forrest
Slaughter, Joey
Starnes, Wayne
Straight, Carrie
Wilkins, David
Zelko, Jaclyn