REPORT OF THE

ROBUST REDHORSE CONSERVATION COMMITTEE ANNUAL MEETING

Charlie Elliott Wildlife Center
Mansfield, Georgia
October 1 – 3, 2013

Oconee River, Georgia
Credit: Georgia DNR

Report compiled by
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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

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

The robust redhorse recovery effort, in its 19th 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 nineteenth annual meeting of the RRCC was held October 1 – 3, 2013 at Charlie Elliott Wildlife Center in Mansfield, Georgia. Approximately 24 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, 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, and Roanoke College Department of Biology. 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 2013 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. It is important to note that due to a Federal government shutdown in October 2013, federal employees did not attend this meeting.

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

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

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

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

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

Introductions – Jimmy Evans
Jimmy Evans gave the opening remarks in lieu of Alice Lawrence, Chair of the RRCC. Alice and all other federal employees were not in attendance this year because of the federal government shutdown that was occurring in October 2013. All participants were asked to introduce themselves and their agency.

Welcome – John Biagi
John mentioned that the GDNR might move RRCC work from Fisheries to non-game conservation in GDNR in the future (once Jimmy retires).

Charlie Elliott Wildlife Center – Rusty Garrison
Discussed the history of Charlie Elliot, things to do in the afternoon. Head count of folks doing the skeet shooting in the afternoon.

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

Georgia 2013 Update – Jimmy Evans

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). Final report completed
- Use of hierarchical occupancy models in the Ocmulgee River, GA (Will Pruitt). Thesis to be completed in December
- Population status and assessment of reproduction and recruitment of robust redhorse in the Broad River system (Carrie Straight and Bud Freeman). Final report completed

Ongoing research

- Oconee River population status assessment (Oconee TWG)
- Ogeechee River population status assessment (Joel Fleming)
- 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 (Catherine Reuter, Jimmy Evans)

Environmental reviews

- Continued negotiations with Eastern Hydro on construction of Denil fish ladder at Juliette Dam on Ocmulgee
- Received $10,000 in DOT mitigation funds for study to monitor Oconee River gravel augmentation sites
- Negotiations with Savannah COE over Savannah River reservoir drought operations
- New Savannah River Bluff L&D fishway design plan
- Service review of Plant Washington nationwide 404 permit application

Public relations

- Live fish displays at Georgia Aquarium and Go-Fish-Georgia Center
- New state park under construction at Balls Ferry on Oconee will increase awareness of recovery efforts
- Georgia Outdoors TV program preparing video on robust redhorse recovery effort

The search continued in 2013 for wild and/or stocked robust redhorse populations above Sinclair Dam (Little River, Murder Creek) and above Wallace Dam (Apalachee and Oconee rivers) (Figure 1). This effort began in 2012 when the following areas were sampled: 1.) Little River from Lake Sinclair to Hwy 129, 2.) Murder Creek from Lake Sinclair upriver 1.5 miles to an impassable shoal, and 3.) the Oconee River from Hwy 15 to Barnett Shoals. A single adult female robust redhorse in peak spawning condition was

collected in 2012 from the Little River just below Hwy 129. In 2013 the Murder Creek site was deleted due to the adequate sample collected in 2012. Sampling continued at the Little River and Oconee River sites and a sample was also collected from the Apalachee River immediately above Lake Oconee. In addition, annual standardized sampling was conducted in 2013 to monitor the status of the wild Oconee River population below Sinclair Dam. A total of 17.9 hours of electrofishing effort was expended at all sites combined in 2013, and no robust redhorse were collected or observed (Table 1).

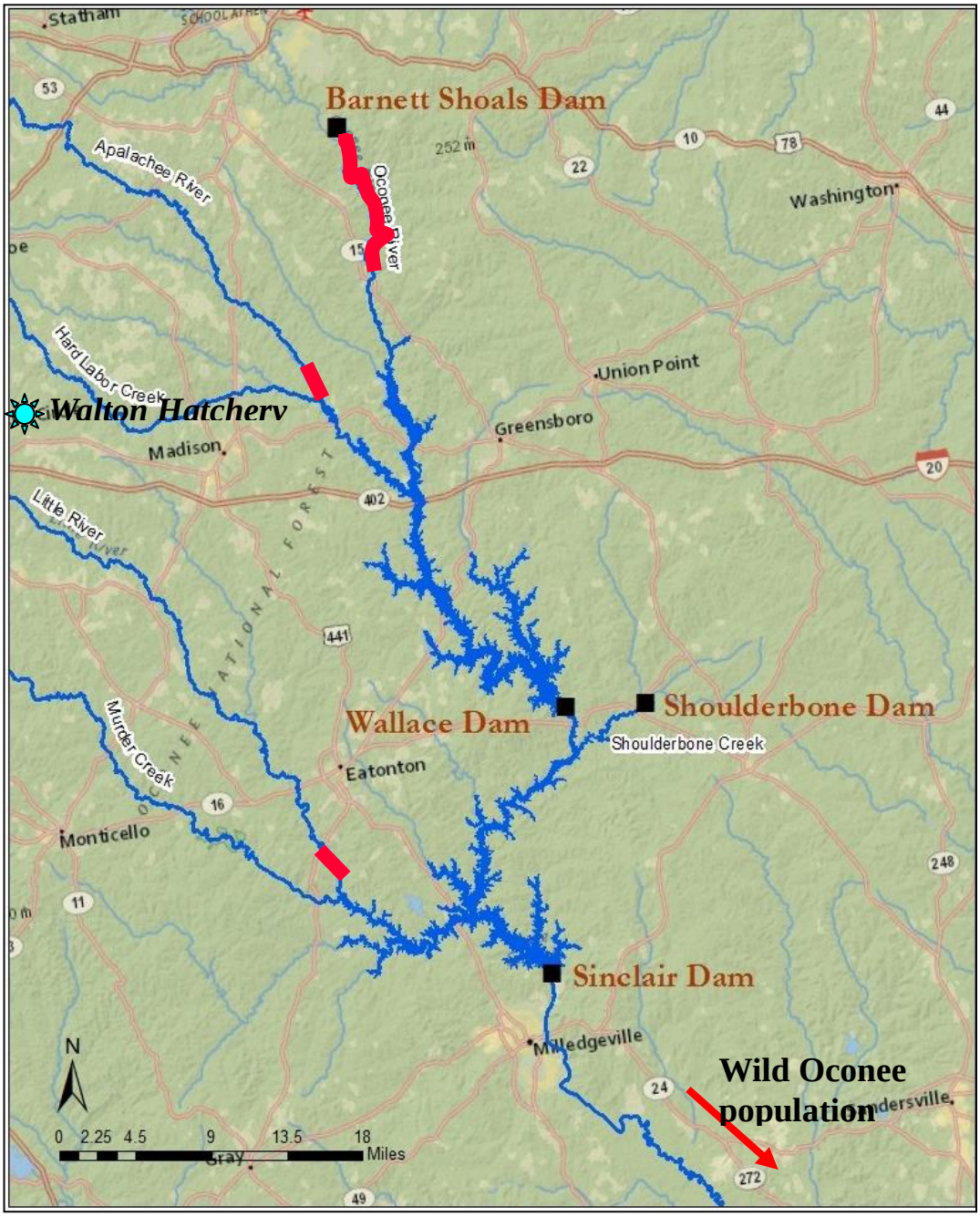


Figure 1. Upper Oconee River sampling locations in 2013. Individual sites are indicated in red.

Table 1. Results of upper Oconee River sampling in 2013.

Location	Date	Sampling Conditions	Water Temp (C)	Objective	EF effort (hrs.)	Results
Oconee R. (RR trestle to Dublin)	05/04/2013	Fair/good	23.2	Population Monitoring	3.3	No RRH Observed
Oconee R. (RR trestle to Dublin)	O6/05/2013	Fair/poor	24.7	Population Monitoring	1.6	No RRH Observed
Oconee R. (RR trestle to Dublin)	06/18/2013	Fair	26.5	Population Monitoring	3.0	No RRH Observed
Oconee R. (Barnett Shoals to above Hwy 15)	04/16/2013	Good	17.3	Survey for Remnant Population	4.1	No RRH Observed
Apalachee R. (L. Oconee up 1.5 mi)	05/22/2013	Fair	Na	Survey for Remnant Population	2.3	No RRH Observed
Little R. (L. Sinclair to Hwy 129)	04/24/2013	Good	15.7	Population Status Survey	2.2	No RRH Observed
Little R. (L. Sinclair to Hwy 129)	05/16/2013	Good	18.7	Population Status Survey	1.4	No RRH Observed
Totals					17.9	

Following is a summary of robust redhorse recovery activities in Georgia planned for 2014.

<u>Oconee River population status assessment (Oconee TWG)</u>

- Intensive sampling effort to assess status of the Oconee River population from Sinclair Dam to Dublin (60 – 80 hrs. total effort). (Wayne Clark, Jimmy Evans)

- Continuing visual, electrofishing, and hydro-acoustic monitoring of Oconee River gravel augmentation sites and Avant Mine spawning site. (Catherine Reuter, Jimmy Evans)

Ogeechee River population status assessment (Joel Fleming)

- Continue electrofishing standardized sampling program, with possible addition of sites in the Louisville area

Recruitment monitoring at Broad River spawning sites

- Assess size structure at spawning aggregation sites in the upper river and at Anthony Shoals staging area to determine if new recruits are entering the population (Jimmy Evans, Carrie Straight, Alice Lawrence)
- Investigate possibility of utilizing genetic methods to document recruitment success (Jimmy Evans, Alice Lawrence, Carrie Straight)

Search for wild and/or stocked populations above Sinclair Dam (Little River, Wallace tailrace) and above Wallace Dam (Apalachee and Oconee rivers)

- Search for spawning sites on the Little and Apalachee rivers (Jimmy Evans, Alice Lawrence); sample lower Apalachee (Chris Nelson)
- Electrofishing in Wallace Dam tailrace (Joey Slaughter)

Provide information to U. S. Fish and Wildlife Service for species assessment and listing priority assignment form

- North Carolina Wildlife Resources Commission, South Carolina DNR, Oconee TWG, Georgia DNR- Georgia Wildlife Resources Division Fisheries and Non-game Sections

South Carolina 2013 Update – Scott Lamprecht

SCDNR personnel traveled to the Savannah River and spawned fish on May 13, 2013. The Columbia Dam on the Broad River (SC) over-topped at times this spring. This year's turbidity prevented good fishway visibility, however by May 6th approximately 60 robust redhorse were observed in the fishway during normal observations. The final number of 64 individuals moved through the fishway this spring during monitoring (this passage allows movement into area downstream of Parr Dam on the Broad).

Some robust redhorse (and other species) were captured for consumption using Vietnamese cast netting downstream of the Columbia Dam and fish passage on April 9th. Robust redhorse are not protected in any way in South Carolina. However, it is illegal to kill/possess robust redhorse in NC and GA.

Sonic tags were used to track fish within the Broad River, piggy-backing onto a sturgeon project (both groups using the same array of receivers to tack tagged fish). Transmitted fish visited Wateree Dam tailrace in the spring. This includes the suspected spawning area that is relatively short area on river right downstream of the dam, which is followed by about 1.5 mile of rocky shoals. The peak of fish moving into tailrace for spawning

season was April 15th to May 5th. All 12 of the actively tracked fish used the Congaree River in the summer/ winter, all the fish visited the Wateree tailrace in the spring, 7 of 12 moved up near mouth of Broad / Saluda in the mixing area of the cold water coming out of the lower Saluda. Two went up the Broad River and 2 went up into the lower Saluda (this reach is cold-water released from Lake Murray). Three fish were using the area in the Santee River (near the mouth of the Congeree and Wateree), but there has been no evidence of the transmitted fish entering the reservoir (Lake Marion is shallow and warm during the summer). During warmer months fish seem to be using area influenced by cold-water releases from Lake Murray.

Future work will involve habitat mapping in area between Parr and Columbia on the Broad River to assess other areas that might be used for spawning.

North Carolina 2013 Update – Ryan Heise

In 2013, the Yadkin Pee Dee Technical Working Group resumed spring boat electrofishing on the Pee Dee River. The goals of this effort are to resume the population monitoring and to collect brood fish for the hatchery program. In addition, we are assessing the population size structure to see if additional recruitment has occurred since the change in minimum flows from Blewett Falls Dam. The spawning and larval emergence period for Robust Redhorse in the Pee Dee River is late-April through mid-May. Beginning in 2009, Duke Energy/Progress has provided a minimum flow of 1,200 cfs at Blewett Falls Dam from April 15 through May 15. Starting April 15, 2011, a minimum flow of 1,200 cfs was maintained all year and beginning in 2012 a springtime minimum flow (February 1 – May 30) of 2,400 cfs was provided. This means that the flows do not drop below these thresholds, but water levels can be much higher during power generation and flood events. The minimum flow ensures that the spawning redds and newly hatched larvae are not dewatered during non-generation periods.

Fifteen robust redhorse were captured between April 19 and May 17; 6 individuals were untagged and 9 were recaptures (7 among season and 2 within season). All of our captures were from the Jones Creek shoal. Not including within season recaptures, 5 of the captures were male and 8 were female. The mean weight was 5307.7 g and ranged from 1495 to 7445 g. Total length ranged from 481 to 741 mm and the mean was 669.6 mm. We captured 2 relatively small male fish this spring (481 and 534 mm TL) which are rarely collected in the Pee Dee River. Based on size, these individuals may be from the 2009 year class where the 1,200 cfs minimum flow was first provided and are now part of the adult spawning population. The next few years of sampling will help us understand more about the influence of the new minimum flows on recruitment.

Yadkin-Pee Dee FERC License Update – Jason Brown

Duke Energy is in the process of relicensing the Blewett Falls Hydroelectric plant on the Pee Dee River. As part of the relicensing efforts Duke Energy has received a North Carolina Division of Water Resources 401 Water Quality Certificate (WQC). This WQC outlines new water quality standards related to river flow and dissolved oxygen. During

2013 Duke Energy made a voluntary effort to comply with the new standards outlined in the WQC.

One of the main reasons Duke Energy has not received a new operational license for Blewett relates to the relicensing effort at upstream facilities (APGI) and the ongoing section 7.0 consultations for Shortnose and Atlantic Sturgeon.

Wateree River Collections 2013 Update – Jason Brown

A total of 16 robust redhorse were collected in 2013 below the Wateree Hydroelectric station during American shad boat electrofishing surveys. Of the 16 collected robust redhorse 5 were female. The fish collected ranged in size from 452 mm to 618 mm. Three new specimens (non-tagged) fish were collected.

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

Yadkin-Pee Dee Propagation Study – Doug Hinshaw

A pilot project began this spring where fertilized Robust Redhorse eggs (about 11,000) were brought to the NC Wildlife Recourses Commission's McKinney Lake Fish Hatchery for rearing. The purpose was to allow staff to experiment with different culture techniques and be ready for next spring (2014) when the stocking program is planned to begin. The eggs from two females were crossed with one male. The hatching was very successful, but rearing in the hatchery was met with several challenges, especially feeding, and 850 juveniles (25 mm) were stocked into a 1/3 acre pond on August 2nd, 2013. The pond was drained on November 1 and 42 Robust Redhorse were collected. Individual size ranged from 64 to 120 mm. Ten individuals are being held at McKinney Lake and will be given to the new Sea Life aquarium in Charlotte for an exhibit. The remaining individuals have been preserved for study at North Carolina State University.

Savannah & Broad Rivers Research Update 2013, Georgia – Carrie Straight and Bud Freeman

In the Broad River, spawning was documented from 17 through 31 May. Rain and high water (high turbidity) prevented visual observations of spawning activity for the 2013 season. Many spawning patches that were used in the past at the main spawning site were covered in a layer of fine sand and did not have any apparent spawning activity. Over the last four years the time of spawning ranged from late-April to the end of May, with water temperatures ranging from 16-24.6 °C. Spawning depths ranged from 0.29-24.6°C and velocities ranged from 0.24 -1.4 m/s at 60% of water depth. In those years when visual observations were possible, we counted a total of 86-107 fish spawning at up to 6 different spawning areas in the Broad River watershed. Our first tagged fish arrived at the known spawning sites approximately 20 days before the spawning season started.

In the Savannah River, we documented a small number of male Robust Redhorse (7+ territorial males) at the lower gravel bar (33.30317, -81.88159) on 18 April 2013. Although no spawning was visible, we placed an acoustic unit at the site on this day and revealed spawning was occurring at the time of our visit (likely in deeper water where spawning was not visible). On 25 April a larger group of spawning fish were visible at the lower bar (63+ individuals), and during our visit on 9 May 2013 there were no visible fish at the lower bar. Robust Redhorse were observed spawning on 13 May 2013 by the South Carolina DNR at this site and brood stock were captured on that day.

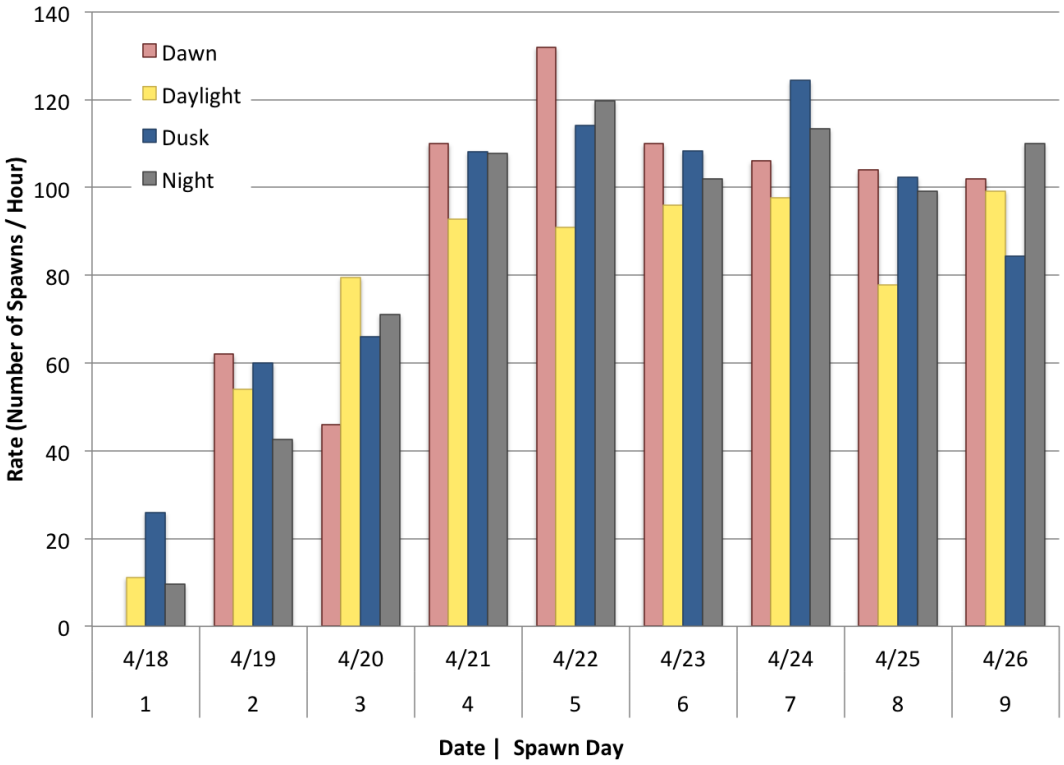


Figure 2. Preliminary acoustic data from spawning Robust Redhorse at the lower gravel bar during the first nine days of spawning. Acoustic signatures indicated spawning events occurred at all hours of the day and increased in rate during the first few days of spawning.

Oconee River Gravel Augmentation Monitoring – Catherine Reuter and JT Pynne

In May 2010, the Georgia Department of Natural Resources completed a two-phase gravel augmentation project on the Oconee River with the aim to improve spawning sites for the Robust Redhorse (Moxostoma robustum). Declining catch rates and observational data indicated a declining population in need of support (Ely 2012). It was hoped that the habitat improvement project would improve known spawning sites and provide additional new spawning habitat. In 2010, sampling of the Oconee River yielded no fish and only one visual observation of Robust Redhorse (RRCC 2010). In 2011, visual and hydroacoustic observation resulted in no observations (RRCC2011). Finally, in 2012, no Robust Redhorse were detected during a 2-day visual monitoring period.

For spring 2013, the goal was continue comprehensive monitoring of the augmented gravel sites in order to ascertain whether Robust Redhorse were engaging in spawning activity at these locations. Unfortunately, a particularly wet spring thwarted the majority of monitoring efforts; high flows on the Oconee frequently precluded visual observations. Only three attempts at observation were possible and only four of the five sites visited. No fish or evidence of spawning was observed at any site at any time. Therefore, no conclusions about the effect of the gravel augmentation project or the fishes' spawning activity during 2013 can be drawn.

Figure 3. Avant Mine, 5/30/2013. Credit: Reuter, Georgia DNR.

Reproductive and Habitat Ecology of the Sicklefin Redhorse, an imperiled endemic species – Scott Favrot, Tom Kwak, and Tomas Ivasauskas

The sicklefin redhorse *Moxostoma* sp. is a potamodromous, undescribed and imperiled species endemic to a restricted geographic range in the Blue Ridge physiographic province of North Carolina and Georgia. Little is known about its ecology, behavior, and reproduction. We quantified the spawning migration, seasonal movement patterns, microhabitat use and suitability, and behavior of sicklefin redhorse in the upper Hiwassee River Basin, North Carolina. Adult sicklefin redhorse most frequently occupied Hiwassee River tributaries during the spawning season (March–May), lower reaches of tributaries and Hiwassee River during the postspawning season (June–November), and lower reaches of Hiwassee River during winter (December–February). They were highly mobile during the spawning season, and displayed site fidelity during the postspawning season, before migrating downstream in winter. Sicklefin redhorse selected microhabitat non-randomly. They were associated with swift thalweg currents, shallow depths, and coarse substrates (e.g., boulder and bedrock) supporting river weed *Podostemum ceratophyllum*, but different microhabitats were occupied during spawning. Sicklefin redhorse reproductive behavior was similar to that for the genus *Moxostoma*, with several important exceptions. Our results demonstrate that sicklefin redhorse ecology is unique among its congenerics, and increased knowledge of this species may guide and enhance management to ensure its survival.

NC Coop Unit Research Updates and Current Research on the Early Life History of Sicklefin Redhorse and Other Catostomids – Tomas Ivasauskas and Tom Kwak

The North Carolina Cooperative Fisheries and Wildlife Research Unit received a grant from the U.S. Fish and Wildlife Service to investigate the early life history of the undescribed and imperiled Sicklefin Redhorse *Moxostoma spp.* Field components commenced in April 2013 and were conducted in the Valley River, a major tributary to the Hiwassee River. Study objectives were related to sampling young-of-year (YOY) Sicklefin Redhorse and other catostomids, identifying YOY fishes, assessing the distributions and habitats of YOY Sicklefin Redhorse and other catostomids, and assessing the phenology of the seven catostomid species present in the drainage. YOY fishes were successfully collected using light traps, drift nets, dip nets, and backpack electrofishing. A suite of habitat parameters were collected at the point of capture for each sampled YOY catostomid. In 2013, larval catostomids were first detected in light traps, drift nets, and dip nets during May, and became vulnerable to backpack electrofishing during July. Of the 850 catostomid specimens that were captured across all months and all gear types, 51 (6%) were identified as belonging to the Redhorse genus *Moxostoma*, and 789 (94%) were identified as Northern Hog Suckers *Hypentelium nigricans*. Because visual identification of larval fishes is notoriously difficult and unreliable, future efforts will focus on positively identifying YOY catostomids based on meristics, morphometrics, and genetics. Preliminary results obtained in 2013 will be used to guide future sampling efforts. Data will be analyzed using a variety of statistical techniques, including occupancy modeling, multivariate, and time-series procedures. These results will enhance ecological understanding and identify management options to ensure the protection and survival of the Sicklefin Redhorse and other fishes during critical early life stages.

North Carolina Water Quality and Contaminants in the Pee Dee – Laura Belica Tom Kwak, Greg Cope, and Ryan Heise

Tens of thousands of chemicals are in use worldwide and contaminants are released into rivers from sources ranging from agricultural operations to wastewater treatment facilities. Contaminants can have a multitude of negative effects on organisms, from acute toxicity to chronic effects such as changes in behavior, morphological deformities, impaired function, and decreased reproductive success. Research investigating effects of contaminants in the Pee Dee River has been initiated at NC State University in collaboration with the NC Wildlife Resources Commission and SC Department of Natural Resources. This research will investigate the prevalence of contaminants and their impacts on fishes in the Pee Dee River, including the robust redhorse.

Work began in 2011 to investigate the prevalence of endocrine disrupting compounds (EDCs) and intersex fish. Endocrine disrupting compounds are a group of contaminants associated with damaging effects on fish and wildlife globally. In fishes, EDC exposure can result in the intersex condition, skewed sex ratios, and population collapse from reduced reproductive success. Notably, in a recent survey of rivers throughout the U.S., southeastern river basins had a higher prevalence of male intersex fish (black bass,

Micropterus spp.), and the highest number of intersex male bass were found in the Pee Dee River (Hinck et al. 2009).

The goal of the Pee Dee River EDC research is to determine which contaminants are present and the prevalence of the male intersex condition. This will be done by collecting water and sediment for contaminant analyses, fish for histopathological analyses, and by conducting in situ-bioassays of captively propagated fish at sites distributed longitudinally along the Pee Dee River.

In 2013, 13 field sites were established along the mainstem of the Pee Dee River from the upper reach to near its mouth. These sites include three reservoirs and span the watershed. Ten field sites are located in the piedmont of NC and three are in the coastal plain of SC. Water and sediment will be analyzed for inorganic and organic contaminants, and water samples will also be analyzed for biologically available estrogenic compounds. In the spring of 2014, male black bass, sunfish, and catfish will be collected from all sites and examined for histopathological indications of contaminant exposure. Also in 2014, in-situ bioassays of captively propagated fish will be conducted at a subset of the sites. Survival, growth, condition metrics of survivors, and histopathological exams for the intersex and other toxicological conditions will be analyzed to provide information on the effects of contaminant exposure on fishes in the Pee Dee River. This research will provide important information on the longitudinal trends of EDC contaminants, the occurrence of intersex in fish, and the potential effects of contaminants on fish growth, survival, and condition.

Another research goal will focus on the Pee Dee River population of robust redhorse. The research will focus on pathways and potential effects of contaminants on the food web and include modeling to explore the potential effects of both contaminants and habitat availability on robust redhorse population dynamics.

The primary research objectives are listed below.

1. Systematic field sampling of physical and biotic habitat (water, sediment, biota).
2. Experimental field bioassay contaminant exposures (in-situ bioassays of captively propagated fish).
3. Traditional and emerging contaminant analyses of water, sediment, and biota – including food web components.
4. Food web structure.
5. Population modeling using Yadkin-Pee Dee TWG data collected from 1999 – 2009.
6. Synthesis of results in the context of robust redhorse recovery.

Preliminary Evaluation of Sampling Methods for Monitoring the Sicklefin Redhorse *Moxostoma* sp. in Georgia – Johnathan Davis

Dr. Davis and students monitored reaches of Brasstown Creek in Georgia using visual surveys, snorkel surveys going upstream then downstream, and downstream seining at the state line (lots of agriculture around that site).

A total of 37 male sicklefin redhorses, ranging from 43-55 cm TL, were captured from April 24th to May 23, 2013. Most / all captures correlated with small boulder and cobble substrates.

Southeast Aquatic Resources Partnership – Scott Robinson

This presentation discusses the data and decision support tools developed or under development by the Southeast Aquatic Resource Partnership (SARP) that may be of use to RRCC as it considers threats and opportunities for the RRCC activities. An overview of the SARP regional riparian assessment, flow alteration assessment, and South Atlantic Aquatic Habitat Connectivity project will be provided, along with demonstrations of how to use the tools. More information on these and other SARP habitat assessment tools is available at www.southeastaquatics.net.

TECHNICAL WORKING GROUP REPORTS

Habitat Technical Working Group – Jimmy Evans
Jimmy gave an update on several current and completed projects for this TWG including the gravel augmentation project in Oconee River, and an augmentation of gravel near Rocky Ford in the Ogeechee River several years ago.

He also mentioned the group's work with the flow manipulation recommendations in the Oconee River to extend run-of-the-river flows into the rearing period for robust redhorse. Additionally, side-scan surveys have been done in the Ocmulgee River from Lloyd Shoals dam downstream to East Juliette.

In South Carolina, they're going to do side-scan surveys from Parr downstream to look for potential spawning habitat. It would be helpful to find spawning habitat in both the Wateree and Broad rivers, as the tagged fish don't seem to be using the lower gravel bars in the system.

North Carolina will be focusing on flow modifications. In this system fish also by-pass potential spawning habitat in lower sections of the river to reach the area in the vicinity of Hitchcock and Jones Creek during the spawning season.

Attendees noted that fish in all systems are bypassing gravel patches (Oconee fish bypassed augmented sites, fish in the Broad GA and SC move past known gravel patches, NC fish move past gravel patches in the PeeDee to reach other patches during the spawning season). It seems that not all gravel is equal.

RRCC Website update – Ryan Heise
The Robust Redhorse Conservation Committee's website is www.robustredhorse.com

Please keep sending in papers/reports to Ryan so that the website can remain updated.

B U S I N E S S

Status of Georgia Fishes Petitioned for Listing – Brett Albanese and Catherine Reuter

Information on the range and conservation status of large numbers of aquatic species is needed for state wildlife action plans, assessments of species petitioned for listing under the U.S. Endangered Species Act, and other reviews carried out by groups such as NatureServe and the American Fisheries Society. A major challenge for these assessments is the lack of comparable data across taxa, which is often limited to presence-absence data or in some cases presence-only data with limited knowledge of areas that have been surveyed. We developed a method to assess the current range and survey needs of aquatic species using a combination of presence-only and presence-absence data. Our method uses a simple GIS algorithm to identify the most recent occurrence record for USGS Hydrologic Unit Code (HUC) 10 digit watersheds and then classifies all watersheds into 5 year intervals. Occurrence records as well as locations of recent surveys where the target species was not detected are then overlayed to produce a conservation status map. This map serves as the key resource for targeting areas in need of additional sampling and can be updated periodically to incorporate new survey results. Maps can also be used as a foundation for assessing conservation status by providing comparable metrics across taxa, such as the number of occupied watersheds (index of range size), proportion of potential watersheds currently occupied (index of range stability) and watershed landcover (index of threat) We are currently applying our method to all imperiled Georgia freshwater fishes. While more detailed monitoring and assessments may be required for some species, our method has the potential to provide useful and consistent information for large numbers of aquatic species.

Recovery of Robust Redhorse – Discussion

A panel discussion was held to discuss the status of recovery of robust redhorse in Georgia, North and South Carolina.

North Carolina

Ryan started catching most robust redhorse in 2005. Telemetry studies, home ranges, habitat use, spawning areas, and migrations have been documented in past research. North Carolina WRC is looking into a future CCAA for a reintroduction program for stocking upstream in the Tillery reach (above Blewett Falls Dam). This will be a long process and a number of years before the CCAA will occur.

South Carolina

There is no confirmed remnant population in the Santee. A stocking program was initiated in 2003 and stockings began in 2004. The target was to produce progeny from 100 reproducing pairs, which they have achieved. 2013 will be the last year of stocking. The hope was that each pairing had equal contribution, but disproportionate survival changes this. SCDNR will use genetic analysis in the future to see how these crosses survive through time.

The Savannah ESU appears to be the most stable population (according to Scott). Tim Garrett believes the Savannah River population has a better length-frequency distribution than the other populations. Scott suggests that growth rates might be slower in the Savannah because of the hydrological regime. There are untagged fish moving into the brood stock population each year. Jimmy suggests the spawning habitat is good, non-spawning habitat is good, and there is an absence of flathead catfish. Tim Garrett's crews are doing targeted sampling for robust redhorse in the Savannah while doing their sport fish surveys. The big question remains…why no recruitment?

Georgia
The robust redhorse recovery project in Georgia can be divided into five phases. Phases I and II have been completed and all current recovery activities concern Phases III – V.

Phase I. After discovery in 1991, status assessment indicates risks due to low recruitment

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

- Refugial ponds
- Broad, Ocmulgee, Ogeechee to establish refugia, and eventually reproducing populations
- Oconee River to augment existing wild population

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

Phase I – Status assessment (1991 – 1993)
A status assessment of the Oconee River robust redhorse population was conducted during the first 2 – 3 years after its discovery in 1991. A primary characteristic of this population appeared to be prevailing low recruitment rates that had existed for at least ten years, and therefore a significant risk to the population was believed to exist if recruitment rates remained low. Since the Oconee River population was the only known population during the 1991 – 1997 period, the concern initially was for the survival of the species. After the later discovery of the Savannah and Pee Dee River populations, survival of the species based solely on the status of the Oconee population became less of a concern. However, after the eventual elevation of all three populations to separate ESU status, the Oconee population was considered the reservoir for a distinct gene pool within

the species, and preservation of this unique genetic legacy became the primary concern for managers.

Phase II – Hatchery program (1994 – 2008)
Managers discussed whether to focus efforts on determining the cause and possibly alleviating the recruitment bottleneck, or to utilize available resources to implement a hatchery program to produce juveniles for establishing several refugial populations. Equally important was the expectation that future recruitment rates among any stocked populations might be higher than those in the wild Oconee population. This could ultimately produce viable populations that would improve the conservation status of the Oconee ESU. Since most of the potential broodfish in the Oconee River were approaching the end of their life span, and there appeared to be few recruits to replace them, it was critical that any hatchery program be implemented while sufficient broodfish were available to meet management objectives. It should be noted that managers recognized the possibility that recruitment rates in the Oconee could improve and that declines in population demographics could be reversed. However, since it was impossible to assess the probability of increased recruitment rates, the risks of delaying implementation of the hatchery program were considered significant.

A large-scale hatchery program was therefore initiated in Georgia in 1994 and continued until 2008. Several Georgia DNR state hatcheries, the U. S. Fish and Wildlife Service hatchery at Warm Springs, and the Dennis Wildlife Center state facility in South Carolina were utilized and eventually a total of about 115,000 robust redhorse fingerlings and larger juveniles were produced and stocked in the Broad, Ogeechee, Ocmulgee, and Oconee rivers in Georgia, as well as in several refugial ponds (primarily at the Piedmont National Wildlife Refuge). All robust redhorse stocked for grow-out in ponds were later transferred to the Ocmulgee and Ogeechee rivers. The stocking program in the Broad River was terminated after only four year classes were stocked due to the discovery of a wild robust redhorse population in the Savannah River. Seven hatchery-produced year classes were stocked in the Ogeechee River and ten year classes in the Ocmulgee. Due to genetics considerations, only a limited number of hatchery-reared individuals comprised of numerous year classes were used to augment the wild Oconee River population. As predicted, the number of broodfish in the Oconee River began to decline, and this became especially notable in the early-mid 2000s. However, by 2008 most hatchery and related genetics management objectives had been met and all suitable riverine sites had been stocked with multiple year classes.

In 2012 a large female robust redhorse in spawning condition was collected from the lower portion of the Little River in the Oconee River drainage above Sinclair Dam. This fish is almost certainly the result of an escapement of about 200 fingerlings from the Walton Hatchery in 1995 due to a pond dam failure. This discovery suggests that a fourth stocked robust redhorse population of unknown size may exist in Georgia in the Lake Sinclair/Little River system.

Phase III – Monitoring (1994 – present)

Success of stockings. Relatively good survival and excellent growth of stocked robust redhorse has been demonstrated in the Broad, Ocmulgee, and Ogeechee rivers, based on targeted monitoring studies. Survival of stocked fish used to augment the wild Oconee River population has, however, apparently been very limited. Stocked fish in the Broad, Ocmulgee, and Ogeechee rivers have reached maturity and spawning activity has been conclusively demonstrated in all rivers through visual observations. Although evidence exists for recruitment within stocked populations in the Broad and Ocmulgee rivers, it is limited and tentative at present. Additional evidence from monitoring studies is needed to conclusively demonstrate the sustainability of stocked populations and to assess the status of a possible Lake Sinclair/Little River population. Monitoring will continue in all stocked rivers in Georgia to evaluate the success of stocking efforts. **Documentation of sustainability of stocked populations remains the highest priority of recovery project managers in Georgia.**

Status of the Oconee River population. The wild robust redhorse population in the Oconee River has declined since its discovery in 1991, based on analyses of electrofishing catch rates and calculated population estimates. Electrofishing catch rates have declined from 10 – 20 per hour in the 1990s to less than one per hour at present. Population estimates have also declined from 400 - 600 adults to less than 100 adults. However, it should be noted that the recent electrofishing effort used to monitor the status of the Oconee population has been relatively low (8-10 hours per year) and is confined geographically to areas where broodfish have traditionally been collected, rather than the entire range of the species in the Oconee River. In addition, population estimates have not been calculated for the last several years due to the low number of robust redhorse collected. The Oconee River robust redhorse population presently appears to exist below the limits of detectability with the sampling effort and methodologies currently utilized. In order to obtain a better understanding of the present status of the Oconee River population, electrofishing effort in 2014 will be increased to 60 – 80 hours and geographically extended to the entire known range of the robust redhorse in the Oconee River below Sinclair Dam. **An accurate determination of the present status of the Oconee River robust redhorse population is a high priority for recovery project managers in Georgia.**

Phase IV –Efforts to improve the status the Oconee River population (1995 – present)

Precise causes of low recruitment rates in the Oconee River robust redhorse population remain unclear, but discussions have focused on the issues of flow regime, sedimentation, contaminants, temperatures, spawning habitat availability, and predation (primarily from flathead catfish first documented in about 1980). Effective management strategies available to address these issues have been assessed and several have been implemented. Remaining options are relatively limited. Run-of-the-river (ROR) flows during the spawning season were implemented in 1996 through the relicensing process for Sinclair Dam and discussions are currently ongoing regarding an extension of ROR flows into the early rearing season. Based on present understanding of spawning habitat requirements, managers believe that an extended period of ROR flows should provide more optimal spawning and early rearing conditions.

An extensive gravel augmentation project was completed in 2010 that resulted in the creation or augmentation of four additional gravel spawning sites. Monitoring of these sites indicates that gravel has persisted and that potentially suitable spawning sites have been created. High flows prevented effective monitoring of spawning activity at these sites in 2013, but an additional monitoring project is planned for 2014. Experts on flathead catfish predation have been consulted regarding the possible impacts of this introduced species on the Oconee River robust redhorse population. Although most specialists in this field believe that flathead catfish predation can reduce recruitment rates, especially in upper Coastal Plain habitats found below Sinclair Dam, there is no consensus on this issue and options to reduce predation pressures are limited and their effectiveness is uncertain. Given limited evidence of effectiveness, significant associated costs, and the inevitable temporary nature of this measure, managers have been reluctant to pursue flathead catfish removal as a management option for the Oconee River robust redhorse population.

Based on these considerations, current management options for enhancing the status of the Oconee River population focus on modifying flows in small increments and increasing spawning habitat availability. Stocking below Sinclair Dam is not considered a viable management tool since previous stockings of fingerlings and sub-adults have not been successful. There have been discussions of stocking above Sinclair and/or Wallace dams where juvenile survival and future recruitment rates could potentially be higher. This option will be explored further in 2014 by conducting a preliminary survey of spawning habitat availability in the Little and Apalachee rivers.

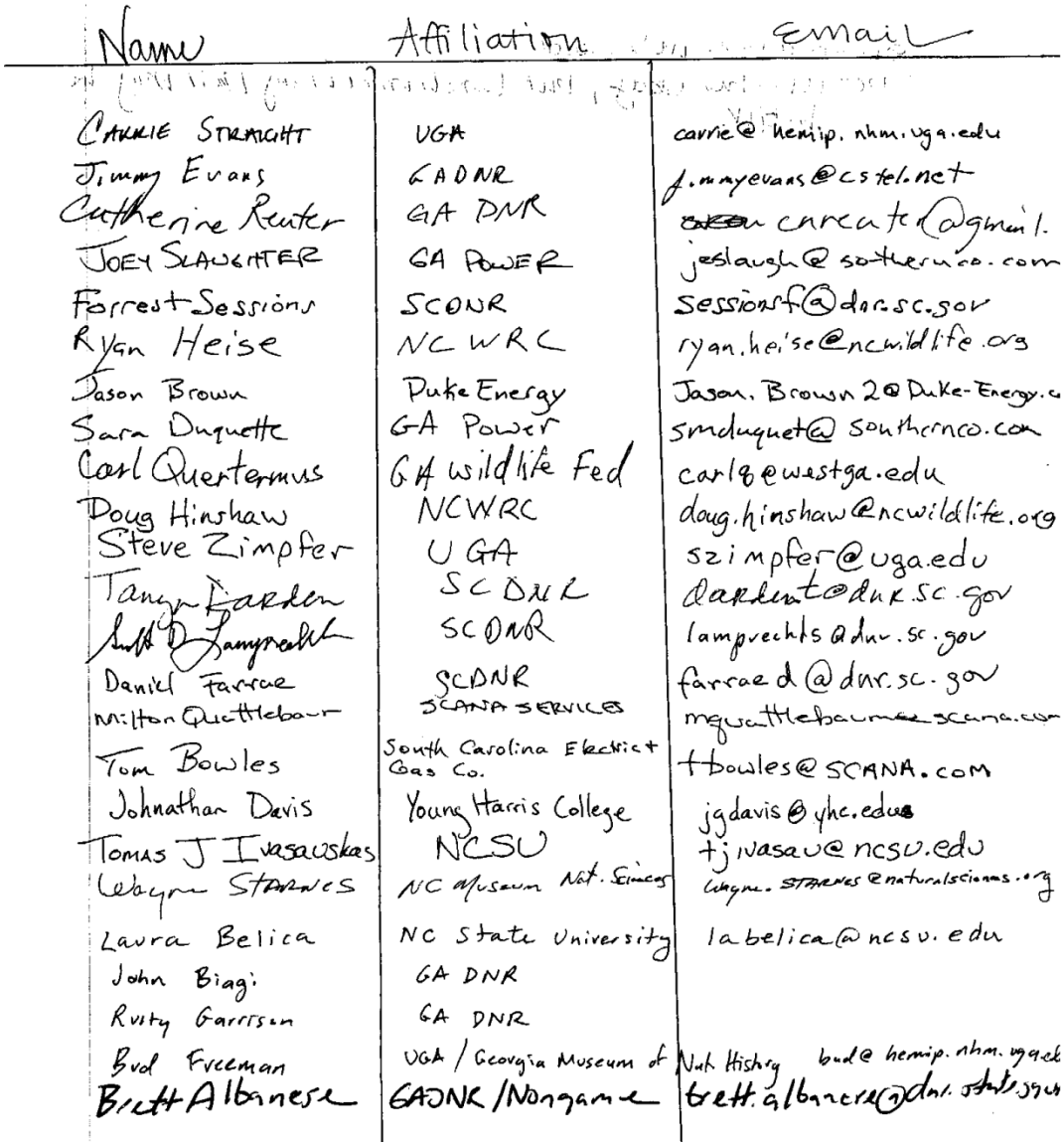
Phase V – Search for other populations (1993 – present)
Efforts are continuing to search for other remnant robust redhorse populations and evaluate habitat for possible future stockings in the Oconee River Basin above Sinclair and Wallace dams. Since a wild robust redhorse population exists below Sinclair Dam, it is possible that a population may have been isolated above the dam after its construction in 1950. The lower reaches of Little River and Murder Creek as well as the Oconee River below Barnett Shoals Dam were sampled in spring 2012. A single large female in spawning condition was collected at the Little River site and it is believed that this fish was the result of the escapement of robust redhorse fingerlings from a failed dam at the Walton Hatchery in 1995. The lower reaches of the Little and Apalachee rivers as well as the Oconee below Barnett Shoals Dam were sampled in spring 2013 and no robust redhorse were observed. Additional sampling will be conducted in the Apalachee River and in the Wallace Dam tailrace, and float trips will be conducted to evaluate spawning habitat in the Little River and Apalachee River in spring 2014. At present, there is no evidence of existing remnant wild robust redhorse populations above Sinclair and Wallace dams, and a decision has not been made regarding stocking in these upriver areas.

Status Summary to the SEAFWA – Discussion
At the request of Mike Harris (Nongame Conservation, GADNR) and the SEAFWA Wildlife Diversity Committee, members of the RRCC agreed to compile information to

facilitate a status assessment of Robust Redhorse. The assessment is necessary because the Robust Redhorse has been petitioned for listing under the U.S. Endangered Species Act. The assessment will include information on the species life history, threats, and current conservation efforts and will be used by FWS to determine if listing is necessary. Jimmy Evans, Ryan Heise, Scott Lamprecht, and Forrest Sessions all agreed to author individual sections of the document. Brett Albanese agreed to edit the compiled document. An April 15th 2014 deadline for a first draft was agreed upon by the assessment authors. Brett also agreed to contact Mark Cantrell for more information on what is actually needed for the species assessment.

A T T A C H M E N T S

Attendees of the 2013 Meeting:



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