REPORT OF THE

ROBUST REDHORSE CONSERVATION COMMITTEE ANNUAL MEETING

Camp Harrison at Herring Ridge
Boomer, North Carolina
October 20 – 22, 2008

Attendees of the 2008 annual meeting.

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

EXECUTIVE SUMMARY

The robust redhorse recovery effort, in its 14th 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 14th annual meeting of the RRCC was held October 20-22, 2008 at Camp Harrison at Herring Ridge in Boomer, North Carolina. Approximately 30 representatives of the signatory agencies to the MOU, university research affiliates and other interests attended the meeting. The 13 signatory agencies include: Georgia Department of Natural Resources, South Carolina Department of Natural Resources, North Carolina Wildlife Resources Commission, Georgia Power Company, Progress Energy (formerly Carolina Power and Light Company), Duke Energy, South Carolina Electric and Gas Company, U.S. Fish and Wildlife Service, U.S. Geological Survey, U.S. Forest Service, U.S. Army Corps of Engineers, Georgia Wildlife Federation, and South Carolina Aquarium. University research affiliates include: University of Georgia Warnell School of Forest Resources, University of Georgia Institute of Ecology, University of Georgia Cooperative Fish and Wildlife Research Unit, 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, Roanoke College Department of Biology, 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 2008 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 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 – Dave Coughlan
Dave welcomed all participants to the 2008 annual meeting. He informed them that the meeting was made possible by generous donations from Duke Energy, Georgia Power, Progress Energy, Santee Cooper, South Carolina Electric and Gas, and U.S. Fish and Wildlife Service.

Installation of New RRCC Chair – Dave Coughlan
Forrest Sessions, South Carolina DNR, was installed as the new RRCC Chairperson by outgoing Chair Dave Coughlan.

MANAGEMENT ACTIVITIES

North Carolina 2008 Update – Ryan Heise
The short-term goals of this project are consistent collection of robust redhorse in the Yadkin-Pee Dee River and determine habitat and life history requirements. Long-term goals are to ensure viable, self-sustaining population in the Yadkin-Pee Dee River basin and determine population size, genetic variability, and recruitment and mortality rates. Methods include boat electrofishing of shoals and side channels for 3 days each week for three weeks between late April and early May and monitor radio-tagged fish and water temps.

There have been 76 robust redhorse captures from 1985 and 2000-2008. There were 73 adults and 3 juveniles collected. The total individuals are 53 with 33 females and 18 males. Most captures occurred in the spring near or on shoals.

There are 3 spawning shoals located at Big Island (near Blewett Falls Dam), Hitchcock Creek Shoal, and Jones Creek Shoal.

The efforts put forth by this group have determined that a small population of robust redhorse persists in the Pee Dee River downstream from Blewett Falls Dam, there are documented spawning shoals and fish show spawning shoal fidelity.

South Carolina 2008 Update – Forrest Sessions
In 2008, six females were crossed with 18 males. A total of 40,000 eggs were collected. Over 25,000 larvae were produced for production efforts. Fish were collected in 2008 using grid and boat electroshocking.

Overall, there have been progeny from 30 females and 90 unique crosses that have been stocked in the Savannah River. The goal is to stock progeny from 100 pairs.

In the fall of 2007, 6,000 Phase I fingerlings were stocked in the Broad River and 3,800 Phase I fingerlings were stocked in the Wateree River. The total number of fish stocked from 2004-present in Broad River (43,652 Phase I) and Wateree River (9,103 Phase I, 2,410 Phase II, 400 Phase III).

A stocking assessment has been conducted and 7 fish have been collected in the Wateree and another 4 fish collected from the Broad River.

Wateree River 2008 Collections – Dave Coughlan
The tailrace of the Wateree Hydro Dam is sampled for diadromous fish in the spring. Four robust redhorse were collected in 2008. Various degrees of tubercles were seen on the snouts, anal and caudal fins. Scale samples were taken and sent to Dr. Jenkins. Length of the four fish ranged from 416-475 mm and weight was 1130-1164 g. Three of the four fish collected had either a coded-wire tag or PIT tag, indicating that these were stocked fish from either 2004 or 2005.

Georgia 2008 Update – Jimmy Evans
Six robust redhorse were collected by boat electrofishing in 2008 from the Oconee River. 3 of these were radio-tagged fish, 1 was a stocked fish, and 2 were wild spawned fish. The total electrofishing effort was 11.0 hours and the total CPUE (no/hour) was 0.54.

Oconee River Population Status Update – Joey Slaughter
The monitoring strategy in general has been divided into two parts. The short-term monitoring (annual changes in population estimate, annual changes in catch rates, between year comparisons) and long-term (statistical trends over multiple years, linear or log-Linear relationships, most statistical trends in fish data use 5-year increments).
The history of Oconee River monitoring has been annual electrofishing data since 1994; additional data not yet included does exist, both prior to 1994 and sporadically since; pre-designated sites exist, and monitoring is generally conducted according to those sites; gears and techniques are generally very similar; environmental variables have also been recorded or can easily be recreated for the sampling periods; and additional sampling data, not specifically ear-marked as "monitoring" can aid in the long-term analysis.

The sampling universe in the Oconee is an 86 mile stretch of river roughly divided by hydrologic and/or geographic landmarks into 14 sites beginning at Sinclair Dam and extending downstream to below Dublin, GA. The reach lengths vary from 1.3 to 20.3 miles and various macro-habitat types exist including shoals, deep outside bends, meanders, etc.

There have been questions in confidence of data collected for this population. Such as:

- Do our sampling points and strategies adequately depict the population?
- Are our data collected in representative habitats according to their availability in the system and not according to where we predict RR will occur?
- Are we collecting enough data to depict appropriate variability among sites?
- Are we including fixed and randomly selected sites in our sampling to make our data more robust?

Our confidence is based on from 1994 through 2008 we have analyzed data collected for a total of 131 samples. Those 131 samples have yielded 1089 robust redhorse (includes duplicate fish). Unfortunately, those 131 samples only included 6 of the 14 available sites. The mean CV for the sampling period = 0.18. Most long-term monitoring programs target a CV = 0.10.

- At CV = 0.10, we have an 80% chance of detecting a 46% linear increase or 38% linear decrease in catch rates over 5 years at an alpha = 0.05.

- At CV = 0.18, we have an 80% chance of detecting a 91% linear increase or 62% linear decrease in catch rates over 5 years at an alpha = 0.05.

For now, we can be confident that Oconee robust redhorse have declined over 15 years in 20% of their range. While the two are tied together, we can be moderately confident that our catch rate data is confirmed by our population estimate data. We cannot rule out the possibility that robust redhorse have simply shifted their habitat use to the other 80% of the river readily available to them. We cannot account for changes to their environment that may have affected our sampling program and ultimately, we cannot statistically confirm or deny that the entire Oconee River population has changed.

How would we fix this? We need to consider a fixed and random site sampling design, redistribute our sampling effort among sites instead of within sites, increase our sample sizes or improve our sampling efficiency to reduce variability, an independent analysis tool to estimate population size, and consider alternate analytical methods.

Broad River, GA Monitoring – Bud Freeman

For the Broad River, GA system, there were preliminary observations of spawning stocked robust redhorse in 2007 and 2008. There were possible spawning events in 2008. PIT and sonic tagged fish in 2009 may give a better idea of the population.

A full scale project is expected to start in winter/spring of 2009. The project goals are to (1) Provide information on the population structure (numbers in each size class) of robust redhorse within the Broad River system, to compare to populations located throughout its range; (2) Provide information on the survival, movements and habitat use of robust redhorse in the Broad River system (using hdRFID tags and sonic telemetry); and (3) Provide information on habitats used for spawning in a river with an unregulated flow regime.

2008 STOCKING RECOMMENDATIONS

Georgia

Piedmont NWR is gradually being cleared of refugial pond fish. The Georgia DNR pond program is over, but some fish are still being held at federal facilities.

South Carolina

They plan to stock in November-December of 2008. In the future, they may radio-tag fish in the Broad River, SC.

2009 BROODSTOCK COLLECTION PLANNING

Georgia

Georgia will enter a population monitoring phase in all three rivers and start standardized sampling.

South Carolina

2009 may be the last year on the Savannah River as they near their target 100 pair mating goal.

North Carolina

They have more radio-tags that can be put out. The Yadkin-Pee Dee TWG will plan as usual.

RESEARCH UPDATES

Robust Redhorse Genetics – Dr. Ike Wirgin

Dr. Wirgin has examined mitochondrial DNA control regions and multi-loci microsatellites in nuclear DNA to determine that there are three populations of robust redhorse (Oconee, Savannah, and Pee Dee). There were fixed differences among the three populations. The highest genetic diversity is in the Savannah River population. In a hatchery study, adults and juveniles from ponds have similar levels of genetic diversity.

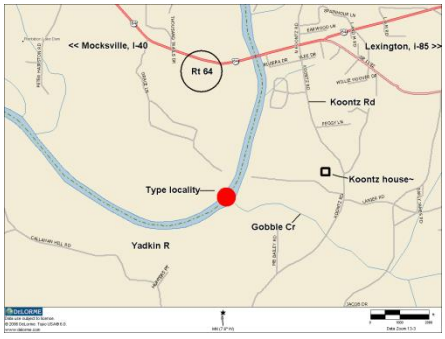
Robust Redhorse Type Locality Hunt – Bob Jenkins

Dr. Jenkins gave a presentation titled "Cope's Type Locality of Robust Redhorse in Yadkin River, NC." The chronology of the robust redhorse discovery is:

- 1869 - Cope captured a robust redhorse.
- 1870 - Cope described species as *Ptychostomus robustus.*
- 1980 - Savannah River specimen, 1st specimen known since Cope (1870): *species rediscovered*.
- 1985 - Pee Dee River specimen taken.
- 1991–92 - Oconee River specimen taken.
- Jun 1992 - Jenkins and Freeman recognized the above specimens as a new species, *Moxostoma rotundum*, rotund redhorse.
- Sep 1992 - Instead, Jenkins determined that Cope (1870) had already described the species, and that the name *robustus* had been wrongly attributed to the (still) undescribed brassy jumprock by Fowler (1913), Robins and Raney (1956), and others.
- 1993 to present - Intensive surveying and study of robust redhorse, and of this species and all allies by Jenkins.

Dr. Jenkins wanted to determine the type locality for robust redhorse because the holotype of a species is the one type specimen of the species, whether or not originally designated and is where the holotype was captured. Also, in problems of species (taxon) identity, and especially in absence of a holotype, more specimens are desired to learn more about the species, and it is important to include topotypic specimens (other specimens from the type locality).

Based on clues from various sources, Dr. Jenkins has discovered the type locality.



Pee Dee River Telemetry and Habitat Use – Michael Fisk
The objectives of this project are to determine spawning habitat suitability by comparing habitat use to availability, quantify the amount of suitable spawning habitat before and after flow regulation, describe how robust redhorse use available spawning and non-spawning habitat before and after minimum flows, and finally assess how flow augmentation may affect egg survival. The study are for this study includes Blewett Falls Dam, NC (river mile 188.2), Cheraw, SC (river mile 164.8), and below Cheraw.

This project will track radio-tagged fish and as of May 2008, 26 fish have been tagged. Microhabitat data is also recorded including location, depth, bottom and mean velocity, substrate composition, position in channel, and cover each time a tracked fish is located.

The future goals include tracking fish until August 2009, recording microhabitat use, comparing before/after minimum flows, and determining available habitat.

Another future goal is to conduct a dewatering experiment in spring 2009.

Scale-aging and year-classes in the Pee Dee – Bob Jenkins
Dr. Jenkins gave an update on his work with scale-aging and year-class determination. He indicated that for robust redhorse ages 7 and above, reading scales will not give a good result. For those fish, opercles or otoliths would be needed for aging.

Reproduction and Recruitment Success in the Oconee – Rebecca Cull-Peterson
Robust redhorse (*Moxostoma robustum*) and notchlip redhorse (*M. collapsum*) are two species of redhorses that reside in the lower Oconee River, Georgia. Robust redhorse is a species of special concern, and attempts to investigate factors affecting the robust redhorse reproductive success have met with limited success. Therefore, catch of robust redhorse young were combined with catch of notchlip redhorse to increase sample size. These congeners with similar spawning repertoire were assumed to respond similarly to environmental conditions. River discharge during spawning and rearing seasons may affect abundance of both redhorses in the lower Oconee River. An information-theoretic

approach was used to evaluate the relative support of models relating abundance of age-0 redhorses to monthly discharge statistics that represented magnitude, timing, duration, variability, and frequency of river discharge events for April through June 1995–2006.

The best-approximating model indicated a negative relationship between redhorses abundance and the mean maximum river discharge and the number of high pulses during June, and a positive relation with intermediate duration of low flows during April-June. This model is 9.58 times more plausible than the next best-fitting model, which revealed a negative relationship between abundance and May mean maximum river discharge and the number of high pulses during June, and a positive relationship between abundance and intermediate duration of low flows during April-June. Management implications from the results indicate low-stable flows for at least a two-week period during spawning and rearing may increase reproductive success of robust and notchlip redhorses.

Habitat Use and Movement Patterns in Oconee – Patrick Ely

The objectives of this research is to compare seasonal habitat use and movement patterns of robust redhorse using radio telemetry and use radio tagged individuals as sentinel fish to locate unknown aggregations or population centers.

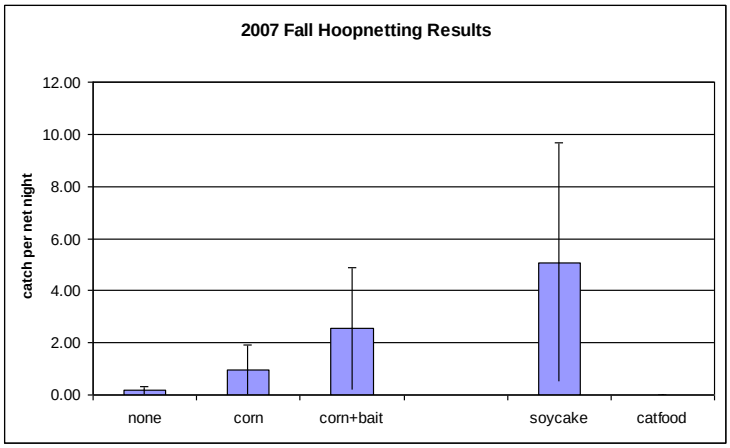
A total of 33 fish were radio-tagged. 29 were implanted and released over a two day period (4/23 & 4/24) and another 4 were transported back to UGA on 4/18 for surgery (4/28) and released on 5/2. The mean weight was 1.72 kg (1.27 – 2.98) and mean length was 499 mm (448 – 576).

A synopsis of summer movements included mortality/expelled at 24 % (8 of 33), downstream movement of 28% (7 of 25), and upstream movement of 72% (18 of 25).

Ocmulgee River Gear Trial 2007-2008 – Joey Slaughter

A gear trial was conducted over two years in 2007 and 2008 using two experiments of a Baiting/Hoop Net Experiment and an Electrofishing Experiment.

The first experiment was conducted in the fall of 2007 and consisted of hoop-netting (randomized sizes/sites; 0.5, 0.75, 1 m diameter) with three settings. The three settings were un-baited (6 nets for 12-16 hours over night), baited with corn (3 days prior to net sets), and baited with soy cakes or cat food and corn (net locations baited for 4 consecutive days with corn and re-set randomly with soy cakes or cat food in bait bags). This part of the experiment also tested electrofishing and corn (3 additional days following last hoop net trial). The temperature was 21.7C ± 0.1 and flows were 330cfs ± 10 for this part of the experiment. Georgia DNR electrofishing survey yielded 2 robust redhorse in the reach, located upstream of HN1 and at HN6 sites. The results of the hoop net collection were not as successful as no robust redhorse were collected in any hoop nets, regardless of treatment. Also, "bycatch" rates increased throughout experimental treatments. Species included: turtles, redbreast sunfish, bluegill, and black crappie. Using electrofishing and corn yielded 2 robust redhorse in the reach, 1 upstream of HN1 and the other on the western bank, upstream of HN5 and immediately downstream of the Butts Co. water intake. It is concluded that fall baiting/hoop netting might not be the best use of limited sampling time and passive gears in general might be more effective when fish are actually in the area in larger numbers and are actively moving about the sampling location.



In spring 2008, methods changed to "enhanced" DNR Standardized electrofishing methods (left bank, right bank, and mid channel; all suckers were netted*; identification to species ~ every 10 minutes*). The temperature was 22-24C and flows approximately 430cfs on both days during this sampling. Two robust redhorse were collected at Hwy. 16 site. It is concluded that increased sampling effort is necessary in the Ocmulgee. The sampling strategy should include netting all available suckers to minimize chances of missing juvenile fish. There is also a need to determine destination of spawning aggregates in the Ocmulgee to increase spring sampling efficiency, and juvenile robust redhorse can be collected using current methodologies, but again, increased effort is necessary.

Joey also informed the group that GPC/UGA research to satisfy the remaining 4 years of the Ocmulgee CCAA is currently in development. It might include:

- Statistically valid long-term monitoring strategy to include best gear types, sample timing, etc.
- Population modeling methodology
- Development of a database framework for use by all entities
- Consolidation of existing collection records/sampling results
- Controlled experiments dealing with catchability and electrofishing response by the species.

Warm Springs NFH Update – Jaci Zelko

There are no updates from Warm Springs National Fish Hatchery. No progeny were raised at the hatchery, as no fish were spawned from the Oconee River in 2008.

Gravel Augmentation Project – Jimmy Evans

Phase I of this project is almost complete. 75 tons of gravel is in place at Avants, ready for deployment. Phase II will place gravel at 5 locations downstream of Avants using a barge and high pressure hose.

Power4Georgians – Allen Conger

Allen Conger, MACTEC, gave a presentation on Plant Washington and the plans for water use. There are two reliable water sources: Oconee River and Cretaceous Aquifer. The surface water intake is designed to reduce entrainment and impingement mortality and will be located upstream of the robust redhorse managed spawning area. The discharge will be located downstream of the spawning area. Surface or groundwater will be used to protect both resources and habitat. Groundwater wells spread throughout the county will minimize impact and wastewater discharge will meet state and federal requirements.

TECHNICAL WORKING GROUP REPORTS

Yadkin-Pee Dee Technical Work Group Activities – Ryan Heise
The Yadkin-Pee Dee TWG's activities for 2008 can be found in the North Carolina update section on page 7.

Genetics Technical Working Group – Greg Moyer
No report was given.

Habitat Technical Working Group – Alice Lawrence
The Habitat TWG Plan is completed and has been uploaded to the website.

Oconee River Technical Working Group – Alice Lawrence
Work continues on the management plan. AT this time, they members of the Oconee TWG estimate the plan is about 90-95% completed.

B U S I N E S S

Research Topics and Resource Needs

- Dewatering experiment
- Tag expulsion rates
- Predation effects on population

Thought Experiment

Chair Dave Coughlin proposed a Thought Experiment. "What would we tell the next conservation committee that will work with a rare sucker/fish?"

- No lawyers and no listing
- Go the cooperative MOU route with a facilitator
- Take a collaborative approach in a non-adversarial way
- Taxonomy must be hammered out to look at life history habits of sister species. There is a need to collect plenty of specimens for taxonomy
- PIT tag everything and keep a standardized database
- Radio-tag and track to learn life history, biology, and susceptibility of sampling gear
- The imminence of the threat should dictate whether you attempt to propagate
- There is still very little knowledge on the status and habitats of young suckers, try to determine this
- Flow chart and lessons learned section would be valuable in making future decisions

List of Attendees

Dave Coughlan	Duke Energy
Bob Jenkins	Roanoke College
Mike Masnik	U.S Nuclear Regulatory Commission
Michael Abney	Duke Energy
Ryan Heise	NC WRC
Brena Jones	NC WRC
Katherine MacFadden	NCWRC
Alice Lawrence	USFWS
Elizabeth Osier	SCDNR
David Wilkins	SC Aquarium
Kim Baker	Duke Energy
Bryn Tracy	NC Div of Water Quality
Tom Sinclair	USFWS
Carl Quertermus	GA Wildlife Federation
Mike Swing	Progress Energy
Jason Brown	Progress Energy
John Morrison	Santee Cooper
Forrest Sessions	SCDNR
Scott Lamprecht	SCDNR

Joe Slaughter	Georgia Power
Tom Kwak	NC State University
Patrick Ely	UGA
Rebecca Peterson	UGA
Morgan Raley	NC Museum of Natural Sciences
Wayne Starnes	NC Museum of Natural Sciences
Michael Fisk	NC State University
Tom Bowles	SCEG
Milton Quattlebaum	SCEG
Bob Doby	Duke Energy
Jimmy Evans	Georgia DNR