

**The**  
**Conservation and Restoration of the Robust Redhorse**  
*Moxostoma robustum*

**Volume 4**

**May 2004**

prepared for the

**Federal Energy Regulatory Commission**  
888 First Street, NE  
Washington, DC 20426

prepared by

**M.A. Abney**  
**Georgia Power Company**  
**Environmental Laboratory**  
**Smyrna, Georgia**



## **ACKNOWLEDGEMENTS**

This report was based on the work of many individuals and organizations that form the Robust Redhorse Conservation Committee. The author has attempted to identify cooperating organizations, but not necessarily individuals, where appropriate within the body of this report. Thanks to the hatchery managers and personnel that contributed to the culture of robust redhorse, and also to the organizations that provided funding, services, and materials. The author also thanks the individuals that provided helpful comments and suggestions on a draft of this report.

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# 1. INTRODUCTION

This report is the fourth report in a series of bi-annual reports required by the Federal Energy Regulatory Commission (FERC) license for Georgia Power Company's (GPC) Sinclair Hydroelectric Project (FERC No. 1951). The new license for the Sinclair Project, issued by the FERC on 19 March 1996 (effective date 1 May 1996), required the submission of a report every two years to the FERC. The license stated these reports should document the status of the robust redhorse and provide a determination regarding the adequacy of flow releases in meeting the needs of the robust redhorse.

The original report, titled *Conservation and Restoration of the Robust Redhorse, Volume 1*, was submitted to the FERC in June 1998. Because conservation activities had begun prior to the issuance of the Sinclair license, *Volume 1*, presented detailed information about the rediscovery of the robust redhorse in 1991, the formation of the Robust Redhorse Conservation Committee (RRCC) in 1995, and other significant activities that occurred through April 1998. The second bi-annual report, titled *Conservation and Restoration of the Robust Redhorse, Volume 2*, was submitted to the FERC in April 2000 and was limited to conservation activities that occurred from June 1998 through April 2000. *Conservation and Restoration of the Robust Redhorse, Volume 3*, was submitted to the FERC in May 2002 and was limited primarily to activities that occurred between June 2000 and April 2002.

This report is limited to activities that occurred between April 2002 and May 2004. When appropriate, some information on currently planned activities is presented. The format generally follows that of volume 3. There are more thorough and detailed reports of research projects available from the RRCC and at website, [www.robustredhorse.com](http://www.robustredhorse.com).

The material for this report was gathered from a multitude of sources, including complete and incomplete project reports, RRCC updates, letters, personal communications, and oral presentations (Appendix A). Some basic background information initially presented in previous reports has been included for readers that may be unfamiliar with the robust redhorse conservation efforts.

## 1.1 Sinclair Hydroelectric Project

Sinclair Dam, a 45 megawatt hydroelectric project owned and operated by GPC, was completed in 1952 on the Oconee River near Milledgeville, GA. The dam forms the 15,330 acre Lake Sinclair, a popular fishing and recreation destination in central Georgia (Figure 1). The Sinclair Project is primarily used to provide generation capacity during peak demand periods, and it serves as the lower reservoir for Georgia Power's Wallace Dam pumped storage project.

During the early stages of FERC relicensing in 1991, a rare fish was "rediscovered" in the Oconee River downstream of the Sinclair Project. The fish was eventually identified as the robust redhorse (*Moxostoma robustum*) by several ichthyologists.



Figure 1. State of Georgia showing the location of GPC's Sinclair Hydroelectric Project and major rivers within the Georgia portion of the historic range for the robust redhorse.

## 1.2 Robust Redhorse (*Moxostoma robustum*)

The robust redhorse was originally described in 1870 by master naturalist Edward Cope from specimens collected in the Yadkin River, NC. Unfortunately, Cope's original specimens were lost, and labels were mistakenly applied to another species. During the next 100 years or so, the real robust redhorse was known by only two specimens, collected from the Savannah River, Georgia/South Carolina in 1980 and from the Pee Dee River, North Carolina in 1985. The two existing specimens were believed to belong to an undescribed species of redhorse. The discovery of the Oconee River population of robust redhorse helped to unravel the history of this species.

That discovery occurred in August 1991, when biologists with the Georgia Department of Natural Resources (GA DNR) collected five large, unrecognized suckers from the Oconee River downstream of Sinclair Dam. Several well-known ichthyologists including Dr. Henry Bart (then curator of the Auburn University fish collection), Dr. Byron Freeman, curator of the University of Georgia (UGA) fish collection, and Dr. Robert Jenkins of Roanoke College, Virginia, worked to unravel the mystery. They concluded the five specimens from the Oconee River were the same species as the two existing specimens that had been collected in 1980 and 1985. They further concluded that all specimens belonged to the species originally described by Cope in 1870. The currently accepted historic range consists of southeastern Atlantic slope rivers, extending from at

least the Altamaha River system in Georgia to at least the Pee Dee River system in North and South Carolina.

Subsequent reviews of available information by many agencies and individuals suggested that conservation and restoration actions should begin immediately for this species. Part of the concern centered on the lack of other records for the species, which potentially indicated that a sole remnant population had been rediscovered in the Oconee River. Another issue was that fish collections from the Oconee River were comprised primarily of larger individuals, prompting concerns about a senescing population or some other problems that might be affecting recruitment of robust redhorse. These potential problems included, but were not limited to, artificial flows from power generation, erosion and siltation, and introduced predatory species such as flathead catfish.

## **2. ADMINISTRATIVE ACTIVITIES**

### **2.1 Robust Redhorse Conservation Committee**

The RRCC was formed by the signing of a Memorandum of Understanding (MOU) in 1995. The RRCC was designed as a stakeholder partnership to restore the robust redhorse throughout its former range. The primary goals of the RRCC are to implement research and conservation measures, enhance recruitment in the existing Oconee River population, and re-establish robust redhorse populations in appropriate river systems within the species' former range.

The RRCC is the overall vehicle directing recovery of the robust redhorse, and has determined priority avenues for necessary research and action. Through formal annual meetings and innumerable informal meetings among members and other interested parties, the RRCC has identified impediments to the recovery effort, conducted research related to those impediments, and formulated solutions and implemented conservation actions. The RRCC has also been very effective in publicizing the recovery effort. As originally intended, the RRCC has been the driving force behind the conservation and restoration of the robust redhorse.

Mr. Greg Looney of the U.S. Fish and Wildlife Service (USFWS) succeeded Ms. Terry DeMeo of the UGA, Institute of Government, as the 4<sup>th</sup> Chair of the RRCC in October 2002. His term will expire in October 2004 when Mr. Ross Self of the South Carolina (SC) DNR, approved at the 2003 RRCC annual meeting, will succeed him. Other members of the Executive Committee (Excom) confirmed by the RRCC at the 2003 annual meeting represent GA DNR, SC DNR, North Carolina Wildlife Resources Commission (NC WRC), USFWS, United States Geological Survey (USGS), two representatives from Utility Companies (GPC and Progress Energy), and a representative from Academia.

## Adopted Documents

### **Memorandum of Understanding**

The current MOU's purpose was to establish and describe the RRCC. Approved in 1995, it expires December 31, 2004. The MOU is currently being revised and will be in effect from Jan 1, 2005 to December 31, 2010. Current revisions by the RRCC will be discussed at the 2004 annual meeting and the resulting document sent to signatories for approval. Changes discussed by the Excom include the following:

1. Per request, removal of the Georgia River Network from a Signatory to a Cooperator;
2. Changing of "species" to Evolutionary Significant Units or "ESUs" in the Policies and incorporation of "Preserving genetic integrity as and where appropriate, when possible and as resources allow"; and
3. Minor editorial changes.

### **Robust Redhorse Conservation Strategy**

The original MOU formed the RRCC and provided some general goals, but did not offer details for implementing the conservation effort. The RRCC saw the need to develop an overall guidance document, or roadmap for the project. The Robust Redhorse Conservation Strategy (Strategy) describes the extent of current knowledge of robust redhorse and its distribution, discusses problems facing the species, and lists specific goals and objectives for robust redhorse conservation throughout its historic range. The Strategy also outlines procedures and actions believed necessary to reach those conservation goals and objectives. The Strategy is intended to be a flexible document and the RRCC may revise the Strategy as new information becomes available. An initial version of the Strategy, drafted by Mike Nichols of GPC, was reviewed by RRCC member organizations and was subsequently approved in March 2000 by Scott Hendricks of GPC, then Chair of the RRCC.

The Strategy was updated by Mr. Nichols with new information on the RRCC policy and guidance. It was distributed to several RRCC members for comment, presented to the RRCC, and approved by Mr. Looney on May 6, 2003.

### **Robust Redhorse Conservation Committee: Policies**

The RRCC has developed sufficient information on the robust redhorse and activities have expanded to the point that unifying policies were needed to implement the long- and short-term goals established in the Strategy. The following policies were taken directly from *Robust Redhorse Conservation Committee: Policies*, adopted October 18, 2002, and describe the current understanding and processes for conserving the robust redhorse.

**Goals Policies**

Measurement of Success: RRCC members and collaborators agree to abide by and support its short- and long-term goals and to use RRCC definitions of specific terms related to measuring the success of the restoration effort.

Species and Population-level Management: The RRCC will continue to manage the extant populations of the species as ESUs; newly discovered populations will be evaluated genetically and will be managed in accordance with its ESU status (i.e., new or existing ESU).

**Conservation Policies**

Criteria for Conducting Surveys for Robust Redhorse: Surveys should be conducted to detect the presence of robust redhorse in suitable rivers and habitats prior to the initiation of reintroduction or augmentation efforts. Further, these surveys should be scheduled and organized as described herein.

Propagation and Breeding: When management actions call for the use of cultured offspring, such use should prevent the loss of genetic variability of an ESU and the species as a whole.

Goals and Objectives of the Refugial Population Program: The RRCC supports the continued establishment and maintenance of refugial populations of robust redhorse to safeguard the species against catastrophic losses of ESU in the wild.

Reintroduction Programs and Monitoring: Reintroductions of robust redhorse into a river system from which the species has been extirpated will be conducted according to a well-developed reintroduction plan that includes the assembly and synthesis of relevant information about the river to be stocked, the identification of potential factors that may limit the success of the reintroduction, and reasonable goals and monitoring schedules. The long-term goal of the reintroduction should be the establishment of a self-sustaining population.

Habitat Restoration: The RRCC will promote habitat restoration and protection.

**Administrative Policies**

Decision Making: The RRCC will use a combination of consensus- and vote-based decision approaches to develop and document 'recommendations' and 'decisions' of the RRCC as a whole or of subsets of members to guide implementation of the robust redhorse recovery and management effort and the structure and function of the RRCC.

Executive Committee and Technical Working Groups: The RRCC will elevate the original Technical Advisory Group (TAG) to the level of an Excom. The RRCC empowers the Excom with the day-to-day issues associated with the regional recovery effort and to address regional issues. In addition, the RRCC will form Technical Working Groups (TWGs) and empower them to address local or special interest issues.



Membership to the Robust Redhorse Conservation Committee: Requests to participate in the RRCC shall be made in writing and addressed to the Chair of the RRCC. The letter should include the party's willingness and ability to bring resources to the conservation effort.

Stakeholder Notification of RRCC Recovery Actions: The RRCC supports notifying potentially affected local governments, large landowners, and other major stakeholders prior to undertaking major conservation or management actions and agreements that involve the RRCC as a whole, a subset of members of the RRCC, or individual RRCC members and will provide meaningful opportunities to these groups to give input on the proposed action.

Evaluating and Communicating Threats to RRCC Recovery Efforts: The RRCC will inform all MOU signatories regarding potential actions that threaten recovery efforts so that each signatory can respond appropriately to agents posing threats or to regulatory agencies as needed during comment periods or in a timely manner.

Annual Meetings: The RRCC will dedicate ample time to research and management updates, presentations from guests who share knowledge of similar endeavors, discussions of information provided, and decisions.

Research: The RRCC will take an active role in determining research topics and prioritizing research needs in support of the robust redhorse recovery, without compromising the investigators' ability to fulfill requirements of the funding agent(s) or to pursue independent publication of research findings. In order to base decisions on sound information, the RRCC will require complete, timely, well-written research results that will serve as the scientific basis for its decisions.

Communications within the RRCC: The RRCC Excom and TWGs should communicate activities and action items of the robust redhorse recovery effort to participants, as appropriate.

**Candidate Conservation Agreement With Assurances for the Robust Redhorse:  
Ocmulgee River, Georgia**

One of the primary stated goals for the RRCC is to create additional populations of robust redhorse by introducing the species to rivers within its historic range. In many cases, reintroduction can be successfully accomplished without incident. However, the RRCC recognized that reintroducing an imperiled species could potentially create local problems and negative publicity. In these cases, the RRCC needed a sound approach for effectively handling one of the most critical components of the conservation effort.

One type of approach may be through the use of Candidate Conservation Agreements with Assurances (CCAA). The Final Policy for CCAAs was published by the USFWS in 1999 (64 Federal Register 32726-32736 and 50 C.F.R. §§ 13 and 17). Essentially, CCAAs are meant to promote conservation actions by encouraging partnerships between private entities and state and federal natural resources agencies. Voluntary participants in

such agreements may receive assurances from the USFWS that limit risk, should the target species of that agreement become listed under the Endangered Species Act (ESA).

The Ocmulgee River, a candidate site for reintroduction, provided an opportunity for some members of the RRCC to apply the CCAA policy. The upper reaches of the Ocmulgee River are influenced by generation from GPC's Lloyd Shoals Hydroelectric facility, which recently completed FERC relicensing. During relicensing, minimum flow was increased to enhance aquatic habitat, and a labyrinth weir was constructed to improve dissolved oxygen concentrations in the river.

GPC has invested considerable time and dollars on environmental enhancements to the upper Ocmulgee River and believes these enhancements should also benefit any potential robust redhorse population. However, GPC also believed that a reintroduction of robust redhorse potentially represented some unacceptable level of risk to the Lloyd Shoals facility, if the species was ever federally listed under the ESA. GPC expressed these concerns to GA DNR and the USFWS, and discussions began that ultimately led to a CCAA for the robust redhorse.

Under the CCAA, GPC volunteered to participate in the reintroduction and provide funding for some critical telemetry studies on the reintroduced fish. GPC also agreed to some population monitoring and reporting. In return, GPC received assurances that if the robust redhorse is ever listed under the ESA, and the CCAA has been implemented in good faith by GPC, the USFWS will not require additional land, water, or resource restrictions beyond those that GPC voluntarily committed to under the terms of the original agreement. These assurances include the preservation of the flow regime described in the current FERC license for the Lloyd Shoals Project which expires in 2023. The assurances will be provided through an Enhancement of Survival Permit which will take effect if and when the robust redhorse is federally listed under the ESA. This CCAA is important because it provides additional conservation actions for the robust redhorse while providing some regulatory certainty and operational flexibility to GPC. However, the CCAA might be more important to the overall conservation effort because it provides a working example of how potential reintroductions, or other problems, could be avoided and turned into a positive cooperative effort to benefit the species. It is believed that this CCAA for the robust redhorse was the second CCAA implemented in the United States. It was also the first CCAA to involve an aquatic species and a private company.

## 2.3 Flow Advisory Team and Technical Working Groups

### **Flow Advisory Team for the Oconee River**

The Flow Advisory Team for the Oconee River (Advisory Team) functions under the overall umbrella of the RRCC with some shared memberships and administration. The current members of the Advisory Team are the GA DNR, USFWS, USGS, and GPC. The primary responsibilities of the Advisory Team are to monitor the effectiveness of the negotiated flows for the Sinclair Project for the robust redhorse in the Oconee River. The agreement provides that the Advisory Team may review flow data from the Oconee

River, studies developed by the RRCC, and other pertinent information related to the robust redhorse to help determine if any changes to the negotiated flow agreement are necessary. If studies suggest that flow changes are needed for the Oconee River to improve habitat for the robust redhorse, the Advisory Team may petition the FERC, under consensus of members, with its recommendations. These recommendations would then be subject to appropriate FERC evaluation and approval.

**Negotiated Flow Agreement**

A negotiated flow agreement was finalized in 1995 (implemented June 1996) prior to the submittal of the license application for the Sinclair Project. The negotiated flow agreement, outlined in Table 1 below, was designed primarily to enhance reproductive success of the robust redhorse. Specifically, the flow agreement provides: 1) significant increases in minimum flows throughout the year, 2) a significant increase in flow stability throughout the year, and 3) run-of-river flows during spawning and early rearing periods for robust redhorse. Although primarily directed at robust redhorse, anadromous species were also considered during the formation of the flow agreement.

Table 1. Negotiated flow agreement for the Sinclair Hydroelectric Project.

MONTH	FLOW	OPERATION
Dec - Feb	500 cfs minimum	normal peaking
Mar - Apr	1500 cfs minimum	modified peaking <sup>a</sup>
May	run-of-river	
Jun <sup>b</sup> - Nov	700 cfs minimum	normal peaking

<sup>a</sup> modified peaking refers to the number of units (1 or 2) utilized, depending on inflow into the reservoir  
<sup>b</sup> from June 1-10, units are operated run-of-river unless electric system demands necessitate normal peaking operation. The agreement also provides for an increase in generation (from 5 to 7 days per week) to reduce extended low-flow periods that previously resulted from little weekend generation.

**Flow Suitability**

The Advisory Team met on March 12, 2004, following the RRCC Excom meeting, reviewed the responsibilities of the Advisory Team and the following:

1. Data were reviewed that were previously presented during the RRCC October 15-16 annual meeting (*Oconee and Ocmulgee Flows - 2003: effects of reservoir operation*, M.C. Nichols, 2003). Under the licensed flow regime, high spring flows are passed during March and April with a 1500 cfs minimum, run-of-river flows are provided during May and if possible until June 10, and 700 cfs or inflow provided from June through November. Under high and low flow conditions during the summer, as seen in 2003 and 2002, respectively, run-of-river flows may extend to a substantial portion of the summer period;
2. The need to complete the final reports for robust redhorse larval fish densities in the Oconee River from 1998 forward and the schedule for doing so was discussed;

3. Weyers et al. (2003) was discussed. This paper found that fluctuating flows "can have negative effects on the growth and survival of larval catostomid suckers". As run-of-river flows are currently provided during the incubation and emergence period in the Oconee River, this finding appears to have little direct bearing on the current flow regime from Sinclair;
4. Changes in the river path were noted on a series of satellite images superimposed on 1962 quad sheets of the Oconee River from Sinclair to Dublin.

Correspondence following the meeting recommended a review of the Sinclair Relicensing Technical Studies. They provide additional information useful in interpreting temporal changes in the Oconee River channel morphology ("*Relicensing Technical Studies: Hydrologic Studies and Hydraulic Modeling Report*", Sinclair Hydroelectric Project FERC Project No. 1951).

As with prior meetings the relationships between temperature, flow regime, and reproductive success in the river are still unclear. GPC still maintains temperature monitors at three locations in the Oconee River and two in the Ocmulgee River during spring months. It is expected that this information will help to better understand environmental cues governing robust redhorse spawning in the Oconee River, which, in turn, will enhance efficiency of broodfish collection and propagation efforts. These data should also compliment ongoing recruitment studies and help to define any potential relationships between the flow regime at Sinclair Dam and reproductive success of robust redhorse.

At this point the direct, and potentially indirect, relationship between flows from Sinclair Dam and the robust redhorse is unclear. The general opinion of the Advisory Team is that the evidence provided by current research and monitoring of robust redhorse does not indicate that a modification of the current flow agreement is necessary.

#### **Habitat TWG**

Formed at the 2002 RRCC annual meeting, the purpose of the Habitat TWG is to oversee robust redhorse habitat restoration activities. The Habitat TWG is responsible for developing guidance that both prioritizes sites for restoration and facilitates suitable habitat restoration activities that can be applied to specific individual river basins. The guidance document, or Habitat Restoration Management Plan, was presented at the 2003 RRCC annual meeting and is currently in review. The document is expected to be revised by the Habitat TWG and adopted by the RRCC on a yearly basis. With the assistance of the Habitat TWG, the respective basin TWG's will be able to select sites, prepare proposals, secure funding, and conduct effective restoration activities within their basin.

#### **Information Technology TWG**

Formed at the 2003 RRCC annual meeting, the purpose of the Information Technology TWG is to create a master database of information, including GIS localities, beginning with work started by Dr. Robert Jenkins. The database will be maintained at the USFWS

Warm Springs National Fish Hatchery by Ms. Jaclyn Zelko, approved chair by the 2003 RRCC annual meeting. River basin data managers will support the TWG.

#### **Broad (SC) TWG**

Formed at the 2002 RRCC annual meeting, the Broad River (SC) TWG submitted a management plan to the RRCC Excom in March 2004. It is currently in review.

#### **Broad (GA) and Savannah TWG**

Formed at the 2002 RRCC annual meeting, there are, currently, not enough data for the TWG to prepare a management plan.

#### **Ocmulgee TWG**

Formed at the 2002 RRCC annual meeting, the Ocmulgee River TWG will develop a management plan in 2004.

#### **Oconee TWG**

Formed at the 2002 RRCC annual meeting, the Oconee River TWG is producing a management plan. A draft is currently being reviewed by TWG members and will be submitted to the RRCC in mid-2004.

#### **Ogeechee TWG**

Formed at the 2002 RRCC annual meeting, the Ogeechee River TWG will develop a management plan in 2004.

#### **Yadkin-Pee Dee TWG**

Formed at the 2002 RRCC annual meeting, the Yadkin-Pee Dee River TWG is surveying for spawning habitat and monitoring water quality to collect data on the system. The TWG will begin development of a Yadkin-Pee Dee Management Plan in 2004.

### **3. ROBUST REDHORSE CONSERVATION STATUS**

#### **3.1 Oconee River Population**

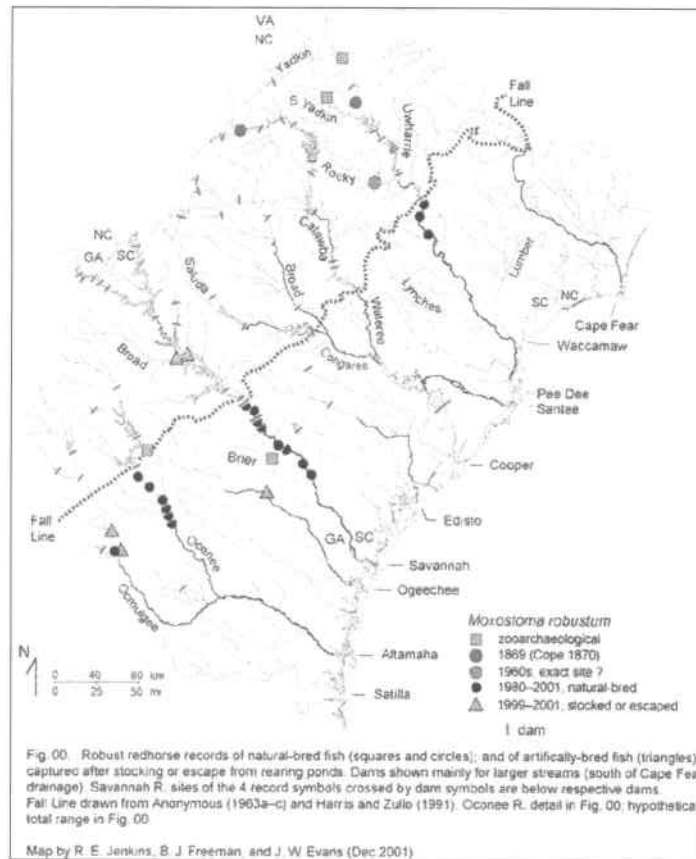
Most information on the status of the Oconee River population is based on electro-fishing catch during spring broodfish collection from 1994 to 2004. During broodfish collection and other studies on the Oconee River between 2002 and 2004, catch rates of adult fish decreased from previous years, and no juveniles or young-of-year were collected. These data indicate a decline in electro-fishing catch rates and a general shift in the length frequency of the catch toward larger individuals. The large mean length of captured individuals and the apparent lack of juvenile fish suggest low recruitment rates of robust redhorse and an aging population within the last decade or two. The amount of recruitment necessary to maintain a viable population of this long-lived species in the Oconee River is unknown. High flows exceeding 8000 cfs during the spring of 2003 made collection efforts difficult, making comparisons among other year's collection results difficult. Additionally, the high flows hampered spawning adult collection efforts as only three robust redhorse and no spawning females were collected. No propagation

was conducted as a result. Additional attempts will occur during May and June of 2004. A total of 240 robust redhorse from six year classes have been stocked in the Oconee River thus far and an additional 30 will be stocked during the spring of 2004.

### 3.2 Other Populations

For the first several years during the RRCC's existence, it was commonly thought that the Oconee River might contain the only remaining population of robust redhorse. This seemed reasonable, considering the extensive survey work on southeastern rivers. It also seemed unlikely that a fish as large as adult robust redhorse could be missed during sampling. However, habitats associated with adult robust redhorse in the Oconee River (swift, moderately deep waters with accumulations of woody debris) are difficult to sample effectively. The robust redhorse has also proven somewhat cryptic and difficult to collect even in pond environments.

The RRCC has organized intensive surveys on several rivers within the believed historic range of the robust redhorse and more are planned. Many of these surveys have documented other existing populations shown in Figure 2 below. This map, created by Dr. Robert Jenkins, Dr. Byron Freeman, and James Evans (GA DNR) in December 2001, partially documents the large effort of the RRCC to increase knowledge and conservation actions for the robust redhorse throughout the historic range of the species.





### **Broad (SC) River**

The present and historic distribution of robust redhorse across the piedmont and upper coastal plain of eastern Georgia and the Carolinas suggest that the species could have once been found in the Broad River, SC (and GA). Efforts, to date, have collected no robust redhorse as plans continue to reestablish a self-sustaining population. Plans are being developed for possible broodfish collection and propagation from the Savannah River population for introduction into the Broad River (SC).

### **Broad (GA) and Savannah Rivers**

Four year classes (32,189 individuals) were stocked in the Broad River, GA, between 1995 and 1998 from the Oconee River stock. Although populations are not expected to mix, due to Clark Hill Reservoir, stocking halted after the incidental collection of a single robust redhorse from the native Savannah River population in October 1998.

Spawning locations and spawning robust redhorse have been observed near Augusta. Collection attempts in spring and summer of 2003 were unsuccessful due to high flows, but spring 2004 attempts have collected multiple broodfish and observed spawning aggregations of 30-40 individuals.

### **Ocmulgee River**

The implementation of the CCAA for the robust redhorse paved the way for the 2002 reintroduction of 6,692 robust redhorse from six year classes into the Ocmulgee River. The CCAA describes goals of the project, responsibilities of the parties to the agreement, provides a timeline and suggested measures of progress toward the goals of the reintroduction.

Three robust redhorse were collected in 2003 with river flows approaching 3000 cfs. All were suspected of being stocked fish. As agreed upon in the CCAA, two telemetry studies learned more about the species' dispersal following stocking, movement patterns and habitat preferences. The completed studies are summarized in the next section.

The implementation schedule under the CCAA will be shifted back one year as provided for in the adaptive management provisions of the CCAA. Survey efforts in 2004 will focus on documenting the presence and growth of introduced robust redhorse. A successful propagation effort in 2004 from the Oconee population is necessary for further stocking.

The RRCC oversaw restoration improvements to Wise Creek Recreation Area in the Oconee National Forest. Thanks to a grant from the National Fish and Wildlife Foundation, 200 feet of riverbank was stabilized that was actively eroding into the river. The improvements should reduce soil erosion into the river which damages robust redhorse spawning habitat by covering up gravel bars. Many other species and the public will benefit from the improved habitat.

### Ogeechee

Since 1998, a total of 38,795 robust redhorse from 6 year classes have been stocked into the Ogeechee River. Surveys in the fall of 2003 collected 22 individuals.

### Yadkin-Pee Dee

Collection efforts, to date, have captured four fish. Efforts will continue to confirm the population status.

## **3.3 Research Summary**

### Telemetry Studies

#### Ocmulgee River

Results for two telemetry studies in the Ocmulgee River were reported in 2003 from tracking a total of 60 telemetered fish beginning in 2002. One study was conducted by Dr. Byron Freeman using sonic transmitters and stationary monitors. Approximately 60% of the introduced fish with telemetry remained above the low head, Juliette Dam, and the remainder traveled downstream but appeared to remain above the confluence with the Oconee River. The second study was conducted by Dr. Cecil Jennings (USGS) using radiotelemetry and periodically tracking individual fish throughout the study reach. Approximately 66% of the introduced fish with radio-telemetry remained above Juliette Dam and the remainder traveled downstream below the dam. The furthest distance traveled downstream was 115 km.

#### Savannah River

A report by Mr. Tim Grabowski and Dr. Jeff Isely, Clemson University, provided telemetry results for adult robust redhorse in the Savannah River. The telemetered fish exhibited movement of greater magnitude (180 km) than found for younger fish tracked in the Ocmulgee River. Fish were significantly more active in the spring with no sex or size effect on total movement. The fish are mostly sedentary in deep water with swift currents associated with woody debris. As of late May, 2004, there are 21 radiotagged individuals in the Savannah River, four of which were seen in spawning aggregations.

### Other studies

Because detailed research summaries are contained in several other reports available from the RRCC, this report will only provide a short description of the research topics. Agendas from the 2002 and 2003 annual meetings of the RRCC are attached to provide the reader with a better idea of the full range of topics under consideration by the RRCC (Appendices B and C).

One of GPC's primary concerns is the relationship between flows at Sinclair Dam and the robust redhorse population in the Oconee River. For this reason, GPC continued to provide funding for reproduction and recruitment studies in the Oconee River to detect changes in reproductive success and telemetry studies to address movement patterns in the Ocmulgee River. GPC is also collecting temperature data from several locations in the Oconee River (and Ocmulgee River) to help understand any potential relationships



between river flow, temperature, and spawning and reproductive success.

In general, research has followed in a similar direction as previous years, building on information gained in initial projects. During the early years of robust redhorse conservation, the capture of broodfish and propagation techniques for fingerling production were primary research interests. As these techniques were developed, some of the focus shifted to enhancing growth, survival, and production in hatchery ponds. Management of genetics in hatchery produced fish is still an important topic as the RRCC supports the use of propagation and stocking as a viable conservation option.

The conservation effort has advanced in both complexity and geographic scope, and the RRCC has observed long-term (several years) survival and good growth of introduced fish. This success, and a few incidental captures of native adult robust redhorse in previously sampled systems, highlighted the need to address potential concerns about mixing hatchery fish with wild populations. In response, the RRCC focused on intensive status surveys in several rivers in Georgia and the Carolinas to hopefully detect additional populations. Genetics research and characterization of these populations is an important topic because there are some genetic distinctions in robust redhorse populations from different river systems.

Balancing reintroduction and establishment of additional populations with genetic concerns is a primary issue for the RRCC. The RRCC has responded by inviting several genetics experts from around the United States to speak and participate in annual meetings, and to provide advice on this subject. Researchers have also examined genetics management in other conservation programs and provided reports and advice to the RRCC. The question of whether to manage for species or individual populations is highly controversial and is one that the RRCC intends to handle properly.

The Altamaha River, formed by the confluence of the Oconee and Ocmulgee Rivers, was identified as one of several Georgia rivers that could potentially contain native robust redhorse populations. Surveys conducted in 2000 and 2002 found no robust redhorse (Evans 2003). The RRCC is also interested in assessing the presence of robust redhorse in the Canoochee River with possible reintroduction efforts in the future. These efforts will take place in conjunction with the Fort Stewart military base.

There is also much interest in habitat preferences and habitat conservation. The RRCC has directed research to identify important habitats and is exploring potential measures to maintain or enhance these habitats. This includes a study on habitat selection by juvenile robust redhorse in an experimental mesocosm. The laboratory system (16 x 4 feet) includes bends, straight-away, and backwater habitats. Researchers have tested the system successfully on other sucker species and are waiting for the collection of robust redhorse. Other research proposals were reviewed and ranked in order of prioritized research needs. Researchers are waiting for the collection of robust redhorse.

Harris et al. (2002) published an article in the *Journal of Fish Biology* resolving phylogenetic relationships among lineages with the *Moxostoma* and 'Scartomyzon' clade.

Published in the Transaction of American Fishers, Weyers et al. (2003) concluded that fluctuating flows from hydropower generation results in increased mortality of larval suckers, including robust redhorse. Discussed by the Advisory Team, this finding appears to have little direct bearing on the current flow regime from Sinclair since run-of-river flows are currently provided during the incubation and emergence period in the Oconee River. In addition, run-of-river flows have been extending into mid-summer during drought periods (1998-2002) and years with high flows (2003).

#### **4. WHERE DO WE GO FROM HERE?**

Much progress has been made toward the original goals of maintaining and enhancing the Oconee River population and identifying other existing populations. Robust redhorse fingerlings, produced with techniques developed by the RRCC, have been stocked in rivers to establish additional populations. In most cases, monitoring has indicated successful survival to at least several years of age.

Now that the RRCC is confident that robust redhorse can be introduced into the wild and survive, there are many new questions relating to these reintroduction efforts. One question is whether it is more efficient to stock young Phase I fingerlings or more advanced Phase II fish. Some believe that Phase II fish may be better able to survive the predation pressures of natural rivers and may offer a better chance of establishing populations. However, larger numbers of Phase I fish can be produced in a more timely fashion with less expense and with greater initial survival rate than Phase II. The RRCC is monitoring populations to see if these introduced fish will make spawning attempts, and if that spawning will be successful.

Other questions relate to reintroduction strategies, and identifying rivers or river reaches that should have high priority. The implementation of the CCAA has been a boost to conservation efforts as one example of how to successfully and positively deal with problematic issues and conservation actions that cross state and jurisdictional boundaries. The appropriate management of genetics issues will also continue to be a priority for the RRCC.

Another difficult issue will be habitat management and possibly restoration. As we learn more about the population dynamics of robust redhorse and what types of habitat may be required for various life stages, it is anticipated that the RRCC will work to address habitat issues.

Overall, the Oconee River population appears stable, and still serves as a source of broodfish for fingerling production. Investigations into population dynamics continue. Three populations have been created through the introduction of Oconee River population offspring: Broad River; Ogeechee River; and Ocmulgee River, GA. An existing native population of unknown size has been detected in the Savannah River, GA, and several individuals collected from the Pee Dee River, NC, may indicate the presence of a third native population.

## APPENDIX A

### **ROBUST REDHORSE LITERATURE OF INTEREST (Partial Listing)**

*Many of these publications were used as references for this report.*

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Jennings, C.A., J.L. Shelton, and G.L. Looney. 1998. Culture techniques and ecological studies of the robust redhorse: assessment of reproductive and recruitment success and incubation temperatures and flows. Georgia Coop Fish and Wildlife Research Unit, University of Georgia, Athens, GA. Final report to Georgia Power Company.

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#### Popular Press

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“A Splashy Comeback” by Stephen Sawicki. *Animals*. Winter 2002.

APPENDIX B

2002 RRCC Annual Meeting Agenda

AGENDA – 2002 ANNUAL MEETING ROBUST REDHORSE CONSERVATION  
COMMITTEE Hickory Knob State Resort Park – McCormick, South Carolina

**OCTOBER 15, 2002**

6:30 pm Reception

**OCTOBER 16, 2002**

8:00 am Welcome – Paul Sandifer, Director SC DNR & Val Nash, Chief of Fisheries  
SC DNR

8:15 am Opening Statements and Introductions – Terry DeMeo, RRCC Chair

**ADMINISTRATIVE POLICIES ON COMMITTEE STRUCTURE AND  
FUNCTION**

Policy 1: Decision Making – Facilitated

Policy 2: Executive Committee and Technical Working Group – Facilitated

Policy 3: Membership to the RRCC – Facilitated

10:00 am Break

Policy 4A: Stakeholder Notification of RRCC Recovery Actions – Facilitated

Policy 4B: Evaluating and Communicating Threats to RRCC Recovery

Efforts – Facilitated Policy 5: Annual Meetings and Research – Facilitated

12:00 pm Lunch

**BIOLOGY OR CONSERVATION POLICIES**

Policy 6: Measurement of Success – Restoration – Facilitated Update on  
Genetics Research – Brady Porter, UGA Policy 7: Species- and Population-  
Level Management – Facilitated Age and Growth of Robust Redhorse by  
Assessment of Opercles and Capture Database – Bob Jenkins, Roanoke  
College Update on Sr/Ca Ratios in Robust Redhorse Otoliths – Dave  
Coughlin, Duke Power Company and Fred Andrus, UGA

2:00 pm Break

**MANAGEMENT POLICIES**

Policy 8: Criteria for Conducting Surveys for Robust Redhorse – Facilitated

Policy 9: Propagation and Breeding – Facilitated Policy 10: Goals and

Objectives of the Refugial Population Program – Facilitated Policy 11:

Reintroduction Programs and Monitoring – Facilitated Policy 12: Habitat

Restoration – Facilitated

6:30 pm Dinner: *Biology and Conservation of the Copper Redhorse (Moxostoma  
hubbsi) Endemic to the Montreal Region of Quebec*, Nathalie Vachon,  
FAPAQ (Société de la faune et des parcs du Québec)

**AGENDA – 2002 ANNUAL MEETING ROBUST REDHORSE CONSERVATION  
COMMITTEE Hickory Knob State Resort Park – McCormick, South Carolina**

**October 17, 2002**

8:00 am Commence

**RIVER BASIN POLICIES**

**Broad River, South Carolina**

Robust Redhorse Restoration Proposal – Forrest Sessions, SC DNR Update on  
Surveys of the Congaree and Wateree Rivers – Scott Lamprecht, SC DNR  
Future Status Survey Needs/Priorities – Discussion Policy 15: Broad River,  
South Carolina Management Plan – Facilitated

10:00 am Break

**Oconee River, Georgia**

Reproduction and Recruitment Success in the Oconee River – Cecil Jennings,  
USGS Temperature Data – Scott Hendricks, Georgia Power Company  
Evaluation of Spawning Aggregates at Avants – Bud Freeman, UGA  
Broodfish Collection Effort – Jimmy Evans, GA DNR Spawning Results and  
Fry Distribution – Greg Looney, USFWS Diffuser Systems in Hatchery  
Ponds, Installation and Water Quality – Jimmy Evans, GA DNR Future Status  
Survey Needs/Priorities – Discussion Policy 13 - Oconee River, Georgia  
Management Plan – Facilitated

**Savannah River, Georgia and South Carolina**

Broodfish Collection Effort – Ross Self, SC DNR Spawning Aggregates,  
Habitat Observations, Dates, Temperature – Jeff Isely, USGS Plans for Fish  
Passage Structures – Alice Palmer, US FWS Telemetry and Population  
Estimates – Jeff Isely, USGS Future Status Survey Needs/Priorities –  
Discussion Policy 14: Savannah River Management Plan – Facilitated

12:00 pm Lunch

**Pee Dee River, North Carolina and South Carolina**

Drought Condition Update – Danielle Pender, NC WRC  
Status Survey Effort – John Crutchfield, CP & L  
Summary of Pee Dee Fish Genetic Analysis – Brady Porter, UGA  
TWG Update – John Crutchfield, CP & L  
Future Status Survey Needs/Priorities – Discussion  
Policy 16: Pee Dee River Management Plan – Facilitated



**AGENDA – 2002 ANNUAL MEETING ROBUST REDHORSE CONSERVATION  
COMMITTEE Hickory Knob State Resort Park – McCormick, South Carolina**

**Ocmulgee River, Georgia**

CCAA Signing and Stocking – Terry DeMeo, UGA  
Telemetry Evaluation using Radio Tags – Cecil Jennings, USGS  
Telemetry Evaluation using Sonic Tags – Bud Freeman, UGA  
Habitat Alterations and Fish Passage Plans – Alice Palmer, US FWS  
Habitat Restoration Update – Dana Poole, Georgia River Network  
Future Status Survey Needs/Priorities – Discussion  
Policy 17: Ocmulgee River Management Plan – Facilitated

2:00 pm Break

**Altamaha River, Georgia**

Status Survey Effort – Jimmy Evans, GA DNR Future Status Survey  
Needs/Priorities – Discussion The Altamaha Georgia's Watershed: A Radio  
Documentary, Georgia Sea Grant, UGA Policy 18: Altamaha River  
Management Plan – Facilitated

**Ogeechee River, Georgia**

Status Survey Effort – Jimmy Evans, GA DNR  
Future Status Survey Needs/Priorities – Discussion  
Policy 19: Ogeechee River Management Plan – Facilitated

**Broad River, Georgia**

Study to Monitor Pump/Storage Activities Update – Cecil Jennings, USGS  
Policy 20: Broad River, Georgia Management Plan – Facilitated

6:30 pm Dinner: *The Species of Redhorses and Jumprocks – Names, Ranges,  
Taxonomic Problems – A Pictorial Tour*, Bob Jenkins, Roanoke College

**October 18, 2002**

8:00 am Commence

**CONSERVATION STRATEGY REVISIONS – DISCUSSION  
STOCKING SCENARIO for FALL 2002 and SPRING 2003 – DISCUSSION**

**ANNOUNCEMENTS and BUSINESS**

Update on Greg's Replacement and Coordinator's Position – Jay Troxel, US FWS  
CINDY Award for Robust Redhorse Video – Jimmy Evans, GA DNR  
Review 2001 and 2002 Work Items – Terry DeMeo, UGA  
Prioritize Research and Work Items for 2003 – Facilitated  
Location and Dates for 2003 Annual Meeting – Discussion

12:00 pm Adjourn

APPENDIX C

2003 RRCC Annual Meeting Agenda

## Agenda

### 9<sup>th</sup> Annual Robust Redhorse Conservation Committee Meeting

**October 14-16, 2003**

*Hickory Knob State Park, SC*

Goals

**At the end of this meeting, the RRCC will have:**

- Developed A Greater Cohesion Among the Membership
- Become Current with the Last Year's Research Efforts
- Been Apprised of 2003 Collections and Surveys
- Refined the MOU
- Identified Interim Milestones and Measures for Achieving the RRCC Goal
- Reviewed and Re-prioritized the Research Agenda
- Created an Action Plan for 2003-2004

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## Agenda

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**October 14, 2003**

**5:30 p.m.** "Get Together"  
*(Ross Self's Cabin at Hickory Knob State Park)*

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## October 15, 2003

- 8:00 a.m. Coffee**
- 8:15 a.m. Welcoming Remarks and Introductions**
- Greg Looney, *Chairman – RRCC*
  - All participants to introduce themselves with a few short thoughts (less than one minute) on who they are, the organizations and constituencies they represent and why participating in a stakeholder group is important for ensuring the future of the Robust Redhorse
- 9:00 a.m. Orientation to the Annual Meeting**  
*Adam R. Saslow – President Consensus Solutions, Incorporated*
- Role Of The Facilitator
  - Materials Provided in your Folders
  - Review Of The Agenda
  - Code of Conduct (Including Discussion And Adoption Of The Decision Rule)
- 9:30 a.m. Vice Chair Election**
- 9:45 a.m. Discussion of Revisions to the MOU**  
Reflecting on 2002 discussions, participants will discuss the need for revision to elements in the MOU including:
- Should "species" be changed to "ESU" to reflect the wording in the Policies?
  - Should "develop captive broodstock" be eliminated from the MOU?
- 10:15 a.m. Break**
- 10:30 a.m. Research Update**
- Oconee River Recruitment - *Cecil Jennings*
  - Robust Redhorse Identification Key – *Stuart Carlton*
  - GIS database – *Alice Palmer*

- Jenkins Excel Spreadsheet to FileMaker Pro/Access – *Jaci Zelco*
- Establishment of Computerized Inventory of Cryopreserved Sperm – *Jaci Zelco*
- Savannah River Research - *Tim Grabowski*

**Noon      Lunch**

**1:00 p.m.      Research Update (continued)**

- Oconee Recruitment – *Cecil Jennings*
- Back Water Holding Area Study – *Cecil Jennings*

**1:45 p.m.      TWG Reports**

- Habitat TWG – *All TWG Members*
- Oconee TWG – *Jimmy Evans*
- Yadkin-Pee Dee TWG – *Dave Coughlan*

**3:00 p.m.      2003 Collections, Surveys and Status<sup>1</sup>**

- Oconee River
  - Temperature data and project operation – *Mike Nichols*
  - Collections – *Jimmy Evans & Jaci Zelco*
- Ocmulgee River
  - Temperature Data and Project Operation – *Mike Nichols*
  - Surveys – *Mike Nichols & Jimmy Evans*
- Savannah River –*Ross Self*
- Broad River, SC –*Ross Self*
- Walton SFH – *Jaci Zelco*
- Refugial populations – *Jimmy Evans*
- Stocking History – *Jimmy Evans*
- Oconee River Status – *Jimmy Evans*

**5:30 P.M.      Adjourn**

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<sup>1</sup> An afternoon break will be taken on an as needed basis

## October 16, 2003

- 8:00 a.m. Coffee**
- 8:15 a.m. Recap of Yesterday's Events**
- Greg Looney, - *Chairman, RRCC*
  - Adam R. Saslow - *President Consensus Solutions, Incorporated*
- 8:30 a.m. Research Agenda**
- Review Of Current Research Needs Document
  - Discussion Of Research Goals (in light of the above)
  - Discussion Of Current Research Priorities
- 10:15 a.m. Break**
- 10:30 a.m. Miscellaneous Issues**
- Ocmulgee Bank Stabilization Project – *Liz Caldwell*
  - Web Site – *Terry DeMeo-King*
- 11:30 a.m. Evaluation of Progress and Development of Interim Milestones and Measures**
- Noon Lunch**
- 1:00 p.m. Evaluation of Progress and Development of Interim Milestones and Measures (continued)**
- 2:00 P.M. Wrap Up and Scheduling of the 10<sup>th</sup> Annual RRCC Meeting**
- 2:30 P.M. Adjourn**

APPENDIX D

October 27, 2003 News Release

For Immediate Release  
October 27, 2003

For more information:  
Dana Skelton  
Georgia River Network  
706-549-4508

## **Wise Creek Recreation Area Receives Improvements**

The Wise Creek Recreation Area in the Oconee National Forest is currently receiving improvements thanks to a grant from the National Fish and Wildlife Foundation that provides stabilization of 200 feet of riverbank that is actively eroding into the river adjacent to the public canoe launch. In addition, road improvements are being made to the Forest Service roads that lead to the site.

The site was selected to receive improvements by the Robust Redhorse Conservation Committee which is a committee of federal and state agencies, universities, corporations and non-profits working to restore the habitat of the Robust Redhorse, (*Moxostoma robustum*). The improvements should reduce soil erosion into the river which ruins the spawning habitat for the fish by covering up the rocky bottom of the river with sediment. Many other species will benefit from the improved habitat.

The Robust Redhorse is a sucker historically found in the southeast from the Pee Dee River in North Carolina to Georgia's Altamaha River. Described in 1869, the status of the fish remained uncertain for over 100 years until it was rediscovered in the Oconee River in 1991. Georgia DNR has released several thousand hatchling reared Robust Redhorse fingerlings into the Ocmulgee River between Lloyd Shoals Dam and Juliette. Movement patterns and habitat use are being monitored using radio telemetry.

Members of the Robust Redhorse Conservation Committee that have made special efforts to improve this particular site include Georgia River Network, University of Georgia, Department of Natural Resources, United States Forest Service, and Georgia Power.

Liz Caldwell, a U.S. Forest Service employee on the Oconee District and member of the Robust Redhorse Conservation Committee, says of the project, "This is a small start in improving water quality as well as a collaborative movement toward Watershed Restoration. We hope that our publics and partners will continue to support these projects in the future."

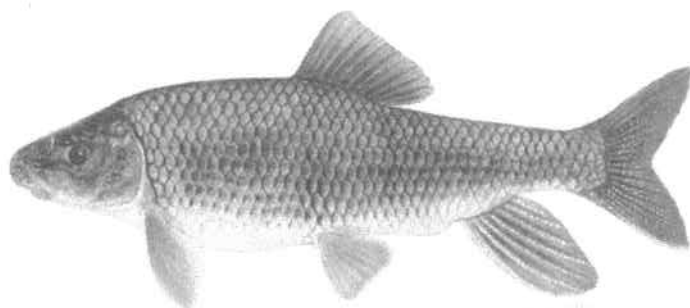
Bank restoration work will be completed by October 31 with the final road improvements occurring shortly thereafter. Signage will be placed at the site to explain the project. For more information about the Robust Redhorse, visit [www.robustredhorse.com](http://www.robustredhorse.com).



APPENDIX E

Robust Redhorse Fact Sheet

# Robust Redhorse Fact Sheet



## The Mystery Fish

The robust redhorse (*Moxostoma robustum*) is a large, long-lived member of the redhorse sucker family. Adults can reach 30 inches in length and weigh up to 17 pounds, although the average length in sample populations is 25 inches and the average weight is 9 pounds. The maximum known age is 27 years. The fish has a thick, robust body with rose-colored fins and a fleshy lower lip.

The robust redhorse was discovered in the Yadkin River North Carolina and first described by Edward Cope in 1869. Yet the fish remained a mystery, unknown to scientists until individuals were captured in the Oconee River, Georgia in 1991. Historically, the robust redhorse was abundant in large Atlantic Slope rivers from the Altamaha River in Georgia to the Pee Dee River in North Carolina. Wild populations are now known to exist in the Ocmulgee and Oconee rivers (Georgia), the Savannah River (Georgia/South Carolina), and the Pee Dee River (North Carolina). Small populations have been established by stocking in the Ocmulgee, Broad, and Ogeechee rivers in Georgia.

## Robust Redhorse Conservation Committee

The Robust Redhorse Conservation Committee (RRCC) was created in 1995 to improve the status of the species throughout its former range. The RRCC is a cooperative, voluntary partnership formed under a Memorandum of Understanding (MOU) between state and federal resource agencies, private industry, and the conservation community. RRCC members to the MOU include:

GA Department of Natural Resources  
SC Department of Natural Resources  
NC Wildlife Resources Commission  
US Fish and Wildlife Service  
US Army Corps of Engineers  
USGS - Biological Resources Division  
US Forest Service

Georgia Power Company  
Progress Energy  
Duke Power Company  
South Carolina Electric and Gas Company  
Georgia Wildlife Federation  
South Carolina Aquarium

In addition to the signatory members, the North Carolina Museum of Natural History and the Georgia River Network are cooperating members. As well, many university research facilities participate as affiliate members.

## Threats to the Species' Future

While much has been learned about the fish since its discovery, many questions about its habitat, life history, and threats to its survival remain. The robust redhorse is difficult to sample and may be easily overlooked or misidentified as a closely-related and more common fish. Non-spawning adults prefer deep, moderately swift areas of the river, often near woody debris. Spawning occurs over clean, shallow gravel deposits in swift current. Adults feed on bivalves, including the asiatic clam (*Corbicula*) and have molariform pharyngeal teeth to crush shells.

Threats to the species' future are believed to include:

- Limited range of known populations;
- Low rate of recruitment to the population;
- Predation from the nonnative flathead and blue catfish;
- Reduced water quality from erosion resulting from land disturbances; and
- Habitat loss and disruption of spawning migrations resulting from dams and impoundments.

## Partnership Accomplishments

The RRCC is currently facilitating recovery efforts and conservation measures by conducting research to answer scientific questions and address management needs including:

- Early life history, population dynamics and genetics research,
- Supplemental breeding and reintroduction programs, establishment of refugial populations, and field surveys for other populations, and
- Educational efforts on the fish, its habitat and the wonders of the natural world.

In addition, the RRCC has devised a Conservation Strategy that establishes short- and long-term conservation goals and management actions and has developed Policies that describe the current understanding of the robust redhorse and the processes under which the partnership operates.

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If you believe you have seen or captured a robust redhorse or want more information, contact:

Jimmy Evans, Fisheries Section  
Georgia Department of Natural Resources  
1014 Martin Luther King Boulevard  
Fort Valley, Georgia 31030  
478-825-6151  
[jimmyevans@cstel.net](mailto:jimmyevans@cstel.net)

Ross Self, Freshwater Fisheries Section  
South Carolina Department of Resources  
Post Office Box 167  
Columbia, South Carolina 29202  
803-734-3808  
[rself@scdnr.state.sc.us](mailto:rself@scdnr.state.sc.us)

Ryan Heise, Nongame Section  
North Carolina Wildlife Resources  
Commission  
201 Trillingham Lane  
Cary, North Carolina 27513  
919-462-9390  
[ryan.heise@earthlink.net](mailto:ryan.heise@earthlink.net)

John Crutchfield,  
Harris Energy and Environment Center  
Carolina Power and Light Company  
3932 New-Hill Hollerman Road  
New Hill, North Carolina 27562  
919-362-3557  
[john.crutchfield@cplc.com](mailto:john.crutchfield@cplc.com)