RESTORATION STATUS OF THE ROBUST REDHORSE

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Abstract. In 1995, a public and private cooperative effort was initiated to restore the robust redhorse to its historic range. The participants banded together as the Robust Redhorse Conservation Committee. The committee holds an annual meeting to review the progress that has been made and prioritize its efforts for the next year. This paper summarizes a major session at the committee's last meeting, including (1) reviewing the progress that has been made to date, (2) summarizing what has been learned about the species, (3) reviewing the ultimate restoration goals, and (4) prioritizing the efforts for the future.

INTRODUCTION

The robust redhorse was once found in large to medium Atlantic slope rivers in North Carolina, South Carolina and Georgia (Figures 1 and 2). Edward Cope first documented this species in 1870 in the Yadkin River in North Carolina. Population levels declined and the species disappeared from the scientific record in the late 1800's. In 1991, several fish from the Oconee River in central Georgia were identified as robust redhorse, effectively rediscovering a species (RRCC, 2005).

A public/private cooperative effort was initiated the following year to restore the species to its historic range. In 1995, the participants formally banded together under a Memorandum of Understanding as the Robust Redhorse Conservation Committee. The group includes Federal and State natural resource agencies, power companies, university research groups, and conservation groups. As the members gathered for the tenth time last October as a formal committee, they reviewed what they had accomplished and set their course for the coming years.

Figure 1 -- Robust Redhorse
(Photo courtesy of Bud Freeman)

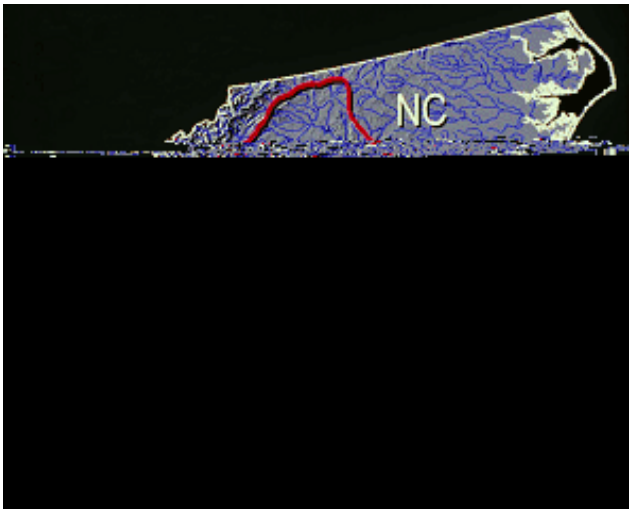

Figure 2 -- Historic Range
(Map courtesy of David Coughlan)

WHAT HAS BEEN ACCOMPLISHED

Life History

When the robust redhorse was rediscovered, nothing was known about its life history. Assumptions could be made based on its taxonomic similarities to other species of suckers, but the environmental tolerances and preferences of the species were not known. Since 1991, much basic biological research has been conducted on this species and the fishery biologists believe they now understand the species' general requirements. A taxonomic key has been developed to allow researchers and field biologists to properly identify this species when they are examining this, and similar-looking species.

Spawning and Stocking Program

The resource agencies have conducted a spawning and stocking program that enables them to introduce young-of-the-year and juvenile robust redhorse into suitable river systems. Over the years, the committee has stocked robust redhorse into five rivers: Oconee, Ocmulgee; Ogeechee, and Broad River in Georgia, and the Broad River in South Carolina. Subsequent recaptures have indicated that the stockings have been successful (J. Evans, personal communication).

Refugial Populations

The committee has stocked fingerlings into ponds to develop refugial populations, both to allow the fish to grow to larger sizes for later stocking and as insurance should a catastrophic event destroy a natural riverine population. Three of the ponds are located at the Piedmont National Wildlife Refuge, while the fourth is located at Fort Gordon.

Genetic Research

The group has conducted genetic research on the robust redhorse. This research has identified that individuals from the Altamaha, Savannah, and Pee Dee Rivers represent distinctly different Evolutionary Significant Units (Wirgin et al, 2001). This has several management implications for the work to restore the species. The biologists also use the genetic information in the spawning program so that they will be aware of the level of genetic diversity produced by the crosses that they perform in the laboratory.

Present Distribution

Besides the original population found in the Oconee River, another population has been found in the Savannah River. Targeted surveys have resulted in the identification of individual robust redhorse in the Ocmulgee River in Georgia and the Pee Dee River in North Carolina/South Carolina (RRCC, 2005). Based on the efforts of the committee's members, this species is now known to exist in seven rivers and five refugial ponds (RRCC, unpublished data).

Public Information Resources

The committee has developed several resources to explain its activities and provide information to the public on the recovery of this rare fish. A web site has been developed that houses much of the research reports findings. That site can be found at: www.robustredhorse.com.

One member prepared a 25-minute video that discusses the robust redhorse and the efforts being conducted to restore the species. That videotape can be obtained from the Social Circle office of the Georgia Department of Natural Resources.

Other members have developed table-top displays and a display showing three life-sized adult robust redhorse on a gravel river bottom. These displays help to capture the interest of the public and allow them to learn about the important work that is being performed to benefit these fish.

Another member developed information signs at a restored site to explain the work that had been conducted and its importance in the overall efforts to restore the species.

The South Carolina Aquarium has included the robust redhorse in one of its displays and the Georgia Aquarium is presently developing a display containing robust redhorse.

QUESTIONS THAT HAVE BEEN ANSWERED

The committee's work has answered several questions that the fishery biologists and managers need to know to restore an imperiled fish species.

First, they have found mature and healthy adult fish. This reveals that the food source for adults is not a problem and that there is not a major disease problem.

Second, they have observed viable spawning. From a habitat perspective, this indicates that at least some suitable spawning habitat is present. From a biological perspective, the viability of the eggs indicates that contaminant levels within the adults are not causing the low population levels.

Third, the presence of younger adults in the Oconee and Savannah Rivers provides some evidence of natural recruitment, although the level of recent recruitment appears low.

Fourth, the seasonal habitats of adult robust redhorse have been characterized in the Savannah River (Grabowski, 2003). Individuals have been found to migrate between distinct areas used for over-wintering, spawning, and post-spawn recovery. During non-spawning periods, adults prefer the deeper water habitat along the outside of bends, in association with woody debris and gravel substrate.

Fourth, stocked robust redhorse can grow successfully in the wild (Hendricks, 2000). This indicates that there are acceptable food sources for the juveniles in all rivers that they have stocked.

Fifth, individuals of this rare species have been found in several river basins. This indicates that the problems leading to the low population levels are not a localized problem, but instead are more likely to be widespread across their historic range.

UNANSWERED QUESTIONS

Although much has been learned, much still remains unknown about this species. At the species level, the following describe the most apparent unknowns:

- Where do the young go?
- What are the seasonal habitats of adults?
- Does the habitat used by juveniles vary by season?
- Do stocked fish behave any differently than native fish?
- What is the sampling efficiency for adults?
- What is the sampling efficiency for juveniles?
- What is the sampling efficiency for larvae?

At the population level, the following describe the most apparent unknowns:

- What is the size and structure of the populations, other than in the Oconee River?
- What is the stability of the population?
- What are the causes of the recent low recruitment rates?
- Is there a critical bottleneck to a population's size?

COMMITTEE GOALS

Having reviewed the progress that has been made by the committee on restoring this species, the questions that have been answered and those that still remain unsolved, the committee reviewed where it had previously agreed that it wanted to go.

In 2003, the committee completed a Conservation Strategy (RRCC, 2003) that documented both the short-term and long-term goals of the group. The committee had decided that restoration of the species would occur when self-sustaining populations occurred in at least six river systems throughout its historic range. A more general statement is that restoration would be accomplished when the species is no longer at risk and in need of special management and protection.

POSSIBLE FUTURE ACTIONS

After reviewing its goals, the committee moved to prioritize its future efforts so that it could best meet its goals. It started by listing the activities that it could conduct. Those include the following:

- Stocking
- Biological research
- Behavioral research
- Field surveys
- Habitat restoration
- Government policies
- Government priorities
- Public information

Rather than discussing each of those possibilities, the group focused on what the remaining questions were and the actions that would be needed to develop answers. The questions fell into two groups, the first dealing with species restoration issues and the second dealing with the recovery process.

Restoration Questions

Is there a recruitment problem? A major question is whether juvenile habitat is a limiting factor in the populations. Although recruitment levels appear low, are they sufficient to sustain their populations? At present we do not know where the young go from when they hatch to when they enter the adult population (about 400 mm). Once the locations become known, questions then arise about the quality of that habitat. Do the juveniles have an adequate food source? Do hydropower operations adversely affect the juveniles? Telemetry and sampling, along with chemically marking larvae, were identified as methods of addressing these questions.

Is spawning habitat a limiting factor? A second major question concerns the spawning habitat. It appears that gravel bars are present in several of the river systems, but the spawning that has been observed occurs at only a very select few sites. How much good spawning habitat is available in each river? Surveys could be conducted and compared to the needs of other related species. Is additional spawning habitat needed? Existing gravel bars could be cleaned or new sites created by the deposition of clean gravel. Bank erosion could be reduced to lower sedimentation of existing gravel bars. Other activities could be conducted to reduce sedimentation within the rivers that may lower the usefulness of existing gravel bars. Are hydropower operations adversely affecting spawning activities or emerging robust redhorse? Monitoring could be conducted to document the spawning success under different river flow conditions.

Recovery Process Questions

Should we continue to stock? A fundamental question of the process of fishery restoration efforts is the level of stocking that should be performed to augment an apparent low natural recruitment levels. Since the observed natural populations of robust redhorse consist primarily of adult individuals, the initial response of fishery biologists is that a problem has likely occurred that removed or continues to remove the young. To protect the existing population, biologists will typically augment the population by stocking young fish. In light of the stocking that has occurred, what is the level of stocking that should be conducted without compromising

the genetic diversity within a particular stream? A multi-year plan has been developed that describes how many juveniles should be stocked if they could be obtained with a desired genetic diversity (J. Evans, personal communication). If that diversity cannot be obtained, then rearing the fry into juveniles may be unnecessary.

Should we continue to spawn from the Oconee River? Committee members have conducted a propagation program each spring on the Oconee River to develop fry for later stocking. A multi-year plan has been developed that describes how much stocking should take place in the Oconee River (J. Evans, personal communication). Should that plan be modified? Some of the juveniles are stocked in the Ocmulgee River, to fulfill the terms of a Candidate Conservation Agreement with Assurances. Beyond that need, how many additional fry and resulting juveniles from the Oconee River are needed to advance the overall goals of restoring the species?

Should we continue to rear juveniles in ponds? The group has encountered problems with rearing juveniles in ponds. Growth has generally been slow in ponds and harvesting can sometimes be difficult (J. Evans, personal communication). The successful development of stocked populations in rivers has reduced the need for an extensive refugial pond program. The committee decided that long term development of individuals into a mixed-age population in ponds proved to be much more difficult than expected. However, the program still has value if conducted on a more limited basis to produce larger fish for research and stocking.

SETTING PRIORITIES

After substantial discussion, the committee listed the following thirteen issues for future efforts: (1) Imprinting/homing; (2) River flows during spawning; (3) Juvenile habitat; (4) Predation; (5) Spawning habitat quality; (6) Spawning habitat quantity; (7) Status of populations; (8) Water temperatures during spawning; (9) Stocking; (10) Genetic diversity; (11) Sediment reduction; (12) Recruitment; and (13) Capture efficiency.

The committee members then voted, identifying the issues that they individually believed would best advance the work of the group towards its goals. Through that vote, the committee established the following priorities (RRCC, in press):

(1) Juvenile habitat
(2) Recruitment
(3) Spawning habitat quality
(4) Status of populations

The committee and its members will use these priorities as they decide what activities to conduct in the next few years.

SUMMARY

The Robust Redhorse Conservation Committee has worked effectively and accomplished much since they were officially formed in 1995. They have organized and implemented fishery research and management activities to restore a rare fish in the Southeast, thereby, keeping this fish off the Endangered Species List. Last fall, the committee took time to review what they had accomplished and what they would like to accomplish through their restoration efforts. With that background, they were able to sort through the numerous activities upon which they could expend their resources and identified the four items most needed to reach their long term goal of self-sustaining populations of robust redhorse existing in at least six river systems throughout its historic range so that the species would no longer be at risk and in need of special management and protection.

ACKNOWLEDGEMENTS

The following organizations are members of the Robust Redhorse Conservation Committee:

Signatory Members
Georgia Department of Natural Resources
South Carolina Department of Natural Resources
North Carolina Wildlife Resources Commission
US Fish and Wildlife Service
US Geological Survey – Biological Resources Division
US Forest Service
US Army Corps of Engineers
Georgia Power/Southern Company
Duke Power Company
Carolina Power and Light Company/Progress Energy
South Carolina Electric and Gas Company
Georgia Wildlife Federation
South Carolina Aquarium

Cooperator Members
North Carolina Museum of Natural History
Georgia River Network

Affiliate Members
University of Georgia, Carl Vinson Institute of Government
University of Georgia, Institute of Ecology
University of Georgia, Warnell School of Forest Resources
University of Georgia, Cooperative Fish and Wildlife Research Unit
Nelson Institute of Environmental Medicine, New York University School of Medicine
Roanoke College, Department of Biology
Fort Gordon Military Installation, Department of Defense

This paper is an attempt to summarize the efforts of the entire committee since 1995 and the progress they have made in restoring the robust redhorse. The information presented here was developed by others and presented at the Committee's annual meetings.

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