STATUS OF ROBUST REDHORSE (*MOXOSTOMA ROBUSTUM*): REINTRODUCTION EFFORTS AND PRELIMINARY RESULTS OF SONIC-TRACKING IN THE OCMULGEE RIVER

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Abstract. With the "rediscovery" of the robust redhorse (*Moxostoma robustum*) in 1993 and the recognition that Georgia harbored the only significant known remaining population of this species, a Robust Redhorse Conservation Committee (RRCC) was created. Reintroduction of robust redhorse in the Ocmulgee River was one conservation goal of this committee. Robust redhorse were released into the Ocmulgee River in 2002. To monitor the success of this reintroduction effort, we are tracking their movements using surgically implanted sonic transmitters. Telemetered robust redhorse moved between 21 and 187 river kilometers downstream of from the release site.

INTRODUCTION

We are using sonic transmitters and receivers to track robust redhorse, *Moxostoma robustum* (figure 1), and discern movement patterns and general habitat use. This research may help future reintroduction and conservation efforts for robust redhorse.

The robust redhorse is a large imperiled catostomid fish native to southeastern Atlantic slope drainages. The species' known native range extends from the Altamaha River drainage in Georgia northward to and including the Pee Dee River drainage in North Carolina and South Carolina. Three known extant wild populations occur in Georgia and are now restricted to a limited portion of 1) the Oconee River between Milledgeville and Dublin, Georgia, 2) the Ocmulgee River between Macon and Hawkinsville and 3) the Savannah River in the Fall Line Zone around and below Augusta, Georgia and North Augusta, South Carolina (Figure 2). A viable wild population of unknown size also persists in the Pee Dee River drainage (North Carolina and South Carolina), where a few individuals have been captured in annual intensive sampling efforts since April 2000.

Figure 1. Robust redhorse (*Moxostoma robustum*). Photo by BJF.

The robust redhorse is considered an imperiled species because of its limited distribution and small population numbers. Even if the robust redhorse persists in the Pee Dee as well as the Savannah and Altamaha drainages, abundances are dramatically reduced compared to E. D. Cope's (1870) accounts of fishery catches of the sucker (Bryant *et al* 1996). The largest known population, in the Oconee River, displays some evidence of recent juvenile recruitment to the population; for example, we have observed smaller males joining spawning activity during two of the past six years. However, because the population is skewed toward older age classes, concerns remain that spawning or juvenile habitat may be limiting. All remaining populations persist in rivers with flows influenced by hydropower dams. Effects of flow alteration by dams on population dynamics of the robust redhorse are not known. Potential loss of suitable habitat because of hydrologic alteration, especially for life history stages with the narrowest habitat requirements, is a primary management concern.

Due to this species' apparent lack of abundance and scientists' insufficient knowledge of the species, the U.S. Fish and Wildlife Service listed it as a Species of Special Concern (formally known as Category 2). In addition, the state of Georgia listed this species as

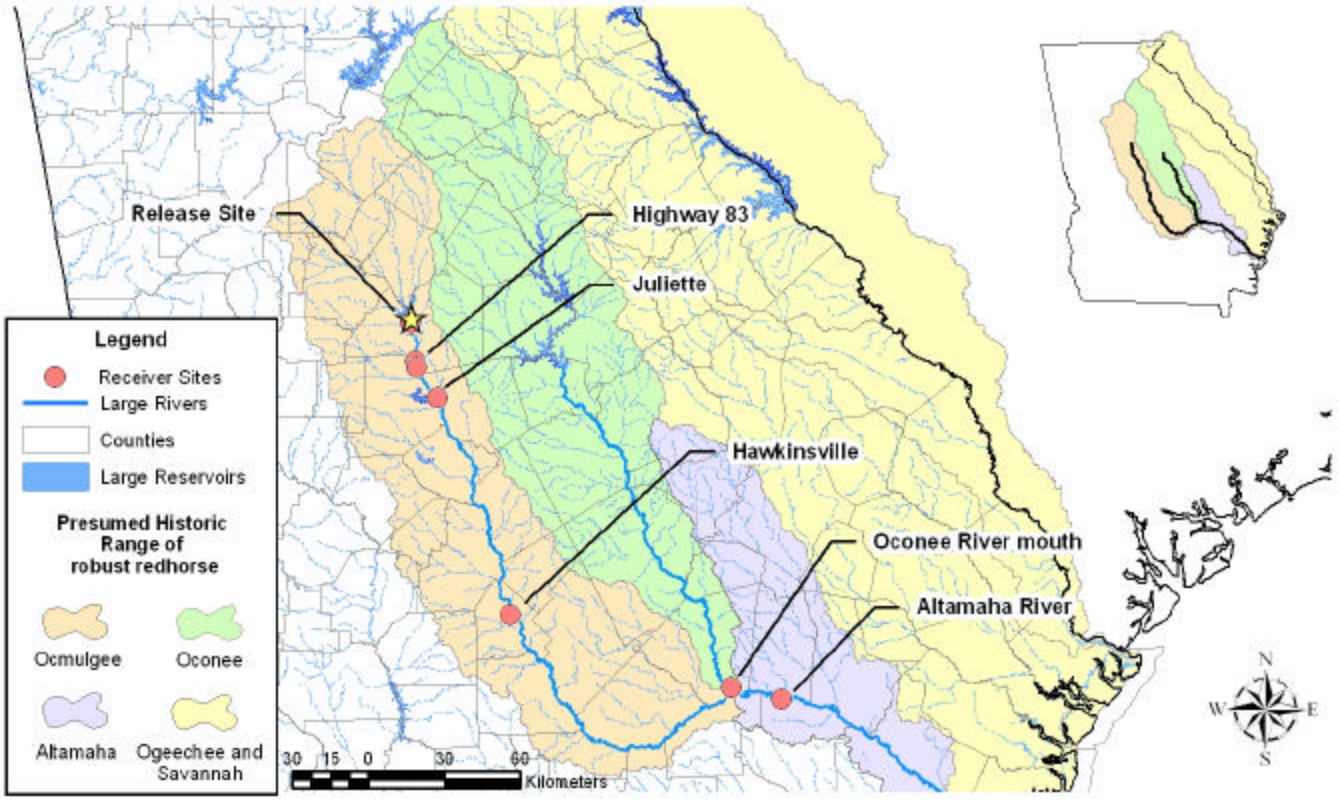

Figure 2. Presumed range of robust redhorse in Georgia, including the Savannah, Ogeechee, and Altamaha River Drainages. Star represents release location of telemetered robust redhorse on 19 March 2002. Open circles represent locations of stationary sonic-receivers within the Altamaha River Drainage.

Endangered. The discovery of a population of this imperiled species below a hydropower project applying for renewal of a 50-year license (Sinclair Dam) propelled the conservation status and potential listing under the Endangered Species Act squarely into the re-licensing discussions.

Robust Redhorse Conservation Committee

To accommodate concerns of all parties, avoid immediate listing and immediately begin recovery efforts, a Memorandum of Understanding (MOU) was signed by federal, state, and private partners, including Georgia Power Company, US Fish and Wildlife Service, Georgia Department of Natural Resources (GDNR), South Carolina Department of Natural Resources (SCDNR), North Carolina Wildlife Resources Commission, United States Geological Survey, and other utilities and conservation groups. The Robust Redhorse Conservation Committee (RRCC) and the Oconee River Flow Advisory Team were formed in 1995 through this MOU with the purpose of addressing species recovery and specifics of the re-licensing of Sinclair Dam.

Acknowledging that the Oconee River population of robust redhorse was possibly the only significant population within the presumed historical range of the fish, the RRCC determined that an establishment of additional populations was essential for the preservation of the species. Goals of the RRCC included identifying potential river systems for reintroduction and implementing a breeding and stocking program utilizing the existing Oconee River population as the source. The initial site chosen for reintroduction was the Broad River watershed (Savannah River Drainage). After the discovery of a wild population of fish in the Savannah River, robust redhorse stocking in the Broad River system was halted. Later genetic research comparing the wild populations of robust redhorse in the Savannah River and Oconee River drainages revealed these two populations were distinctly different (Wirgin *et al.* 2001). Conservation efforts should maintain these two separate evolutionary significant units (ESU). This finding created concerns over potential contamination of the Savannah ESU by Altamaha ESU fish that were stocked in the Broad River watershed.

Candidate Conservation Agreement with Assurances

Shortly after this time, the RRCC created a Candidate Conservation Agreement with Assurances (CCAA) to be submitted to the U.S. Fish and Wildlife Service. Along with this agreement, a stocking program was created for releasing robust redhorse into the Ocmulgee River. The CCAA is based on US FWS policy and is the first in the nation dealing with an aquatic species. These agreements are used to encourage non-Federal agencies to conserve imperiled species before they must be listed under the Endangered Species Act. This agreement gives the applicants, in this case Georgia Power Company, the assurance that if the species is listed in the future they will not be subject to changes in restrictions of their land and water use in the designated area (Hall 2001). This CCAA covers an area on the Ocmulgee River between Lloyd Shoals Dam and the low-head dam at Juliette, GA. Through this agreement Georgia Power helped fund the reintroduction of robust redhorse into the Ocmulgee River and research on the success of this effort.

METHODS

Implanting Transmitters

At Thomson Fish Hatchery, we measured the length of each fish and recorded which transmitter would be implanted into the fish. Because the transmitters range in size, we implanted the largest transmitters into larger individuals. Transmitters ranged from 4.2-5 g and measured 24-30 mm in length. Fish receiving the transmitters ranged from 215-292 mm in standard length and were fish ranging from 2-3 years in age.

To implant the transmitter, we anesthetized each fish using MS222 (approx. 100mg/L) diluted in water. After the fish was anesthetized, we created a small incision in the abdomen and inserted the transmitter. The incision was sutured, and we returned the fish to an aerated holding tank in which they would be transferred to the release site. The surgical procedure lasted approximately two minutes per fish. After placing all of the fish in an aerated holding tank, we transported them to the release site. The release site for this group of fish was located at the boat ramp on the Ocmulgee River just downstream of Lloyd Shoals Dam, near Monticello, Georgia.

Receiver Placement

We used VEMCO® VR2 receivers and transmitters to track movements of robust redhorse after their release into the Ocmulgee River. Each receiver weighs 1175 g and is 205mm in length with a diameter of 60mm. This small receiver detects transmissions in the 69.0kHz frequency and can log information from 25,000 coded transmitters. We are currently using two different techniques for tracking telemetered fish. By placing receivers in semi-permanent "stations", we can track individuals that move beyond each receiver and those that remain within the range of the receivers. In addition, we periodically "spot-check" 20-30 areas for presence/absence of fish by dropping a receiver in the water for a minimum of 12 minutes to detect all fish within range of the receiver.

We initially placed one receiver immediately downstream of the release location (0.1 river km downstream of release site), two receivers upstream of State Highway 83 (on opposite banks of the river, 21 river km downstream), and one receiver in the Ocmulgee River at Georgia Power's water outtake for Lake Juliette (39.5 river km downstream). Later stationary receivers were placed in the following places: in the Ocmulgee just south of Hawkinsville (187.2 river km downstream), in the Altamaha River near Georgia Power's Plant Hatch (422.1 river km downstream), and in the Oconee River near its mouth (392.7 river km downstream).

RESULTS

Of the 28 fish released with sonic transmitters on 19 March 2002, no fish were recorded NEAR the release site after 25 April 2002. Most telemetered fish remained upstream of Highway 16 (within 2 river km downstream of the release site) until the beginning of April. This date coincided with a high flow event caused by increased precipitation. After this date only a few fish remained in the vicinity of the release site and all fish were gone by 25 April 2002. Discharge from Lloyd Shoals Dam at this time was almost 9,000 cubic feet per second (cfs), where as the flow before this date ranged between 800 and 1,000 cfs.

By 27 March the first individual was recorded at the downstream stationary receivers above Highway 83 and by 29 March at the receiver below the low-head dam at the Juliette receiver. This individual traveled approximately 40 river km to the Juliette receiver in the 10-day period after its release. It also traveled the 17.9 river kilometers between the receivers above highway 83 to the Juliette receiver in 42 hours.

By the middle of July, over 70% of the telemetered fish (n=20) were recorded at the Highway 83 receivers and almost 40% of the fish (n=11) were recorded near

the Juliette receiver. On 26 May 2002, a single individual was also recorded at the receiver just downstream of Hawkinsville, GA. This fish represents the farthest downstream record of a telemetered fish (187.2 river km downstream of the release site).

All eleven fish recorded at the Juliette receiver were recorded between 29 March and 24 May. However, five of the fish recorded at the two receivers upstream of Highway 83 occurred between mid-June and mid-July.

Fish recorded at these receivers also traveled at different speeds. For example, one individual reached the Highway 83 receivers within 10 days of its release, whereas another individual did not reach the Highway 83 receivers until 17 July.

Because receivers are attached near the waterline, high flows since October 2002 have prevented us from gathering additional data from the receivers.

DISCUSSION AND RECOMMENDATIONS

Although the robust redhorse released in the Ocmulgee River were older than those released in the Broad River, the movements of the Broad River fish may provide some insight into the movements of the Ocmulgee River fish. Fish stocked into the Broad River system were captured only within 24-48 hours after their release. For the next 2-3 years surveys within the release reach yielded no stocked individuals. Collection efforts revealed wide-spread occurrence of stocked robust redhorse in Clark's Hill Reservoir beginning three years after release (Freeman *et al.* 2002). Four to five years after their release, some fish were captured near potential spawning locations upstream of Clark's Hill Reservoir in the Broad River system. One similarity between these two groups of stocked fish is that all fish moved downstream after their initial stocking. This result might be an innate life-history event for robust redhorse or may be the result of pond-reared fish being released into a fluvial environment. In the future, knowledge about cues for migration and movements of wild-reared fish may help direct management of water flow in our hydrologically-altered world.

Since timely data gathering is a concern, attaching receivers to floating buoys increase the possibility of gathering data from receivers in times of variable flow. This system allows the receiver position to adjust relative to river stage.

A possible threat to released fish in this system as is true with many other systems in the world is the presence of a non-native predatory fish. Flathead catfish (*Pylodictis olivaris*) are predators of robust redhorse in the Altamaha River drainage and could potentially cause problems by consuming stocked fish (Bradford and Grutin 2000). Increasing sample sizes (more tagged individuals) should decrease the effect of single individuals being consumed by these predators. Another way to decrease the probability of tagged fish being consumed by predators might be to choose larger sized fish to receive implanted transmitters.

CONCLUSIONS

In waterways with limited barriers robust redhorse are capable of moving great distances, which may be indicative of a life history characteristic of this species. This method of passively tracking fish is relatively new in freshwater systems, and should be considered as a viable option when tracking fish capable of traveling long distances. This method does not require as much time as other telemetry methods and for large-bodied fish some transmitters last over a year. Initial cost for receivers may be prohibitive for some, but the cost may be mitigated by the reduced time needed for daily tracking of radio or sonic tagged individuals.

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