Bin 39110
5131 Maner Road
Smyrna, GA 30080

Tel 404.799.2159
Fax 404.799.2141

GEORGIA POWER
A SOUTHERN COMPANY

December 18, 2009

Ms. Sandy Tucker
U. S. Fish and Wildlife Service
Westpark Center, Suite D
105 Westpark Drive
Athens, Georgia 30606

Dear Ms. Tucker:

The enclosed is a summary of the conservation actions conducted during 2009 for the Candidate Conservation Agreement with Assurances for the Robust Redhorse, *Moxostoma robustum*, Ocmulgee River, Georgia, (CCAA) as described in Agreement Number 1448-40181-01-K-005. This report summarizes activities conducted during 2009 towards fulfillment of phases 1 and 2 of the CCAA. Specific activities addressed include monitoring the abundance and distribution of introduced robust redhorse (Conservation Action 3) and monitoring the adult population in the Ocmulgee River and estimating population size (Conservation Action 4), as a result of our January 2008 modification to the CCAA.

Please contact me at 404-799-2159 if you have further questions regarding this report.

Sincerely,

Joe E. Slaughter, IV
Fisheries Biologist
Georgia Power Company

December 18, 2009
CCAA 2009 Progress Report
1448-40181-01-K-005

XC:
With attachments.

Jimmy Evans, Georgia Department of Natural Resources
Ted Will, Georgia Department of Natural Resources
Forrest Sessions, Chairman Robust Redhorse Conservation Committee
Hallie Meushaw, Troutman Sanders
John Biagi, Georgia Department of Natural Resources
Mike Harris, Georgia Department of Natural Resources
Chuck Huling, Georgia Power
Doug Jones, Georgia Power
Greg Brown, Georgia Power
Cheryl Wheeler, Georgia Power
Mike Phillips, Georgia Power

2009 Progress Report: Candidate Conservation Agreement with Assurances for the Robust Redhorse, *Moxostoma robustum*, Ocmulgee River, Georgia

Agreement Number 1448-40181-01-K-005

Conservation Action 1. *Georgia DNR will stock the Project Site with approximately 4,000 hatchery-reared robust redhorse fingerlings each year for five years.*

On January 3, 2008, the FWS issued a modification to the CCAA, which allows GPC to move forward with Conservation Actions 3 and 4 under the Adaptive Management provision without reaching the original stocking target of 20,000 fingerlings. As such, no formal stocking program is currently underway, although a single stocking event (as described below) took place in 2009.

On December 3, 2009, hatchery personnel from US Fish and Wildlife Service's Warm Springs Hatchery stocked 26 adult robust redhorse into the Ocmulgee River at the Highway 83 boat ramp after consultation with myself and Jimmy Evans at GADNR. Among the 26 were individuals from at least five year classes ranging from 1993 through 2004, and representing sizes from 409 to 520 mmTL. These fish were of hatchery origin, produced from Oconee River wild broodstock, and were being housed at Warm Springs prior to recent construction activities on site. All individuals were PIT tagged prior to release and several were tagged with either external anchor or coded wire tags. For more details on individual specimens stocked or their origin, please see Appendix 1.

Conservation Action 2. *Georgia Power will fund two surveys, one in year 1 (2002) and one in year 3 (2004) on the movement of introduced juvenile robust redhorse.*

A third movement survey was completed in 2008 by UGA, and the final report from that study was submitted with the 2007-08 update. Given the completion of the two prescribed studies and the additional 2008 study, we believe there are no further requirements related to this Conservation Action.

Conservation Action 3. *Georgia Power will conduct or fund six surveys in order to monitor abundance and distribution of juvenile and adult robust redhorse within Project Site.*

The fourth of six status surveys, performed in alternating years, under Conservation Action 3 was conducted in 2009. That survey is described below.

The fourth status survey was conducted in Spring 2009. That survey included electrofishing within the Lloyd Shoals Dam to the East Juliette low-head dam reach in an effort to monitor survival of stocked fish. The 2009 survey for Conservation Action 3 was conducted in conjunction with the second adult population survey described under Conservation Action 4 (below), as both surveys utilize the same methodologies and target the same areas within the reach. Results of both surveys were presented at the 2009 Robust Redhorse Conservation Committee Annual Meeting in Hampton County, SC, and that presentation is included in Appendix 2.

In summary, five robust redhorse individuals were collected during four days of electrofishing within the reach (total of 320 minutes of electrofishing pedal time), two of which were previously stocked and/or tagged individuals and the remaining three were unmarked. We also located a major gravel deposition area associated with a large shoal complex downstream of the Wise Creek confluence and upstream of the Highway 83 boat ramp that yielded three of the collected specimens. It is believed that this location may contain a large portion of the available spawning habitat within the upper Ocmulgee and will be a targeted sampling site in years to come. In general, our 2009 results suggest that stocked robust redhorse are persisting within the Ocmulgee, however, samples sizes are too low to estimate survival or precisely quantify success of stocking efforts.

We continue to see untagged robust redhorse in the Ocmulgee River, possibly suggesting an existing population there. The fifth and sixth monitoring surveys under Conservation Action 3 are scheduled for 2010-2011 and will be conducted in conjunction with adult population surveys outlined in Conservation Action 4 and through a large-scale research study conducted by Dr. Cecil Jennings with USGS and funded by GPC (see below and Appendix 3).

Conservation Action 4. *Following the establishment of an adult refugial population in the Project Site, Georgia Power will fund three surveys to measure population size utilizing the mark-recapture methods used to estimate the population size of the Oconee River robust redhorse population.*

In conjunction with the 2009 survey for Conservation Action 3 described above, the second survey under Conservation Action 4 was conducted in Spring 2009. GPC sampled various sections of the Ocmulgee River using standardized electrofishing techniques as described above. A total five robust redhorse were collected, believed to represent at least two year classes. Three of the individuals collected were untagged/unmarked juveniles of various lengths, which may indicate some level of successful reproduction and recruitment within the system. For further information, please refer to Appendix 2.

In December 2009, GPC and USGS entered into a research contract to conduct intensive monitoring surveys in the Ocmulgee River between Lloyd Shoals Dam and the East Juliette low-head dam. That study is scheduled to begin in January 2010 with estimated completion in late 2011. Attached is the final scope of work for the contract (Appendix 3), but in general, the study is aimed at intensive monitoring for adult and sub-adult robust redhorse within the study reach, coupled with population estimation using an occupancy modeling approach. In general, expected results from this study include a population estimate for robust redhorse inhabiting this reach, a sampling prescription for long-term monitoring within the reach to include estimates of needed effort and sampling locations, and a statistically valid methodology for estimating population size which could be extrapolated to other areas of interest where sampling gears are less effective or catch rates are inadequate for more traditional population estimates. The development of the occupancy model for the Ocmulgee should also help to alleviate concerns over adequacy of sampling gears or techniques by accounting for capture probability of individuals.

Appendix 1

Stocking records for the December 3, 2009 stocking event obtained from USFWS Warm Springs Hatchery personnel.

Record #	Data Originator	Date Capture	Year Capture	River or Reservoir	Location (General)	Location Collected	Lat Long	Effort Hour For Days (hrs)	Temp (C)	Recaptures	Stocked? ?
32	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
33	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
34	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
35	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
36	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
37	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
38	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
39	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
40	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
41	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
42	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
43	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
44	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
45	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
46	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
47	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
48	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
49	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
50	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
51	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
52	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
53	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
54	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
55	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
56	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y
57	J. Zelko	3-Dec-09	2009	Ocmulgee	Highway 83 boat ramp	-	33 09.582; 83 49.393	-	11.7	-	Y

Year Class	Total length (mm)	Weight (g)	Sex	Stage	Ripe?	New PIT Tag	Old PIT Tag	Right Floy Tag	Left Floy Tag	Radio Tag	CWT Location	Sampling Reason	REMARKS
2004	440	2.5	U		no	-	4034054F6B	01152	none	-	behind dorsal fin	Fish was raised in ponds at Walton Fish Hatchery, GADNR before transfer to Warm Springs NFH in Nov 2007. A genetic sample was taken at that time.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
?	409	1.9	U		no	-	403370337E	lost	none	-	none found	Fish was raised in ponds at Walton Fish Hatchery, GADNR before transfer to Warm Springs NFH in Nov 2007. A genetic sample was taken at that time.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
2004	435	2.3	U		no	-	40335E4351	01155	none	-	behind dorsal fin	Fish was raised in ponds at Walton Fish Hatchery, GADNR before transfer to Warm Springs NFH in Nov 2007. A genetic sample was taken at that time.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
?	432	2.2	U		no	-	40335F2E40	01154	none	-	none found	Fish was raised in ponds at Walton Fish Hatchery, GADNR before transfer to Warm Springs NFH in Nov 2007.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
2004	416	2.2	U		no	-	4034010176	00776	none	-	behind dorsal fin	Fish was raised in ponds at Walton Fish Hatchery, GADNR before transfer to Warm Springs NFH in Nov 2007. A genetic sample was taken at that time.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
?	430	2.3	U		no	-	403370190F	00777	none	-	none found	Fish was raised in ponds at Walton Fish Hatchery, GADNR before transfer to Warm Springs NFH in Nov 2007. A genetic sample was taken at that time.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
2004	425	2.1	U		no	-	4034045C16	lost	none	-	behind dorsal fin	Fish was raised in ponds at Walton Fish Hatchery, GADNR before transfer to Warm Springs NFH in Nov 2007. A genetic sample was taken at that time.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
2004	452	2.8	U		no	-	403362201C	01156	none	-	behind dorsal fin	Fish was raised in ponds at Walton Fish Hatchery, GADNR before transfer to Warm Springs NFH in Nov 2007. A genetic sample was taken at that time.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
?	437	2.6	U		no	-	4033684678	01151	none	-	none found	Fish was raised in ponds at Walton Fish Hatchery, GADNR before transfer to Warm Springs NFH in Nov 2007. A genetic sample was taken at that time.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
?	420	2.4	U		no	-	4033747711	01156	none	-	none found	Fish was raised in ponds at Walton Fish Hatchery, GADNR before transfer to Warm Springs NFH in Nov 2007. A genetic sample was taken at that time.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
1995	443	2.4	U		no	-	443360743D	none	none	-	right cheek	Fish was raised in pond at Piedmont NWR, GA before transfer to Warm Springs NFH. Fish was examined in spring 2007 but saw no signs of spawning condition.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
1993	413	2.7	M		no	-	442F05003D	none	none	-	left cheek	Fish was raised in pond at Piedmont NWR, GA before transfer to Warm Springs NFH. Fish was spawned in spring 2007. Milt was used to fertilize eggs.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
1995	435	2.8	U		no	-	442F32220E	none	none	-	right cheek	Fish was raised in pond at Piedmont NWR, GA before transfer to Warm Springs NFH. Fish was examined in spring 2007 and 2008 but saw no signs of spawning condition.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
1993	480	2.9	M		no	-	442F2F6143	none	none	-	left cheek	Fish was held at UGA, Whitehall before transfer to Warm Springs NFH. Milt was collected in 2005 and used to fertilize eggs in the field.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
2004	418	2.1	U		no	-	40340C4479	lost	none	-	behind dorsal fin	Fish was raised in ponds at Walton Fish Hatchery, GADNR before transfer to Warm Springs NFH in Nov 2007. A genetic sample was taken at that time.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
?	460	3	M		no	-	442E3F4766	none	none	-	none found	Fish was held at UGA, Whitehall before transfer to Warm Springs NFH. Milt was collected in 2007 and used to fertilize eggs.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
?	482	3.2	U		no	-	442C566430	none	none	-	none found	Fish was raised in pond at Piedmont NWR, GA before transfer to Warm Springs NFH. Fish was examined in spring 2007 but saw no signs of spawning condition.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
?	518	3.7	M		no	-	4430003D44	none	none	-	none found	Fish was held at UGA, Whitehall before transfer to Warm Springs NFH. Fish was examined in spring 2007 but saw no signs of spawning condition. Collected milt from male in 2005.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
1993	500	3.9	U		no	-	442D523352	none	none	-	left cheek	Fish was held at UGA, Whitehall before transfer to Warm Springs NFH. Fish was examined in spring 2007 but saw no signs of spawning condition. Could be a female.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
?	505	3.7	M		no	-	442E205568	none	none	-	none found	Fish was raised in pond at Piedmont NWR, GA before transfer to Warm Springs NFH. Fish was spawned in spring 2007. Milt was used to fertilize eggs.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
?	483	3.3	U		no	-	442D741614	none	none	-	none found	Fish was raised in pond at Piedmont NWR, GA before transfer to Warm Springs NFH. Fish was examined in spring 2007 and 2008 but saw no signs of spawning condition.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
2000	485	3.8	U		no	-	442D7D0A75	none	none	-	front of dorsal on right sid e	Fish was raised in pond at Piedmont NWR, GA before transfer to Warm Springs NFH. Fish was examined in spring 2007 and 2008 but saw no signs of spawning condition.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
1999/2000	490	3.4	M		no	-	442E310E46	none	none	-	nape or front of dorsal	Fish was raised in pond at Piedmont NWR, GA before transfer to Warm Springs NFH. Fish was spawned in spring 2007. Milt was used to fertilize eggs.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
?	456	3.8	U		no	-	442F5D7063	none	none	-	none found	Fish was raised in pond at Piedmont NWR, GA before transfer to Warm Springs NFH. Fish was examined in spring 2007 but saw no signs of spawning condition.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
?	520	4.8	F		no	-	44336F1E1D	none	none	-	none found	Fish was raised in pond at Piedmont NWR, GA before transfer to Warm Springs NFH. Fish was spawned in spring 2007.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.
?	506	4.3	F		no	-	442E441345	none	none	-	none found	Fish was held at UGA, Whitehall before transfer to Warm Springs NFH. Fish was spawned in 2007.	Fish were previously held at Warm Springs National Fish Hatchery for the captive refugia program. Fish were stocked into the Ocmulgee Dec 3, 2009.

Ocmulgee River CCAA 2009 Update

Presented to the Robust Redhorse Conservation Committee on September 15, 2009 at Webb Plantation in Hampton County, SC

By

Joe E. Slaughter, IV
Georgia Power Company

Ocmulgee River CCAA 2009 Update

Joe E. Slaughter, IV
jeslaugh@southernco.com

GEORGIA POWER
A SOUTHERN COMPANY

CCAA Status

Phase 1:

- 14,000+ fingerlings stocked through 2008
- hatchery production of Oconee stock suspended in 2008 due to low broodfish collection rates in 2007

Phase 2:

- stocking success and adult population monitoring
- sampling for stocking success has been ongoing
- adult population monitoring began in 2007, but sampling is challenging in the Ocmulgee

GEORGIA POWER
A SOUTHERN COMPANY

CCAA Sampling Universe

- Lloyd Shoals Dam to Juliette low-head dam
- DNR and GPC have conducted annual sampling efforts with limited numbers collected, but some noteable small successes
- The best available habitat exists in isolated segments below LS Dam, between Hwy 16 and above Hwy 83, and immediately below Juliette Dam.
- Access to the section between Hwys. 16 and 83 is limited due to several impassable shoals

GEORGIA POWER
A SOUTHERN COMPANY

Hwy. 16 Sampling Location

Hwy. 83 Sampling Location

GEORGIA POWER
A SOUTHERN COMPANY

2009 Results

- ~320 min. (5.3 hrs) of pedal time over 4 days
- Temperatures from 17.5-22.5 C
- covered sections from LS Dam to Hwy 16 and below Wise Cr. to Juliette Dam
- primary focus was on gravel deposits associated with shoal/riffles and deep pools
- run sections were very shallow with very few deep pools (>1m)

GEORGIA POWER
A SOUTHERN COMPANY

2009 Results

- We collected a total of 5 RRH in 2009 (0.9/hr)
- 1 ripe male (444mmTL) collected in the reach below LS Dam (no CWT, no PIT, no other markings; T = 17.5).
- 1 RRH (347mmTL, not ripe,undetermined sex) collected at the first shoal DS of Wise Cr. (untagged, unmarked; T = 21.1)
- 3 RRH collected in a large gravel deposit area between shoals between Wise Cr. & Hwy. 83

GEORGIA POWER
A SOUTHERN COMPANY

2009 Results

- 3 RRH collected in a large gravel deposit area between shoals between Wise Cr. & Hwy. 83 (T = 21.1)
- 452 mmTL, CWT recap (R opercle), not ripe
- 391 mmTL, no recap, not ripe
- 383 mmTL, CWT recap (L opercle), not ripe

- This section represents a tremendous habitat available to RRH with approximately 0.5 miles of gravel, run/riffle habitat bounded by two large shoals, the upper of which is impassable by boat

- OCM RRH Mecca…?

GEORGIA POWER
A SOUTHERN COMPANY

Conclusions

- We are seeing some small number of RRH within the system
- Sampling remains challenging, but the large gravel/shoal complex DS of Wise Creek seems promising
- We continue to see untagged RRH in the Ocmulgee, suggesting an existing population of RRH in the OCM

- Population estimation will be difficult given low sample collections
- Alternate methods for estimating OCM population are necessary

GEORGIA POWER
A SOUTHERN COMPANY

What now…?

- Alternate sampling methods including additional gear types, increased effort, and sampling outside of spawning season
- GPC/GA-DNR collaborative habitat mapping using side-scan sonar and ground-truthing of substrate types
- GPC/USGS research contract (2009-2011) to sample portions of the OCM and construct population estimates exploring advanced modeling techniques.

GEORGIA POWER
A SOUTHERN COMPANY

Appendix 3

Use of occupancy modeling to estimate the abundance and distribution of introduced robust redhorse in upper reaches of the Ocmulgee River, GA.

Cecil A. Jennings and James T. Peterson, Co-Principal Investigators
U. S. Geological Survey
Georgia Cooperative Fish and Wildlife Research Unit
Daniel B. Warnell School of Forest Resources
University of Georgia
Athens, GA 30602-2152

Phone: 706-542-5260(voice), 706-542-8356 (fax)

Email: jennings@warnell.uga.edu
peterson@warnell.uga.edu

September 2009

Introduction

A Candidate Conservation Agreement with Assurances for the robust redhorse, *Moxostoma robustum* (CCAA), was developed as a collaborative effort between Georgia Power Company, Georgia Department of Natural Resources, and the US Fish and Wildlife Service to expedite the reintroduction of the robust redhorse into the Ocmulgee River, Georgia (Department of Interior 2001). As part of the recovery effort, the agreement also calls for series of "Conservation Actions" aimed at achieving project's objectives. These conservation actions included telemetry studies to ascertain initial and subsequent dispersal rate, habitat use, and movement patterns of the stocked individuals; they also included status assessment population – specifically determining the abundance and distribution of the stocked population after many years classes have been stocked in the study reach (Dept. of Interior 2001).

Much progress has been made on proposed conservation actions, but additional conservation actions remain to be implemented. Two separate telemetry investigations have been conducted on stocked robust redhorse in the study reach. The first telemetry study, conducted during spring and summer 2002, was a short-term (i.e., 90 days) investigation of initial dispersal and habitat use (Jennings and Shepard 2003). The second telemetry study, conducted during a 12-month period beginning in April 2006, investigated seasonal habitat use and spawning migrations of the stocked fish (Grabowksi and Jennings 2009). Per the schedule of conservation actions outlined in the CCAA for robust redhorse, multiple status surveys are needed to document the population size and distribution of juvenile and adult robust redhorse in the study reach (Dept. of Interior 2001). These are supposed to occur in alternate years during low-water conditions (Dept. of Interior 2001).

Status surveys to determine if a species is present or to estimate it's abundance are used widely in ecology. However, there is a growing body of literature that recognizes limitation in such surveys if the less-than-perfect detection of the species of interest is not accounted for in the analysis of the survey data (see synthesis by MacKenzie et al. 2005). Imperfect detection of animals refers to the phenomenon of an animal (or species) being present in a study site, but it is not documented by the researcher (see review by MacKenzie et al. 2005). Generally, ignoring incomplete detection of species results in biased estimates of vital population parameters and may lead to incorrect inferences about the status of the target population (MacKenzie 2005).

In situations were estimating the number of animals in an area may be difficult, in part because of incomplete detection, site occupancy (i.e., the proportion of monitoring "sites" within a study area occupied by the target species) can be used as a surrogate for abundance (McKenzie et al. 2005). MacKenzie et al. (2002) proposed general sampling methods for estimating site occupancy when species detection is < 1.0. Because sampling robust redhorse in the Ocmulgee River is difficult and detection probabilities there are well below 1.0 (Grabowski and Jennings 2009), I propose to use the methods first proposed by MacKenzie et al. (2002) and expanded by MacKenzie et al. (2005) to estimate site occupancy of robust redhorse in a reach of the Ocmulgee River and use to use this data as a surrogate for the species abundance in the target reach (see description below). The proposed work is being undertaken pursuant to the terms of the CCAA, which calls for a series of status surveys to estimate the size of the robust redhorse

population in the Ocmulgee River from Lloyd Shoals Dam downstream to Juliette Dam. These surveys also will document the spatial distribution of robust redhorse within the study reach.

Methods

Fish sampling

Robust redhorse will be sampled with boat mounted-electrofishing at least quarterly in the study reach. Each robust redhorse captured will be check for the presence of coded wire tags, Passive Integrated Transponder (PIT) tags. If a tag is present, relevant information, by tag type (i.e., location of tag for coded wire tag or tag number for PIT tag) will be recorded. A uniquely numbered PIT tag will be given to any robust redhorse without one. In addition, total length (TL) in mm and weight (kg) will be recorded for each fish. Recaptures also will be noted. All fish will be released back to the river near the site where they were captured.

Occupancy Modeling

The approach to occupancy model advocated by MacKenzie et al. (2002) depends on dividing the entire area of interest into sites. These sites may be habitat patches or discrete sampling units (e.g., quadrats). For the purposes of this research, the study reach will be divided into about five reaches based on accessibility (i.e., not all of the study reach is navigable) and nearest boat ramp, and these reaches will be treated as sites in the subsequent analysis of site occupancy. Generally, these sites will be: the area below Lloyd Shoals Dam down to the shoals at GA Hwy 16, the boat ramp at GA Hwy 83 upstream to first set of shoals, the boat ramp at GA Hwy 83 downstream to the Towaliga River confluence (TRC), TRC downstream to Juliette Dam, and the area immediately downstream of Juliette Dam. Each site will be stratified into mesohabitat types (e.g., pools, glides) and a random selection of habitat units will be selected, with a greater proportion of sample units selected from known preferred robust redhorse habitats. Each selected habitat will be geo-referenced to allow field crews to revisit (resample) then during each sampling period.

The actual modeling of site occupancy based on the presence/absence of robust redhorse in the sampling reaches will be conducted with specialized computer software such as Program Presence, which is available at http://www.mbrpwrc.usgs.gov/software/doc/presence/presence.html#input (accessed 22 September 2009) or Program Mark, which is available at http://warnercnr.colostate.edu/~gwhite/mark/mark.htm (accessed 22 September 2009). The data generated by this sampling best fits the single-species, multiple-season occupancy models described by Mckenzie et al. (2005). In addition to the occupancy data, an appropriate suite of covariates (e.g., discharge, habitat type) will be measured and included in the modeling.

Population estimation

Attempts will be made to estimate the number of robust redhorse in the entire study reach. Such attempts will be possible if sufficient numbers of individuals can be captured, marked, and recaptured. Sampling robust redhorse in this reach has been difficult (e.g., Grabowski et al. 2009), and this difficulty inspired the occupancy modeling approached as an alternative to population estimation. However, if population estimation is feasible, then every effort will be made to produce a statistically rigorous estimate of the number of robust redhorse in the study reach. Any such estimate will be produced with population estimation models contained in Program Mark. If sufficient data are available, population size will be estimated using a new estimator that combines occupancy and mark-recapture data (Conroy et al. 2008).

Expected results and products

This work will provide long-term data on dispersal behavior, habitat use, and movement patterns of hatchery-reared robust redhorse released into regional rivers. Specifically, husbandry efforts by the Warm Spring Fish Technology Center (USFWS) have produced many stockable-sized fish, but questions about their dispersal behavior, long-term habitat use and movement patterns have hindered decisions about when and where to release these fish. As a result, ongoing efforts to restore this species to much of its historic range (i.e., medium-sized and large rivers in the Piedmont and Upper Coastal Plain physiographic provinces of the Atlantic Slope) also have been hindered. Also, information about the habitat use of juveniles (relative to that of adults) will help interpret size-class data from the Oconee River population and facilitate better management decisions for protecting this species. Finally, this work will provide evidence of the value of stocking robust redhorse in selected river reaches for the purposes of establishing refugial populations.

Literature Cited

Conroy, M. J., J. P. Runge, R. J. Barker, M. R. Schofield, and C. J. Fonnesbeck. 2008. Efficient estimation of abundance for patchily distributed populations via two-phase, adaptive sampling. Ecology 89:3362–3370.

Department of the Interior. 2001. Candidate Conservation Agreement with Assurances and Permit Application for a Proposed Reintroduction of the Robust Redhorse. Federal Register 66(210):54776-54778.

Grabowski, T. B., F. D. Ferguson, J. T. Peterson, and C. A. Jennings. 2009. Capture probability and behavioral response of the robust redhorse, a cryptic riverine fish, to electrofishing. North American Journal of Fisheries Management. 29:721-729.

Jennings, C. A. and D. C. Shepard. 2003. Movement and habitat use of hatchery-reared juvenile robust redhorse Moxostoma robustum released in the Ocmulgee River, GA. Final Report prepared for Georgia Power Company. 36 p.

MacKenzie, D. I., J. D. Nichols, G. B. Lachman, S. Droege, J. A. Royale, and C. A. Langtimm. 2002. Estimating site occupancy rates when detection probabilities are less than one. Ecology 83(8):2248-2255.

MacKenzie, D. I. 2005. What are the issues with presence-absence data for wildlife managers? Journal of Wildlife Management 69(3):849-860.

MacKenzie, D. I., J. D. Nichols, J. A. Royale, K. H. Pollock, L. L. Bailey, and J. E. Hines. 2005. Occupancy Estimation and Modeling: inferring patterns and dynamics of species occurrence. Elsevier, San Diego, California. 324 p.