APPENDIX A-4

SALUDA HYDROELECTRIC PROJECT FRESHWATER MUSSEL ENHANCEMENT PROGRAM

SOUTH CAROLINA ELECTRIC & GAS COMPANY

COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

(FERC NO. 516)

LOWER SALUDA RIVER FRESHWATER MUSSEL ADAPTIVE MONITORING AND ENHANCEMENT PROGRAM

FINAL

JULY 2009

Prepared by:

Kleinschmidt

Energy & Water Resource Consultants

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

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COLUMBIA, SOUTH CAROLINA

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1.0 INTRODUCTION

The Saluda Hydro Project (Project) is a 202.6 megawatt (MW) licensed hydroelectric facility located on the Saluda River in Lexington, Newberry, Richland, and Saluda counties of South Carolina (Figure 1-1) that is owned and operated by South Carolina Electric & Gas Company (SCE&G or Licensee).

The Project is currently licensed by the Federal Energy Regulatory Commission (FERC No. 516), and the present license is due to expire in the year 2010. To initiate relicensing of the project, SCE&G prepared and issued the Initial Consultation Document (ICD) on April 29, 2005. In response to the ICD, the United States Fish and Wildlife Service (USFWS), South Carolina Department of Natural Resources (SCDNR), and several Non-governmental Organizations (NGO's) requested that SCE&G conduct studies characterizing the mussel fauna occurring in the Project vicinity and identify potential Project impacts to these species. SCE&G subsequently formed a Freshwater Mussels and Macroinvertebrate Technical Working Committee (TWC) to address relicensing requests related to these organisms.

With oversight from this TWC, SCE&G subsequently contracted with a regional expert (John M. Alderman) to conduct mussel surveys of the lower Saluda River (LSR) and upper Congaree River downstream of the Project dam, as well as the Project reservoir (Lake Murray) and its major tributaries. The surveys, conducted during the summer of 2006, documented 15 native freshwater mussel species as occurring in Lake Murray, its tributaries, and the upper Congaree River (Alderman, 2006).

No mussels were documented directly downstream of the Project in the LSR. Further, the study found mussel assemblages to be more diverse and have greater abundance on the Broad River side of the Congaree River than on the LSR side. These findings prompted USFWS, SCDNR and other stakeholders to request mitigation for the lack of mussel fauna in their comments on the Saluda Draft License Application and in subsequent consultation.

Resource agencies and stakeholders cited years of low dissolved oxygen levels and cold water releases as likely having had an adverse impact on mussel assemblages in the LSR. The program contained herein was prepared pursuant to this request.

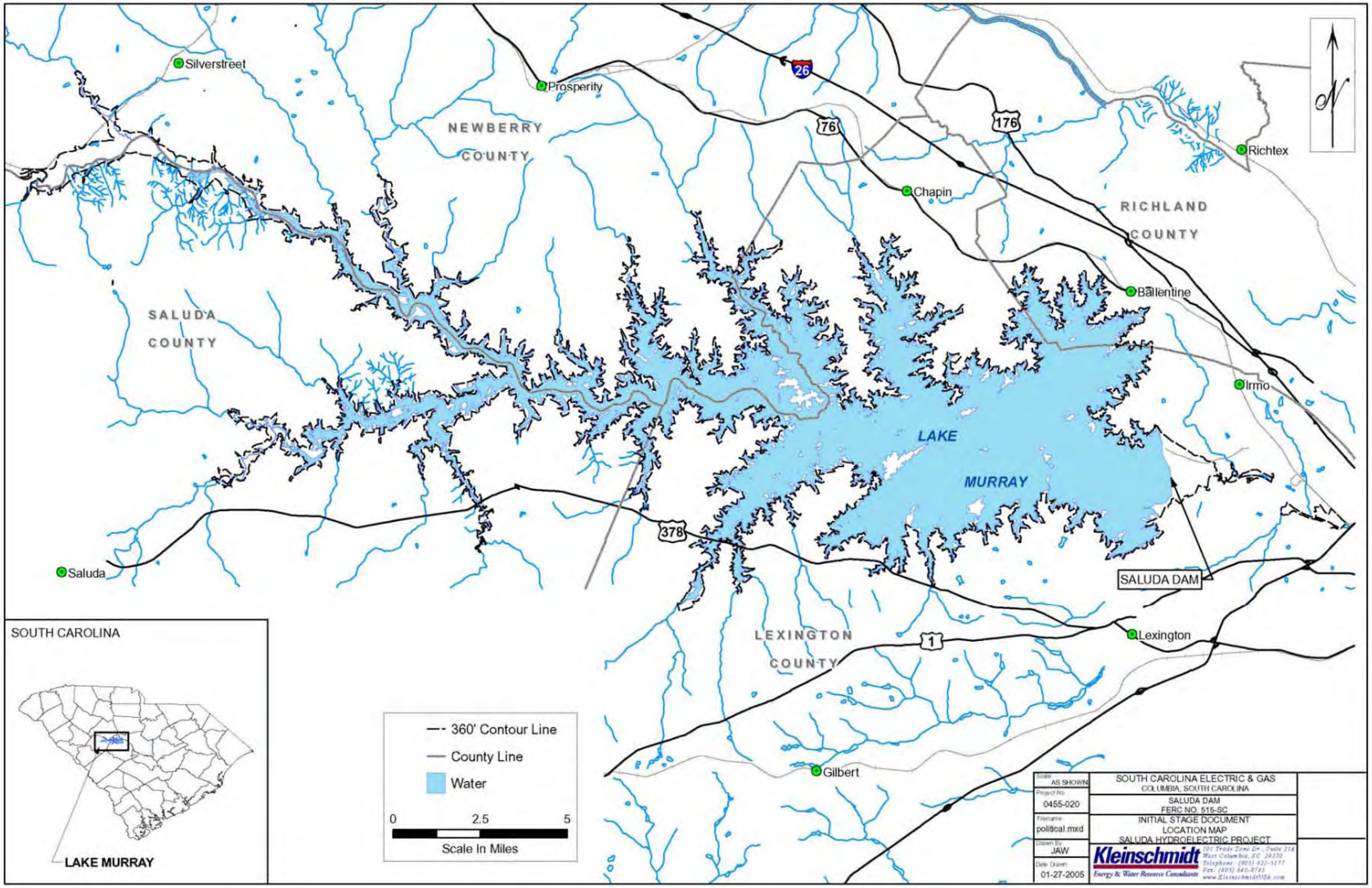

Figure 1-1: Location Map for the Saluda Hydroelectric Project (FERC No. 516)

2.0 BACKGROUND

The southeastern United States is considered the “epicenter” of North American freshwater mussel biodiversity, with approximately 90% of the 300 species known from the U.S. occurring in the region (USGS, 2000). However, the freshwater mussel fauna of most southeastern river systems has declined dramatically in the past 30 years. In the past, one of the largest impacts to mussels was the construction of large dams which converted large amounts of riverine habitat into impoundments. Subsequently, mussel populations that remained in unimpounded streams were impacted by habitat degradation caused by dredging, mining, point and non-point source pollution, and siltation. Presently, most remaining mussel populations are highly fragmented, occupying small reaches of their historic range where habitats have remained relatively unimpacted. It is estimated that 70% of our freshwater mussels are extinct, endangered, or in need of special protection (Williams, et. al. 1993).

Twenty-four species of native freshwater mussel are known to occur or are thought to have occurred historically in the Santee River Basin in South Carolina (Alderman and Bogan, 2004) (Table 2-1). However, prior to the current relicensing, little information was available regarding their distribution in Lake Murray, its tributaries, or the LSR. As previously noted, surveys conducted in support of relicensing found 15 native freshwater mussel species in Lake Murray, its tributaries, and the upper Congaree River (Alderman, 2006). While none of the species encountered are federally or state listed as threatened or endangered, a number are consider federal species of concern (Table 2-2).

In Lake Murray and its tributaries, 11 native freshwater mussel species were identified, with the sample area dominated by backwater-adapted species such as Eastern floater and paper pondshell (Table 2-2). Among the species detected in the Lake Murray surveys was the savannah lilliput (*Toxolasma pullus*), a federal species of concern that is being considered by the USFWS for listing under the Endangered Species Act (Amanda Hill, USFWS, Pers. Comm.). Recent reports of discovery a non-native lilliput (*Toxolasma parvus*) in Lake Murray have promoted concerns this non-native species could potentially compete with and displace the native *T. pullus* population. T. parvus, a native of the Upper Mississippi River Basin, uses similar habitats as native *T. pullus* and has been confirmed from at least one location in Lake Murray (J. Alderman, Alderman Environmental Services, Inc., Pers. Comm.).

Surprisingly, no native mussels were documented in the LSR from downstream of the Saluda Dam to the confluence with the Broad River (Table 2-2). Nine native species were documented in the upper Congaree River and the confluence area of the Broad and Saluda rivers. Riverine species such as Carolina slabshell and Roanoke slabshell were dominant in these two areas. Several of the species collected in the upper Congaree River and the confluence area were not collected upstream of the Saluda Dam, which could suggest the need for an anadromous host and or the lack of species-specific habitat.

Alderman (2006) also noted a greater abundance of mussels on the Broad River side of the confluence area and the upper Congaree River than on the Saluda River side, suggesting that hypolimnetic (coldwater) releases may be a limiting factor in mussel distribution. Similarly, preliminary data from the University of South Carolina suggest temporal differences in timing of mussel gravidity between areas in the Broad River upstream of the Broad/LSR confluence and areas downstream of the confluence in the upper Congaree (J. Price, Univ. of SC, Unpublished Data). Dr. Price's data suggest that downstream females are gravid one to several months later than mussels in the Broad River. Additionally, Dr. Price's data documented higher rates of gravidity in Broad River females as compared to mussels in the upper Congaree downstream of the confluence. A downstream temperature study conducted in 2006 and 2007 by SCE&G in support of relicensing found that hypolimnetic influences from Project releases (reduced water temperatures on the Saluda side of the Congaree River) extend as far downstream as 16 miles below the confluence before mixing is complete (Kleinschmidt, 2008).

SCE&G has proposed to implement minimum flow releases from Saluda Hydro to support target riverine species in the LSR (Table 2-1). The proposed flows are significantly higher than the current 180 cfs minimum flow in the LSR and will likely represent a significant habitat enhancement for many aquatic species. Conversely, implementation of the flows will also result in increased volumes of cool water being released to the areas of the Upper Congaree that harbor freshwater mussel species. As such, the USFWS has requested the monitoring of mussel aggregations in the Congaree River to evaluate potential effects of these new flows (USFWS letter dated January 28, 2009).

Table 2-1: Summary or Proposed Minimum Flows for Lower Saluda River

TIME PERIOD	FLOW (cfs)
January 1 – March 31	700
April 1 – May 10	1,000 plus SCDNR striped bass spawning flows[1]
May 11 – May 31	1,000
June 1 – December 31	700

Table 2-2: Native Freshwater Mussels of the Santee River Basin in South Carolina (Source: Alderman and Bogan, 2004, except where otherwise noted)

COMMON NAME	SPECIES	G RANK[1]	FEDERAL STATUS[2]	STATE STATUS[3]	OCCURRENCE IN BASIN[4]
Roanoke Slabshell	*Elliptio roanokensis*	G2G3	SOC		X
yellow lampmussel	*Lampsilis cariosa*	G3G4	SOC	SOC	X
Carolina slabshell	*Elliptio congaraea*	G4	SOC	SOC	X
Carolina Lance	*Elliptio angustata*	G4	SOC		X
Common Elliptio	*Elliptio complanata*	G5			X
Variable Spike	*Elliptio icterina*	G4			X
Atlantic Spike	*Elliptio producta*	G4			X
Savannah Lilliput	*Toxolasma pullus*	G3	SOC	SOC	X
Eastern floater	*Pyganodon cataracta*	G5		SOC	X
paper pondshell	*Utterbackia imbecillis*	G5		SOC	X
Rayed Pink Fatmucket	*Lampsilis splendida*	G3	SOC	SOC	X
Eastern Creekshell	*Villosa delumbis*	G4		SOC	X
Creeper	*Strophitus undulatus*	G5			X
Florida pondhorn	*Uniomerus carolinianus*	G4			X
northern lance	*Elliptio fisheriana*	G4			X
barrel floater	*Anodonta couperiana*	G4		SOC	H?
brook floater	*Alasmidonta varicosa*	G3		SOC	H,N
Triangle floater	*Alasmidonta undulata*	G4			H
Carolina heelsplitter	*Lasmigona decorata*	G1	E	E	X
Pod lance	*Elliptio folliculata*	G2G3Q			X
Eastern pondmussel	*Ligumia nasuta*	G4			X
Southern rainbow	*Villosa vibex*	G5Q		SOC	H
Notched rainbow	*Villosa constricta*	G3		SOC	N
Carolina creekshell	*Villosa vaughaniana*	G2			X
Eastern lampmussel	*Lampsilis radiata*	G5			X

[1] G1 = Critically Imperiled; G2 = Imperiled; G3 = Vulnerable; G4 = Apparently Secure; G5 = Secure
[2] Endangered; SOC = Species of Concern
[3] E = Endangered; SOC = Species of Concern (Source: SCDNR, 2008)
[4] X = extant; H = historical; N = just into N. Carolina

[1] Further detail regarding striped bass flows will be provided as negotiations are complete.

Table 2-3: Occurrence and Status of Freshwater Mussel Species Documented in the Vicinity of the Saluda Hydroelectric Project, including the Lower Saluda and Upper Congaree Rivers and Lake Murray and Selected Tributaries (Source: Alderman, 2006)

COMMON NAME	SPECIES	G RANK	FEDERAL STATUS	OCCURANCE[2]
Roanoke Slabshell	*Elliptio roanokensis*	G2G3	SOC	BR, CO
yellow lampmussel	*Lampsilis cariosa*	G3G4	SOC	BR, CO
Carolina slabshell	*Elliptio congaraea*	G4	SOC	CO
Carolina Lance	*Elliptio angustata*	G4	SOC	LM, LMT, BR, CO
Common Elliptio	*Elliptio complanata*	G5		LM, LMT, BR, CO, S*
Variable Spike	*Elliptio icterina*	G4		LMT, CO
Atlantic Spike	*Elliptio producta*	G4		LM, LMT
Savannah Lilliput	*Toxolasma pullus*	G3	SOC	LM, LMT
Eastern floater	*Pyganodon cataracta*	G5		LM, LMT
paper pondshell	*Utterbackia imbecillis*	G5		LM, LMT
Rayed Pink Fatmucket	*Lampsilis splendida*	G3	SOC	LM, CO
Eastern Creekshell	*Villosa delumbis*	G4		LM, LMT, BR, CO, S*
Creeper	*Strophitus undulatus*	G5		S*, CO
Florida pondhorn	*Uniomerus carolinianus*	G4		LM, LMT
northern lance	*Elliptio fisheriana*	G4		LM

[1] G1 - Critically Imperiled; G2 - Imperiled; G3 - Vulnerable; G4 - Apparently Secure; G5 - Secure
[2] BR = Broad; CO = Congaree; S = Saluda; LM = Lake Murray; LMT = Lake Murray Tributaries
* Refers to Saluda River side of confluence area, not in Lower Saluda River proper.

3.0 MONITORING AND RESTORATION PROGRAM

The mechanism governing mussel distributions in the Saluda Project vicinity remain unclear at this time. Potential factors influencing mussel distributions likely include biotic factors, such as presence and abundance of suitable host fish, and abiotic environmental factors such as water temperature, dissolved oxygen, and access to suitable habitats. Due to these uncertainties, SCE&G proposes to employ a phased, adaptive strategy for mussel monitoring and restoration efforts. Specifically, SCE&G proposes implementation of the following after issuance of a new FERC license for the Saluda Project.

3.1 Freshwater Mussel Working Group

SCE&G will coordinate formation of a Saluda Hydro Freshwater Mussel Working Group to provide technical expertise and guidance for mussel monitoring. Potential participants will likely include SCE&G staff, representatives from state and federal resource agencies, such as USFWS and SCDNR, as well as academic and other regional mussel experts. The Working Group will meet at

least annually to review relevant data, evaluate effectiveness of monitoring and restoration efforts to date, and to establish goals and objectives for the coming year. Minutes will be prepared for all meetings and filed with the FERC as part of the annual report (See Section Reporting 4.0).

3.2 Phase I Surveys

The following Phase I activities will be implemented within either one year or two years of issuance the new license as described below.

3.2.1 Savannah Lilliput Assessment in Upper Lake Murray

Within two years of issuance of the new FERC license, SCE&G will conduct an in-depth survey for Savannah lilliput (*Toxolasma pullus*) in upper Lake Murray to further document distribution, abundance, and reproductive status of this species. As previously noted, the Savannah lilliput is a federal Species of Concern being considered by the USFWS for listing under the Endangered Species Act. Data gathered as part of this survey will aid the USFWS in better understanding of the status of this species.

This survey will focus on Lake Murray and its tributaries, beginning in the vicinity of the Buffalo Creek area of Lake Murray (near the easternmost junction of Saluda and Newberry counties) and extending upstream into the reservoir headwaters. Survey methodology will be consistent with the 2006 reconnaissance survey of the area (Alderman, 2006), and will consist of timed, qualitative searches utilizing tactile methods (probing into substrate) and visual methods (snorkeling and/or batiscope inspections in shallow water and visual shoreline searches).

Specific sites within the survey area will be selected and prioritized based on appearance of best available habitat, with shallow shoreline areas preferred by this species given initial priority. As many sites as

possible will be surveyed during a two week survey period (10 field days). The survey team will consist of at least three trained biologists. All sites surveyed will be documented with a Global Positioning System (GPS). Approximately 1-2 person hours will be expended at each site to determine presence/absence and to maximize the number of sites examined. If presence of Savannah lilliput is confirmed at a site based on occurrence of live or dead specimens, an additional 6–12 person hours, or possibly more if needed, will be expended at each site in order to adequately document the population. Specifically, the following parameters will be collected at each site where *T. pullus* is found.

- Abundance and Catch-Per-Unit-Effort, based on total number of live and dead individuals collected.
- Length measurements (mm) for all live and fresh-dead specimens to allow development of size-class estimates and aid in determining if reproduction is taking place.
- Determination of gravidity based on examination of a sub-set of female mussels from the site.
- Estimated age of live specimens based on growth ring patterns.
- General habitat conditions, including dominant substrate, approximate slope of bank, extent of shoreline vegetative cover, depth range of population.

Microhabitat water quality data will be collected in each tributary arm surveyed and will include:

- Dissolved Oxygen (DO)
- Water Temperature
- pH
- Conductivity
- Water Hardness

All non-native lilliputs (*T. parvus*) observed during the study will be documented according to the methods described above.

3.2.2 Baseline Characterization of Congaree River Freshwater Mussel Fauna

Within one year of issuance of the new FERC license, SCE&G will initiate a baseline survey of the freshwater mussel fauna occurring in the Congaree River from the LSR/Broad confluence downstream through the area of cold water influence (approximately 16 river miles). The purpose of this data will be to provide an assessment of baseline conditions prior to the onset of significant changes associated with implementation of the new instream flow regime for the LSR, including the downstream extent of temperature effects on native mussel fauna.

Methodology will be consistent with the surveys conducted as part of the 2008 relicensing study (Alderman, 2008), and will consist of timed searches of appropriate habitat using SCUBA, tactile methods (probing into substrate) and visual methods (snorkeling and/or batiscope inspections in shallow water and visual shoreline searches). All live mussels encountered will be identified to species, enumerated, measured to the nearest mm, and returned to the point of collection. Any juvenile mussels encountered will be documented for purposes of assessing recruitment. General habitat conditions, such as dominant substrate, approximate slope of bank, extent of shoreline vegetative cover, presence of submerged aquatic vegetation, and depth range of population, will be documented.

3.3 Phase II Survey and Activities

The following Phase II activities will be implemented ten years following completion of the baseline survey described in Section 3.2.2.

3.3.1 Follow-Up Congaree River Survey

Under direction of the Freshwater Mussel Working Group, a follow-up survey of the Congaree River mussel fauna will be initiated ten years following completion of the baseline study outlined above in Section 3.2.2. This survey will again focus on the Congaree River from the LSR/Broad confluence downstream through the area of cold water influence (approximately 16 river miles) and will utilize the same methods described above in Section 3.2.2. The purpose of this survey will be to gather information on changes in the mussel fauna resulting from implementation of minimum flows in the LSR following a ten year attenuation period. In addition, the survey will identify sites suitable for experimental reintroduction/augmentation with cultured native mussel species. Specific sites recommended for mussel reintroduction/augmentation will be determined in consultation with the Freshwater Mussel Working Group.

3.3.2 Mussel Restoration Program

Phase II (10 years after the baseline survey) SCE&G will contribute $75,000.00 to the USFWS to assist in restoration activities for freshwater mussels. Restoration activities may include experimental studies, reintroduction and/or population augmentation as determined by the USFWS in consultation with the Freshwater Mussel Working Group. SCE&G will also contribute in-kind services to mussel culture efforts through collection of mussel brood stock and host fish in coordination with the follow-up survey described above in Section 3.2.1 and electrofishing during that year.

3.4 Phase III Survey

An additional follow-up survey will be conducted a minimum of five years following the initiation of mussel reintroductions outlined above in Phase II. The purpose of this survey will be to assess the effectiveness of stocking efforts and will focus on those areas where mussel populations have been augmented or reintroduced. The specific scope, timing and objectives of this survey will be further refined prior to implementation in consultation with the Freshwater Mussel Working Group.

4.0 REPORTING

SCE&G will file four reports detailing the status of freshwater mussel monitoring efforts conducted as part of this program. A draft report will be distributed to the Working Group for review and comment by the end of February of each year after a survey. The final report will be filed with the FERC and distributed to the Working Group by April 30 of the year after a survey.

5.0 FUNDING

SCE&G will provide funding and in-kind services as described in the program.

6.0 IMPLEMENTATION SCHEDULE

Phase I activities will be implemented within one year (Baseline Characterization Survey) or two years (Savannah Lilliput Assessment) of issuance the new license. Phase II will be implemented ten years following completion of the Phase I baseline survey. Phase III will be implemented no sooner than five years following initiation of mussel reintroduction discussed in Phase II.

7.0 LITERATURE CITED

Alderman, J.M. 2006. Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree Rivers, Lake Murray, and Selected Tributaries. Prepared for Kleinschmidt Associates. October 31, 2006. 166 pp.

Alderman, J.M. and A.E. Bogan. 2004. Workbook and Key to the Freshwater Bivalves of South Carolina.

South Carolina Department of Natural Resources (SCDNR). 2008. Rare, Threatened and Endangered Species County Listings. Available online at https://www.dnr.sc.gov/pls/heritage/county_species.select_county_map.

United States Geological Survey (USGS). 2000. Facts Sheet: Conservation of Southeastern Mussels. Available online at http://fl.biology.usgs.gov/southeastmussels.pdf.

Williams J.D., M.L. Warren, K.S. Cummings, J.L. Harris, and R.J. Neves**.** 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18:6- 22.