SOUTH CAROLINA GAS & ELECTRIC COMPANY

COLUMIBA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

FERC NO. 516

DIADROMOUS FISH STUDIES 2006

AMERICAN EEL (*Anguilla rostrata*) SURVEY

SEPTEMBER 2006

Prepared by:

Kleinschmidt

Energy & Water Resource Consultants

SOUTH CAROLINA GAS & ELECTRIC COMPANY
COLUMIBA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
FERC NO. 516

DIADROMOUS FISH STUDIES 2006

AMERICAN EEL (*Anguilla rostrata*) SURVEY

SEPTEMBER 2006

Prepared by:

Kleinschmidt
Energy & Water Resource Consultants

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SALUDA HYDROELECTRIC PROJECT

FERC NO. 516

DIADROMOUS FISH STUDIES 2006

AMERICAN EEL (*Anguilla rostrata*) SURVEY

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDROELECTRIC PROJECT
FERC NO. 516

DIADROMOUS FISH STUDIES 2006
AMERICAN EEL (*Anguilla rostrata*) SURVEY

1.0 INTRODUCTION

The Saluda Hydroelectric Project (the Project), which is owned and operated by the South Carolina Electric & Gas Company (SCE&G), is located in the midlands of South Carolina, astride the Saluda River. Nearly 10 miles west of the city of Columbia, the Project lies within the boundaries of Richland, Newberry, Saluda and Lexington Counties. The Project consists of Lake Murray reservoir, the Saluda Dam and its spillway, the back-up Saluda Berm, Saluda Powerhouse, intake towers and associated penstocks. On April 29th of 2005, SCE&G filed the Notice of Intent (NOI) to relicense the Project with the Federal Energy Regulatory Commission (FERC), as well as issuing the Initial Consultation Document (ICD) to the FERC and stakeholders. The current license is due to expire August 31, 2010.

In preparation for relicensing, SCE&G consulted with state and federal resource agencies, including the South Carolina Department of Natural Resources (SCDNR), U.S. Fish and Wildlife Service (USFWS), and NOAA Fisheries, to discuss agency goals regarding diadromous fish restoration in the Santee River Basin and gain early insight into diadromous fish study needs relative to relicensing of the Project (see meeting notes in Appendix A). In response to agency consultation and comments received in response to the ICD, SCE&G developed a Diadromous Fish Study Plan to document occurrence of target species in Project waters (Appendix B). Target species identified in the study plan include the American shad, hickory shad, blueback herring, and the American eel. In addition the study plan identifies the following objective for diadromous studies downstream of the Project: (1) to document presence / absence of target diadromous fish species in the Lower Saluda River (LSR) and the upper Congaree River during the spring migratory period; (2) to determine the relative abundance and spatial and temporal distributions of species found to be present in the reach; and (3) to document spawning of these species in the Saluda River relative to the Congaree River.

The purpose of this study was to provide insight into the current American eel population in the LSR. A report regarding the studies performed to document the presence/abundance, relative abundance, and spawning of blueback herring, hickory shad and American shad is being prepared under a separate cover.

2.0 BACKGROUND INFORMATION ON THE AMERICAN EEL

The American eel (*Anguilla rostrata*) is elongate, with a single continuous dorsal fin that extends to join with the caudal and anal fins. Though coloration changes throughout the development process, immature adult eels (yellow eels) usually range from yellow to greenish-brown in color. Sexually mature adults (silver eels) obtain a metallic bronze or black coloration upon migration to spawning grounds.

Considered a unique panmictic species, the American eel is the only catadromous fish in North America; meaning that although they spend the majority of their life cycle in fresh or brackish water, they migrate to the ocean to spawn. While specific information regarding the spawning of the American eel is limited, it is documented that eel spawning grounds are located in the Sargasso Sea, a portion of the Atlantic Ocean south of Bermuda.

Due to their highly migratory behavior, eels utilize a variety of habitat types in order to complete their life cycle. Necessary habitat includes both open oceans and large coastal tributaries, as well as small freshwater streams, lakes and ponds. The life cycle of the eel consists of several distinct stages which include larval stages (pre-leptocephalus and leptocephalus), the glass eel stage, the elver, the yellow eel, and the silver eel.

Larval eels can be distinguished by their unusual willow-leaf shape and transparent skin. Less than 2 inches long, the larval eel floats on currents for as long as a year in order to reach its destination, coastal estuaries. During this journey, the larval eel begins to develop adult body characteristics and grow to an approximate length of 2 inches. However, it does not become pigmented until reaching freshwater, hence the term glass eel. The elver stage is attained once the glass eel begins to ascend into brackish and freshwater streams. This stage is characterized by the pigmentation of the eel's skin and growth to a length of around 2 ½ to 3 ½ inches. Slowly the eel matures into the yellow eel stage, which can take years. The yellow eel is considered the sexually immature adult form. While some yellow eels search out homes upstream, others remain in brackish waters until maturity. An immature eel's diet is variable and can consist of phytoplankton, insects, crustaceans and variety of fish species. It can take from 7 to 30 years for the eel to fully mature. This maturation process begins as the yellow eel begins its migration back to the Sargasso Sea to spawn. During seaward migration, eels cease feeding, and the eel

takes on a metallic coloration as the body prepares itself for a saltwater environment. Little is known about the oceanic spawning migration. It is generally believed that an American eel dies after spawning, and does not return to freshwater.

The distribution of the American eel spans a large range throughout North America. A few, small populations have been found as far north as Greenland, and as far south as the northern coast of South America. In the United States, the American eel can be found along Atlantic coastal freshwaters and estuaries and as far inland as the Mississippi and Great Lakes drainages (USF&W 1983).

3.0 DESCRIPTION OF PROJECT STUDY AREA

Eel sampling was performed at five locations on the LSR and one location on the Broad River (figure A). The LSR originates at the base of the Saluda Dam and extends downstream through the 10 mile stretch of free-flowing Saluda River, where it merges with the Broad River to form the Congaree River near downtown Columbia. The majority of the Broad River is located in the piedmont province of central South Carolina and was also incorporated into the study to evaluate whether the absence of eels in our sampling was due to avoidance of the Saluda River and/or preference for the Broad River. Both stream flow and water depth are highly variable along the LSR due to the influence of releases from the Saluda Project. Typically, water depths range from 3 to 15 feet with the minimum daily flow from the project averaging around 350 cfs. The Broad River also has highly variable stream flow and depths due to natural flooding events and because the river is regulated by multiple dams in the upper reaches of the river which are managed to provide hydroelectric power. One of these dams (Columbia Canal Hydroelectric Project) is located approximately 1.7 miles upstream of the junction of the Saluda and Broad Rivers.

Eel pots were deployed at five points along the LSR and one point on the Broad River below the Columbia diversion dam. These locations were chosen according to resource agency recommendations, and include: (1) the Saluda Dam spillway; (2) the Saluda tailrace; (3) the mouth of Rawls creek adjacent to Saluda Shoals Park; (4) the mouth of Twelvemile creek; (5) the LSR downstream of Interstate 26 near the USGS gage station; (6) and the Broad River adjacent to the diversion dam (Figure A). Detailed descriptions of each sampling site are provided below.

3.1 Sampling Site Descriptions

3.1.1 The Spillway

The concrete spillway consists of a 2,900-foot long man-made channel located approximately 500 feet from the south end of the Dam. The discharge from the spillway enters the channel which subsequently empties into the LSR below the powerhouse. The eel pot was positioned in the center of the spillway channel at the base of an outcropping of bedrock (see Figures H & I). At this

location, leakage flows from the spillway gates enter the river, providing a possible attraction site for eels. The bedrock ledge also provides a natural barrier at which eels may tend to congregate (M. Cantrell, USFWS, Pers. Comm).

3.1.2 The Tailrace

Approximately 1000 ft downstream of the Saluda Dam, an eel pot was deployed into the LSR directly below USGS gage number 02168504 (see Figures L & M). The substrate along with the river bank was composed of sand with very little vegetation. Due to varied flows from the Project, the pot was placed mid-river beside exposed bedrock.

3.1.3 Rawls Creek

Rawls Creek is a small, shallow tributary of the LSR approximately 1 mile downstream of the Saluda Dam. The eel pot was placed a short distance from the confluence with the LSR, within the confines of the Saluda Shoals Park. Project flows heavily influence stream depth, and the pot had to be repositioned at different points along the thickly vegetated bank in order to remain continuously submerged (see Figures F & G). In general, tributary water levels appeared to be highly susceptible to urban run-off, which also likely contributed to the water level fluctuations observed at this site.

3.1.4 Twelvemile Creek

Twelvemile Creek and Fourteenmile Creek are two small streams that merge and enter the LSR approximately 4 miles downstream of the dam. The mouth of Twelvemile Creek provided a mid-river eel pot deployment site. The pot was originally set off the bank at the base of the Corley Mill Dam (located on Twelvemile Creek). However, due to vandalism, the pot had to be relocated to the mouth of the stream at the LSR confluence (see Figures J & K).

3.1.5 USGS Gage Station

Downstream from Interstate 26, an eel pot was deployed directly into the LSR at USGS Gage Station number 02169000, just upstream from Mill Race Rapids and approximately 1.6 miles upstream from the confluence of the Saluda with the Broad. Water depths typically average 3 to 4 feet at this site, and the shoreline is densely vegetated with overhanging shrubs and trees (see Figures B, C, D & E).

3.1.6 Broad River

The Broad River is impounded by the Columbia diversion dam located 1.7 miles above the confluence of the Broad and Saluda rivers. The diversion dam is a timber crib, rock-filled, concrete-capped structure, approximately 1000 ft long, reaching a maximum height of 14 ft above the riverbed. An eel pot was deployed in a gravel riffle area approximately 100 ft downstream of the dam. Flows over the diversion dam heavily influenced stream flow and depth, and the pot had to be repositioned at different areas below the dam in order to remain submerged. Due to inaccessibility, the Broad River sample location was not easily accessible and the trap was removed two months into the study.

Figure A: 2005 Diadromous Fish Sampling Locations

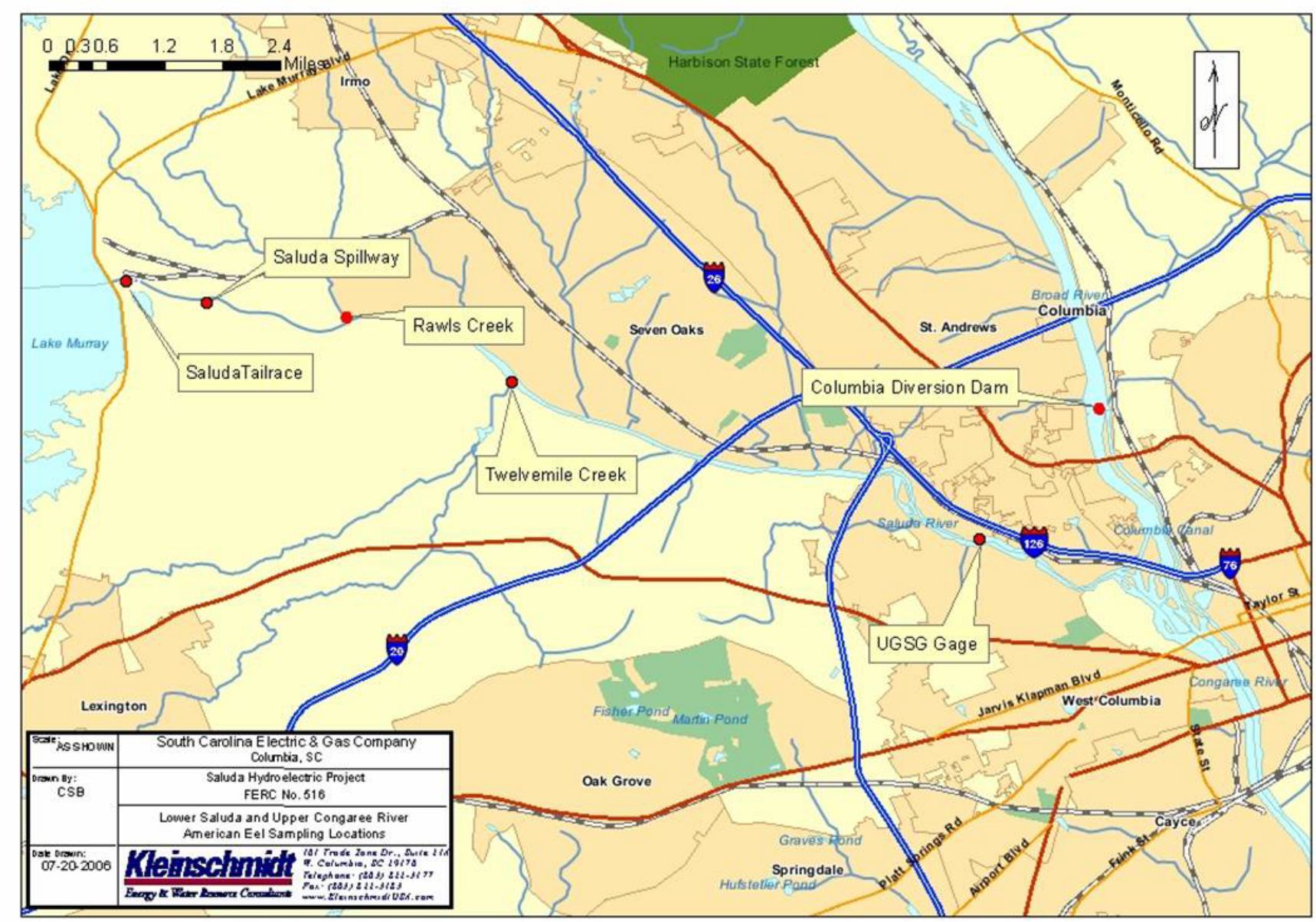


Figure B: Eel Pot Deployment Point at the USGS Gage Station

Figure C: Bank View at the USGS Gage Station (arrow indicates location of eel pot)

Figure D: USGS Gage Station

Figure E: Lower Saluda River Downstream of USGS Gage Station

Figure F: Eel Pot Deployment Point at Rawls Creek

Figure G: View of Rawls Creek
(with Eel Pot Deployment Point circled in red)

Figure H: Eel Pot Deployment Point at the Spillway

Figure I: View of the Spillway
(with deployment site circled in red)

Figure J: View of Pot Deployment Site at the Mouth of Twelvemile Creek (approximate position of pot circled in red)

Figure K: Mouth of Twelvemile Creek as it Enters the Lower Saluda River

Figure L: Eel Pot Deployment at the Saluda Dam Tailrace

Figure M: View of the Tailrace
(arrow indicates eel site deployment)

Figure N: Standard Eel Pot that was Used Throughout Sampling

4.0 GENERAL METHODS AND DATA ACQUISITIONS

Eel pots used during the sampling period consisted of double-entry, galvanized wire mesh cylinders, measuring about 2 ½ feet long (see Figure L). These pots have proven successful in sampling eels during previous studies performed on the St. Lawrence River (C. Frese, Kleinschmidt Associates, Pers. Comm.). Pots were individually baited with shrimp, raw chicken, sardines, and/or herring. Each pot was re-baited on two-week intervals or as needed. A 1 lb weight was also placed in the eel pots to insure that they remained submerged. When possible, eel pots were fished at shallow nearshore sites which included diverse shelter types, such as snags and/or plant masses. However, due to varying flows and/or vandalism, some pots were deployed mid-channel and positioned in such a spot where they were not readily noticeable. Under the circumstance of vandalism or theft, the trap was replaced as soon as feasible.

Eel pots were deployed on February 13, 2006 and allowed to fish continuously until early June, with the exception of the Broad River location and/or when a pot was stolen or vandalized. The eel pots were inspected twice a week under most circumstances. Any bycatch was field identified and released. Data recorded for each sample included: date, times in-&-out, length of eel, weight of eel, type of bait, and any bycatch. Catch per unit of effort (CPUE) was calculated as well.

Water quality data (temperature and dissolved oxygen) for the sample period were obtained from three U.S. Geological Survey (USGS) gages located along the Saluda and Broad rivers: 1) Saluda River downstream of Lake Murray Dam (# 02168504), located about 1000 feet downstream of the Saluda Dam on the LSR, 2) Saluda River near Columbia (# 02169000), located approximately 1.6 miles upstream of the confluence of the Broad and Saluda Rivers, and 3) the Broad River west of Jenkinsville, SC (# 02160991).

5.0 RESULTS

Between the months of February and June, eel traps were fished for an approximate total of 15243 trap hours; however, no eels were captured. Tables 1 through 6 summarize the trap hours for each location. Although no eels were collected, there was a considerable amount of bycatch for each sample location, which included several invertebrate and fish species (Table 7).

During the sampling period, the average water temperature of the LSR downstream of the Saluda Dam was 12.71 ˚C (gage number 02168504) and Broad River had an average water temperature of 19.38 ˚C (gage number 02160991) (See figures M, N, & O).

6.0 DISCUSSION

Existing fisheries data indicate that American eels in the LSR may be uncommon or rare. The results of this study were consistent with the American eel survey conducted on the LSR in 2005 (Kleinschmidt, 2005). General methods and sample locations of this study were similar to that of the 2005 study, excluding the tailrace and the Broad River sample locations. During the 2005 sampling period, traps were fished for approximately 9972 trap hours with no eels collected. The Broad River was incorporated into the 2006 study to evaluate the effectiveness of our sampling method and to investigate whether the absence of eels in our sampling was due to preference to the Broad River. As stated above, trapping in the Broad River was terminated two months into the study, due to inaccessibility of the sample location. Trapping efforts on the Broad River were approximately 1527 hours, which is about one tenth of the trapping time on the LSR.

There was a noticeable difference between the water temperatures of the LSR and Broad River. The average water temperature for the LSR below the dam was 12.71 ˚C and the average water temperature for the Broad River near Jenkinsville, South Carolina averaged 17.38 ˚C. Studies have shown that eels are capable of tolerating a wide range of physiochemical conditions. Karlsson et al. (1984) reported that yellow eels prefer summer water temperatures of 17.4 ± 2 ˚C.

Eels are occasionally captured along the LSR during standardized fishery sampling performed by SCE&G and SCDNR. Hal Beard of SCDNR indicated that during his 2005 fall sampling period he collected three eels total while electrofishing at ten sites along the Lower Saluda River. (H. Beard, SCDNR, Pers. Comm.). Similarly, Steve Summer of SCANA Services, Inc., noted that he captured one eel during standardized electrofishing conducted during April of 2005 (S. Summer, SCANA Services, Inc., Pers. Comm.). This information, coupled with the results of our sampling to date suggests that the distribution of eels in the LSR may be fairly low, although further sampling may be needed. It could also be surmised that the use of eel pots may not be an effective sampling method for this region.

American eel sampling performed by Duke Power on the Wateree River (also in the Santee Basin) in support of their efforts to relicense the Catawba-Wateree Hydro Project (FERC No. 2232) are reported in *Diadromous Fish Sampling in the Wateree River – 2004 & 2005*. The report noted that eel traps were fished at six different locations for a total of 116 trap weeks in 2005 with a collection rate of only 0.009 eels per trap week (1 eel for the duration of the sampling season). It was also noted that in 2004 there were no eels collected in the eel pots for the entirety of the sampling season. The low catch rate illustrated through sampling on the Wateree River appears consistent with the results achieved in 2005 and 2006 LSR sampling efforts. Better success was demonstrated through the use of an eel ramp and trap installed at the Catawba-Wateree Hydropower Project on the Wateree River; which collected over 50 American eels.

To further investigate the presence/absence of in-migrating juvenile American eels in the LSR downstream of the Saluda Hydroelectric Project, the USFWS recommended installing an eel ramp (appendix D). It was agreed that sampling should begin in May 2006 or as soon as experimental eel sampling ramps can be installed and will continue though October 2007. Sample locations include the Saluda Project spillway and at the USGS gage located on the LSR mainstream down stream of the Saluda Dam (#02168504).

Table 1: Diadromous Fish Studies – Eel Pot Surveys – USGS Gage Station

DATE	TRAP RETRIEVED	TRAP DEPLOYED	TOTAL EFFORT (Hr)
2/13/2006*	3:18	3:23	
2/24/2006	4:09	4:14	264.5
2/27/2006	2:57	3:02	71.11
3/7/2006	12:55	1:00	212
3/10/2006	3:27	3:31	74.25
3/14/2006	11:00	11:07	92.15
3/20/2006	3:25	3:30	148.15
4/3/2006	1:07	1:13	277.5
4/7/2006	11:00	11:05	95
4/11/2006[1]	10:00	10:04	
4/18/2006[2]	10:25	10:31	
4/25/2006	2:22	2:31	172
4/28/2006	12:08	12:11	70.5
5/10/2006	9:40	9:47	262
5/15/2006	12:40	12:47	122
5/24/2006	11:55	12:01	215
6/2/2006	10:00	10:06	214
6/19/2006**	11:05	11:11	409
Total			**2699.16**

* Date trap was deployed

** Date trap was retrieved

[1] Indicates a situation where the trap was either stolen or vandalized, and effort and contents of trap could not be assessed

[2] Indicates when a new eel trap was deployed after an occurrence of vandalism or theft

Table 2: Diadromous Fish Studies – Eel Pot Surveys – Rawls Creek

DATE	TRAP RETRIEVED	TRAP DEPLOYED	TOTAL EFFORT (Hr)
2/13/2006*	12:50	1:10	
2/24/2006	3:27	3:45	261.5
2/27/2006	1:20	1:45	69.5
3/7/2006	1:46	2:00	192
3/10/2006	2:51	3:05	73
3/14/2006	11:41	11:50	92.5
3/20/2006	1:18	1:50	145.25
4/3/2006	1:52	2:01	336
4/7/2006	11:45	11:54	93.75
4/11/2006	11:12	11:23	95.25
4/18/2006	11:35	11:48	168
4/25/2006[3]			
4/28/2006	12:58	1:11	241
5/10/2006	10:17	10:35	285
5/15/2006	1:03	1:16	122.5
5/24/2006	12:19	12:29	215
6/2/2006	10:31	10:50	214
6/19/2006**	12:01	12:17	409
Total			**3013.25**

* Date trap was deployed

** Date trap was retrieved

[1] Indicates a situation where the trap was either stolen or vandalized, and effort and contents of trap could not be assessed

[2] Indicates when a new eel trap was deployed after an occurrence of vandalism or theft

[3] Indicates a situation in which the trap could not be accessed due to a high water event, inclement weather situation or inaccessibility

Table 3: Diadromous Fish Studies – Eel Pot Surveys – Spillway

DATE	TRAP RETRIEVED	TRAP DEPLOYED	TOTAL EFFORT (Hr)
2/13/2006*	2:04	2:14	
2/24/2006	3:22	3:29	262.75
2/27/2006[3]			
3/7/2006	2:38	2:45	263
3/10/2006	2:17	2:27	71.75
3/14/2006	12:18	12:27	94
3/20/2006	2:05	2:18	145.5
4/3/2006	2:30	2:36	336.25
4/7/2006	12:15	12:24	93.25
4/11/2006	11:48	11:57	95.25
4/18/2006	12:18	12:26	168.25
4/25/2006[3]			
4/28/2006	1:34	1:44	241
5/10/2006	10:55	11:10	285
5/15/2006	1:31	1:37	122.25
5/24/2006**	12:36	12:52	215
Total			**2393.25**

* Date trap was deployed

** Date trap was retrieved

[1] Indicates a situation where the trap was either stolen or vandalized and effort and contents of trap could not be assessed

[2] Indicates when a new eel trap was deployed after an occurrence of vandalism or theft

[3] Indicates a situation in which the trap could not be accessed due to a high water event or inclement weather situation

Table 4: Diadromous Fish Studies – Eel Pot Surveys – Corley Mill/Twelvemile Creek

DATE	TRAP RETRIEVED	TRAP DEPLOYED	TOTAL EFFORT (Hr)
2/13/2006*	2:40	2:48	
2/24/2006	3:12	3:15	264.25
2/27/2006[3]			
3/7/2006	3:05	3:10	264
3/10/2006	2:00	2:07	70.75
3/14/2006	12:37	12:45	94.5
3/20/2006	2:28	2:37	145.75
4/3/2006	2:45	2:58	312
4/7/2006	12:35	12:45	96.60
4/11/2006	12:08	12:19	95.5
4/18/2006	12:38	12:51	168
4/25/2006[3]			
4/28/2006	1:56	2:00	241
5/10/2006	11:28	11:38	285.5
5/15/2006	1:45	1:52	122
5/24/2006	12:55	1:03	215
6/2/2006	12:06	12:12	215
6/19/2006**	12:43	12:48	408.5
Total			**2998.35**

* Date trap was deployed

** Date trap was retrieved

[1] Indicates a situation where the trap was either stolen or vandalized and effort and contents of trap could not be assessed

[2] Indicates when a new eel trap was deployed after an occurrence of vandalism or theft

[3] Indicates a situation in which the trap could not be accessed due to a high water event or inclement weather situation

Table 5: Diadromous Fish Studies – Eel Pot Surveys – Tailrace

DATE	TRAP RETRIEVED	TRAP DEPLOYED	TOTAL EFFORT (Hr)
2/13/2006*	1:28	1:48	
2/24/2006	3:47	3:55	266
2/27/2006	1:56	2:03	70
3/7/2006	2:07	2:12	192
3/10/2006	2:39	2:44	72.5
3/14/2006	11:57	12:07	93.25
3/20/2006	2:55	3:07	146.75
4/3/2006	2:10	2:18	335
4/7/2006	11:59	12:08	93.25
4/11/2006	11:30	11:36	95.75
4/18/2006	11:59	12:06	168
4/25/2006[3]			
4/28/2006	1:18	1:22	241.25
5/10/2006[1]	10:42	10:48	
5/15/2006[2]	1:20	1:26	
5/24/2006	12:35	12:42	215
6/2/2006	10:57	11:10	214.25
6/19/2006**	12:26	12:32	409.25
Total			**2612.25**

* Date trap was deployed

** Date trap was retrieved

[1] Indicates a situation where the trap was either stolen or vandalized and effort and contents of trap could not be assessed

[2] Indicates when a new eel trap was deployed after an occurrence of vandalism or theft

[3] Indicates a situation in which the trap could not be accessed due to a high water event or inclement weather situation

Table 6: Diadromous Fish Studies – Eel Pot Surveys – Broad River

DATE	TRAP RETRIEVED	TRAP DEPLOYED	TOTAL EFFORT (Hr)
2/13/2006*	4:30	4:55	
2/24/2006	4:23	4:50	263.75
2/27/2006	3:25	3:49	70.75
3/7/2006	1:08	1:22	189
3/10/2006	3:49	3:54	74.25
3/14/2006	11:15	11:22	91.5
3/20/2006	3:38	3:52	148
4/3/2006	1:23	1:34	333.75
4/7/2006	11:13	11:28	93.75
4/11/2006	10:14	10:52	94.75
4/18/2006	10:51	11:04	168
4/25/2006[3]	2:37	2:48	
4/28/2006[1]**	12:22	12:41	
Total			**1527.5**

* Date trap was deployed

** Date trap was retrieved

[1] Indicates a situation where the trap was either stolen or vandalized and effort and contents of trap could not be assessed

[2] Indicates when a new eel trap was deployed after an occurrence of vandalism or theft

[3] Indicates a situation in which the trap could not be accessed due to a high water event, inclement weather situation, or inaccessibility

Table 7: Bycatch Collected by Location

Spillway							
Species Collected	crayfish sp.	spotted sunfish	green sunfish	blue catfish			
Total Number Collected Per Species	9	1	14	1			
Rawls Creek							
Species Collected	crayfish sp.	pirate perch	darter				
Total Number Collected Per Species	57	4	1				
Twelvemile Creek							
Species Collected	crayfish sp.	pirate perch					
Total Number Collected Per Species	43	1					
USGS Station							
Species Collected	crayfish sp.	spotted sunfish	water scorpion	dragonfly larvae	freshwater shrimp	snails	darter
Total Number Collected Per Species	33	1	1	1	1	11	1
Tailrace							
Species Collected	crayfish sp.	yellow bullhead	bluegill	pirate perch			
Total Number Collected Per Species	70	1	2	1			
Broad River							
Species Collected	bluegill	redbreast sunfish	spottail shiner				
Total Number Collected Per Species	1	1	1				

Figure O: Temperature and Dissolved Oxygen Data as Recorded at USGS Gage Number 02168504 for the Duration of the Sampling Period

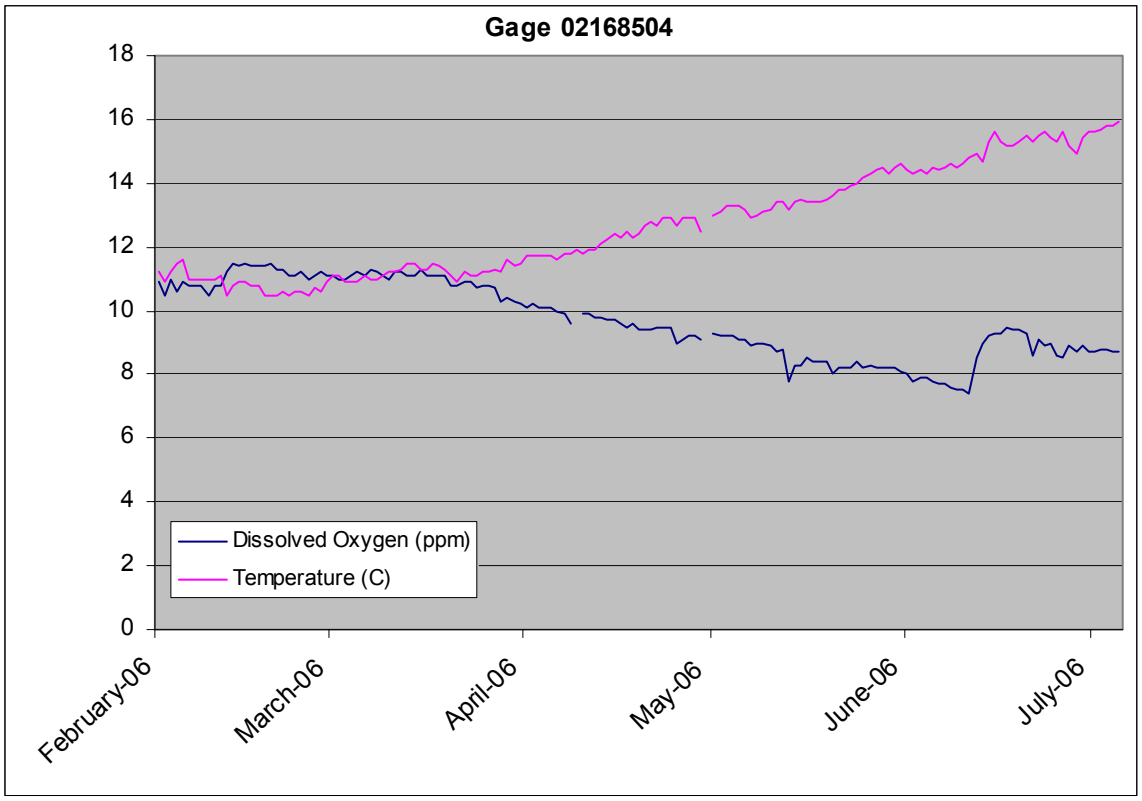


Figure P: **Temperature and Dissolved Oxygen Data as Recorded at USGS Gage Number 02169000 for the Duration of the Sampling Period**

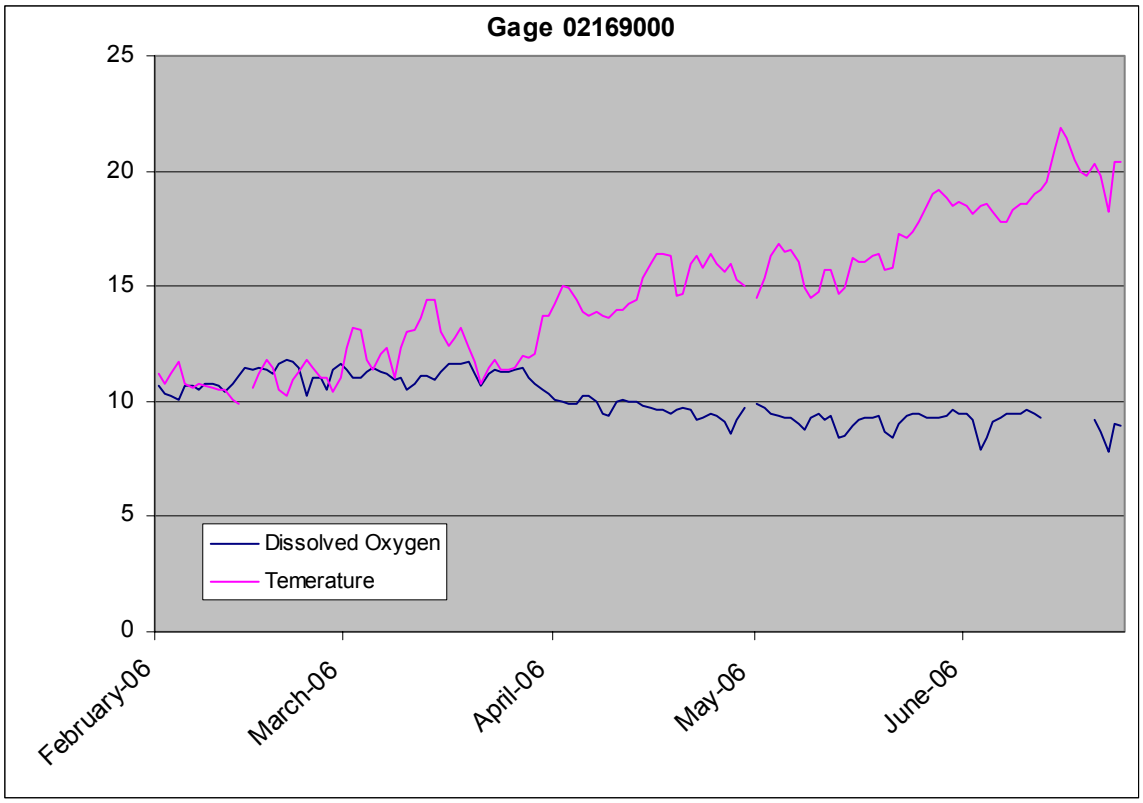
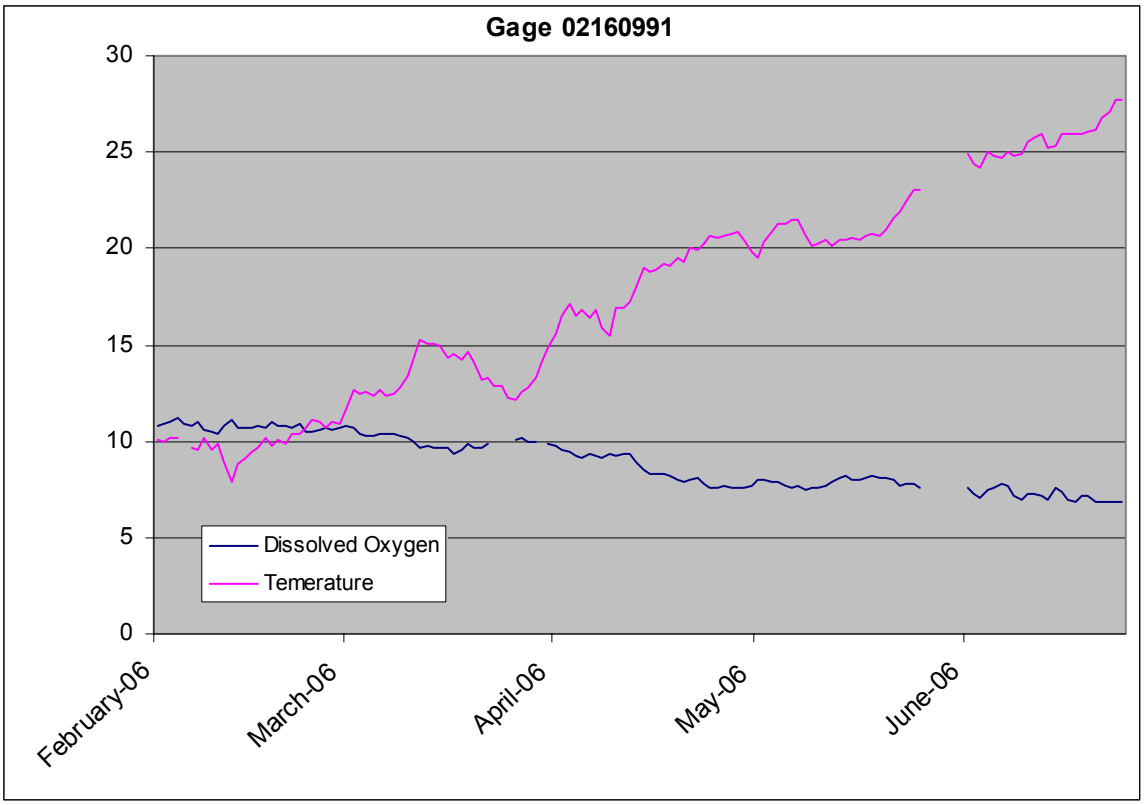


Figure Q: Temperature and Dissolved Oxygen Data as Recorded at USGS Gage Number 02160991 for the Duration of the Sampling Period



7.0 REFERENCES

Atlantic States Marine Fisheries Commission. 2000. Interstate Fishery Management Plan for the American Eel. Report No. 36; 79pp.

Coughlan, D. J., B. K. Baker, D. H. Barwick, G. E. Vaughan, A. B. Garner, W. R. Doby, J. E. Derwort, W. M. Rash, and GeoSyntec, Inc. 2005. Diadromous Fish Sampling in the Wateree River – 2004 & 2005. Catawba-Wateree Hydro Project, FERC No. 2232; 74pp.

Karlsson, L., G. Ekbohm, and G. Steinholtz. 1984. Comments on a study of the thermal behavior of the American eel (Anguilla rostrata) and some statistical suggestions for temperature preference studies. Hydrobiologia 109:75 – 78.

U.S. Fish and Wildlife Service. 1983 – 19_. Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates. U.S. Fish Wildl. Serv. Biol> Rep. 82 (11). U.s. Army Corps of Engineers, TR EL-82-4.

APPENDIX A

MEETING TO DISCUSS THE DEVELOPMENT OF THE DIADROMOUS FISH STUDY PLAN
NOVEMBER 10, 2004

Saluda Hydro Relicensing – Diadromous Fish Study Meeting – November 10, 2004
Meeting Location – SCE&G Training Center – Columbia, SC

Revision 12-10-04

Attendees:

Steve Summer	SCE&G	Dick Christie	SCDNR
Bill Argentieri	SCE&G	Steve Leach	SCDNR
Kristina Massey	SCE&G	Hal Beard	SCDNR
Randy Mahan	SCE&G	Amanda Hill	USFWS
Alan Stuart	Kleinschmidt	Mark Cantrell	USFWS
Shane Boring	Kleinschmidt	Alison Guth	Kleinschmidt

Action Items:

- Prepare a study plan for sampling diadromous fish on the Lower Saluda River and distribute to the resource agencies for review and comment.
- Obtain and distribute D.O. and flow data to the agencies. SCE&G will obtain data from the USGS.
- Organize canoes, transportation, etc. that is needed for a low flow float trip on the lower Saluda on the 29th of November (to be taken care of by Alison).
- Set up meeting with Prescott Brownell of NOAA fisheries about sturgeon issues.
- Check on permitting for studies, who needs to be there?
- Steve Leach and Mark Cantrell said that they could provide an electronic copy of the Santee Cooper Basin Diadromous Fish Passage Restoration Plan to anyone who needs it.

Meeting Notes:

These notes summarize the major items discussed during the meeting and are not intended to be a transcript or analysis of the meeting.

Alan Stuart opened the meeting at 10:00 AM and noted that the focus of the meeting would be to discuss: (1) Target Species and Restoration Plans for the Lower Saluda River (LSR), (2) Historical data needs, (3) NOAA shortnose sturgeon sampling permit, (4) Lower Saluda River Sampling logistics, (5) Sampling in Lake Murray tributaries and, (6) Establish a date for low flow float trip on the Lower Saluda River & above Lake Murray.

Target Species and Restoration Plans:

The agencies began this discussion by briefly stating the target species that they would like to see included in the diadromous fish study. The fish mentioned include blueback herring, hickory and American shad, American eel, Atlantic and shortnose sturgeon, and striped bass. Dick Christie noted that the Broad River Basin is considered number one (most promising) for fish restoration in the Santee Cooper Diadromous Fish Passage Restoration Plan. He also mentioned that the restoration plan is considered a general, wide-reaching plan.

The group decided that more studies need to be performed in order for the agencies to more fully develop their restoration plan, which is considered a living document.

Historical Data Needs:

Mark Cantrell mentioned that the flows into Lake Murray vs. the flows out of Lake Murray would provide great comparison data from which to figure out a fish's response to flow. Amanda Hill mentioned that she would like to look at temperature distributions as requested by Doug Cooke. Simple temperature data comparing the Broad River and LSR may rule out the presence of sturgeon.

Amanda Hill stated that it would be helpful to know the temperature data above and below the dam. This would allow the agencies to determine how far downstream the project influences. Steve Leach brought up the possibility of using USGS as a source for temperature data, possibly from the last 10-15 years. Dick Christie concurred that January through August would be good months to look at in regards to temperatures, flows, etc.

Amanda Hill asked if there were temperature and D.O. monitors on the Congaree itself. In response, it was stated that there was only stage data on Gervais Street. Also that there is possible data for city at sewer plant, which needs to be checked into. Moreover, around October of '88 through the present there should be data available at the dam. The agencies asked SCE&G to investigate locations for additional monitors, and the agencies will provide what data they already have. It was pointed out that SCDHEC may have some data prior to 1988.

Mark Cantrell of the USFWS asked how the project operations have changed since they first began. In response, Kristina Massey stated that since there is no flood storage pool, the project has always operated to pass large inflows so the dam won't be overtopped. Up to the late 1950s, the project was operated as a base-load facility, and the lake fluctuated much more than it does at the present. From the 1960s to 1990s, the project moved into a load-following and peaking mode, generating when power was most needed on the system and reducing the amount of annual lake fluctuation. The annual flow of water through the system has remained relatively unchanged. Currently the project is used primarily to meet system reserve needs.

Alan inquired as to where the striped bass fit into the study plan. Hal Beard replied that the striped bass use the river for refuge and then they leave and no one is sure when they arrive, what the environmental demands are and where they go. It is possible that over-exploitation could occur. Although inconclusive, work conducted by Gene Hayes suggests that, to some degree, landlocked striped bass may utilize the Upper Saluda River as spawning area. Generally, the LSR is a two-tiered fishery, trout in the winter and striped bass in the summer. Hal continued to mention that there is also concern that the striped bass could become genetically depressed due to the over fishing of the best individuals.

Mark Cantrell would like to know how stripers have been sampled historically. The group stated that the sampling performed by Hal Beard is the first sampling that has been done on a regular basis. Hal indicated he usually samples in May/October. Dick suggested that IFIM study work has been done by Isley and Jobsis.

NOAA Shortnose Sturgeon sampling permit:

- Will be discussed in a meeting with Prescott Brownell

Saluda River Sampling Logistics:
Gill Netting:

When: Start in the beginning of March (1x a week) then increase to 3x's a week from the third week in March through April
4am to 10am or 2pm to 8pm.

Where: One gillnet near the mouth of the Saluda River near the Congaree River and one towards the dam.

Supplies: 2 ½" to 7" stretch mesh nets. One net should be constructed of 2.5-inch stretched mesh, the other of 5-inch stretched mesh.

How: Possibly set at an angle to the bank. Fish two nets (one net of each mesh size) at each site, to cover approximately one half of the river's width if possible.

The group began to discuss gillnetting and its caveats. Hal Beard mentioned that he will be interested in how the gill netting is going to be performed; he has not had much luck with it in the past. However, he has achieved the most luck with it when the nets were set at an angle to the bank, rather than perpendicular. When considering a site for the net, one must consider both access and velocity. (i.e., Is velocity going to increase fish catch?)

According to Dick, in order to target American shad and blueback herring, the smallest mesh size needs to be 2 ½ " for smaller fish and as much as 7" for larger adults. Moreover, net panels need to be made to the right length and height in order to cover the channel. The group mentioned that SCE&G may want to test the feasibility of gillnetting in 2004.

Mark Cantrell clarified that the goals of this early study were as follows: to determine the presence or absence of target species, what their distribution is in the habitat, and where along the river they are located.

Kristina brought up the fact that flows may be a serious setback when gillnetting, all depending on how wet of a winter and spring we have.

The group decided that sampling should occur in 6 hour time periods. The time period for setting and monitoring gill nets should be during either 2:00 pm -8:00 pm, or possibly 4:00 am to 10:00 am. According to Dick Christie there should be a gill net set up at least at one site around the mouth of the Saluda River at the Congaree River and one in the upper reaches, near the dam (Saluda Shoals). Hal Beard suggested that one of the nets should be located about 100m below the zoo bridge.

Alan suggested using the passage rates at St Stephens as a catalyst to increase sampling efforts in the LSR. Coordination with SCDNR, as was done during the relicensing of Columbia Hydro, was proposed. There needs to be coordination with Doug Cooke and Steve

Leach to find out when the fish are being passed. Steve Leach responded that the peak at Pinopolis Dam occurs around March 7th and at St. Stevens around the 20th of March.

The discussion turned to possible sampling times and dates. It was mentioned that SCE&G may only need to sample using gill nets once a week until end of March, beginning of April, and then increase up to around 3x's a week. Hal cautioned against sampling too far into April because of the large amount of stripers.

The agencies indicated that it may be acceptable to electrofish while gill nets were soaking.

Note: *The following comments and clarifications were made by the resource agencies following the meeting*: Starting in February, set nets once a week for one run. A run will include setting nets at each site and then returning to the first site to retrieve the nets. The nets should be allowed to fish for at least 4 hours. In addition to sampling for early run fish, this would allow for resolution of problems associated with access, site selection, and various trip-based logistical problems to be addressed.

After notification of "significant" alosine passage at the Santee Cooper dams, increase sampling dates to twice per week (The agencies suggested shooting for Monday and Thursdays, to allow for some variation due to hazardous weather conditions).

The sites should be run at least twice in a day, so that nets are checked without removing from the water, if possible, on the first run, and then retrieved on the second or third trip. The goal is to fish the nets for as much of the daylight period as possible. The number of trips will be dependent on the amount of time required to make one run of the nets, travel time, etc. and can be adjusted accordingly. Nets should be fished in this mode through April and then reduced to one run (on one day) per week through May if alosine catch has decreased significantly.

The sites should be determined by locating adequate fishing habitat in close proximity to a private, public or improvised launching facility. Ideally, three sampling locations should be sampled. These locations should roughly correspond to upper, middle and lower sections of the river. A potential upper-river site should be near the SCE&G ramp at Saluda Shoals. The middle river should be generally between Fourteen Mile Creek and the Interstate 20 Bridge; the lower-river site suggested is in the vicinity of Riverbanks Zoo. Actual locations may have to be adjusted at the time of sampling due to varying flow conditions.

One additional site in the Congaree River near the confluence of the Broad and Saluda Rivers would provide information on relative abundance of fish in the river and provide indications as to whether they are selecting for the Saluda or Congaree. Sampling with the same techniques and timing as in the Saluda River would also provide insight to the effectiveness of gear and techniques, and was strongly encouraged by the agencies. Fishing near the Rosewood landing on Congaree River may prove suitable for this site.

If the catch of non-target species is high at any of the sampling sites, the length of time nets are fished can be shortened to reduce by-catch.

Eel Traps:

When: February to April

Where: At the mouths of rivers, channels and islands

Supplies: Eel pots can possibly be ordered from Wildco

Amanda Hill of FWS mentioned that they would like eel pots to be set at the mouths of rivers, channels and islands and that they were looking for potential elvers. She also stated that these would not be as laborious as gillnetting, the eel traps only needed to be checked every couple of days. Hal Beard indicated that in the past he has caught about three eels in a 10 day sampling season on average, and also that he had 5 yrs of data. Amanda replied that she would like to get that data from him if at all possible. The group mentioned that the first step was to compile as much historical data as possible.

The discussion turned to time periods in which to sample. Mark Cantrell said that February to April would be the best time to deploy eel pots.

The USFWS will provide info on equipment suppliers such as Wildco.

Note: *The following comments and clarifications were made by the resource agencies following the meeting*: Efforts should be made to determine whether eel traps can be fished on a corresponding schedule with gill nets sets. If locations as previously described (e.g. creek entrances) can be located near gill net sites, they should be utilized. Eel traps should be set there upon first deployment of the day, and checked at the end of the day. They could also be left set until the next trip (once twice a weekly sampling starts), when they should be checked and re-baited.

Plankton Nets:

When: While gill netting

Where: DNR would prefer that plankton nets be set to fish off the bottom

Supplies ½ meter, 220/500 micron single nets, possibly with flow meter attached

Amanda Hill mentioned that they would like SCE&G to put up fixed plankton nets to gather eggs and larvae. In response, Alan mentioned that if gillnetting and electrofishing provide no results, plankton nets may be unnecessary. Amanda said that plankton nets are just another way of determining presence or absence, and they are definitely needed during the spring of 2005, if nothing else.

In regards to the nets themselves, Mark Cantrell mentioned that they would prefer tows but it may be difficult to do in the river, so maybe stationary nets would be better for a given period of time. Moreover, in regards to catching herring, shad and stripers, Mark pointed out that ½ meter, 220 micron would perform the best. He also stated that a flow meter would provide volume measurements, but you would need a meter attached to each net unless they

are paired closely together. The group decided that single nets, not bongo nets, should be used. DNR would prefer that the river was fished off the bottom.

It was concluded that plankton nets can be sampled while electrofishing and gillnetting are taking place.

Note: *The following comments and clarifications were made by the resource agencies following the meeting*: Efforts should be made to fish plankton nets in conjunction with gillnets. Plankton nets may be anchored after the first gill net set at each site and retrieved upon the last gillnet retrieval of the day. This will allow for filtering the maximum volume of water during low flow periods, increasing the likelihood of sampling alosine eggs and larvae. However, if clogging with vegetation, detritus, etc. becomes problematic, plankton nets may be retrieved at the retrieval stage of the first run for gillnets each day. If clogging is still problematic, then shorter sampling times should be investigated.

Telemetry Study:

FWS expressed the desire to have a telemetry study preformed with some sentinel fish for American shad. This study will help the agencies determine if the shad utilize the Broad and LSR or just the Broad River. Also, if they have thermal preferences and selection based upon the water temperature. Dick Christie believes it would be a good idea to do this because we do not know where they go. Dick Christie also mentioned that it would benefit SCE&G if the American Shad went up the Broad River.

Kristina made the point that if we were going to do this it needed to be done right, and it may be too late to put it together properly by the springtime.

It was discussed that the fish would probably be tagged in Pinopolis. However, SCE&G does not want to study the whole basin just to determine presence in the LSR. Alan suggested that it could possibly be combined with the Columbia fish passage project effectiveness testing and yield more information and better results.
It was suggested that fish needed for the effectiveness tracking effort could be obtained from the Congaree River.

In the end, it was decided that telemetry will be performed as a second phase, along with studies associated with the Columbia Hydro Fish Passage Testing.

Temperature Monitoring:

The influence of the project, water temperature wise, downstream was again brought up. Mark Cantrell mentioned the possible need for temperature monitoring downstream, to the Congaree. Moreover, the most likely time that water temperature is affected is in the summer and fall. Amanda Hill stated that describing the thermal environment of the LSR would help determine if a possible temperature difference influences a fish's choice of sub-basin.

In regards to location, it was stated that there should be temperature sensors 1 mile downstream of dam and 1 mile upstream from zoo. Steve Summer mentioned that SCE&G could put some tidbits (temperature recorders) near the confluence on the left and right

banks. Mark Cantrell suggested that they do a transect across the river and decide where equilibrium is reached in mixing of both rivers. However SCE&G mentioned that quite a few transects would be needed to determine this, which may be difficult. Steve Summer suggested that one tidbit should be placed in the Saluda and one in the Broad River near the confluence just to track the differences for now. Mark Cantrell stated that the tidbit needs to be positioned towards the bottom but still in the water column. SCE&G mentioned that there are continuous temperature monitors in the Saluda River about 1,000 feet downstream of the hydro plant, and upstream of the zoo that are operated by USGS. It was also mentioned that there is a continuous temperature monitor in the Broad River immediately downstream of Parr Hydro, also operated by the USGS. Data from all three of these gages is available on the USGS website.

Steve Leach stated that the preferred spawning water temperature range for sturgeon is 7-18 degrees C. He also pointed out that the divergence of water temperatures between the Broad and LSR begins earlier in year then previously thought, begins around April, and is also more of an obvious difference what was once thought.

Hal Beard pointed out that it is possible that fish orient themselves toward flow instead of temperature.

It was decided that this study would be "tabled" as well.

Sampling in Lake Murray tributaries:

The agencies indicated that they would like an evaluation of potential spawning areas in the Lake and in tributaries. Amanda Hill stated that a characterization of the physical habitat below the dam and above the Lake would be helpful. This can possibly be submitted in GIS format, and would be used to determine if there is potential diadromous fish spawning habitat.

Hal Beard pointed out that Gene Hayes did some cursory work to determine if stripers could possibly be reproducing in middle Saluda, and his determination concluded that numbers were insignificant.

"Tabled" Studies

- Telemetry Study
- Temperature Monitoring in LSR and Congaree.
- Will possibly do a future Habitat Evaluation if it is in conjunction with a required flow study.
- Will determine need of habitat study after video fly-over and float trip.

Low Flow Float Trip on the Lower Saluda River:

The meeting concluded with a discussion of the canoe trip that was going to be taking place on the Lower Saluda River during low flows (400-500 cfs). It was determined that the 29th of November was the best date for everyone.

Amanda and Alan will both ask Prescott Brownell to attend.

The meeting adjourned at approximately 3:00 pm.

APPENDIX B

2005 DIADROMOUS FISH STUDY PLAN

Saluda Hydroelectric Project (FERC No. 516)
Study Plan

Study Plan Name: 2005 Diadromous Fish Studies
Applicable Hydro Projects: Saluda Hydro FERC No. 516

I. Study Objective

The objectives of this study are: (1) to document presence / absence of target diadromous fish species in the Lower Saluda River (LSR) and the upper Congaree River during the spring migratory period; (2) to determine the relative abundance and spatial and temporal distributions of species found to be present in the reach; and (3) to document spawning of these species in the Saluda River relative to the Congaree River. Target anadromous species for the study include American shad (*Alosa sappadissima*), hickory shad (*Alosa mediocris*), and blueback herring (*Alosa aestivalis*). One catadromous species, the American eel (*Anguila rostrata*), will also be targeted. The following tasks will be necessary to meet this objective:

a) Review and evaluation of historical records of target diadromous fish species occurrence in the Saluda-Congaree portion of the Santee - Cooper River Basin; and
b) Sampling of the LSR and upper Congaree River for target diadromous species during the spring spawning season.

II. Basis

Restoration of anadromous clupeids to South Carolina waters has become an important objective of resource agencies. Each spring, efforts to pass migrating American shad and blueback herring are undertaken at the first barriers to migration in the Santee - Cooper system. Once passed, these fish have several migration pathways from which to choose. One such pathway results in these fish entering the Saluda River near Columbia. The relative abundance and potential spawning of this segment of the population is of particular interest to managers.

The FERC licensing process requires an assessment of potential impacts to fish and wildlife resources by the project and its operations (18CFR4.51). The United States Fish and Wildlife Service (USFWS) has mandatory conditioning authority for fishway prescriptions at all FERC licensed hydro projects; and the National Oceanographic and Atmospheric Administration – National Marine Fisheries Service (NOAA Fisheries) has similar mandatory conditioning authority where anadromous and/or catadromous species are involved.

III. Geographic and Temporal Scope

Diadromous fish studies will focus on the Lower Saluda River (LSR), from downstream of Saluda Hydro Dam to its confluence with the Broad River, and the upper Congaree River, from its origin at the confluence of the Saluda and Broad rivers to Rosewood Boat Landing. Studies are scheduled to begin in February 2005, with a final report issued by December 31, 2005.

IV. Summary of Existing Data

The South Carolina Department of Natural Resources (SCDNR), USFWS, and NOAA Fisheries have collaborated to develop the Santee Cooper Basin Diadromous Fish Passage Restoration Plan (USFWS et al. 2001), which has been submitted to and accepted by FERC as a Comprehensive Plan under Section 10(a)(2)(a) of the Federal Power Act. The plan identifies the Saluda River as being less than optimal for diadromous fish restoration efforts for a variety of reasons including: the large number of dams in the basin (approximately 13); the limited number of river miles available to upstream migrating fish prior to reaching the Saluda Hydro Dam (approximately 10); and the cost and potential biological limitation (i.e., pressure-related impacts to outmigrating fish) of establishing fish passage at the Saluda Hydro Dam. In addition, cold hypolimnetic water released from the Saluda Hydro Dam may cause migrating fish to select the warmer water of the Broad River and not enter the Saluda (USFWS et al. 2001).

According to two recent reviews (Welch 2000, Newcomb and Fuller 2001), the target species noted above (American shad, hickory shad, blueback herring, and American eel) are among the diadromous fish species that occurred historically in Saluda-Congaree sub-basin. Shortnose sturgeon (*Acipenser brevirostrum*) and Atlantic sturgeon (*Acipenser oxyrinchus*) also occurred historically in the sub-basin; however, these species have not been recently documented in the study area upstream of old Granby Lock and Dam. While some limited fish passage above old Granby Lock and Dam may be possible through the abandoned lock or during high flows, passage may be hindered for bottom-oriented species (USFWS et al. 2001) such as sturgeons.

V. Methodology

a) Review of Historical Distributions of Target Species

Two reviews of historical occurrences of target species in the Santee-Cooper River Basin have been completed (Welch 2000, Newcomb and Fuller 2001). These two reports, along with any relevant supplemental information that can be acquired from study participants and resource agencies, will be reviewed and used to update historical distribution patterns in the Saluda-Congaree sub-basin.

b) Sampling of Target Species

Gillnetting

Adult American shad, hickory shad, and blueback herring will be sampled using gillnetting methods during the 2005 spawning season. Sampling for target species will occur at the following four locations (Figure 1):

1. The LSR at Hope Ferry Landing;
2. The LSR upstream of the Gardendale Canoe Landing;
3. The LSR adjacent to Riverbanks Zoo; and
4. The Congaree River in the vicinity of Rosewood Landing.

Beginning on or around February 1 of each sampling year, gillnets will be set once per week for one run. A typical run during this period will include setting nets at each site and then returning to the first site to retrieve the nets. Nets will be set during daylight hours and

fished for at least 4 hours. In addition to sampling for early run fish, this would allow for resolution of problems associated with access, site selection, and for various trip-based logistical problems to be addressed. This sampling schedule will continue through March 1, or until notification is received from the SCDNR that significant numbers of anadromous alosids have begun to move through the St. Stephens Fish Lift at Pineopolis Dam.

Following notification of significant movements of alosids at St. Stephens, sampling will increase to twice per week. During this period, sampling sites will be run at least twice in a day. Following deployment, nets will be checked without being removed from the water on the first run (if possible), and then retrieved on the second or third trip. Nets will be fished for as much of the daylight period as possible, with the number of trips dependent on the amount of time required to make one run of the nets, travel time, etc. Twice-per-week sampling will continue on this schedule through April of each sampling year.

Beginning on or around May 1, sampling will be reduced to once per week and will continue until approximately June 1. Sampling during this period will follow the once-per-week sampling regime as described above.

Gillnetting will utilize two 100 ft-long (30.5 m) monofilament gill nets at each sampling location: (1) one – 30 m x 2 m, 2.5 in (6.4 cm) stretch mesh; and (2) one – 30 m x 2 m, 5 in (12.7 cm) stretch mesh. Each net will be set perpendicular or at an angle to the shore, with the larger mesh net set downstream of the smaller. All fish collected in the gill nets will be identified to species, weighed (0.1 kg), measured for total length (mm), sexed (if possible without sacrificing), and released alive when possible. A measurement of water temperature (ºC) and dissolved oxygen (mg/L) will also be taken at each location.

Survey data will be evaluated for presence or absence of diadromous species known to have occurred historically in this reach of the Saluda/Congaree sub-basin. In addition, a species list will be compiled of all species encountered during the study. Catch per Unit Effort (number of fish/net hours fished) will be determined and presented in the final report. Data will be compared by date and location.

Ichthyoplankton Sampling

Ichthyoplankton nets will be fished in conjunction with gillnets, whenever possible. Specifically, one plankton net (0.5 m x 1 m, 1.0 mm mesh; surface and bottom), equipped with flowmeter, will be fished in the general vicinity of each gillnetting location. Nets will be anchored facing upstream in sufficient flow to sample effectively. Nets will be deployed after the first gillnet is set at each location and allowed to fish for four hours. If no ichthyoplankton are collected, or if clogging of the net proves to be problematic, the length of time that the nets are fished may need to be adjusted in consultation with the resource agencies.

Ichthyoplankton samples will be preserved in Buffered Neutral Formalin (BNF) and returned to the laboratory for identification. All alosid larvae and eggs will be measured for standard length (0.1 mm) and identified to the lowest possible taxon. Larval densities (number / cm^3) will be calculated, compared by date and location, and presented in the final report.

American Eel Sampling

Eel Traps will be baited and allowed to fish undisturbed for two days each week from February through May. Traps will also be deployed at the following locations to document presence/absence and relative abundance of adult and juvenile American eels:

1. The LSR at the mouth of the Saluda Dam spillway;
2. The mouth of Rawls Creek adjacent to Saluda Shoals Park;
3. The mouth of Twelvemile Mile Creek or the base of Corley Mill Dam, depending on suitable access; and
4. The LSR downstream of Interstate 26 near the USGS gage station.

All captured eels will be identified, measured for total length (0.1 mm), examined and released and the location of capture will be noted.

VI. Schedule and Required Conditions

a) The review of historical occurrences of target diadromous fish species in the Saluda/Congaree sub-basin will be completed by the end of February 2005.

b) Sampling for target diadromous species below the Saluda Hydro Dam will be conducted from February through May during 2005. A draft report summarizing the 2005 sampling results will be issued by November 1, 2005, with a final report issued by December 31, 2005. The final report will include all sampling results and conclusions regarding presence and population status of diadromous species, as well as a summary of historical distributions in the area.

VII. Use of Study Results

Results of the diadromous fish study will be used as an information resource during discussion of relicensing issues with the SCDNR, USFWS, relicensing issue working groups and other relicensing stakeholders.

VIII. Study Participants

	NAME	ORGANIZATION	PHONE	E-MAIL
Applicant Leads	Stephen E. Summer	SCANA Services	(803)217-7357	ssummer@scana.com
	Alan W. Stuart	Kleinschmidt	(803)822-3177	alan.stuart@kleinschmidtusa.com
	Shane Boring	Kleinschmidt	(803)822-3177	shane.boring@kleinschmidtusa.com
Agency Leads	Dick Christie	SCDNR	(803)289-7022	dchristie@infoave.net
	Amanda Hill	USFWS	(843)727-4707, x24	Amanda_hill@fws.gov
	Prescott Brownell	NOAA Fisheries	(843)762-8591	Prescott.brownell@noaa.gov
Other Participants	William Argentieri	SCE&G	(803)217-9162	bargentieri@scana.com
	Randy Mahan	SCANA Services	(803)217-9538	rmahan@scana.com

APPENDIX C

DIADROMOUS TECHNICAL WORKING COMMITTEE MEETING NOTES
APRIL 17, 2006

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
DIADROMOUS FISH TECHNICAL WORKING COMMITTEE

Via Conference Call
April 17, 2006

final csb 05/23/06

ATTENDEES:

Bill Argentieri, SCE&G
Pres Brownell, NOAA Fisheries (NMFS)
Amanda Hill, USFWS
Bret Hoffman, Kleinschmidt
Alan Stuart, Kleinschmidt Associates
Shane Boring, Kleinschmidt Associates
Steve Leach, SCDNR

ACTION ITEMS:

- Draft study plan for eel ladder sampling
  Shane Boring

MEETING NOTES:

These notes serve as a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring opening the meeting at approximately 10:00 AM, noting that, during the February Diadromous Fish TWC meeting, three potential locations for experimental eel sampling ramps were identified: (1) the concrete wing wall adjacent to the Saluda powerhouse taildeck (north bank), (2) the USGS gage downstream of Saluda Dam, and (3) the project spillway. He added that since that time, he and Bret Hoffman had made field visits to these sites and that the purpose of today's meeting would be to review the field visits and determine if any of the sites are suitable for deployment of an experimental ramp. Discussions regarding each of the sites are summarized below:

Concrete Wall Adjacent to Powerhouse

Bret Hoffman noted that a ramp deployed in this area would be subject to highly variable tailwater elevations and high flows when multiple units are in operation. Bret added, and Bill Argentieri agreed, that an application at this location would require a significant engineering effort and expensive installation to withstand potential water velocities. After some additional discussion, the group agreed that this location likely was not suitable for the materials proposed for the experimental ramp (i.e., corrugated plastic pipe or similar materials) and that the USGS gage and spillway are likely better locations for deployment.

USGS Gage Below Saluda Dam

Shane noted that, while there is sufficient flow at the USGS gage to attract eels, it is generally consistent across the channel and does not provide an attraction flow specifically at the gage location. Steve Leech agreed that a ramp at the gage likely would not sample the entire population migrating up the river (due to lack of an attraction flow directly at the gage); however, a ramp at this location might help in determining presence/absence of elvers in the area immediately downstream of the dam. He added that inmigrating elvers are bank-oriented; thus making this location potential suitable for sampling. After some discussion, the group agreed that, considering the low cost of building the experimental ramps, it would be worth it to deploy a ram at this location.

Spillway

After reviewing the pictures from the field visit (distributed to the TWC via e-mail on (03/17/2006), Shane noted that the spillway presents the easiest installation for an eel ramp, adding that a small attraction flow is provided at the base of the spillway's rocky reach by leakage from the gates. He added, however, that he has some concerns about whether inmigrating eels will enter the spillway channel from the Saluda's mainstem due to lack of flow at the spillway mouth. He added that, under certain conditions (i.e. rising river level) the spillway downstream of the rocks may actually flow backwards. Steve Leach reiterated that, while this site has limitations, it still may be beneficial for determining presence/absence. Noting the ease and relative inexpensive of installation, the group agreed that an attempt should be made to install an experimental ramp at this location.

Following review of the potential eel ramp locations, Shane was tasked with drafting and distributing a study plan focusing on the spillway and USGS gage locations. The meeting adjourned at approximately 10:45 AM.

APPENDIX D

STUDY PLAN: EVALUATION OF USAGE OF THE LOWER SALUDA RIVER BY IMMIGRATING JUVENILE AMERICAN EELS (*ANGUILA ROSTRATA*)

Saluda Hydroelectric Project (FERC No. 516)

Study Plan: Evaluation of Usage of the Lower Saluda River by Inmigrating Juvenile American Eels (*Anguila rostrata*)

Diadromous Fish Technical Working Committee
May 23, 2006

I. Study Objective

To determine presence/absence of inmigrating juvenile American eels (*Anguila rostrata*) in the Lower Saluda River (LSR) downstream of the Saluda Hydroelectric Project.

II. Geographic and Temporal Scope

Sampling for juvenile eels (elvers) will focus on the LSR immediately downstream of the Saluda Hydroelectric Project (from the project spillway upstream to the Saluda Dam).

Sampling is slated to begin in May 2006, or as soon as experimental eel sampling ramps can be installed (see Section III for additional detail), and will continue through October 2007.

III. Methodology

Experimental eel sampling ramps will be deployed at Saluda Project spillway (Figure 1) and at the USGS gage located on the LSR's mainstem downstream of the Saluda Project Dam (# 02168504; Figure 2). Eel ramps will be constructed of corrugated plastic pipe (4' to 10' diameter) or similar materials; a continuous flow will be provided using a pump or gravity feed to provide an attraction flow and to protect ascending eels from desiccation. Ramps will be anchored such that the downstream end remains submerged under normal low flow conditions (approximately 450 ft^3/second). The upstream opening will extend above normal high water and will be outfitted with a secured holding chamber of sufficient design to minimize predation or other mortality of captured animals. Captured eel will be counted, photo-documented, and measured, if size allows.

Figure 1 Potential Eel Ramp Location: Saluda Spillway

Figure 2. Potential Eel Ramp Location: USGS Gage Below Saluda Dam (# 02168504)

IV. Schedule and Required Conditions

Sampling will begin in May 2006, or as soon as experimental eel sampling ramps can be installed, and will continue through October 2007. Diadromous Fish TWC members will be notified via e-mail in the event that juvenile eels are captured, and an e-mail update will be issued monthly thereafter. A final report summarizing the study findings will be issued upon completion of the study period. All data collected will be provided in electronic format to agencies and interested stakeholders. Study methodology, timing, and duration may be adjusted based on consultation with the resource agencies and interested stakeholders.

V. Use of Study Results

Study results will be used as an information resource during discussion of relicensing issues with the SCDNR, USFWS, NOAA – Fisheries (National Marine Fisheries Service), Fish & Wildlife RCG, Diadromous Fish TWC, and other relicensing stakeholders.

VI. Study Participants

NAME	ORGANIZATION	PHONE	E-MAIL
Diadromous Fish Technical Working Committee			
Gerrit Jobsis	Am. Rivers/CCL	(803)771-7114 x 22	gjobsis@americanrivers.org
Alan Stuart	Kleinschmidt	(803)822-3177	Alan.stuart@kleinschmidtusa.com
Richard Kidder	LMA	(803)892-6539	rkidder@pbtcomm.net
Stephen E. Summer	SCANA Services	(803)217-7357	ssummer@scana.com
Dick Christie	SCDNR	(803)289-7022	dchristie@infoave.net
Steve Leach	SCDNR	(843)825-3388	leachs@dnr.sc.gov
Prescott Brownell	NOAA Fisheries	(843)953-7204	Prescott.brownell@noaa.gov
Amanda Hill	USFWS	(843)727-4707, x303	Amanda_hill@fws.gov
Shane Boring	Kleinschmidt	(803)822-3177	shane.boring@kleinschmidtusa.com
Additional Applicant Contacts			
William Argentieri	SCE&G	(803)217-9162	bargentieri@scana.com
Randy Mahan	SCANA Services	(803)217-9538	rmahan@scana.com

VII. List of Attachments

ATTACHMENT A: Map of Diadromous Fish Sampling Locations on the Lower Saluda and Upper Congaree Rivers

ATTACHMENT B: Meeting Notes from November 10, 2004, Diadromous Fish Study Meeting

ATTACHMENT C: Sampling Recommendations Provided by Resource Agencies (Received via e-mail December 8, 2004)

VIII. List of References

Newcomb, T.J. and J.S. Fuller. 2001. Anadromous and catadromous fish survey of Santee/Cooper Basin in North Carolina and South Carolina. Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA. Final Report, Prepared for Duke Power, June 25, 2001. 25 pp.

United States Fish and Wildlife Service, National Marine Fisheries Service, and South Carolina Department of Natural Resources. 2001. Santee-Cooper Basin diadromous fish passage restoration plan.

Welch, S.M. 2000. A report on the historical inland migrations of several diadromous fishes in South Carolina Rivers. Department of Aquaculture, Fisheries and Wildlife, Clemson University, Clemson, SC. Report prepared for Mr. Douglas W. Cook, South Carolina Department of Natural Resources. December 4, 2000. 19 pp.

APPENDIX: E

SAMPLING RECOMMENDATIONS PROVIDED BY RESOURCE AGENCIES

(RECEIVED VIA E-MAIL FROM SCDNR ON DECEMBER 8, 2004, WITH CONCURRENCE FROM USFWS ON DECEMBER 7, 2004)

SAMPLING RECOMMENDATIONS PROVIDED BY RESOURCE AGENCIES

RE: *Saluda River Sampling Logistics*
Gill netting:

After discussion with various biologists in the area we suggest the following changes to the gillnetting sampling regime that was originally discussed on November 10, 2004. These changes are designed to most effectively sample for determination of spatial and temporal distributions of alosine fishes in the system and to begin to generate an index of quantity. The general concept is to set nets near sites with boat access, so that after nets are set at one site, the boat can be trailered to the next site. For these first year studies, it is assumed that changes will need to be occur to compensate for unforeseen or as of yet poorly understood issues of manpower, river levels, site selection, gear applicability and other factors.

When: Starting in February, set nets once a week for one run. A run will include setting nets at each site and then returning to the first site to retrieve the nets. The nets should be allowed to fish for at least 4 hours. In addition to sampling for early run fish, this would allow for resolution of problems associated with access, site selection, and various trip-based logistical problems to be addressed.

After notification of "significant" alosine passage at the Santee Cooper dams, increase sampling dates to twice per week (We'd suggest shooting for Monday and Thursdays, to allow for some variation due to hazardous weather conditions).

The sites should be run at least twice in a day, so that nets are checked without removing from the water, if possible, on the first run, and then retrieved on the second or third trip. The goal is to fish the nets for as much of the daylight period as possible. The number of trips will be dependent on the amount of time required to make one run of the nets, travel time, etc. and can be adjusted accordingly. Nets should be fished in this mode through April and then reduced to one run (on one day) per week through May if alosine catch has decreased significantly.

NOTE: length of sets, etc. should be adjusted if impacts to other species are discovered.

Where: The sites should be determined by locating adequate fishing habitat in close proximity to a private, public or improvised launching facility. Three locations spread out along the river should be sampled, allowing managers to determine if fish are ascending rapids and are present at the dam. The locations should roughly correspond to upper, middle and lower sections of the river. A probable upper-river site should be near the SCE&G ramp at Saluda Dam. The actual gill netting site may have to be adjusted in varying flow conditions. The middle river should be generally between Fourteen Mile Creek and the Interstate 20 Bridge; the lower-river site suggested is in the vicinity of Riverbanks Zoo. As noted; actual locations may have to be adjusted due to varying flow conditions.

One additional site in the Congaree River near the confluence of the Broad and Saluda Rivers would provide information on relative abundance of fish available to use the Saluda River, and is strongly encouraged. Sampling with the same techniques and timing as in the Saluda River would provide insight to the effectiveness of gear and techniques. Fishing near the Rosewood landing on Congaree River may prove suitable for this site.

Supplies: Fish two nets at each site, approximately one half of the river's width. One net should be constructed of 2.5-inch stretched mesh, the other of 5-inch stretched mesh.

How: Nets should be "set" from the riverbank out perpendicular or angled to the shoreline, depending on flow conditions. Larger mesh nets should be fished downstream of the smaller mesh nets.

Eel Traps

Efforts should be made to determine whether eel traps can be fished on a corresponding schedule with gill nets sets. If locations as previously described (e.g. creek entrances) can be located near gill net sites, they should be utilized. Eel traps should be set their upon first deployment of the day, and checked at the end of the day, but probably may be left set until the next trip (once twice a weekly sampling starts). On the next trip, eel traps should be checked and re-baited.

Plankton nets

Efforts should be made to fish plankton nets in conjunction with gillnets. Plankton nets may be anchored after the first gill net set at each site and retrieved upon the last gillnet retrieval of the day. This will allow for filtering the maximum volume of water during low flow periods, increasing the likelihood of sampling alosine eggs and larvae. However, if clogging with vegetation, detritus, etc. becomes problematic, plankton nets may be retrieved at the retrieval stage of the first run for gillnets each day. If clogging is still problematic, then shorter sampling times should be investigated.