APPENDIX F

Aquatic Rare, Threatened, and Endangered Species Survey Synopsis

Aquatic Rare, Threatened, and Endangered Species Survey Synopsis

Sabal Trail Project

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Cardno ENTRIX
R. Jason Dickey & Richard W. Cantrell

Overview

Cardno ENTRIX has completed assessment of Rare, Threatened, and Endangered (RTE) aquatic species, including fish, mussels, and crayfish at streams and rivers intersected by the Sabal Trail Transmission (STT) corridor in Alabama, Georgia, and Florida. A tiered approach was used to evaluate all perennial stream and river crossings along the STT corridor. This began with a desktop review of GIS aerials, state historical database records, species occurrence maps, and life history characteristics. Crossings which were inconclusive were visited as part of an initial reconnaissance to assess habitat suitability. In total, three creeks were prioritized for mussel survey and four creeks were prioritized for fish survey based on the likely presence of RTE species and/or presence of suitable habitat. Surveys were performed during August 11th– 28th, 2014. One of the fish survey sites, Hodchodkee Creek, Stewart County, Georgia, could not be accessed due to landowner constraints. Two RTE fish species were observed, both within small creeks in Stewart County, GA, tributary to the Chattahoochee River. No RTE mussels or crayfish were observed.

Survey Methodologies

Mussel sampling techniques were based on the Freshwater Mussel Survey Protocol (Protocol) developed by the U.S. Fish and Wildlife Service and the Georgia Department of Transportation (GADNR) specifically for the drainages within the Sabal Trail right-of-way (ROW) portions throughout FL, GA, and eastern AL (Carlson et al. 2008). This Protocol was written for the expressed purpose of determining presence/absence of protected species. The standard Prescribed Survey Area (PSA) for wadeable streams stated in the Protocol (100 meters upstream and 300 meters downstream from the impact) was assumed at all crossings.

All mussel surveys were qualitative (*i.e.*, presence/absence) and were conducted via tactile and visual means. SCUBA diving facilitated surveys in deeper (>3 ft depth) habitats while snorkeling aided sampling in shallower areas. Survey efforts began at the downstream-most end of the PSA and gradually progressed upstream at a pace that allowed all productive habitats to be adequately inspected. All mussel surveys will be conducted in the presence of staff having a section 10(a)(1)(A) recovery permit, as well as applicable state scientific collecting permits.

All native Unionids collected were gathered in mesh bags and periodically sorted and enumerated by species. Captured mussels were returned to the general area from which they were collected.

Representative photographs of each species were be collected, as well as general habitat conditions within the PSA. Physiochemical data (pH, conductivity, temperature, dissolved oxygen) were also measured using properly calibrated YSI multi-parameter sondes.

Fish sampling techniques were based on the standard operating procedures (SOP) outlined by the Georgia Department of Natural Resources (GADNR) for fish biomonitoring in wadeable streams (GADNR 2005). The survey length was estimated as 25 times mean stream width in accordance with this SOP. This equated to an approximately 200-meter survey reach at most sites. Backpack electrofishing (BPEF) was the primary method of collection in accordance with conventional electrofishing techniques as described by Reynolds (1996). Stream widths at all sites necessitated the use of two BPEF units operating simultaneously. Voltage and frequency settings were adjusted to achieve as close to 2 amperes as possible but low conductivities (< 150 µmhos/cm) ultimately limited the strength and extent of the BPEF electrical field. A net tender closely shadowed each of the BPEF operators with a third net tender positioned downstream from the group to capture any fish exhibiting a delayed stun. A D-frame invertebrate dipnet will also be used to target crayfish within undercut banks, submerged aquatic vegetation, and inundated macrophytes.

Sampling began at the downstream-most end of the survey length and gradually progressed upstream at a pace that allowed all available habitats to be adequately sampled. Stunned fish captured and held in five-gallon buckets with routinely replenished water to await processing. During processing, readily identifiable fish were identified to species and enumerated. For conclusive identification, some individuals were preserved in 10% buffered formalin and taxonomically identified with the aid of a microscope. Representative photographs of each species were collected at each site. General habitat conditions were also noted and physiochemical data (pH, conductivity, temperature, dissolved oxygen) was measured using properly calibrated YSI multi-parameter sondes.

Antecedent Weather

Hydrologic data were generally not available at all target stations and so USGS gauges at similarly sized drainages were relied upon for determining an adequate survey window. Sougahatchee Creek near Auburn, Alabama (USGS 02418230) was used as a surrogate gauge for Halawakee Creek and Little Uchee Creek while Pataula Creek near Georgetown, Georgia (USGS gauge 02343225) was relied upon as surrogate for Mossy Creek and Frog Bottom Creeks. Precipitation and stage records for these gauge stations are depicted in **Figure 1**. The study area incurred a series of moderate (< 0.5 inch) storm events during spring 2014, which at times elevated stage in smaller creeks and rivers for a short period of time. Smaller watersheds such as those visited during this survey swiftly receded to previous flows within 4-5 days of each storm, but water clarity tended to remain poor for a lengthier period of time.

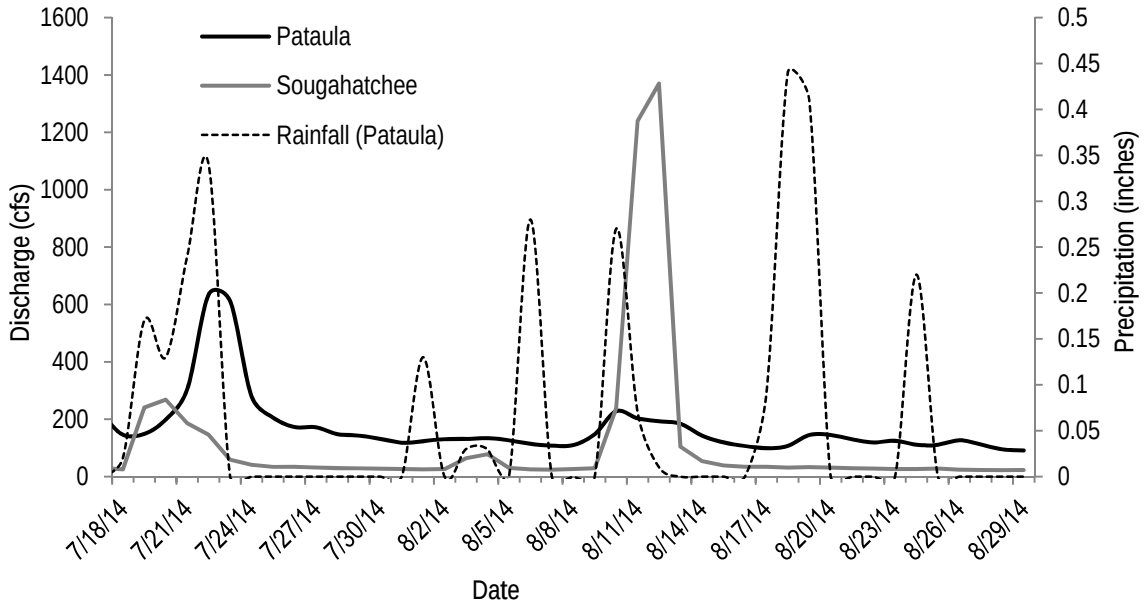

Figure 1. USGS stage and rainfall records (45-day) for two representative drainages within southeastern Alabama and southwestern Georgia.

Mussel Survey Results

Halawakee Creek, Lee County, Alabama (Spread 1)

Survey efforts at Halawakee Creek began on Monday, August 11, 2014 but were quickly halted due to an approaching thunderstorm. The storm cell sat stationary over the project area for several hours and produced between 1.0 – 1.5 inches of rainfall, which resulted in a postponement of further survey until Thursday, August 14th because of rising stream flow. Stage and flow were only slightly elevated on August 14th but water clarity was poor with a maximum visibility of approximately 4-6 inches; see **Photograph 1**. Survey efforts on August 11th were predominantly visual with tactile assistance; whereas, survey efforts on August 14th were solely tactile. Even still, the survey team was able to adequately examine all suitable habitats within the survey area. Cardno ENTRIX returned to Halawakee Creek on August 28th to resurvey a portion of the survey area under improved conditions. Water clarity on August 28th was excellent and stage/flow had returned to a seasonal base flow; see **Photograph 2**.

The surveyed habitat within Halawakee Creek was a sequence of bedrock riffles separated by deeper (3-5 ft) runs/pools; see **Photograph 3**. Loose substrate within the bedrock portions was limited to isolated pockets of coarser sand and cobble within the eddies formed by larger rocks. Substrate within the runs/pools tended to be mostly coarse sand and cobble within the deeper, mid-channel areas (**Photograph 4**) and a finer sand/silt mix along the banks. Mussels were rarely encountered within the bedrock portions and the coarser sand, mid-channel areas of the runs/pools, and only infrequently encountered along the silt/sand matrix of the banks. Periphyton was common throughout the stream but was especially abundant within the larger runs/pools with decreased canopy cover; see **Photograph 5**.

The anticipated survey extent at Halawakee Creek was to encompass the environmental survey corridor and additional areas 300 meters downstream and 100 meters upstream from the corridor boundaries. Landowner limitations prevented access to the lower portion of this survey extent, thus the downstream terminus of the survey area extended only 100 meters downstream from the centerline to avoid potential conflict.

Combined survey efforts on August 11th and 14th totaled approximately 15 person-hours. Survey efforts on August 28th totaled an additional 8 person-hours. The initial 15 person-hour survey produced 17 individual mussels, representing two species: *Elliptio pullata and Villosa vibex*; see **Table 1**. Representative photographs of each species are provided in **Photographs 6 – 7**. The Asiatic clam (*Corbicula fluminea*) was common, but not enumerated or photographed during the survey. Relict shell material belonging to the same two species observed alive was common in the fine silt/sand substrates along the bank. The follow-up survey effort on August 28th produced only four individual mussels, representing the same two species, *E. pullata* and *V.vibex*. Some of the individuals sampled on August 28th may have been recaptures from the earlier survey efforts.

Table 1. Mussel capture summary at three creeks sampled during August, 2014 in support of the Sabal Trail Transmission Project.

Common	Genus	Species	Halawakee Creek			Mossy Creek	Little Uchee Creek	
Date			8/11/2014	8/14/2014	8/28/2014	8/13/2014	8/14/2014	8/27/2014
Variable Spike	*Elliptio*	*pullata*		11	2	58	1	2
Southern Rainbow	*Villosa*	*vibex*		6	2	7		2
Little Spectaclecase	*Villosa*	*lienosa*				19	1	
Gulf Liliput	*Toxolasma*	cf. *paulum*				24		

Mossy Creek, Terrell County, Georgia (Spread 2)

The total survey extent at Mossy Creek included the environmental survey corridor and additional areas 300 meters downstream and 100 meters upstream from the corridor boundaries. Survey efforts were accomplished on August 13th by a three-person crew. The storms which had affected eastern Alabama in the days prior were not evident within this watershed and hydrologic conditions were amiable for survey. Survey efforts were both visual and tactile and the survey team was able to adequately examine all suitable habitats within the survey area.

Habitat within Mossy Creek consisted of a relatively uniform soft sand/silt substrate intermixed with woody debris; see **Photograph 8**. Undercut banks and exposed root masses were common, as were submerged leaf mats. Submerged aquatic vegetation (SAV) was present, but rare and consisted of a few isolated pockets of tapegrass (*Valisineria americana*) ; see **Photograph 9**. Average stream width was approximately eight feet with depth rarely exceeding 1.5 ft. A notable exception was the portion of creek immediately proximal to the existing transmission right-of-way. Stream width and depth within this reach was two to three times greater than the prevailing creek and substrate was too unconsolidated to walk through; see **Photograph 10**. It's unclear whether this is a result of beaver activity or installation of the existing gas pipeline; likely a combination of

both. An unnamed perennial channel follows parallel to the south of Mossy Creek and eventually converges approximately 130 meters downstream from the Project centerline. Habitat within this channel was generally similar to that observed within Mossy Creek proper.

Total survey effort on August 13th totaled approximately 15 person-hours and produced 108 individual mussels, representing four species: *E. pullata, V. vibex, V. lienosa, and Toxolasma* cf. *paulum*. Representative photographs of each species are provided in **Photographs 11 – 14**. The Asiatic clam (*Corbicula fluminea*) was common, but not enumerated or photographed during the survey. During a reconnaissance of Mossy Creek in April 2014, a single mussel was collected which was initially thought to be the rayed creekshell (*Anodontoides radiatus*); unfortunately, the specimen was mistakenly returned to the creek before a definitive identification could be made. The rayed creekshell can superficially resemble the southern rainbow (*V. vibex*) and the April surveyor acknowledged that the questionable mussel might be a juvenile *V. vibex*. Based on the results of the August survey, we feel that this individual was very likely a southern rainbow and that the rayed creekshell is likely not present within the surveyed reaches of Mossy Creek.

Little Uchee Creek, Lee County, Alabama (Spread 1)

The total anticipated survey extent at Little Uchee Creek included the environmental survey corridor and additional areas 300 meters downstream and 100 meters upstream from the corridor boundaries. Survey efforts began on Thursday, August 14th. Stage and flow were slightly elevated due to recent rainfall (≤ 72 hrs) and water clarity was poor with a maximum visibility of approximately 4-6 inches; see **Photograph 15**. Survey efforts were solely tactile and generally focused on the near-bank portions where habitat was more supportive for mussels (*i.e.*, firmer substrate base of silt/sand mix). Cardno ENTRIX returned to Little Uchee Creek on August 27th to resurvey a portion of the survey area under improved conditions. Water clarity on August 27th was excellent and stage/flow had returned to a seasonal base flow; see **Photograph 16**. Survey efforts on this day were both visual and tactile.

Habitat within Little Uchee Creek was a sequence of bedrock riffles separated by deeper (3-5 ft) runs/pools. Substrate within the bedrock portions was limited to isolated pockets of coarser sand and cobble within the eddies formed by larger rocks. Substrate within the runs was variable. Mid-channel habitat consisted of coarse sand and rock interspersed between boulders. Substrates along the near-bank portions were still rock dominated but rock sizes tended to be smaller and the prevailing sediments consisted of finer sand/silt matrix. Periphyton and filamentous algae was common throughout but had a tendency to dominate in larger runs with decreased canopy cover, to the extent that habitat was 100% smothered; see **Photograph 17**.

Combined survey efforts on August 11th and 14th totaled 12 person-hours. Survey efforts on August 28th totaled an additional 12 person-hours. The initial 12 person-hour survey produced two individual mussels, representing two species: *E. pullata and V. lienosa*. Representative photographs of each species are provided in **Photographs 18 – 20**. The Asiatic clam was common but not enumerated or photographed. The follow-up survey effort on August 28th produced four individual mussels, representing three species: *E.pullata, V.lienosa*, and *V. vibex*. Some of the individuals sampled on August 28th may have been recaptures from the earlier survey efforts.

Fish & Crayfish Survey Results

Mossy Creek, Terrell County, Georgia (Spread 2)

A fish survey was performed at Mossy Creek on August 25th, 2014. Backpack electrofishing (BPEF) was the primary method of collection. Dip nets were also used to selectively target undercut banks and patches of SAV. The survey length was estimated as 25 times mean stream width in accordance with the Georgia Department of Natural Resources (GADNR) protocol for fish biomonitoring in wadeable streams (GADNR 2005). At Mossy Creek, this equated to an approximately 200-meter survey reach.

Voltage and frequency settings were adjusted to achieve as close to 2 amperes as possible but low conductivity (< 150 µmhos/cm) ultimately limited the strength and extent of the BPEF electrical field. To help compensate, two BPEF operators worked in tandem to simultaneously sample opposing banks while moving in an, upstream fashion; see **Photograph 21**. A net tender closely shadowed each of the BPEF operators with a third net tender positioned downstream from the group to capture any fish exhibiting a delayed stun.

In total, 151 individuals representing 18 species were captured during 4,608 seconds of total shock time; see Table **2**. Catch-per-unit-effort (CPUE) was approximately 118 fish per hour. The species and abundances sampled were typical and as expected for the given habitat. Sunfish (*Lepomis* spp.) accounted for approximately half of the fish abundance collected. Other abundant species included pirate perch (*Aphredoderus sayanus*), brook silverside (*Labidesthes sicculus*), and coastal shiner (*Notropis petersoni*). Representative photographs of each species are provided in **Photographs 22 – 39**.

Pataula Creek, Stewart County, Georgia (Spread 2)

A fish and crayfish survey was performed at Pataula Creek on August 26th, 2014. Backpack electrofishing (BPEF) was the primary method of collection. Dip nets were also used to selectively target undercut banks and patches of SAV. The survey length was estimated as 25 times mean stream width in accordance with the Georgia Department of Natural Resources (GADNR) protocol for fish biomonitoring in wadeable streams (GADNR 2005). At Pataula Creek, this equated to an approximately 200-meter survey reach.

Voltage and frequency settings were adjusted to achieve as close to 2 amperes as possible but low conductivity (< 90 µmhos/cm) ultimately limited the strength and extent of the BPEF electrical field. To help compensate, two BPEF operators worked in tandem to simultaneously sample opposing banks while moving in an, upstream fashion. A net tender closely shadowed each of the BPEF operators with a third net tender positioned downstream from the group to capture any fish exhibiting a delayed stun.

In total, 112 fish representing 17 species were captured during 3,456 seconds of total shock time; see **Table 2.** Catch-per-unit-effort (CPUE) was approximately 117 fish per hour. The white-tubercled crayfish (*Procambarus spiculifer*) was common at this site but was not enumerated; see

Photograph 40. Weed shiner (*Notropis texanus*) was the most common fish species sampled, followed by redbreast sunfish (*Lepomis auritus*), spotted sunfish hybrids (*L. miniatus x punctatus*), and silverjaw minnow (*N. buccatus*). The target RTE fish at this crossing, broadstripe shiner (*Pteronotropis euryzonus*), was confirmed as present; see **Photograph 41**. Representative photographs of all other species observed at this site are provided in **Photographs 42 – 58**. The target RTE crayfish, grainy crayfish (*Procambarus verrucosus*) was not encountered.

Table 2. Fish capture summary at three creeks sampled during August, 2014 in support of the Sabal Trail Transmission Project.

Common	Genus	Species	Mossy Creek	Pataula Creek	Frog Bottom Creek
Yellow Bullhead	*Ameiurus*	*natalis*	1	2	5
Pirate Perch	*Aphredoderus*	*sayanus*	20	8	1
Lake Chub Sucker	*Erimyzon*	*sucetta*	5	1	
Redfin Pickerel	*Esox*	*americanus*	2	8	
Brown Darter	*Etheostoma*	*edwini*	6	2	
Gulf Darter	*Etheostoma*	*swaini*	2		
Goldstripe Darter	*Etheostoma*	*parvipinne*			3
Blackspotted Topminnow	*Fundulus*	*olivaceous*		1	
Eastern Mosquitofish	*Gambusia*	*holbrooki*	2	1	
Southern Brook Lamprey	*Ichthyomyzon*	*gagei*		2	1
Brook Silverside	*Labidesthes*	*sicculus*	11		
Redbreast Sunfish	*Lepomis*	*auritus*	25	15	5
Bluegill Sunfish	*Lepomis*	*macrochirus*	23		16
Redear Sunfish	*Lepomis*	*microlophus*	6		
Spotted Sunfish (hybrid)	*Lepomis*	*miniatus* x *punctatus*	22	13	
Warmouth	*Lepomis*	*gulosus*	2		1
Longear Sunfish	*Lepomis*	*megalotis*		3	3
Green Sunfish	*Lepomis*	*cyanellus*			4
Juvenile Sunfish (Unid)	*Lepomis*	*sp.*		1	
Largemouth Bass	*Micropterus*	*salmoides*			1
Spotted Sucker	*Minytrema*	*melanops*	1	2	
Golden Shiner	*Notemigonus*	*crysoleucas*	3		
Coastal Shiner	*Notropis*	*petersoni*	9		
Silverjaw Shiner	*Notropis*	*buccatus*		10	32
Longnose Shiner	*Notropis*	*longirostris*			53
Weed Shiner	*Notropis*	*texanus*		30	2
Speckled Madtom	*Noturus*	*leptacanthus*		3	4
Black Madtom	*Noturus*	*funebris*			1
Blackbanded Darter	*Percina*	*nigrofasciata*	7	3	8
Apalachee Shiner	*Pteronotropis*	*grandipinnis*	4		
Broadstripe Shiner	*Pteronotropis*	*euryzonus*		7	
Creek Chub	*Semotilus*	*atromaculatus*			139

Table 2. Fish capture summary at three creeks sampled during August, 2014 in support of the Sabal Trail Transmission Project.

Common	Genus	Species	Mossy Creek	Pataula Creek	Frog Bottom Creek
Total Abundance			151	112	278
Shock Time (hrs)			**1.28**	**0.96**	**1.44**
Catch Per Unit Effort (#/hr)			118	117	193

Frog Bottom Creek, Stewart County, Georgia (Spread 2)

A fish and crayfish survey was performed at Frog Bottom Creek on August 27th, 2014. Backpack electrofishing (BPEF) was the primary method of collection. Dip nets were also used to selectively target undercut banks and patches of SAV. The survey length was estimated as 25 times mean stream width in accordance with the Georgia Department of Natural Resources (GADNR) protocol for fish biomonitoring in wadeable streams (GADNR 2005). At Frog Bottom Creek, this equated to an approximately 200-meter survey reach. This reach is bisected by a rip-rap crossing along the existing transmission line easement that has impounded upstream waters and effectively blocked upstream passage of fish; see **Photograph 59**.

Voltage and frequency settings were adjusted to achieve as close to 2 amperes as possible but low conductivity (< 75 µmhos/cm) ultimately stifled the strength and extent of the BPEF electrical field. To help compensate, two BPEF operators worked in tandem to simultaneously sample opposing banks while moving in an, upstream fashion. A net tender closely shadowed each of the BPEF operators with a third net tender positioned downstream from the group to capture any fish exhibiting a delayed stun.

In total, 278 fish representing 17 species were captured during 5,184 seconds of total shock time; see Table **2**. Catch-per-unit-effort (CPUE) was approximately 193 fish per hour. Additionally, 28 white-tubercled crayfish (*Procambarus spiculifer*) were also captured; see **Photograph 60**. The vast majority (99%) of fish were captured downstream from the rip-rap crossing of and existing transmission line. The creek chub (*Semotilus atromaculatus*) dominated the downstream community where it accounted for 50% of total catch. Longnose shiner (*Notropis longirostris*) and silverjaw minnow were also abundant and together accounted for 30% of total catch. Only 13 individuals were captured upstream from the rip-rap. They were comprised of largemouth bass (*Micropterus salmoides*), redbreast sunfish, bluegill sunfish, weed shiner, and yellow bullhead (*Ameirus natalis*). The goldstripe darter (*Etheostoma parvipinne*), one of the RTE fish species targeted during this survey, was confirmed present downstream from the rip-rap crossing; see **Photograph 61**. Representative photographs of all other species observed at this site are provided in **Photographs 62 – 72**.

PHOTOGRAPHIC DOCUMENTATION

Photograph 1: Halawakee Creek, AL on August 14th, 2014

Photograph 2: Halawakee Creek, AL on August 28th, 2014

Photograph 3: Riffle/Run/Pool sequence at Halawakee Creek, AL

Photograph 4: Coarse sand substrate at Halawakee Creek, AL

PHOTOGRAPHIC DOCUMENTATION

Photograph 5: Abundant periphyton at Halawakee Creek, AL

Photograph 6: *Elliptio pullata* collected from Halawakee Creek, AL

Photograph 7: *Villosa vibex* collected from Halawakee Creek, AL

Photograph 8: Instream habitat at Mossy Creek, GA

PHOTOGRAPHIC DOCUMENTATION

Photograph 9: Patchy SAV (foreground) at Mossy Creek, GA

Photograph 10: Atypical habitat: existing easement at Mossy Creek, GA

Photograph 11: *Elliptio pullata* collected from Mossy Creek, GA

Photograph 12: *Villosa vibex* collected from Mossy Creek, GA

PHOTOGRAPHIC DOCUMENTATION

Photograph 13: *Villosa lienosa* collected from Mossy Creek, GA

Photograph 14: *Toxolasma* cf. *paulum* collected from Mossy Creek, GA

Photograph 15: Little Uchee Creek, AL on August 14th, 2014

Photograph 16: Little Uchee Creek, AL on August 27th, 2014

PHOTOGRAPHIC DOCUMENTATION

Photograph 17: Abundant periphyton at Little Uchee Creek, AL

Photograph 18: *Elliptio pullata* collected from Little Uchee Creek, AL

Photograph 19: *Villosa lienosa* collected from Little Uchee Creek, AL

Photograph 20: *Villosa vibex* collected from Little Uchee Creek, AL

PHOTOGRAPHIC DOCUMENTATION

Photograph 21: Dual backpack electrofishers at Mossy Creek, GA

Photograph 22: *Ameiurus natalis* captured at Mossy Creek, GA

Photograph 23: *Aphredoderus sayanus* captured at Mossy Creek, GA

Photograph 24: *Erimyzon sucetta* captured at Mossy Creek, GA

PHOTOGRAPHIC DOCUMENTATION

Photograph 25: *Esox americanus* captured at Mossy Creek, GA

Photograph 26: *Etheostoma edwini* captured at Mossy Creek, GA

Photograph 27: *Etheostoma swaini* captured at Mossy Creek, GA

Photograph 28: *Gambusia holbrooki* captured at Mossy Creek, GA

PHOTOGRAPHIC DOCUMENTATION

Photograph 29: *Labidesthes sicculus* captured at Mossy Creek, GA

Photograph 30: *Lepomis auritus* captured at Mossy Creek, GA

Photograph 31: *Lepomis macrochirus* captured at Mossy Creek, GA

Photograph 32: *Lepomis microlophus* captured at Mossy Creek, GA

PHOTOGRAPHIC DOCUMENTATION

Photograph 33: *Lepomis miniatus* x *punctatus* captured at Mossy Creek, GA

Photograph 34: *Lepomis gulosus* captured at Mossy Creek, GA

Photograph 35: *Minytrema melanops* captured at Mossy Creek, GA

Photograph 36: *Notemigonus crysoleucas* captured at Mossy Creek, GA

PHOTOGRAPHIC DOCUMENTATION

Photograph 37: *Notropis petersoni* captured at Mossy Creek, GA

Photograph 38: *Percina nigrofasciata* captured at Mossy Creek, GA

Photograph 39: *Pteronotropis grandipinnis* captured at Mossy Creek, GA

Photograph 40: *Procambarus spiculifer*

PHOTOGRAPHIC DOCUMENTATION

Photograph 41: *Pteronotropis euryzonus* at Pataula Creek, GA

Photograph 42: *Ameiurus natalis* captured at Pataula Creek, GA

Photograph 43: *Aphredoderus sayanus* captured at Pataula Creek, GA

Photograph 44: *Erimyzon sucetta* captured at Pataula Creek, GA

Photograph 45: *Esox americanus* captured at Pataula Creek, GA

Photograph 46: *Etheostoma edwini*

Photograph 47: *Fundulus olivaceous* captured at Pataula Creek, GA

Photograph 48: *Gambusia holbrooki*

PHOTOGRAPHIC DOCUMENTATION

Photograph 49: *Ichthyomyzon gagei* captured at Pataula Creek, GA

Photograph 50: *Lepomis auritus* captured at Pataula Creek, GA

Photograph 51: *Lepomis miniatus* x *punctatus* captured at Pataula Creek, GA

Photograph 52: *Lepomis megalotis* captured at Pataula Creek, GA

PHOTOGRAPHIC DOCUMENTATION

Photograph 53: *Lepomis* sp. (juv.) captured at Pataula Creek, GA

Photograph 54: *Minytrema melanops* captured at Pataula Creek, GA

Photograph 55: *Notropis buccatus* captured at Pataula Creek, GA

Photograph 56: *Notropis texanus* captured at Pataula Creek, GA

PHOTOGRAPHIC DOCUMENTATION

Photograph 57: *Noturus leptacanthus* captured at Pataula Creek, GA

Photograph 58: *Percina nigrofasciata* captured at Pataula Creek, GA

Photograph 59: Rip-rap easement crossing at Frog Bottom Creek, GA

Photograph 60: *Procambarus spiculifer* at Frog Bottom Creek, GA

PHOTOGRAPHIC DOCUMENTATION

Photograph 61: *Etheostoma parvipinne* captured at Frog Bottom Creek, GA

Photograph 62: *Ameiurus natalis* captured at Frog Bottom Creek, GA

Photograph 63: *Aphredoderus sayanus* captured at Frog Bottom Creek, GA

Photograph 64: *Ichthyomyzon gagei*

PHOTOGRAPHIC DOCUMENTATION

Photograph 65: *Lepomis macrochirus* captured at Frog Bottom Creek, GA

Photograph 66: *Lepomis cyanellus* captured at Frog Bottom Creek, GA

Photograph 67: *Notropis buccatus* captured at Frog Bottom Creek, GA

Photograph 68: *Notropis longirostris* captured at Frog Bottom Creek, GA

PHOTOGRAPHIC DOCUMENTATION

Photograph 69: *Noturus leptacanthus* captured at Frog Bottom Creek, GA

Photograph 70: *Noturus funebris* captured at Frog Bottom Creek, GA

Photograph 71: *Percina nigrofasciata* captured at Frog Bottom Creek, GA

Photograph 72: *Semotilus atromaculatus* captured at Frog Bottom Creek, GA