FISH KILL INVESTIGATION REPORT

Ogeechee River
Effingham, Bulloch, Screven, Bryan and Chatham Counties, Georgia
May 20, 2011

Reported by:
Tim Barrett and Joel Fleming

June 10, 2011

Department of Natural Resources
Wildlife Resources Division
Fisheries Section
Region VII

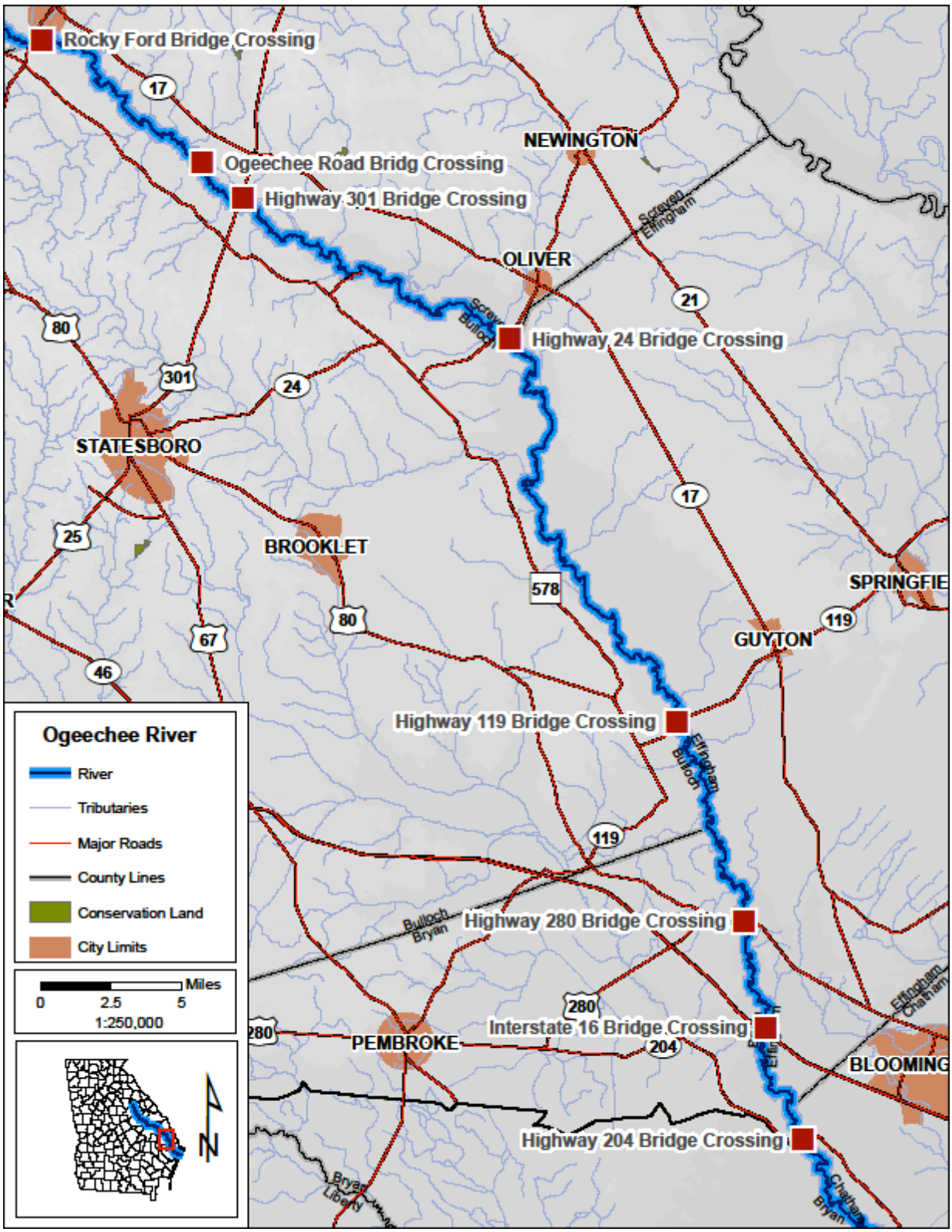
Ogeechee River Fish Kill Investigation
May 20, 2011

Notification and Details of the Investigation

On May 20, 2011 at 1430 hours, Tim Barrett, Region VII Wildlife Resources Division (WRD) Fisheries supervisor, received a call from Ted Will of the Georgia Department of Natural Resources Fisheries Headquarters in Social Circle regarding a fish kill report on the Ogeechee River at Hwy 301, Bulloch County. Assistant chief Will relayed that a citizen had reported seeing dead fish in the river around the Hwy 301 bridge on May 20. Barrett was within relatively close proximity to this area and proceeded directly to a site upstream of the reported kill in an attempt to find an upper limit of the fish kill. The first site that Barrett assessed was the Rocky Ford boat ramp in Bulloch County Georgia (Figure 1). At this site, Barrett observed no dead fish and saw multiple species of fish swimming in good condition. Water quality parameters of dissolved oxygen and temperature were within normal range. After assessing the Rocky Ford boat ramp area, Barrett proceeded to the Hwy 301 bridge crossing (Figure 1). Upon arrival Barrett noticed many dead and dying fish. Several fish had lesions on the skin and gills. Some fish were in the process of dying and some appeared to have been dead for several days. Several groups of people were swimming in the river and reported seeing dead fish 4 to 5 days prior to May 20. An angler that was in the river actively fishing reported catching fish the weekend prior (May 14) but he reported that he had not caught any fish on the present day. Dissolved oxygen readings were found to be in the normal range (7.8 milligrams per liter (mg/l)). Barrett then contacted the State Operations Center at 1818 hours to report the fish kill. Barrett received a call from the Environmental Protection Divisions (EPD) Emergency Response Coordinator Michelle Cortez at 1900. Barrett then proceeded to Hwy 24 bridge crossing and encountered dead and dying fish at this site as well. In an attempt to locate the extent of the kill, Barrett continued to locate and inspect sites further downstream. Upon arrival at the Hwy 119 bridge crossing, Barrett observed only one dead darter near the boat ramp.

On May 21, Barrett and Fisheries Technician Ben Ballard met at Richmond Hill Hatchery at 0700 and proceeded to the river to further investigate the upper portion of the kill area. Barrett and Ballard launched a boat above the Hwy 301 bridge crossing at a private ramp adjacent to the Ogeechee Road bridge crossing (Figure 1) and proceeded downstream in an attempt to locate the start of the fish kill. Live fish were observed swimming and appeared unstressed and no dead fish were observed at the Ogeechee Road ramp. Dissolved oxygen was 6.8 mg/L and pH was 7.5 at the ramp. Barrett and Ballard found no dead fish in a stretch from Ogeechee Road for 2.0 river miles downstream. The first dead fish were encountered approximately 50 yards below the King America Finishing Inc. effluent pipe. Numerous wading birds and vultures lined the riverbank downstream from that point and a noticeable odor of dead fish was present. Dissolved oxygen just below the effluent was 7.0 mg/L and the pH was 7.5. Barrett and Ballard continued downstream and observed varying stages of mortality. Many fish appeared to have died several days prior while many were near death. The team continued downriver assessing the kill. Dead fish of multiple species and sizes were observed floating on the top of the water and on the river bottom but enumeration of bottom fish was difficult due to water depth and clarity. In this segment of the river, several groups of people were observing the dying fish from the riverbank.

Figure 1. Location of Bridge Crossing in the May, 2011 Ogeechee River Fish Kill Area.



One group reported seeing dead fish two days prior. The team arrived at the Hwy 301 bridge crossing where two more groups of people stated that they had seen fish starting to die on Thursday (May 19). Barrett contacted the EPD Designated Duty Officer Michele Cortez at 1229 hours to update her on the status and extent of the fish kill. At 1233 hours Biologist Barrett contacted WRD Assistant Chief of Fisheries Matt Thomas to update him on the status of the investigation and the extent of the fish kill.

This same morning, in an attempt to locate the current lower extent of the fish kill, another crew consisting of Region VI Fisheries personnel, Fisheries Technician Ward Crosby and Utility Worker Brentz McGhin, departed from Waycross, GA to an area of the Ogeechee between Hwy 301 and Hwy 24. This crew launched a boat at a location known as Williams Landing and found dead fish. The crew could not find the lower extent of the kill in this area, but measured dissolved oxygen, which was within the normal range, and began counting dead fish.

Later in the day on May 21, Barrett and Ballard took the boat out at Hwy 301 and drove to the Hwy 24 bridge boat ramp where more dead and dying fish of all sizes and species were observed. Barrett and Ballard then drove by highway to the Hwy 119 bridge crossing in order to determine if the fish kill had extended downstream past that site. At this site, only one dead darter species was observed. Dissolved oxygen and pH readings were in the normal range within the Ogeechee at the Hwy 119 bridge crossing. Based on these observations, the lower extent of most of the fish kill appeared to be within the segment of river of the Hwy 24 bridge crossing to the Hwy 119 bridge crossing on May 21.

On May 22, Barrett met with County officials from Screven, Bulloch, Bryan, Effingham and Chatham along with employees from Georgia EPD and US Environmental Protection Agency to brief the group on the extent of the kill as of Saturday, May 21. Barrett then went back to the Ogeechee River with Fisheries Technician Chris Harper to the Hwy 119 bridge crossing to determine if the kill had progressed downstream into new areas. The only dead fish encountered was a darter. An angler reported seeing multiple dead “minnow” species earlier that day.

On May 23, WRD Fisheries Biologist Joel Fleming and Fisheries Technician Roger Harrell arrived the Ogeechee River at the Hwy 119 bridge crossing where only one dead darter had been reported on May 22. Upon arrival, they noticed many dead and dying fish of varying species at the ramp. Fish had discolored patches on their sides and gills. Fleming and Harrell then drove by highway to the Hwy 80 bridge crossing (Figure 1) and again observed numerous dead and dying fish of varying species. Late in the day, on May 23, Fleming and Harrell drove by highway to the Hwy 204 bridge crossing (Figure 1) (which was later determined to be the approximate lower boundary of the fish kill) where only two dead fish were observed, which had likely drifted from upriver areas.

By late in the day on May 24, Fleming and Harrell observed dying and dead fish at the Hwy 204 bridge crossing where dying fish had not been observed the prior day. Crosby and Brentz McGhin collected fifteen dying fish of numerous different species for disease analysis at Auburn University. WRD fisheries staff picked up the fish from Crosby and drove them to Auburn.

On May 26, WRD Fisheries personnel Ben Ballard and Roger Harrell went to monitor the kill near Hwy 204 bridge crossing and found new dying fish at this site. Auburn’s fish disease lab staff reported on this day that all fish submitted had severe bacterial infections of Flavobacterium columnare, commonly known as columnaris disease, and were dying from the

infection. Large necrotic areas were grossly obvious and upon microscopic examination large numbers of the bacteria present. The lesions observed were severe enough to kill the fish; in some cases 40% of the gills were necrotic.

On May 27, Barrett and Ballard went to the area above the upper extent of the kill to take an electrofishing sample and determine if the columnaris had spread upstream. In the electrofishing sample, only live, healthy fish were found in the area. There were no apparent signs of columnaris in the fish observed. Barrett and Ballard proceeded downstream to the King America Finishing Inc. effluent pipe. Basic water quality of dissolved oxygen, temperature and pH was taken above and below the effluent. Fleming and Harper collected and preserved a sample of fish from an area above the Hwy 204 bridge crossing to send to Auburn University for analysis in an attempt to do further histology study of the gill area and gain possible further understanding of the root cause of the columnaris outbreak.

From May 28-May 30 Barrett contacted Fort Stewart Biologist Rachael Hallman to receive updates from observations adjacent to or within Fort Stewart boundaries. No new dead fish were reported in the Ogeechee or the Canoochee during this time. Technician Harrell was the on-call employee and reported that no calls had been received concerning fish kills.

May 31 – Two teams of Fisheries Section personnel monitored the Ogeechee from Hwy 204 to the estuary for new dead fish. Both teams found that there were no new dead fish in the lower Ogeechee. The dead fish that were encountered appeared to have been dead for at least several days.

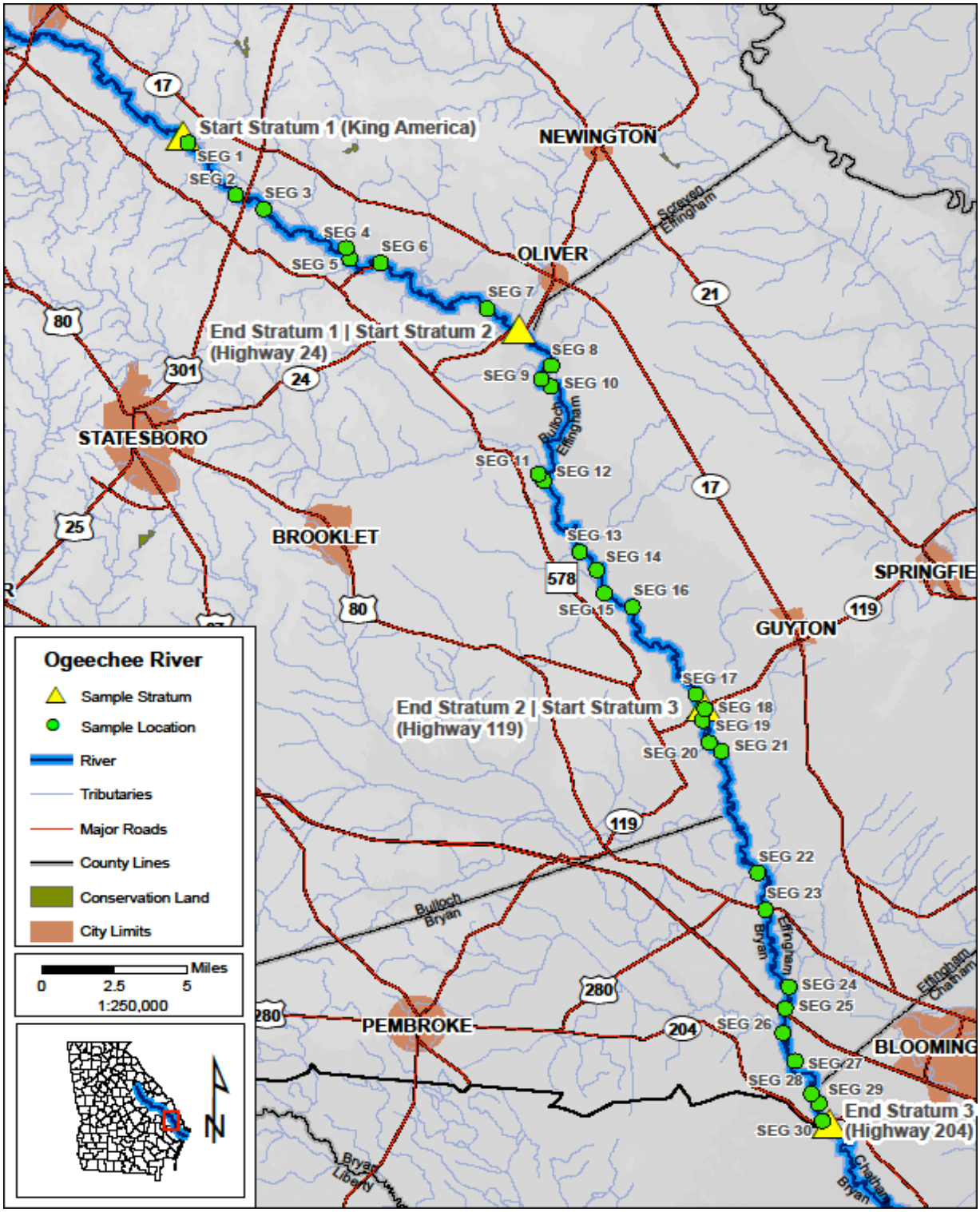
Through these efforts to determine the spatial and temporal extent of this fish kill, this investigation revealed that this fish kill extended 70 miles beginning approximately 50 yards downstream of the King America Finishing effluent pipe and ended in the area of the Hwy 204 bridge crossing. The kill persisted over many days, killing thousands of fish and impacting more than 20 different species within the fish kill area.

Data Collection, Determination of Number of Fish Killed and Valuation of Fish Loss

The initial findings of this investigation revealed an extensive fish kill, both in area and number of fish. Because of the extent of the kill (70 miles and thousands of fish), subsampling techniques were utilized.

The number of fish killed (with associated standard error) was estimated using the methodologies as described in Southwick and Loftus (2003). The fish kill area was stratified into 3 different strata that were selected by distance downstream of the beginning of the kill (Figure 2). Each stratum was then separated into stations. All fish observed within each sampling station were identified and body length measured to nearest inch. A total of 30 stations were sampled (Figure 2). To determine the number of fish within a particular stratum, the number of fish in the sample segments was then multiplied by the number of segments in the stratum. The number of fish within each 1-inch size-class for each species was then determined based on the proportion of the size-class in the sample. Estimates from each stratum were summed to determine the number of fish within the entire kill area.

Figure 2. Location of 30 sample sites for enumeration of dead fish in the May, 2011 Ogeechee River Fish Area.



Once numbers of fish were quantified, the value of the loss from the fish kill was calculated. The value of the fish killed was calculated by multiplying the number of fish within each 1-inch size-class for all species by the estimated value of that particular size-class and species of fish. Values for each 1-inch size-class for all species were estimated using the 2002 value information in Southwick and Loftus (2003) with an adjustment of 3% yearly inflation. This 3% inflation rate is based on the 1914-2010 U.S. average inflation rate of approximately 3.3% as determined by U.S. Department of Labor statistics. If values for specific 1-inch size-classes of particular fish were not defined in Southwick and Loftus (2003) then value for that size class was determined by weight values as defined in this publication and approximate weights generated from the best available data from GA DNR and other natural resource agencies. Values for each size-class and species were then summed to determine the total loss. The total value of all fish that were lost in the fish kill is depicted in Table 1.

Water quality data were collected on numerous occasions during the fish kill investigation in Screven, Bulloch, Effingham, and Bryan Counties, Georgia at twenty-four sites (Table 2). Collections were made utilizing a YSI Model 85 oxygen meter and a YSI Model 55 oxygen meter, Hach Models 17-n (pH) test kit.

Table 1. Species, number and monetary value of fish killed in the Ogeechee River, Screven, Bulloch, Effingham, Bryan, Chatham Counties, Georgia, based on the number counted from May 23- May 27, 2011.

Fish Species (or Group)	Number of Fish Killed	Monetary Value[a]
Crappie	582	$2,269.04
Bowfin	951	$1,279.18
Bullhead Catfish	257	$896.28
Channel/White Catfish	937	$1,236.83
Darter	1,467	$1,276.74
Eel	26	$79.85
Gar	193	$6,235.33
Largemouth Bass	4,078	$42,065.07
Minnow	509	$58.09
Pickerel	681	$18,034.28
Needlefish	21	$32.92
Shad	89	$301.07
Striped Bass	47	$2,613.44
Sucker	176	$803.48
Sunfish	28,619	$48,271.83
Total	**38,634 (+/- 4,480)**	**$125,453.43**

[a] Investigation and Monetary Values of Fish and Freshwater Mussel Kills. 2003. Investigation and valuation of fish kills. American Fisheries Society Special Publication 30.

Table 2. Water quality data collected May 21 - 31, 2011 during the Ogeechee River fish kill investigation.

Site	Date	Water Temperature (C)	Dissolved Oxygen (mg/l)	Total Hardness (mg/l)	Conductivity (us)	pH	Salinity (ppt)
Above Fish Kill							
Ogeechee River Rd. Bridge	5/21/2011		7.5			6.8	
Ogeechee River Rd. Above King Finishing	5/24/2011		7.2		106		0
Ogeechee River Rd. Bridge	5/27/2011	26.5	7.24		115.3		0.1
Just above King Finishing Discharge	5/27/2011	27.5	7.51		112.4		0.1
Within Fish Kill							
King Finishing Discharge Pipe	5/21/2011	25.8	7			7.5	
Below Treatment pipe ~50meters	5/21/2011	23.8	7.3			7	
Williams Landing	5/21/2011		7.6				
Hwy 119	5/23/2011		7.55			7	
GoBar Landing	5/23/2011	29.2	7.7				
Downstream From GoBar Landing	5/23/2011	29.1	8.9				
Downstream of King Finishing Discharge	5/24/2011		7.4		650		0
Downstream of Hwy 119	5/24/2011		7.35			7.25	
Interstate 16 Bridge	5/24/2011		7.66		161	7.5	
Below Flat Ford	5/25/2011		8.57		156	7.5	
Hwy 24 Bridge	5/25/2011	28.7	8.02	48		7.25	
Hwy 204 Ramp	5/26/2011	27.3	7.5		154	7.5	
At King finishing Discharge	5/27/2011	32	5.2		3687		1.9
Approx. 50 meters Below Discharge (RBDS)	5/27/2011	27.5	7.17		110.6		0.1
Approx. 50 meters Below Discharge (Middle River)	5/27/2011	27.5	7.18		111.9		0.1
Approx. 50 meters Below Discharge (LBDS)	5/27/2011	27.9	6.96		454.5		0.2
Approx. 100 meters Below Discharge (RBDS)	5/27/2011	27.6	7.59		112.4		0.1
Approx. 100 meters Below Discharge (Middle River)	5/27/2011	27.6	7.01		115		0.1
Approx. 100 meters Below Discharge (LBDS)	5/27/2011	27.9	7.18		273.5		0.2
Kings Ferry	5/31/2011	28.7	6.22		864		0.4

Conclusion

This fish kill affected all sizes of more than twenty fish species over a range of 70 river miles. This type of large scale fish kill involving numerous fish species dying from a disease is uncommon in Georgia Coastal Rivers. Columnaris bacterium is ubiquitous and naturally-occurring in the environment and is usually preceded by some sort of stressor. The location of the first dead fish encountered beginning 50 yards downstream of the King America Finishing discharge points to a common stressor affecting all species of fish in this area. Upstream electrofishing samples showed no visible signs of disease upriver of the King America effluent.

The cost of the investigation, $26,078.96 (Table 3), plus the value of the fish killed ($125,453.00) (Table 1), yields a total fish kill investigation cost of $151,531.96 (Table 4).

Table 3. Fish kill investigation costs for the Ogeechee River fish kill in Screven, Bulloch, Effingham, Bryan, Chatham County, Georgia, on May 20, 2011.

Personnel	Job Title	Hours	Personnel Cost	Vehicle	Mileage	Cost
Ben Ballard	Fisheries Technician III	79.0	$1,931.83	129852	1,748	$891.48
Tim Barrett	Fisheries Regional Supervisor	239.5	$8,965.21	121953	574	$292.74
Ward Crosby	Fisheries Technician III	62.0	$2,122.88	119059	963	$491.13
Joel Fleming	Fisheries Biologist II	135.5	$4,646.72	129779	475	$242.25
Chris Harper	Fisheries Technician IV	67.5	$2,047.28			
Roger Harrell	Fisheries Technician III	81.5	$2,099.07	129723	237	$120.87
Donald Harrison	Fisheries Biologist II	24.0	$833.04	129822	467	$238.17
Jason Howard	Fisheries Technician III	2.0	$52.10	121515	224	$114.24
Brentz McGhin	Utility Worker	32.5	$440.38			
Chad Sexton	Fisheries Technician III	21.0	$549.57			
Total		**744.5**	**$23,688.08**		**4,688**	**$2,390.88**

Table 4. Total costs for the Ogeechee River fish kill in Screven, Bulloch, Effingham, Bryan, Chatham County, Georgia, on May 20, 2011.

Cost Category	Cost
Fish killed	**$125,453.00**
Investigation Personnel	**$23,688.08**
Investigation Vehicles	**$2,390.88**
Total Cost of Fish Kill	**$151,531.96**

Literature Cited

Southwick, R. I., and A. J. Loftus, editors. 2003. Investigation and Valuation of Fish and Freshwater Mussel Kills. American Fisheries Society, Special Publication.30, Bethesda, Maryland.