Final Report

Biological and Recreational Monitoring of the Impacts of the 2008 Bonnet Carré Spillway Opening, St. Charles Parish, Louisiana

Prepared for

U.S. Army Corps of Engineers
New Orleans District
New Orleans, Louisiana

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Biological and Recreational Monitoring of the Impacts of the 2008 Bonnet Carré Spillway Opening, St. Charles Parish, Louisiana

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ORGANIZATION OF REPORT

The main report consists of:

Section 1	Introduction
Section 2	Oysters Collected Before and After the 2008 Bonnet Carré Spillway Opening
Section 3	Fish and Other Aquatic Organisms Collected Before and After the 2008 Bonnet Carré Spillway Opening
Section 4	Commercial Blue Crab Landings Collected Before and After the 2008 Bonnet Carré Spillway Opening
Section 5	Salinity, Turbidity, and Water Temperature Before and After the 2008 Bonnet Carré Spillway Opening
Section 6	2008 Bonnet Carré Spillway Opening Impacts on Recreation
Section 7	Conclusions
Section 8	Recommendations

The appendices consist of:

Appendix A	Louisiana Department of Wildlife and Fisheries Trawl, Seine, and Gillnet Sampling
Appendix B	Environmental Data
Appendix C	Recreational Data

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SECTION 1 - INTRODUCTION

SECTION 1 - INTRODUCTION

This report evaluates some of the short-term effects of the 2008 opening of the Bonnet Carré Spillway on fisheries and recreation. The Spillway is located in St. Charles Parish, Louisiana and is a flood control feature of the Mississippi River and Tributaries Project (MR&T Project).

Historical flooding by the Mississippi River and the need for navigational improvements prompted the federal legislature to establish the Mississippi River Commission (MRC) in 1879. The MRC jurisdiction over the Mississippi River spanned from its headwaters to the Head of Passes near the Gulf of Mexico. The program experimented with various strategies for improving the Mississippi River and then focused on a *levees only* program. The Mississippi River flood in 1927, which inundated large parts of Louisiana, Mississippi, Arkansas, Illinois, Kentucky, and Tennessee, resulted in the development of the Flood Control Act of 1928. This legislation authorized the U.S. Army Corps of Engineers to design and construct flood control projects on the Mississippi River and its tributaries and the Sacramento River in California. The focus shifted away from a *levees only* program to a mix of levees, floodways, and spillways.

The comprehensive river management program, designated the MR&T Project, is governed by the MRC. The MR&T project is the largest flood control project in the world; its goal is to control the *project flood*, which is the largest flood expected to occur and is larger than the record flood of 1927. The project flood is estimated to be 3,000,000 cubic feet per second (cfs) at Red River Landing, located about 60 miles below Natchez, Mississippi. The MR&T Project consists of flood containment levees; floodways (spillways) for passage of excess flows; channel improvements and stabilizations for efficient navigation, increased flood-carrying capacity, and levee protection; and major tributary drainage basin improvements including dams and reservoirs, pumping stations, and auxiliary channels. Floodways within the MR&T Project consist of: the Birds Point-New Madrid Floodway, the Morganza Floodway, the West Atchafalaya Floodway, and the Bonnet Carré Spillway.

The Birds Point-New Madrid Floodway consists of a setback levee and a riverfront levee between Cairo, Illinois and New Madrid, Missouri. Fuse plugs (low-levee sections) allow water to enter the floodway below Cairo and re-enter the river above New Madrid; the floodway is designed to reduce flood heights at and above Cairo.

The Old River Control structures are located where the Mississippi and Atchafalaya Rivers diverge and consist of the Low Sill, Overbank, and Auxiliary Structures. The Old River Control Structures were constructed to prevent the Mississippi River from flowing down the Atchafalaya River and are designed to divert 1,500,000 cfs of project flood Mississippi River water into the Atchafalaya River, the Morganza Floodway, and the West Atchafalaya Floodway. The Morganza and West Atchafalaya Floodways carry flows down opposite sides of the Atchafalaya River until the Atchafalaya River levee system ends and then merge into a single floodway to the Gulf of Mexico. The remaining 1,500,000 cfs of the project flood flow would continue down the main channel below the Morganza Floodway.

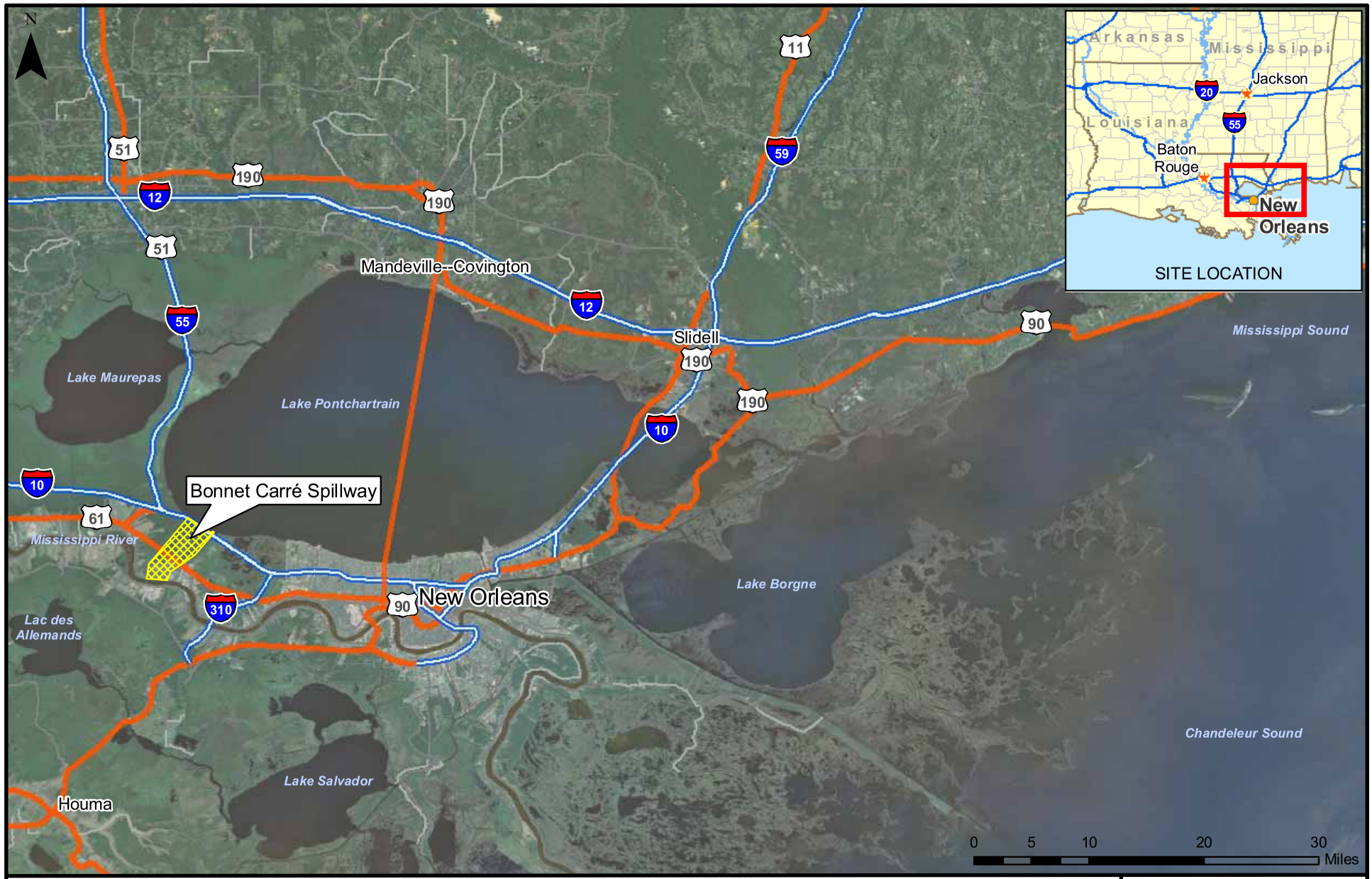
The Bonnet Carré Spillway (Figures 1-1 and 1-2) is located about 25 miles upriver from New Orleans, Louisiana on the site of an old crevasse (levee breach) and is designed to divert water from the Mississippi River to Lake Pontchartrain and the Gulf of Mexico. The Bonnet Carré Spillway can divert up to 250,000 cfs (design capacity) of the main channel flow; the remaining 1,250,000 cfs of the project flood would flow down the Mississippi River to the Gulf of Mexico.

Construction of the Bonnet Carré Spillway began in 1928 and the Spillway was finished in 1931. The Spillway structure is a 7,000 foot long concrete weir (Figure 1-3) consisting of 350 bays (Figure 1-4). Each bay holds 20 pine *needles* (timber pins) that can be lifted out of the structure by two cranes. The pins do not fully seal the structure and water constantly leaks into the floodway when the river is above the level of the weir. The Spillway is 5.7 miles long and is bordered on the north and south by 19-foot-high guide levees (Figure 1-2). Water released into the spillway flows from the Mississippi River into Lake Pontchartrain and then through an eight-mile-long strait (called the Rigolets) and Chef Menteur Pass into Lake Borgne. Lake Borgne, because of land loss, is a bay with an open connection to the Gulf of Mexico.

The Bonnet Carré Spillway is opened to prevent the Mississippi River stage at the Carrolton gage, just north of New Orleans, from reaching 20 feet mean sea level (MSL). The spillway is opened when the MRC determines that the rising river is deemed to be a threat to New Orleans. The spillway has been opened nine times during high water events since construction: 1937, 1945, 1950, 1973, 1979, 1983, 1997, and 2008. In 2008, the spillway was partially opened on April 11th and remained open until May 8th. The maximum flow during the 2008 opening was 160,000 cfs with an average flow of 113,000 cfs. Opening data for 2008 and previous openings are presented in Table 1-1.

Compared to openings in previous years, the fewest number of bays (160) were open during 2008, and only 1975 had a lower maximum flow (110,000 cfs). The Spillway has generally been opened in April, although openings have occurred as early as January (1937) and February (1950) and as late as May (1983). The Spillway has been opened for as little as 13 days (1975) to as long as 75 days (1973). The maximum number of bays opened has varied from 160 bays (2008) to all 350 bays (1945, 1950, 1973, 1979, and 1983), with the maximum flow ranging from 110,000 (1975) to 318,000 cfs (1945). Compared to the 1997 Spillway opening (Figure 1-5), the 2008 opening was a slightly shorter duration (28 versus 33 days), fewer bays were opened (160 versus 298 bays), and it occurred almost three weeks later (April 11th versus March 17th).

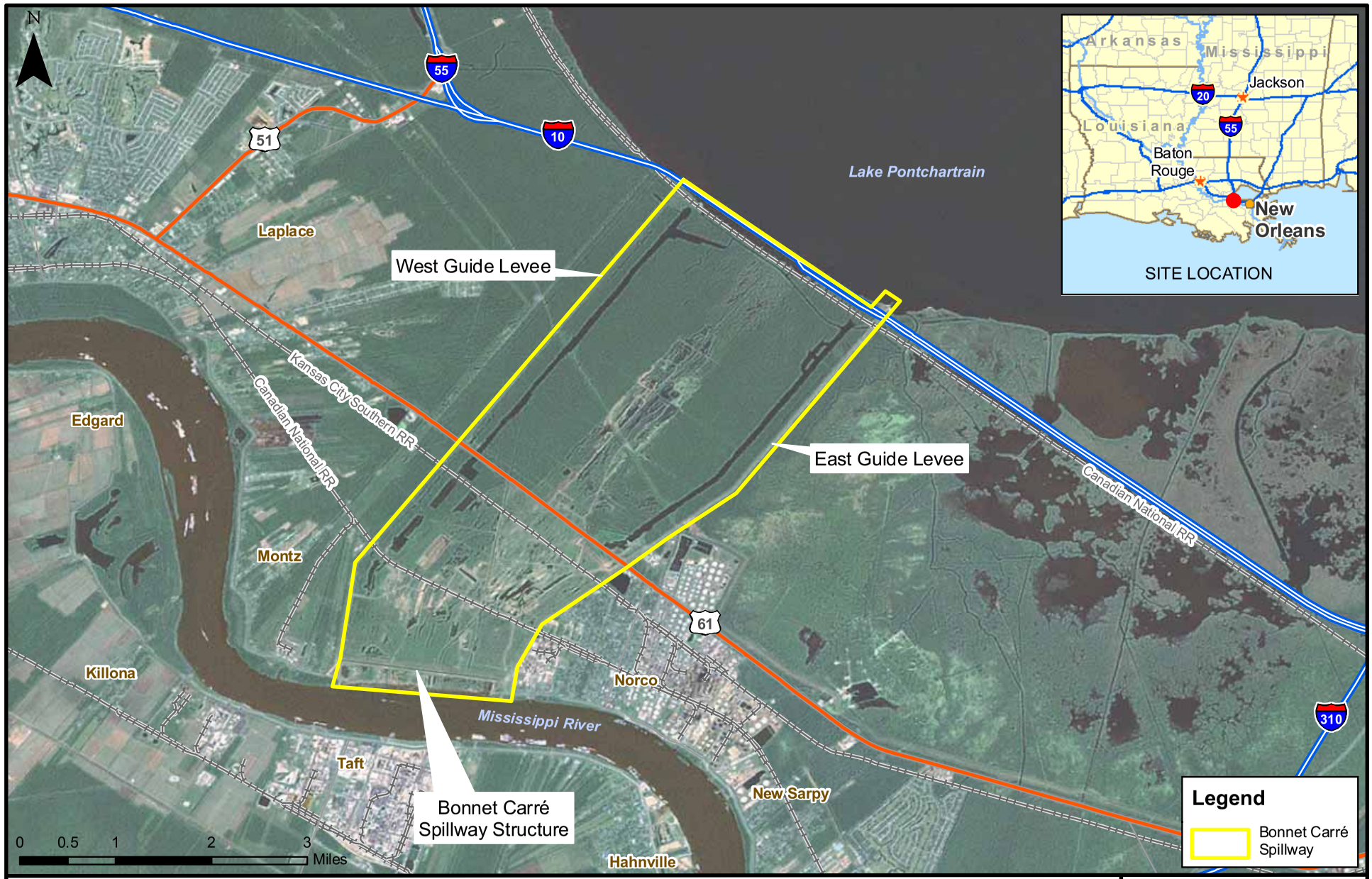
Some possible concerns that have been brought up about opening the Bonnet Carré Spillway include: effects on commercial and recreational fishing landings, diversion of endangered species such as pallid sturgeon *(Scaphirhynchus albus)* from the Mississippi River into Lake Pontchartrain, introduction of invasive species such as bighead carp (*Hypophthalmichthys nobilis)* and grass carp *(Ctenopharyngodon idella)* into Lake Pontchartrain, sediment deposits in Lake Pontchartrain, the introduction of pollutants from



BONNET CARRÉ SPILLWAY LOCATION MAP

GEC

Figure: 1-1
Date: December 2008
Scale: 1:750,000
Source: ESRI/GEC
Map ID: 27316921-1157



OVERVIEW OF BONNET CARRÉ SPILLWAY

GEC

Figure: 1-2

Date: December 2008

Scale: 1:90,000

Source: ESRI/GEC

Map ID: 27316921-1179

Figure 1-3. The Bonnet Carré Spillway

Figure 1-4. Close-up of Open Bonnet Carré Spillway Bays

Table 1-1. Historic Bonnet Carré Spillway Opening Data

Year	Date Opened	Date Closed	Number of Days Opened	Max. Number Bays Open	Maximum Flow (cfs)
1937	Jan. 30	Mar. 7	37	285	211,000
1945	Mar. 23	May 18	57	All 350	318,000
1950	Feb. 10	Mar. 19	38	All 350	223,000
1973	Apr. 8	Jun. 21	75	All 350	195,000
1975	Apr. 14	Apr. 26	13	225	110,000
1979	Apr. 18	May 21	34	All 350	191,000
1983	May 20	Jun. 23	35	All 350	268,000
1997	Mar. 17	Apr. 18	33	298	243,000
2008	Apr. 11	May 8	28	160	160,000

Source: USACE data.

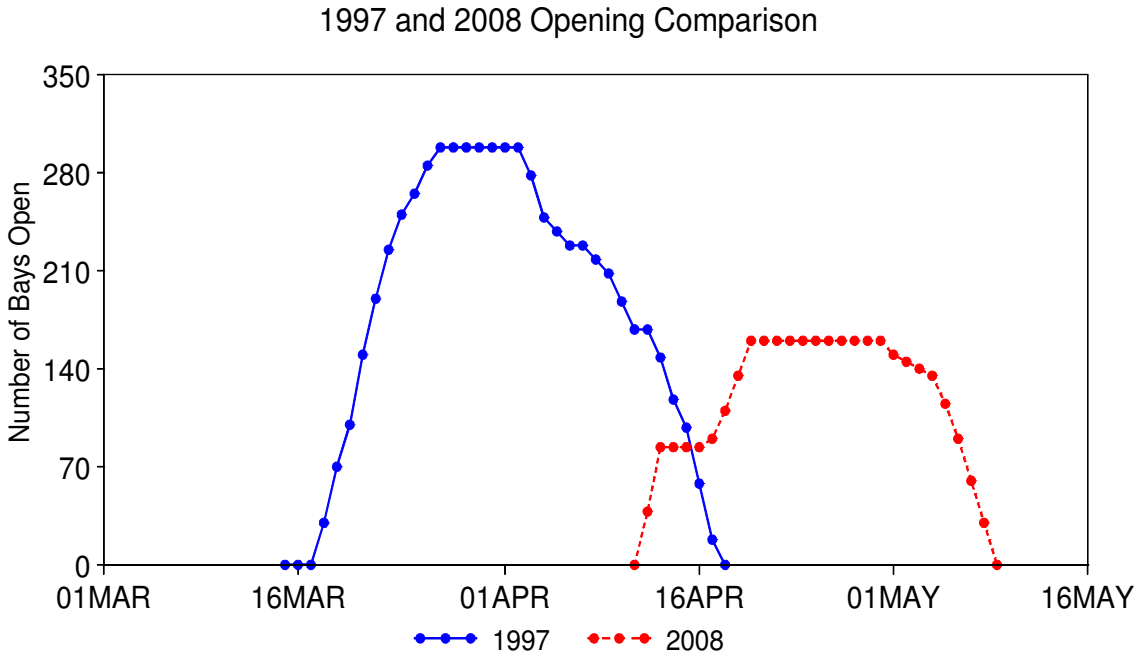


Figure 1-5. 2008 Bonnet Carré Spillway Opening Compared to the 1997 Opening.

Mississippi River water, and high nitrogen and phosphorus levels in Mississippi River water resulting in algal blooms causing fish kills in Lake Pontchartrain.

This study was designed to collect, analyze, and report on effects of the 2008 Bonnet Carré Spillway opening on commercial and recreational fisheries in Lake Pontchartrain and Lake Borgne, and waters south of Mississippi Sound, as well as recreational activity within the Bonnet Carré Spillway. G.E.C., Inc. was tasked under Contract Number W912P8-07-D0008, Task Order 0021. Fisheries data were collected by the Louisiana Department of Wildlife and Fisheries for population assessment. The data collected in 2008 after the Spillway opening were compared to historical data from these areas to assess short-term impacts due to the 2008 Bonnet Carré Spillway opening. Commercial landings data for blue crabs after the Spillway opening were compared with historical landings. A recreational survey was conducted after the Spillway opening to assess changes in recreational usage. This report is divided into sections on: (2) oysters; (3) fish and other aquatic organisms; (4) commercial blue crab landings; (5) salinity, turbidity, and water temperature data; (6) impacts on recreation; (7) conclusions; and (8) recommendations.

SECTION 2 – OYSTERS COLLECTED BEFORE AND AFTER THE 2008 BONNET CARRÉ SPILLWAY OPENING

SECTION 2 - OYSTERS COLLECTED BEFORE AND AFTER THE 2008 BONNET CARRÉ SPILLWAY OPENING

INTRODUCTION

Louisiana contributes over 30 percent of the U.S. supply of the eastern oyster *(Crassostrea virginica)*. The oyster fishery in Louisiana is divided into public seed grounds and private bedding grounds (where seed oysters are transferred for growth). Public reefs are opened for harvesting and seed collection during the fall and winter each year (Wirth and Minton 2004).

Square meter and oyster dredge samples collected by LDWF from oyster reefs within Lake Borgne and waters south of the Mississippi Sound during 2008 and prior years were examined to see if there were any short-term effects of the 2008 Bonnet Carré Spillway opening.

METHODS

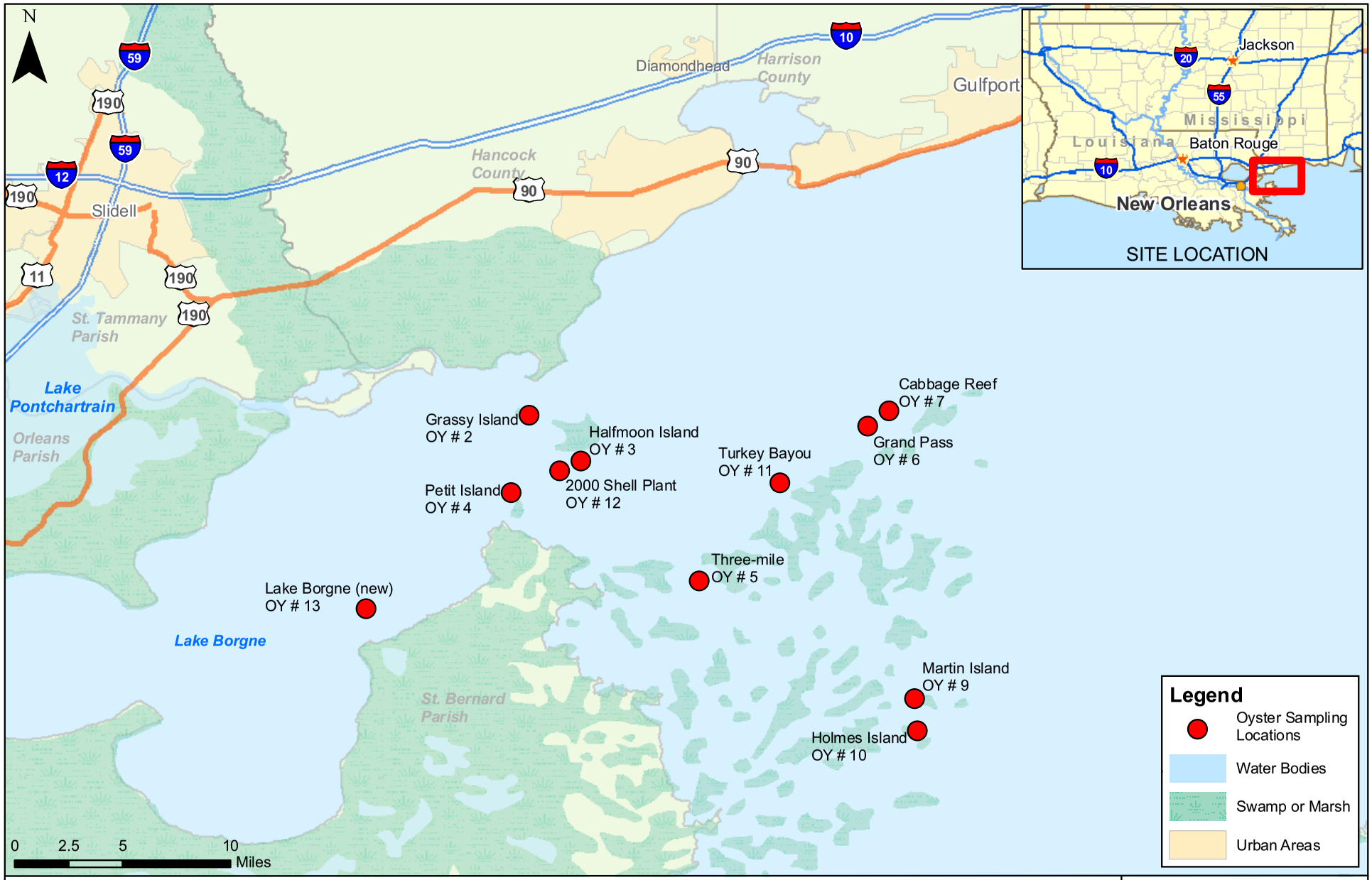
Square Meter

A one-meter square frame was used by LDWF on the public seed grounds, seed reservations, and tonging areas to examine oyster density and availability (i.e., seed and sack oysters) per unit area and to provide ancillary data on oyster recruitment, hooked mussel *(Ischadium recurvum)* density, mortality, and predators. The square-meter frame was randomly thrown onto an oyster reef. A SCUBA diver removed all oysters, associated macroscopic organisms, and loose surface shell within the frames. All oysters and shells from recently dead oysters larger than 25 mm were counted and measured in 5-mm intervals. Shells from dead oysters were classified as *box* (both valves attached) or *valve* (one valve). Oyster size was determined by measuring the *straight-line* distance from the hinge to the apex of the shell. Live gastropod, crab, and mussel predators were counted. Cultch type and reef condition were noted. A minimum of two replicate samples were taken at each station.

Oysters and oyster-associated fauna were sampled by meter-square oyster sampler at stations OY2, OY3, OY4, OY5, OY6, OY7, OY9, OY11, and OY12 during 2000 through 2002, 2004 through 2006, and 2008 (Figure 2-1). One sample per year was typically taken in June or July at five to seven stations. Stations OY3, OY6, and OY12 were not sampled as frequently as the other stations; station OY8 was only sampled twice.

Oyster Dredge

A 24-inch-wide oyster dredge was used by LDWF to sample oysters, fouling organisms, and other sessile marine organisms. This gear characterizes recruitment (i.e., spat set) and size distribution of oysters and provides ancillary data on oyster mortality and predators. The oyster dredge was towed from the boat for three minutes at each station.



OYSTER SAMPLING LOCATIONS

GEC

Figure: 2-1
Date: December 2008
Scale: 1:400,000
Source: LDWF/ESRI/GEC
Map ID: 27316921-1143

Dredge samples were processed as above for square meter samples, although only 100 each of live oysters (greater than 25 mm), box and valve shells were measured with the remaining live oysters counted, and the number of spat oysters (smaller than 25 mm) were counted or estimated.

Oysters and oyster-associated fauna were sampled by oyster dredge at stations OY2, OY4, OY5, OY6, OY7, OY11, OY12, and OY13 from 2000 through 2006 and 2008 (Figure 2-1). Samples were generally taken from March through October and occasionally November during some years. Generally, 11 to 13 samples were collected at each station during each year.

RESULTS

Square-Meter

Numbers of oysters caught by LDWF in the square-meter sampler in 2008 after the Spillway opening were similar to those caught in previous years (Table 2-1). Catches varied from a low of 174 in 2002 to a high of 633 in 2001. Fewer hooked mussels were reported from 2008, 2006, and before 2004, than during 2004 and 2005. A few southern oyster drills *(Stramonita haemastoma)* were collected in 2005, 2006, and 2008. More oysters were collected in the square meter sampler at station OY7 at Cabbage Reef in the northeast portion of the oyster reefs sampled (Table 2-2). Hooked mussels were collected most frequently at stations OY2 Grassy Island and OY4 Petit Island near the eastern edge of Lake Borgne.

Table 2-1. Oyster Catches for the Meter-Square Oyster Sample, By Year

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Number of samples	*6*	*8*	*9*	*0*	*8*	*7*	*6*	*0*	*8*	*52*
hooked mussel	.	.	.	.	2,412	1,718	109	.	20	4,259
eastern oyster	411	633	174	.	271	258	302	.	252	2,301
unidentified mud crab	.	.	.	.	.	39	20	.	2	61
mud crab spp.	.	.	.	.	43	.	.	.	.	43
southern oyster drill	.	.	.	.	.	4	2	.	2	8
bigclaw snapping shrimp	.	.	.	.	.	.	.	.	2	2
florida stone crab	.	.	.	.	2	.	.	.	.	2
rangia clam	.	.	.	.	1	.	.	.	.	1
	411	633	174	0	2,729	2,019	433	0	278	6,677

Table 2-2. Oyster Catches for the Meter-Square Oyster Sampler, By Station

Species	OY 2	OY 3	OY 4	OY 5	OY 6	OY 7	OY 8	OY 9	OY 10	OY 11	OY 12	OY 13	Total
Number of samples	*7*	*5*	*7*	*7*	*5*	*7*	*0*	*2*	*0*	*7*	*5*	*0*	*52*
hooked mussel	1,789	281	1,433	27	.	1	.	.	.	562	167	.	4,259
eastern oyster	118	197	76	196	57	1,121	.	6	.	263	267	.	2,301
unidentified mud crab	13	.	4	4	4	17	.	.	.	5	14	.	61
mud crab spp.	3	8	6	7	5	4	.	.	.	3	7	.	43
southern oyster drill	.	.	.	.	1	7	.	.	.	.	.	.	8
bigclaw snapping shrim	.	.	.	2	.	.	.	.	.	.	.	.	2
Florida stone crab	1	1	.	.	.	.	.	.	.	.	.	.	2
rangia clam	.	.	.	.	.	.	.	.	.	.	1	.	1
	1,924	487	1,519	236	67	1,149	0	6	0	833	456	0	6,677

Oyster Dredge

The number of oysters LDWF collected using an oyster dredge in 2008 were similar to previous years, although the numbers were not as high as those collected in 2005 and 2006 (Table 2-3). Hooked mussel catches were highest in 2004 and 2005 and more hooked mussels than oysters were collected in 2008. More oysters were collected at stations OY5 (Three-mile Reef) in the center of the reefs sampled and OY7 (Cabbage Reef) in the northeast portion of the reefs sampled (Table 2-4).

Table 2-3. Oyster Catches for the 24-Inch Oyster Dredge, By Year

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Number of samples	*56*	*55*	*59*	*60*	*69*	*65*	*45*	*0*	*72*	*481*
hooked mussel	.	.	.	246	55,132	30,277	2,153	.	5,566	93,374
eastern oyster	6,410	3,388	4,684	4,757	6,746	12,215	9,667	.	5,135	53,002
mud crab spp.	.	.	.	319	735	.	.	.	.	1,054
unidentified mud crab	.	.	.	.	.	434	261	.	160	855
southern oyster drill	.	.	.	10	21	12	9	.	19	71
gulf stone crab	.	.	.	.	.	4	.	.	12	16
bigclaw snapping shrimp	.	.	.	.	.	.	2	.	.	2
Florida stone crab	.	.	.	.	2	.	.	.	.	2
rangia clam	.	.	.	.	2	.	.	.	.	2
skilletfish	.	.	.	.	.	1	.	.	1	2
blue crab	.	.	.	.	.	.	1	.	.	1
gulf toadfish	.	.	.	.	.	.	1	.	.	1
naked goby	.	.	.	.	.	.	1	.	.	1
sand seatrout	.	.	.	.	.	1	.	.	.	1
	6,410	3,388	4,684	5,332	62,638	42,944	12,095	0	10,893	148,384

Table 2-4. Oyster Catches for the 24-Inch Oyster Dredge, By Station

Species	OY 2	OY 3	OY 4	OY 5	OY 6	OY 7	OY 8	OY 9	OY 10	OY 11	OY 12	OY 13	Total
Number of samples	*89*	*0*	*89*	*95*	*2*	*94*	*0*	*0*	*0*	*94*	*1*	*17*	*481*
hooked mussel	21,369	.	60,559	780	10	132	.	.	.	7,328	5	3,191	93,374
eastern oyster	3,961	.	4,686	17,518	289	19,006	.	.	.	5,937	29	1,576	53,002
mud crab spp.	242	.	259	222	3	236	.	.	.	91	1	.	1,054
unidentified mud crab	148	.	194	193	.	232	.	.	.	68	.	20	855
southern oyster drill	.	.	.	.	.	71	.	.	.	.	.	.	71
gulf stone crab	.	.	6	3	.	.	.	.	.	3	.	4	16
bigclaw snapping shrimp	.	.	.	2	.	.	.	.	.	.	.	.	2
Florida stone crab	.	.	2	.	.	.	.	.	.	.	.	.	2
rangia clam	.	.	2	.	.	.	.	.	.	.	.	.	2
skilletfish	.	.	.	1	.	1	.	.	.	.	.	.	2
blue crab	1	.	.	.	.	.	.	.	.	.	.	.	1
gulf toadfish	.	.	.	1	.	.	.	.	.	.	.	.	1
naked goby	.	.	.	.	.	1	.	.	.	.	.	.	1
sand seatrout	.	.	1	.	.	.	.	.	.	.	.	.	1
	25,721	0	65,709	18,720	302	19,679	0	0	0	13,427	35	4,719	148,384

DISCUSSION

The 2008 Spillway opening did not appear to have any obvious effects on oyster numbers in the samples collected, at least on a short-term basis. The number of oysters collected in the meter-square oyster sampler and the oyster dredge by LDWF after the 2008 Spillway opening was similar to collections from previous years. The 2008 Spillway opening was smaller than many of the previous openings. The Spillway opening was also followed at the end of August, and in mid-September by the passage of Hurricanes Gustav and Ike, which sent storm surges into Lake Pontchartrain and increased salinities.

During 1997, the Spillway was open for five more days and 138 more bays were open than during 2008. No significant differences in collections of oysters in Lake Borgne or Louisiana waters south of Mississippi Sound (USACE 1998) or in Mississippi Sound (Perret et al. 1998) were reported from the 1997 opening. Freshwater impacts associated with the 1997 opening lasted only 30 to 35 days in Lake Borgne and waters south of Mississippi Sound (USACE 1998).

The quantity of Spillway discharge and the amount of time the freshwater remains on the oyster beds affect the level of oyster mortality. During years of heavy Spillway discharge, 100% of the oysters in Mississippi Sound west of Bay St. Louis have been killed (Gunter 1953). High water periods in the Pearl River often coincide with high water in the Mississippi River; the combination of freshwater from both sources can increase mortality of oysters (Gunter 1953). Oysters in western Mississippi Sound are subject to frequent damage from Pearl River discharges (Butler 1949, Owen and Walters 1950). The 1973 Spillway opening, coupled with high discharges from the Pearl River and high local rainfall, resulted in mortalities of 50 percent in the Lake Borgne complex (Dugas and Perret 1975). The 1950 opening did not cause material damage to the major oyster reefs of Louisiana because the opening was early in the year and of short duration. Gowanloch (1950) believed the 1937 Spillway opening was beneficial to oysters, whereas the 1945 opening (which had nearly twice the flow of the 1937 and 1950 openings) destroyed oysters in Louisiana and Mississippi.

Oysters farther away from the Spillway may benefit from the Spillway opening. Owen and Walters (1950) believed that the benefits to oysters in the southern Louisiana marsh and eastern Mississippi Sound far outweighed the adverse effects on the oysters in north Mississippi Sound and on reefs opposite the mouth of the Pearl River. Thick growths of young oysters can occur after freshwater events (Gunter 1950). Viosca (1927) suggested that although some oyster beds close to Mississippi River outputs are temporarily destroyed by excess freshwater, old reefs may be rehabilitated.

Salinity affects oyster distributions, and very low salinities can cause oyster mortalities, although the low salinity tolerance of oysters has been subject to debate. Adult oysters are typically found within a salinity range of 10 to 30 ppt in estuaries in the Gulf of Mexico; however, they can tolerate 2 to 40 ppt (Stanley and Sellers 1986). After the 1983 Spillway opening, Chatry and Millard (1986) reported oyster survival throughout the spring

and early summer in salinities of 2 to 5 ppt; significant mortalities only occurred when salinities fell below 2 ppt for several weeks. Actively feeding oysters were encountered in this same study at salinities as low as 3 ppt and temperatures in excess of 30°C. The susceptibility of oysters to low salinities appears to depend on the previous condition of the oyster (fatness), the length of time the oyster is exposed, and the water temperature (Gunter 1953). In general, lower temperatures are positively correlated with the quality or condition of the oysters (Owen and Walters 1950). Oyster mortalities after the 1950 opening were lower due to cooler temperatures and lower salinities during the three to four years prior to the opening (Gunter 1953). Gowanloch (1950) and other authors suggested that in addition to the duration of time the Spillway is open and the crest volumes involved, a more important factor may be the time of the year the Spillway is open in relation to the spawning activities of the oysters.

Salinity also affects the distribution of oyster predators and parasites. Higher levels of parasitism generally occur in higher salinity waters (Gauthier et al. 2007). The southern oyster drill is an important predator on oysters. Oyster drill populations fluctuate due to environmental changes, such as changes in salinity or temperature (Brown et al. 2004). Oyster drills are typically found in the higher salinity portions of estuaries, where salinities are greater than 15 ppt (Butler 1954). However, the salinity at which mortality occurs fluctuates depending upon the salinity the oyster drills were accustomed to and how quickly the salinity declines (Butler 1985). The 1950 Spillway opening killed or greatly reduced the incidence of boring sponges, boring clams, oyster drills, and likely *Perkinsus marinus,* a microscopic parasite on oysters (Gunter 1953). The 1950 Spillway opening was much larger than the 2008 opening. Water temperatures below 12°C also have been found to limit oyster drill feeding (Butler 1985). Black drum *(Pogonias cromis)* also prey on oysters (Brown et al. 2003) and are likely to be more abundant in higher salinity areas in the northern Gulf of Mexico.

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SECTION 3 – FISH AND OTHER AQUATIC ORGANISMS COLLECTED BEFORE AND AFTER THE 2008 BONNET CARRÉ SPILLWAY OPENING

SECTION 3 - FISH AND OTHER AQUATIC ORGANISMS COLLECTED BEFORE AND AFTER THE 2008 BONNET CARRÉ SPILLWAY OPENING

INTRODUCTION

Freshwater inflow to estuaries is a key component to the ecological balance for the aquatic system, especially for fisheries. The opening of the Spillway increases freshwater input into the Lake Pontchartrain estuary compared to years when the Spillway is not opened. There are other inputs, such as rivers that have widely fluctuating freshwater impacts. The Lake Pontchartrain estuary is oligohaline, and most estuarine species are adapted to fluctuating salinities. Many estuarine species occur in low salinity portions of estuaries during one or more life stages.

The LDWF routinely uses trawls, gill nets, and seines to assess fish and other organisms at stations in Lake Pontchartrain, Lake Borgne, and south of Mississippi Sound. These data were examined to determine baseline populations of fish and other organisms in these areas during non-diversion years and to evaluate whether there were any differences after the 2008 Spillway opening within these areas.

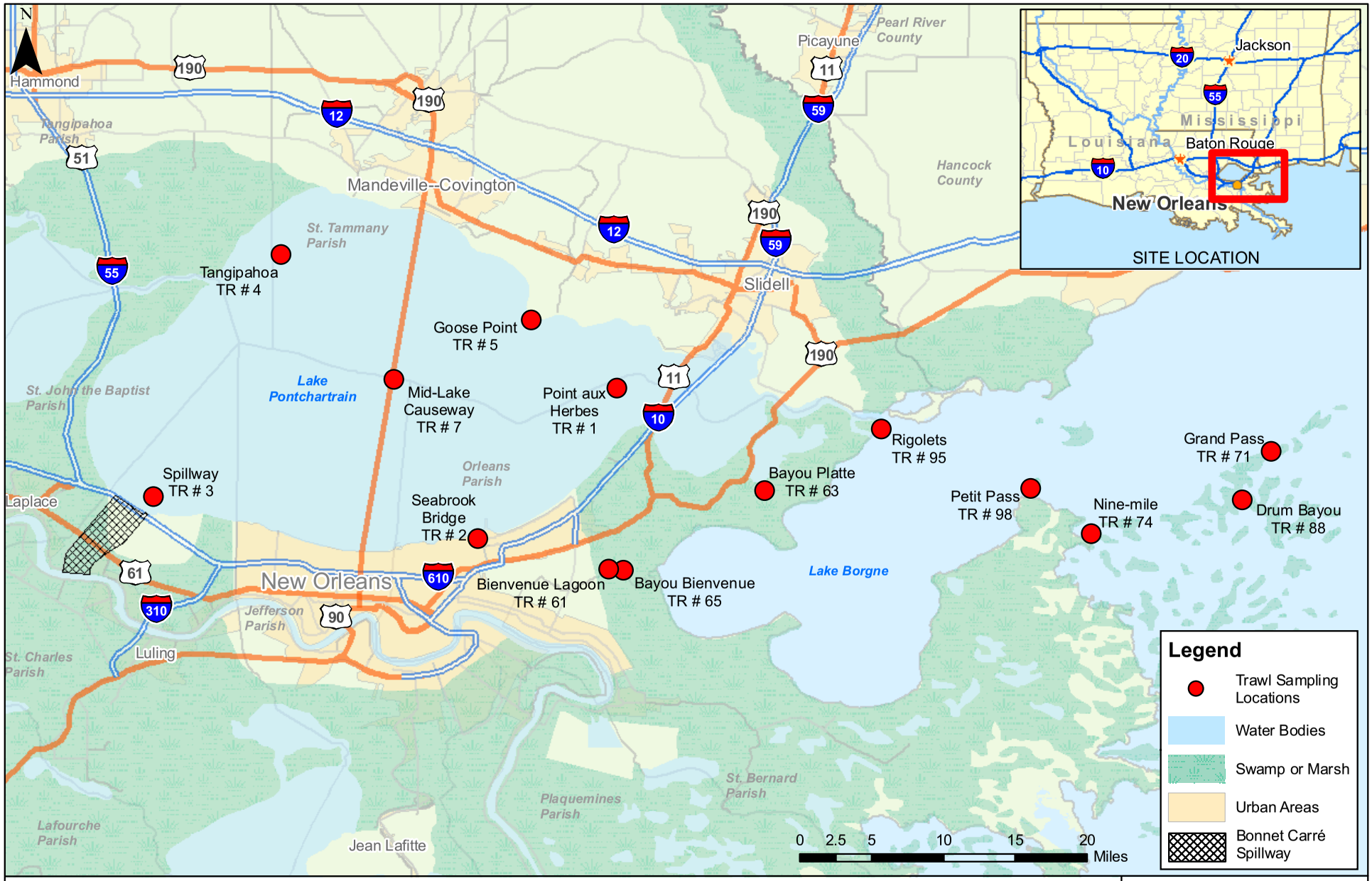
METHODS

Trawl Data

The LDWF collected from one to five trawl samples per month at six stations (1, 2, 3, 4, 5, and 7) in Lake Pontchartrain and eight stations (61, 63, 65, 71, 74, 88, 95, and 98) in Lake Borgne and south of Mississippi Sound (Figure 3-1). The Lake Pontchartrain stations were sampled from 2000 through 2008, although not every month was sampled in 2000, 2003, 2004, and 2006, and samples were only reported through October of 2008.

Stations 65, 74, and 95 in Lake Borgne and south of Mississippi Sound were sampled from 2000 through 2008, although during 2006, not all months were sampled and samples were only reported up to November of 2008. Stations 61, 63, 71, 88, and 98 in Lake Borgne and south of Mississippi Sound were sampled infrequently and were excluded from this review.

Ten-minute trawl tows were taken using a 16-foot flat otter trawl with ¾-inch bar mesh in the body and ¼-inch bar mesh in the codend. Trawls were towed at a constant speed in a weaving or circular pattern to allow the prop wash to pass on either side of the trawl. All organisms were placed in plastic bags, labeled, and transported to the laboratory. Organisms were identified to species, when possible, counted, and up to 50 of each species in each sample were measured in 5 millimeter (mm) intervals.



TRAWL SAMPLING LOCATIONS

GEC

Figure: 3-1
Date: December 2008
Scale: 1:600,000
Source: LDWF/ESRI/GEC
Map ID: 27316921-1145

Gillnet Data

Gill net samples were collected by the LDWF at Lake Pontchartrain stations 111, 112, 113, 114, and 115 and Station 110 in Bayou Deedie west of Lake Borgne (Figure 3-2). An experimental 8-ft by 750-ft gill net consisting of a sequence of five 150-foot panels was used; each panel contained a progressively larger mesh size: 1-, 1.25-, 1.5-, 1.75-, and 2-inch bar mono mesh.

Fish were forced into the net by running the net skiff around the inside and outside of the net at least two or three times in gradually tightening circles. All organisms were removed from the net and placed in baskets corresponding to each mesh panel of the net. Up to 30 individuals of certain species were individually measured (total length in mm); the remaining individuals of these species were counted.

Seine Data

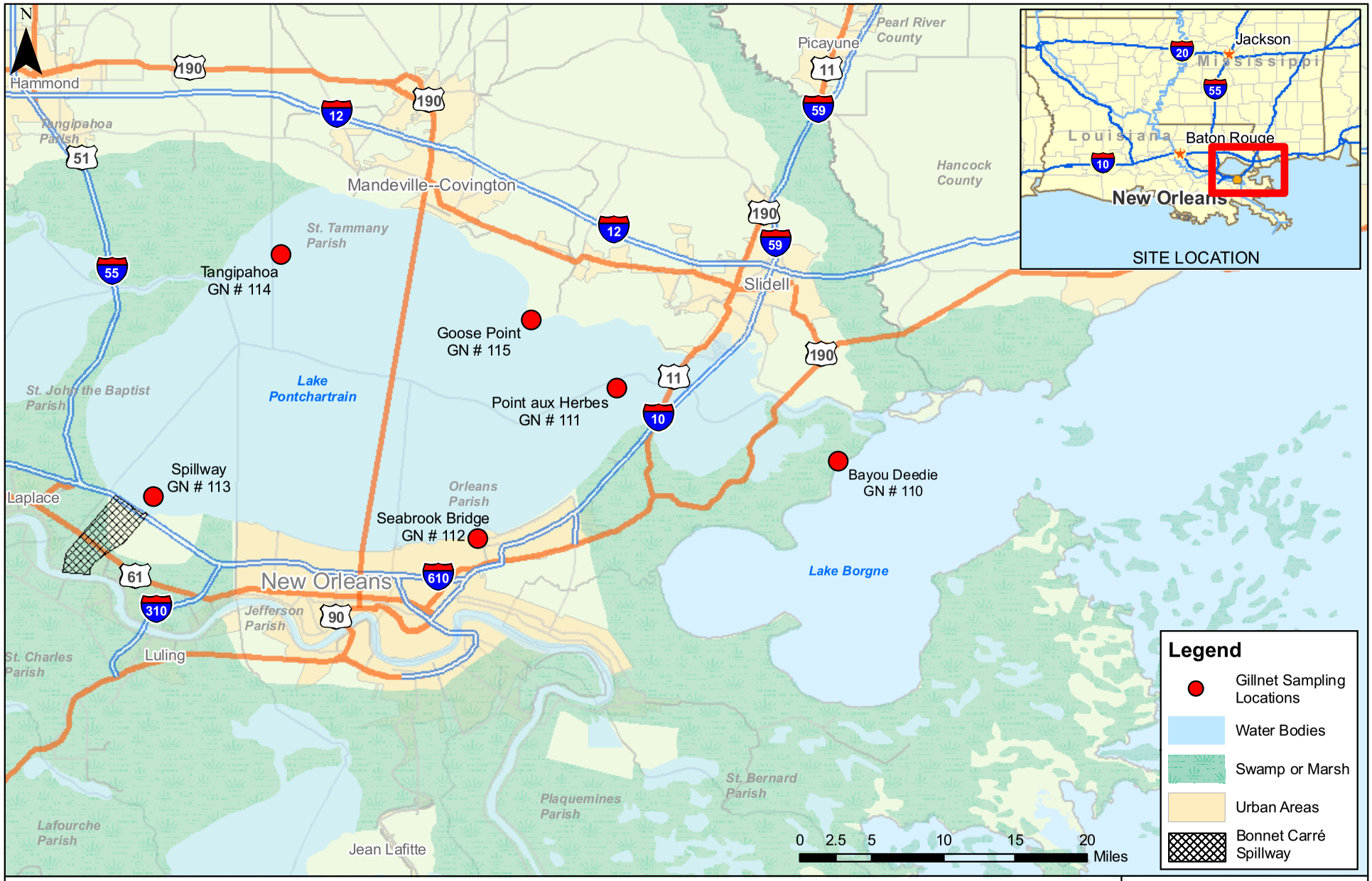
The LDWF collected seine samples at Lake Pontchartrain stations 154, 155, 156, 157, and 158 (Figure 3-3) from 2000 through 2008. A 50' nylon bag seine with ¼ inch delta mesh was used to sample. All organisms collected were identified to species and counted. Up to 30 randomly selected individuals of certain species were measured to the nearest millimeter.

DATA ANALYSIS

Trawl Data

The most abundant species collected in the Lake Pontchartrain trawl stations were selected for detailed analyses. Catches from all stations were combined, and the data for the most abundant species were analyzed using analysis of variance to determine if catches for years and months were significantly different. If the catches among the years analyzed differed significantly, a contrast was done to determine if the 2008 data collected after the Bonnet Carré Spillway opening differed significantly from data collected in previous years for the same time period.

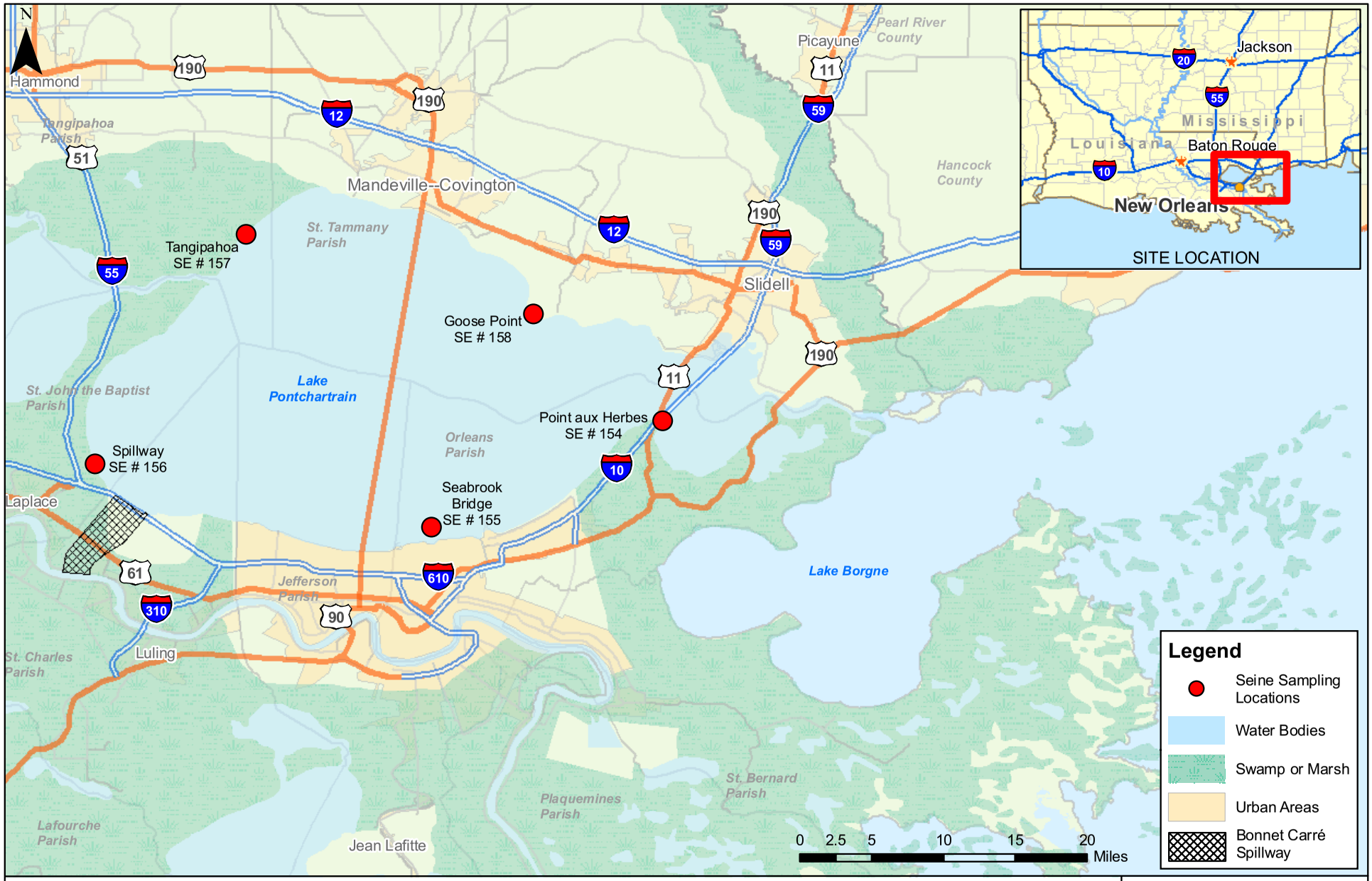
Lake Pontchartrain trawl data were examined for the months (May through October) and years (2001, 2002, 2007, and 2008) where sufficient data were collected. Similar analyses were performed for abundant species collected in Lake Borgne and waters south of Mississippi Sound at Stations 65, 74, and 95 for the years 2001 through 2004 and 2007 to 2008 for May through October.



GILLNET SAMPLING LOCATIONS

GEC

Figure: 3-2
Date: December 2008
Scale: 1:600,000
Source: LDWF/ESRI/GEC
Map ID: 27316921-1177



SEINE SAMPLING LOCATIONS

GEC

Figure: 3-3
Date: December 2008
Scale: 1:600,000
Source: LDWF/ESRI/GEC
Map ID: 27316921-1178

Gillnet Data

The most abundant species collected in gillnets were analyzed in a similar method to species collected by trawls. Months and years where sufficient gillnet data were collected were May, July, and August for 2001, 2002, and 2005 through 2008. The SAS (SAS Institute, Inc. 2008) contrast cannot interpret missing cells, so the June data were excluded from the analysis.

Seine Data

The most abundant species collected in seines were analyzed as described above for the trawl data. Months and years where sufficient data were collected were: May through October for 2001, 2002, 2007, and 2008.

All Data

Since the Spillway opened in mid-April, samples from April collected before April 11th were analyzed as March samples under a March-April combination month for each year and referred to as March. The April samples collected after the 11th were analyzed as May samples under an April-May combination month for each year and referred to as May.

Data were checked for normality using a Shapiro-Wilks test and for homogeneous variances using a Levene's test. The data were not normally distributed and had non-homogenous variances. The data were log transformed: $\log_{10}$ (number+1) before the analysis of variance. Data tables and graphs are presented using non-transformed data.

In all analyses, a p-value of 0.05 was considered significant and a value of 0.01 was considered highly significant. All statistical analyses were done using SAS Analytics Pro Version 9.1 (SAS Institute, Inc. 2008).

RESULTS

A list of species collected by all gears at all stations is located in Appendix Table A-1 and includes common and scientific names for each species. Catch per unit effort (CPUE) data for the most abundant species collected by each gear and analyzed are presented in Appendix Tables A-2 through A-5 and Appendix Figures A-1 through A-3. Analysis of variance tables are located in Appendix Tables A-6 through A-9.

Trawl Data

Overall

A total of 298,322 fish and other organisms (66 different species) were collected by trawling by LDWF in Lake Pontchartrain from 2000 through 2008 (Table 3-1). The bay

Table 3-1 Organisms Collected by Trawling in Lake Pontchartrain From 2000 through 2008, By Year (2008 data is only through October)

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	TOTAL
Number of trawls	*71*	*158*	*124*	*44*	*22*	*86*	*76*	*118*	*119*	*818*
bay anchovy	17,422	47,391	24,123	4,002	3,218	26,449	14,221	63,530	70,907	271,263
Atlantic croaker	26	2,825	968	1,464	75	1,219	602	1,906	2,172	11,257
gulf menhaden	1	1,018	679	579	7	3,089	142	365	523	6,403
sand seatrout	10	221	49	70	22	146	142	2,051	306	3,017
blue crab	1	31	38	25	27	39	27	87	2,165	2,440
northern brown shrimp	14	636	22	1	6	38	39	282	618	1,656
northern white shrimp	16	17	21	9	21	13	155	46	517	815
spot	.	143	6	2	3	25	3	4	144	330
inland silverside	7	101	18	2	4	18	1	7	1	159
blue catfish	.	23	9	7	27	26	.	1	25	118
hogchoker	2	32	6	2	12	8	1	7	45	115
striped anchovy	15	22	11	.	2	32	21	9	.	112
threadfin shad	3	23	27	1	.	.	2	4	10	70
silver perch	16	9	9	1	.	3	9	6	7	60
hardhead catfish	.	6	5	.	2	1	13	19	7	53
least puffer	15	11	7	.	.	.	.	12	6	51
spotted seatrout	11	5	5	4	.	.	2	8	5	40
sheepshead	1	13	3	4	3	7	.	1	.	32
naked goby	.	7	5	1	.	1	1	7	8	30
southern flounder	1	1	1	.	.	1	3	6	14	27
gulf pipefish	1	.	8	.	1	1	.	11	2	24
black drum	1	6	1	.	1	1	1	3	9	23
Atlantic stingray	.	8	1	.	.	.	1	4	7	21
pinfish	1	10	1	2	2	1	.	1	1	19
striped mullet	.	6	4	7	1	.	.	.	1	19
bay whiff	.	4	1	.	.	5	1	2	4	17
southern puffer	.	.	.	.	.	.	15	.	.	15
Atlantic bumper	3	.	.	.	2	.	.	1	4	10
channel catfish	.	1	2	1	.	.	.	.	5	9

Table 3-1 (cont'd). Organisms Collected by Trawling in Lake Pontchartrain From 2000 through 2008, By Year (2008 data is only through October)

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	TOTAL
inshore lizardfish	.	.	.	.	.	.	6	2	1	9
ladyfish	.	1	.	.	.	2	3	.	3	9
gafftopsail catfish	.	4	.	1	.	.	1	1	1	8
harvestfish	5	.	1	.	.	.	.	.	2	8
rainwater killifish	.	.	8	.	.	.	.	.	.	8
skipjack herring	.	3	1	3	.	.	.	.	1	8
skilletfish	1	2	3	.	.	.	.	.	1	7
bighead searobin	.	1	1	2	1	.	.	.	.	5
chain pipefish	.	.	.	.	.	.	.	5	.	5
Atlantic cutlassfish	.	2	2	.	.	.	.	.	.	4
gulf butterfish	.	.	4	.	.	.	.	.	.	4
banded drum	.	.	.	.	.	.	.	.	3	3
blackcheek tonguefish	.	1	.	.	1	.	.	.	1	3
freshwater drum	1	2	.	.	.	.	.	.	.	3
gulf toadfish	.	1	.	1	.	.	.	.	1	3
alligator gar	.	.	.	.	.	.	1	.	1	2
Atlantic moonfish	.	.	.	.	.	.	.	.	2	2
Atlantic spadefish	.	.	.	.	.	.	.	1	1	2
Atlantic thread herring	.	.	.	.	.	.	2	.	.	2
clown goby	.	.	.	.	.	.	.	.	2	2
Harris mud crab	2	.	.	.	.	.	.	.	.	2
riverine grass shrimp	2	.	.	.	.	.	.	.	.	2
sailfin molly	.	.	.	.	.	.	.	.	2	2
American eel	.	.	.	.	.	.	1	.	.	1
Atlantic mud crab	1	.	.	.	.	.	.	.	.	1

Table 3-1 (cont'd). Organisms Collected by Trawling in Lake Pontchartrain From 2000 through 2008, By Year (2008 data is only through October)

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	TOTAL
Atlantic needlefish	.	.	1	.	.	.	.	.	.	1
bluegill	.	.	.	.	.	.	.	.	1	1
code goby	.	.	.	.	.	1	.	.	.	1
crevalle jack	.	.	.	.	.	.	.	1	.	1
fringed flounder	.	.	.	.	.	.	1	.	.	1
gizzard shad	.	.	1	.	.	.	.	.	.	1
leatherjacket	.	1	.	.	.	.	.	.	.	1
red drum	.	.	.	.	.	.	.	1	.	1
river shrimp	.	.	.	.	.	.	.	.	1	1
southern kingfish	.	.	.	.	.	.	.	1	.	1
speckled worm eel	1	.	.	.	.	.	.	.	.	1
yellow bass	.	1	.	.	.	.	.	.	.	1
	17,580	52,589	26,052	6,191	3,438	31,126	15,417	68,392	77,537	298,322

anchovy *(Anchoa mitchilli)* was the most abundant species collected in these trawl samples and was 90.9 percent of the total catch. Other abundant species included Atlantic croaker (*Micropogonias undulatus)*, gulf menhaden *(Brevoortia patronus)*, sand seatrout *(Cynoscion arenarius)*, blue crab *(Callinectes sapidus)*, and northern brown shrimp *(Farfantepenaeus aztecus)*. Together, these six species comprised 99.2 percent of the Lake Pontchartrain catch. Catches in 2008 were similar to previous years, although more bay anchovies and blue crabs were collected during 2008.

The bay anchovy was the most abundant species collected at all stations in Lake Pontchartrain; catches were highest at Station 2 in the southeastern corner of the lake (Table 3-2). Atlantic croaker catches were highest at Station 4 in the northwest corner and Station 7 in the center of the lake. More gulf menhaden were collected at Station 3 near the Spillway opening and Station 5 in the lake's northeast corner. Catches of sand seatrout were highest at Station 7, blue crabs at Station 3, and northern brown shrimp at Station 5.

At the three stations in Lake Borgne and south of Mississippi Sound, a total of 382,129 fish and other organisms (representing at least 95 species) were collected from 2000 to 2008 (Table 3-3). The bay anchovy was 59.2 percent of the total catch. Other abundant species included northern brown shrimp, Atlantic croaker, northern white shrimp *(Litopenaeus setiferus)*, sand seatrout, spot *(Leiostomus xanthurus)*, gulf menhaden, blue crab, hardhead catfish *(Ariopsis felis),* and grass shrimp species (*Palaemonetes* spp.). Together, these ten species were 97.2 percent of the catch. Catches in 2008 appeared to be similar to previous years.

The bay anchovy was the most abundant species caught at all stations in Lake Borgne (Table 3-4), although 68.5 percent of the anchovies were collected at Station 65 in Bayou Bienvenue in the western portion of the lake. More Atlantic croaker and sand seatrout were caught at Station 65. Catches of northern brown shrimp were higher at Station 74 south of Mississippi Sound and northern white shrimp catches were also slightly higher at this station.

Of the most abundant species collected in trawls, only the bay anchovy, Atlantic croaker, gulf menhaden, sand seatrout, blue crab, northern brown shrimp, northern white shrimp, spot, and hardhead catfish had sufficient data for analysis.

Bay anchovy

In the Lake Pontchartrain trawl samples, the years ($p<0.01$) and months ($p<0.01$) tested differed significantly; however, there was also a significant year by month interaction ($p<0.05$-Appendix Table A-2 and A-6, Appendix Figure A-1). Catches in 2008 differed significantly from the other three years tested; 2008 catches were generally higher than the other years, although May and July catches were slightly lower than 2007. Catches in 2007 and 2008 were higher than those in 2001 and 2002. Bay anchovy catches generally were lowest in May, peaked in August, then declined in September and October. There were some exceptions to this pattern: 2008 (July lower than June); 2002 (low except the September peak); and 2001 (September lower than October).

Table 3-2. Organisms Collected by Trawling in Lake Pontchartrain From 2000 through 2008, By Station

Species	1	2	3	4	5	7	Total
Number of trawls	*136*	*137*	*137*	*135*	*136*	*137*	*818*
bay anchovy	32,815	77,419	35,959	40,397	37,173	47,500	271,263
Atlantic croaker	902	1,704	1,351	3,184	1,639	2,477	11,257
gulf menhaden	621	323	2,610	870	1,541	438	6,403
sand seatrout	111	112	80	277	253	2,184	3,017
blue crab	48	35	2,130	95	108	24	2,440
northern brown shrimp	197	78	50	227	799	305	1,656
northern white shrimp	85	28	99	256	213	134	815
spot	66	45	70	7	133	9	330
inland silverside	.	.	3	2	154	.	159
blue catfish	5	7	38	55	10	3	118
hogchoker	1	2	38	56	10	8	115
striped anchovy	34	19	8	12	21	18	112
threadfin shad	.	40	3	8	5	14	70
silver perch	17	8	6	1	27	1	60
hardhead catfish	18	4	4	10	16	1	53
least puffer	8	2	6	6	25	4	51
spotted seatrout	6	.	8	5	17	4	40
sheepshead	20	1	3	1	6	1	32
naked goby	7	.	9	4	7	3	30
southern flounder	1	3	2	11	6	4	27
gulf pipefish	.	.	2	1	21	.	24
black drum	6	.	10	4	2	1	23
Atlantic stingray	3	.	3	4	11	.	21
pinfish	9	1	.	.	9	.	19
striped mullet	2	1	5	3	.	8	19
bay whiff	3	4	3	1	2	4	17
southern puffer	14	.	.	.	1	.	15
Atlantic bumper	4	.	.	.	4	2	10
channel catfish	.	1	1	7	.	.	9
inshore lizardfish	5	.	.	1	2	1	9
ladyfish	2	5	2	.	.	.	9
gafftopsail catfish	.	5	1	.	.	2	8
harvestfish	6	1	.	.	.	1	8
rainwater killifish	.	.	.	.	8	.	8
skipjack herring	.	5	3	.	.	.	8
skilletfish	1	1	2	.	1	2	7
bighead searobin	1	2	1	.	1	.	5
chain pipefish	1	.	.	.	4	.	5

Table 3-2 (cont'd). Organisms Collected by Trawling in Lake Pontchartrain From 2000 through 2008, By Station

Species	1	2	3	4	5	7	Total
Atlantic cutlassfish	.	3	.	.	.	1	4
gulf butterfish	.	4	.	.	.	.	4
banded drum	.	1	1	1	.	.	3
blackcheek tonguefish	1	2	.	.	.	.	3
freshwater drum	.	.	3	.	.	.	3
gulf toadfish	1	2	.	.	.	.	3
alligator gar	.	1	1	.	.	.	2
Atlantic moonfish	.	2	.	.	.	.	2
Atlantic spadefish	1	.	.	.	1	.	2
Atlantic thread herring	.	1	.	1	.	.	2
clown goby	.	.	1	.	.	1	2
Harris mud crab	.	.	.	.	2	.	2
riverine grass shrimp	.	.	.	.	2	.	2
sailfin molly	.	.	2	.	.	.	2
American eel	.	.	.	.	1	.	1
Atlantic mud crab	.	.	.	.	1	.	1
Atlantic needlefish	.	.	.	.	.	1	1
bluegill	.	.	.	.	1	.	1
code goby	.	1	.	.	.	.	1
crevalle jack	.	1	.	.	.	.	1
fringed flounder	.	.	.	1	.	.	1
gizzard shad	.	.	.	.	.	1	1
leatherjacket	.	.	.	.	1	.	1
red drum	.	.	.	1	.	.	1
river shrimp	.	.	.	.	.	1	1
southern kingfish	.	.	1	.	.	.	1
speckled worm eel	.	1	.	.	.	.	1
yellow bass	.	.	1	.	.	.	1
	35,022	79,875	42,520	45,509	42,238	53,158	298,322

Table 3-3. Organisms Collected by Trawling in Lake Borgne and South of Mississippi Sound From 2000 through 2008, By Year

Common Name	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Number of trawls	*119*	*129*	*129*	*129*	*129*	*113*	*102*	*132*	*83*	*1,065*
bay anchovy	13,769	9,289	20,107	16,626	36,144	15,269	10,770	56,354	47,932	226,260
northern brown shrimp	9,240	5,385	6,592	4,009	4,631	3,029	6,230	3,535	6,228	48,879
Atlantic croaker	3,435	2,809	3,653	2,664	1,886	5,597	1,862	4,612	4,283	30,801
northern white shrimp	835	886	4,222	4,014	3,037	4,216	5,837	2,608	5,013	30,668
sand seatrout	941	697	3,180	1,531	1,399	1,364	1,542	2,440	2,450	15,544
spot	491	4,661	626	25	57	413	78	270	259	6,880
gulf menhaden	483	248	727	584	404	475	175	310	140	3,546
blue crab	223	237	453	705	660	189	522	337	168	3,494
hardhead catfish	874	258	317	363	590	82	283	127	270	3,164
grass shrimp spp.	.	3	457	384	782	179	272	165	52	2,294
gafftopsail catfish	70	55	302	126	155	117	304	89	427	1,645
inland silverside	402	4	81	93	388	.	50	6	433	1,457
least puffer	156	78	87	94	202	161	89	152	34	1,053
silver perch	112	16	32	67	81	97	94	196	230	925
Atlantic brief squid	218	.	3	1	46	.	263	68	3	602
star drum	3	1	10	11	2	2	5	3	471	508
spotted seatrout	46	42	42	80	65	62	16	47	28	428
blackcheek tonguefish	15	30	53	52	96	28	61	49	14	398
striped anchovy	23	106	20	39	33	52	17	46	33	369
Atlantic bumper	241	6	5	10	28	4	10	44	1	349
river shrimp	.	12	25	47	68	58	46	.	.	256
bay whiff	4	1	27	14	14	47	119	19	8	253
southern flounder	6	8	33	32	1	27	39	14	27	187
Atlantic stingray	15	9	14	11	17	12	23	16	17	134

Table 3-3 (cont'd). Organisms Collected by Trawling in Lake Borgne and South of Mississippi Sound From 2000 through 2008, By Year

Common Name	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
chain pipefish	.	.	4	.	121	1	2	1	1	130
threadfin shad	15	20	10	22	4	38	5	.	16	130
inshore lizardfish	19	17	35	6	5	3	7	31	6	129
ladyfish	.	1	.	8	57	34	6	7	16	129
southern kingfish	13	3	10	6	16	16	15	34	4	117
sharptail goby	13	3	12	15	16	36	2	6	13	116
pinfish	14	21	23	4	37	6	1	5	2	113
naked goby	1	2	5	6	33	10	23	20	10	110
rough silverside	.	.	.	107	.	.	.	.	.	107
Atlantic cutlassfish	11	7	4	4	5	1	9	42	14	97
hogchoker	2	6	10	15	12	13	9	14	11	92
northern pink shrimp	7	4	4	6	14	10	3	22	1	71
striped mullet	.	1	4	.	1	2	.	1	51	60
bighead searobin	.	19	9	3	5	4	1	9	4	54
Atlantic spadefish	1	.	4	5	4	5	16	9	2	46
gulf pipefish	.	.	3	18	6	14	2	3	.	46
clown goby	.	.	.	.	10	2	2	15	5	34
mantis shrimp	34	.	.	.	.	.	.	.	.	34
Atlantic midshipman	3	8	10	.	2	1	6	.	3	33
darter goby	.	.	2	.	10	.	3	9	5	29
fringed flounder	10	5	.	.	.	7	.	.	1	23
crevalle jack	.	1	5	8	6	1	.	1	.	22
harvestfish	4	.	4	1	5	.	.	1	7	22
gulf toadfish	.	4	4	4	2	.	2	3	1	20

Table 3-3 (cont'd). Organisms Collected by Trawling in Lake Borgne and South of Mississippi Sound From 2000 through 2008, By Year

Common Name	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
western mosquitofish	.	.	.	1	1	2	16	.	.	20
butterfish	18	1	.	.	.	.	.	.	.	19
sheepshead	2	4	4	1	7	.	1	.	.	19
shrimp eel	2	4	7	1	1	1	.	1	1	18
sheepshead minnow	.	7	.	3	7	.	.	.	.	17
bigclaw snapping shrimp	.	2	5	.	1	1	4	2	1	16
red drum	.	12	1	1	1	.	.	.	.	15
skipjack herring	.	.	6	2	1	.	.	.	1	10
gizzard shad	1	.	5	.	.	1	.	2	.	9
skilletfish	.	.	1	.	1	3	4	.	.	9
black drum	.	1	.	.	.	.	1	.	5	7
lookdown	1	.	1	1	1	1	.	2	.	7
southern hake	.	5	.	2	.	.	.	.	.	7
bank cusk eel	.	.	.	.	.	.	6	.	.	6
blue catfish	.	.	3	.	1	.	1	.	.	5
gulf killifish	.	.	3	.	.	1	.	.	1	5
leatherjacket	.	2	.	2	.	1	.	.	.	5
scaled sardine	.	.	1	.	.	2	.	2	.	5
southern stingray	.	2	3	.	.	.	.	.	.	5
spanish mackerel	.	.	.	3	.	2	.	.	.	5
gulf kingfish	4	.	.	.	.	.	.	.	.	4
spanish sardine	.	.	.	.	.	1	1	.	2	4
American eel	.	1	2	.	.	.	.	.	.	3
goby spp.	.	.	3	.	.	.	.	.	.	3
gray snapper	.	1	.	.	.	1	.	1	.	3
gulf butterfish	2	.	.	.	.	.	.	1	.	3

Table 3-3 (cont'd). Organisms Collected by Trawling in Lake Borgne and South of Mississippi Sound From 2000 through 2008, By Year

Common Name	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
mud crab spp.	.	.	.	.	2	1	.	.	.	3
river shiner	.	.	.	3	.	.	.	.	.	3
speckled worm eel	1	2	.	.	.	.	.	.	.	3
violet goby	.	.	2	1	.	.	.	.	.	3
alligator gar	.	.	.	.	.	2	.	.	.	2
Atlantic moonfish	1	.	.	.	.	.	.	.	1	2
diamondback terrapin	.	.	.	.	.	1	1	.	.	2
lined sole	1	.	1	.	.	.	.	.	.	2
naked sand darter	.	.	2	.	.	.	.	.	.	2
stone crab spp.	.	.	.	.	.	2	.	.	.	2
striped blenny	.	.	.	1	.	.	.	1	.	2
Atlantic threadfin	.	.	1	.	.	.	.	.	.	1
blackedge cusk eel	.	.	.	.	.	.	.	.	1	1
Clupeid sp.	.	.	.	.	.	.	.	1	.	1
crested cusk eel	.	.	.	.	.	.	1	.	.	1
dusky anchovy	.	1	.	.	.	.	.	.	.	1
fat sleeper	.	.	.	.	1	.	.	.	.	1
green goby	.	.	1	.	.	.	.	.	.	1
gulf stone crab	.	.	.	.	.	.	.	1	.	1
jack sp.	.	1	.	.	.	.	.	.	.	1
planehead filefish	.	.	.	.	1	.	.	.	.	1
redear sunfish	.	.	1	.	.	.	.	.	.	1
rock sea bass	.	.	.	.	.	1	.	.	.	1
sailfin molly	.	.	1	.	.	.	.	.	.	1
sand snapping shrimp	.	1	.	.	.	.	.	.	.	1
striped burrfish	.	.	.	.	.	1	.	.	.	1
white mullet	.	.	.	.	1	.	.	.	.	1
	31,782	25,010	41,284	31,842	51,184	31,709	28,857	71,754	68,707	382,129

Table 3-4. Organisms Collected by Trawling in Lake Borgne and South Mississippi Sound from 2000 through 2008, By Station

Species	65	74	95	Total
Number of trawls	*369*	*368*	*328*	*1,065*
bay anchovy	155,047	34,703	36,510	226,260
northern brown shrimp	14,404	30,129	4,346	48,879
Atlantic croaker	14,300	9,762	6,739	30,801
northern white shrimp	13,912	15,676	1,080	30,668
sand seatrout	10,184	4,185	1,175	15,544
spot	3,865	2,545	470	6,880
gulf menhaden	1,709	487	1,350	3,546
blue crab	1,489	705	1,300	3,494
hardhead catfish	700	1,462	1,002	3,164
grass shrimp spp.	564	1,558	172	2,294
gafftopsail catfish	278	1,322	45	1,645
inland silverside	1,347	92	18	1,457
least puffer	444	357	252	1,053
silver perch	405	351	169	925
Atlantic brief squid	33	482	87	602
star drum	3	505	.	508
spotted seatrout	283	115	30	428
blackcheek tonguefish	46	314	38	398
striped anchovy	67	46	256	369
Atlantic bumper	4	265	80	349
river shrimp	67	92	97	256
bay whiff	75	132	46	253
southern flounder	93	65	29	187
Atlantic stingray	41	51	42	134
chain pipefish	125	1	4	130
threadfin shad	44	70	16	130
inshore lizardfish	36	69	24	129
ladyfish	82	11	36	129
southern kingfish	6	62	49	117
sharptail goby	59	57	.	116
pinfish	14	29	70	113
naked goby	85	6	19	110
rough silverside	107	.	.	107
Atlantic cutlassfish	11	82	4	97
hogchoker	65	10	17	92
northern pink shrimp	27	6	38	71
striped mullet	52	5	3	60

Table 3-4 (cont'd). Organisms Collected by Trawling in Lake Borgne and South Mississippi Sound from 2000 through 2008, By Station

Species	65	74	95	Total
bighead searobin	7	28	19	54
Atlantic spadefish	18	26	2	46
gulf pipefish	42	.	4	46
clown goby	10	12	12	34
mantis shrimp	1	33	.	34
Atlantic midshipman	17	16	.	33
darter goby	16	11	2	29
fringed flounder	1	18	4	23
crevalle jack	2	5	15	22
harvestfish	1	14	7	22
gulf toadfish	19	1	.	20
western mosquitofish	20	.	.	20
butterfish	.	1	18	19
sheepshead	1	1	17	19
shrimp eel	8	9	1	18
sheepshead minnow	13	2	2	17
bigclaw snapping shrimp	3	13	.	16
red drum	6	4	5	15
skipjack herring	2	6	2	10
gizzard shad	5	2	2	9
skilletfish	5	2	2	9
black drum	2	5	.	7
lookdown	.	7	.	7
southern hake	1	6	.	7
bank cusk eel	.	6	.	6
blue catfish	.	.	5	5
gulf killifish	2	3	.	5
leatherjacket	1	1	3	5
scaled sardine	.	4	1	5
southern stingray	.	3	2	5
spanish mackerel	1	1	3	5
gulf kingfish	1	1	2	4
spanish sardine	.	4	.	4
American eel	2	1	.	3
goby spp.	1	2	.	3
gray snapper	3	.	.	3
gulf butterfish	1	1	1	3

Table 3-4 (cont'd). Organisms Collected by Trawling in Lake Borgne and South Mississippi Sound from 2000 through 2008, By Station

Species	65	74	95	Total
mud crab spp.	.	2	1	3
river shiner	.	3	.	3
speckled worm eel	2	.	1	3
violet goby	2	1	.	3
alligator gar	2	.	.	2
Atlantic moonfish	1	1	.	2
diamondback terrapin	.	2	.	2
lined sole	2	.	.	2
naked sand darter	.	2	.	2
stone crab spp	.	2	.	2
striped blenny	1	1	.	2
Atlantic threadfin	.	1	.	1
blackedge cusk eel	.	1	.	1
clupeid sp.	.	1	.	1
crested cusk eel	.	1	.	1
dusky anchovy	.	1	.	1
fat sleeper	1	.	.	1
green goby	1	.	.	1
gulf stone crab	.	1	.	1
jack sp.	1	.	.	1
planehead filefish	.	.	1	1
redear sunfish	.	.	1	1
rock sea bass	.	1	.	1
sailfin molly	1	.	.	1
sand snapping shrimp	.	1	.	1
striped burrfish	.	1	.	1
white mullet	1	.	.	1
	220,300	106,081	55,748	382,129

In Lake Borgne samples, the years ($p<0.01$) and months ($p<0.01$) tested were significantly different (Appendix Table A-3 and A-7, Appendix Figure A-1). The July and August trawl bay anchovy catches were high for 2001, 2007, and 2008, but 2002 catches were highest in June. Catches in 2008 differed from the other three years tested; 2008 catches during September and October were much higher than the other years.

Atlantic croaker

For the Lake Pontchartrain trawl stations, there was a significant difference between years ($p<0.01$) and months ($p<0.01$) tested for Atlantic croaker catch; but the interaction between years and months was also significant ($p<0.01$). During 2008 and 2002, there was a general trend of higher catches in May and declines until October; however, 2001 and 2007 catches were higher in June (2007) and May and July (2001) (Appendix Table A-2 and A-6; Appendix Figure A-1). Catches in 2008 differed significantly from the other years; catches in 2007 differed as described above, and 2002 catches were generally low.

The Lake Borgne trawl data had a significant difference between months ($p<0.01$) and years ($p<0.01$) tested for Atlantic croaker (Appendix Table A-3 and A-7; Appendix Figure A-1). However, monthly catches also differed between years ($p<0.01$); this was likely because 2008 had high catches during July through September. As a result, Atlantic croaker catches in 2008, after the Spillway opening, were higher than 2000 through 2007.

Gulf menhaden

For the Lake Pontchartrain trawl stations, there was a significant difference between months ($p<0.01$) tested for gulf menhaden catch (Appendix Table A-2 and A-6; Appendix Figure A-1). Catches from May through June were generally higher than those from August through October.

The months were significantly different ($p<0.01$) analyzed for gulf menhaden collected in Lake Borgne trawls (Appendix Table A-3 and A-7; Appendix Figure A-1). Catches were generally highest in May and lower from July through October. There were some additional peaks for some years: June (2002), July (2001), and August (2003), but these differences were not significant.

Sand seatrout

For the Lake Pontchartrain trawl stations, there was a significant difference between years ($p<0.01$) and months ($p<0.05$) tested for sand seatrout catch (Appendix Table A-2 and A-6; Appendix Figure A-1); but the interaction between years and months was also significant ($p<0.01$). Catches were generally low, except during June 2007; this catch was either unusual, or possibly a data entry error (Appendix Figure A-1). Catches in 2008 differed significantly from the other years and were higher in June (except for the 2007 catch described above) and September.

In Lake Borgne trawl samples, the years ($p<0.01$) and months were significantly different ($p<0.01$-Appendix Table A-3 and A-7; Appendix Figure A-1). The CPUE generally peaked in May through July, although it actually was higher in September in 2000 and July of 2007. Catches in 2008 were significantly different from the other years; this appears to be because the CPUE in June 2008 was higher than the other years.

Blue crab

For Lake Pontchartrain trawl samples, years differed significantly ($p<0.01$) for blue crab catches (Appendix Table A-2 and A-6; Appendix Figure A-1). Catches in 2008 were significantly higher ($p<0.01$) than the other years due to high catches in May.

Months were significantly different ($p<0.01$) in Lake Borgne trawl catches for blue crabs; catches peaked during May through July and were lower for August through November (Appendix Table A-3 and A-7; Appendix Figure A-1).

Northern brown shrimp

In the Lake Pontchartrain trawl samples, years ($p<0.01$) and months ($p<0.01$) differed significantly (Appendix Table A-2 and A-6; Appendix Figure A-1). However, there was also a significant interaction between months and years ($p<0.01$). Although catches were highest in June during 2008 and 2007, few brown shrimp were caught during June in 2001 and few were collected during any of the months evaluated during 2002.

The Lake Borgne trawl data had a significant difference between years ($p<0.01$) and months ($p<0.01$-Appendix Table A-3 and A-7; Appendix Figure A-1). More brown shrimp were collected during May and June than August through November, and catches were higher during 2008 and 2000 than the other years during May.

Northern white shrimp

Not enough white shrimp were collected in Lake Pontchartrain trawls to analyze. In the Lake Borgne trawl samples, the years ($p<0.01$) and months differed ($p<0.01$-Appendix Table A-3 and A-7; Appendix Figure A-1). Catches generally were highest during August through October and peaked during different months for different years. Catches in 2008 were significantly different from other years; CPUE was generally higher in 2008, except for August and September.

Spot

Spot were not collected in sufficient numbers in Lake Pontchartrain trawls to analyze. There was a significant difference between years ($p<0.01$) and months ($p<0.01$) for spot, and the year month interaction was significant ($p<0.01$) in Lake Borgne trawls (Appendix Table A-3 and A-7; Appendix Figure A-1). Peak catches occurred in May for 2000 through 2002, but this peak did not occur for the other years examined. Catches in 2008 differed from the

other years and were generally higher, except during May when 2000, 2001, and 2002 were higher and June when 2001 was higher.

Hardhead catfish

Not enough hardhead catfish were collected in Lake Pontchartrain trawls to analyze. The months differed significantly ($p<0.01$) for hardhead catfish in Lake Borgne samples; CPUE was higher in August through September than the other months tested. (Appendix Table A-3 and A-7; Appendix Figure A-1)

Gillnet Data

Overall

A total of 9,587 organisms representing 45 species was collected by gillnets. Overall, the gulf menhaden was the most abundant organism collected in gillnets, comprising 38.8 percent of the total catch (Table 3-5). Twelve species, including gulf menhaden, hardhead catfish, Atlantic croaker, spotted seatrout *(Cynoscion nebulosus)*, gafftopsail catfish *(Bagre marinus)*, spot, striped mullet *(Mugil cephalus)*, gizzard shad *(Dorosoma cepedianum),* blue crab, skipjack herring (*Alosa chrysochloris),* ladyfish *(Elops saurus),* and red drum *(Sciaenops ocellatus)* constituted 95.8 percent of the total gill net catch. Catches in 2008 were similar to previous years.

Catches of gulf menhaden were higher at stations 114 and 115 in the northern portion of Lake Pontchartrain (Table 3-6). Catches at Station 110, Bayou Deedie in the northwest portion of Lake Borgne were higher than the other stations for hardhead catfish, spotted seatrout, Atlantic croaker, and striped mullet; however, nearly twice as many samples were taken at this station.

The smaller mesh panels generally caught more species and had higher catches (Table 3-7). The number of different species caught in each panel was: 1-in (33), 1.25-in (30), 1.5-in (26), 1.75-in (28), and 2-in (25). Catches of gulf menhaden, Atlantic croaker, spotted seatrout, spot, striped mullet, and skipjack herring were higher in the smaller mesh panels, whereas catches of gafftopsail catfish were higher in the larger mesh panels.

Of the most abundant species collected in gillnets, only the gulf menhaden and hardhead catfish had sufficient data for analysis.

Gulf menhaden

Gulf menhaden catches differed significantly among months ($p<0.05$); catches were generally highest in May, and although there were some differences between the years, they were not significant (Appendix Table A-4 and A-8; Appendix Figure A-2).

Table 3-5. Organisms Collected by Gillnets in Lake Pontchartrain and Bayou Deedie from 2000 through 2008, By Year

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Number of sets	*236*	*389*	*385*	*210*	*155*	*275*	*209*	*380*	*293*	*2,532*
gulf menhaden	202	825	509	281	58	515	336	427	567	3,720
hardhead catfish	99	119	123	113	29	92	319	206	313	1,413
Atlantic croaker	99	187	112	87	49	19	44	94	80	771
spotted seatrout	70	95	100	88	81	103	72	92	62	763
gafftopsail catfish	54	138	99	6	4	28	100	150	161	740
spot	94	131	119	41	8	15	22	72	44	546
striped mullet	45	11	95	62	36	12	10	21	58	350
gizzard shad	4	25	66	34	23	31	10	60	66	319
blue crab	3	19	38	20	25	19	36	19	14	193
skipjack herring	8	41	16	26	6	15	2	10	38	162
ladyfish	3	18	11	12	4	6	25	12	15	106
red drum	3	4	24	13	49	.	1	7	.	101
black drum	9	19	1	.	10	2	1	16	6	64
spanish mackerel	22	5	9	.	2	1	3	1	9	52
crevalle jack	4	6	14	3	.	2	4	3	14	50
sand seatrout	2	4	19	2	.	.	.	3	4	34
sheepshead	2	6	2	8	4	1	5	2	.	30
blue catfish	.	17	1	5	.	1	.	2	1	27
southern kingfish	6	3	.	.	1	1	10	1	4	26
northern white shrimp	1	3	.	1	2	1	8	1	1	18
bull shark	1	1	4	3	1	1	.	2	.	13
alligator gar	.	.	3	.	3	.	.	1	5	12
southern flounder	.	3	2	2	2	.	.	.	.	9

Table. 3-5 (cont'd). Organisms Collected by Gillnets in Lake Pontchartrain and Bayou Deedie from 2000 through 2008, By Year

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
pinfish	.	2	2	.	.	.	1	3	.	8
cownose ray	1	.	1	.	.	.	1	1	3	7
bluefish	.	.	1	.	.	.	3	2	.	6
longnose gar	.	1	2	.	.	1	1	1	.	6
silver perch	3	.	.	.	3	.	.	.	.	6
Atlantic sturgeon	.	.	2	3	.	.	.	.	.	5
leatherjacket	.	.	.	.	.	.	1	4	.	5
northern brown shrimp	.	2	1	.	.	.	.	.	.	3
spotted gar	.	.	.	1	1	.	.	1	.	3
threadfin shad	.	1	.	.	.	.	1	.	1	3
Atlantic bumper	.	1	1	.	.	.	.	.	.	2
Atlantic stingray	.	.	.	.	1	.	.	1	.	2
harvestfish	.	.	.	.	.	.	1	1	.	2
yellow bass	.	.	1	1	.	.	.	.	.	2
Atlantic cutlassfish	1	.	.	.	.	.	.	.	.	1
bay whiff	.	.	.	.	1	.	.	.	.	1
channel catfish	.	1	.	.	.	.	.	.	.	1
diamondback terrapin	.	.	.	.	.	.	.	1	.	1
freshwater drum	.	.	1	.	.	.	.	.	.	1
spanish sardine	.	.	.	.	.	.	1	.	.	1
striped bass	.	.	1	.	.	.	.	.	.	1
white mullet	1	.	.	.	.	.	.	.	.	1
	737	1,688	1,380	812	403	866	1,018	1,217	1,466	9,587

Table 3-6. Organisms Collected by Gillnets in Lake Pontchartrain and Bayou Deedie from 2000 through 2008, By Station

Species	110	111	112	113	114	115	Total
Number of sets	*770*	*353*	*347*	*356*	*347*	*359*	*2,532*
gulf menhaden	290	177	252	614	1,370	1,017	3,720
hardhead catfish	1,213	128	12	11	5	44	1,413
Atlantic croaker	447	86	6	17	51	164	771
spotted seatrout	575	75	10	18	6	79	740
gafftopsail catfish	145	99	107	143	65	181	898
spot	172	106	33	16	22	197	546
striped mullet	167	34	2	16	59	72	350
gizzard shad	24	14	.	20	193	68	319
blue crab	193	.	.	.	.	.	193
skipjack herring	28	20	11	33	44	26	162
ladyfish	75	12	1	2	3	13	106
red drum	60	.	.	2	1	38	101
black drum	31	18	.	5	.	10	64
Spanish mackerel	22	3	19	1	3	4	52
crevalle jack	27	6	3	3	2	9	50
sand seatrout	8	16	1	.	1	8	34
sheepshead	17	11	.	.	.	2	30
blue catfish	1	.	3	2	8	13	27
southern kingfish	23	2	.	.	.	1	26
northern white shrimp	14	.	.	.	3	1	18
bull shark	4	.	1	.	.	8	13
alligator gar	1	.	.	5	4	2	12
southern flounder	7	1	.	.	.	1	9
pinfish	5	1	.	1	.	1	8
cownose ray	3	1	.	1	.	2	7
bluefish	5	.	.	.	.	1	6
longnose gar	.	.	.	.	5	1	6
silver perch	6	.	.	.	.	.	6
Atlantic sturgeon	1	1	.	.	.	3	5
leatherjacket	5	.	.	.	.	.	5
northern brown shrimp	.	2	.	.	.	1	3
spotted gar	3	.	.	.	.	.	3
threadfin shad	2	.	1	.	.	.	3
Atlantic bumper	2	.	.	.	.	1	3
Atlantic stingray	2	.	.	.	.	.	2
harvestfish	2	.	.	.	.	.	2
yellow bass	.	.	.	1	.	1	2
Atlantic cutlassfish	.	.	.	.	1	.	1
bay whiff	1	.	.	.	.	.	1
channel catfish	.	.	.	.	1	.	1
diamondback terrapin	1	.	.	.	.	.	1
freshwater drum	.	.	.	.	.	1	1
Spanish sardine	1	.	.	.	.	.	1
striped bass	.	.	.	.	.	1	1
white mullet	1	.	.	.	.	.	1
	3,584	813	462	911	1,847	1,970	9,587

Table 3-7. Organisms Collected by Gillnets in Lake Pontchartrain and Bayou Deedie from 2000 through 2008, By Panel Mesh

Species	1-inch	1.25-inch	1.5-inch	1.75-inch	2-inch	Total
Number of sets	*509*	*505*	*503*	*510*	*505*	*2,532*
gulf menhaden	1,134	1,771	712	68	35	3,720
hardhead catfish	392	304	396	234	87	1,413
Atlantic croaker	477	204	64	21	5	771
spotted seatrout	180	238	187	106	52	763
gafftopsail catfish	29	62	140	217	292	740
spot	156	208	161	21	.	546
striped mullet	98	92	102	43	15	350
gizzard shad	21	31	107	106	54	319
blue crab	45	51	39	34	24	193
skipjack herring	124	22	13	3	.	162
ladyfish	42	36	16	9	3	106
red drum	4	4	39	12	42	101
black drum	3	4	16	12	29	64
spanish mackerel	15	16	12	3	6	52
crevalle jack	24	9	6	4	7	50
sand seatrout	22	4	5	2	1	34
sheepshead	1	2	7	9	11	30
blue catfish	.	3	7	12	5	27
southern kingfish	14	8	3	1	.	26
northern white shrimp	12	6	.	.	.	18
bull shark	1	1	.	2	9	13
alligator gar	.	1	.	2	9	12
southern flounder	.	2	3	1	3	9
pinfish	3	4	1	.	.	8
cownose ray	.	.	1	.	6	7
bluefish	2	3	.	1	.	6
longnose gar	1	1	2	2	.	6
silver perch	6	.	.	.	.	6
Atlantic sturgeon	1	2	.	1	1	5
leatherjacket	5	.	.	.	.	5
northern brown shrimp	2	1	.	.	.	3
spotted gar	.	.	1	1	1	3
threadfin shad	3	.	.	.	.	3
Atlantic bumper	2	.	.	.	.	2
Atlantic stingray	.	2	.	.	.	2
harvestfish	.	.	.	.	2	2
yellow bass	.	1	.	1	.	2
Atlantic cutlassfish	1	.	.	.	.	1
bay whiff	1	.	.	.	.	1
channel catfish	.	.	1	.	.	1
diamondback terrapin	.	.	1	.	.	1
freshwater drum	.	.	.	.	1	1
spanish sardine	1	.	.	.	.	1
striped bass	.	.	.	1	.	1
white mullet	1	.	.	.	.	1
	2,823	3,093	2,042	929	700	9,587

Hardhead catfish

No significant differences were found between months or years analyzed for hardhead catfish collected in gillnets (Appendix Table A-4 and A-8; Appendix Figure A-2).

Seine Data

Overall

A total of 133,398 organisms representing 51 species was collected in the seine samples in Lake Pontchartrain (Table 3-8). The gulf menhaden was the most abundant species collected, constituting 42.7 percent of the total seine catch. Nine species, including gulf menhaden, bay anchovy, inland silverside *(Menidia beryllina)*, Atlantic croaker, rainwater killifish *(Lucania parva)*, spot, striped mullet, blue crab, and northern brown shrimp comprised 95.8 percent of the seine catch. Seine catches in 2008 were slightly lower than 2007 and 2005; catches were highest in 2001 and 2002.

Seine catches were highest at station 156, located near the Spillway and lowest at Station154, the easternmost seine station (Table 3-9). Catches of gulf menhaden were highest at Stations 156 and 157, the westernmost seine stations. More bay anchovies were caught at the Spillway Station (156). Other species that were caught in greater numbers at one station included: inland silversides and rainwater killifish (Station 158 at Goose Point in the northeast corner), Atlantic croaker (Station 157 in the northwest corner), spot and striped mullet (station 154 in the eastern portion).

Of the most abundant species collected in seines, only the bay anchovy, gulf menhaden, and inland silverside had sufficient data for analysis.

Bay anchovy

There was a significant difference between months sampled ($p<0.05$) for bay anchovies collected in seines (Appendix Table A-5 and A-9; Appendix Figure A-3). Catches were variable, but especially high in October 2008 and August 2001. The years tested were not significantly different, however.

Gulf menhaden

Months were significantly different ($p<0.01$) for gulf menhaden collected in seines (Appendix Table A-5 and A-9; Appendix Figure A-3). For most of the years tested, catches were highest in May and June, and few menhaden were collected from June through October.

Inland silverside

Years differed significantly ($p<0.01$) for inland silversides collected in seines; however, 2008 was not significantly different from the other years tested (Appendix Table A-

Table 3-8. Organisms Collected by Seining in Lake Pontchartrain from 2000 to 2008, By Year

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	TOTAL
Number of Samples	*30*	*60*	*59*	*27*	*12*	*50*	*40*	*60*	*50*	*388*
gulf menhaden	31	16,289	6,712	4,400	3	14,256	2,474	9,342	3,460	56,967
bay anchovy	4,181	6,457	6,317	3,352	15	383	92	2,179	4,100	27,076
inland silverside	3,858	5,596	7,150	1,958	17	263	270	2,786	1,343	23,241
Atlantic croaker	11	2,614	919	860	.	219	77	1,390	544	6,634
rainwater killifish	136	59	4,467	51	2	1	.	14	53	4,783
spot	17	2,809	506	7	.	375	32	324	340	4,410
striped mullet	37	981	281	372	13	263	70	239	489	2,745
blue crab	84	181	166	39	13	62	59	314	141	1,059
northern brown shrimp	3	152	62	3	.	23	66	116	438	863
gulf pipefish	41	63	436	31	1	14	.	13	65	664
naked goby	205	239	120	52	.	1	1	14	12	644
ladyfish	11	86	18	25	.	72	95	209	96	612
northern white shrimp	42	7	47	.	.	6	59	40	358	559
Atlantic needlefish	33	78	64	12	2	90	60	64	29	432
pinfish	17	218	35	1	1	12	3	55	55	397
spotted seatrout	140	22	66	2	1	13	6	30	56	336
striped anchovy	32	17	85	24	3	1	1	23	82	268
silver perch	11	.	65	.	.	13	37	8	70	204
sailfin molly	8	1	143	2	.	1	.	10	7	172
gizzard shad	2	132	12	.	.	1	.	3	5	155
leatherjacket	24	9	12	.	1	38	15	10	12	121
red drum	11	10	2	4	.	5	9	29	48	118
sand seatrout	1	13	21	5	1	41	3	3	27	115
threadfin shad	.	21	47	8	.	2	.	12	8	98
channel catfish	.	89	3	.	.	.	.	1	1	94
clown goby	35	16	25	.	.	1	.	10	1	88
least puffer	47	13	5	.	.	.	.	14	1	80
hardhead catfish	6	18	22	.	.	.	1	.	29	76
skilletfish	33	5	1	.	1	.	.	4	9	53
Atlantic stingray	1	13	12	2	.	.	4	7	6	45
southern flounder	.	9	12	2	.	.	3	8	2	36
bay whiff	9	14	4	1	.	.	.	1	5	34
black drum	.	.	.	2	.	7	3	8	12	32
hogchoker	5	5	6	4	.	2	1	1	6	30
skipjack herring	.	.	3	10	.	1	5	4	7	30
southern kingfish	9	.	1	.	.	1	6	3	7	27
blue catfish	.	5	3	1	2	7	.	2	3	23
chain pipefish	2	3	6	.	.	.	7	4	.	22
bluegill	.	.	4	.	.	.	.	.	8	12
largemouth bass	.	8	.	.	.	.	.	.	1	9
blackcheek tonguefish	2	1	2	.	.	.	2	.	.	7
gafftopsail catfish	.	.	3	.	.	.	.	3	.	6
inshore lizardfish	4	1	.	.	.	.	.	.	.	5
freshwater drum	.	2	1	.	.	1	.	.	.	4
crevalle jack	.	.	.	.	.	.	.	.	3	3
alligator gar	.	.	1	.	.	.	.	.	1	2
Atlantic thread herring	.	.	.	.	.	1	1	.	.	2
texas cichlid	.	.	.	.	.	.	.	.	2	2
Atlantic bumper	.	.	1	.	.	.	.	.	.	1
code goby	.	.	.	.	.	.	.	.	1	1
sheepshead	.	1	.	.	.	.	.	.	.	1
	9,089	36,257	27,868	11,230	76	16,176	3,462	17,297	11,943	133,398

Table 3-9. Organisms Collected by Seining in Lake Pontchartrain from 2000 to 2008, By Station

Species	154	155	156	157	158	Total
Number of seine hauls	*78*	*78*	*79*	*74*	*79*	*388*
gulf menhaden	3,329	12,791	21,245	17,384	2,218	56,967
bay anchovy	2,900	3,288	10,842	7,174	2,872	27,076
inland silverside	2,417	4,598	398	905	14,923	23,241
Atlantic croaker	507	1,449	1,156	2,440	1,082	6,634
rainwater killifish	94	4	11	16	4,658	4,783
spot	210	3,790	15	60	335	4,410
striped mullet	197	1,704	136	413	295	2,745
blue crab	145	140	218	162	394	1,059
northern brown shrimp	338	7	25	8	485	863
gulf pipefish	224	12	3	14	411	664
naked goby	70	9	198	144	223	644
ladyfish	62	332	64	113	41	612
northern white shrimp	265	2	105	113	74	559
Atlantic needlefish	67	214	26	21	104	432
pinfish	182	92	0	0	123	397
spotted seatrout	75	79	38	61	83	336
striped anchovy	175	70	7	1	15	268
silver perch	179	6	0	0	19	204
sailfin molly	5	2	14	4	147	172
gizzard shad	0	135	12	6	2	155
leatherjacket	59	25	9	11	17	121
red drum	16	86	1	5	10	118
sand seatrout	15	2	47	40	11	115
threadfin shad	14	2	16	65	1	98
channel catfish	0	0	3	90	1	94
clown goby	12	0	0	6	70	88
least puffer	43	36	0	1	0	80
hardhead catfish	17	2	27	28	2	76
skilletfish	17	1	3	23	9	53
Atlantic stingray	5	1	26	7	6	45
southern flounder	2	25	2	2	5	36
bay whiff	2	31	0	0	1	34
black drum	11	0	7	1	13	32
hogchoker	0	1	2	23	4	30
skipjack herring	0	11	7	11	1	30
southern kingfish	7	19	1	0	0	27
blue catfish	0	2	12	8	1	23
chain pipefish	13	1	0	0	8	22
bluegill	0	1	5	6	0	12
largemouth bass	0	1	0	3	5	9
blackcheek tonguefish	0	4	0	0	3	7
gafftopsail catfish	0	0	3	3	0	6
inshore lizardfish	1	4	0	0	0	5
freshwater drum	0	0	3	1	0	4
crevalle jack	0	1	0	0	2	3
alligator gar	0	0	1	1	0	2
Atlantic thread herring	1	1	0	0	0	2
texas cichlid	0	2	0	0	0	2
Atlantic bumper	1	0	0	0	0	1
code goby	0	0	0	1	0	1
sheepshead	1	0	0	0	0	1
	11,678	28,983	34,688	29,375	28,674	133,398

5 and A-9; Appendix Figure A-3). In general, 2001 catches during May and June and 2002 catches during July through October were higher than catches during the other years tested.

Summary

A summary table of the results of the analysis of variance is included as Table 3-10. The only significant differences between LDWF trawl catches for 2008 compared to the other years examined (2001, 2002, and 2007) were for bay anchovy, Atlantic croaker, sand seatrout, blue crab, and northern brown shrimp in Lake Pontchartrain. The CPUE of these species was generally higher in 2008 except for Atlantic croaker and sand seatrout. Trawl catches of bay anchovy, Atlantic croaker, northern white shrimp, sand seatrout, and spot in Lake Borgne during 2008 differed significantly from the other years (2000 to 2004 and 2007) examined; except for spot, all these species had higher catches during 2008. The gill net and seine samples for 2008 were not significantly different from the baseline (non-diversion) years.

DISCUSSION

The data indicated that the opening of the Bonnet Carré Spillway in 2008 had little overall effect on the distribution of fishes and aquatic organisms. Trawl catches of bay anchovy, blue crab, and brown shrimp in Lake Pontchartrain and bay anchovy, Atlantic croaker, northern white shrimp, and sand seatrout in Lake Borgne were higher in 2008 than in the other years tested. Trawl catches of gulf menhaden in Lake Pontchartrain; and blue crab, gulf menhaden, hardhead catfish, and northern brown shrimp in Lake Borgne were not significantly different. The only species with significantly lower catches in 2008 after the Spillway opening were Atlantic croaker and sand seatrout in Lake Pontchartrain and spot in Lake Borgne. Gillnet catches of gulf menhaden and hardhead catfish, and seine catches of bay anchovy, gulf menhaden, and inland silversides were not significantly different among the years tested. Catches of some of the less abundant species may have been lower in 2008 after the Spillway opening, but these species were collected in insufficient numbers to analyze.

Many factors can affect populations of fish and other aquatic organisms, including yearly variability in spawning and migration patterns; other environmental factors such as high freshwater inflow from streams and rivers, storms, rainfall, drought; and effects of fishing, such as shrimping, crabbing, etc. Even if catches of a particular species are lower during a particular year after a Spillway opening, it is difficult to isolate one particular cause. A number of factors could be responsible, and demonstration of a cause and effect is difficult. Trawl catches of most species are often variable from year to year.

The time of year the Spillway is open may affect marine transient species differently depending on migration patterns. Transient marine species migrate into estuaries for a portion of their life cycle, remain in the estuary for a period of time, and then emigrate to higher salinity waters. An index of movement for abundant marine transient species collected in traps in an estuary in southwestern Louisiana is depicted in Figure 3-4 (from

Table 3-10. Summary Table of Analyses of Variance and Examination for Selected Species

Gear	Stations	Species	year	month	year*month	2008 different	reason for 2008 difference
Trawl	Lake Pontchartrain	bay anchovy	p<0.01	p<0.01	p<0.05	p<0.01	higher CPUE June 2008
		Atlantic croaker	p<0.01	p<0.01	p<0.01	p<0.01	higher CPUE June 2007; July/Oct. 2001
		gulf menhaden	NS	p<0.01	NS	NS	
		sand seatrout	p<0.01	p<0.05	p<0.01	p<0.01	higher CPUE June 2007
		blue crab	p<0.01	NS	NS	p<0.01	higher CPUE May 2008
		northern brown shrimp	p<0.01	p<0.01	p<0.01	p<0.01	higher CPUE May 2001; June 2008
Trawl	Lake Borgne and south of Mississippi Sound	bay anchovy	p<0.01	p<0.05	NS	p<0.01	higher CPUE Oct. Nov. 2008
		Atlantic croaker	p<0.01	p<0.01	p<0.01	p<0.01	higher CPUE July - Sept. 2008
		blue crab	NS	p<0.01	NS	NS	
		gulf menhaden	NS	p<0.01	NS	NS	
		hardhead catfish	NS	p<0.01	NS	NS	
		northern brown shrimp	p<0.01	p<0.01	NS	NS	
		northern white shrimp	p<0.01	p<0.01	NS	p<0.01	higher CPUE Sept. Oct. 2008
		sand seatrout	p<0.01	p<0.01	NS	p<0.01	higher CPUE June 2008
		spot	p<0.01	p<0.01	p<0.01	p<0.01	higher CPUE May 2000, 2001, 2002
Gillnet	Lake Pontchartrain	gulf menhaden	NS	p<0.05	NS	NS	
		hardhead catfish	NS	NS	NS	NS	
Seine	Lake Pontchartrain	bay anchovy	NS	p<0.05	NS	NS	
		gulf menhaden	NS	p<0.01	NS	NS	
		inland silverside	NS	p<0.01	NS	NS	

Rogers and Herke 1985). Although the timing may be slightly different due to geographic location, a similar pattern of movement exists in Lake Pontchartrain and Lake Borgne.

The Spillway is typically opened in April and May due to high Mississippi River levels, although it has been opened as early as January and as late as June. The species that are migrating into the estuary during that time and may be more susceptible to the effects of Spillway openings include Gulf menhaden, northern brown shrimp, and sand seatrout. Gulf menhaden generally migrate into the estuary from February through March, and then emigrate; peak LDWF trawl catches were generally in March-April and April-May (Appendix Table A-2). Brown shrimp typically come into the estuary in March and leave in May; peak LDWF trawl catches in Lake Pontchartrain were in April-May and June. However, catches of gulf menhaden and northern brown shrimp in May through October 2008 were not significantly different than non-Spillway years. Sand seatrout catches were significantly lower during 2008. Sand seatrout migration into the estuary generally begins in April; peak LDWF trawl catches in Lake Pontchartrain were in April-May and June.

Atlantic croaker emigrate from January through March and would be expected to be less likely to be affected by Spillway openings; peak LDWF catches in Lake Pontchartrain trawls were generally during April-May and June. However, Atlantic croaker catches in 2008 were significantly lower than the non-Spillway years examined. Atlantic croaker generally migrate into the estuary in September. Trawl catches generally lag behind the catches reported in Figure 3-4 for the marsh traps (Rogers and Herke 1985). This is likely due to differences in mesh size. The larvae and young juveniles that typically migrate into the estuary can be caught in the smaller trap mesh (3 mm). However, the trawl mesh is larger and they must grow to a size susceptible to the trawl mesh.

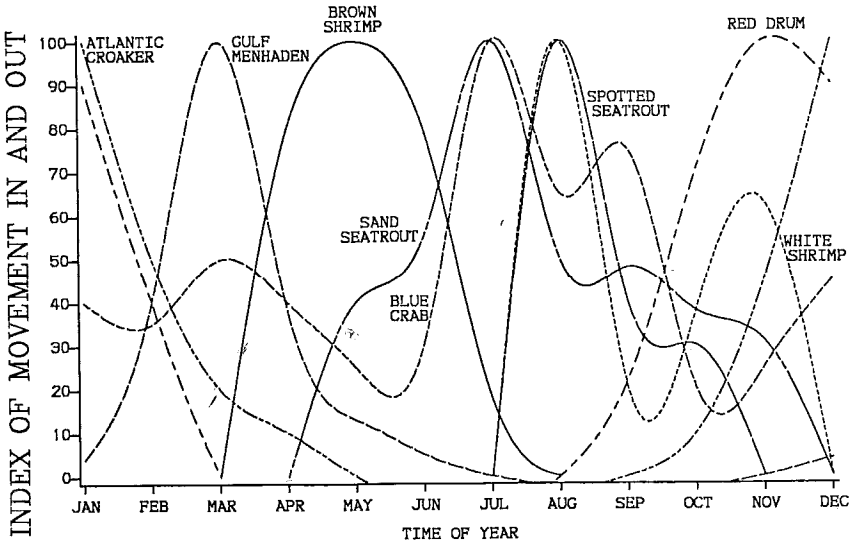


Figure 3-4. Timing of Movement of Eight Important Species into and out of Marsh Ponds in Southwest Louisiana (from Rogers and Herke 1985)

The LDWF data used in this analysis were not collected specifically to examine the effects of the Bonnet Carré Spillway opening. The amount of pre-opening data that was available and comparable to the 2008 data for this report was limited. Establishing baseline data at specific stations is important to examining environmental effects.

Salinity is a limiting factor to the distribution of thousands of aquatic organisms (Gunter 1961). Estuaries, such as Lake Pontchartrain, by nature can have fluctuations in salinity. High river flows and rainfall events reduce salinities, whereas storms, winds, and tides increase salinities. Most of the organisms in estuaries are marine species, even in the very lowest salinity reaches (Gunter 1956).

The most abundant species collected in Lake Pontchartrain have a wide tolerance to changes in salinity. Christensen et al. (1997) developed an index to evaluate how sensitive common Gulf of Mexico organisms were to changes in salinity. Of the abundant organisms collected by LDWF, adult bay anchovy, grass shrimp, blue crab, and silversides were classified with low sensitivity in Lake Pontchartrain; Atlantic croaker, sand seatrout, and spot were classified with moderate sensitivity. Juveniles of many species tend to have higher tolerances to salinity changes than adults. In Lake Pontchartrain, these include juvenile gulf menhaden and brown shrimp with low sensitivity and juvenile white shrimp and hardhead catfish with moderate sensitivity.

In 2008, fewer Spillway bays were open, and the Spillway opening was a shorter duration than some of the previous openings. During 1997, more bays were open and the Spillway was open for a slightly longer duration. Larger and longer Spillway openings (such as in 1945, 1950, 1973, 1979, and 1983) may have more of an effect on fish and crustaceans than the effects seen in this study and studies of the 1997 opening.

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SECTION 4 – COMMERCIAL BLUE CRAB LANDINGS COLLECTED BEFORE AND AFTER THE 2008 BONNET CARRÉ SPILLWAY OPENING

SECTION 4 - COMMERCIAL BLUE CRAB LANDINGS COLLECTED BEFORE AND AFTER THE 2008 BONNET CARRÉ SPILLWAY OPENING

INTRODUCTION

Blue crabs are found throughout estuaries and in adjacent marine waters. In Lake Pontchartrain, mating occurs in relatively fresh areas during the warmer months (Darnell 1959). Sperm transferred to female crabs may remain viable for over a year and can be used for multiple spawnings (Perry and McIlwain 1986). Because Lake Pontchartrain is a relatively fresh estuary, spawning and larval development occur in the more saline waters of Lake Borgne and Chandeleur Sound (Darnell 1959). Blue crab megalopae then enter fresher areas such as Lake Pontchartrain. Juvenile crabs are widely distributed throughout gulf estuaries and are found nearly year-round (Perry and McIlwain 1986). Recruitment of blue crabs into Lake Pontchartrain is reported to be highest during the late spring, early summer, and fall. Male and female blue crabs are distributed differently in relation to salinity. Adult males appear to prefer lower salinity waters, whereas mature females prefer higher salinities (Perry and McIlwain 1986). Adult male blue crabs are frequently observed in rivers and lakes miles from the Gulf of Mexico.

The blue crab is an important shellfish in Louisiana and the dominant commercial fishery of Lake Pontchartrain (Thompson and Stone 1980). In 2007, hard shell blue crab landings in the United States were 136.7 million pounds, with a dockside value of $123.2 million (National Marine Fisheries Service 2008a). Louisiana landed 32 percent of the total U.S. commercial hard blue crab landings in 2007 with over 44.6 million pounds and a dockside value of nearly $34.3 million (National Marine Fisheries Service 2008b). Soft shell (postmolt) and peeler (pre-molt) blue crab landings in Louisiana comprise a smaller percentage of the catch, but have a higher value and in 2007 were over 203,000 pounds (valued at over $550,000).

A significant recreational fishery for blue crabs also exists, but little data are available on this fishery. Since their introduction in the mid- to late- 1950s, crab traps (or pots) have become the primary gear type used to capture hard crabs (Adkins 1972). Large numbers of blue crabs are also collected by commercial and recreational trawling. Little information exists on the numbers of crabs captured in trawls; however, this number may be quite high. One commercial shrimper trawling in the mouth of a deep bayou after a strong cold front was reported to have caught eight to nine thousand pounds of crabs in one day (Adkins 1972).

METHODS

Commercial blue crab landings (hard, soft, and peeler combined) from 1999 through September 2008 for Lake Pontchartrain, Lake Borgne, and Breton Sound were provided by the LDWF. Trip tickets (where fishermen report catches and fishing locations) were not required until 1999; therefore, comparisons prior to that year are difficult. The landings are summed at the non-confidential level. Data for 2008 are preliminary, could be subject to change, and do not

encompass the entire year (only up to September). Landings data were reported by whole weight pounds landed and ex-vessel (dockside) value. Monthly landings from each area from January through September 2008 were also reported.

RESULTS

Commercial blue crab landings (hard, soft, and peeler combined) in Lake Pontchartrain ranged from 1.4 to 2.8 million pounds over the 10-year period (Table 4-1, Figure 4-1a). Higher landings were generally reported during 2003 to 2007 than during 1999 through 2002. The low 2005 landings appear to reflect the effects of Hurricane Katrina, compounded by a reduction in dockside crab prices. The 2008 landings (reported through September) appear to be on track with previous years and peaked during July and August (Table 4-2, Figure 4-1b).

The highest blue crab landings in Lake Borgne occurred in 2007; the 2008 landings (reported through September) were also higher than landings from previous years (Table 4-1, Figure 4-2a). Lake Borgne crab landings were much lower than landings from Lake Pontchartrain and Breton Sound. This area also reported higher landings during 2003 to 2007 than during 1999 through 2002. Landings varied from 192 to 892 thousand pounds during the 10-year period. Hurricane Katrina did not appear to have as much of an effect on 2005 landings in Lake Borgne. The 2008 landings (reported through September) were highest during July (Table 4-2, Figure 4-2b).

The 2008 landings in Breton Sound (Figure 4-3a, reported up to September) appear lower than recent years, and are similar to 2005 catches, which were apparently affected by Hurricane Katrina. Landings in Breton Sound were highly variable over the 10-year period (Table 4-1, Figure 4-3b). The highest landings occurred in 1999, 2006, and 2007; the lowest landings were in 2000 and 2001. Dockside values of blue crabs landed from Breton Sound were generally lower than values of landings from Lake Pontchartrain and Lake Borgne (Table 4-1). Breton Sound landings (reported through September) also peaked during July.

Table 4-1. Trip Ticket Data on Blue Crab Landings (Hard, Soft, and Peeler Combined) in Lake Pontchartrain, Lake Borgne, and Breton Sound, Louisiana from 1999-2008 (*only through September 2008)

	Lake Pontchartrain		Lake Borgne		Breton Sound	
Year	Landings (pounds)	Value	Landings (pounds)	Value	Landings (pounds)	Value
1999	1,516,251	$1,301,623	206,816	$180,813	5,959,436	$3,833,202
2000	1,514,953	$1,495,149	192,495	$193,941	1,840,502	$1,426,961
2001	1,424,277	$1,708,808	283,469	$311,579	1,742,819	$1,457,701
2002	1,922,313	$2,089,754	196,585	$182,916	3,733,971	$2,361,794
2003	2,581,130	$3,328,842	374,037	$339,962	4,499,477	$3,300,480
2004	2,429,071	$2,732,349	396,687	$309,152	4,216,437	$3,125,611
2005	1,395,962	$1,476,664	365,558	$357,817	2,341,328	$2,186,226
2006	2,802,439	$2,394,658	369,649	$288,473	6,591,263	$3,740,857
2007	2,566,394	$2,498,498	892,486	$705,257	6,142,322	$4,913,413
2008*	1,993,071*	$2,470,014*	424,880*	$421,593*	2,415,092*	$2,111,390*

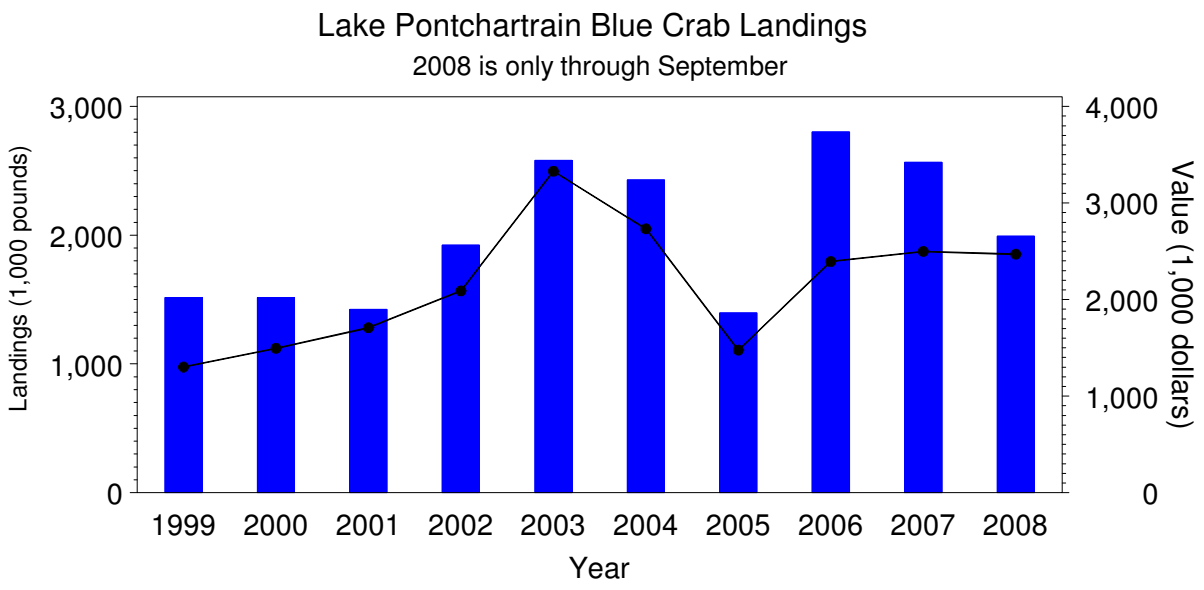

Figure 4-1a. Louisiana Blue Crab Landings in Lake Pontchartrain

Table 4-2. Monthly Trip Ticket Data on Blue Crab Landings (Hard, Soft, and Peeler Combined) in Lake Pontchartrain, Lake Borgne, and Breton Sound, Louisiana for 2008

	Lake Pontchartrain		Lake Borgne		Breton Sound	
Month	Landings	Value	Landings	Value	Landings	Value
January	58,951	$60,422	26,967	$27,846	154,867	$130,612
February	97,413	$116,345	38,337	$44,468	180,900	$187,227
March	149,231	$226,532	26,675	$34,411	178,359	$190,761
April	222,347	$295,961	33,723	$43,081	309,285	$309,375
May	171,452	$267,136	55,332	$64,182	413,675	$409,752
June	286,694	$410,895	84,143	$86,154	497,136	$424,905
July	611,802	$643,174	126,877	$95,356	550,309	$355,308
August	509,986	$562,028	72,029	$61,022	247,909	$195,030
September	307,897	$298,260	34,620	$25,031	123,116	$89,295

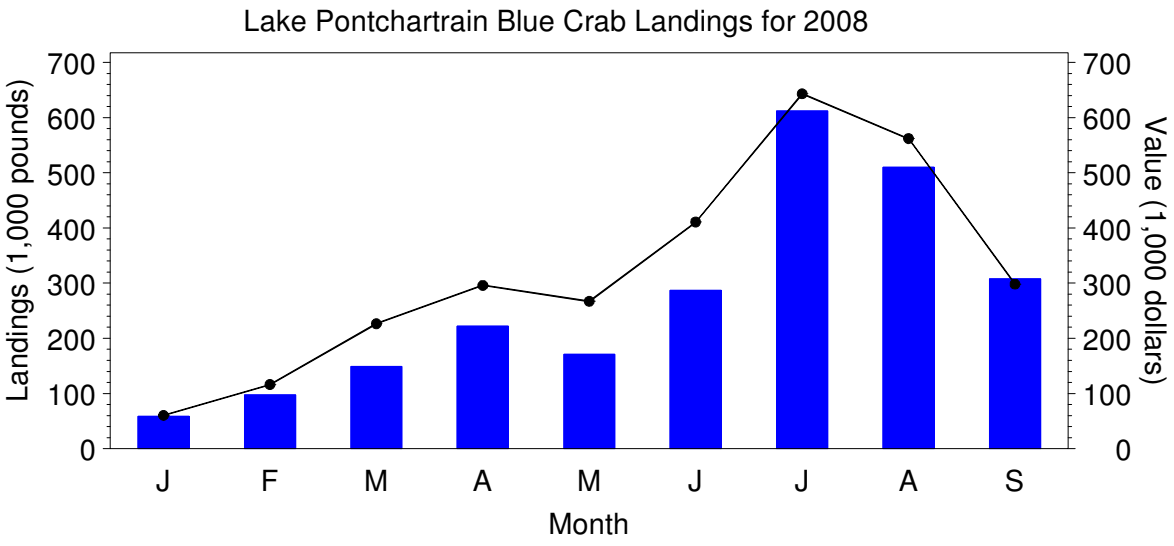

Figure 4-1b. Commercial Blue Crab Landings (Hard, Soft, and Peeler Combined) in Lake Pontchartrain

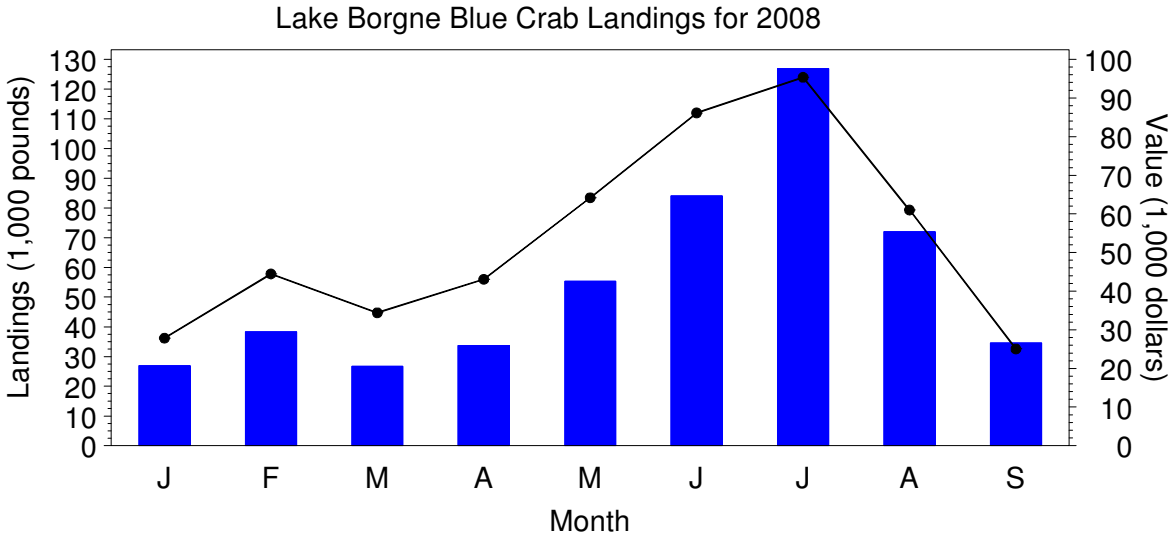

Figure 4-2a. Lake Borgne Blue Crab Landings for 2008

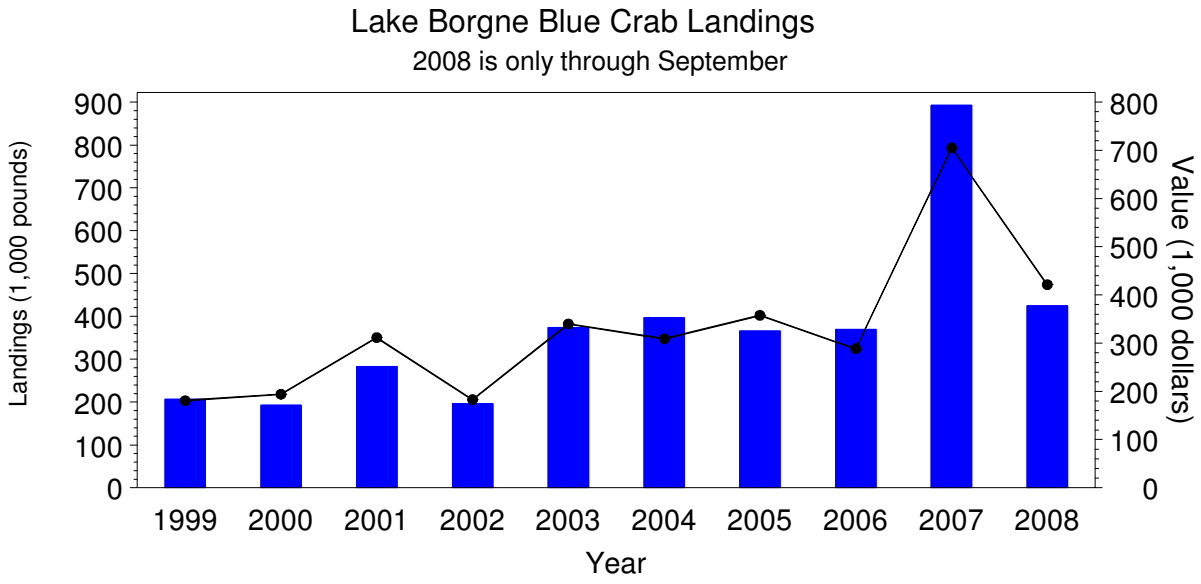

Figure 4-2b. Louisiana Blue Crab Landings in Lake Borgne

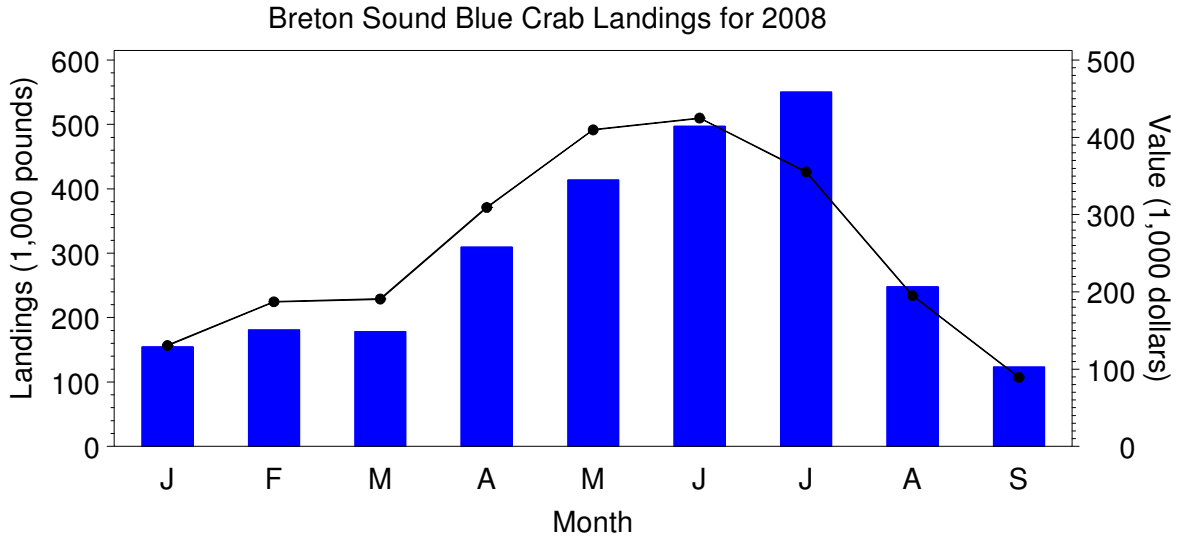

Figure 4-3a. Breton Sound Blue Crab Landings for 2008

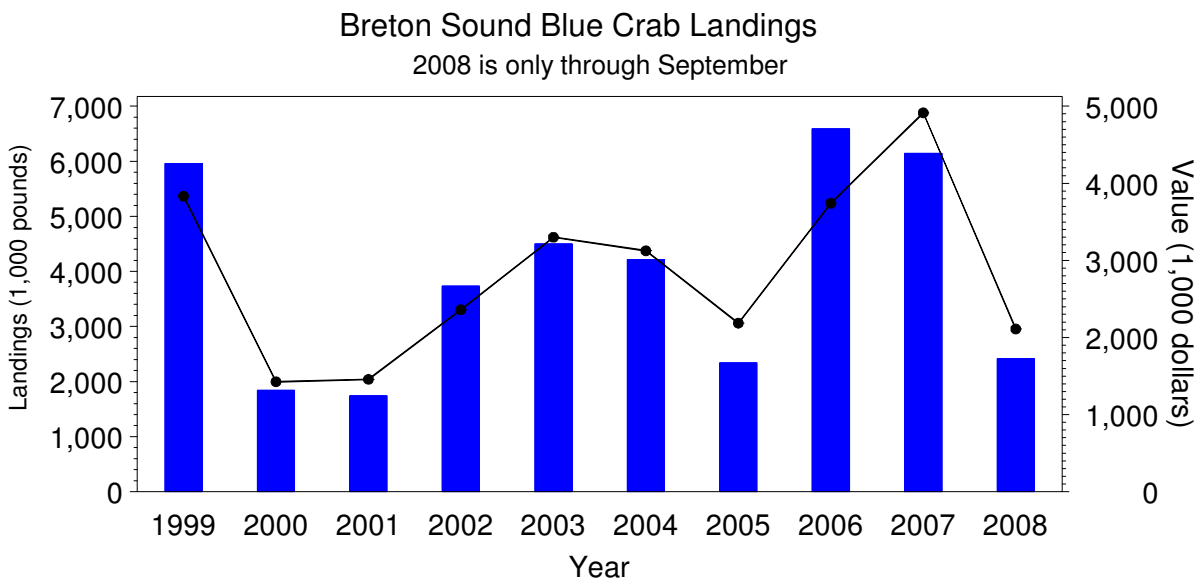

Figure 4-3b. Breton Sound Blue Crab Landings

DISCUSSION

Although blue crab landings data for 2008 were incomplete, catches for the first nine months suggest that 2008 landings would be similar to other years. In fact, in Lake Borgne, the partial 2008 landings exceeded all previous years except 2007. Previous studies have reported higher catches of blue crabs in Lake Pontchartrain when the Spillway was open and in lakes Pontchartrain and Maurepas during other low salinity periods. In 1973, 37 percent of the blue crabs collected with trawls and seines were caught during April, May and June when the Spillway was open and the lowest salinities occurred (Tarver and Savoie 1976). Larger catches were reported during and after the 1997 spillway opening (USACE 1998). Blue crab landings in Lake Pontchartrain and Lake Maurepas were higher after the 1973, 1979, 1983, and 1997 (for available data) Spillway openings. Landings after the 1975 opening were slightly lower, but the spillway was open for a short time period and had the fewest bays open (USACE 1998). Tarver (1974) suggested that large catches of crabs in Lake Borgne following the 1973 Spillway opening may be due at least in part to the dead or dying oysters, and the small size of Lake Borgne may have concentrated the crabs, thus making them easier to catch.

High blue crab landings generally coincide with high river flow years. Guillory (2000) compared blue crab landings and sampling data with salinity and river discharge data. In eight out of nine high river flow years, blue crab landings were higher than the previous year. In six of the eight low river flow years, the landings were down from the previous year. Several other studies have reported highest crab catches at the lowest salinities (Adkins 1972; Tarver and Savoie 1976; USACE 1998). Tarver and Savoie (1976) caught blue crabs over a wide salinity range (0 to 19.9 percent).

Many studies have demonstrated an inverse correlation of crab size with salinity. Larger crabs prefer salinities lower than 10 ppt and migrate into Lake Pontchartrain from higher salinity waters (Thompson and Stone 1980). The lower dockside values of crabs from Breton Sound compared to values of crabs from Lake Pontchartrain and Lake Borgne could be due to differences in crab sizes. These values could reflect the presence of larger crabs in Lake Pontchartrain landings than in Lake Borgne or Breton Sound where salinities are generally higher.

Commercial catches are affected by many factors including the level of effort, the price per pound, size limits, weather conditions, and economics. Horst and Holloway (2002) examined the Louisiana crab industry from 1987 through 2000. During this time period, the number of individuals licensed to fish commercially for blue crabs increased 23.9%. However, the maximum commercial blue crab catch occurred in 1987. Price per pound of hard blue crabs in Louisiana ranged from $0.29 in 1986 to $0.71 in 2000, but although there was a general trend towards increased prices, the highest price occurred in 1995 ($0.79). During the same period, the number of recreational crab trap gear licenses increased over 274%; however, there was also an increased awareness regarding the requirement to purchase licenses (Horst and Holloway 2002).

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SECTION 5 – SALINITY, TURBIDITY, AND WATER TEMPERATURE BEFORE AND AFTER THE 2008 BONNET CARRÉ SPILLWAY OPENING

SECTION 5 - SALINITY, TURBIDITY, AND WATER TEMPERATURE BEFORE AND AFTER THE 2008 BONNET CARRÉ SPILLWAY OPENING

INTRODUCTION

Lake Pontchartrain is an oligohaline estuary in southeastern Louisiana located between Lake Maurepas and Lake Borgne. Two tidal passes connect Lake Pontchartrain to Lake Borgne, the Rigolets and Chef Menteur Pass. Because of land loss, Lake Borgne has become an open bay into Mississippi Sound and the Gulf of Mexico. Mississippi Sound extends from Lake Borgne to Mobile Bay, Alabama and is separated from the Gulf of Mexico by a series of barrier islands (Cat, Ship, Horn, Petit Bois, and Dauphin Islands).

The LDWF measures salinity, turbidity, and water temperature at each sampling location in Lake Pontchartrain, Lake Borgne, and south of Mississippi Sound. Data are also collected by the Louisiana Universities Marine Consortium (LUMCON) and the Lake Pontchartrain Basin Foundation (LPBF). These data were examined to see if there were any short-term effects of the 2008 Bonnet Carré Spillway opening.

METHODS

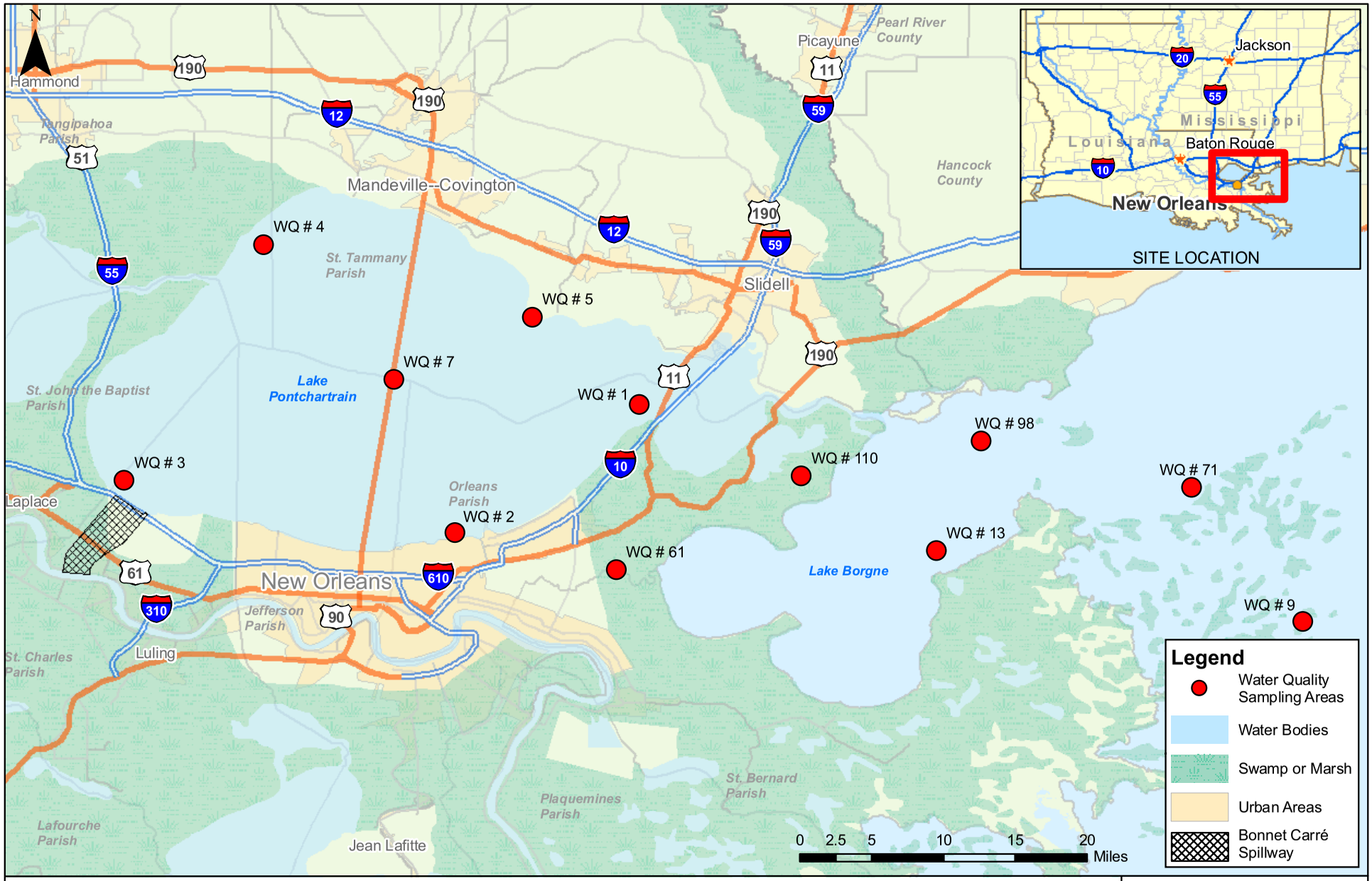
LDWF Data

Salinity, conductivity, and water temperature were collected by LDWF at each oyster, trawl, gillnet, and seine station (Figure 5-1). Nearby stations were combined into water quality areas to simplify data examination. These combination water quality (WQ) areas were: Area 1 (1, 111, and 154); Area 2 (2, 112, and 155); Area 3 (3, 113, and 156); Area 4 (4, 114, and 157); Area 5 (5, 115, and 158); Area 7 (7); Area 61 (61 and 65); Area 71 (71, 88, and 74); Area 98 (98 and 95); and Area 110 (110 and 63). Areas 9 and 13 had very limited data and are not presented.

Salinity (ppt) and water temperature (°C) were measured using a Beckman RS-5 portable salinometer, or equivalent. Turbidity was measured with a 30 cm, white secchi disk suspended from a staff or line and lowered into the water until it was no longer visible. The disk was then gradually raised until it was visible below the surface; distance was measured to the nearest 0.01 ft. The Secchi Disk depth is a measure of transparency and is inversely related to turbidity.

LUMCON Data

LUMCON has an environmental monitoring station in Lake Pontchartrain located at 30º 18.894'N, 90º 16.831'W, near LDWF Area 4. Measurements recorded by this station include water temperature, salinity, and turbidity. The data for 2001 through 2008 were accessible online at http://weather.lumcon.edu/stationdata.asp?stationid=103.



LDWF WATER QUALITY SAMPLING AREAS

GEC

Figure: 5-1
Date: December 2008
Scale: 1:600,000
Source: LDWF/ESRI/GEC
Map ID: 27316921-1182

Lake Pontchartrain Basin Foundation

The Lake Pontchartrain Basin Foundation (LPBF) measured salinity and turbidity at eight stations in Lake Pontchartrain (Figure 5-2); four stations are located along the north shore of the lake (Tchefuncte River, Bayou Castine, Fontainebleau Beach, and Northshore Beach) and four stations are along the south shore (Laketown, Bonnabel Boat Launch, Old Beach, and Pontchartrain Beach). Salinity was measured with a YSI 85 Meter and turbidity was measured with a Hach 2100P Portable Turbidimeter. Data for 2008 through November 11th were examined.

RESULTS

Salinity

LDWF

During 2008, minimum salinities were recorded by the LDWF at several areas in Lake Pontchartrain after the Bonnet Carré Spillway opening: Area 3 near the Spillway and 5 near Bayou Lacombe (0.2 ppt), Area 1 in the eastern part of the lake (1.6 ppt), and Area 2 near the Inner Harbor Navigation Canal (2.1 ppt). Few data were available for Area 7 near the Causeway in the center of the lake (Figure 5-3f). High spring river flows into Lake Maurepas appear also to be an important factor in the low salinities observed in Lake Pontchartrain; Area 4 near Pass Manchac had a salinity of 0.2 ppt on April 7th before the Spillway was opened. Lowest salinities recorded at stations in the vicinity of Lake Borgne and south of Mississippi Sound were: Area 110 in Bayou Deedie (1.5 ppt), Area 13 in the eastern part of Lake Borgne (2.4 ppt), Area 98 near the Pearl River (2.3 ppt), and Area 71 south of Mississippi Sound (5.0 ppt).

Highest salinities reported in the LDWF data at each Area in Lake Pontchartrain in 2008 were: Area 5 (10.6 ppt), Areas 1 and 2 (8 ppt), Area 3 (6.5 ppt), and Area 4 (6.8 ppt). In Lake Borgne and south of Mississippi Sound, the highest salinities reported were: Area 71 (28.6 ppt), Area 98 (15.2 ppt), Area 13 (14.4 ppt), Area 61 (13.7 ppt), and Area 110 (11.7 ppt).

Salinities in the LDWF data for Lake Pontchartrain varied among the years sampled. LDWF data from 2000-2007 (non-diversion years) were averaged for comparison to 2008 data (figures 5-3a through 5-3f). Salinities at the beginning of 2008 were generally slightly higher than the non-diversion average at all areas. Few data were available for Area 7. After the Spillway opened on April 11th, salinities at all areas dropped below the average, although Area 2 near the opening of the Inner Harbor Navigation Canal had a salinity increase during June. Salinities at Areas 4 and 5 were below the average until mid-August, when they were higher than the average. Areas 2 and 3 had salinities lower than the average after mid-August. Area 1 also had lower salinities, but there was a slight increase in early August.

LDWF data for Lake Borgne and waters south of Mississippi Sound are presented for 2008, 1997, and the non-diversion year average 1998 to 2007 (figures 5-4a to 5-4d). Bayou

LAKE PONTCHARTRAIN BASIN FOUNDATION
WATER QUALITY SAMPLING LOCATIONS

GEC

Figure: 5-2
Date: December 2008
Scale: 1:600,000
Source: LDWF/ESRI/GEC
Map ID: 27319621-1181

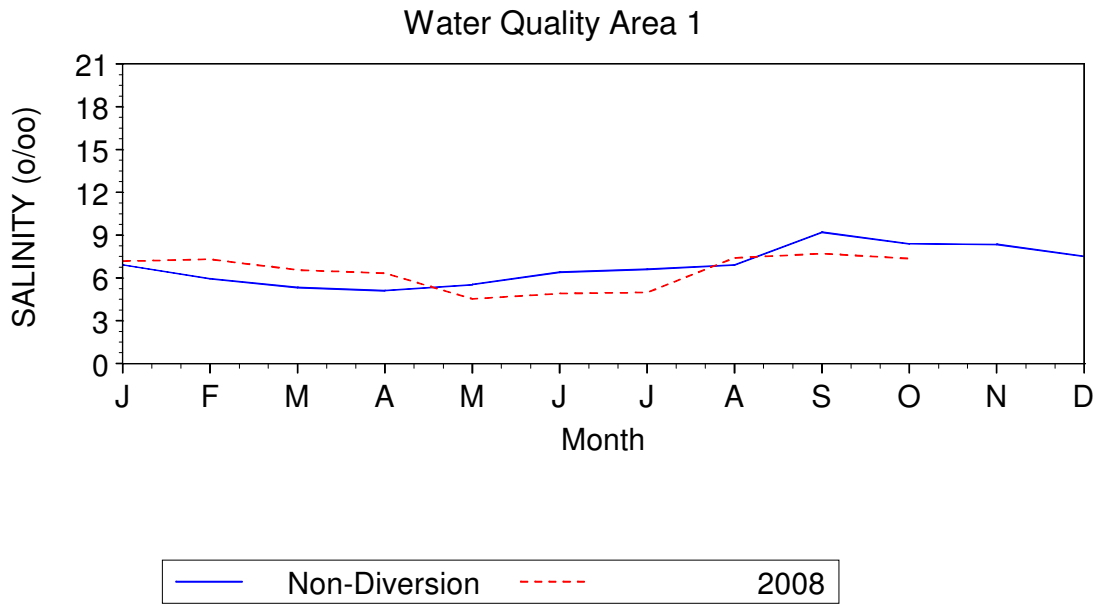


Figure 5-3a. Lake Pontchartrain Salinities for 2008 and Average Non-Diversion Years

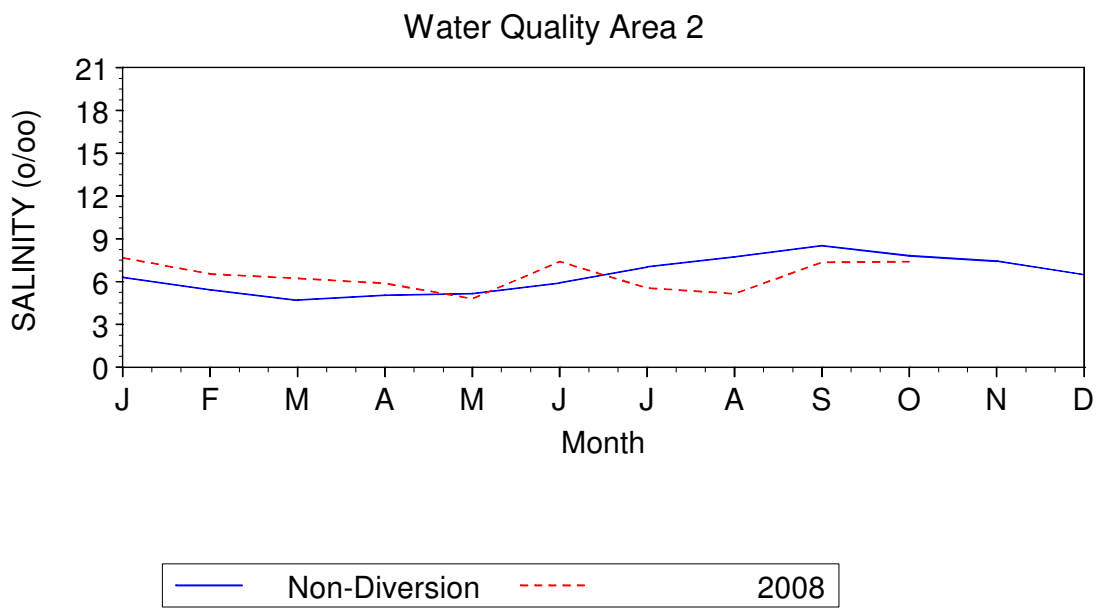


Figure 5-3b. Lake Pontchartrain Salinities for 2008 and Average Non-Diversion Years

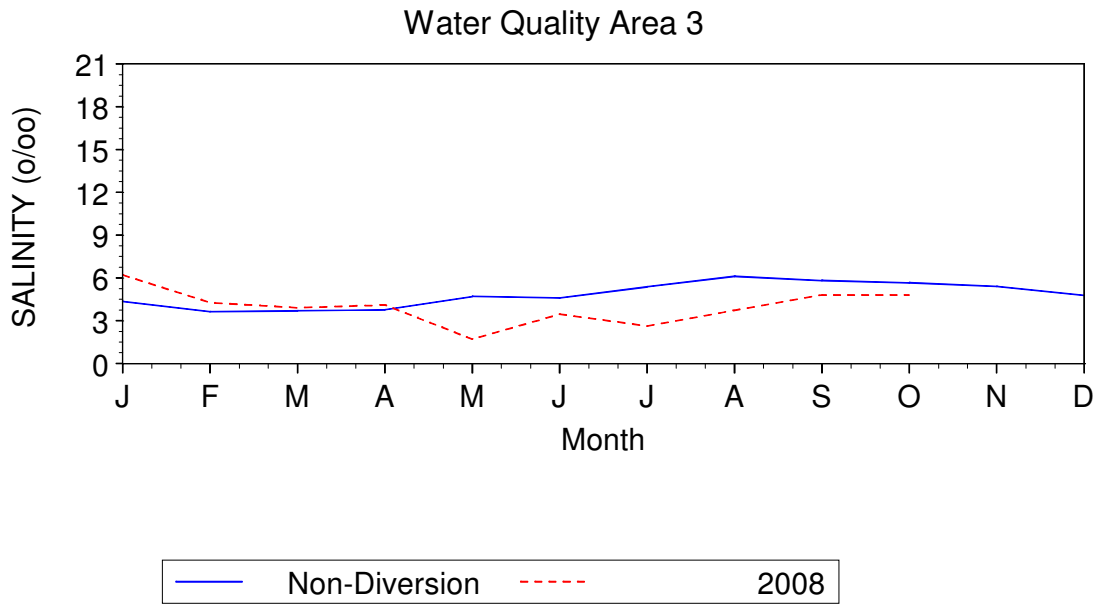


Figure 5-3c. Lake Pontchartrain Salinities for 2008 and Average Non-Diversion Years

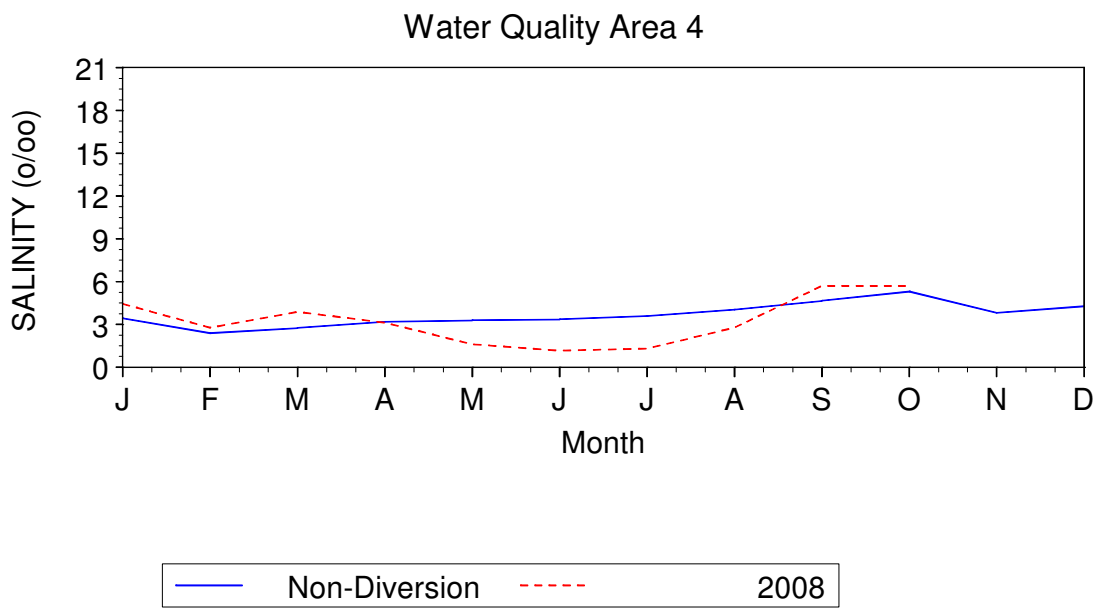


Figure 5-3d. Lake Pontchartrain Salinities for 2008 and Average Non-Diversion Year

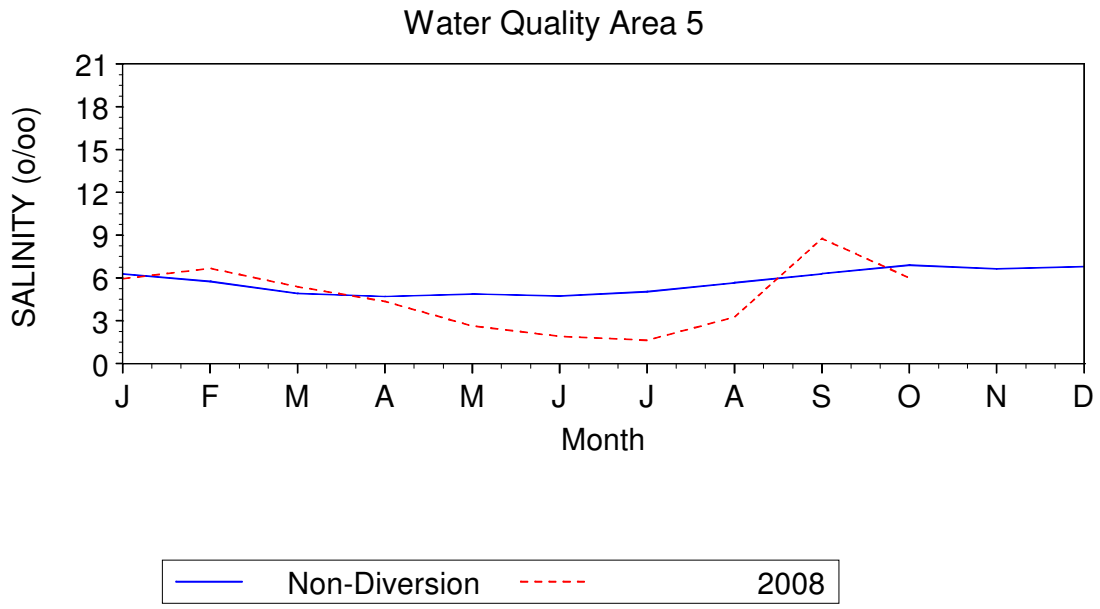


Figure 5-3e. Lake Pontchartrain Salinities for 2008 and Average Non-Diversion Years

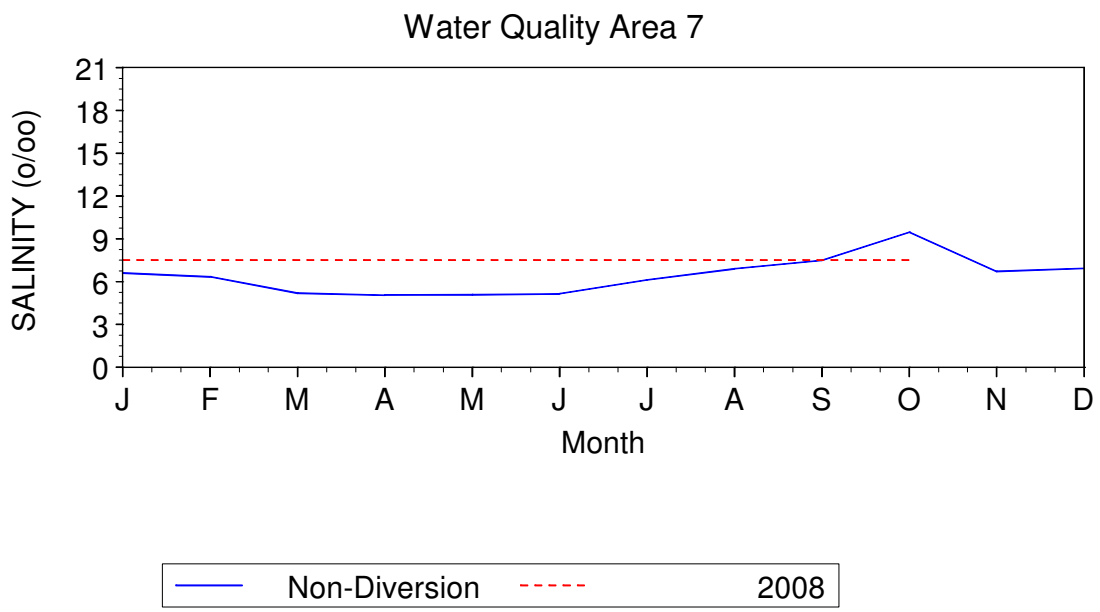


Figure 5-3f. Lake Pontchartrain Salinities for 2008 and Average Non-Diversion Years

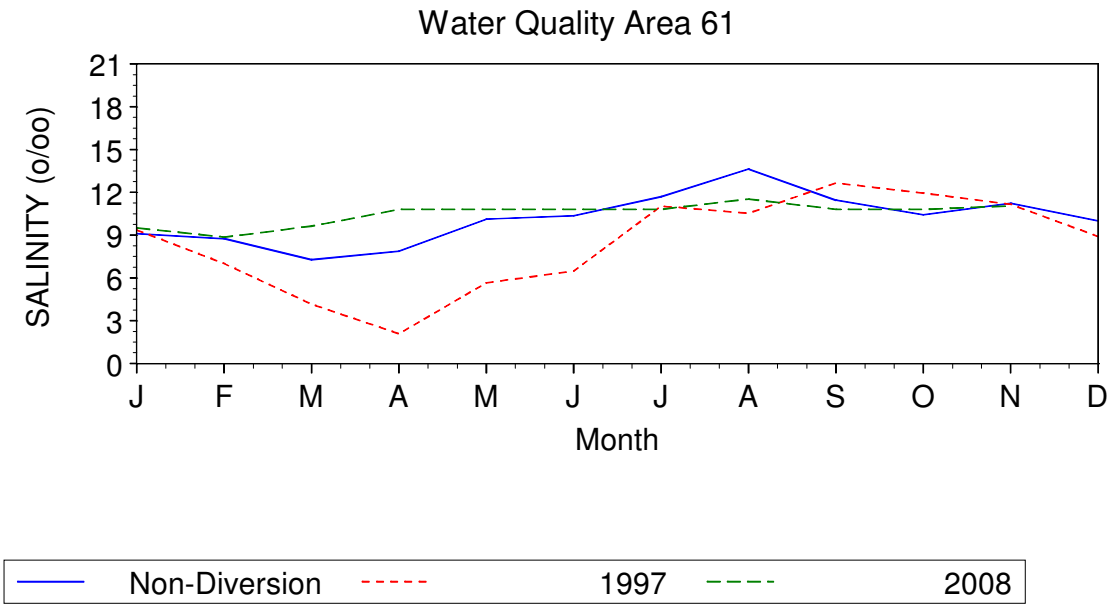


Figure 5-4a. Lake Borgne Salinities for 2008, 1997 and Average Non-Diversion Years

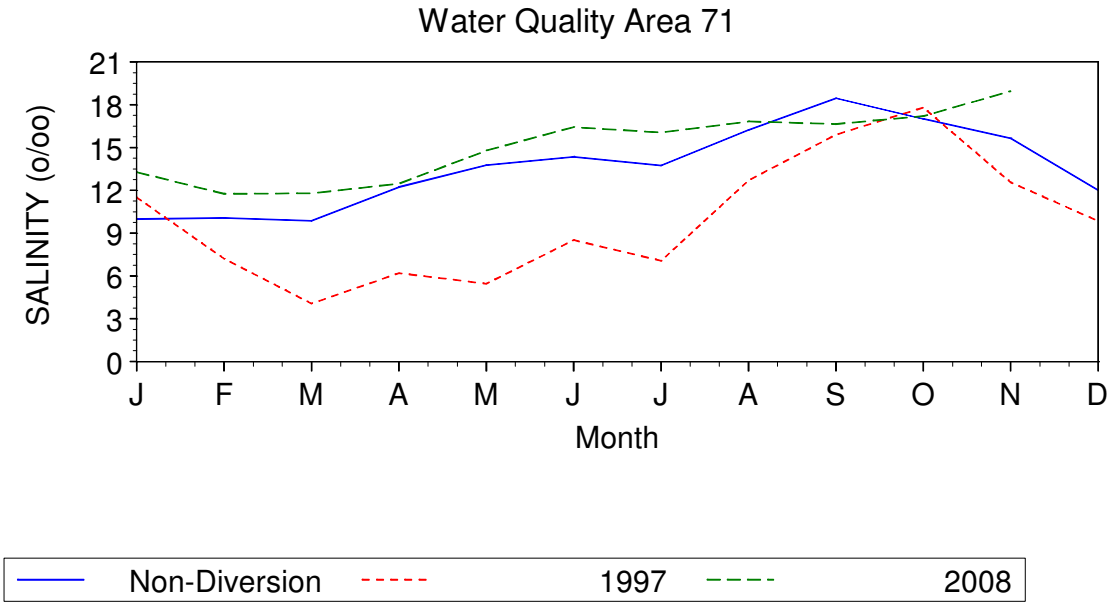


Figure 5-4b. Lake Borgne Salinities for 2008, 1997 and Average Non-Diversion Years

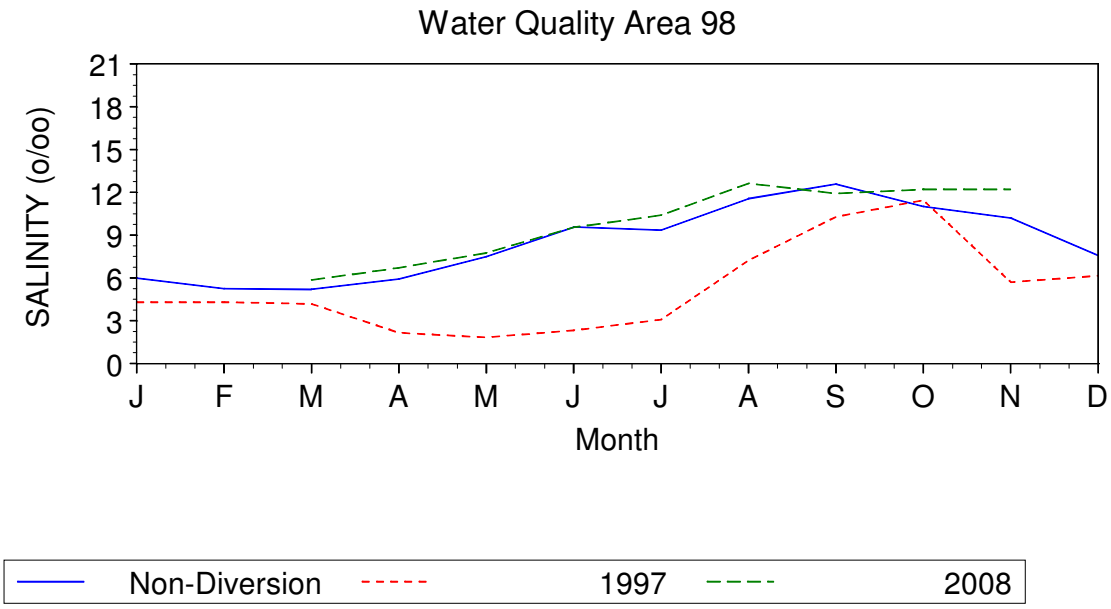


Figure 5-4c. Lake Borgne Salinities for 2008, 1997 and Average Non-Diversion Years

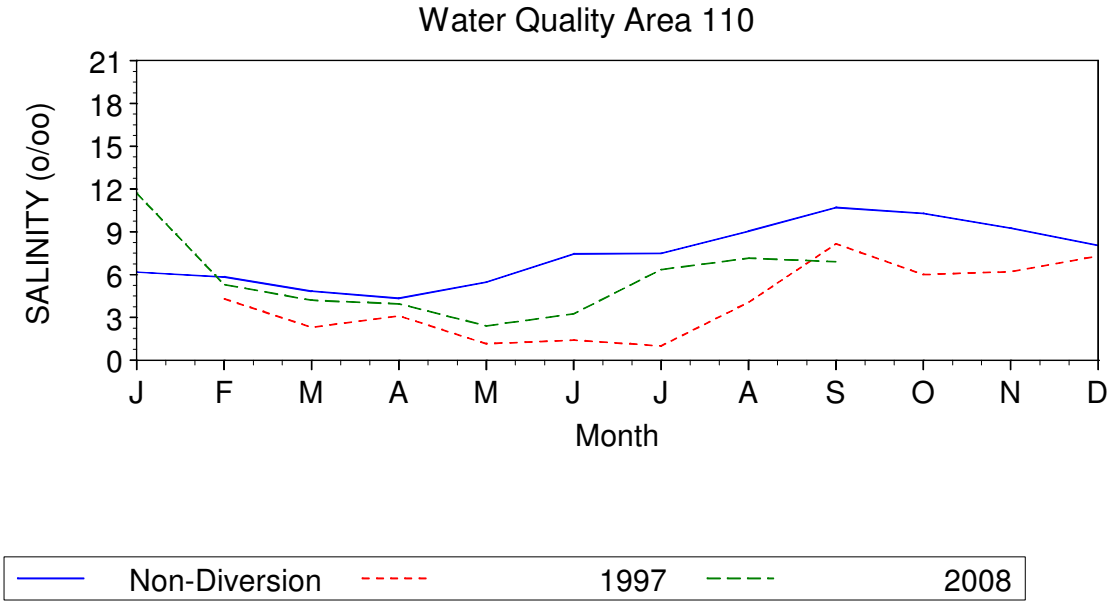


Figure 5-4d. Lake Borgne Salinities for 2008, 1997 and Average Non-Diversion Years

Bienvenue (Area 61) and Bayou Deedie (Area 110) are located on the west shore of Lake Borgne. Salinities in Bayou Deedie during 2008 were lower than the non-diversion average from late January to early September (all available data). Salinities at this Area during 1997 were lower than 2008 (except for September) and the non-diversion years. Bayou Bienvenue 2008 salinities were similar to the non-diversion year mean except from February through mid-June (above) and mid-June to mid-September (below). The 1997 salinities at this Area were lower than the average except for mid-August to November. Salinities at Areas 71 and 98 south of Mississippi Sound were generally higher than the non-diversion year average except from mid-August through late September/October. Salinities during 1997 were generally lower than the non-diversion average, except during early October.

LUMCON

LUMCON data for Lake Pontchartrain (at a station close to LDWF Area 4) for 2001 through 2008 are presented in Appendix figures B-1a to B-1h. Salinities in 2008 were variable, ranging from near 1 ppt (February, June, and late August), to 6 ppt (early April, September with the passage of Hurricanes Gustav and Ike, and early December due to the passage of a cold front. Data from 2001 through 2007 for the same station are also presented (note the salinity scale differs for each graph) to show the variability of salinity in Lake Pontchartrain in non-diversion years due to variations in input of freshwater and higher salinity water.

LPBF

Lake Pontchartrain Basin Foundation salinity data for 2008 are presented in Appendix figures B-4a to B-4d (south shore) and B-5a to B-5d (north shore). Salinities at the Tchefuncte River Station were generally low, ranging from 0 to 4 ppt. Bayou Castine, Fountainebleau Beach, and Northshore Beach salinity readings were similar, although Northshore Beach had spikes during July and Early August. South shore station salinities were similar and were lowest in mid-April.

Turbidity

LDWF

The opening of the Spillway in 2008 did not appear to have an obvious effect on Secchi disk depths. Secchi disk depth is inversely related to turbidity; lower readings mean the water is more turbid, higher readings mean the water is more transparent. LDWF secchi disk depths in Lake Pontchartrain during 2008 (figures 5-5a to 5-5f) were generally below the non-diversion average, except before February in Areas 1, 2, 3, and 7 and in March (Area 2) and April (Area 4). Little secchi disk data was available for Area 7 in 2008.

Bayou Bienvenue (Area 61) readings in 2008 and 1997 (another Spillway opening year) were similar to the non-diversion average (figures 5-6a to 5-6d). In Bayou Deedie

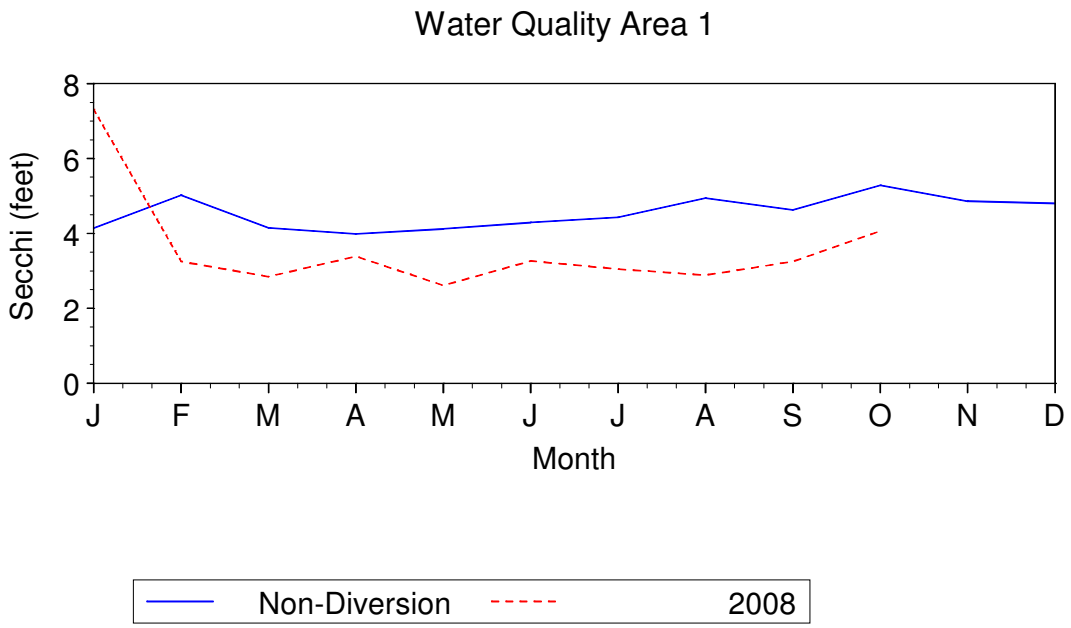


Figure 5-5a. Lake Pontchartrain Secchi Depth for 2008 and Average Non-Diversion Years

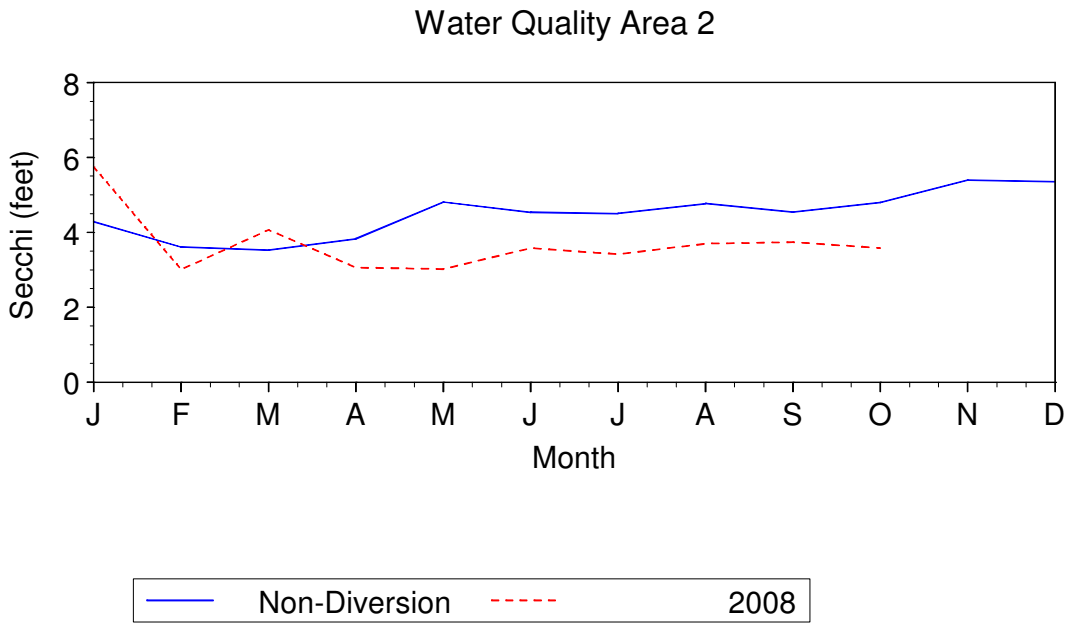


Figure 5-5b. Lake Pontchartrain Secchi Depth for 2008 and Average Non-Diversion Years

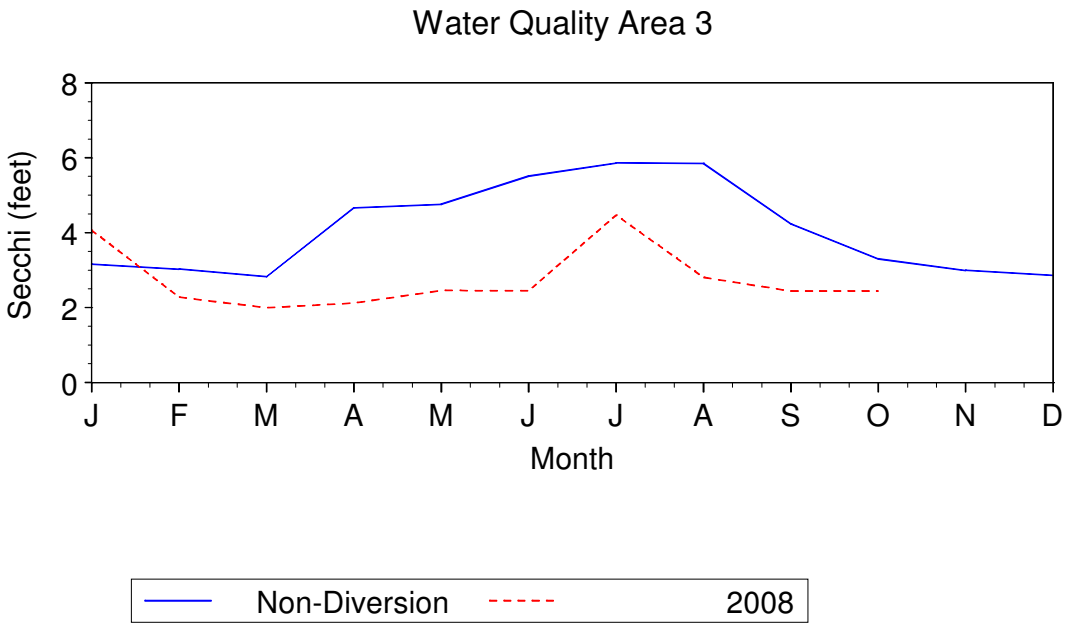


Figure 5-5c. Lake Pontchartrain Secchi Depth for 2008 and Average Non-Diversion Years

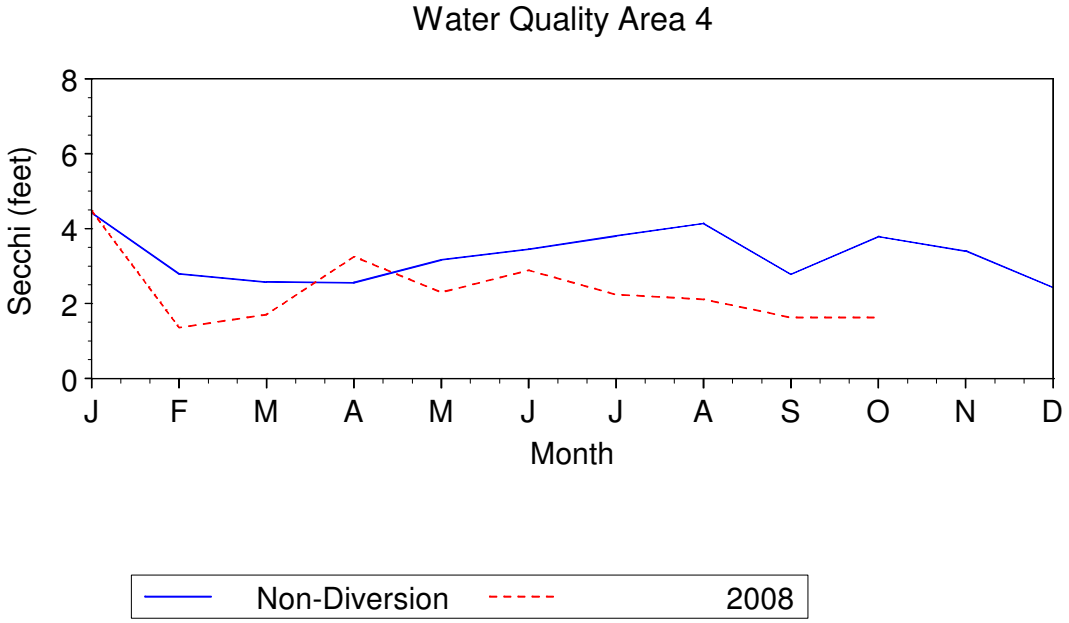


Figure 5-5d. Lake Pontchartrain Secchi Depth for 2008 and Average Non-Diversion Years

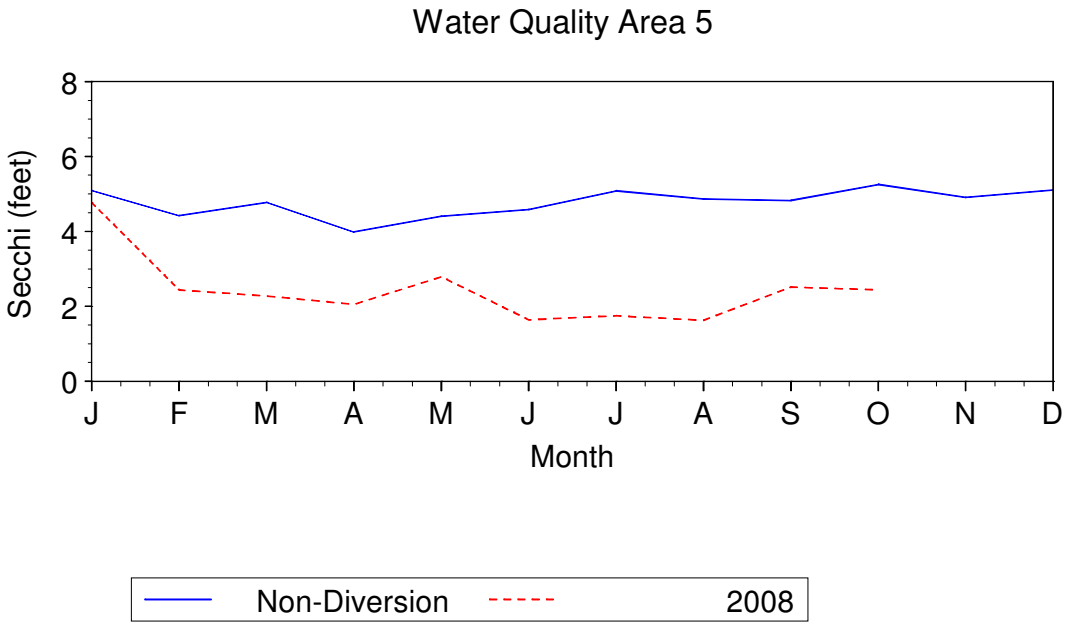


Figure 5-5e. Lake Pontchartrain Secchi Depth for 2008 and Average Non-Diversion Years

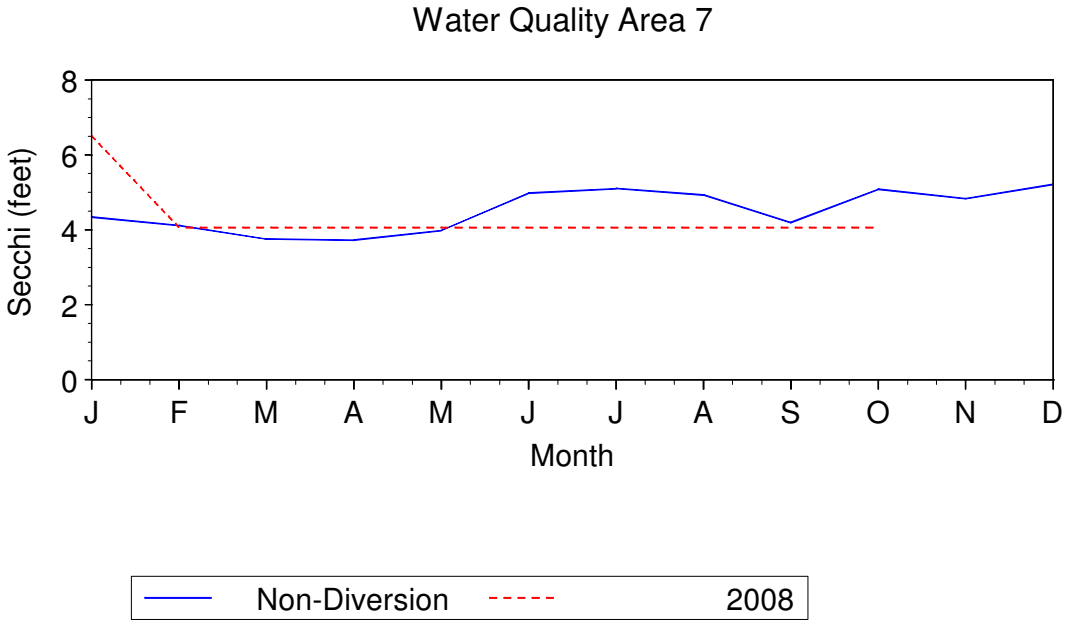


Figure 5-5f. Lake Pontchartrain Secchi Depth for 2008 and Average Non-Diversion Years

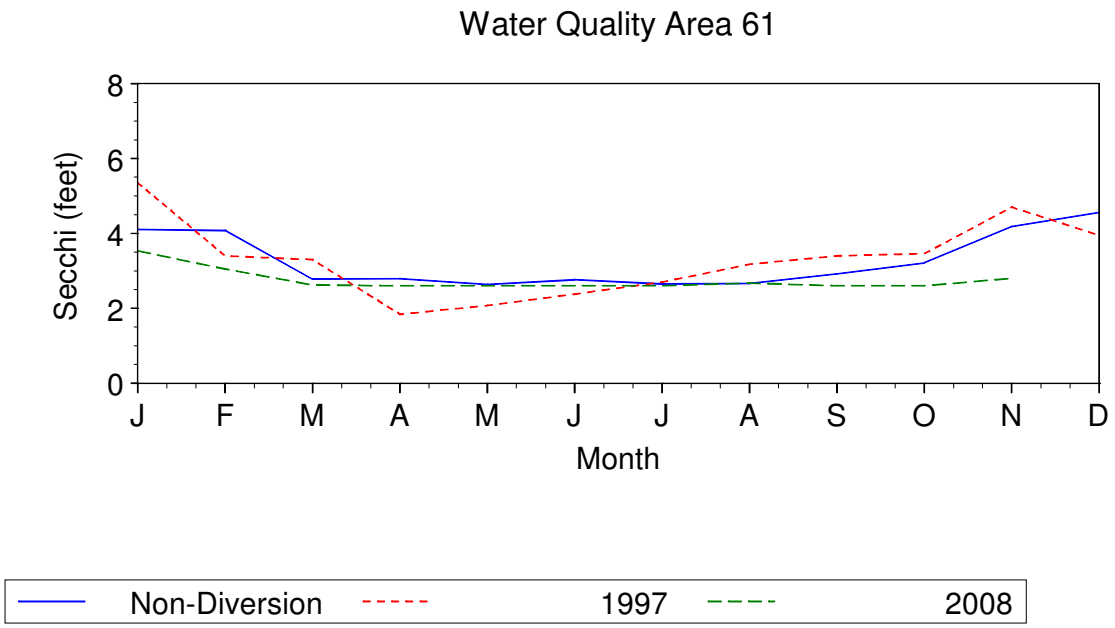


Figure 5-6a. Lake Borgne Secchi Depth for 2008, 1997 and Average Non-Diversion Years

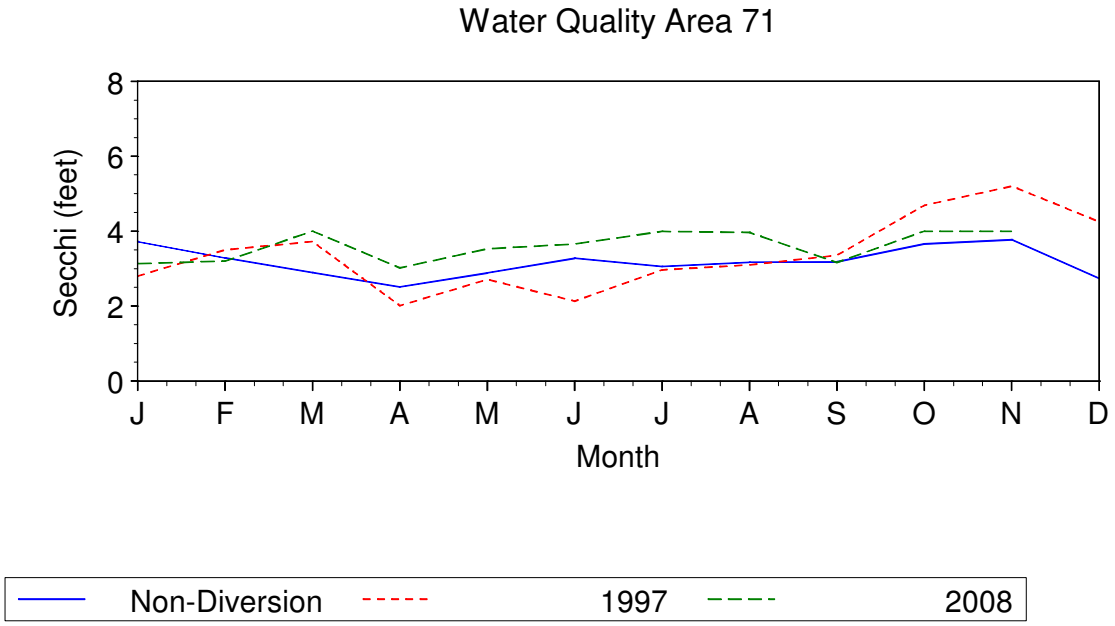


Figure 5-6b. Lake Borgne Secchi Depth for 2008, 1997 and Average Non-Diversion Years

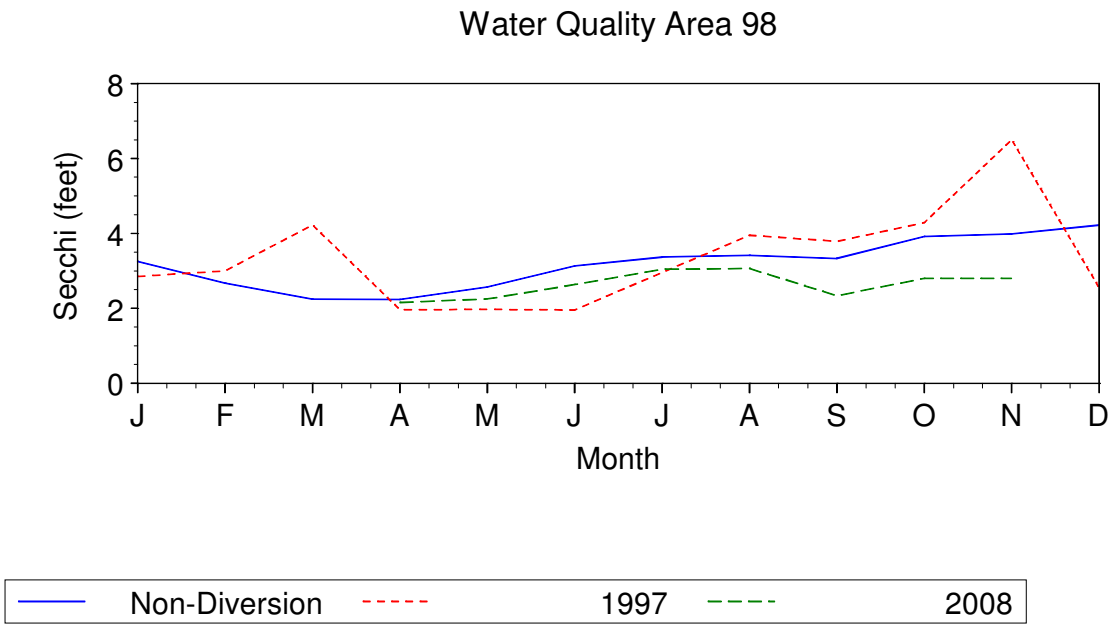


Figure 5-6c. Lake Borgne Secchi Depth for 2008, 1997 and Average Non-Diversion Years

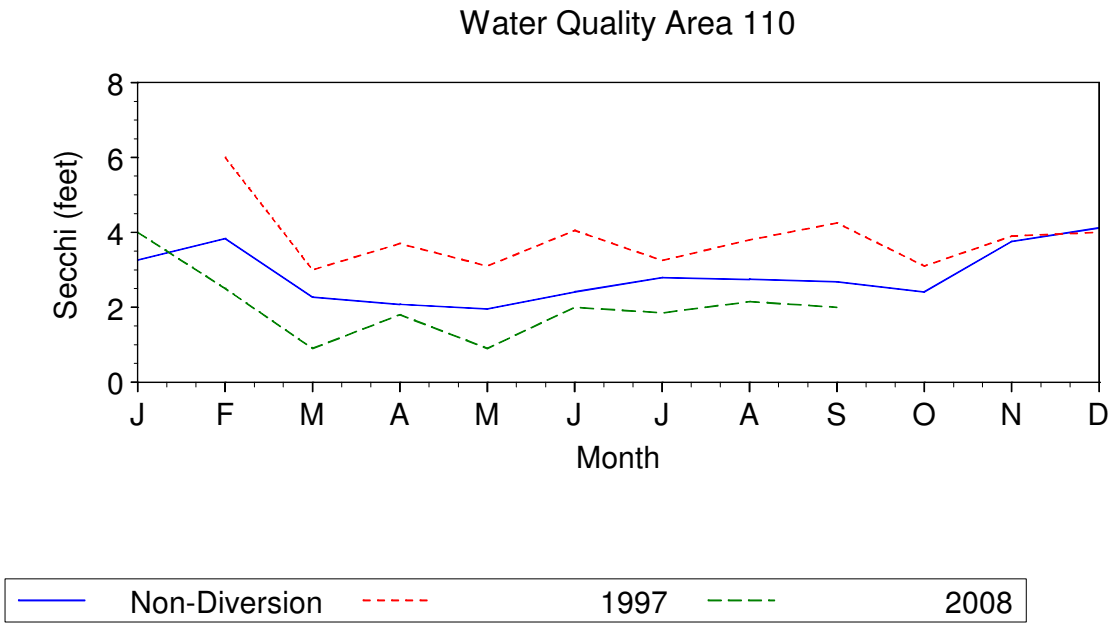


Figure 5-6d. Lake Borgne Secchi Depth for 2008, 1997 and Average Non-Diversion Years

(Area 110), 1997 Secchi disk depths were generally higher and 2008 depths were generally lower than the non-diversion average. Secchi disk depths recorded in 2008 and 1997 were similar to the non-diversion average at Areas 71 and 98.

LUMCON

Turbidity readings (in NTUs) recorded at the LUMCON station in Lake Pontchartrain are presented in Appendix figures B-2a to B-2h. Turbidities spiked in late April and early May of 2008 after the Spillway opening. Additional turbidity peaks occurred in August, September, October, and November of 2008. Turbidity data from 2001 to 2007 are also presented to indicate the natural variability in turbidity in Lake Pontchartrain.

LPBF

The Lake Pontchartrain Basin Foundation turbidities (in NTUs) at south shore stations show higher turbidities at Laketown and Bonnabel Boat Launch in mid-April (Appendix figures B-6a to B-6d). A spike also occurred at Old Beach in mid-June. The north shore sites (Appendix figures B-7a to B-7d) did not appear to show the increase in turbidity levels at this time. Fountainebleau Beach turbidities were variable in May through the end of August.

MODIS 250m TRUE COLOR IMAGES

MODIS 250m True Color Images were downloaded from the MODIS Rapid Response Project at NASA/GSFC website at http://rapidfire.sci.gsfc.nasa.gov/subsets/index.php?subset=AERONET_Stennis. Satellite images of Lake Pontchartrain were examined for April 7, 13, and 29; May 4 and 20; and July 16, 2008.

In the April 7 image (Figure 5-7A), the Spillway was closed, but there appears to be a small amount of turbidity in Lake Pontchartrain near the Spillway opening which was likely due to leakage through the structure due to high Mississippi River levels. The April 13 image (Figure 5-7B) appears to have been taken after the Spillway opened and the turbidity plume is larger. The image from April 29 (Figure 5-7C) shows the turbidity plume has spread along the south shore of Lake Pontchartrain and into the western part of Mississippi Sound. The May 4 image (Figure 5-7D) is similar to the April 29 image except the plume does not appear to have a distinct edge and there are additional sources of turbidity in the upper part of Lake Pontchartrain, which appears to be from the Tchefuncte River, and in Lake Maurepas, which appears to be from the Natalbany and Tickfaw Rivers. The May 20 image (Figure 5-7E) was taken after the Spillway was closed and the turbidity in Lake Pontchartrain is diffuse, although the cloud reflections may have made it more difficult to discern the turbidity. The July 16 image (Figure 5-7F) was chosen because the June and early July images had considerable cloud cover. The Spillway was closed and the turbidity plume appears to be gone; but there are also some cloud reflections in this image.

MODIS 250m True Color Image
April 7, 2008

Image courtesy of MODIS Rapid Response Project at NASA/GSFC

GEC
Figure: 5-7A
Date: February 2009
Scale: N/A
Source: NASA
Map ID: 27316921-1286

MODIS 250m True Color Image
April 13, 2008

Image courtesy of MODIS Rapid Response Project at NASA/GSFC

GEC
Figure: 5-7B
Date: February 2009
Scale: N/A
Source: NASA
Map ID: 27316921-1287

MODIS 250m True Color Image
April 29, 2008

Image courtesy of MODIS Rapid Response Project at NASA/GSFC

GEC
Figure: 5-7C
Date: February 2009
Scale: N/A
Source: NASA
Map ID: 27316921-1288

MODIS 250m True Color Image
May 4, 2008

Image courtesy of MODIS Rapid Response Project at NASA/GSFC

GEC
Figure: 5-7D
Date: February 2009
Scale: N/A
Source: NASA
Map ID: 27316921-1289

MODIS 250m True Color Image
May 20, 2008

Image courtesy of MODIS Rapid Response Project at NASA/GSFC

GEC
Figure: 5-7E
Date: February 2009
Scale: N/A
Source: NASA
Map ID: 27316921-1290

MODIS 250m True Color Image
July 16, 2008

Image courtesy of MODIS Rapid Response Project at NASA/GSFC

GEC
Figure: 5-7F
Date: February 2009
Scale: N/A
Source: NASA
Map ID: 27316921-1291

Water Temperature

LDWF

In Lake Pontchartrain, water temperatures (figures 5-8a to 5-8f) were generally lower than the non-diversion average from mid-March through October in Areas 1, 2 and 3 (except in July in Area 3). Water temperatures in Areas 4 and 5 were similar to the non-diversion average except they were lower after mid-July in Area 4. Few data were available for Area 7 in 2008.

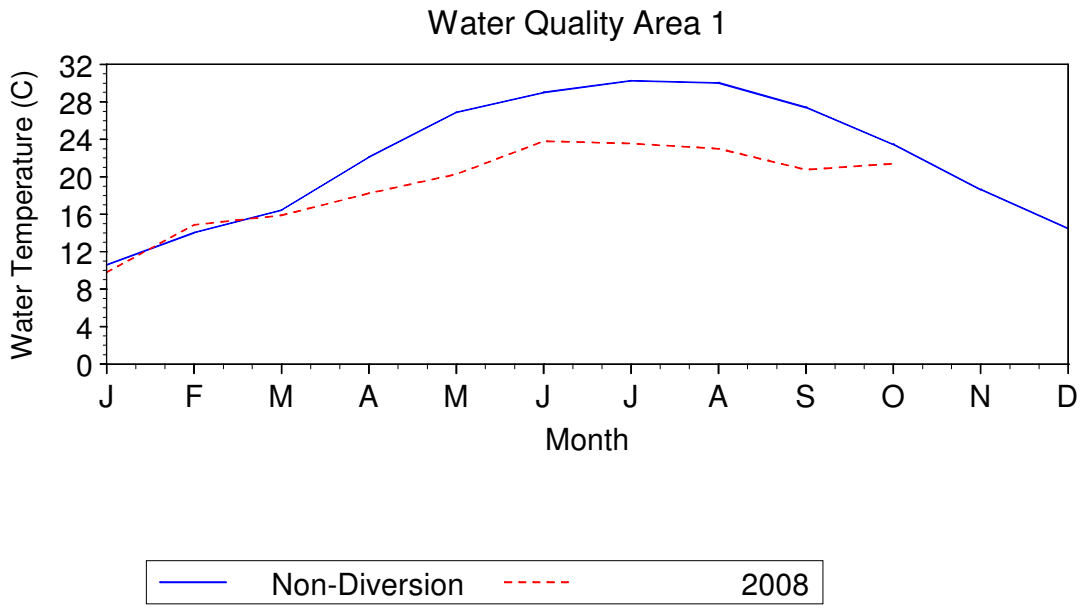


Figure 5-8a. Lake Pontchartrain Water Temperature for 2008 and Average Non-Diversion Years

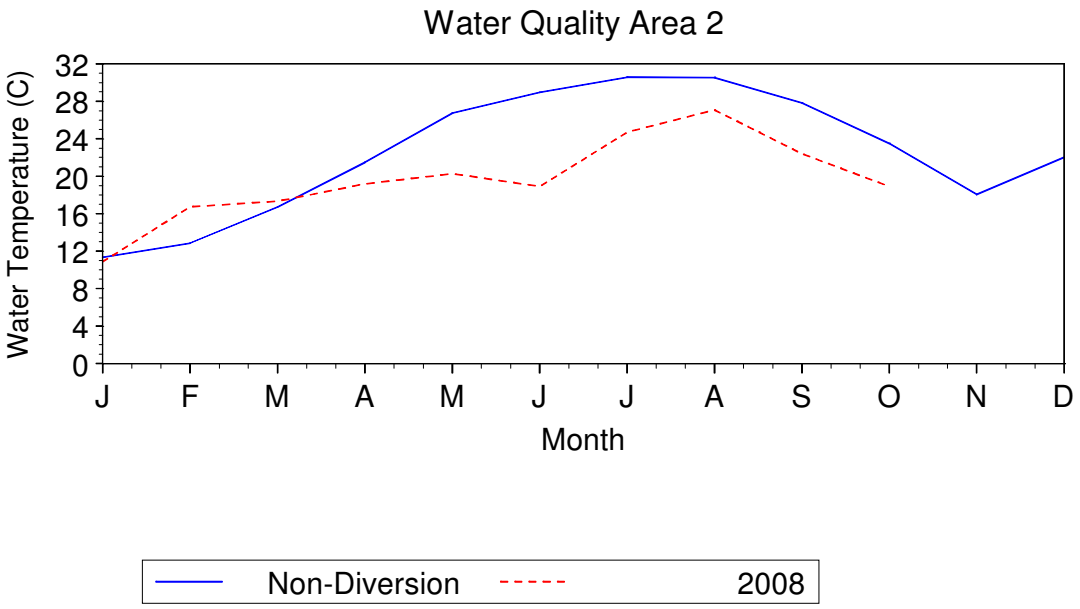


Figure 5-8b. Lake Pontchartrain Water Temperature for 2008 and Average Non-Diversion Years

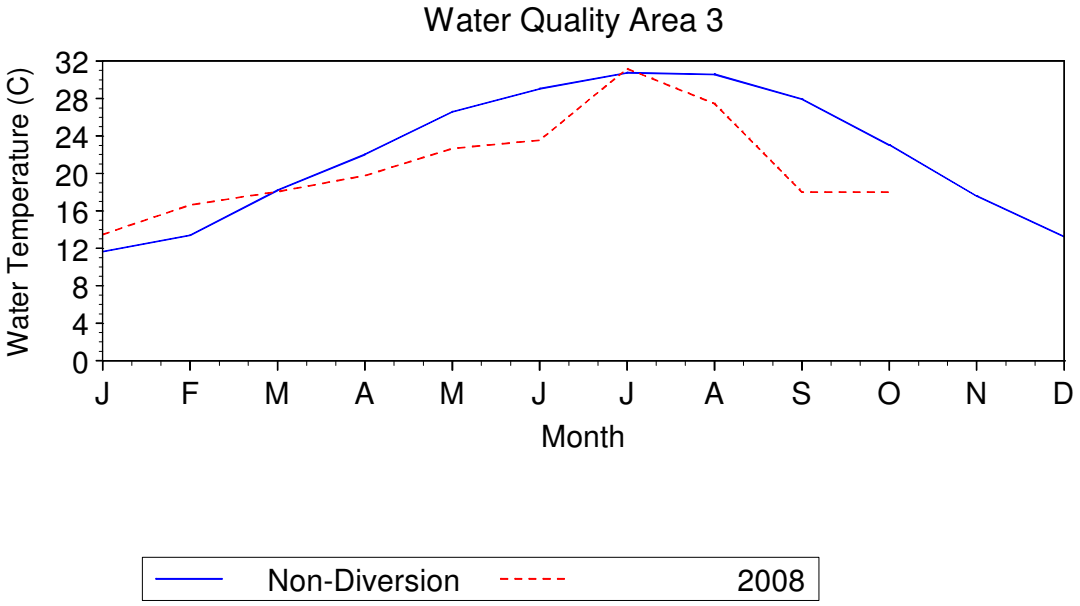


Figure 5-8c. Lake Pontchartrain Water Temperature for 2008 and Average Non-Diversion Years

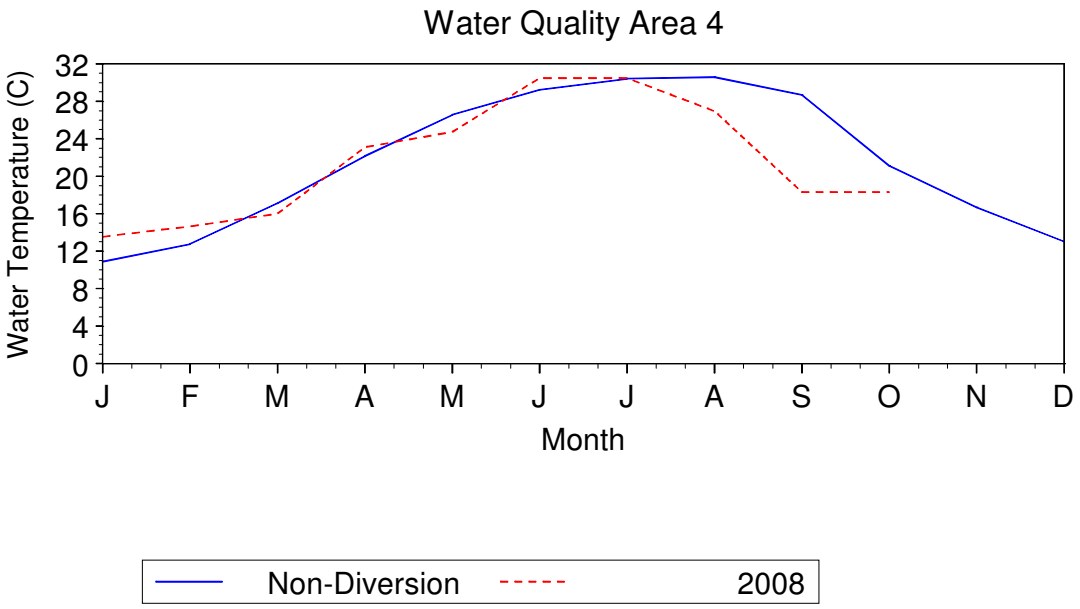


Figure 5-8d. Lake Pontchartrain Water Temperature for 2008 and Average Non-Diversion Years

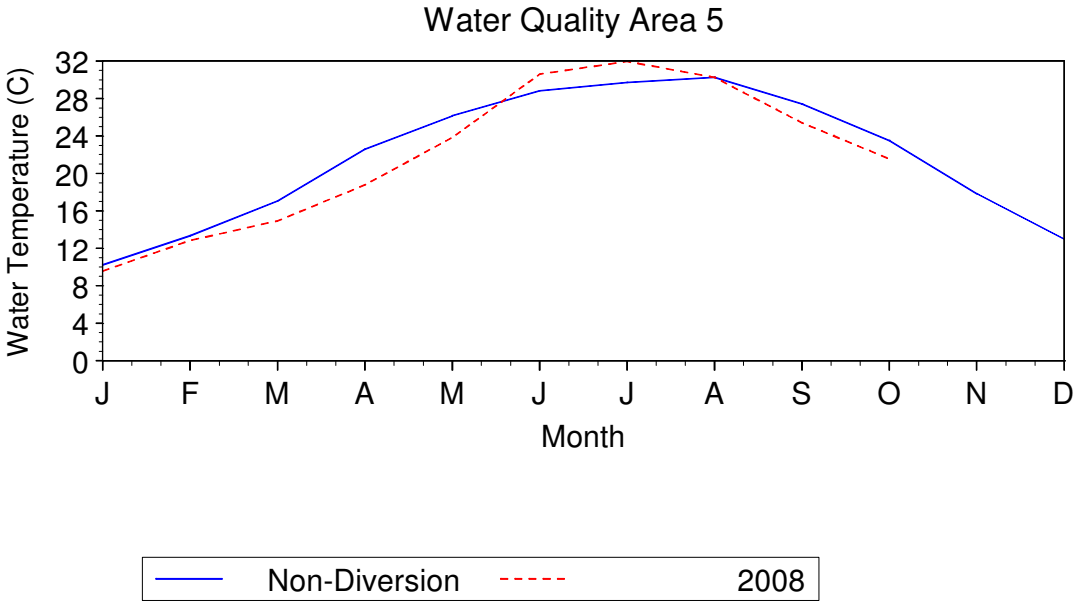


Figure 5-8e. Lake Pontchartrain Water Temperature for 2008 and Average Non-Diversion Years

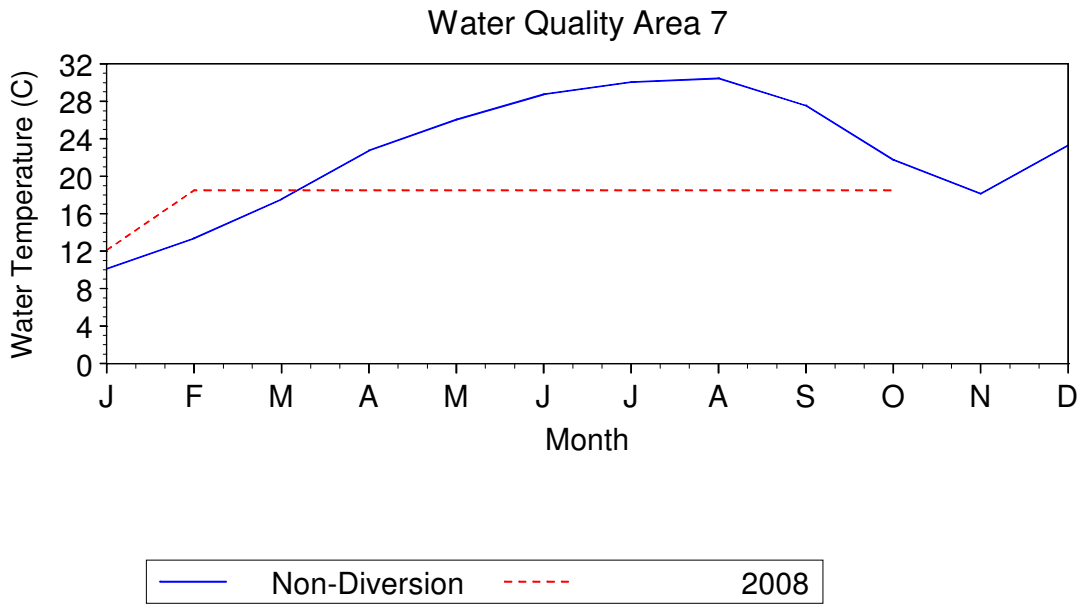


Figure 5-8f. Lake Pontchartrain Water Temperature for 2008 and Average Non-Diversion Years

Lake Borgne station water temperatures are presented in figures 5-9a to 5-9d. Temperatures in all four areas in Lake Borgne and waters south of Mississippi Sound in 2008 were similar to the non-diversion year average. Water temperatures during 1997 in Areas 61, 71, and 98 were generally lower than the non-diversion year average.

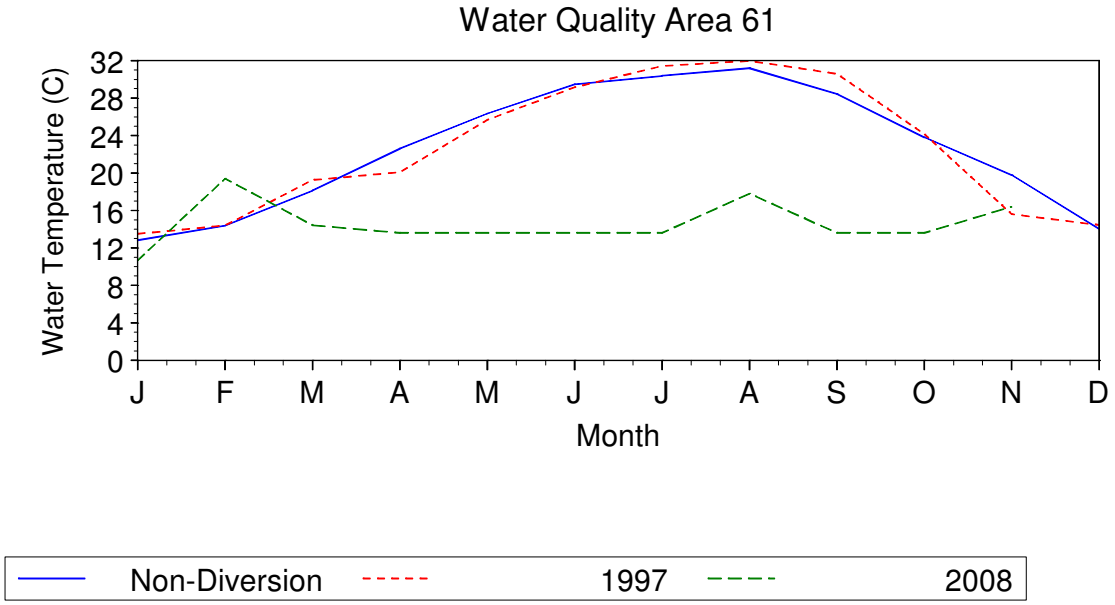


Figure 5-9a. Lake Borgne Water Temperature for 2008, 1997 and Average Non-Diversion Years

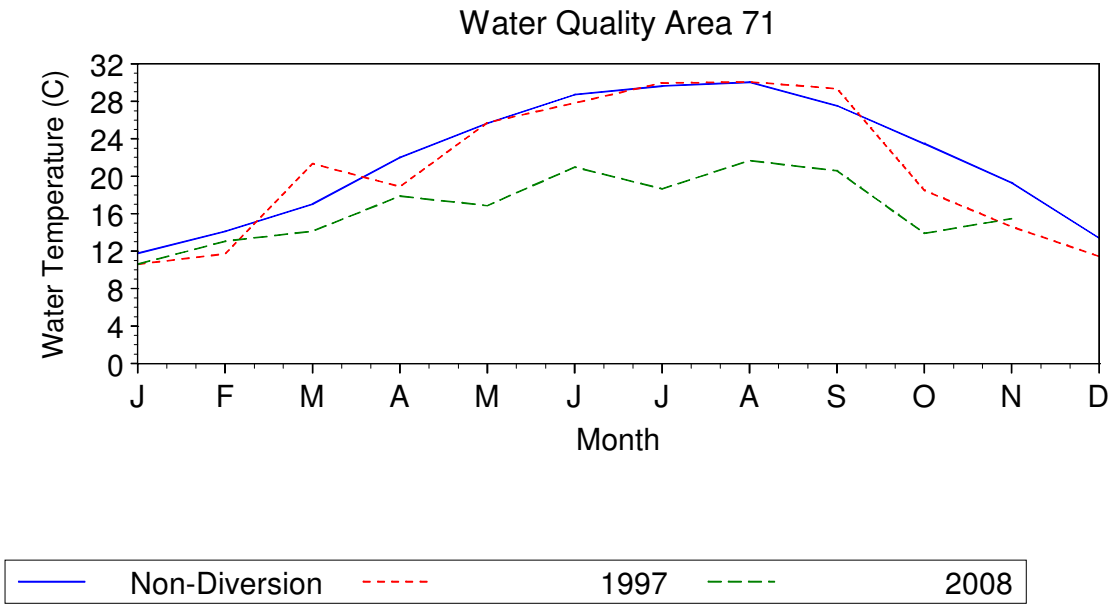


Figure 5-9b. Lake Borgne Water Temperature for 2008, 1997 and Average Non-Diversion Years

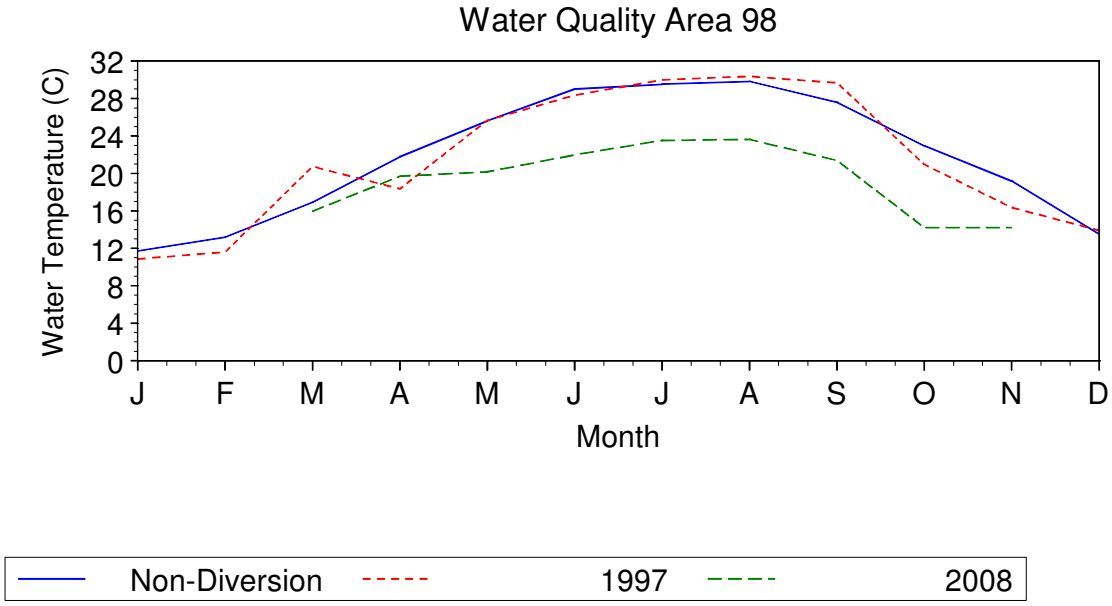


Figure 5-9c. Lake Borgne Water Temperature for 2008, 1997 and Average Non-Diversion Years

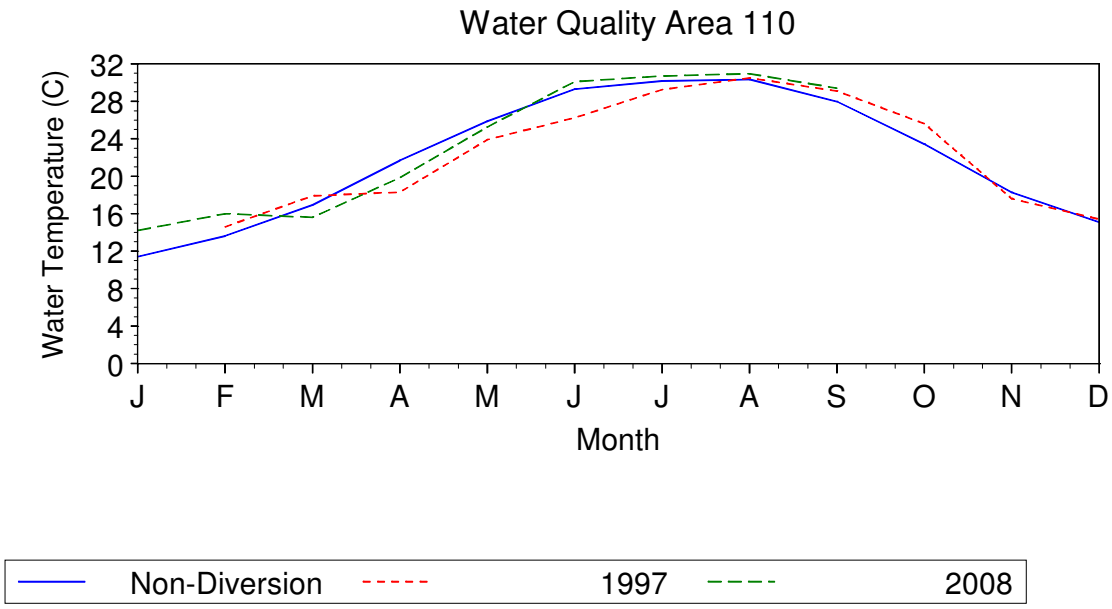


Figure 5-9d. Lake Borgne Water Temperature for 2008, 1997 and Average Non-Diversion Years

LUMCON

Water temperatures at the LUMCON station in Lake Pontchartrain (Appendix figures B-3a through B-3h) were highest (around 30°C) during June through early September and lowest during winter months. Similar trends were observed during 2001 through 2007.

DISCUSSION

Lake Pontchartrain is a large brackish lake, with a surface area of 1,631 km². In general, the western half of the lake is dominated by streamflow, whereas the eastern half is governed by tidal exchange (Swenson 1980a). The diurnal tide in the east end of the lake generally ranges from 0.098 to 1.47 feet (McCorquodale and Georgiou 2004). Sikora and Kjerfve (1985) analyzed 31 years (1946 to 1982) of daily salinity and discharge data for Lake Pontchartrain and determined that freshwater discharge was the single largest predictor affecting salinity in the lake.

Many rivers and bayous flow into Lake Pontchartrain and Lake Maurepas. Fresh water enters the north shore of Lake Pontchartrain from the Tangipahoa and Tchefuncte Rivers and Bayous Liberty, Lacombe, and Bonfouca. Flows from the Amite, Blind, Tickfaw, and Natalbany Rivers enter Lake Maurepas and then to Lake Pontchartrain through Pass Manchac located in the northwestern part of Lake Pontchartain. The input from the Amite River has been increasing significantly over the past 60 years (Wu 2005). Stormwater runoff is pumped from New Orleans into the south shore of the lake and is four percent of the total freshwater lake input (Sikora and Kjerfve 1985). When the Mississippi River is high, fresh

water can be released into the lake through the Bonnet Carré Spillway into the southwest portion of the lake. The Pearl River flows into western Mississippi Sound and is an important influence on salinities in the sound (Perret et al. 1998) and eastern Lake Pontchartrain (Sikora and Kjerfve 1985).

Higher salinity waters flow primarily through several tidal passes into the eastern half of Lake Pontchartain; a manmade canal in the southeastern portion of the lake provides additional higher salinity water. The tidal passes from Lake Borgne are the Rigolets and Chef Menteur Pass. Manmade channels such as the Inner Harbor Navigation Canal which is connected to the Mississippi River Gulf Outlet (MRGO-connected to the Gulf of Mexico) and the Gulf Intracoastal Waterway (GIWW-connected to Lake Borgne and the Rigolets) have increased the mean salinity in the southern portion of the lake (Junot, et al. 1983; Swenson 1980b). The opening of the MRGO shifted the salinity regime from stable oligohaline to rapidly changing salinities with occasional values above 15 ppt (Poirrier 1979). Plans are currently underway to close the connection of the Mississippi River Gulf Outlet to the Gulf of Mexico.

The average depth of Lake Pontchartrain is 11 feet, with a maximum depth of 18 feet (Stern et al. 1968). Because it is shallow, Lake Pontchartrain is a vertically well-mixed system (Swenson 1980a) and conductivity (used to measure salinity) increases only slightly with an increase in depth at locations away from the tidal passes. Salinities (conductivities) are significantly higher on the east side of the lake (Swenson 1980a). Except near tidal passes, circulation currents in the lake are wind driven and the average wind speed over the lake is generally above 6.7 miles per hour (McCorquodale and Georgiou 2004).

Freshwater input from other rivers makes it difficult to attribute environmental conditions to effects of the Bonnet Carré Spillway. Although low salinities (0.2 ppt) were observed at several stations in Lake Pontchartrain in 2008 after the Spillway was opened, they were low at some stations before the Spillway was opened. High river flows appear to be a contributing factor; U.S. Geological Survey (USGS) discharge data indicate high discharge rates during late January through March for many of the area's rivers. There is a natural seasonal variation in freshwater inflows from the watersheds flowing into Lake Pontchartrain. High flows generally occur in the winter and spring due to rainfall and low flows occur during the summer and fall (Wu 2005). The Bonnet Carré Spillway is typically opened during the spring when local river discharges are generally higher. Salinities in Lake Pontchartrain were also increased by the passage of Hurricanes Gustav and Ike in late August and September.

After the 1997 Spillway opening, salinities in Lake Pontchartrain, particularly during the spring were lower, although summer salinities were higher than the historical average (USACE 1998). Surface salinities of 0 ppt were recorded at the westernmost stations in Mississippi Sound during March and all stations by the week of April 16th. The salinities then gradually increased at all stations. Bottom salinities did not reach 0 ppt in all places. Surface and bottom temperatures decreased through the middle of April then increased. However, there was also high river flow by the Pearl River during this time period, making

separation of the influences of the Spillway and the Pearl River impossible (Perret et al. 1998).

A long-term increase in turbidity in Lake Pontchartrain has been reported (Thompson and Stone 1980). However, Francis et al. (1994) examined secchi disk transparency in LP from 1953 through 1990. Although there appeared to be a significant decrease in transparency of about 40 percent, the data did not account for differences in salinity and wind speed. Secchi disk transparency was found to be positively correlated with salinity and negatively correlated with wind speed. When the data were seasonally adjusted for wind speed and salinity, there was no longer a significant decrease in transparency over time.

Turbidities appear to differ between the eastern and western sides of Lake Pontchartrain. The western portion of the lake generally has higher overall turbidities than the eastern portion (Cho 2007). Easterly-driven waves make the bottom unstable in this area, and the sediments are easily suspended, resulting in increased turbidity. In contrast, a higher proportion of sand exists in the northeastern and southern portion of the lake; these sands are transported and deposited by western longshore drifts along the north and south shores (Cho 2007). Winds equal to or greater than 15 miles per hour are required to suspend the bottom sediments of Lake Pontchartrain; these winds generally occur about 15 percent of the time (Swenson 1980a). Occasional high winds, during cold fronts and other times, especially during the winter, can resuspend bottom sediments (Thompson and Verret 1980).

Freshwater and saltwater inputs affect turbidities in Lake Pontchartrain. Thompson and Fitzhugh (1985) found the lake was clearer during higher salinity periods and more turbid during fresher periods. Wu (2005) compared the sediment loadings of three of the rivers flowing into Lake Pontchartrain and Lake Maurepas; the Amite River was found to have the highest annual sediment loading (147 tons/year), compared to the Tickfaw (18 tons/year) and Tangipahoa (51 tons/year) Rivers.

There did not appear to be an obvious difference in Secchi disk depths in Lake Pontchartrain after the 2008 Spillway opening. River output before and after the Spillway opening likely affected turbidities in the lake, as did the passage of Hurricanes Gustav and Ike in late August and September. During the 1997 Spillway opening, Secchi disk visibilities were lower than the historical averages, except during other Spillway opening years, although summer visibilities were higher than historical averages (USACE 1998).

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SECTION 6 – 2008 BONNET CARRÉ SPILLWAY OPENING IMPACTS ON RECREATION

SECTION 6 - 2008 BONNET CARRÉ SPILLWAY OPENING IMPACTS ON RECREATION

INTRODUCTION

This section of the report describes the recreational impact of the 2008 opening of the Bonnet Carré Spillway. The area analyzed for impact was twofold, since Spillway openings affect recreational activities in the Spillway itself and in the lakes and waterways that receive the released waters.

The impact analysis involved three distinct but related data gathering efforts: (a) interviews with persons using lakes Pontchartrain, Catherine, and Borgne for water-based recreation relative to their activities and the possible impact of the Spillway opening on their activity patterns; (b) observations and chronicling of activities and apparent numbers of recreationists at access sites in the study area; and (c) interviews with persons/groups using the Spillway proper for recreation.

METHODS

This section describes the procedures followed to select samples of: (1) locations/dates for the interviews with lake users and for observations at lake access sites; and (2) dates for interviewing Spillway users and observing activities at the Spillway.

The sampling process began with determining the level of effort to be expended on field work; that is, the number of days during which interviewing would be carried out. The level of effort was defined in terms of the effort necessary to yield an unbiased, comprehensive view of the Bonnet Carré Spillway opening "event" and its attendant effects on recreation at the Spillway and in Lake Pontchartrain and waters to the east. Determinations were made for the lake use study and for the Spillway use study independently in terms of the number of days that would be required to obtain the needed information at the least cost. It was also determined that holidays, holiday weekend days, and weekend days would be the most heavily sampled because these days have the highest usage. It was also judged that by the fall of the year most of the immediate effects of the opening would be past. Interviewing was scheduled from the April opening through October. The number of days in each category is shown below for both the Lake Users Survey and the Spillway Users Survey:

	Lake Users Survey	**Spillway Users Survey**
Holidays	12	1
Weekend Days	33	14
Weekdays	12	1
Special Days	3	0
Total Days (April-October)	60	16

Lake Users Survey

A list of landings from the 1997 study on how the Spillway opening affected the lake users (USACE 1998) was used as a basis to determine where interviews should be done. A search of new locations was also done to learn of any new launches that had been built since 1997. A field crew visited all the facilities on the combined list and characterized them as to apparent relative usage and accessibility. Some of the landings used during the last study had been damaged by hurricanes and had yet to reopen. Locations were judged to be high use, medium use, and low use based on field observations. The final list contained 26 proposed interview sites.

The Spillway was opened on April 11, 2008, and Mississippi River water spread through Lake Pontchartrain, the Rigolets, the Chef Menteur area, and into Lake Borgne over 28 days from the Spillway opening. In order to establish the conditions prior to the time when the Spillway waters reached certain areas, field personnel began immediately to gain insight into current levels of recreation in the Lake Pontchartrain area, where interviews were carried out at 22 locations during 14 days ending on April 25.

A randomized sample of interview sites and dates was generated for the months of April through October. In a simple procedure, the 26 sites were listed according to their judged level of usage. Low use sites were listed once, medium use sites were listed three times, and high usage sites were listed five times. Sequential numbers were assigned to the listings. A table of random numbers was used to select the interview sites, which were listed in the order drawn until enough draws had been made to cover the number of interview days remaining. Originally, 18 holiday/holiday weekend interview days were assigned; but because of Hurricane Gustav, six days had to be canceled and the days were made up randomly through the duration of the study. All weekend dates in April through October were listed and sequential numbers assigned. Using a random number table, a sample of weekend dates was drawn and assigned to the next 25 listed. The week day selection was made in the same manner and assigned to the next 12 sites listed. This sampling plan was reviewed by Corps of Engineers, New Orleans District, personnel and was the basis for the data gathering effort, which was conducted by a single interviewer at each site on each day.

The access/interview sites tended to group within fairly definable regions. For this reason, interviewers were also instructed to observe the activity at adjacent sites and to conduct interviews at sites in close proximity to the principal site selected for that day's interviewing effort. For example, if Fort Pike was the site selected for a given day, the interviewer was instructed to observe periodically activity at Rigolets Marina across the Rigolets Pass from Fort Pike and at Chef Harbor Marina.

Some changes were made to the sampling plan because of inclement weather and the closing of some sites due to subsequent storm damage. If a day was missed, it was made up on the closest available day, with the day of the week remaining the same. If the day was missed because the site was unavailable as a result of storm damage, another location with the same weight was randomly chosen and was substituted for that site. This was common

for sites located in the far eastern part of the study area where storm surge was a problem and serious damage occurred.

Spillway Users Survey

The procedure for developing the sampling plan for data collection in the Spillway was similar to that for the Lake Users Survey. The holiday/holiday weekends were scheduled first, and then the remaining weekend days from June through October were listed and assigned sequential numbers. As with the Lake Users Survey sampling procedure, the requisite number of days was then selected using a random number table. Only one person was sent out to survey on holidays and weekends rather than two as in the 1997 Spillway opening study.

All scheduled interview dates were covered, with the exception of August 30 and 31, which were interrupted by Hurricane Gustav. These days were rescheduled, and all of the interview time was recovered.

Interview Forms, Questionnaires, and Data Recording Forms

Questionnaires and survey directions were developed for both the Lake Users Survey and the Spillway Users Survey with the cooperation and input of District personnel. Interviewer instructions were incorporated into the Lake Users Survey form, but separate interviewer instructions were developed for the Spillway form. Forms for recording observation information for both surveys were also developed. Databases and coding instructions were developed for data entry. Quality control was used to locate such things as out of range entries and logical inconsistencies.

The Lake Users Survey form evolved through four versions prior to any surveying being performed. Core questions remained the same, but additional questions were added and the format was changed. All Lake Users Surveys completed from the beginning of the survey time period were identical. The Spillway Users Survey evolved through four versions early in the study. Again, the core questions remained the same, but additional questions were added and the format was changed. All Spillway Users Surveys for August until the end of the study followed the same survey form. Copies of the several survey forms, data recording forms, and coding instructions are included in Appendix C of this report.

LAKE USERS SURVEY

Initial Efforts

The data gathering efforts for the Lake Users Survey began before a target audience had been identified in detail and a formal survey instrument had been developed. A field crew was dispatched to the study area on the day the Spillway was opened. They spent the next two weeks talking to people and observing recreational activity in order to get a sense of the situation before Spillway waters reached various areas or had a dramatic impact in terms

of water quantity and quality. These two weeks were also used to visit the prospective survey sites to determine relative levels of usage and accessibility.

The results of the initial data gathering efforts are presented in Appendix C. Because these were not systematic surveys or observations, they cannot be quantified. They included a number of commercial operators that were not included in the later survey effort. The general conclusions that can be drawn from these initial efforts are as follows:

1. The opening of the Spillway in 1997 caused disruptions to recreational fishing and to commercial shrimping and crabbing, but the long-term effects were positive.
2. Negative effects decreased with distance from the Spillway, indicating that there was no widespread uniform effect.
3. Little opposition was expressed to the current opening of the Spillway, which was thought to be necessary.
4. It was expected that the current Spillway opening would have the same effects as the 1997 opening, including temporary disruption and long-term positive effects.
5. Recreational fishing would be disrupted, but the fish would move to other areas, leading to increased activity in some areas and modifications of fishing behavior (fishermen would change locations, and there would be a small shift in species sought).
6. Some commercial operations providing services to particular groups of fishermen would experience decreased business.
7. Crabbing would be disrupted, but the crabs would move to other areas and the long-term effects would be increased abundance. Recreational crabbing would cease in areas occupied by fresh water. Commercial crabbers would move their operations (if possible) ahead of the fresh water line or to other areas.
8. Brown and white shrimp would move out of Lake Pontchartrain, but the white would come back sooner because they are more tolerant of fresh water. Commercial shrimpers would move to other areas of activity, particularly in the direction of the Gulf of Mexico.
9. Other forms of water-based recreational activity (such as pleasure boating, sailing, and water skiing) would be little affected in terms of level of activity and only mildly affected in terms of quality of experience (primarily aesthetics).
10. Recreational experiences in the first two weeks after the Spillway opening were generally of poor quality. However, the period was extremely windy, making it difficult for respondents to distinguish Spillway effects in the context of general turbulence.

Surveys

During the two-week period, the target audience was clarified and the preliminary survey form was modified. The survey was directed toward recreational users, although some commercial operators were surveyed when encountered at survey sites. Also during the initial two-week period, the preliminary list of sites that would serve as the basis of the surveys was modified, and current use levels were determined. The locations of the 26

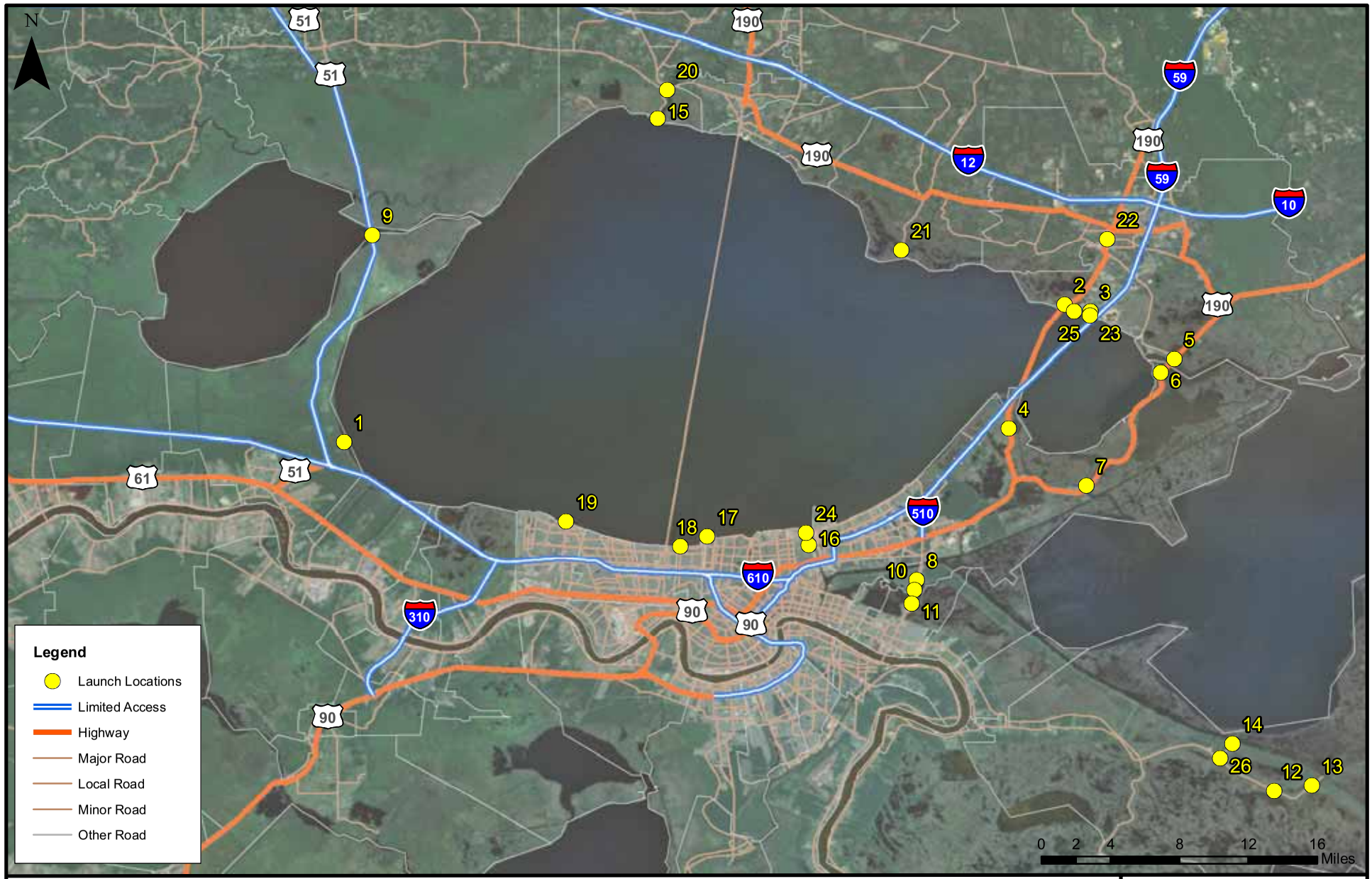
survey sites are shown in Figure 6-1. As can be seen from the figure, the survey sites were concentrated in areas near the Spillway, but also distributed widely to cover the potential range of impacts and to provide an opportunity for comparing recreational experiences proximate to the Spillway to those more distant.

Usage levels for the various sites were determined during the two-week period through personal observation and contacts with commercial operations and state and federal agencies. The identified use levels are shown in Table 6-1. The use levels were employed to identify the relative weight that should be given to each site in terms of the number of surveys that should be conducted. The actual number of surveys conducted at each site is shown in the table. As can be seen from the table, there is a fairly good correspondence between the use levels and the number of surveys conducted. However, the allocations were not straightforward because it was necessary to insure that heavily used sites distant from the Spillway did not distort the survey results.

Table 6-1. Lake Survey Sites, Surveys, and Use Levels

Map I.D.	Location	Number of Surveys	Use Level
1	Frenier Beach Area	4	Medium
2	Tite/Cousins Launch north end Hwy 11 Bridge	18	Medium
3	The Dock at end of Hwy 11 Bridge	31	Medium
4	Bayou Sauvage Launch off Hwy 11	5	Medium
5	Rigolets Harbor Marina	116	High
6	Fort Pike Boat Launch	29	Low
7	Chef Harbor Marina	6	Medium
8	Claudia and Stanley's Boat Launch Paris Road	3	Low
9	Pass Manchac	45	High
10	Bait Inc. Paris Road	78	High
11	Gulf Outlet Marina Paris Road	44	High
12	Launch at 6405 Hopedale Hwy	5	Low
13	Breton Sound Marina	63	High
14	Blackie Campos Shell Beach	17	High
15	Mouth of Tchefuncte	38	High
16	Seabrook Boat Launch	65	High
17	West End Blvd Boat Launch	14	Medium
18	Bonnabel Boat Launch	73	High
19	Williams Blvd Boat Launch	83	High
20	Marina Del Rey Madisonville	19	Medium
21	Mouth of Bayou Lacombe	75	High
22	Bayou Liberty Area Heritage Park	2	High
23	End of Lakeview Road	4	Low
24	Lakeshore Drive	10	low
25	Other - Slidell-Jetty	3	Low
26	Shell Beach	3	Low
	Total	**853**	

Source: G.E.C., Inc.



LAKE USERS SURVEY SITES

GEC

Figure: 6-1
Date: December 2008
Scale:1:500,000
Source: ESRI/GEC
Map ID: 27316921-1137

The following discussion is based on the 853 completed surveys. The discussion follows the general order of the questions in the survey instrument, which can be found in Appendix C. Some retrospective questions were used in the survey (for example, how this trip compared to prior trips) because there are no baseline measurements of recreational experiences during non-Spillway opening periods that could be used as a basis for comparison. The study did not attempt to determine how many recreationists who used places such as Lake Pontchartrain might have stayed home because of the opening of the Spillway. Thus, negative consequences might have been underestimated; and the persons who participated in the surveys might be weighted somewhat in the direction of more frequent users.

For critical points, comparisons are made with the report on the 1997 Spillway opening. The Spillway was opened on March 17 in 1997 and on April 11 in 2008. The number of surveys conducted in 1997 (614) was fairly similar to the number conducted for the 2008 study (853), and the period during which the surveys were conducted was similar (March through October in 1997 and April through October in 2008). However, the 2008 opening provided less overall discharge than the 1997 opening, with the volume of water diverted through the Spillway in 2008 (6.1 million acre-feet) about 64 percent of the volume diverted in 1997.

The effects of the Spillway opening were not instantaneous throughout the study area. For about a week after the Spillway was opened, fresh water followed a southerly track because of prevailing northerly winds, with much of the water exiting Lake Pontchartrain through Chef Menteur Pass and the Inner Harbor Navigation Canal. Figure 6-2 shows the location of the turbidity line in Lake Pontchartrain on April 29, 18 days after the Spillway was opened. Fresh water eventually spread throughout the lake, but salinity levels never reached zero over most of the lake. Hurricane Gustav occurred in September, driving salt water from the Gulf into Lake Pontchartrain.

The study area was divided into six major subareas: (1) Western Lake Pontchartrain; (2) North Shore of Lake Pontchartrain; (3) Eastern Lake Pontchartrain; (4) Passes Area (Lake Catherine); (5) Lake Borgne; and (6) South Shore of Lake Pontchartrain. Table 6-2 shows the number of surveys that were conducted in each subarea during each month of the study. As can be seen from the table, heavy emphasis was placed in the surveys on the South Shore of Lake Pontchartrain and the movement of water from the Spillway to the east. Only 32 surveys were conducted in April because this was the remaining week in the month of the initial effort, and only 70 surveys were conducted in August because of Hurricane Gustav. High numbers of surveys were conducted in May because of the Memorial Day weekend and in July because of the July 4th holiday.

Survey respondents were asked to provide zip codes for the area in which they resided. Figure 6-3 shows the comparative intensity of the locations of the survey respondents in Louisiana. As can be seen from the figure, the lake users were heavily concentrated on the north and south shores of Lake Pontchartrain, but extended to the state lines to the north and east, to the coastal areas to the south, and to the Lafayette

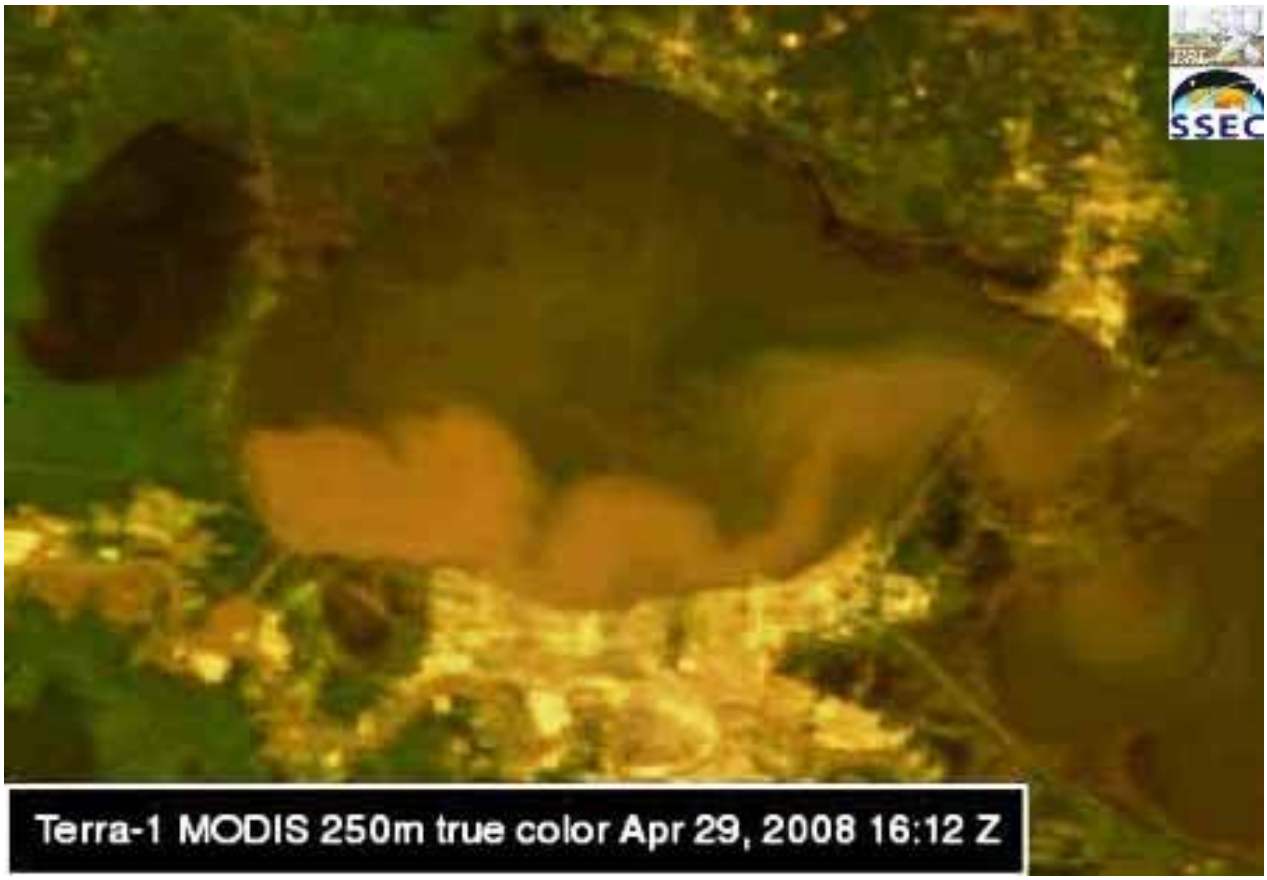
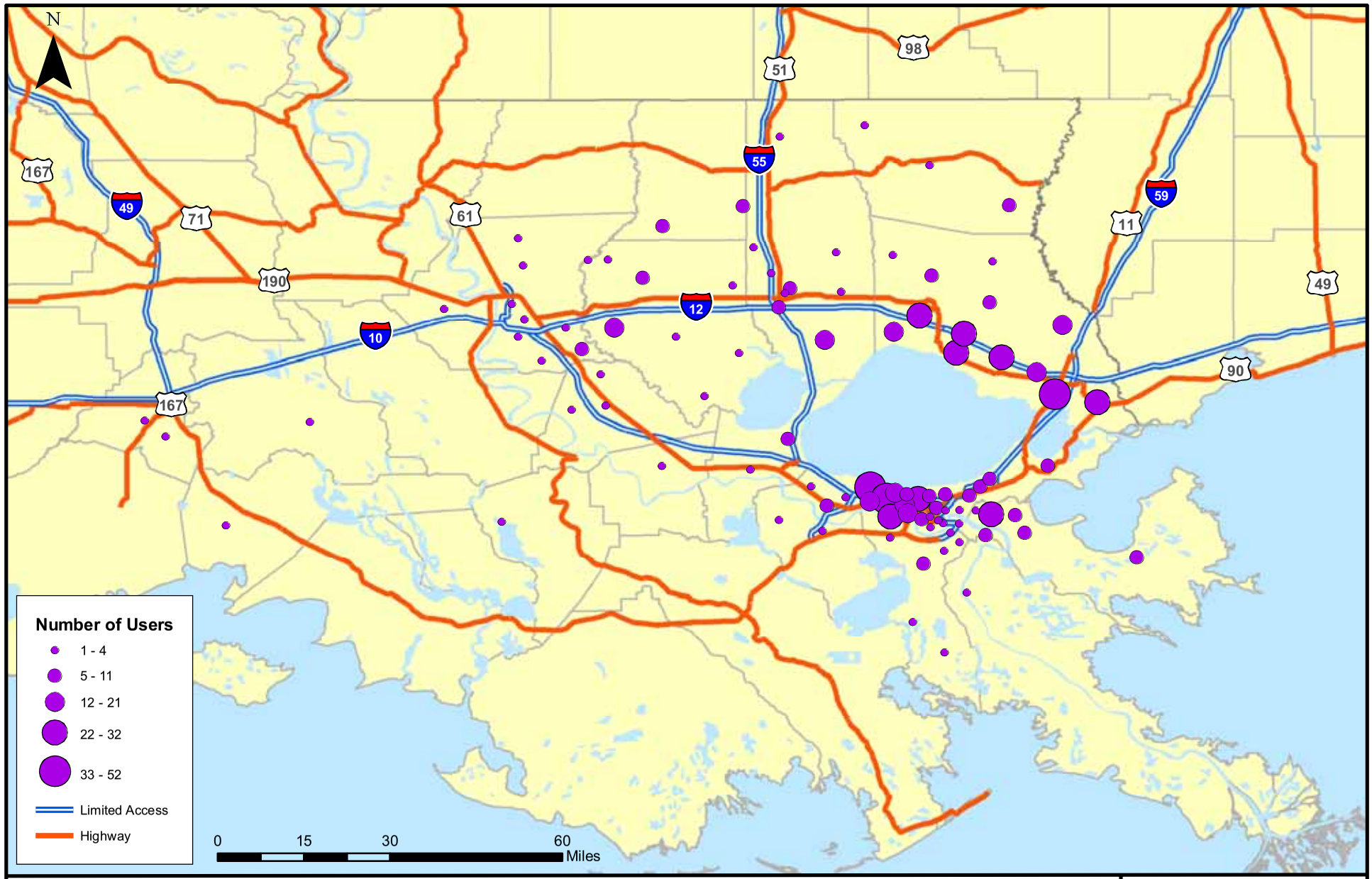


Figure 6-2. Location of the Turbidity Line in Lake Pontchartrain

Table 6-2. Lake Surveys by Subarea by Month

Subarea	April		May		June		July		August		September		October		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Western Lake Pontchartrain	0	0%	33	12%	0	0%	0	0%	21	30%	0	0%	0	0%	54	6%
North Shore Lake Pontchartrain	32	100%	65	23%	2	2%	32	18%	3	4%	12	12%	13	14%	159	19%
Eastern Lake Ponchartrain	0	0%	16	6%	18	18%	5	3%		0%	7	7%	2	2%	48	6%
Passes Area (Lake Catherine)	0	0%	14	5%	29	29%	29	16%	46	66%	22	22%		0%	140	16%
Lake Borgne	0	0%	80	29%	29	29%	39	22%		0%	7	7%	56	60%	211	25%
South Shore Lake Pontchartrain	0	0%	69	25%	21	21%	75	42%		0%	54	53%	22	24%	241	28%
Total	32	100%	277	100%	99	100%	180	100%	70	100%	102	100%	93	100%	853	100%

Source: G.E.C., Inc.



LAKE SURVEY RESIDENCES OF RESPONDENTS

Number of Users by Zipcode

GEC

Figure: 6-3
Date: December 2008
Scale:1:1,500,000
Source: ESRI/GEC
Map ID: 27316921-1136

area to the west. There were also some recreationists who came in from Mississippi and Texas and even as far away as Iowa, accounting for 20 of the surveys.

Survey Results

Total Activities

Most of the surveys were conducted at boat ramps (along with docks, piers, jetties, and banks) and involved more than one person in each party. Recreational parties were asked about the nature of the activities engaged in during the trip, with more than one activity as a possible response. The results are shown in Table 6-3. As can be seen from the table, the 853 surveys included 916 activity types. Fishing was by far the most important, cited by 629 of the 853 respondents (69 percent), followed by pleasure boating (15 percent) and then crabbing (10 percent); these three activities accounted for 94 percent of the total. Interest in specific activity types is readily apparent from the fact that only 61 of the 853 surveys identified more than one activity, and only two of these identified three activities. Most of the multiple activities were accounted for by fishing trips that also involved crabbing (23) and pleasure boating (19). The two surveys that identified three activities were water skiers who also engaged in pleasure boating and swimming/tubing.

Table 6-3. Lake Survey Total Activities

Activity	Total Number	Percent
Fishing	629	69%
Pleasure Boating	133	15%
Crabbing	92	10%
Jet Skiing	18	2%
Other	16	2%
Water Skiing	12	1%
Trawling	9	1%
Sailing	3	0.3%
Swimming	3	0.3%
Parasailing	1	0.1%
Total	916	100%

Source: G.E.C., Inc.

The 2008 results were fairly similar to those in 1997, but 1997 registered a higher number of multiple-activity trips. In 1997, the 614 surveys accounted for 818 activity types; fishing accounted for 63 percent of the total and pleasure boating accounted for 16 percent of the total. These two categories accounted for 79 percent in 1997 and 84 percent in 2008, indicating dominance of these activity types over time. Water skiing accounted for seven percent in 1997 compared to one percent in 2008, and crabbing accounted for three percent in 1997 compared to 10 percent in 2008. Because crabbing was reportedly good during both years and particularly during the period of Spillway opening, the difference can probably be

accounted for by survey intensities at different sites. Water skiing was probably limited in 2008 because of the high price of fuel.

Primary Activities

Recreational users were asked about the nature of the primary activity that was engaged in on the trip. The results are shown in Table 6-4. As can be seen from the table, the results were nearly the same as those for the total activities question, with 613 of the 853 respondents (72 percent) engaged in fishing, 14 percent in pleasure boating, and nine percent in crabbing, together accounting for 95 percent of the total primary activities. Of the 613 surveyed groups who were fishing, 533 were engaged in boat fishing, 49 were engaged in dock/pier fishing, and 31 were engaged in bank fishing. Of the 73 surveyed groups who were crabbing, 37 were engaged in boat crabbing, 26 in bank crabbing, and 10 percent in dock/pier crabbing. The "Other" category included such things as hunting and checking out the boat.

Table 6-4. Lake Survey Primary Activities

Activity	Number of Surveys	Percent
Fishing	613	72%
Pleasure Boating	119	14%
Crabbing	73	9%
Jet Skiing	17	2%
Other	10	1%
Water Skiing	9	1%
Trawling	8	1%
Sailing	3	0.4%
Swimming	1	0.1%
Parasailing	0	0%
Total	853	100%

Source: G.E.C., Inc.

The dominance of boating activities is reflected in the fact that 700 of the 853 surveys involved boaters. The dominant size class (47 percent) was constituted by 327 bay boats in the 18-20 foot range. Smaller boats included 159 (23 percent) in the 15-17 foot range and 26 (four percent) in the 8-14 foot range. Larger boats included 168 (24 percent) in the 21-24 foot range and 20 (three percent) in the 25-42 foot range, with the latter category including some sailboats.

The 1997 study did not address primary activities.

Participants

Most of the surveys were conducted with groups of more than one person. Table 6-5 shows the number of persons in each group by activity type for the primary activities. As can be seen from the table, the average number of persons per activity was fairly similar, so that the relative ranking and importance of the dominant activity types did not change. Fishing accounted for 66 percent of the participants, pleasure boating for 19 percent of the participants, and crabbing for nine percent of the participants; these three activity types accounted for 94 percent of the participants.

Table 6-5. Lake Survey Participants by Activity Type

Activity	Number of Surveys	Number of Persons Involved	Average Persons per Activity
Fishing	613	1,392	2
Pleasure Boating	119	413	3
Crabbing	73	194	3
Jet Skiing	17	33	2
Other	10	19	2
Waterskiing	9	39	4
Trawling	8	18	2
Sailing	3	7	2
Swimming	1	6	6
Parasailing	0	0	0
Total	853	2,121	2

Source: G.E.C., Inc.

Fishing

There were 629 groups who indicated that they had engaged in some fishing, including 613 who indicated fishing as the primary activity and 16 who indicated fishing as a secondary activity. The 629 groups who indicated that they had engaged in fishing were asked what types of fish were sought on the trip, with more than one species as a possible response. The results are shown in Table 6-6. As can be seen from the table, the 629 groups targeted 916 species. Half of the fishing groups sought speckled trout, and 26 percent sought redfish. Another 10 percent ("Any or All") would take what they could get. The only fresh water species of interest was bass, but they were sought by only nine of the fishing groups.

Table 6-6. Lake Survey Fish Sought

Fish Sought	Number	Percent
Speckled Trout	459	50%
Redfish	234	26%
Any or All	93	10%
Other	55	6%
Drum	27	3%
White Trout	20	2%
Flounder	11	1%
Bass	9	1%
Croakers	8	1%
Total	916	100%

Source: G.E.C., Inc.

The number of fish caught by the 629 groups who engaged in fishing is shown in Table 6-7, with sizes of the most important species. The 629 groups caught 3,835 fish, for an average of six fish per trip. The gafftops and stingrays were incidental catches and were not brought back on boats. The fish sizes are average. Overall, 66 percent of the 629 groups who sought fish caught fish, and 68 percent of the 613 groups who cited fishing as the primary activity caught fish. Of the 629 groups, 60 percent caught the desired species.

Table 6-7. Lake Survey Number of Fish Caught

Fish	Number Caught	Average Size (Inches)	Average Size (Pounds)
Speckled	2,342	16.26	
Redfish	385	19.90	
Croakers	270	9.54	
Drum	235	17.99	
White Trout	233	12.52	
Flounder	83	14.62	
Bass	64	12.2	2.12
Sheephead	26		
Catfish	180		
Gar	2		
Perch	5		
Stingray	4		
Gafftop	6		
Total	3,835		

Source: G.E.C., Inc.

In the 1997 study, 517 groups were involved in fishing, and these targeted 846 species. Speckled trout were the most important, but were sought by only 32 percent of the groups (compared to 50 percent in 2008). Redfish accounted for 23 percent (compared to 26 percent in 2008), and most of the groups who fished for trout also fished for redfish. "Anything and Everything" was the third most important category, at 16 percent. Bass was the most important fresh water species sought in 1997 and 2008; by eight percent of the groups in 1997 and only one percent of the groups in 2008.

Trip Comparisons

All 853 surveyed groups were asked how the present trip compared to previous trips before the Spillway opened in terms of quality. The results are shown in Table 6-8 for the 853 surveyed groups and also in terms of the number of groups who indicated that fishing, pleasure boating, or crabbing was the primary activity. As can be seen from the table, 45.3 percent of the respondents indicated that the question was not applicable (28.4 percent), there was no response (12.1 percent), or the respondent was not sure (4.8 percent). Of the remaining responses, the largest group (26.6 percent) was constituted of persons who said that the trip was about the same as trips before the Spillway opening, followed by 22.8 percent who found the experience diminished or greatly diminished and 5.4 percent who found the experience improved or greatly improved.

Table 6-8. Lake Survey Trip Quality Comparisons

	Primary Activities		Fishing		Pleasure Boating		Crabbing	
Comment	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Greatly Improved	1	0.1%	1	0.2%	0	0%	0	0%
Improved	45	5.3%	40	7%	0	0%	4	5%
Same	227	26.6%	188	31%	21	18%	10	14%
Diminished	190	22.3%	178	29%	1	1%	11	15%
Greatly Diminished	4	0.5%	4	0.7%	0	0%	0	0%
Not Sure	41	4.8%	38	6%	0	0%	3	4%
No Response	103	12.1%	54	9%	24	20%	17	23%
Not Applicable	242	28.4%	110	18%	73	61%	28	38%
Total	853	100%	613	100%	119	100%	73	100%

Source: G.E.C., Inc.

Table 6-8 also shows the disparate effect of Spillway opening on groups whose primary activity was fishing, pleasure boating, or crabbing, which together account for 95 percent of the survey responses. The Spillway opening had a significant negative effect on the quality of fishing trips, a modest negative effect on the quality of crabbing activities (most of which were bankside or nearshore), and no effect on pleasure boating. Even with respect to fishing, the negative effects were not highly dramatic, only 29 percent indicated a diminished experience and only 0.7 percent indicated a greatly diminished experience.

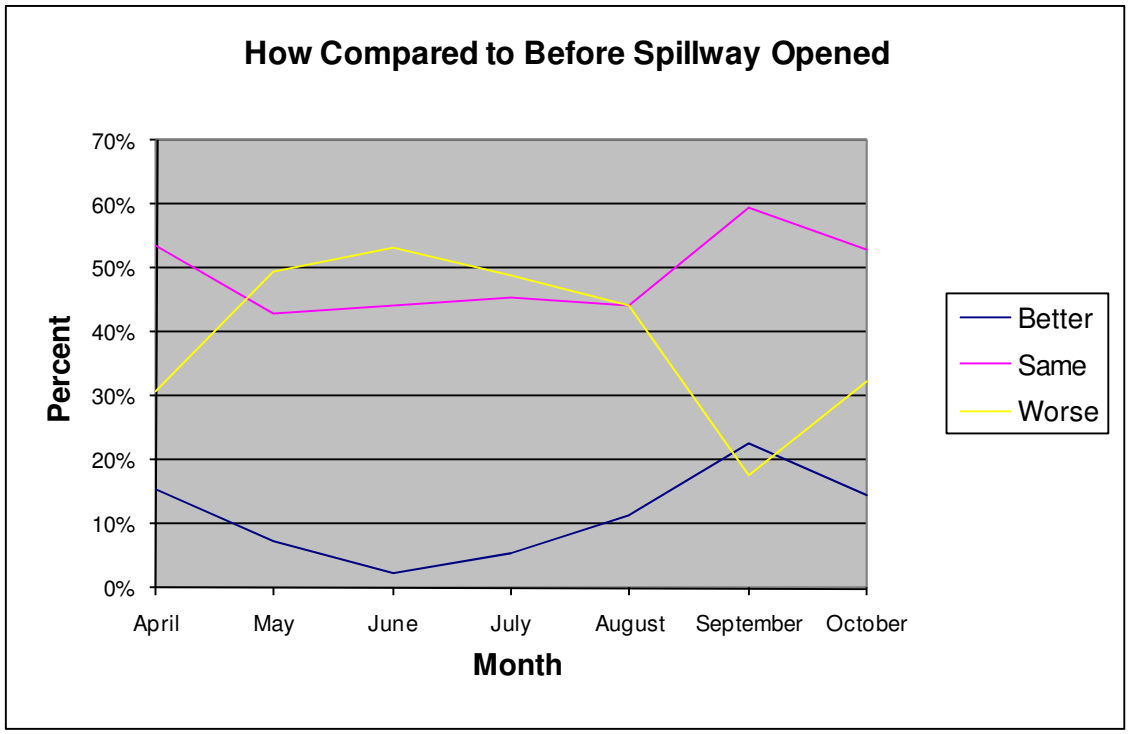
Tables 6-9 and 6-10 use the same responses as table 6-8, but group them into the three categories of better, same, or worse. Table 6-9 eliminates all of the not applicable, no

response, and not sure responses for the 853 surveyed groups and combines the improved and greatly improved categories into a "Better" category and the diminished and greatly diminished categories into a "Worse" category to show trip comparisons by month for the primary activities in relation to trips before the Spillway opening. The data are represented graphically in Figure 6-4. As can be seen from the table and figure, negative experiences peaked in June and fell off dramatically beginning in August. Table 6-10 and Figure 6-5 provide the same perspective for the 613 groups who indicated that fishing was their primary activity. As can be seen from the table and figure, fishing in comparison to pre-Spillway opening was essentially in flat negative territory from May to August, then improved dramatically in September and declined slightly in October.

Table 6-9. Lake Survey Trip Comparisons by Month

	April	May	June	July	August	September	October
Better	15%	7%	2%	5%	11%	23%	15%
Same	54%	43%	44%	46%	44%	60%	53%
Worse	31%	50%	53%	49%	44%	18%	32%

Source: G.E.C., Inc.



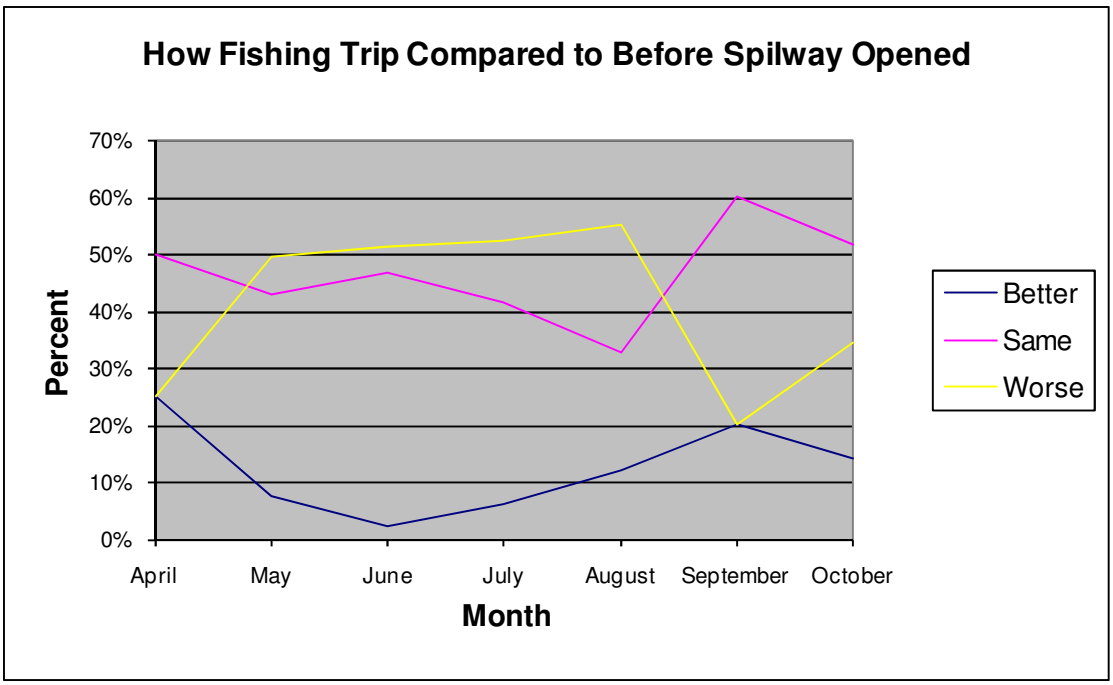
Source: G.E.C., Inc.

Figure 6-4. Lake Survey Trip Comparisons by Month

Table 6-10. Lake Survey Fishing Trip Comparisons by Month

	April	May	June	July	August	September	October
Better	25%	7%	2%	6%	12%	20%	14%
Same	50%	43%	47%	41%	33%	60%	52%
Worse	25%	50%	51%	52%	55%	20%	34%

Source: G.E.C., Inc.



Source: G.E.C., Inc.

Figure 6-5. Lake Survey Fishing Trip Comparisons by Month

The 1997 study did not address trip comparisons for all user groups. For 362 saltwater fishing trips, the 1997 study found that five percent reported very good catches, 15 percent reported good catches, 26 percent reported fair catches, 33 percent reported poor catches, and 20 percent caught no fish at all. This was fairly similar to the 2008 study. The monthly success rates were also fairly similar, particularly when differences in analysis are taken into consideration (particularly the anomalously low number of surveys in April during the 1997 study). With the Spillway opening in March, the 1997 study found the poorest success rates in saltwater fishing in March, May, and June, with increasing success in July, August, and September followed by a slight decline in October (as in the 2008 study).

Area Visited

The 853 surveyed groups were asked where they had gone on the trip. The results are presented in Table 6-11. As can be seen from the table, about 52 percent of the trips had been to various areas in Lake Pontchartrain, followed by 11 percent to Lake Borgne, 10 percent to the Passes Area/Lake Catherine, and six percent to Lake Maurepas and the I-55 canals. Another 21 percent of the respondents went to another place or were uncertain where they had been. Within Lake Pontchartrain, 55 percent of the trips were to the south shore, 27 percent of the trips were to the north shore, 17 percent of the trips were to the eastern portion, and only one percent of trips were to the western portion.

Table 6-11. Lake Survey Area Visited

Area	Number	Percent
South Shore Lake Pontchartrain	242	28%
North Shore Lake Pontchartrain	120	14%
Other	120	14%
Lake Borgne	96	11%
Passes Area/Lake Catherine	88	10%
Eastern Lake Pontchartrain	73	9%
Uncertain	60	7%
Lake Maurepas and I-55 Canals	48	6%
Western Lake Pontchartrain	6	1%
Total	853	100%

Source: G.E.C., Inc.

The Spillway opening had little effect on the selection of the geographic area for visitation. Only 18 percent of the groups indicated that this was not the area that they normally visited, and only three percent (29 groups) indicated that they had gone to an area other than the one normally visited because of the Spillway opening. In responding to an additional question, 82 groups (10 percent) that said that they would have gone elsewhere if the Spillway had not been opened. The discrepancy with the results of the prior question can probably be explained by respondents' disregard of the linkage of this question with the Spillway opening. They were probably simply expressing where they should have gone in relation to where they had gone.

Most of the 82 responses are random and therefore provide no pattern that requires explanation. However, there were 10 groups that went to the south shore of Lake Pontchartrain and said they would have gone elsewhere if the Spillway had not been opened. These appear to have been people who came to the south shore specifically because of the Spillway opening. There were also 30 groups who had gone to the "Other" category and indicated they would have gone to Lake Borgne if the Spillway had not been opened.

Almost all of these groups had fished in Breton Sound because of high winds on Lake Borgne.

In the 1997 study, 24 percent (144) of the surveyed groups indicated that Spillway opening had affected their use of the lakes. When the 144 groups were asked whether they had changed where they fished or recreated to another location in the study area, 23 percent said yes and 77 percent said no. When asked if they had changed to locations outside of the study area, 23 percent said they had. Seven groups said they had changed to new locations both within and outside of the study area. These numbers reflect the same general level of impact as the 2008 study.

Use Changes

The 853 surveyed groups were asked if their use of Lake Pontchartrain or Lake Borgne had changed since the Spillway had opened. The results are shown in Table 6-12. As can be seen from the table, only 113 (13 percent) of the respondents indicated that they had changed usage because of the Spillway opening. The most important change was in the geographic area used (46 respondents), followed by trips not taken that normally would have been taken (27 respondents) and then by decreases in the number of fish caught (16 respondents), which together accounted for 79 percent (89 respondents) of the 113 groups that had changed usage. A small number of notations (17) to this question indicated concerns about dirty water, debris, alligators, snakes, grass, and algae blooms.

Table 6-12. Lake Survey Use Changes

How Changed	Number
Area Used	46
Canceled Trips	27
Decrease in Fish Caught	16
Stopped Coming	6
Activity	6
Less Crabs	4
Change in Fish Sought	3
Boating Rather than Fishing	1
Stopped Skiing Due to Alligators	1
Crabbing Rather than Fishing	1
Fish Caught	1
Using More	1
Total	113

Source: G.E.C., Inc.

In the 1997 study, 24 percent (144) of the surveyed groups indicated that the Spillway opening had affected their use of the lakes. Another 72 percent said it had not, and four percent said it was too soon to tell. Of the 144 groups, approximately one-third indicated that they had changed activities or the kind of fishing to some degree.

Trip Numbers

The 853 surveyed groups were asked about how many trips they had made to Lake Pontchartrain and Lake Borgne since the Spillway opened and how many trips they would have made if the Spillway had not opened. The results are shown in Table 6-13. As can be seen from the table, there was an overall reduction in trips of 15 percent. The primary declines (excluding "Other") were in fishing (777 trips), pleasure boating (119), and crabbing (45). This is not surprising since these activities accounted for 95 percent of the total primary activities. It should be noted that the Spillway opening had a positive effect on the number of sailing trips.

Table 6-13. Lake Survey Changes in Number of Trips Since Spillway Opening

Activity	Total Trips Since Opening	Total Trips if Not Opened	Difference	Percent Change
Fishing	4,304	5,081	-777	-15%
Pleasure Boating	546	665	-119	-18%
Crabbing	328	373	-45	-12%
Other	122	182	-60	-33%
Trawling	99	118	-19	-16%
Jet Skiing	89	90	-1	-1%
Water Skiing	40	48	-8	-17%
Swimming	7	7	0	0%
Sailing	5	3	2	67%
Parasailing	0	0	0	0%
Total	5,540	6,504	-964	-15%

Source: G.E.C., Inc.

The 853 surveyed groups were also asked about how many trips to Lake Pontchartrain and Lake Borgne they normally made in a year, how many trips they expected to make in 2008, and if the difference was caused by the Spillway opening. The results for the first two elements are presented in Table 6-14. As can be seen from the table, the impact expected by respondents in terms of decline in number of trips was large (2,407), but the expected impact in terms of decline in the percentage of trips was small (nine percent). In a separate question concerning causation, only 14 percent (116) of the respondents indicated that the difference between normal years and 2008 was the result of the Spillway opening. Comparison of Table 6-14 (with a nine percent decrease) to Table 6-13 (with a 17 percent

decrease) indicates that some groups intended to make up for trips lost during the Spillway opening.

Table 6-14. Lake Survey Comparison of Trips During 2008 to Normal Year

Activity	Total Trips This Year	Total Trips in Normal Year	Difference	Percent Change
Fishing	17,467	19,102	-1,635	-9%
Pleasure Boating	2,745	3,091	-346	-11%
Crabbing	1,950	2,240	-290	-13%
Trawling	412	475	-63	-13%
Jet Skiing	378	417	-39	-9%
Water Skiing	353	356	-3	-1%
Other	209	242	-33	-14%
Sailing	69	67	2	3%
Swimming	10	10	0	0%
Parasailing	0	0	0	0%
Total	23,593	26,000	-2,407	-9%

Source: G.E.C., Inc.

The 853 surveyed groups were asked if they planned to use areas not impacted by the Spillway opening in the future. One-fifth (169) said that they would, citing 47 different locations, 21 (45 percent) of which are in the study area. The only areas with double-digit responses were Hopedale (20) in the study area and Venice (22), Delacroix (21), and Grand Isle (15) outside of the study area.

In the 1997 study, 18 percent of the respondents indicated that they had reduced their use of lakes Pontchartrain and Borgne since the Spillway opening, and 27 percent indicated that future use would be affected, but with steadily declining percentages in the latter months of the survey. Of the 27 percent who said that future use would be affected, 45 percent indicated that they would change their future recreational activities, and 70 percent said that they would use the lakes less; of these, 29 percent said they would move to another location in the study area and 40 percent said they would change to locations outside of the study area.

Recreation Quality

The 853 surveyed groups were asked how opening of the Spillway affected their recreational enjoyment of lakes Pontchartrain and Borgne. The results are shown in Table 6-15 for the 853 surveyed groups and also in terms of the number of groups indicating that fishing, pleasure boating, or crabbing was the primary activity. As can be seen from the

table, 65 percent of the respondents indicated that there had been no change. However, 29 percent indicated that their enjoyment had been diminished (24 percent) or greatly diminished (five percent), and only 3.5 percent indicated that it had been improved (three percent) or greatly improved (0.5 percent).

Table 6-15. Lake Survey Recreational Quality Assessments

	Primary Activities		Fishing		Pleasure Boating		Crabbing	
Affect Use	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Greatly Improved	4	0.5%	4	1%	0	0%	0	0%
Improved	23	3%	19	3%	1	1%	3	4%
No Change	556	65%	389	63%	89	75%	46	64%
Diminished	205	24%	149	24%	26	22%	18	25%
Greatly Diminished	46	5%	39	6%	0	0%	5	7%
Do Not Use	6	1%	5	1%	1	1%	0	0%
Not Applicable	13	2%	8	1%	2	2%	1	1%
Total	853	100%	613	100%	119	100%	73	101%

Source: G.E.C., Inc.

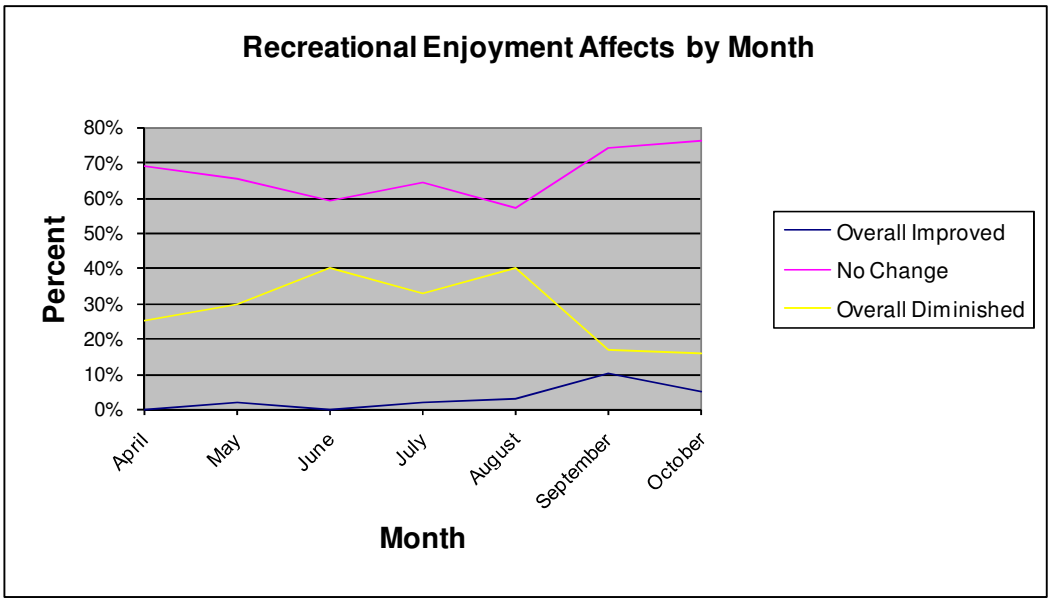
Table 6-15 also shows the different effects of the Spillway opening on groups whose primary activity was fishing, pleasure boating, or crabbing, which together account for 95 percent of the survey responses. The least-affected users were pleasure boaters, of whom three-fourths indicated no change, 22 percent indicated a diminished experience, and one percent indicated an improved experience. There was little difference between the experiences of the fishing and crabbing groups. No change was experienced by 63 percent of the fishing groups, but 30 percent had a diminished (24 percent) or greatly diminished (six percent) experience, and only four percent indicated that they had an improved (three percent) or greatly improved (one percent) experience. Similarly, no change was experienced by 64 percent of the crabbing groups, but 32 percent had a diminished (25 percent) or greatly diminished (seven percent) experience, only four percent indicated that they had an improved experience, and none indicated that they had a greatly improved experience.

The not applicable and do not use responses for the 853 surveyed groups were eliminated; the improved and greatly improved categories were combined into an "Overall Improved" category; and the diminished and greatly diminished categories were combined into an "Overall Diminished" category in Table 6-16 to show trip comparisons by month for the primary activities in relation to the effects of Spillway opening on recreational enjoyment in the lakes. The data are represented graphically in Figure 6-6. As can be seen from the table and figure, negative experiences peaked in June and August, with substantial improvements in the quality of experiences thereafter. Table 6-17 and Figure 6-7 provide the same perspective for the 613 groups who indicated that fishing was their primary activity. As can be seen from the table and figure, negative experiences in relation to fishing peaked in August, with substantial improvements in the quality of the experiences thereafter.

Table 6-16. Lake Survey Recreational Quality Comparisons by Month

	April	May	June	July	August	September	October
Overall Improved	0%	2%	0%	2%	3%	10%	5%
No Change	69%	65%	59%	64%	57%	74%	76%
Overall Diminished	25%	30%	40%	33%	40%	17%	16%

Source: G.E.C., Inc.



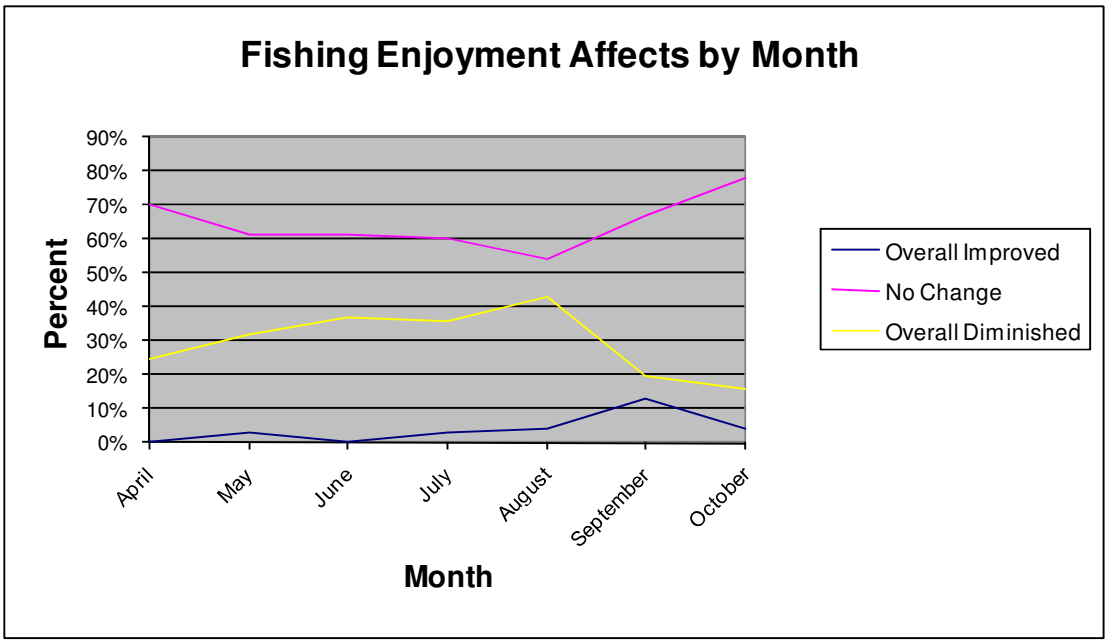
Source: G.E.C., Inc.

Figure 6-6. Lake Survey Recreational Quality Comparisons by Month

Table 6-17. Lake Survey Fishing Quality Comparisons by Month

	April	May	June	July	August	September	October
Overall Improved	0%	3%	0%	3%	4%	13%	4%
No Change	70%	61%	61%	60%	54%	67%	78%
Overall Diminished	25%	32%	37%	36%	43%	20%	16%

Source: G.E.C., Inc.



Source: G.E.C., Inc.

Figure 6-7. Lake Survey Fishing Quality Comparisons by Month

No comparable analysis was performed in the 1997 study.

Concerns and Issues

The 853 surveyed groups were asked whether they had any additional concerns or issues that they would like to express. The results are presented in Table 6-18, with 21 percent (180) presenting comments. Many of the comments clustered in the areas of quality of fishing and the debris, pollution, and algae blooms occasioned by the Spillway opening. Agreement with the opening was expressed by 23 groups, with three in opposition. The category "Corps Project" refers to miscellaneous comments concerning Corps projects such as the suggestion that dikes be erected on the Mississippi River Gulf Outlet.

Table 6-18. Lake Survey Comments on Concerns and Issues

Concern	Number
None	673
Algae Bloom	11
Debris	17
Gas Prices	6
Bad Fishing	14
Better Fishing	15
No Change	14
Corps Project	18
Pollution	10
Against Opening	3
Do Not Use Lake	4
Will Return Later in Year	2
First Time Back	6
Repair/Build New Facilities	9
Duration Spillway Open	8
Improved Next Year	6
Agree with Opening	23
More Grass	1
Need Live Bait	1
Lake is Improving Since Spillway	1
Bad Weather	1
Leave Open	3
Freshwater	5
Trash	2

Source: G.E.C., Inc.

SPILLWAY USERS SURVEY

In addition to its flood control function, the Spillway has developed into an extensively used outdoor recreation area, with approximately 250,000 visitors each year. The public is allowed access provided that their activities do not interfere with the operation and maintenance of the project. The 7,623 acres of land and water provide opportunities for fishing, crawfishing, hunting, dog training, camping, and wildlife watching. More specialized activities include ATV and motorcycle riding, retriever dog field trials, and model airplane flying competitions. The Spillway contains three boat launching sites and a recreational facility and primitive campground provided by St. Charles Parish. Park Ranger staff is on-site to provide visitor assistance and manage the Spillway's natural resources.

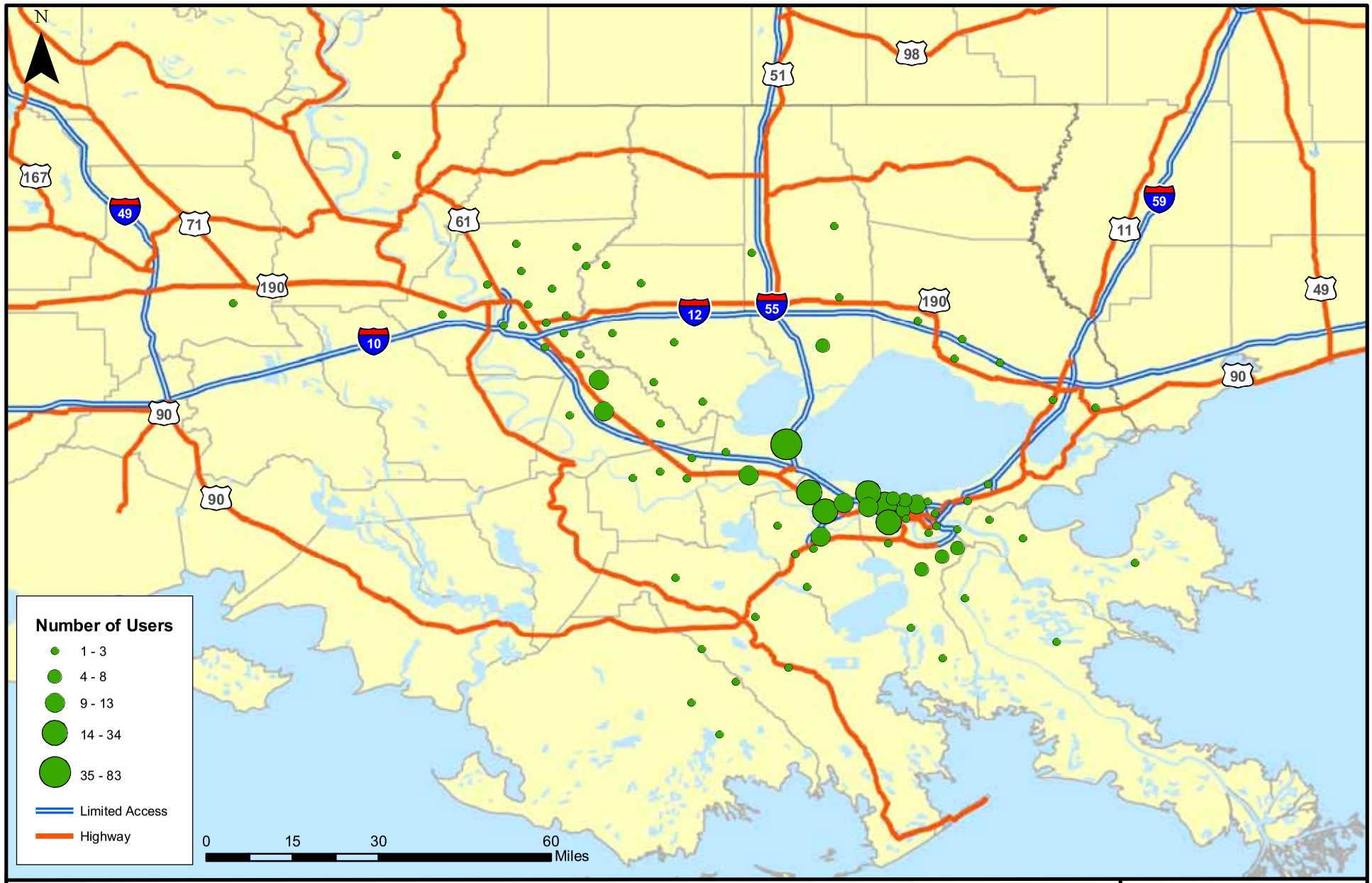
The Spillway was closed on May 8, 2008, and the survey of Spillway users began on June 8, 2008, and extended through the end of October. The surveys were conducted using a formal survey instrument, which can be found in Appendix C. During the five-month period, surveys were completed with 445 groups representing 1,660 persons. Survey respondents were asked to provide zip codes for the area in which they resided. Figure 6-8 shows the comparative intensity of the locations of the survey respondents in Louisiana. As can be seen from the figure, the Spillway users were heavily concentrated in the New Orleans area, but within a band extending along Interstate 10 up to the Baton Rouge area. There were also some recreationists who came in from Mississippi and Texas.

The various areas of the Spillway have developed a degree of differentiation over time based on terrain, natural features, and access, including two designated ATV areas and the St. Charles Parish campground. Because the Spillway is so large, it was necessary to divide it into 10 major areas for the purpose of detailed recreation analysis, as shown in Figure 6-9. This is the same map that was used for the 1997 Spillway opening analysis, with the minor exception of the inclusion in 2008 of the Lake Offshore area. Unlike the Lake Users Survey, which was largely conducted at boat ramps at the conclusion of trips, the Spillway Users Survey was highly dependent on user locations and access and was conducted while the activities were taking place.

Comparisons are made to the 1997 Spillway opening report where possible. The Spillway was opened on March 17 and closed on April 18 in 1997 and opened on April 11 and closed on May 8 in 2008. The Spillway Users Survey was conducted from May through October in 1997 and from June through October in 2008. In both cases, the surveys began in the month following the closure of the Spillway gates. However, 32 survey days were allocated to the 1997 study compared to 16 for the 2008 study. Much of the additional time in 1997 was devoted to observations of recreational activities as contrasted with the conduct of formal surveys.

Group Numbers

In the five-month survey period from June through October, 445 total surveys were completed. The number of groups, number of persons, average group size, number of



BONNET CARRÉ SURVEY RESIDENCES OF RESPONDENTS

Number of Users by Zipcode

GEC

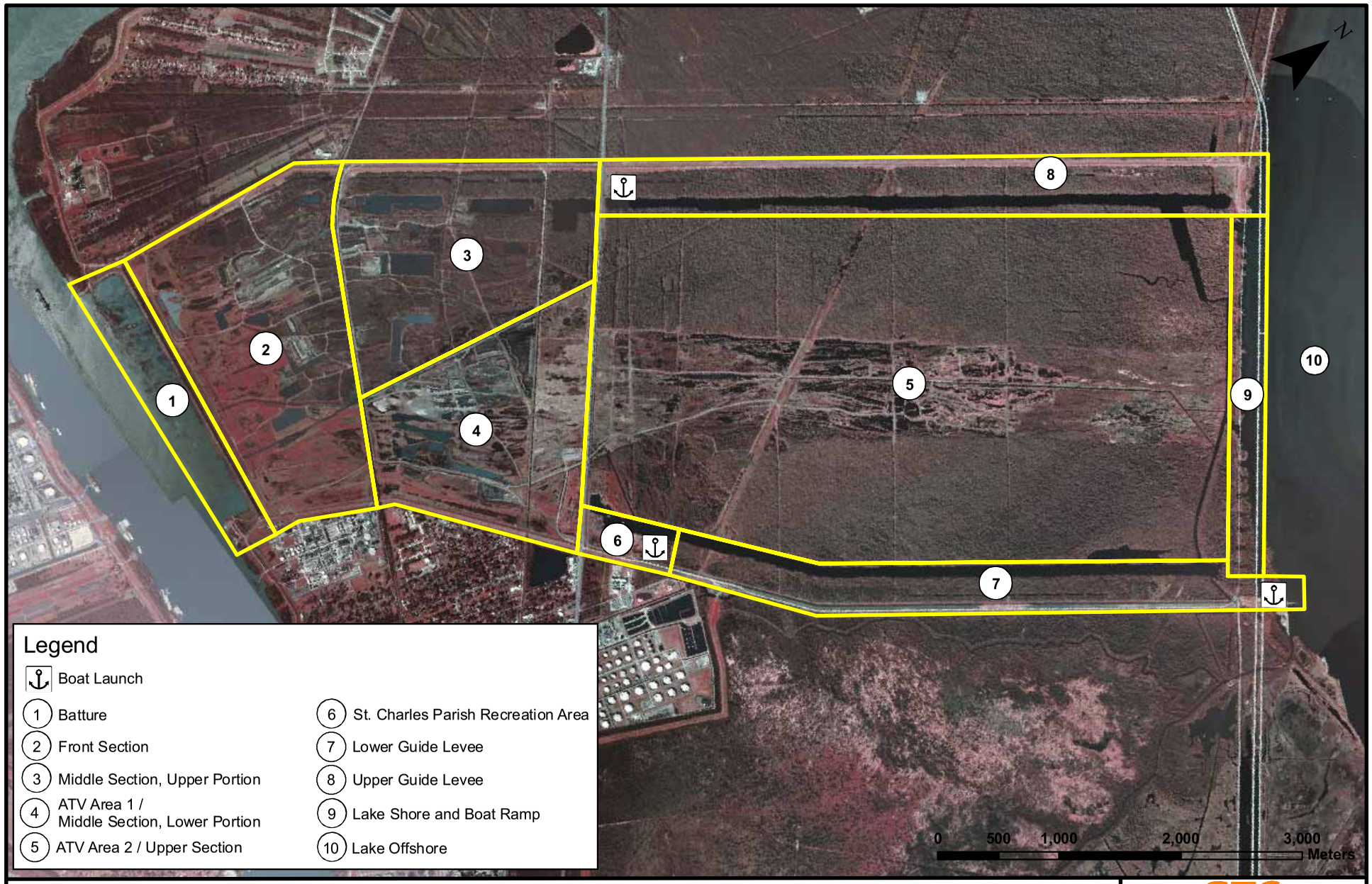
Figure: 6-8

Date: December 2008

Scale:1:1,500,000

Source: ESRI/GEC

Map ID: 27316921-1136



RECREATION SEGMENTS

Bonnet Carré Spillway Recreation Segments

GEC

Figure: 6-9
Date: December 2008
Scale: 1:44,000
Source: USGS/GEC
Map ID: 27316921-990

vehicles, and average number of vehicles per group are shown in Table 6-19. As can be seen from the table, the 445 surveyed groups included 1,660 people with 669 associated vehicles (access vehicles such as automobiles, trucks, and motorcycles, but not on-site recreational vehicles such as ATVs). On average, there were approximately 3.7 people and 1.5 vehicles per group. The largest group size was a party of 100 people who were continuous users of the Spillway for multiple activities using the St. Charles Parish campground as a base. The largest number of vehicles was 14, which were associated with 32 persons (the second largest group) who were also continuous multiple-activity users with the campground as a base.

Table 6-19. Spillway Survey Number of Groups, People, and Vehicles by Month

Month	Number of Groups	Number of People	Average Persons Per Group	Number of Vehicles	Average Vehicles Per Group
June	50	302	6.0	83	1.7
July	25	76	3.0	42	1.7
August	145	570	3.9	237	1.6
September	82	274	3.3	111	1.4
October	143	438	3.1	196	1.4
Total	445	1,660	3.7	669	1.5

Source: G.E.C., Inc.

These results are very similar to those found in 1997. In 1997, 485 groups were surveyed, accounting for 1,686 people with 1,073 associated vehicles. The averages were also fairly similar, with 3.5 people and 2.2 vehicles per group.

Activities

The 445 responding groups were asked what activities they had engaged in, were engaging in, and would be engaging in on the day of the survey. The results are show in Table 6-20, which also shows the number of persons and vehicles involved. The number of groups in the table (593) is higher than the surveyed groups (445) because many of the groups were engaging in more than one activity (for example, picnicking and bank fishing) on the day of the survey. As can be seen from the table, the top five activities by number of participating groups were (in rank order) crabbing, bank fishing, ATV riding, motorcycling, and boating and water skiing, together accounting for two-thirds of the total group activities. In terms of the number of people participating, ATV riding replaced crabbing as the highest ranking activity, and picnicking replaced motorcycling in the top five because of the much higher average number of picnickers (10) compared to motorcyclers (3) in their respective groups. The high numbers for socializing (30 groups and 255 persons) should be noted because the Spillway is a favored location for getting together after work.

The 1997 report recorded much higher numbers for persons and vehicles. The rank order of the top five activities in terms of the number of persons involved was crabbing, boat fishing, ATV riding, picnicking, and socializing. The 1997 study did not include a boating

and skiing category or any category related to boating other than boat fishing. If the numbers of people in engaged in boat fishing and boating and skiing are added together, boating related activities would rank first in the 2008 survey.

Table 6-20. Spillway Survey Number of Groups, People, and Vehicles by Spillway Activity

Activity	Groups	Number of People	Number of Vehicles	Average People per Group	Average Vehicles per Group
Crabbing	103	353	154	3	1
Bank Fishing	85	343	107	4	1
ATV	83	368	152	4	2
Motorcycling	68	227	100	3	1
Boating and Skiing	57	324	81	6	1
Picnicking	35	343	106	10	3
Socializing	30	255	110	9	4
Boat Fishing	27	198	52	7	2
Relaxing	24	134	55	6	2
Bicycling	17	44	21	3	1
Dog Training/Play	12	26	15	2	1
Swimming	11	95	26	9	2
Radio Control Planes	9	10	9	1	1
Sightseeing/Driving	6	14	6	2	1
Jet Skiing	5	14	6	3	1
Crawfishing	4	44	17	11	4
Hunting	4	7	5	2	1
Walking/Hiking	2	4	2	2	1
Camping	2	5	3	3	2
Bird Watching	2	3	2	2	1
Photography	2	3	2	2	1
Catching Bait	2	4	2	2	1
Horseback Riding	1	12	3	12	3
Trawling	1	4	1	4	1
Sunbathing	1	2	1	2	1
4-Wheel Drive	0	0	0	0	0
Total	593	2,836	1,038	5	2

Source: G.E.C., Inc.

Activity Locations

Table 6-21 shows the location of the 445 groups when they were surveyed in terms of the major areas that were identified for detailed recreation analysis (see Figure 6-9). Area 3 (the upper portion of the middle section) does not appear in this table because its entrance was barricaded, and no surveys were conducted in the area. As can be seen from the table, more than half (51 percent) of the surveyed groups accounting for 57 percent of the people were in the St. Charles Parish Recreation Area (Area 6). This area has the most amenities of all the Spillway areas, including a boat launch and pavilion for picnics and socializing. It is contiguous to the town of Norco and is also the most accessible of the areas, with a location just off U. S. Highway 61. It was followed in importance by the lower portion of the middle

section (Area 4), which accounted for 30 percent of the surveyed groups and 30 percent of the people. This area is designed for ATV and motorcycle use, with trails and tracks made specifically for these activities. It includes ATV Area 1, is fronted by the recreation area on the east, is contiguous to the town of Norco, and is easily accessed through U.S. Highway 61.

Table 6-21. Spillway Survey Number of Groups, People, and Vehicles by Spillway Area

Area	Number of Groups	Number of People	Number of Vehicles
Batture	1	1	1
Front Section	14	20	17
Middle Section, Lower Portion/ATV 1	133	497	214
Upper Section/ATV 2	5	15	7
St. Charles Parish Recreation Area	225	947	351
Lower Guide Levee	20	55	21
Upper Guide Levee	32	90	40
Lake Shore and Boat Ramp	13	32	16
Lake Offshore	2	3	2
Total	445	1,660	669

Source: G.E.C., Inc.

The 445 groups were asked about the location of the activities they had engaged in, were engaging in, and would be engaging in on the day of the survey in terms of the major areas identified for detailed recreation analysis (see Figure 6-9). The results are shown in Table 6-22, which also excludes Area 3. As can be seen from the table, the total number of activities (710) is much larger than the number of surveys (445). This is because many groups participated in more than one activity, and some groups participated in the same activity in more than one area.

Table 6-22. Spillway Activities by Area

Activity	Area 1	Area 2	Area 4	Area 5	Area 6	Area 7	Area 8	Area 9	Area 10	Total
Sightseeing/Driving		1			4		1			6
Picnicking					33	2				35
Walking/Hiking					1	1				2
Camping					2					2
Bird Watching					1					1
Photography		1			2			1		4
Bicycling				2	11	13				26
Motorcycling			63	2	1					66
ATV			77	7		1				85
Swimming					10	5				15
Crawfishing			3	1	1					5
Crabbing			2	10	42	26	15	24	8	127
Bank Fishing	1	1	6	2	50	10	13	5	4	92
Boat Fishing				2	18	16	4	8	6	54
Catching Bait					1					1
Boating and Skiing				4	40	35	7	7	4	97
Jet Skiing				1	1	4	2			8
Dog Training/Play		2			8		1			11
Radio Control Planes		8			1					9
Socializing				1	26	1				28
Horseback Riding				1	1					2
Hunting		1		1						2
Relaxing					21	2				23
Sunbathing					1					1
Trawling					1	1		1	4	7
Shrimping									1	1
Total	1	14	151	34	277	117	43	46	27	710

Source: G.E.C., Inc.

Area 6 (the St. Charles Parish Recreation Area) accounted for 39 percent of the total recreation activities, followed by Area 4 at 21 percent and Area 7 at 16 percent; these three areas accounted for more than three-fourths (76 percent) of the total activities. Area 7 extends from the recreation area to the lake, where there is a boat launch, and includes the lower borrow canal and guide levee, which provide ideal conditions for water-based and water-associated recreation. According to the survey results, bank fishing, crabbing, and boating and skiing are the primary activities in Area 6; ATV riding and motorcycling are the primary activities in Area 4 (which includes ATV Area 1); and boating, skiing, and crabbing are the primary activities in Area 7. The least used areas are 1 and 2 on the east, including the Spillway structure and contiguous lands, which are the least accessible portions of the Spillway.

The 1997 study did not record the locations of the surveyed groups or the locations of the recreational activities of the surveyed groups. However, it did involve extensive observations of persons and vehicles and assigned these numbers to activity types in the various Spillway areas. In the 1997 study, Area 6 was the most used (based primarily on boat fishing, picnicking, bank fishing, and socializing), followed by Area 5 (based primarily on bank fishing, picnicking, socializing, and boat fishing) and then by Area 4 (based primarily on ATV riding, motorcycling, 4-wheel driving, and socializing). Area 1 was the least used area (as in the 2008 survey), but Area 2 ranked fourth in terms of number of activities observed.

Activity Evaluations

The 445 groups were asked about the quality of the recreational experience on the day of the survey. Nearly all groups (95 percent) rated their experience as "O.K." or better; 21 percent answered "O.K.", 50 percent answered good, and 24 percent answered great. Three percent did not answer the question, and two percent (eight groups) rated their experience as poor. The ratings did not change over time and were fairly evenly distributed (in terms of the quality of experience) over the areas. Of the eight poor rankings, four were in Area 7 (the lower borrow canal/guide levee), two were in Area 6 (the recreation area), and one was in Area 4 (which includes ATV Area 1). All of the poor rankings were related to the quality of fishing or crabbing on the day of the survey.

Prior Use

There were two questions related to prior use of the Spillway, both indicate that recreational activities in the Spillway are dominated by continuous, frequent users. Of the 445 surveyed groups, 292 (66 percent) indicated that it was not their first trip to the Spillway since it was opened on April 11. This is particularly significant because no groups were interviewed more than once, so the high prior use numbers were not influenced by the selection of respondents. In addition, 408 (92 percent) of the 445 surveyed groups indicated that they had engaged in recreational activities in the Spillway prior to April 11.

The activities prior to April 11 are shown in Table 6-23, including the number of activities by type and the number of times a year that the respondents had participated in

those activities (the number of years was not asked). As can be seen from the table, the most popular activities in past usage have been (in rank order) crabbing, bank fishing, ATV riding, and motorcycling, with crawfishing, boating and skiing, and boat fishing contending for fifth place. The rank order, by number of times a year is bank fishing, crabbing, ATV riding, socializing, and motorcycling. Comparing this table with Table 6-20 above, which shows the activities engaged in on the day of the survey, the relative rankings are quite similar, indicating the usage patterns have been consistent over time.

Table 6-23. Spillway Survey Activities Prior to Opening

Activity	Number of Activities	Total Number of Times a Year	Average Trips Per Year
Crabbing	149	3637	24
Bank Fishing	133	3776	28
ATV	112	2085	19
Motorcycling	73	1618	22
Crawfishing	67	755	11
Boating and Skiing	66	1069	16
Boat Fishing	65	1351	21
Picnicking	36	1148	32
Socializing	33	2021	61
Swimming	32	678	21
Not Applicable	21	0	0
Bicycling	20	867	43
Dog Training/Play	15	528	35
Hunting	15	208	14
Radio Control Planes	10	778	78
Relaxing	10	904	90
Sightseeing/Driving	9	483	54
Jet Skiing	7	83	12
Bird Watching	6	34	6
Catching Bait	5	47	9
Camping	4	27	7
Walking/Hiking	3	270	90
Photography	2	70	35
4-Wheel Drive	2	100	50
Horseback Riding	1	1	1
Archery	1	20	20
Radio Control Cars	1	20	20
Running	1	4	4
Shrimping	1	10	10
Trawling	1	10	10

Source: G.E.C., Inc.

Opening Effects

The similarity of activities prior to the Spillway opening to those since the Spillway opening also suggest that the opening did not affect recreational use patterns. An additional question addressed this issue directly. Only seven of the 445 responding groups indicated that Spillway flooding would change their future use. On the negative side, problems were cited with respect to a dock, ponds, and a closed road. On the positive side, some groups would engage in more fishing because of the increased quality of fishing. In addition, none of the respondents indicated that they would not resume normal use of the Spillway in terms of activity levels. The 45 groups that answered this question as not applicable were either first-time users or were not regular Spillway users. On the other hand (as should be expected), 293 groups (66 percent) indicated that they would have made 2,207 more trips if the Spillway had not been opened, producing an average of about eight lost trips per group. In addition, the Spillway opening appears to have had a temporary effect on group sizes, with 141 groups (32 percent) indicating that, on average, there were six fewer people and two fewer vehicles on the day of the survey in comparison to normal visits.

Desired Facilities/Improvements

The New Orleans District is in the process of developing a new master plan for the Spillway. As a consequence, an additional question was asked to gain insight into facilities and improvements that Spillway users would like to see added to increase their recreational enjoyment. The results are shown in Table 6-24. One-fourth of the respondents did not have any suggestions. The largest desire was for additional bathrooms (15 percent), followed by additional pavilions and shaded areas (10 percent) and running water (nine percent). Most suggestions were for areas 4 and 6 because these are the areas in which recreational activities are concentrated and a majority of the surveys were conducted.

Final Comments

The final question of the survey asked whether the groups had any additional comments. The comments were categorized and are presented in Table 6-25. Most of the respondents had no additional comments, but some had more than one comment. The most common comment (38) was that the respondents appreciated the ability to use the Spillway, and 11 agreed with the Spillway opening (with no dissenting opinions). Suggestions made by at least 10 persons included more trash cans (10), improved access to other parts of the Spillway (11), more patrolling (120), and repair roads or trails (16).

Table 6-24. Additional Facilities/Improvements Suggested by Spillway Users

Additional Facilties Desired	Area 1	Area 2	Area 4	Area 5	Area 6	Area 7	Area 8	Area 9	Area 10	Total	Percent
None		5	31	1	76	2	7			122	25%
Bathrooms	1	1	6		34	12	10	8		72	15%
Shade/Pavilion		5	19	2	18		2	1		47	10%
Running Water			33		9					42	9%
More Trails/Tracks			31							31	6%
Need Trash Cans			4		6	3	5	2	1	21	4%
Picnic Tables			2		10	1	4			17	4%
Improve Launch					9		2	2		13	3%
Fix Road/Trails			1	1	11					13	3%
Barbeque Pits			2		9		1			12	2%
Playground		1			10		1			12	2%
Concession Stand			5		5					10	2%
Lighting					4	1	1	2	1	9	2%
Improve Camp Grounds			1	1	4		1			7	1%
Improve Canal					6					6	1%
Electricity			1		5					6	1%
More Police	1		2		2		1			6	1%
Improve/Add Fishing Pier					2	4				6	1%
Repair Trails			5							5	1%
Other					5					5	1%
Bait Shop		1			3					4	1%
Clean Beaches					2		1			3	1%
More Signs					2					2	0%
Improve Courtesy Dock at Lake						2				2	0%
Separate ATVand Motorcycle Area			2							2	0%
More Access to Ponds			2							2	0%
Target Range					1					1	0%
Improve Swimming Area						1				1	0%
Better Literature on Facility			1							1	0%
Improved Signs			1							1	0%
Fewer Facilities		1								1	0%
More Area for Dog Training		1								1	0%

Source: G.E.C., Inc.

Table 6-25. Additional Comments

Additional Comments	Number of Comments
None	277
Appreciate the Ability to Use Spillway	38
Repair Roads/Trails	16
More Patrolling	12
Improve Access to Other Parts of Spillway	11
Agrees With Opening	11
More Trash Cans	10
Cut Grass	7
Shade/Pavilion	7
Add More to Parks	6
Better/More Markings	6
Separate Areas for ATVs and Motorcycles	5
Boat Launch Needs Repairs	5
Adequate Police Patrols	5
Add Campgrounds	5
More Tracks for ATVs	5
Channels Need Dredging	4
Build Fishing Pier	4
Running Water	3
Improve Website	3
Improved Crawfishing	2
Crabbing Returned to Normal	2
Better Fishing Since Spillway was Opened	1
More Convient Camping Permits	1
Happy to See Portable Bathrooms	1
Keep Horses off Bike Trail	1
Permanent Bathrooms	1
Boat Rentals	1
Lighting	1
Barbeque Pits	1
Separate Areas for Skiers and Fishermen	1
Open Truck Trails Again	1
Allow for Use at Night	1
Worse Crabbing	1

Source: G.E.C., Inc.

CONCLUSIONS

Lake Users Survey

The surveyed lake users were primarily residents of the north and south shores of Lake Pontchartrain, and fishing for speckled trout in Lake Pontchartrain was the primary recreational activity. Other important uses included pleasure boating and crabbing. According to the respondents, the Spillway opening had a negative effect on the quality of fishing from May through July and caused a modest reduction in the number of fishing trips taken and a modest shift in the areas fished. The shift was primarily from the west to east as the lake users moved to Seabrook and into Lake Borgne from western Lake Pontchartrain areas. Crabbing was also negatively affected, but partly because many of the interviewed crabbers operated from banks or piers. Pleasure boating was not affected.

The results of the opening in 2008 are similar to those of the 1997 opening.

Spillway Users Survey

Spillway users tend to be continuous, frequent users concentrated in the New Orleans area. The primary uses are crabbing, bank fishing, ATV riding, motorcycling, picnicking, and boating and water skiing. The Spillway was unusable for many activities while the diversion of water from the Mississippi River occurred. When the Spillway gates were closed, many people enjoyed the improvements in fishing and crawfishing. Once all of the areas that had been open prior to the flooding were reopened, Spillway users continued with their normal activities. The primary effects of Spillway opening were a minor reduction in the number of trips that would have been made and a temporary reduction in the number of people per group.

The results of the opening in 2008 are similar to those of the 1997 opening.

LITERATURE CITED

U.S. Army Corps of Engineers (USACE). 1998. Biological and Recreational Monitoring of the Impacts of the 1997 Opening of the Bonnet Carré Spillway Southeastern Louisiana. Final Report Contract No. DACW29-96-D0009.

SECTION 7 – CONCLUSIONS

SECTION 7 – CONCLUSIONS

FISHERIES

The data indicated that the opening of the Bonnet Carré Spillway in 2008 had little overall effect on the distribution of fishes and aquatic organisms. Trawl catches of bay anchovy, blue crab, and brown shrimp in Lake Pontchartrain and bay anchovy, Atlantic croaker, northern white shrimp, and sand seatrout in Lake Borgne were higher in 2008 than in the other years tested. Trawl catches of gulf menhaden in Lake Pontchartrain and blue crab, gulf menhaden, hardhead catfish, and northern brown shrimp in Lake Borgne were not significantly different. The only species with significantly lower catches in 2008 after the Spillway opening were Atlantic croaker and sand seatrout in Lake Pontchartrain and spot in Lake Borgne. Gillnet catches of gulf menhaden and hardhead catfish, and seine catches of bay anchovy, gulf menhaden, and inland silversides were not significantly different among the years tested. Catches of some of the less abundant species may have been lower in 2008 after the Spillway opening, but these species were collected in insufficient numbers to analyze.

Differences in catches during 2008 do not necessarily imply a cause and effect. Numerous factors affect fish and invertebrate populations in Lake Pontchartrain and Lake Borgne. Decreases in salinity are governed by direct rainfall on the lakes, and indirect rainfall affecting riverine input into the area. Salinity increases are affected by the passage of cold fronts resulting in frontal return of higher salinity water, hurricanes, and tropical storms creating storm surges.

Catches naturally vary among years, months, and locations. Environmental conditions such as salinity, turbidity and water temperature are variable and are affected by many factors. High river discharges in the late winter and spring and the storm surges such as that from Hurricanes Gustav and Ike in late August and September likely affected distributions.

By definition, estuaries are dynamic systems where fresh water and salt water mix. Many of the organisms present in the estuaries are adapted to changes in salinity and other environmental conditions. The mobile organisms can simply move to areas where conditions are more suitable. Sessile animals, such as oysters and other bivalves, may be more susceptible to environmental changes. Lake Pontchartrain is an oligohaline estuary, with salinities generally ranging from 0 to 5 ppt. Salinities in Lake Borgne and waters south of Mississippi Sound are higher since Lake Borgne is open to the Gulf of Mexico. The input of freshwater into Lake Pontchartrain should not have a large effect on the already low salinities in this area.

In 2008, fewer Spillway bays were open, and the Spillway opening was a shorter duration than some of the previous openings. During 1997, more bays were open and the Spillway was open for a slightly longer duration. Larger and longer Spillway openings (such

as in 1945, 1950, 1973, 1979, and 1983) may have more of an effect on fish and crustaceans than the effects seen in this study and studies of the 1997 opening.

RECREATION

Lake Users Survey

The surveyed lake users were primarily residents of the north and south shores of Lake Pontchartrain, with fishing for speckled trout in Lake Pontchartrain as the primary recreational activity. Other important uses include pleasure boating and crabbing. According to the respondents, the Spillway opening had a negative effect on the quality of fishing from May through July and caused a modest reduction in the number of fishing trips taken and a modest shift in the areas fished. Crabbing was also negatively affected, but partly because many of the interviewed crabbers were operating from banks or piers. Pleasure boating was not affected.

The results of the opening in 2008 are similar to those of the opening in 1997.

Spillway Users Survey

Spillway users tend to be continuous, frequent users concentrated in the New Orleans area. The primary uses are crabbing, bank fishing, ATV riding, motorcycling, picnicking, and boating and water skiing. The Spillway was unusable for many activities while the diversion of water from the Mississippi River was taking place. When the Spillway gates were closed, many people enjoyed the improvements in fishing and crawfishing. Once all of the areas that had been open prior to the flooding were reopened, Spillway users continued with their normal activities. The primary effects of Spillway opening were a minor reduction in the number of trips that would have been made and a temporary reduction in the number of people per group.

The results of the opening in 2008 are similar to those of the opening in 1997.

SECTION 8 – RECOMMENDATIONS

SECTION 8 – RECOMMENDATIONS

Some suggestions for evaluating future Bonnet Carré spillway openings follow.

FISHERIES DATA

Ideally, a sampling program should be designed to specifically test for spillway opening effects. Samples should be collected on a regular basis, preferably every two weeks, at the same stations within Lake Pontchartrain. Replicate samples should be taken at each station. Samples collected during years when the spillway is closed would provide a baseline for evaluating effects when the spillway is opened. Trawls could be used to sample, although any sampling gear used will be selective for, or against, certain species or types of species. Ideally, more than one gear would be used to sample.

RECREATIONAL USER DATA

There is no baseline information on use of the lakes or the Spillway. In the case of the Lake Users Survey, it is possible that some fishermen who use Lake Pontchartrain regularly did not do so because of the Spillway opening and therefore would not have been encountered in the surveys. Consequently, the negative effects of Spillway opening on lake users could be underestimated. The absence of a baseline for both surveys was rectified to some degree by asking questions about prior use. However, it is difficult to determine the significance of negative responses when comparisons are made between generalized experiences and those specific to a particular time period and place. Consequently, it is recommended that a study be conducted during a year in which the Spillway is not opened to get a better perspective on the normal levels of use, activities, and enjoyment of both the lake and Spillway users.

Appendix A

LDWF TRAWL, SEINE, AND GILLNET SAMPLING

Table A-1. Species collected by all gears in all studies.

Common name	Scientific name
alligator gar	*Atractosteus spatula*
American eel	*Anguilla rostrata*
Atlantic brief squid	*Lolliguncula brevis*
Atlantic bumper	*Chloroscombrus chrysurus*
Atlantic croaker	*Micropogonias undulatus*
Atlantic cutlassfish	*Trichiurus lepturus*
Atlantic herring	*Clupea harengus*
Atlantic midshipman	*Porichthys plectrodon*
Atlantic moonfish	*Selene setapinnis*
Atlantic mud crab	*Panopeus herbstii*
Atlantic needlefish	*Strongylura marina*
Atlantic spadefish	*Chaetodipterus faber*
Atlantic stingray	*Dasyatis sabina*
Atlantic thread herring	*Opisthonema oglinum*
Atlantic threadfin	*Polydactylus octonemus*
aviu shrimp	*Acetes americanus*
banded drum	*Larimus fasciatus*
bank cusk eel	*Ophidion holbrooki*
bay anchovy	*Anchoa mitchilli*
bay whiff	*Citharichthys spilopterus*
bayou killifish	*Fundulus pulvereus*
bigclaw snapping shrimp	*Alpheus heterochaelis*
bigeye searobin	*Prionotus longispinosus*
bighead searobin	*Prionotus tribulus*
black buffalo	*Ictiobus niger*
black crappie	*Pomoxis nigromaculatus*
black drum	*Pogonias cromis*
blackcheek tonguefish	*Symphurus plagiusa*
blackedge cusk eel	*Lepophidium brevibarbe*
blue catfish	*Ictalurus furcatus*
blue crab	*Callinectes sapidus*
bluefish	*Pomatomus saltatrix*
bluegill	*Lepomis macrochirus*
bluntnose jack	*Hemicaranx amblyrhynchus*
bonnethead (shark)	*Sphyrna tiburo*
butterfish	*Peprilus triacanthus*
chain pipefish	*Syngnathus louisianae*
channel catfish	*Ictalurus punctatus*
clown goby	*Microgobius gulosus*
clupeid sp.	*Clupeidae*
code goby	*Gobiosoma robustum*
common grass shrimp	*Palaemonetes vulgaris*
cownose ray	*Rhinoptera bonasus*
crappie	*Pomoxis spp*
crested blenny	*Hypleurochilus geminatus*
crested cusk eel	*Ophidion josephi*
crevalle jack	*Caranx hippos*
daggerblade grass shrimp	*Palaemonetes pugio*
darter goby	*Ctenogobius boleosoma*
diamond killifish	*Adinia xenica*

Table A-1. Species collected by all gears in all studies.

Common name	Scientific name
diamondback terrapin	*Malaclemys terrapin*
donax shells	*Donax spp.*
dusky anchovy	*Anchoa lyolepis*
eastern oyster	*Crassostrea virginica*
fat sleeper	*Dormitator maculatus*
florida stone crab	*Menippe mercenaria*
freckled blenny	*Hypsoblennius ionthas*
freshwater catfish	*Ictalurus spp.*
freshwater drum	*Aplodinotus grunniens*
freshwater goby	*Ctenogobius shufeldti*
frillfin goby	*Bathygobius soporator*
fringed flounder	*Etropus crossotus*
gafftopsail catfish	*Bagre marinus*
gizzard shad	*Dorosoma cepedianum*
goby spp.	*Gobiidae*
golden topminnow	*Fundulus chrysotus*
grass shrimp spp.	*Palaemonetes spp.*
gray snapper	*Lutjanus griseus*
green goby	*Microgobius thalassinus*
green sunfish	*Lepomis cyanellus*
gulf butterfish	*Peprilus burti*
gulf killifish	*Fundulus grandis*
gulf kingfish	*Menticirrhus littoralis*
gulf menhaden	*Brevoortia patronus*
gulf pipefish	*Syngnathus scovelli*
gulf stone crab	*Menippe adina*
gulf toadfish	*Opsanus beta*
halfbeak	*Hyporhamphus unifasciatus*
hardhead catfish	*Ariopsis felis*
Harris mud crab	*Rhithropanopeus harrisii*
harvestfish	*Peprilus paru*
hogchoker	*Trinectes maculatus*
inland silverside	*Menidia beryllina*
inshore lizardfish	*Synodus foetens*
jack sp.	*Carangidae*
ladyfish	*Elops saurus*
lane snapper	*Lutjanus synagris*
largemouth bass	*Micropterus salmoides*
largescaled spinycheek sleeper	*Eleotris amblyopsis*
least killifish	*Heterandria formosa*
least puffer	*Sphoeroides parvus*
leatherjacket	*Oligoplites saurus*
lined sole	*Achirus lineatus*
longnose gar	*Lepisosteus osseus*
longnose killifish	*Fundulus similis*
lookdown	*Selene vomer*
mantis shrimp	*Squilla empusa*
mud crab spp.	*Micropanope spp.*
naked goby	*Gobiosoma bosc*
naked sand darter	*Ammocrypta beani*

Table A-1. Species collected by all gears in all studies.

Common name	Scientific name
northern brown shrimp	*Farfantepenaeus aztecus*
northern hog sucker	*Hypentelium nigricans*
northern pink shrimp	*Farfantepenaeus duorarum*
northern white shrimp	*Litopenaeus setiferus*
pinfish	*Lagodon rhomboides*
planehead filefish	*Stephanolepis hispidus*
rainwater killifish	*Lucania parva*
red drum	*Sciaenops ocellatus*
redear sunfish	*Lepomis microlophus*
river shiner	*Notropis blennius*
river shrimp	*Macrobrachium ohione*
riverine grass shrimp	*Palaemonetes paludosus*
rock sea bass	*Centropristis philadelphica*
rough silverside	*Membras martinica*
roughneck shrimp spp.	*Rimapenaeis spp.*
sailfin molly	*Poecilia latipinna*
saltmarsh topminnow	*Fundulus jenkinsi*
sand seatrout	*Cynoscion arenarius*
sand snapping shrimp	*Alpheus floridanus*
scaled sardine	*Harengula jaguana*
seabob	*Xiphopenaeus kroyeri*
sharptail goby	*Gobionellus hastatus*
sheepshead	*Archosargus probatocephalus*
sheepshead minnow	*Cyprinodon variegatus*
shortnose gar	*Lepisosteus platostomus*
shrimp eel	*Ophichthus gomesi*
silver jenny	*Eucinostomus gula*
silver perch	*Bairdiella chrysoura*
silver seatrout	*Cynoscion nothus*
skilletfish	*Gobiesocidae*
skilletfish	*Gobiesox strumosus*
skipjack herring	*Alosa chrysochloris*
southern flounder	*Paralichthys lethostigma*
southern hake	*Urophycis floridana*
southern kingfish	*Menticirrhus americanus*
southern puffer	*Sphoeroides nephelus*
southern stingray	*Dasyatis americana*
spanish mackerel	*Scomberomorus maculatus*
spanish sardine	*Sardinella aurita*
speckled worm eel	*Myrophis punctatus*
spot	*Leiostomus xanthurus*
spotted bass	*Micropterus punctulatus*
spotted gar	*Lepisosteus oculatus*
spotted seatrout	*Cynoscion nebulosus*
star drum	*Stellifer lanceolatus*
stone crab spp	*Menippe spp*
striped anchovy	*Anchoa hepsetus*
striped bass	*Morone saxatilis*
striped blenny	*Chasmodes bosquianus*
striped burrfish	*Chilomycterus schoepfii*

Table A-1. Species collected by all gears in all studies.

Common name	Scientific name
striped mullet	*Mugil cephalus*
texas cichlid	*Herichthys cyanoguttatus*
threadfin shad	*Dorosoma petenense*
violet goby	*Gobioides broussoneti*
warmouth	*Lepomis gulosus*
western mosquitofish	*Gambusia affinis*
white bass	*Morone chrysops*
white mullet	*Mugil curema*
yellow bass	*Morone mississippiensis*

Table A-2. Catch per unit effort (CPUE) of abundant species in Lake Pontchartrain Trawls.

Bay anchovy CPUE by trawl in Lake Pontchartrain

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	.	102	120	48	.	13	6	32	9
February	.	34	263	121	.	28	0	203	231
March-April	.	45	86	90	.	240	45	128	121
April-May	.	42	50	120	.	124	140	210	182
June	.	102	213	108	.	451	322	388	973
July	38	543	279	.	.	1,010	384	850	846
August	207	904	184	.	.	470	221	1,315	1,370
September	354	627	801	.	157	.	.	1,118	1,139
October	433	728	337	.	190	.	.	602	696
November	190	424	259	.	145	4	.	313	.
December	84	366	126	.	100	4	.	510	.

Atlantic croaker CPUE by trawl in Lake Pontchartrain

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	.	0	0	38	.	2	0	1	0
February	.	0	8	5	.	3	0	0	2
March-April	.	4	11	25	.	4	3	13	18
April-May	.	56	16	60	.	43	3	41	34
June	.	3	5	20	.	4	31	62	28
July	1	32	2	.	.	3	10	5	17
August	0	1	6	.	.	7	4	6	16
September	0	8	1	.	1	.	.	1	4
October	0	23	4	.	0	.	.	2	2
November	0	12	13	.	11	0	.	1	.
December	0	15	5	.	2	0	.	1	.

Table A-2. Continued.

Gulf menhaden CPUE by trawl in Lake Pontchartrain

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	.	0	0	0	.	0	0	0	0
February	.	2	4	27	.	1	0	0	3
March-April	.	22	15	10	.	47	1	3	4
April-May	.	21	12	26	.	98	3	17	12
June	.	6	15	10	.	5	6	1	3
July	0	1	0	.	.	9	0	0	2
August	0	0	0	.	.	0	0	0	2
September	0	0	0	.	1	.	.	0	1
October	0	0	0	.	0	.	.	0	0
November	0	0	0	.	1	0	.	0	.
December	0	0	0	.	0	0	.	0	.

Sand seatrout CPUE by trawl in Lake Pontchartrain

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	.	0	0	1	.	0	0	0	0
February	.	0	0	0	.	0	0	0	0
March-April	.	0	0	0	.	0	0	0	0
April-May	.	5	1	5	.	4	1	0	1
June	.	1	0	2	.	2	8	170	8
July	0	2	0	.	.	1	1	0	3
August	0	0	0	.	.	1	2	0	1
September	0	1	0	.	2	.	.	0	8
October	0	1	1	.	1	.	.	0	1
November	0	1	0	.	1	0	.	0	.
December	0	0	1	.	1	0	.	0	.

Table A-2. Continued.

Blue crab CPUE by trawl in Lake Pontchartrain

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	.	0	0	1	.	0	0	0	0
February	.	0	0	0	.	0	0	0	0
March-April	.	0	0	1	.	0	0	1	0
April-May	.	0	0	1	.	1	0	0	67
June	.	0	0	0	.	0	0	1	2
July	0	1	0	.	.	0	1	1	3
August	0	0	0	.	.	0	1	1	2
September	0	0	0	.	1	.	.	1	3
October	0	0	0	.	0	.	.	1	2
November	0	0	1	.	4	0	.	0	.
December	0	0	1	.	1	0	.	0	.

Northern brown shrimp CPUE by trawl in Lake Pontchartrain

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	.	0	0	0	.	0	0	0	0
February	.	0	0	0	.	0	0	0	0
March-April	.	0	0	0	.	0	0	0	0
April-May	.	22	0	0	.	1	1	6	4
June	.	0	0	0	.	0	2	13	33
July	0	4	0	.	.	0	0	0	3
August	0	0	1	.	.	0	0	0	1
September	0	0	0	.	0	.	.	0	0
October	0	0	0	.	0	.	.	0	0
November	0	0	0	.	1	0	.	0	.
December	0	0	0	.	0	0	.	0	.

Table A-3. Catch per unit effort (CPUE) of abundant species in Lake Borgne trawls.

Northern brown shrimp CPUE by trawl in Lake Borgne

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	0	0	0	1	0	0	0	1	0
February	0	0	0	0	0	0	0	1	0
March-April	6	2	0	0	0	0	6	4	12
April-May	404	155	249	145	167	87	156	132	355
June	65	124	69	67	58	56	198	42	110
July	17	12	9	6	9	15	1	9	6
August	10	11	1	1	4	3	0	3	1
September	10	10	5	3	2	.	0	0	2
October	8	7	19	2	2	6	.	1	5
November	2	5	10	1	7	3	.	1	0
December	0	6	3	0	0	0	.	0	.

Northern white shrimp CPUE by trawl in Lake Borgne

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	0	0	1	2	1	1	43	2	0
February	0	0	2	1	0	0	0	1	1
March-April	0	0	2	4	3	4	8	2	3
April-May	1	0	3	8	4	6	40	11	42
June	0	1	1	14	10	9	21	6	30
July	7	2	43	25	43	22	164	49	66
August	6	8	153	24	77	144	99	60	42
September	39	8	19	124	38	.	77	24	107
October	16	16	55	80	44	152	.	25	250
November	5	14	76	19	33	86	.	17	55
December	0	54	34	6	0	16	.	8	.

Table A-3. Continued.

Blue crab CPUE by trawl in Lake Borgne

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	7	1	2	2	1	1	3	1	0
February	1	1	4	1	50	2	1	2	1
March-April	1	1	4	6	4	2	3	0	1
April-May	1	2	4	11	4	1	10	2	1
June	1	2	7	6	7	2	7	11	6
July	2	4	4	2	2	2	6	5	2
August	1	1	1	2	2	1	3	3	2
September	2	1	2	3	2	.	2	0	1
October	1	2	2	2	1	2	.	1	4
November	2	3	4	1	3	1	.	1	1
December	10	2	6	19	0	2	.	0	.

Bay anchovy CPUE by trawl in Lake Borgne

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	34	50	247	142	131	120	46	359	0
February	64	23	254	249	57	124	88	77	94
March-April	189	64	93	116	183	100	156	522	187
April-May	92	66	246	85	151	99	108	250	243
June	66	74	68	106	169	106	149	225	464
July	68	77	167	119	497	181	116	369	362
August	219	85	172	127	361	199	38	235	751
September	98	83	104	100	316	.	46	722	972
October	179	62	102	209	422	273	.	882	1,964
November	145	79	175	150	810	234	.	204	1,003
December	12	144	174	141	208	23	.	752	.

Table A-3. Continued.

Atlantic croaker CPUE by trawl in Lake Borgne

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	1	7	5	9	2	80	5	92	3
February	9	15	12	13	24	47	5	49	51
March-April	45	43	75	50	29	114	41	94	77
April-May	146	67	93	62	41	99	34	65	74
June	2	16	6	8	12	23	12	19	11
July	1	2	2	5	3	5	7	5	45
August	1	3	2	9	2	6	3	4	89
September	1	2	1	3	2	.	4	1	94
October	0	1	1	1	1	1	.	1	0
November	0	12	5	0	10	2	.	5	12
December	0	22	14	3	2	5	.	0	.

Spot CPUE by trawl in Lake Borgne

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	0	0	0	1	0	1	0	0	0
February	4	12	0	1	0	4	0	3	1
March-April	4	226	1	0	0	3	0	3	4
April-May	19	18	24	0	1	10	1	4	4
June	4	8	1	0	1	2	2	2	5
July	1	0	0	0	0	0	1	0	5
August	0	0	0	0	1	1	0	1	3
September	0	1	0	0	0	.	0	1	1
October	0	1	0	0	0	2	.	2	2
November	0	3	1	0	1	3	.	1	3
December	0	0	11	0	0	3	.	4	.

Table A-3. Continued.

Gulf menhaden CPUE by trawl in Lake Borgne

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	1	0	1	0	0	3	1	17	0
February	0	0	4	3	4	1	5	1	18
March-April	11	4	8	10	6	11	5	7	2
April-May	17	2	4	15	9	7	2	1	1
June	0	2	25	1	1	3	0	0	1
July	1	5	11	1	1	2	0	0	1
August	0	1	0	3	1	1	0	0	1
September	0	1	0	0	1	.	0	0	0
October	0	0	0	0	1	0	.	0	1
November	0	0	0	0	0	0	.	0	0
December	0	0	0	0	1	3	.	0	.

Sand seatrout CPUE by trawl in Lake Borgne

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	0	0	0	0	0	0	1	0	0
February	0	0	0	0	0	1	0	0	0
March-April	1	0	1	0	0	2	1	0	0
April-May	6	6	82	21	28	19	14	15	47
June	13	6	24	25	14	26	42	57	106
July	4	2	14	11	6	11	25	64	39
August	6	9	23	17	12	25	9	21	11
September	35	14	39	16	14	.	15	6	29
October	8	7	8	15	13	13	.	8	11
November	3	4	1	4	9	4	.	6	11
December	0	8	1	1	0	1	.	0	.

Table A-3. Continued.

Hardhead catfish CPUE by trawl in Lake Borgne

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	0	0	0	0	0	0	0	0	0
February	0	0	1	0	0	0	0	0	0
March-April	1	1	1	1	0	1	0	1	1
April-May	1	0	1	1	1	0	1	0	0
June	2	0	0	0	0	0	4	0	0
July	7	0	4	2	0	2	10	3	3
August	33	13	9	4	18	2	3	3	12
September	21	5	6	16	32	.	2	2	13
October	0	1	2	3	2	0	.	0	1
November	0	1	0	0	0	0	.	0	0
December	0	0	0	0	0	0	.	0	.

Table A-4. Catch per unit effort (CPUE) of abundant species in Lake Pontchartrain and Bayou Deedie gillnet samples.

Gulf menhaden CPUE by gill net

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	0	0	0	0	0	0	0	0	0
February	0	0	6	0	0	1	1	0	0
March-April	0	11	18	4	0	1	6	11	8
April-May	2	36	5	18	0	12	29	22	5
June	0	12	2	0	1	9	0	3	61
July	1	27	0	1	0	39	4	1	7
August	1	3	2	0	4	0	0	0	12
September	24	7	17	0	6	18	0	5	21
October	1	4	18	0	5	0	.	1	35
November	2	0	4	0	2	0	.	1	2
December	0	3	1	0	1	0	.	3	.

Hardhead catfish CPUE by gill net

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0
March-April	1	2	1	0	2	0	0	1	0
April-May	22	2	3	5	6	2	24	7	11
June	4	5	4	33	2	2	5	4	13
July	2	1	1	5	1	4	8	6	10
August	1	3	2	1	1	1	2	3	8
September	1	1	4	1	0	10	2	3	4
October	0	1	2	0	0	1	.	2	3
November	0	0	0	0	0	0	.	0	0
December	0	0	0	0	0	0	.	0	.

Table A-5. Catch per unit effort (CPUE) of abundant species in Lake Pontchartrain seines.

Bay anchovy CPUE by seine in Lake Pontchartrain

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	.	2	27	1	.	1	0	36	0
February	.	2	52	69	.	1	1	0	3
March-April	.	191	207	352	.	0	6	79	23
April-May	.	138	92	119	.	1	0	40	8
June	.	102	162	19	.	0	1	11	8
July	43	26	74	.	.	0	3	42	8
August	379	204	81	.	.	0	0	0	31
September	97	20	72	.	.	.	.	10	69
October	202	92	137	.	3	8	.	66	657
November	98	222	157	.	0	64	.	16	.
December	17	111	79	.	0	2	.	80	.

Gulf menhaden CPUE by seine in Lake Pontchartrain

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	.	1	0	1	.	0	1	1	0
February	.	317	14	10	.	7	5	0	48
March-April	.	773	80	69	.	1	5	102	5
April-May	.	910	498	399	.	1,257	450	1,062	386
June	.	422	403	4	.	329	27	24	2
July	1	10	15	.	.	1	2	1	4
August	4	6	2	.	.	0	0	0	0
September	0	1	1	.	.	.	.	0	12
October	0	17	0	.	0	0	.	0	1
November	0	1	0	.	1	0	.	0	.
December	1	0	0	.	0	0	.	0	.

Table A-5. Continued.

Inland silverside CPUE by seine in Lake Pontchartrain

SAMPMON	2000	2001	2002	2003	2004	2005	2006	2007	2008
January	.	11	13	76	.	1	12	76	35
February	.	60	162	72	.	3	8	77	10
March-April	.	132	84	64	.	9	9	87	45
April-May	.	138	54	72	.	2	8	48	31
June	.	212	184	86	.	1	5	47	48
July	68	21	174	.	.	0	2	15	33
August	27	5	146	.	.	0	0	2	4
September	22	30	250	.	.	.	.	9	10
October	242	78	66	.	1	0	.	32	17
November	276	253	175	.	1	25	.	57	.
December	137	46	106	.	2	14	.	42	.

Table A-6. Analyses of Variance for abundant organisms collected in Lake Pontchartrain trawls.

---------- COMMNAME=ATLANTIC CROAKER ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	4	2001 2002 2007 2008
SAMPMON	6	5 6 7 8 9 10

Number of Observations Read 335
Number of Observations Used 335

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	23	293.0247433	12.7402062	8.24	<.0001
Error	311	480.7206537	1.5457256		
Corrected Total	334	773.7453970			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.378710	67.64253	1.243272	1.838004

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	3	38.7998295	12.9332765	8.37	<.0001
SAMPMON	5	164.9753328	32.9950666	21.35	<.0001
YEAR*SAMPMON	15	89.2495810	5.9499721	3.85	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	25.3415269	8.4471756	5.46	0.0011
SAMPMON	5	166.2380357	33.2476071	21.51	<.0001
YEAR*SAMPMON	15	89.2495810	5.9499721	3.85	<.0001

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	15.89204222	15.89204222	10.28	0.0015

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	25.3415269	8.4471756	1.42	0.2761
SAMPMON	5	166.2380357	33.2476071	5.59	0.0042

Table A-6. Continued

---------- COMMNAME=BAY ANCHOVY ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	4	2001 2002 2007 2008
SAMPMON	6	5 6 7 8 9 10

Number of Observations Read 335
Number of Observations Used 335

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	23	493.287029	21.447262	9.54	<.0001
Error	311	699.384393	2.248824		
Corrected Total	334	1192.671422			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.413598	29.60303	1.499608	5.065725

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	3	214.1970596	71.3990199	31.75	<.0001
SAMPMON	5	208.8567776	41.7713555	18.57	<.0001
YEAR*SAMPMON	15	70.2331918	4.6822128	2.08	0.0106

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	135.7903534	45.2634511	20.13	<.0001
SAMPMON	5	201.6712188	40.3342438	17.94	<.0001
YEAR*SAMPMON	15	70.2331918	4.6822128	2.08	0.0106

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	47.85474315	47.85474315	21.28	<.0001

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	135.7903534	45.2634511	9.67	0.0008
SAMPMON	5	201.6712188	40.3342438	8.61	0.0005

Table A-6. Continued.

---------- COMMNAME=BLUE CRAB ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	4	2001 2002 2007 2008
SAMPMON	6	5 6 7 8 9 10

Number of Observations Read 335
Number of Observations Used 335

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	23	22.5270219	0.9794357	1.93	0.0072
Error	311	157.9043394	0.5077310		
Corrected Total	334	180.4313612			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.124851	198.0004	0.712552	0.359874

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	3	19.27082972	6.42360991	12.65	<.0001
SAMPMON	5	1.03229050	0.20645810	0.41	0.8441
YEAR*SAMPMON	15	2.22390165	0.14826011	0.29	0.9959

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	18.95047193	6.31682398	12.44	<.0001
SAMPMON	5	0.96425632	0.19285126	0.38	0.8625
YEAR*SAMPMON	15	2.22390165	0.14826011	0.29	0.9959

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	14.63753188	14.63753188	28.83	<.0001

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	18.95047193	6.31682398	42.61	<.0001
SAMPMON	5	0.96425632	0.19285126	1.30	0.3153

Table A-6. Continued.

---------- COMMNAME=GULF MENHADEN ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	4	2001 2002 2007 2008
SAMPMON	6	5 6 7 8 9 10

Number of Observations Read 335
Number of Observations Used 335

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	23	128.9556448	5.6067672	5.56	<.0001
Error	311	313.5918446	1.0083339		
Corrected Total	334	442.5474894			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.291394	160.3235	1.004158	0.626333

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	3	10.7319360	3.5773120	3.55	0.0149
SAMPMON	5	111.4199020	22.2839804	22.10	<.0001
YEAR*SAMPMON	15	6.8038068	0.4535871	0.45	0.9626

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	5.0576635	1.6858878	1.67	0.1730
SAMPMON	5	108.9552050	21.7910410	21.61	<.0001
YEAR*SAMPMON	15	6.8038068	0.4535871	0.45	0.9626

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	3.40912167	3.40912167	3.38	0.0669

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	5.0576635	1.6858878	3.72	0.0352
SAMPMON	5	108.9552050	21.7910410	48.04	<.0001

Table A-6. Continued.

---------- COMMNAME=NORTHERN BROWN SHRIMP ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	4	2001 2002 2007 2008
SAMPMON	6	5 6 7 8 9 10

Number of Observations Read 335
Number of Observations Used 335

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	23	143.0739465	6.2206064	8.12	<.0001
Error	311	238.2036744	0.7659282		
Corrected Total	334	381.2776209			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.375249	156.5083	0.875173	0.559186

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	3	22.81863592	7.60621197	9.93	<.0001
SAMPMON	5	55.20052089	11.04010418	14.41	<.0001
YEAR*SAMPMON	15	65.05478965	4.33698598	5.66	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	14.95823232	4.98607744	6.51	0.0003
SAMPMON	5	46.20549648	9.24109930	12.07	<.0001
YEAR*SAMPMON	15	65.05478965	4.33698598	5.66	<.0001

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	9.24627097	9.24627097	12.07	0.0006

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	14.95823232	4.98607744	1.15	0.3613
SAMPMON	5	46.20549648	9.24109930	2.13	0.1177

Table A-6. Continued.

---------- COMMNAME=SAND SEATROUT ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	4	2001 2002 2007 2008
SAMPMON	6	5 6 7 8 9 10

Number of Observations Read 335
Number of Observations Used 335

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	23	66.1351104	2.8754396	4.67	<.0001
Error	311	191.5635828	0.6159601		
Corrected Total	334	257.6986932			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.256637	156.0570	0.784831	0.502913

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	3	23.17461487	7.72487162	12.54	<.0001
SAMPMON	5	13.33304644	2.66660929	4.33	0.0008
YEAR*SAMPMON	15	29.62744905	1.97516327	3.21	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	25.79351251	8.59783750	13.96	<.0001
SAMPMON	5	9.04014695	1.80802939	2.94	0.0132
YEAR*SAMPMON	15	29.62744905	1.97516327	3.21	<.0001

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	22.81242718	22.81242718	37.04	<.0001

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	25.79351251	8.59783750	4.35	0.0215
SAMPMON	5	9.04014695	1.80802939	0.92	0.4973

Table A-7. Analyses of variance for abundant organisms collected in Lake Borgne and south of Mississippi Sound Trawls.

---------- COMMNAME=ATLANTIC CROAKER ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	7	2000 2001 2002 2003 2004 2007 2008
SAMPMON	7	5 6 7 8 9 10 11

Number of Observations Read 609
Number of Observations Used 609

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	48	1010.869839	21.059788	17.63	<.0001
Error	560	669.006111	1.194654		
Corrected Total	608	1679.875951			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.601753	69.27618	1.093002	1.577746

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	6	85.7816913	14.2969486	11.97	<.0001
SAMPMON	6	792.0120333	132.0020055	110.49	<.0001
YEAR*SAMPMON	36	133.0761149	3.6965587	3.09	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	86.8243484	14.4707247	12.11	<.0001
SAMPMON	6	753.0930092	125.5155015	105.06	<.0001
YEAR*SAMPMON	36	133.0761149	3.6965587	3.09	<.0001

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	64.62751270	64.62751270	54.10	<.0001

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	86.8243484	14.4707247	3.91	0.0041
SAMPMON	6	753.0930092	125.5155015	33.95	<.0001

Table A-7. Continued.

---------- COMMNAME=BAY ANCHOVY ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	7	2000 2001 2002 2003 2004 2007 2008
SAMPMON	7	5 6 7 8 9 10 11

Number of Observations Read 609
Number of Observations Used 609

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	48	273.615012	5.700313	1.57	0.0103
Error	560	2034.156676	3.632423		
Corrected Total	608	2307.771688			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.118562	46.43144	1.905892	4.104743

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	6	124.1166176	20.6861029	5.69	<.0001
SAMPMON	6	43.8549937	7.3091656	2.01	0.0622
YEAR*SAMPMON	36	105.6434008	2.9345389	0.81	0.7816

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	112.8686994	18.8114499	5.18	<.0001
SAMPMON	6	46.4537749	7.7422958	2.13	0.0482
YEAR*SAMPMON	36	105.6434008	2.9345389	0.81	0.7816

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	43.06021708	43.06021708	11.85	0.0006

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	112.8686994	18.8114499	6.41	0.0001
SAMPMON	6	46.4537749	7.7422958	2.64	0.0318

Table A-7. Continued.

---------- COMMNAME=BLUE CRAB ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	7	2000 2001 2002 2003 2004 2007 2008
SAMPMON	7	5 6 7 8 9 10 11

Number of Observations Read 609
Number of Observations Used 609

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	48	76.6727885	1.5973498	2.05	<.0001
Error	560	436.1665590	0.7788689		
Corrected Total	608	512.8393475			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.149506	109.6455	0.882535	0.804899

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	6	16.95035242	2.82505874	3.63	0.0015
SAMPMON	6	23.06572287	3.84428715	4.94	<.0001
YEAR*SAMPMON	36	36.65671318	1.01824203	1.31	0.1121

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	9.02306491	1.50384415	1.93	0.0739
SAMPMON	6	20.75413388	3.45902231	4.44	0.0002
YEAR*SAMPMON	36	36.65671318	1.01824203	1.31	0.1121

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	0.77234861	0.77234861	0.99	0.3198

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	9.02306491	1.50384415	1.48	0.2138
SAMPMON	6	20.75413388	3.45902231	3.40	0.0093

Table A-7. Continued.

---------- COMMNAME=GULF MENHADEN ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	7	2000 2001 2002 2003 2004 2007 2008
SAMPMON	7	5 6 7 8 9 10 11

Number of Observations Read 609
Number of Observations Used 609

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	48	60.5352989	1.2611521	1.89	0.0004
Error	560	373.2871546	0.6665842		
Corrected Total	608	433.8224535			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.139539	219.0518	0.816446	0.372718

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	6	9.73745336	1.62290889	2.43	0.0248
SAMPMON	6	33.27280832	5.54546805	8.32	<.0001
YEAR*SAMPMON	36	17.52503726	0.48680659	0.73	0.8772

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	6.59741616	1.09956936	1.65	0.1313
SAMPMON	6	30.22839822	5.03806637	7.56	<.0001
YEAR*SAMPMON	36	17.52503726	0.48680659	0.73	0.8772

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	0.00291551	0.00291551	0.00	0.9473

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	6.59741616	1.09956936	2.26	0.0595
SAMPMON	6	30.22839822	5.03806637	10.35	<.0001

Table A-7. Continued.

---------- COMMNAME=HARDHEAD CATFISH ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	7	2000 2001 2002 2003 2004 2007 2008
SAMPMON	7	5 6 7 8 9 10 11

Number of Observations Read 609
Number of Observations Used 609

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	48	194.2337003	4.0465354	4.79	<.0001
Error	560	473.0976062	0.8448172		
Corrected Total	608	667.3313064			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.291060	146.6266	0.919139	0.626857

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	6	11.3790531	1.8965089	2.24	0.0377
SAMPMON	6	148.1175783	24.6862631	29.22	<.0001
YEAR*SAMPMON	36	34.7370688	0.9649186	1.14	0.2651

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	7.8353651	1.3058942	1.55	0.1610
SAMPMON	6	143.6364329	23.9394055	28.34	<.0001
YEAR*SAMPMON	36	34.7370688	0.9649186	1.14	0.2651

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	0.00623961	0.00623961	0.01	0.9315

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	7.8353651	1.3058942	1.35	0.2597
SAMPMON	6	143.6364329	23.9394055	24.81	<.0001

Table A-7. Continued.

---------- COMMNAME=NORTHERN BROWN SHRIMP ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	7	2000 2001 2002 2003 2004 2007 2008
SAMPMON	7	5 6 7 8 9 10 11

Number of Observations Read 609
Number of Observations Used 609

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	48	1237.122959	25.773395	15.29	<.0001
Error	560	944.173126	1.686023		
Corrected Total	608	2181.296085			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.567150	58.98283	1.298470	2.201437

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	6	65.899837	10.983306	6.51	<.0001
SAMPMON	6	1086.396212	181.066035	107.39	<.0001
YEAR*SAMPMON	36	84.826910	2.356303	1.40	0.0649

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	60.635685	10.105947	5.99	<.0001
SAMPMON	6	1091.011871	181.835312	107.85	<.0001
YEAR*SAMPMON	36	84.826910	2.356303	1.40	0.0649

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	0.18958910	0.18958910	0.11	0.7375

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	60.635685	10.105947	4.29	0.0023
SAMPMON	6	1091.011871	181.835312	77.17	<.0001

Table A-7. Continued.

---------- COMMNAME=NORTHERN WHITE SHRIMP ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	7	2000 2001 2002 2003 2004 2007 2008
SAMPMON	7	5 6 7 8 9 10 11

Number of Observations Read 609
Number of Observations Used 609

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	48	660.438607	13.759138	6.66	<.0001
Error	560	1156.265968	2.064761		
Corrected Total	608	1816.704575			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.363537	76.96035	1.436928	1.867101

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	6	251.3379531	41.8896589	20.29	<.0001
SAMPMON	6	322.0683332	53.6780555	26.00	<.0001
YEAR*SAMPMON	36	87.0323202	2.4175645	1.17	0.2315

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	208.6197949	34.7699658	16.84	<.0001
SAMPMON	6	315.6557531	52.6092922	25.48	<.0001
YEAR*SAMPMON	36	87.0323202	2.4175645	1.17	0.2315

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	115.4205559	115.4205559	55.90	<.0001

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	208.6197949	34.7699658	14.38	<.0001
SAMPMON	6	315.6557531	52.6092922	21.76	<.0001

Table A-7. Continued.

---------- COMMNAME=SAND SEATROUT ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	7	2000 2001 2002 2003 2004 2007 2008
SAMPMON	7	5 6 7 8 9 10 11

Number of Observations Read 609
Number of Observations Used 609

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	48	209.221679	4.358785	2.05	<.0001
Error	560	1193.152740	2.130630		
Corrected Total	608	1402.374419			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.149191	80.27614	1.459668	1.818308

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	6	88.69377673	14.78229612	6.94	<.0001
SAMPMON	6	54.25253785	9.04208964	4.24	0.0003
YEAR*SAMPMON	36	66.27536452	1.84098235	0.86	0.6970

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	66.52420899	11.08736817	5.20	<.0001
SAMPMON	6	58.22360307	9.70393384	4.55	0.0002
YEAR*SAMPMON	36	66.27536452	1.84098235	0.86	0.6970

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	36.34958323	36.34958323	17.06	<.0001

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	66.52420899	11.08736817	6.02	0.0002
SAMPMON	6	58.22360307	9.70393384	5.27	0.0006

Table A-7. Continued.

---------- COMMNAME=SPOT ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	7	2000 2001 2002 2003 2004 2007 2008
SAMPMON	7	5 6 7 8 9 10 11

Number of Observations Read 609
Number of Observations Used 609

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	48	166.5499427	3.4697905	5.02	<.0001
Error	560	387.0489410	0.6911588		
Corrected Total	608	553.5988837			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.300849	171.8998	0.831360	0.483630

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	6	38.24437436	6.37406239	9.22	<.0001
SAMPMON	6	75.05026218	12.50837703	18.10	<.0001
YEAR*SAMPMON	36	53.25530619	1.47931406	2.14	0.0002

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	27.05250199	4.50875033	6.52	<.0001
SAMPMON	6	70.85046588	11.80841098	17.08	<.0001
YEAR*SAMPMON	36	53.25530619	1.47931406	2.14	0.0002

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	8.68135180	8.68135180	12.56	0.0004

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	27.05250199	4.50875033	3.05	0.0163
SAMPMON	6	70.85046588	11.80841098	7.98	<.0001

Table A-8. Analyses of Variance for abundant organisms collected in Lake Pontchartrain and Bayou Deedie gillnet samples.

GILL NET

---------- COMMNAME=GULF MENHADEN ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	6	2001 2002 2005 2006 2007 2008
SAMPMON	3	5 7 8

Number of Observations Read 149
Number of Observations Used 149

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	58.0115026	3.4124413	1.67	0.0569
Error	131	268.2004109	2.0473314		
Corrected Total	148	326.2119135			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.177834	148.5926	1.430850	0.962935

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	5	18.99426854	3.79885371	1.86	0.1065
SAMPMON	2	13.10651584	6.55325792	3.20	0.0439
YEAR*SAMPMON	10	25.91071820	2.59107182	1.27	0.2564

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	5	20.90063572	4.18012714	2.04	0.0769
SAMPMON	2	14.08128581	7.04064291	3.44	0.0350
YEAR*SAMPMON	10	25.91071820	2.59107182	1.27	0.2564

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	3.59778961	3.59778961	1.76	0.1873

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	5	20.90063572	4.18012714	1.61	0.2429
SAMPMON	2	14.08128581	7.04064291	2.72	0.1142

Table A-8. Continued.

---------- COMMNAME=HARDHEAD CATFISH ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	6	2001 2002 2005 2006 2007 2008
SAMPMON	3	5 7 8

Number of Observations Read 149
Number of Observations Used 149

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	22.0434374	1.2966728	0.90	0.5804
Error	131	189.6911826	1.4480243		
Corrected Total	148	211.7346200			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.104109	139.2124	1.203339	0.864390

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	5	14.13520658	2.82704132	1.95	0.0900
SAMPMON	2	0.43009646	0.21504823	0.15	0.8621
YEAR*SAMPMON	10	7.47813435	0.74781344	0.52	0.8761

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	5	12.63833691	2.52766738	1.75	0.1286
SAMPMON	2	0.55527105	0.27763552	0.19	0.8258
YEAR*SAMPMON	10	7.47813435	0.74781344	0.52	0.8761

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	4.06366933	4.06366933	2.81	0.0963

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	5	12.63833691	2.52766738	3.38	0.0479
SAMPMON	2	0.55527105	0.27763552	0.37	0.6990

Table A-9. Analyses of Variance for abundant organisms collected in Lake Pontchartrain seines.

---------- COMMNAME=BAY ANCHOVY ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	4	2001 2002 2007 2008
SAMPMON	6	5 6 7 8 9 10

Number of Observations Read 129
Number of Observations Used 129

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	23	142.2551787	6.1850078	1.62	0.0523
Error	105	400.4019081	3.8133515		
Corrected Total	128	542.6570869			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.262146	72.89255	1.952780	2.678985

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	3	16.64769674	5.54923225	1.46	0.2311
SAMPMON	5	49.83473286	9.96694657	2.61	0.0287
YEAR*SAMPMON	15	75.77274912	5.05151661	1.32	0.2007

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	17.71721376	5.90573792	1.55	0.2063
SAMPMON	5	49.65299864	9.93059973	2.60	0.0291
YEAR*SAMPMON	15	75.77274912	5.05151661	1.32	0.2007

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	1.83896621	1.83896621	0.48	0.4889

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	17.71721376	5.90573792	1.17	0.3544
SAMPMON	5	49.65299864	9.93059973	1.97	0.1426

Table A-9. Continued.

---------- COMMNAME=GULF MENHADEN ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	4	2001 2002 2007 2008
SAMPMON	6	5 6 7 8 9 10

Number of Observations Read 129
Number of Observations Used 129

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	23	276.5572664	12.0242290	2.73	0.0003
Error	105	463.0615102	4.4101096		
Corrected Total	128	739.6187767			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.373919	136.3291	2.100026	1.540409

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	3	6.6764331	2.2254777	0.50	0.6799
SAMPMON	5	243.3634187	48.6726837	11.04	<.0001
YEAR*SAMPMON	15	26.5174146	1.7678276	0.40	0.9761

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	10.3641483	3.4547161	0.78	0.5058
SAMPMON	5	242.9336614	48.5867323	11.02	<.0001
YEAR*SAMPMON	15	26.5174146	1.7678276	0.40	0.9761

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	3.13162232	3.13162232	0.71	0.4013

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	10.3641483	3.4547161	1.95	0.1643
SAMPMON	5	242.9336614	48.5867323	27.48	<.0001

Table A-9. Continued.

LAKE PONTCHARTRAIN SEINE

---------- COMMNAME=INLAND SILVERSIDE ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	4	2001 2002 2007 2008
SAMPMON	6	5 6 7 8 9 10

Number of Observations Read 129
Number of Observations Used 129

The GLM Procedure

Dependent Variable: NUMBER

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	23	106.4057117	4.6263353	1.38	0.1400
Error	105	352.7605115	3.3596239		
Corrected Total	128	459.1662231			

R-Square	Coeff Var	Root MSE	NUMBER Mean
0.231737	73.42249	1.832928	2.496412

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	3	19.01369283	6.33789761	1.89	0.1364
SAMPMON	5	63.60221899	12.72044380	3.79	0.0034
YEAR*SAMPMON	15	23.78979986	1.58598666	0.47	0.9497

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	21.89570304	7.29856768	2.17	0.0956
SAMPMON	5	62.92404025	12.58480805	3.75	0.0037
YEAR*SAMPMON	15	23.78979986	1.58598666	0.47	0.9497

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
2008 VS. OTHER YEARS	1	3.38102861	3.38102861	1.01	0.3181

Tests of Hypotheses Using the Type III MS for YEAR*SAMPMON as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	3	21.89570304	7.29856768	4.60	0.0178
SAMPMON	5	62.92404025	12.58480805	7.94	0.0008

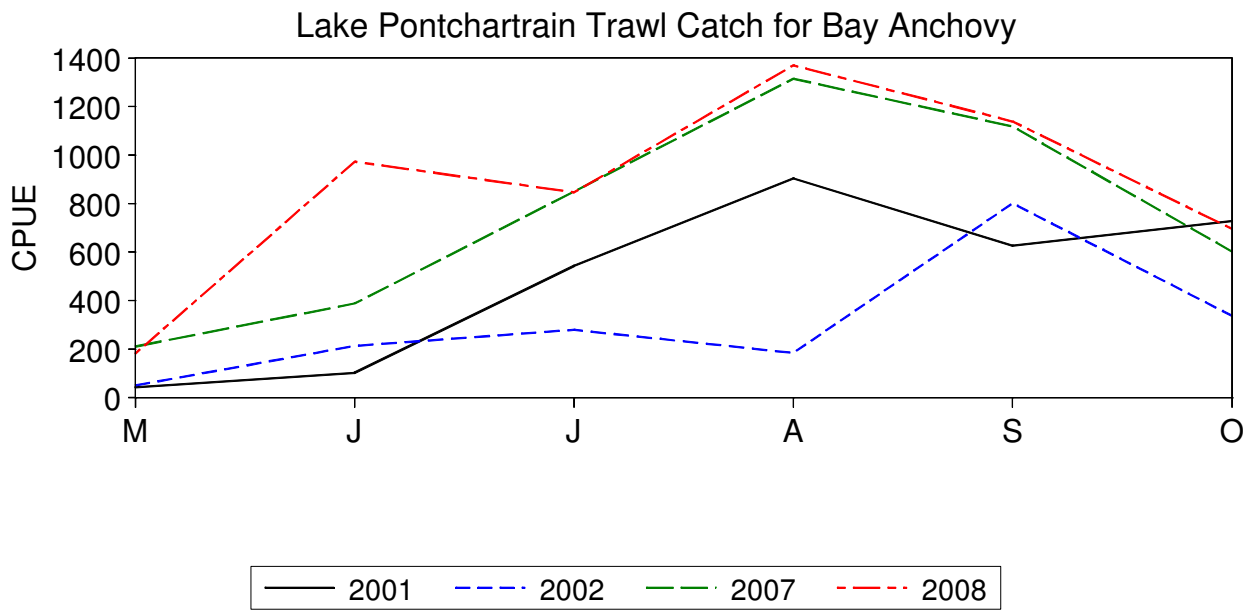


Figure A-1a. CPUE Used in Lake Pontchartrain Trawl ANOVA

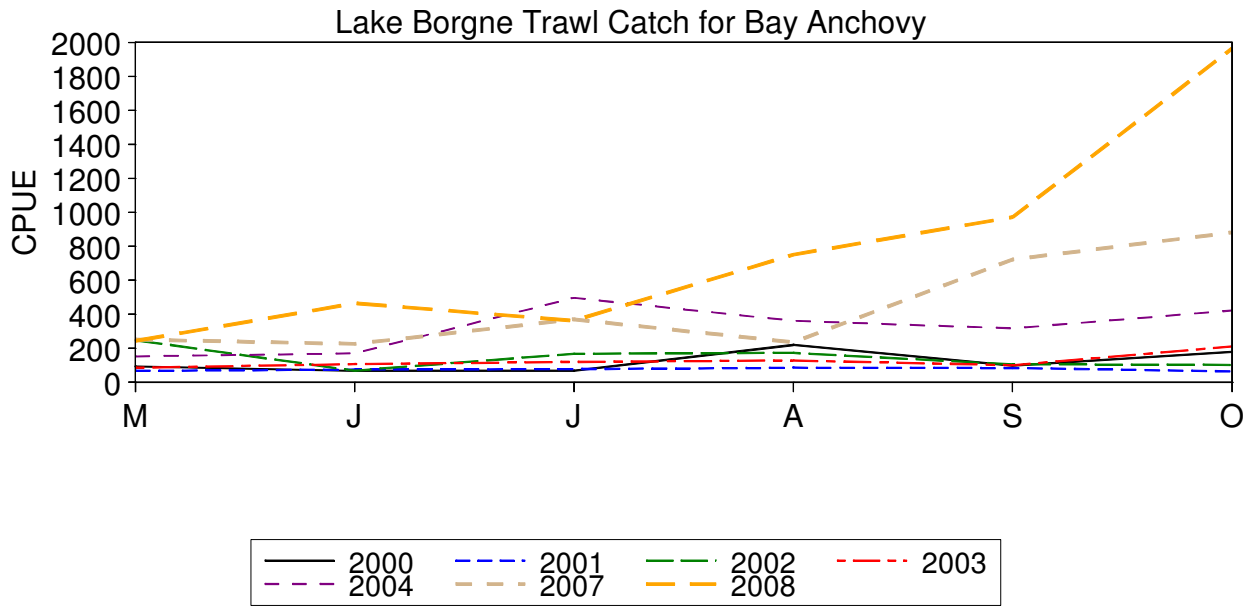


Figure A-1b. CPUE Used in Lake Borgne Trawl ANOVA

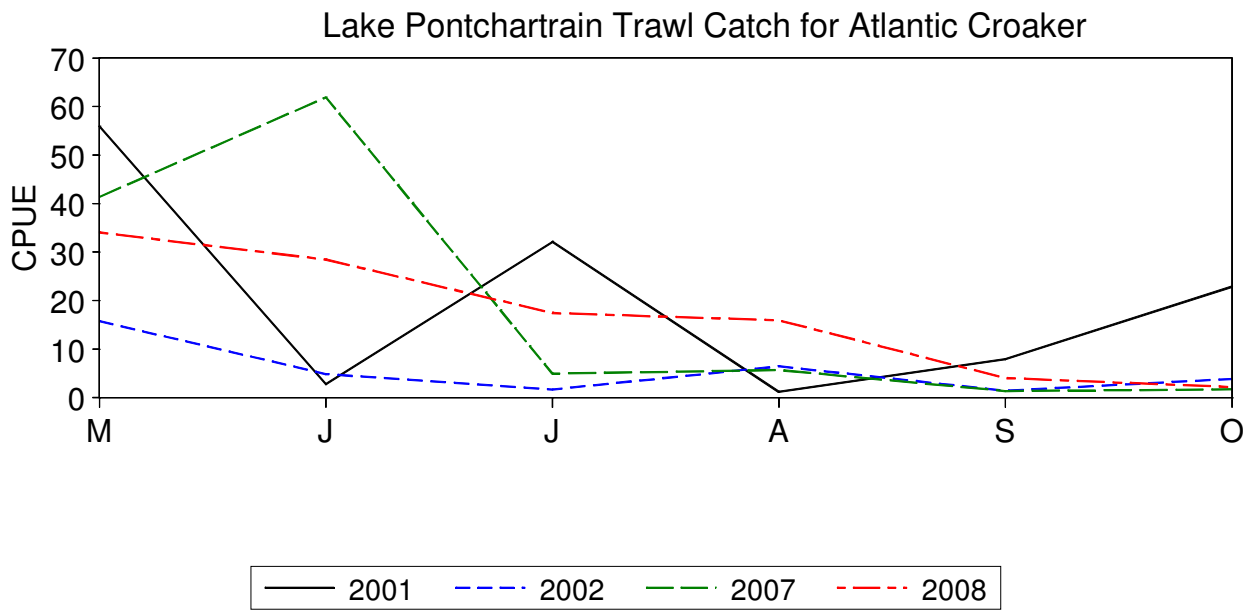


Figure A-1c. CPUE Used in Lake Pontchartrain Trawl ANOVA

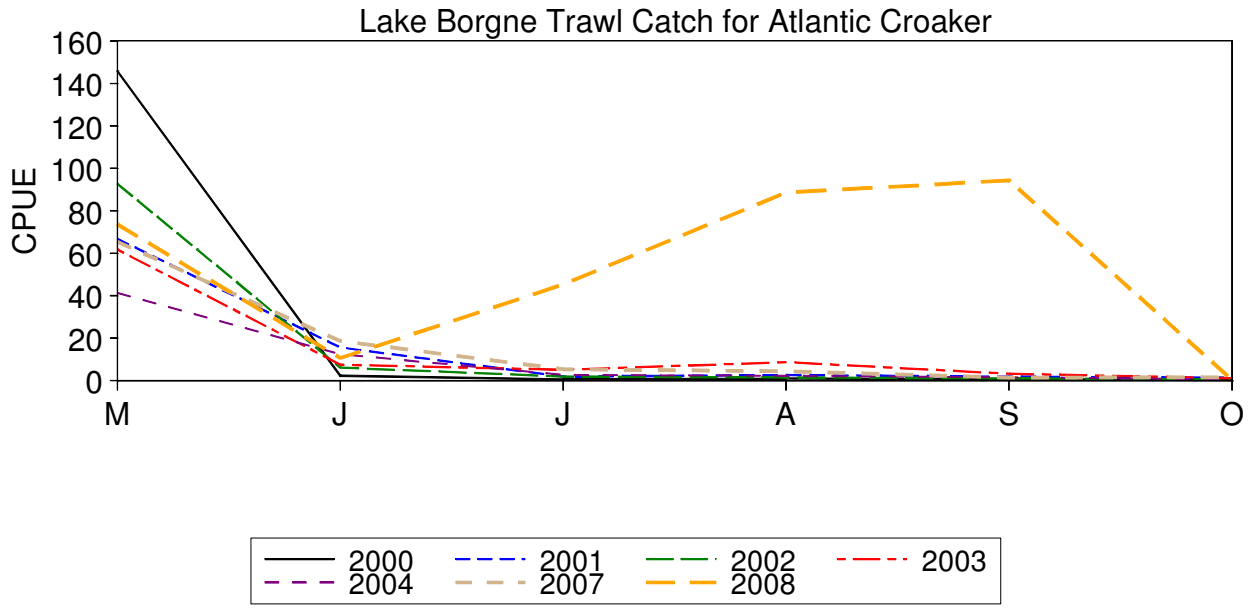


Figure A-1d. CPUE Used in Lake Borgne Trawl ANOVA

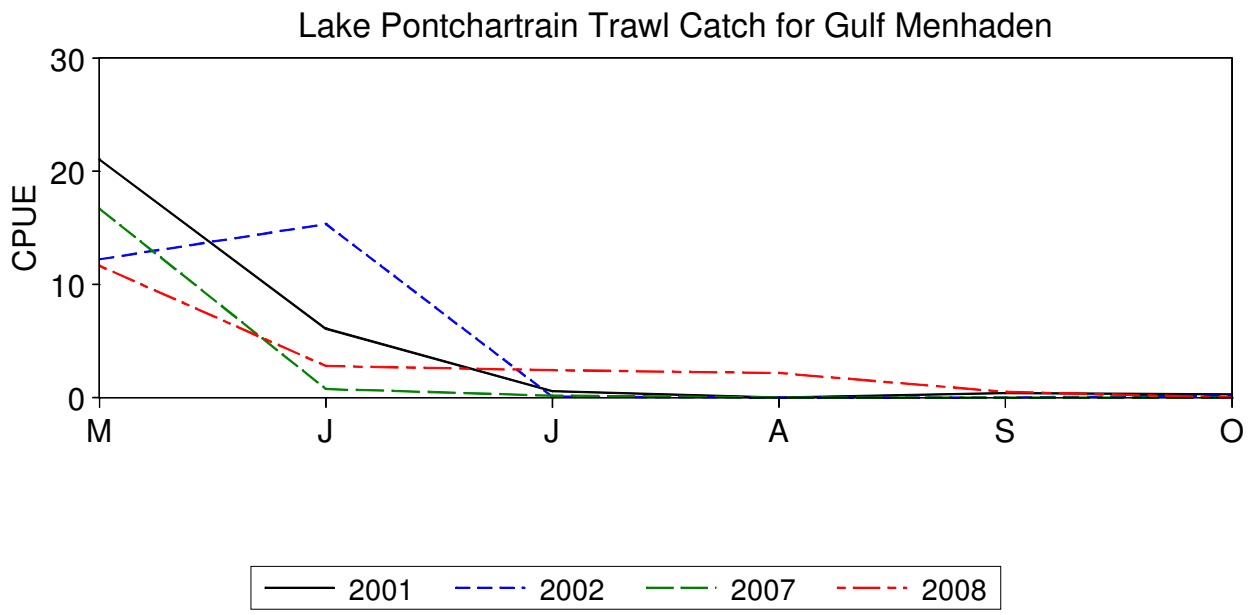


Figure A-1e. CPUE Used in Lake Pontchartrain Trawl ANOVA

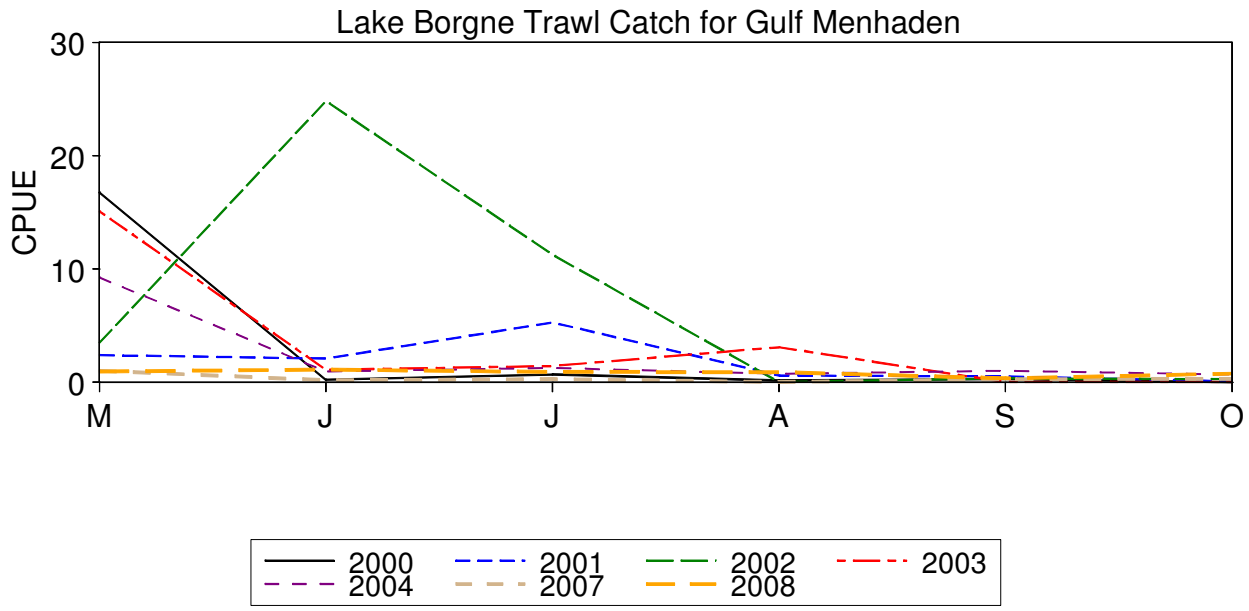


Figure A-1f. CPUE Used in Lake Borgne Trawl ANOVA

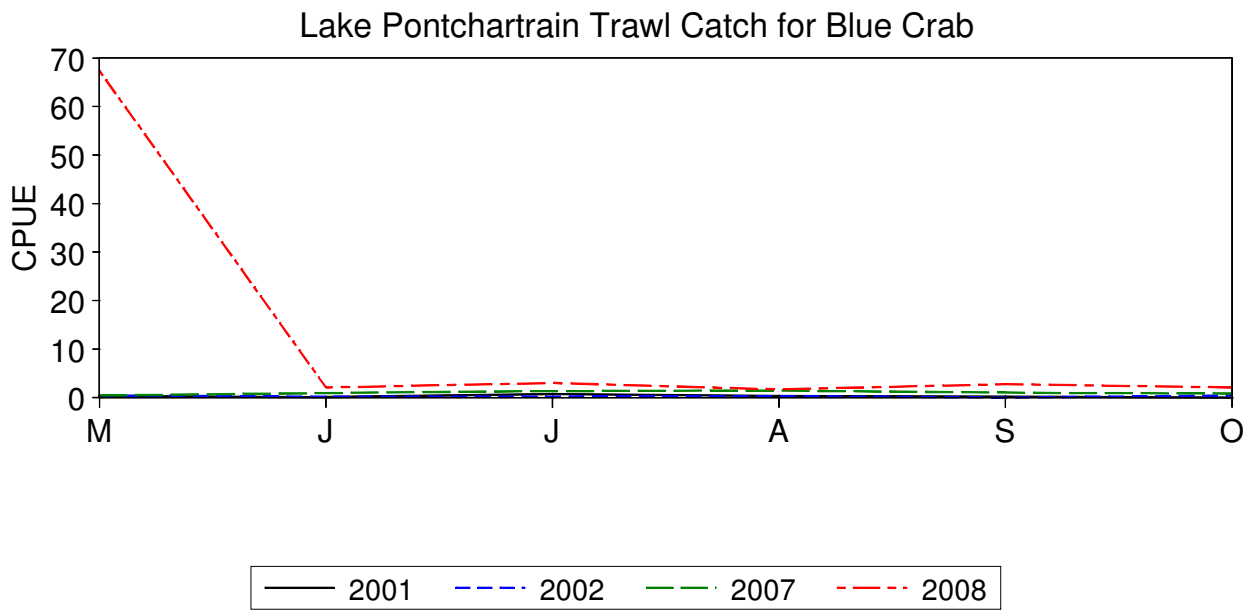


Figure A-1g. CPUE Used in Lake Pontchartrain Trawl ANOVA

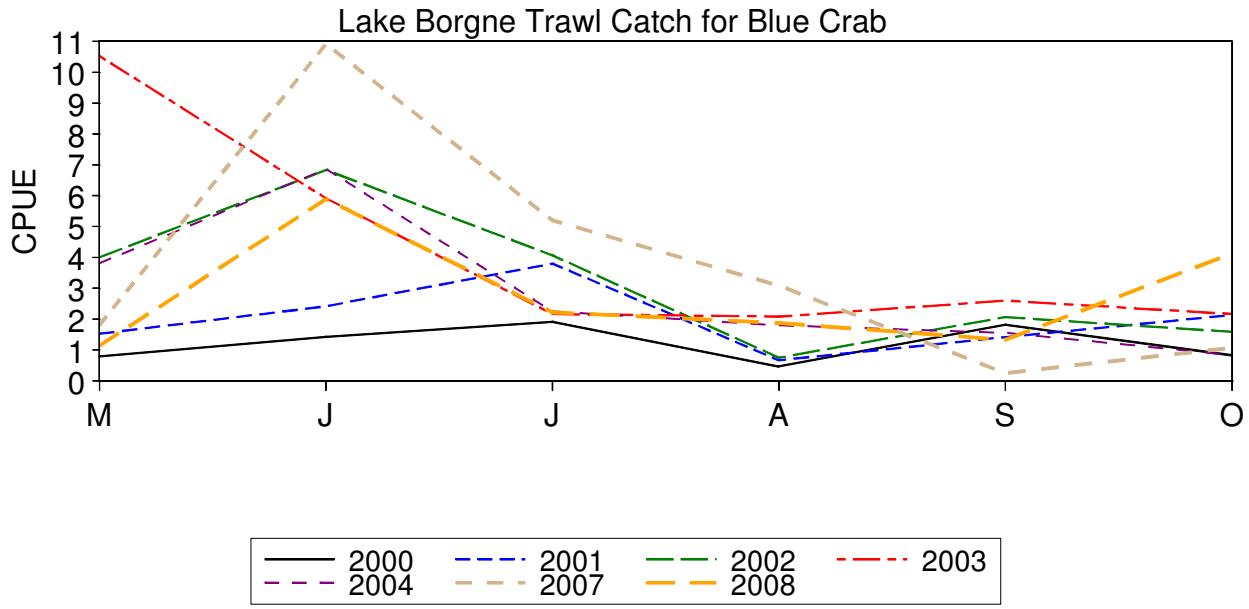


Figure A-1h. CPUE Used in Lake Borgne Trawl ANOVA

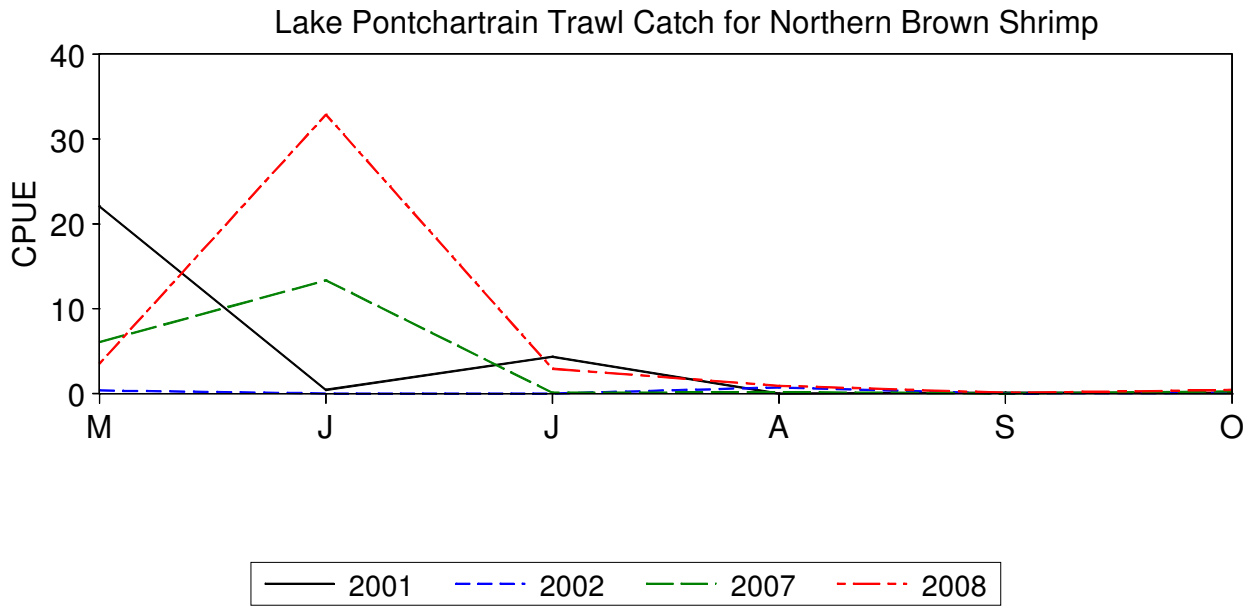


Figure A-1i. CPUE Used in Lake Pontchartrain Trawl ANOVA

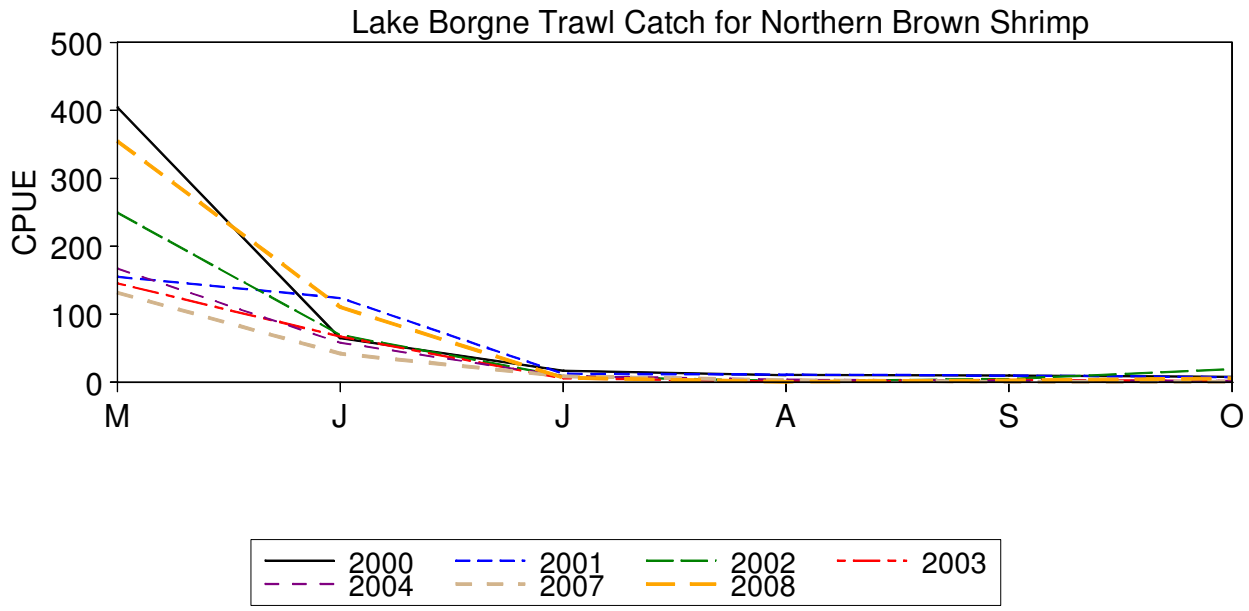


Figure A-1j. CPUE Used in Lake Borgne Trawl ANOVA

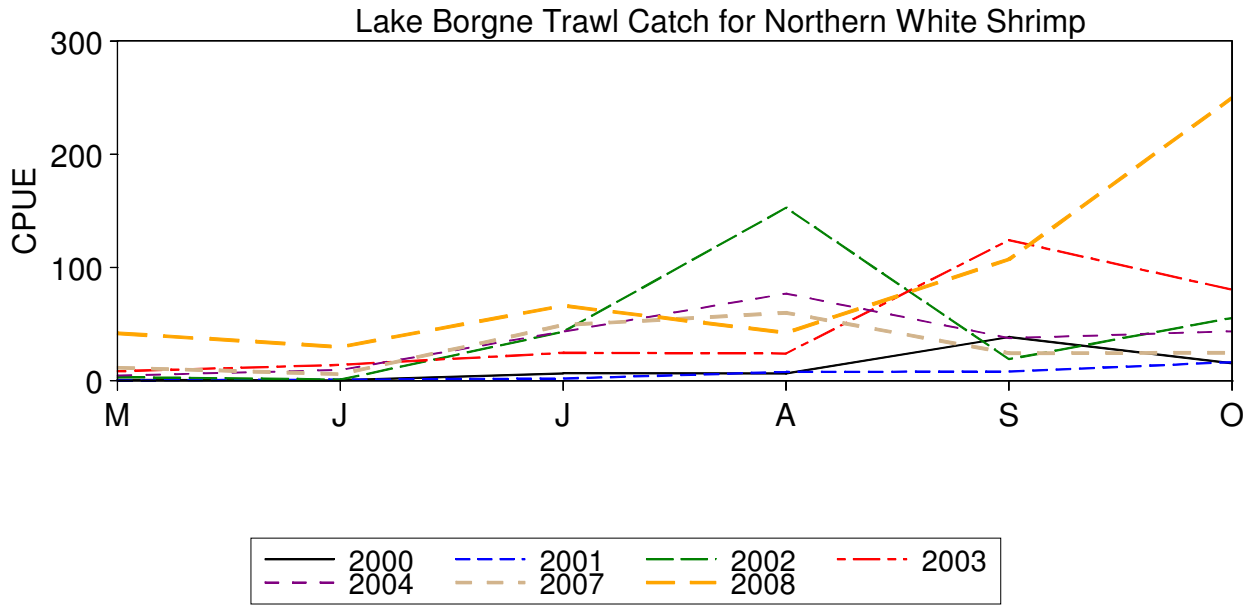


Figure A-1k. CPUE Used in Lake Borgne Trawl ANOVA

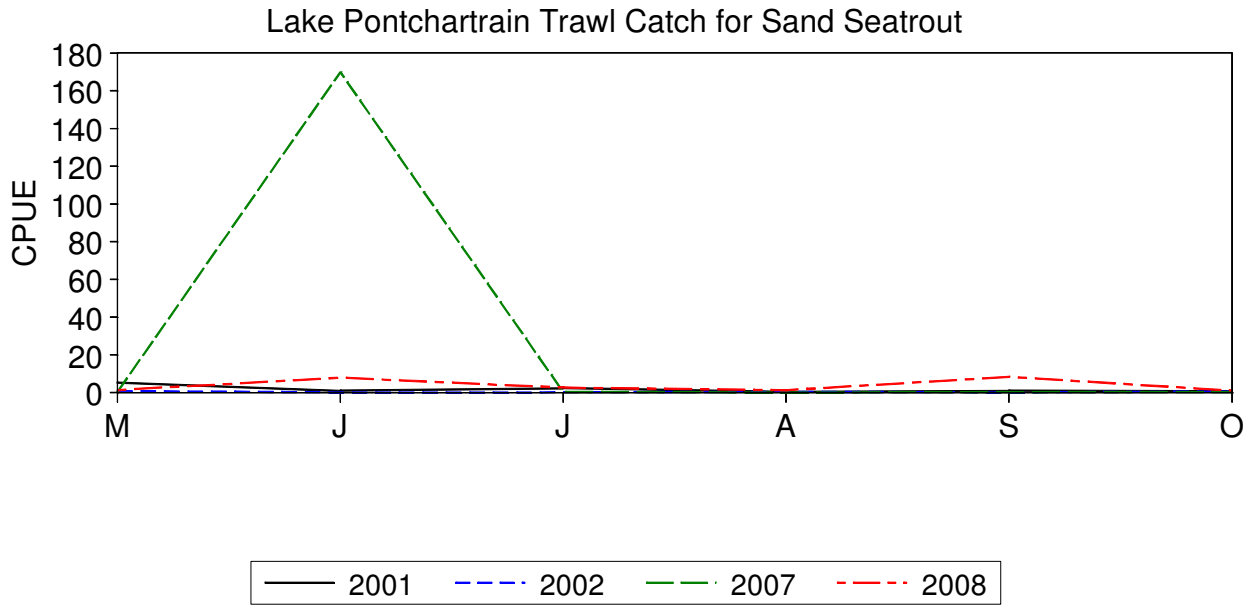


Figure A-1l. CPUE Used in Lake Pontchartrain Trawl ANOVA

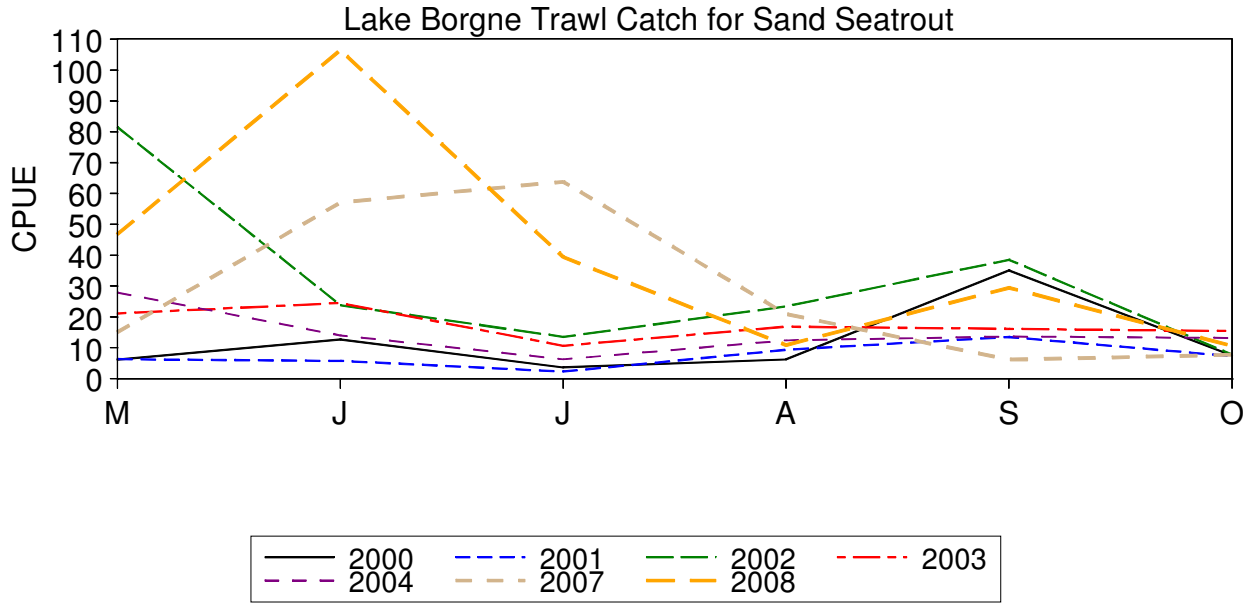


Figure A-1m. CPUE Used in Lake Borgne Trawl ANOVA

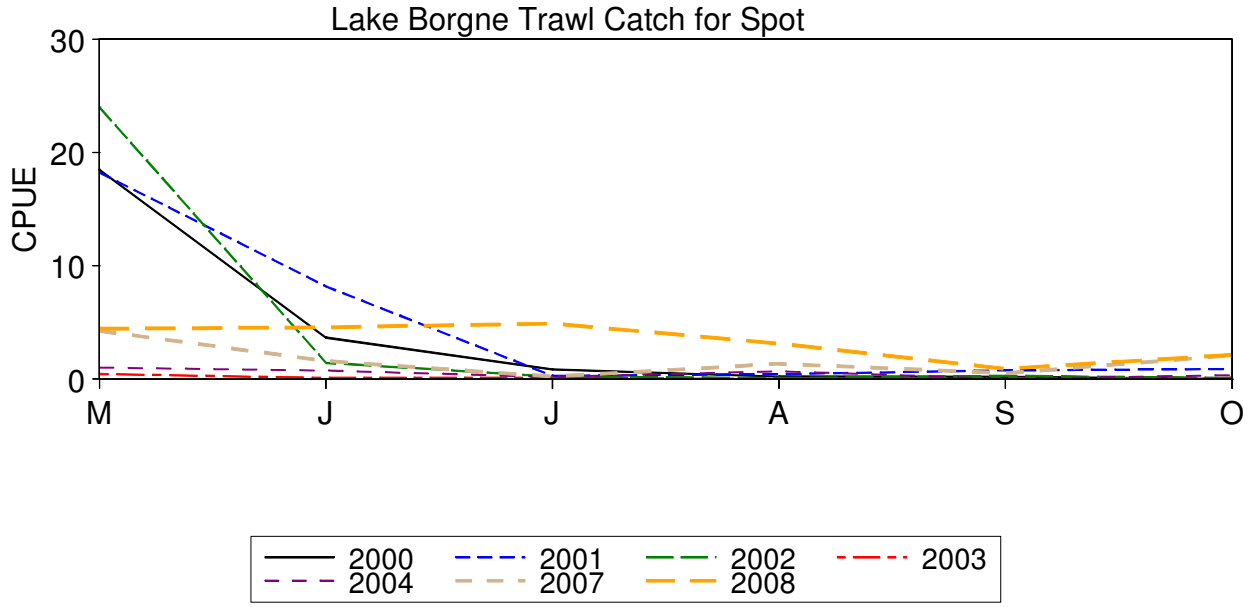


Figure A-1n. CPUE Used in Lake Borgne Trawl ANOVA

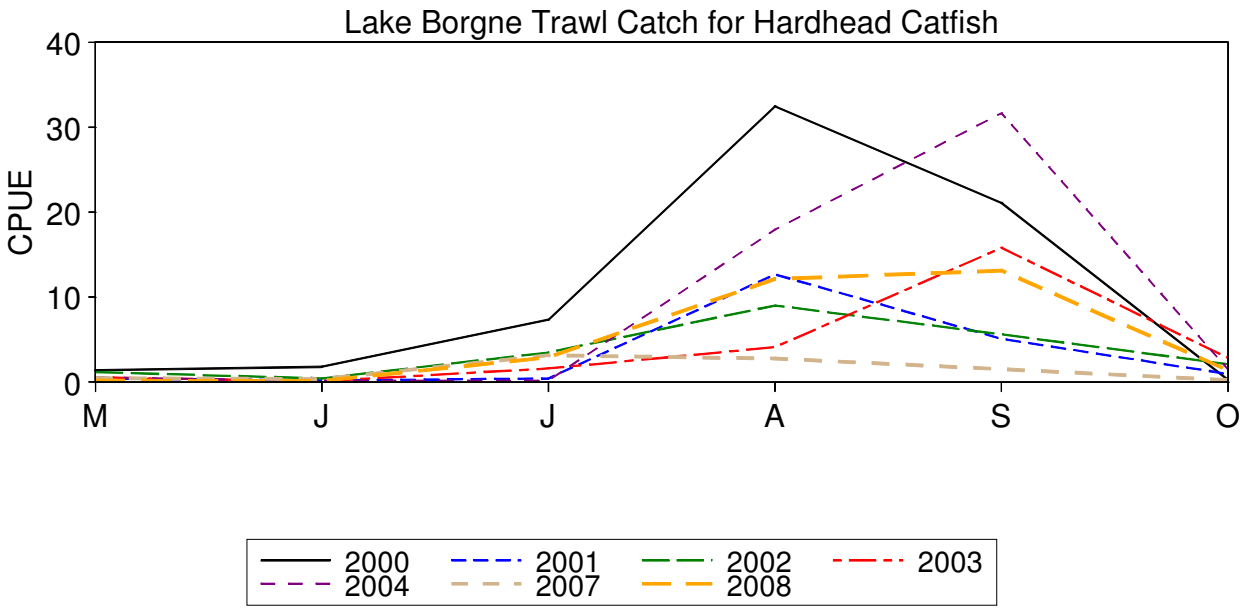


Figure A-1o. CPUE Used in Lake Borgne Trawl ANOVA

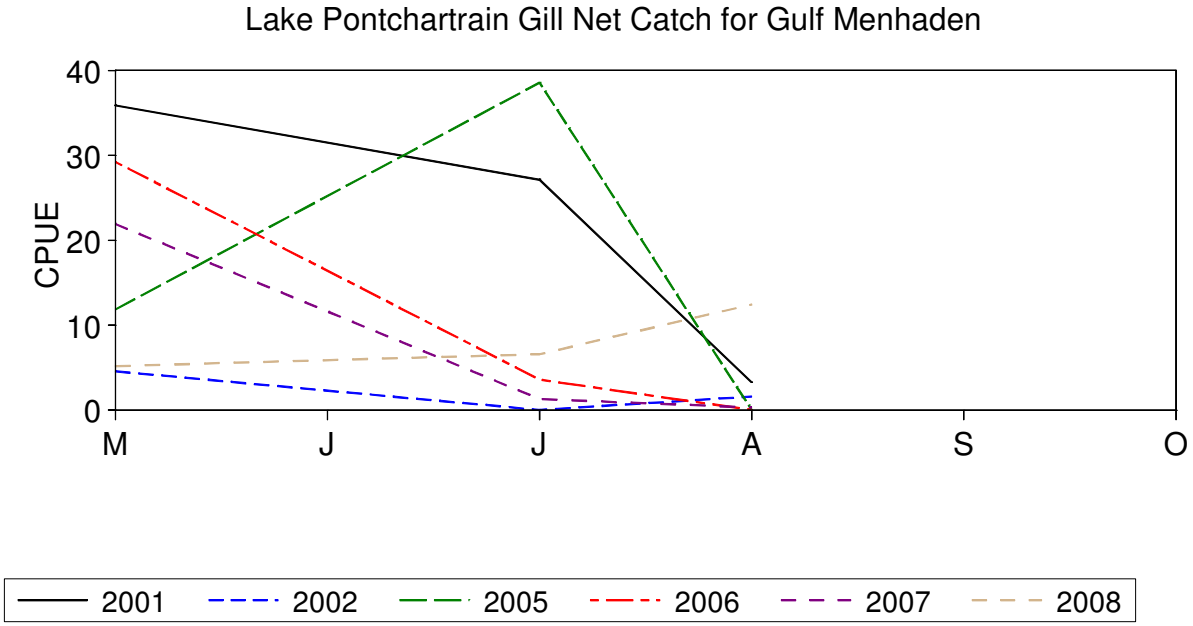


Figure A-2a. CPUE Used in Lake Pontchartrain Gillnet ANOVA

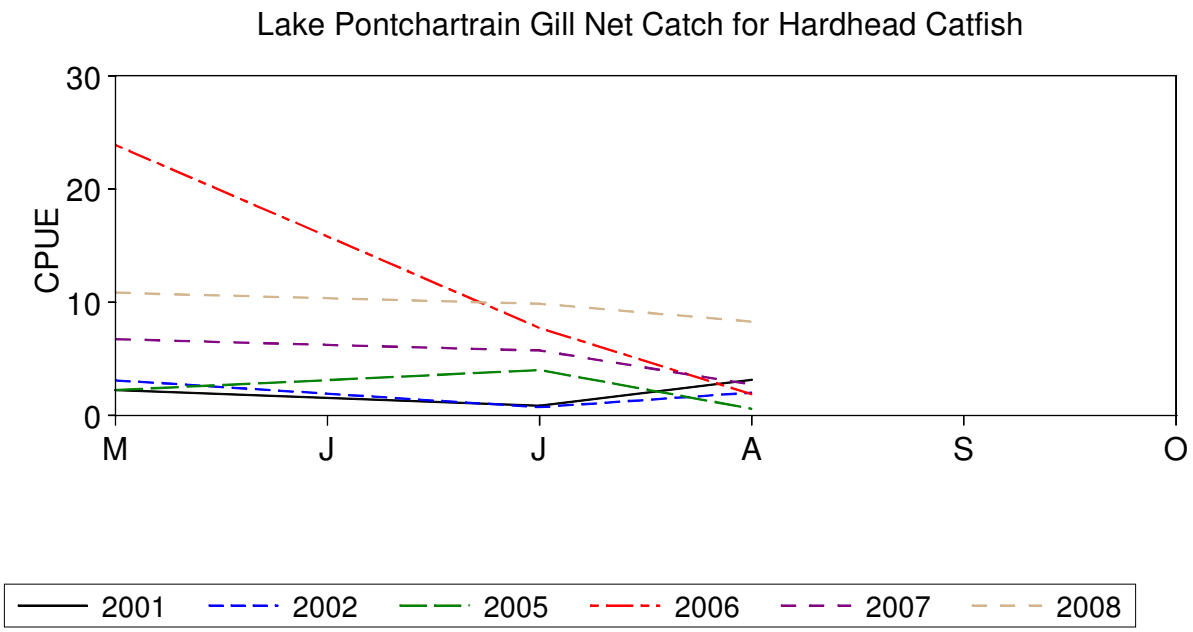


Figure A-2b. CPUE Used in Lake Pontchartrain Gillnet ANOVA

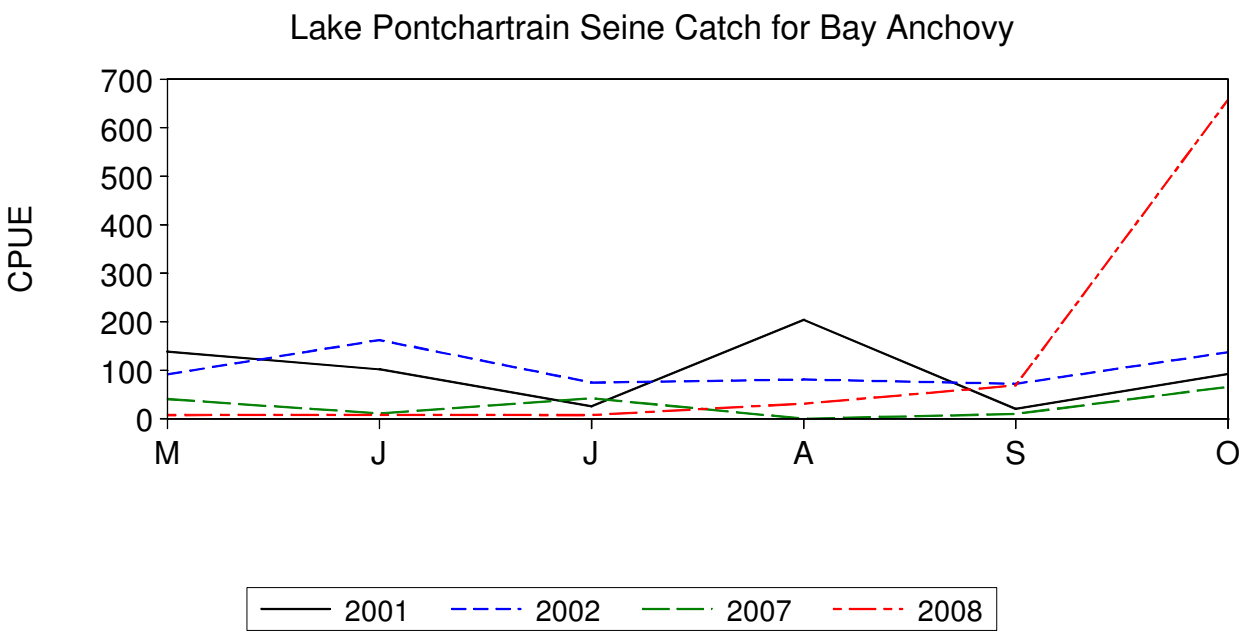


Figure A-3a. CPUE Used in Lake Pontchartrain Seine ANOVA

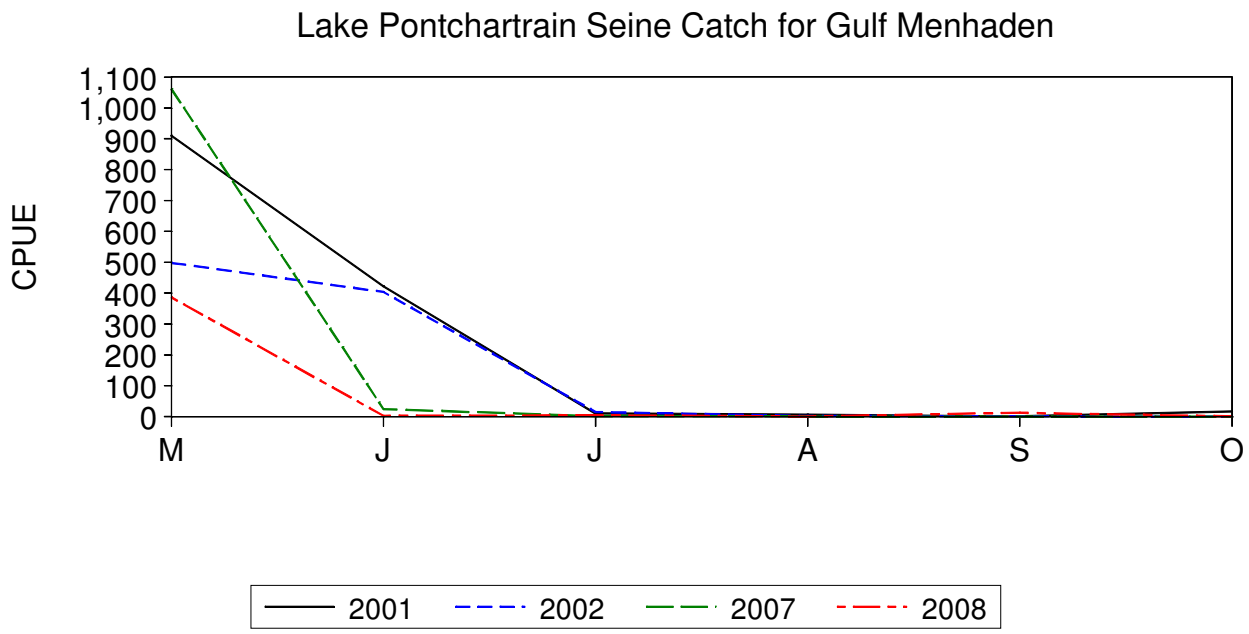


Figure A-3b. CPUE Used in Lake Pontchartrain Seine ANOVA

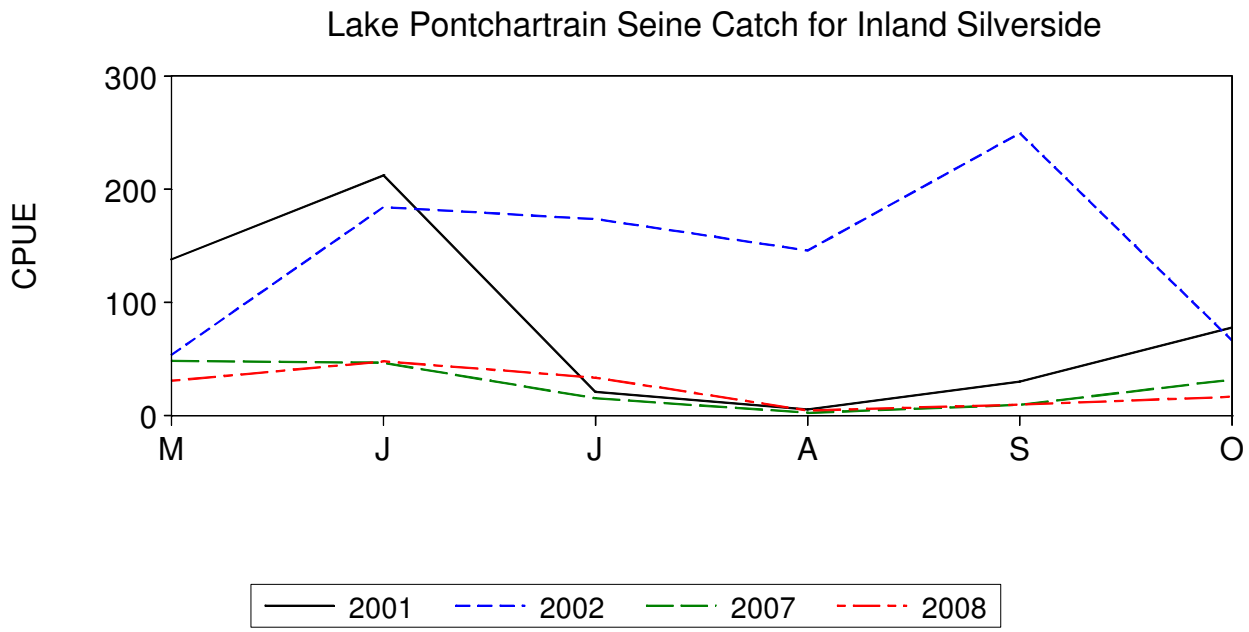


Figure A-3c. CPUE Used in Lake Pontchartrain Seine ANOVA

Appendix B

ENVIRONMENTAL

Appendix B

ENVIRONMENTAL

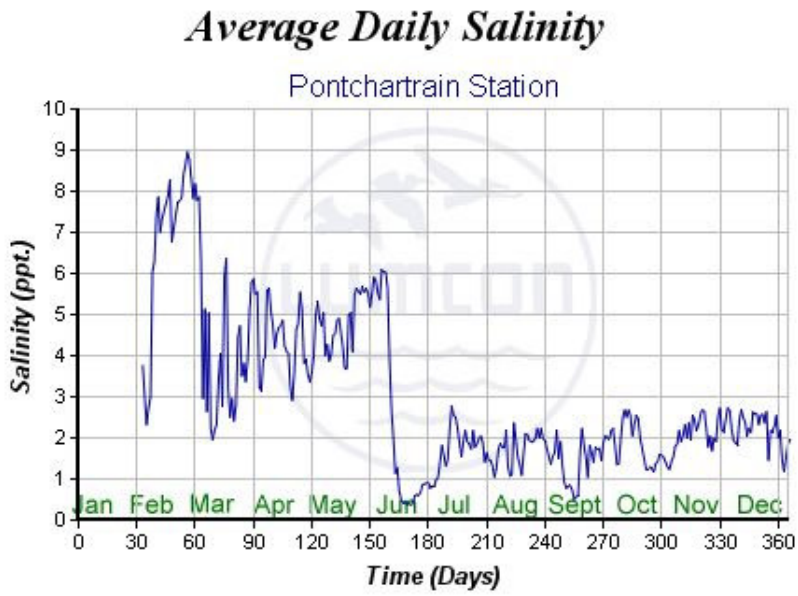


Figure B-1a. LUMCON Salinity 2001

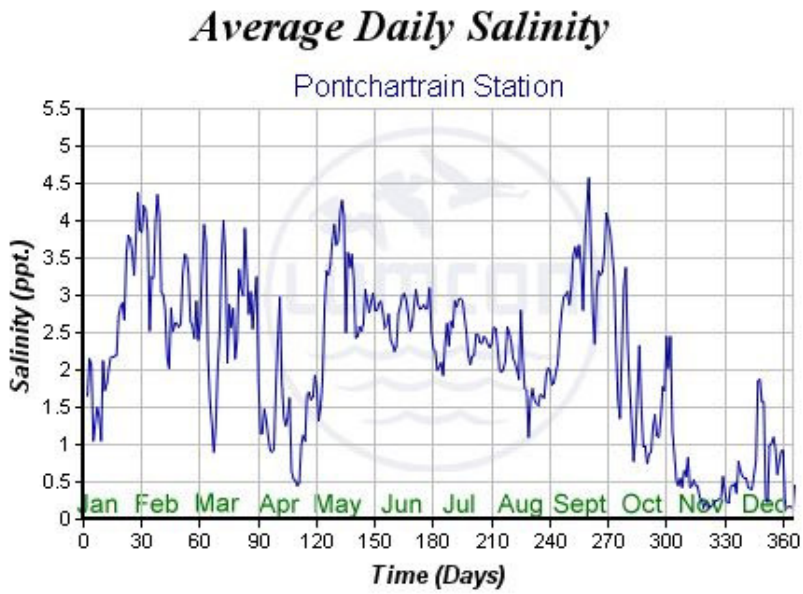


Figure B-1b. LUMCON Salinity 2002

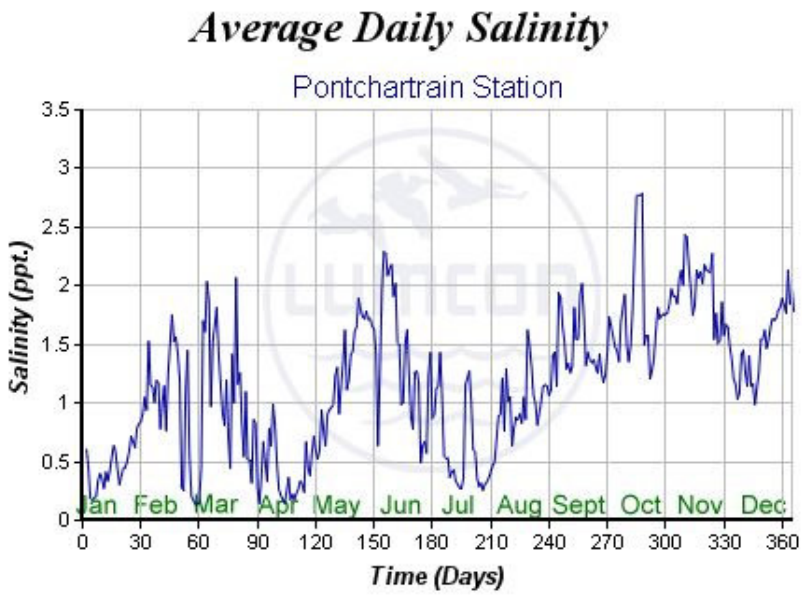


Figure B-1c. LUMCON Salinity 2003

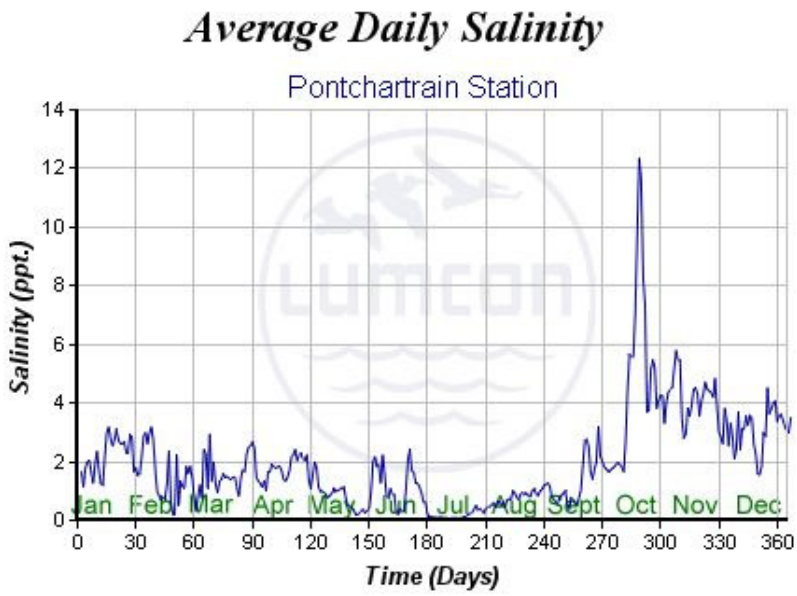


Figure B-1d. LUMCON Salinity 2004

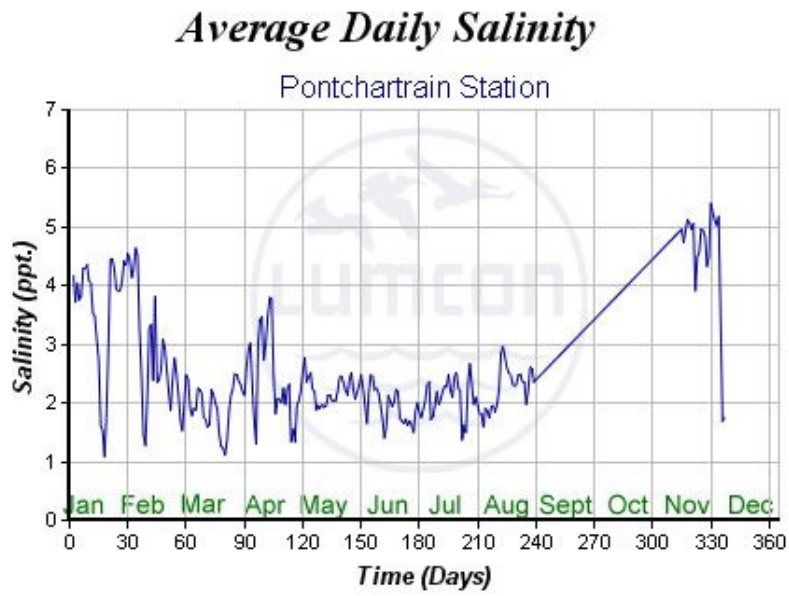


Figure B-1e. LUMCON Salinity 2005

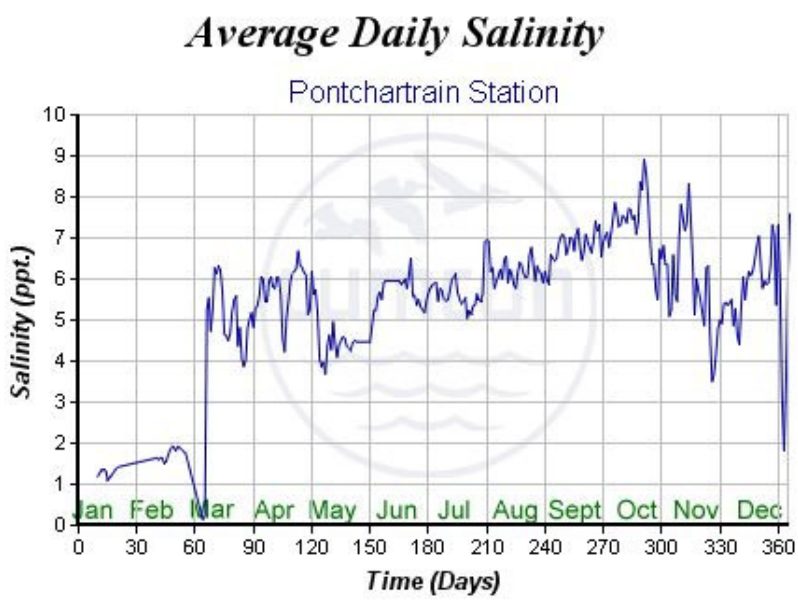


Figure B-1f. LUMCON Salinity 2006

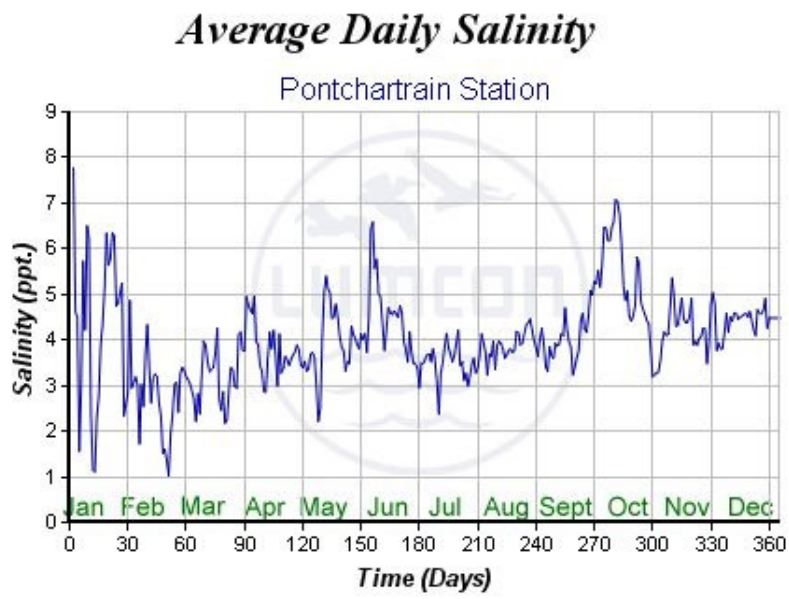


Figure B-1g. LUMCON Salinity 2007

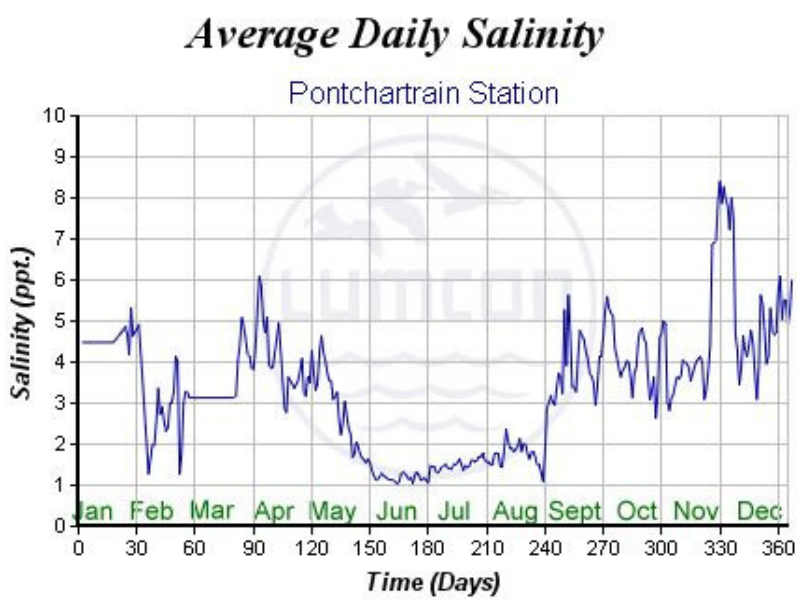


Figure B-1h. LUMCON Salinity 2008

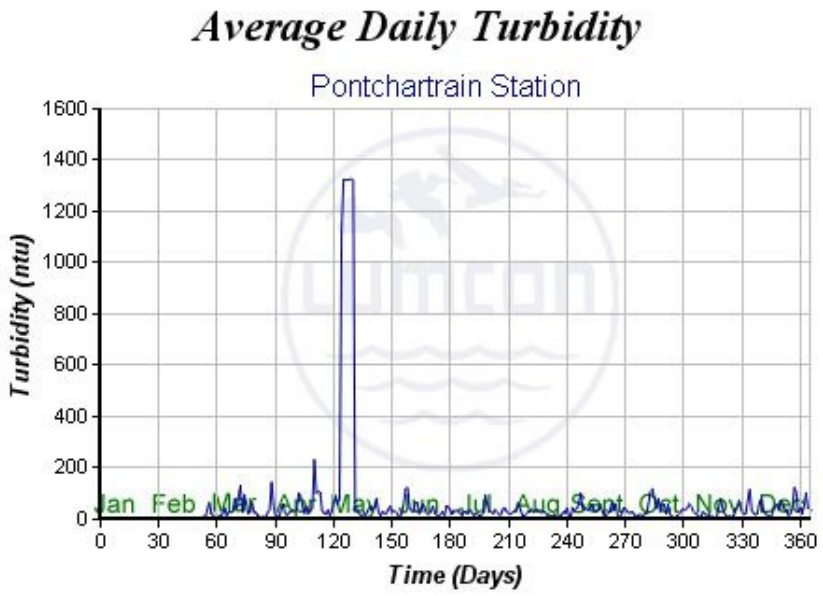


Figure B-2a. LUMCON Turbidity 2001

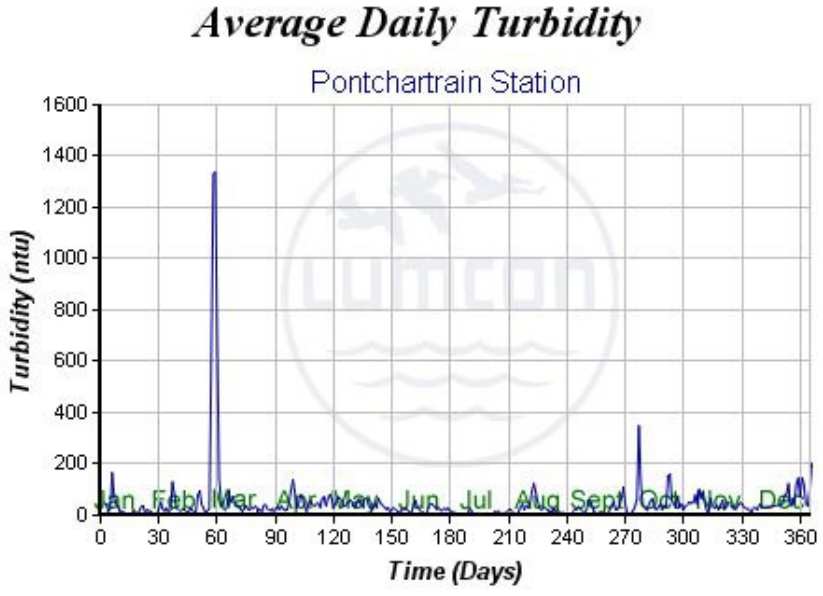


Figure B-2b. LUMCON Turbidity 2002

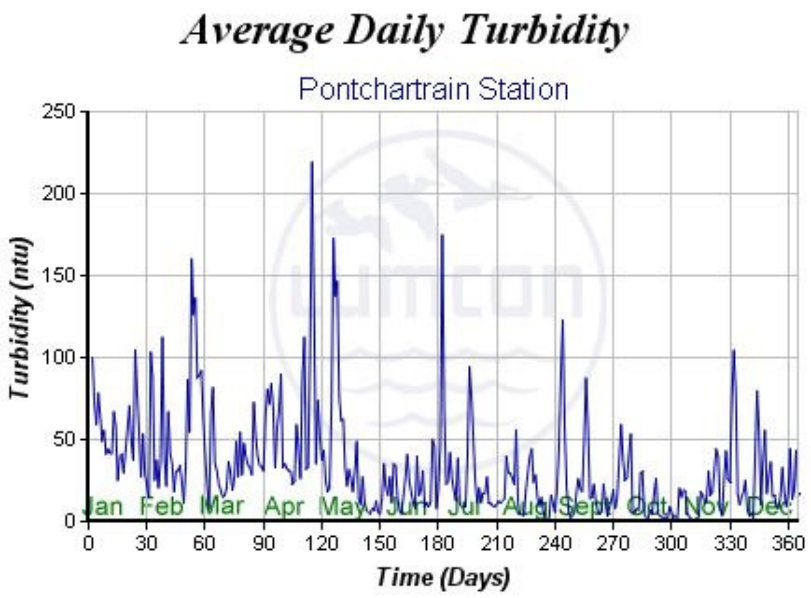


Figure B-2c. LUMCON Turbidity 2003

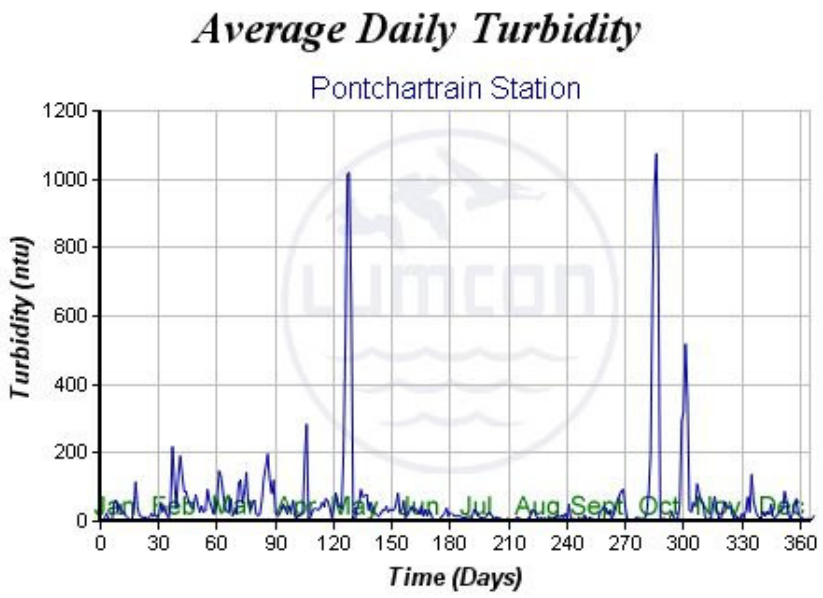


Figure B-2d. LUMCON Turbidity 2004

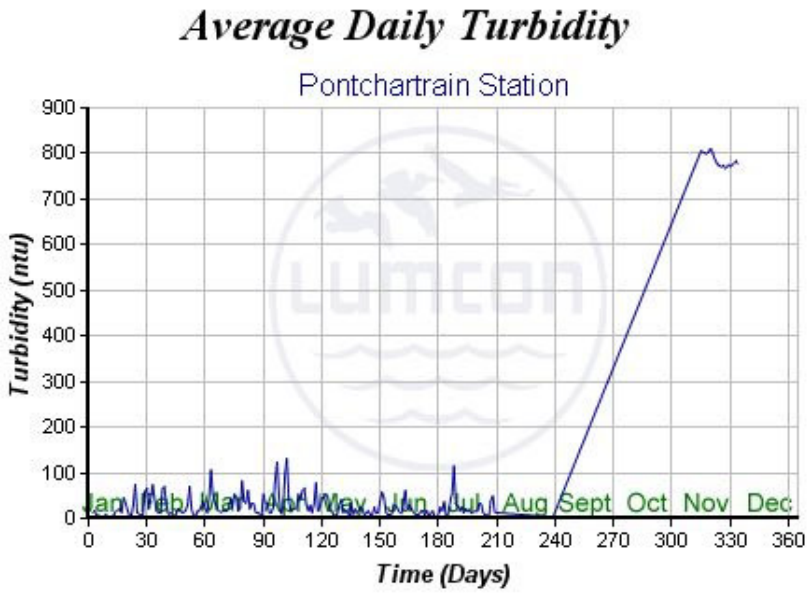


Figure B-2e. LUMCON Turbidity 2005

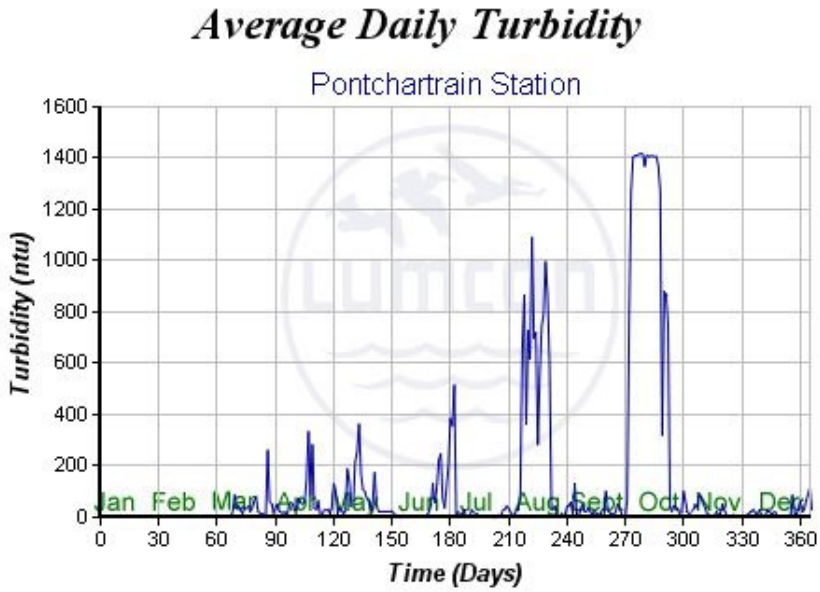


Figure B-2f. LUMCON Turbidity 2006

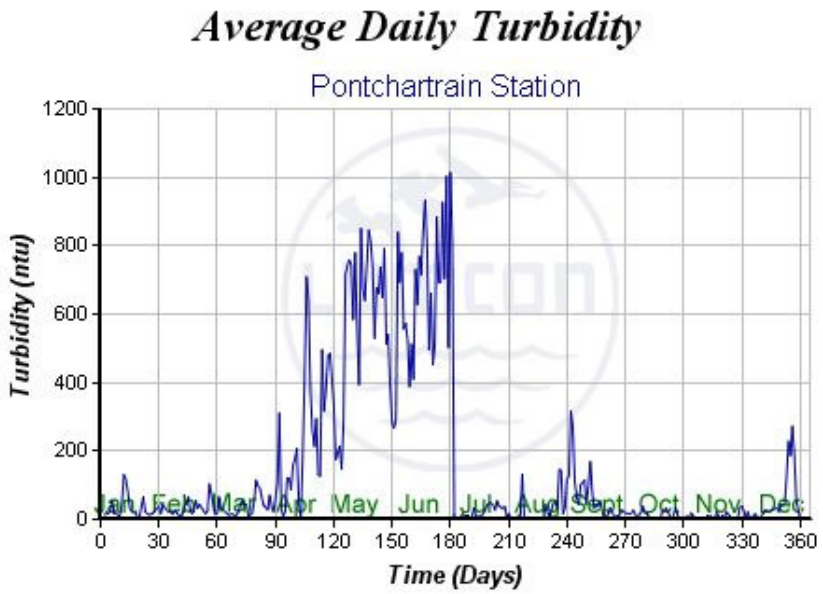


Figure B-2g. LUMCON Turbidity 2007

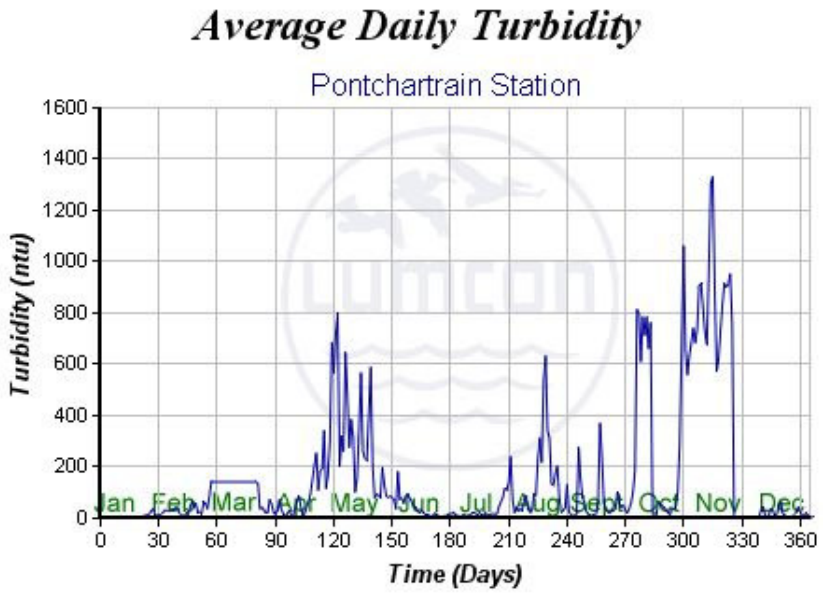


Figure B-2h. LUMCON Turbidity 2008

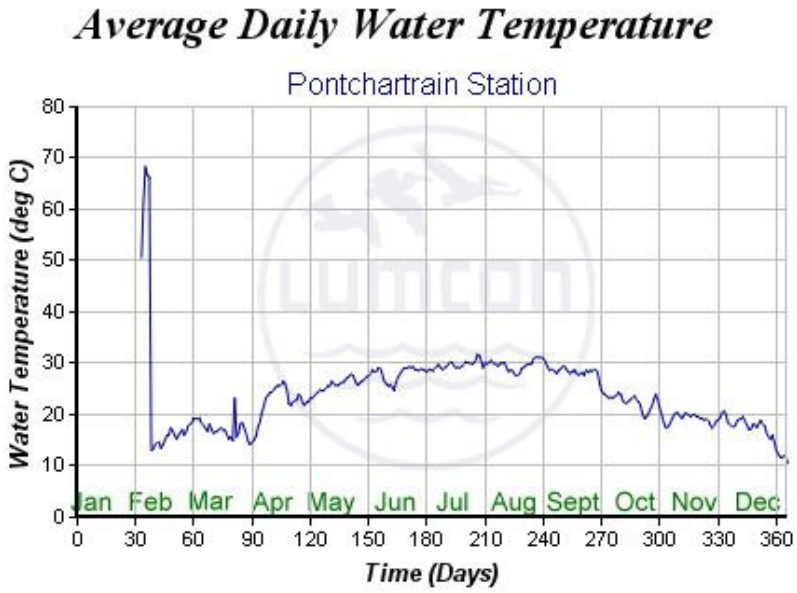


Figure B-3a. LUMCON Water Temperature 2001

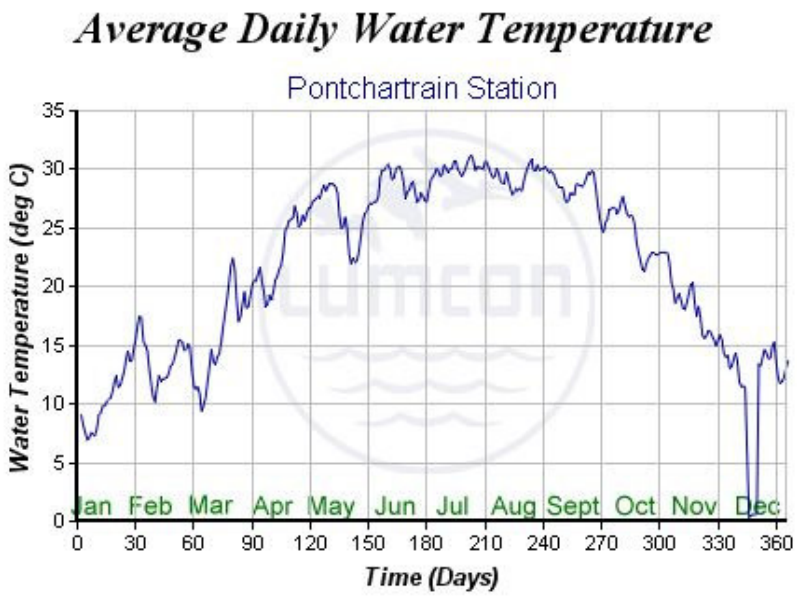


Figure B-3b. LUMCON Water Temperature 2002

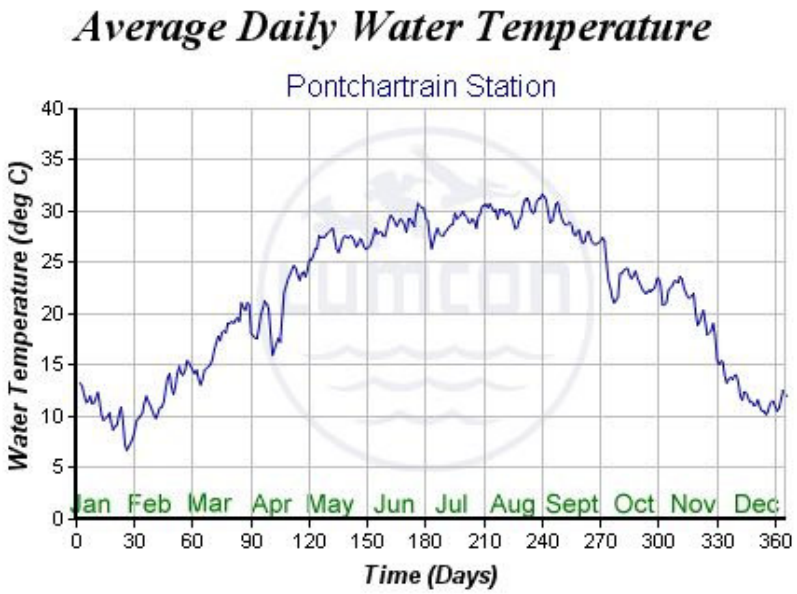


Figure B-3c. LUMCON Water Temperature 2003

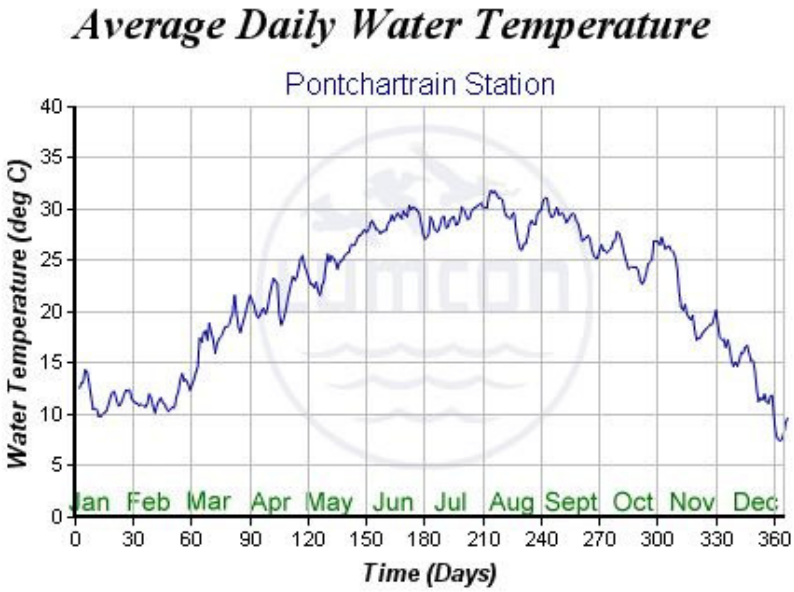


Figure B-3d. LUMCON Water Temperature 2004

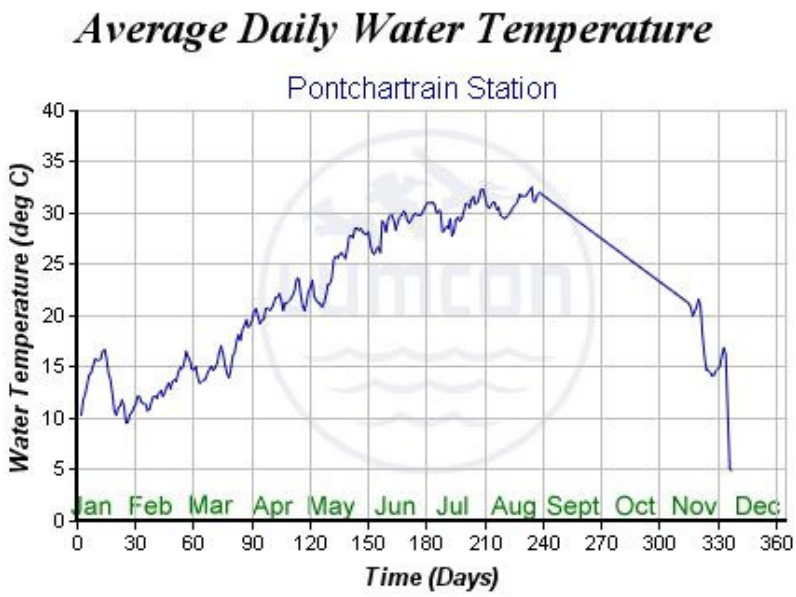


Figure B-3e. LUMCON Water Temperature 2005

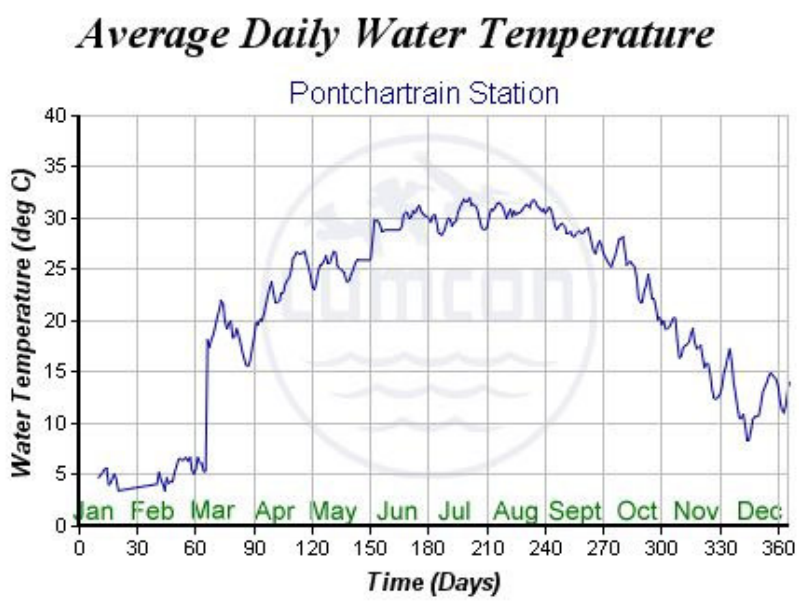


Figure B-3f. LUMCON Water Temperature 2006

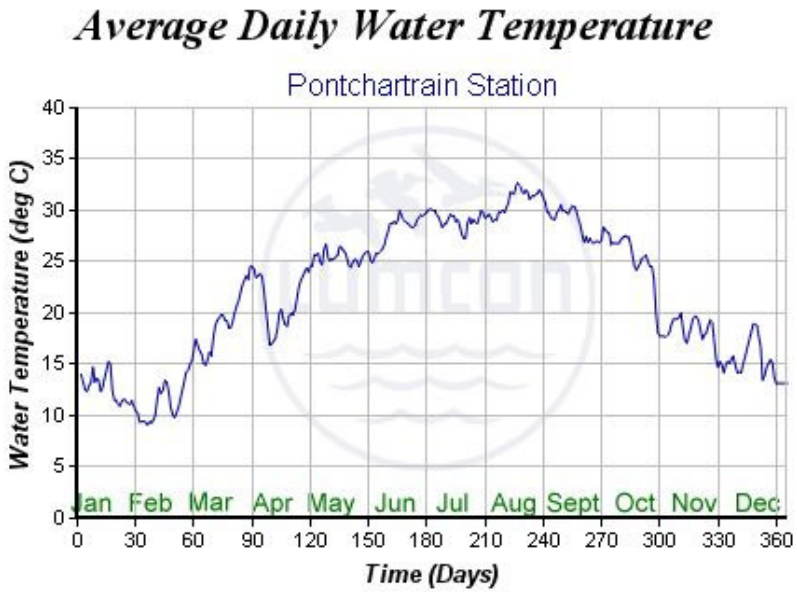


Figure B-3g. LUMCON Water Temperature 2007

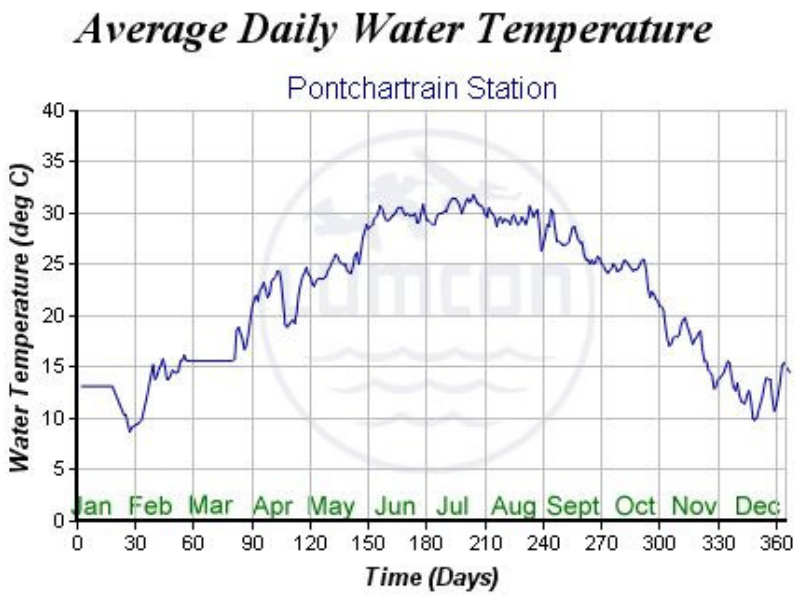


Figure B-3h. LUMCON Water Temperature 2008

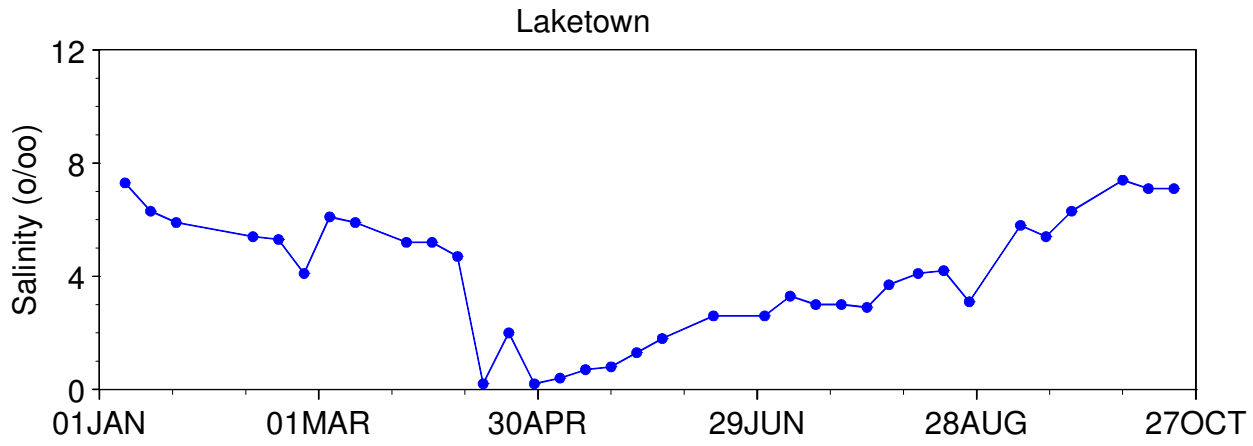


Figure B-4a. Laketown Salinity for 2008

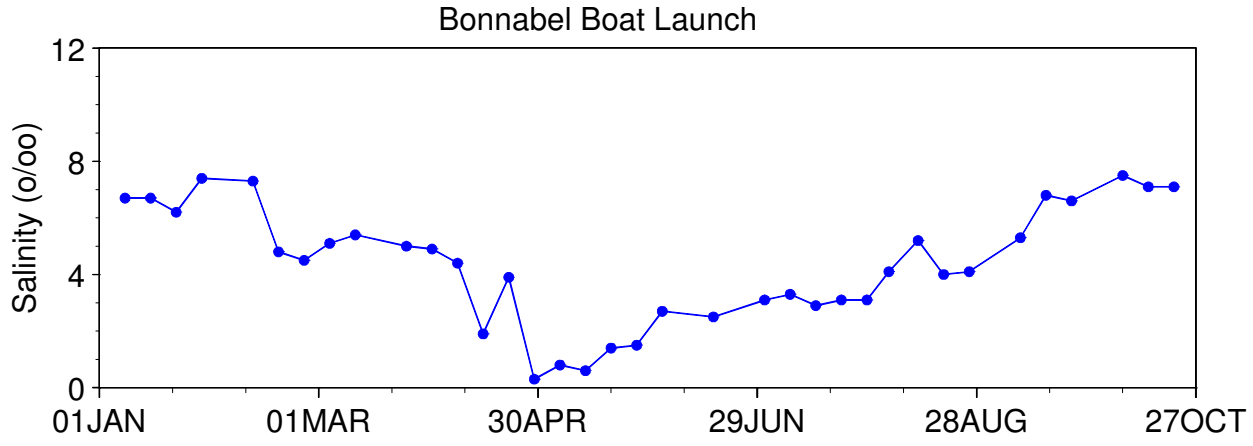


Figure B-4b. Bonnabel Boat Launch Salinity for 2008

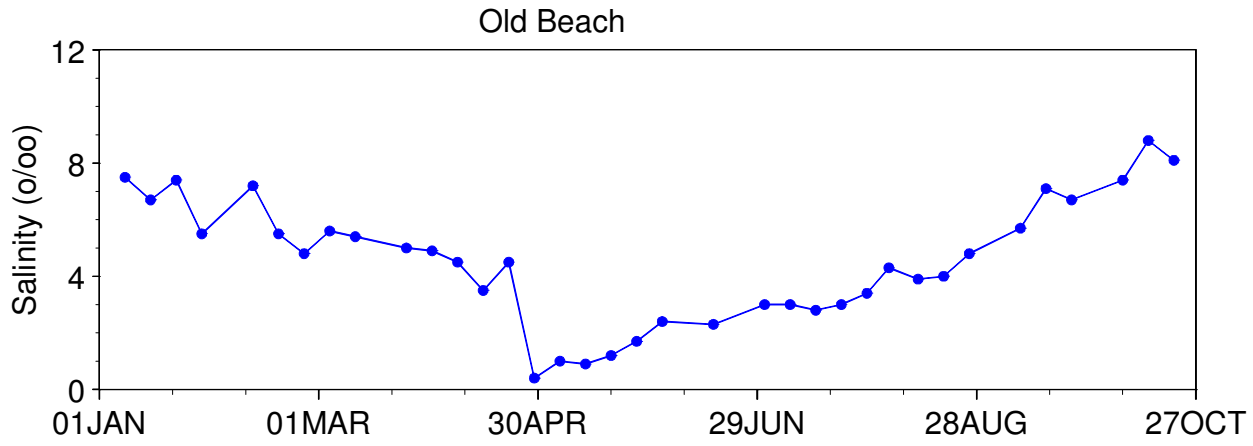


Figure B-4c. Old Beach Salinity for 2008

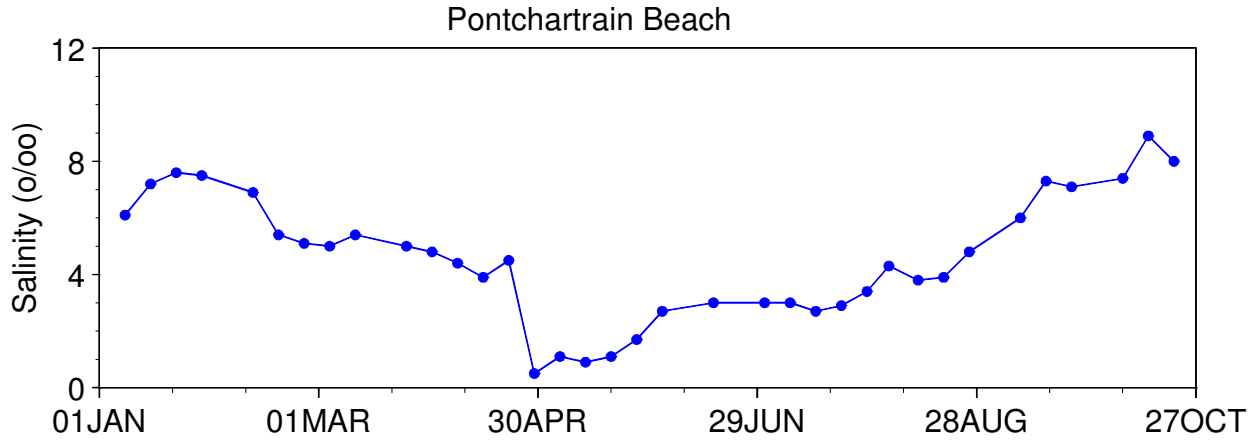


Figure B-4d. Pontchartrain Beach Salinity for 2008

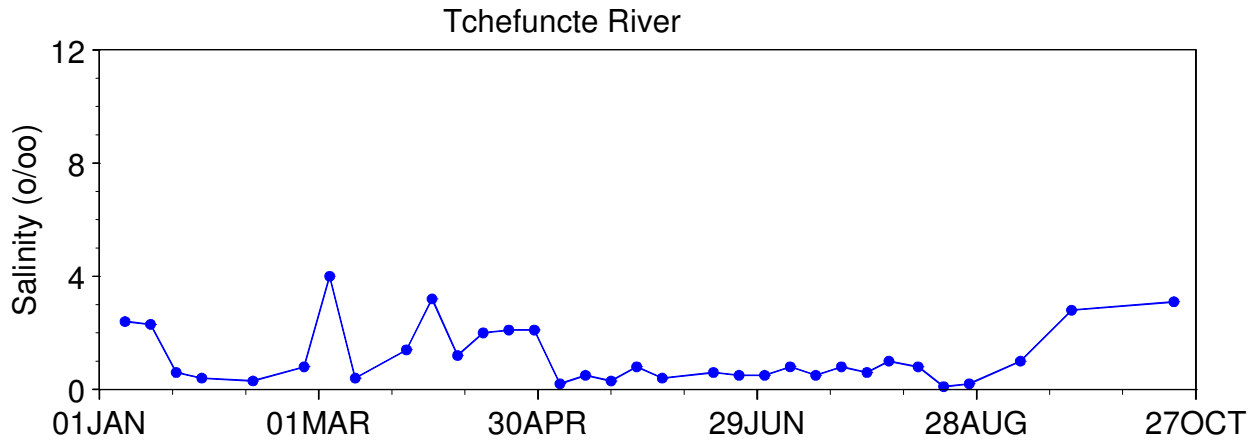


Figure B-5a. Tchefuncte River Salinity for 2008

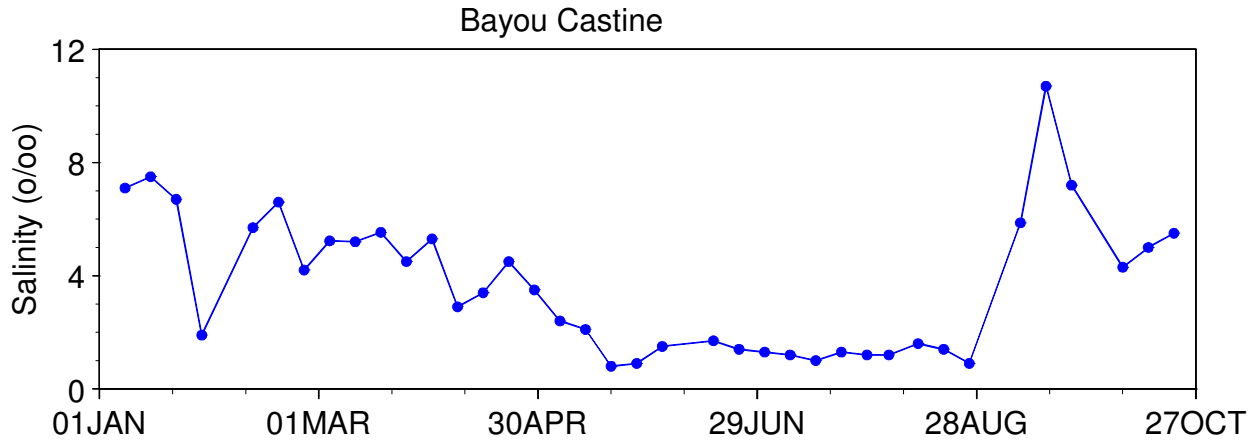


Figure B-5b. Bayou Castine Salinity for 2008

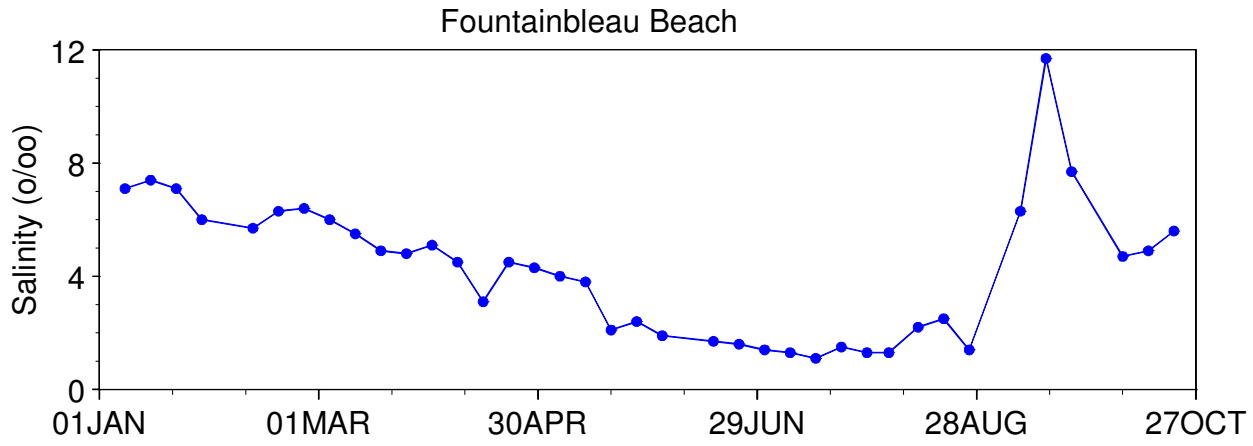


Figure B-5c. Fountainbleau Salinity for 2008

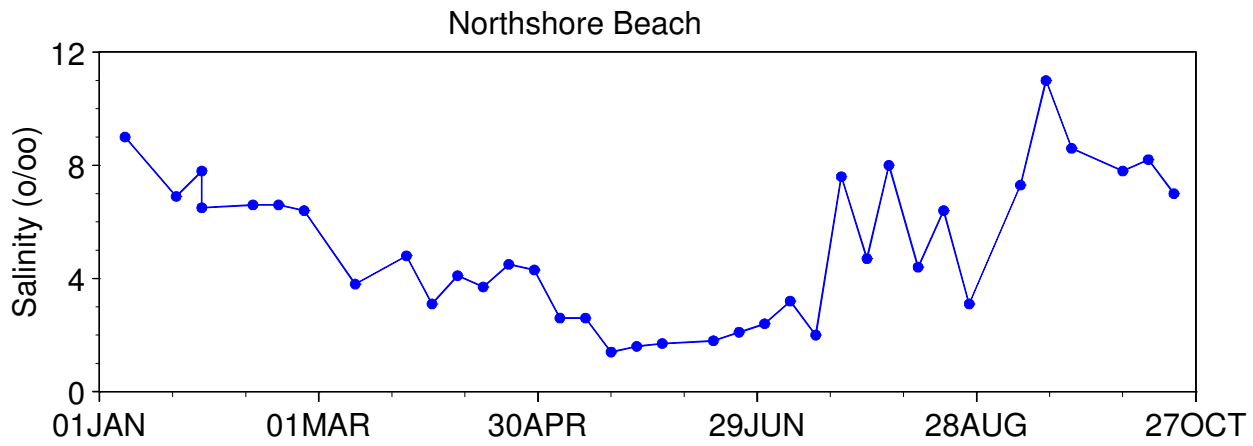


Figure B-5d. Northshore Beach Salinity for 2008

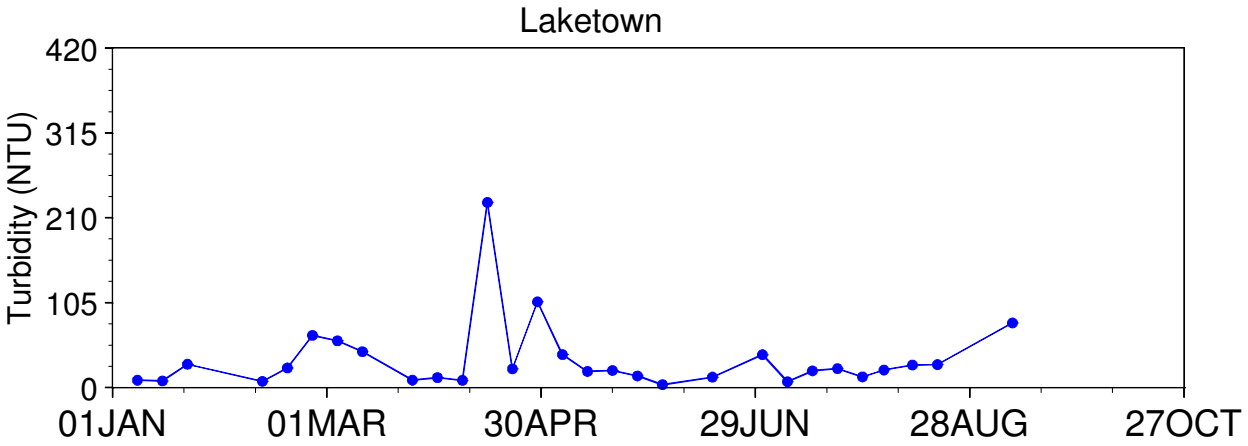


Figure B-6a. Laketown Turbidity for 2008

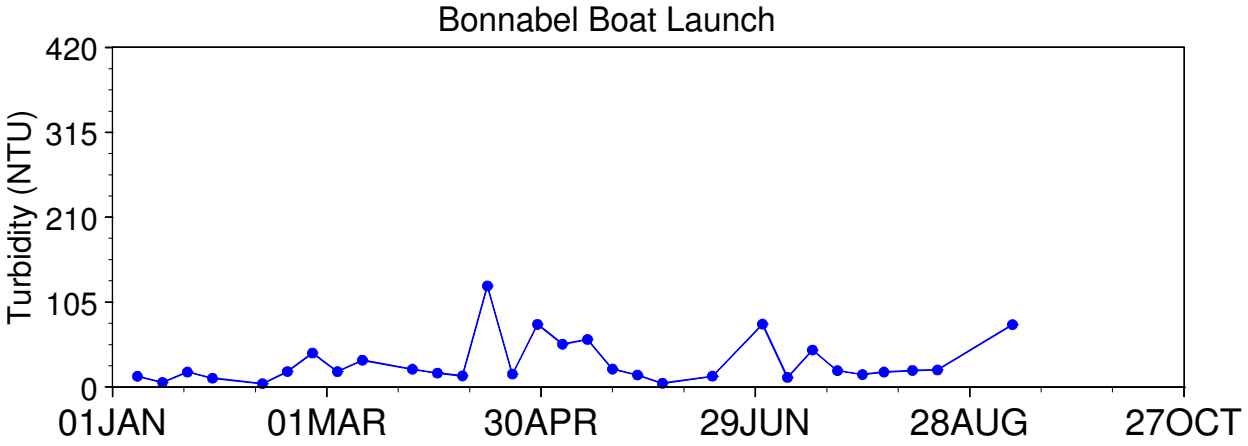


Figure B-6b. Bonnabel Boat Launch Turbidity for 2008

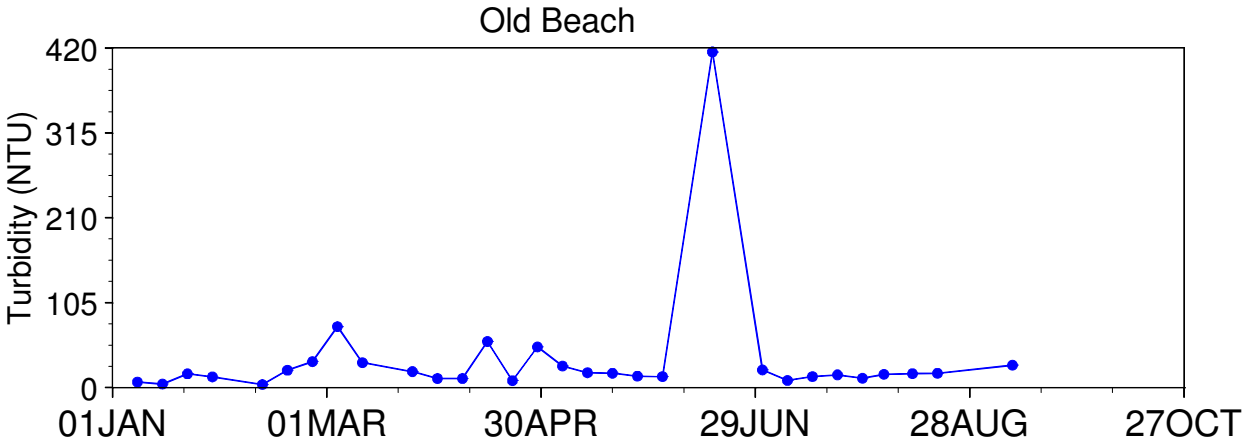


Figure B-6c. Old Beach Turbidity for 2008

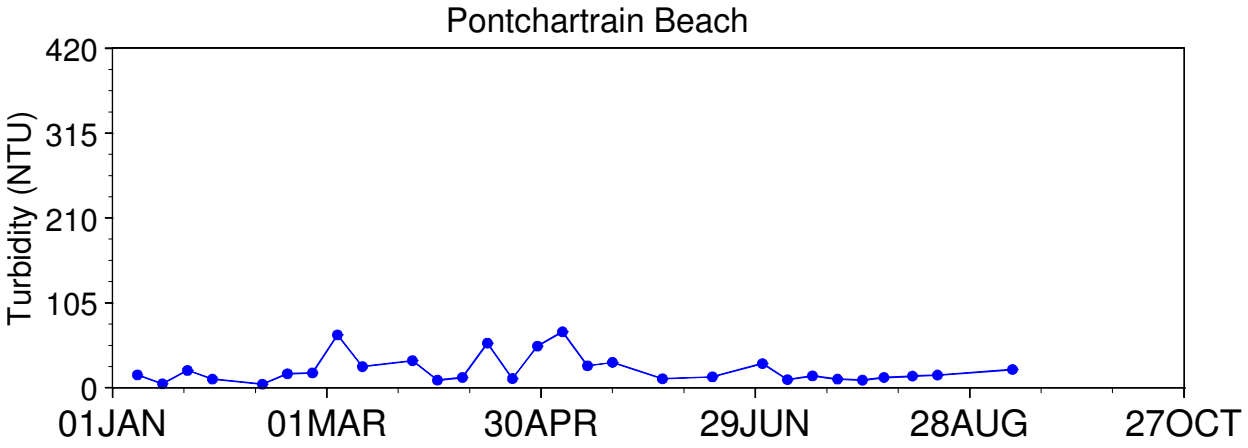


Figure B-6d. Pontchartrain Beach Turbidity for 2008

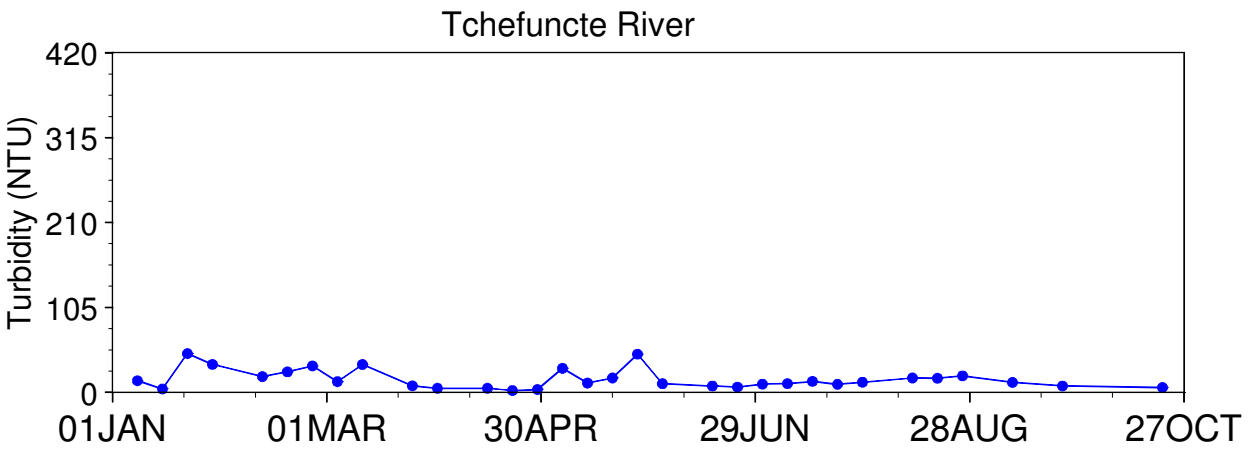


Figure B-7a. Tchefuncte River Turbidity for 2008

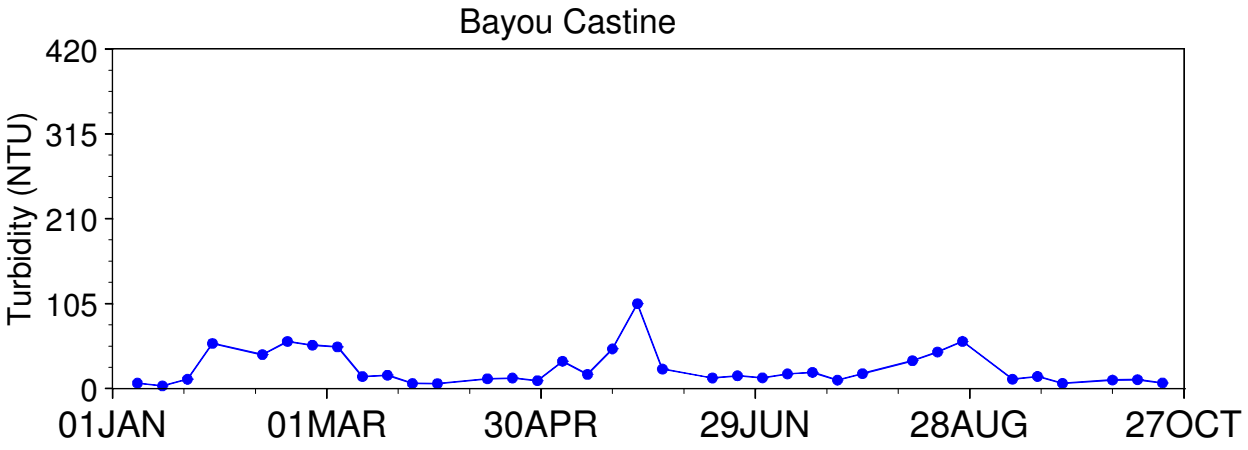


Figure B-7b. Bayou Castine Turbidity for 2008

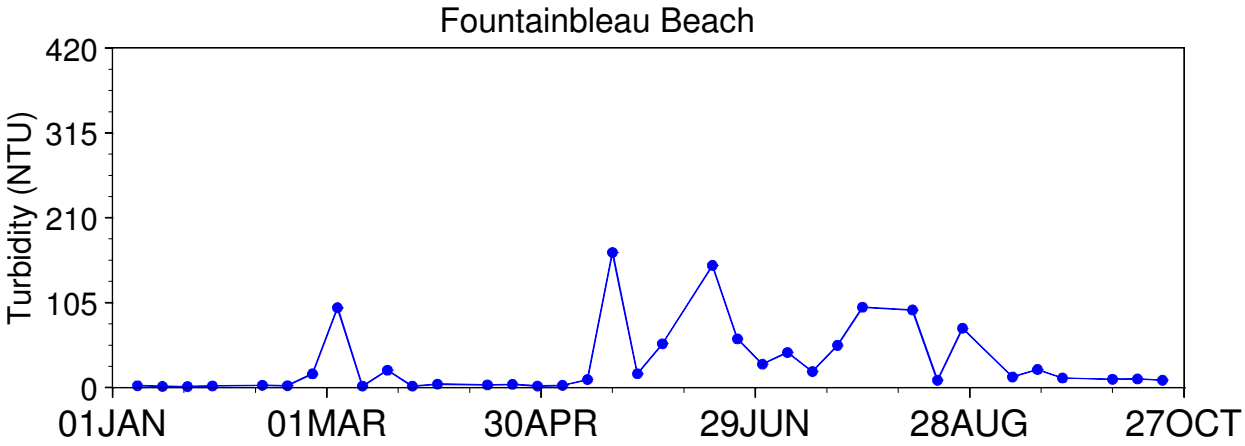


Figure B-7c. Fountainbleau Turbidity for 2008

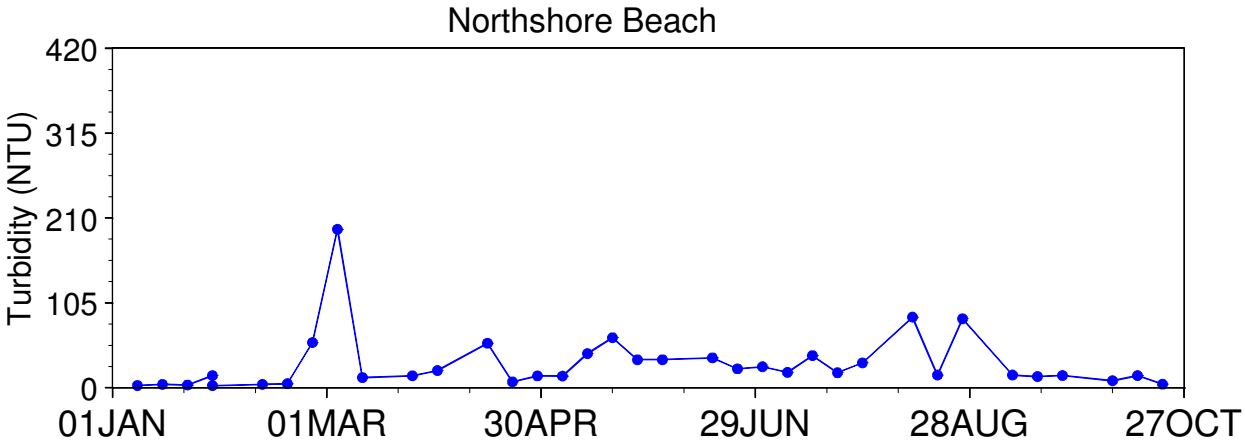


Figure B-7d. Northshore Beach Turbidity for 2008

Appendix C

RECREATION

APPENDIX C

THIS DOCUMENT INCORPORATES THE QUESTIONAIRE, DATABASE STRUCTURE DESCRIPTION AND CODING INSTRUCTIONS FOR THE 2008 LAKE USE INTERVIEWS

IDNO (N 4)

2008 Bonnet Carre' Opening Survey Form – Lake Users

DATE __(D 8)_ TIME (N 5 2)___

LOCATION _(10)_____ INTERVIEWER____(2)_____

WEATHER CONDITIONS __(2)_____

Variable name	Type	size/spaces
IDNO	N	4
Date	D	8
Time	N	5 2

(ENTER TIME OF DAY—USE 24 HOUR—RECORD MINUTES IN DECIMAL POSITIONS. Example: A quarter after 2 pm would be recorded as 14.15)

Location	C	10
Site_no	N	3

(ENTER LOCATION NAME OR MNEMONIC FROM LIST. ENTER SITE_NO FROM LIST.)

Site No.	Site Name or Location	Code Name or Mnemonic
001	Frenier Beach area (end of Peavine Road)	Frenier
002	Pass Manchac	Manchac
003	Mouth of Tchefuncte River (Madisonville)	Tchefunct
004	North side Hwy 22 bridge in Madisonville	22 bridge
005	Marina del Rey (Madisonville)	Del Rey
006	Mouth of Bayou Lacombe	Lacombe
007	Glockner/hwy 434 (on Bayou Lacombe)	Glockner
008	Bayou Liberty area (Heritage Park)	Heritage
009	Bayou Liberty Marina	Liberty
010	St. Genevieve Church Launch	Genevieve
011	Tite/Cousins Launch (N. end Hwy 11 bridge)	Tite
012	The Dock (down road to east at end of Hwy 11 bridge)	Dock
013	Slidell Marina	Slidell

014	Bayou Sauvage Launch Off Hwy 11 just S. of Irish Bayou	Sauvage
015	Rigolets Harbor Marina	Rigolets
016	Fort Pike boat launch	Pike
017	Lake Catherine Marina	Catherine
018	Chef Harbor Marina	Chefharb
019	Claudia and Stanley's Boat Launch (2651 Paris Road)	Claudia
020	Bait , Inc (2001 Paris Rd—by Paradise Casino)	Bait
021	Gulf Outlet Marina (Marina Rd. off Paris Rd. S. of Bienvenue)	GOM
022	Bayou Charters (Hopedale Hwy.)	Byuchart
023	Dudenhefer's Fishing Charters (Hopedale Hwy.)	Dude
024	Louisiana Fishing Expeditions (Hopedale Hwy.)	Lafish
025	Get-A-Way Fishing Charters (Hopedale Hwy.)	Getaway
026	Launch and hoist at 6405 Hopedale Hwy.	6405Hope
027	Breton Sound Marina	Breton
028	Fishing Magician Charters Yscloskey Hwy)	Magician
029	Blackie Campo's (Shell Beach)	Campo
030	Seabrook Boat Launch (Industrial canal and Lake Pont.)	Seabrook
031	West End Blvd boat launch	Westend
032	Bonnabel Blvd boat launch and pier	Bonnabel
033	Williams Blvd boat launch and pier	Williams
034	Bonne Carre' Lower Guide Levee boat launch	LGL

Interviewer C 2
(Enter interviewer initials)

Weather N 2
(Enter code for weather conditions)

1) Sunny/partly cloudy
2) Sunny/partly cloudy/windy
3) Sunny/clear
4) Sunny/clear/windy
5) Cloudy/windy
6) Cloudy/light wind
7) Cloudy/cool
8) Hazy/mild
9) Cloudy/light rain
10) Hazy/sunny
11) Stormy
12) Clearing after T'storms
13) Stormy/ Squalls
14) Partly cloudy
15) Scattered clouds
16) Windy/Heavy rain
99) No data

Wind dir C 3
(Enter code for wind direction
N, NNE, NE, ENE, etc. 88=Variable 99=No data)

Wind spd N 2
(Enter code for wind speed
Enter wind speed in miles per hour. 88=calm 99=No data)

Hello! My name is _____ with GEC in Baton Rouge. We are working with the New Orleans District of the Army Corps of Engineers to monitor the effects on recreation in Lake Pontchartrain and Lake Borgne of opening the Bonnet Carre Spillway on April 11. Would you please help by answering a few questions about your use of these lakes?

NUMBER OF PEOPLE IN PARTY ___

People	N	2

(Enter number of people in party 99=no data)

DEPARTING / RETURNING ___

Depretrn	C	1

(Enter letter D for departing, R for returning, N for not applicable X=no data

BANK ___ DOCK/PIER ___ BOAT ___ SIZE OF BOAT (FT.) _____

Boat bank	C	4

(Enter Bank for bank, Pier for dock/pier, Boat for boat)

Boat size	N	2

(Enter length of boat in feet)

1. What were your activities this trip? (If no fishing skip to question 5)

1.) Fishing
2.) Crabbing
3.) Trawling
4.) Water Skiing
5.) Jet Skiing
6.) Pleasure Boating
7.) Swimming
8.) Sailing
9.) Parasailing
10.) Other

Activ1	N	2
Activ2	N	2
Activ3	N	2

(Enter number of activity. 88=not applicable 99=no data)

NOTE: additional activities can be added

2. What was your primary activity this trip?

1.) Fishing
2.) Crabbing
3.) Trawling
4.) Water Skiing
5.) Jet Skiing
6.) Pleasure Boating
7.) Swimming
8.) Sailing
9.) Parasailing
10.) Other

Prime	N	2

(Enter number of activity. 99=no data)

NOTE: additional activities can be added

3. If fishing, what kind of fish were you fishing for?

1) Speckled Trout
2) Redfish
3) Drum
4) White Trout
5) Croakers
6) Bass
7) Flounder
8) Other

Sought1	N	2
Sought2	N	2
Sought3	N	2

(Enter number of fish type in question 3. 99=no data

4a. What kind of fish and what size fish were caught?

Number and approximate size in inches

1) Speckled Trout
2) Redfish
3) Drum
4) White Trout
5) Croakers
6) Bass
7) Flounder

Caught1	N	2
Caught2	N	2
Caught3	N	2

(Enter number of type of fish caught. 98=zero fish caught 88=not applicable 99=no data)

NOTE: Additional types of fish can be added

Numbfish1	N	2

(Enter number (amount) of caught1 fish. 98=zero fish caught 88=not applicable 99=no data))

Numbfish2	N	2

(Enter number (amount) of caught2 fish. 98=zero fish caught 88=not applicable 99=no data))

Numbfish3	N	2

(Enter number (amount) of caught3 fish. 98=zero fish caught 88=not applicable 99=no data))

Sizefish1 N 2
(Enter size in inches of caught1 fish. 88=not applicable 99=no data)
Sizefish2 N 2
(Enter size in inches of caught2 fish. 88=not applicable 99=no data)
Sizefish3 N 2
(Enter size in inches of caught3 fish. 88=not applicable 99=no data)

4b. How does this compare to trips before the April 11 opening?

Compare N 1
(1=better 2=about the same 3=worse 8=not applicable 9=no data)
NOTE: Additional "conditions" can be added as required.)

5. Are you a commercial fisherman?

1) Y 2) N
Commercial N 1
(1=yes, 2=no, 8= not applicable, 9=no data)

6. Where did you go?

1) Lake Maurepas and I-55 Canals
2) Western Lake Pontchartrain
3) North Shore Lake Pontchartrain
4) Eastern Lake Pontchartrain
5) Passes Area / Lake Catherine
6) Lake Borgne
7) South Shore Lake Pontchartrain
8) Other (Please specify)

Used area N 2
(Enter number of area listed. 88=not applicable 99=no data)
NOTE: Additional areas, sub-areas can be listed

7. Is that the area you normally use in Lake Pontchartrain / Lake Borgne?

1) Y 2) N

Norm used N 1
(1=yes, 2=no 8=not applicable 9=no data)
NOTE: Additional "conditions" can be coded

8. Did you go there because of the effects of the spillway opening?

1) Y 2) N

Why go N 1

(1=yes, 2=no 8=not applicable 9=no data)

NOTE: Additional "conditions" can be coded

9. If the spillway had not been opened, where would you have gone?

1) Lake Maurepas and I-55 Canals
2) Western Lake Pontchartrain
3) North Shore Lake Pontchartrain
4) Eastern Lake Pontchartrain
5) Passes Area / Lake Catherine
6) Lake Borgne
7) South Shore Lake Pontchartrain
8) Other

Prefer go N 2

(Enter number of area listed. 88=not applicable 99=no data)

NOTE: Additional areas, sub-areas can be listed

10. Has your use of Lake Pontchartrain / Lake Borgne changed since the spillway opened?

1) Y 2) N

Change use N 1

(1=yes, 2=no 8=not applicable 9=no data)

NOTE: Additional "conditions" can be coded

How?

How change N 2

(Develop categories for answers based on accumulated responses. 88=not applicable, 99=no data)

11a. How many trips to Lake Pontchartrain / Lake Borgne have you made since the spillway opened on April 11?

Trip since N 2

(Enter number of trips. 88=not applicable 99=no data)

11b. If the spillway had not been opened how many trips do you think you would have made since April 11?

Non trips N 2

(Enter number of trips. 88=not applicable 99=no data)

12a. How many trips to Lake Pontchartrain / Lake Borgne do you make in a normal year?

Norm year N 2

(Enter number of trips. 88=not applicable 99=no data)

12b. How many trips to Lake Pontchartrain / Lake Borgne do you anticipate making this year?

This year N 2

(Enter number of trips. 88=not applicable 99=no data)

12c. Is the difference in trips because of the opening of the spillway?

Difference N 2

(1=yes, 2=no 88=not applicable 99=no data)

NOTE: Explanatory comments can be categorized and coded

13. In the future, do you plan to use other areas not impacted by the spillway opening?

New areas N 1`

(1=yes, 2=no 8=not applicable 9=no data)

Where? _____ Is this area within Lake Pontchartrain / Lake Borgne?

Where new N 2

(Develop list/coding of new areas. 88=not applicable 99=no data)

14. How has the opening of the Bonnet Carre Spillway affected your recreation enjoyment in Lake Pontchartrain / Lake Borgne?

1. Greatly improved
2. Improved
3. No change
4. Diminished
5. Greatly Diminished
6. Do not use

Affect use N 2

(Enter number of response. 8=not applicable 9= no data)

NOTE: Categories/coding of explanations can be develope

15. What is your zip code?

Zip code N 5

(Enter zip code. 99999=no data)

16. Are there other concerns and issues that you have?

Concerns N 2

(Responses will be categorized and coded.)

Coded Responses

Code	Concern	Number
1	None	673
2	Algae Bloom	11
3	Debris	17
4	Gas Prices	6
5	Bad Fishing	14
6	Better Fishing	15
7	No Change	14
8	Corps Project	18
9	Pollution	10
10	Against Opening	3
11	Do Not Use Lake	4
12	Will Return Later in Year	2
13	First Time Back	6
14	Repair/Build New Facilities	9
15	Duration Spillway Open	8
16	Improved Next Year	6
17	Agree with Opening	23
18	More Grass	1
19	Need Live Bait	1
20	Lake is Improving Since Spillway	1
21	Bad Weather	1
22	Leave Open	3
23	Freshwater	5
24	Trash	2

Source: G.E.C., Inc.

The following is additional Protocol which was established during the Lake Survey Process

Please follow the protocol below when filling out surveys and entering data from lake user surveys into the database.

For all quantities enter digits only, leave blank for "don't know" or indeterminate quantities such as "a few", "more".

Time-	Enter Colon between hour and minutes digits (730 enter 7:30)
Location-	Enter Digit for Location unless other, then mark other plus location description
Missing Time –	Enter time between previous and next entry.
Boat Size –	Enter digits only (19' enter 19). Enter decimals for fractions.
Activity-	List each different activity only once
Fish Caught-	Leave blank if none Enter other plus species name is type fish is not listed Enter Crabs for crabs
Number of Fish –	Enter 0 for None Enter lower number of a range Crabs convert dozens to a number Do not count fish thrown back because of size limit
Area Normally Used-	Yes or No, unless first time, then NA
Departing/Returning-	For boaters only
Trips since spillway opening -	Enter 1 if first trip since opening Enter midpoint of range Convert times per week to a digit Enter 0 if no trips to study area (Paris Rd.)
Non-trips	Enter 0 for "no effect"
Trips in Normal Year-	Convert times per week to a digit Enter midpoint of range Convert times per week to a digit
Trips this Year-	Conditional responses leave blank (e. g. If it clears up) Vague responses leave blank (e. g. Lots less, not as many) Convert times per week to a digit

THIS DOCUMENT INCORPORATES THE QUESTIONAIRE, DATABASE STRUCTURE DESCRIPTION AND CODING INSTRUCTIONS FOR THE 2008 SPILLWAY USER INTERVIEWS

2008 Bonnet Carre' Opening Survey Form – Spillway Users – August 2008

DATE ___ TIME ___ LOCATION _____

INTERVIEWER_____ WEATHER CONDITIONS _____

(ENTER LOCATION NAME OR MNEMONIC FROM LIST. ENTER SITE_NO FROM LIST.)

1. Batture
2. Front Section
3. Middle Section Upper Portion
4. Middle Section Lower Portion
5. Upper Section
6. St. Charles Parish Rec Area
7. Lower Guide Levee
8. Upper Guide Levee
9. Lake Shore and Boat Ramp
10. Lake Offshore

Interviewer
(Enter interviewer initials)

Weather N 2
(Enter code for weather conditions)

1) Sunny/partly cloudy
2) Sunny/partly cloudy/windy
3) Sunny/clear
4) Sunny/clear/windy
5) Cloudy/windy
6) Cloudy/light wind
7) Cloudy/cool
8) Hazy/mild
9) Cloudy/light rain
10) Hazy/sunny
11) Stormy
12) Clearing after T'storms
13) Stormy/ Squalls
14) Partly cloudy
15) Scattered clouds
16) Windy/Heavy rain
99) No data

Hello! My name is _____ with GEC in Baton Rouge. We are working with the New Orleans District of the Army Corps of Engineers to monitor the impact on recreation of opening the Bonnet Carre' Spillway on April 11. Would you please help by answering a few questions about your use of the spillway?

NUMBER OF PEOPLE IN PARTY ___ NUMBER OF VEHICLES _____
(Enter number of people in party 99=no data)

1. Is this the usual size of your party or group when you visit the Spillway?
Yes / No

(If no) How many People _____ Vehicles _____ are usually in your group?
(Enter number of people and vehicles in party 99=no data)

Note to interviewer: if necessary, explain that automatic traffic counters count vehicles for usage estimation purposes.)

2 Is this your first trip to the Spillway since the gates were opened on April 11?
Yes / No (If no)—How many trips have you made since the opening?
_____
(Enter number of trips)

3. Do you think you would have made more trips if the spillway had not flooded?
Yes / No
(If Yes) How many more? ____
Comments*:*

(Enter number of trips)

4. What are your activities this trip? *(Circle all that apply)*

1.) Sightseeing / Driving
2.) Picnicking
3.) Walk/Hike
4.) Camping
5.) Bird Watching
6.) Photography
7.) Bicycles
8.) Motor Cycles
9.) ATV
10.) 4-Wheel Drive
11.) Swimming
12.) Crawfishing
13.) Crabbing
14.) Bank Fishing
15.) Boat Fishing
16.) Catching Bait
17.) Boating and Skiing
18.) Jet Ski
19.) Dog Train / Play
20.) Radio Control Planes
21.) Socialize
22.) Horseback Riding
23.) Hunting
24.) Relaxing

5. During this trip, in what part of the spillway did you/ will you go? What were your activities in those areas?

1.) Area 1	Y	N	Activities -
2.) Area 2	Y	N	Activities -
3.) Area 3	Y	N	Activities -
4a.) Area 4a	Y	N	Activities -
4b.) Area 4b	Y	N	Activities -
5a.) Area 5a	Y	N	Activities -
5b.) Area 5b	Y	N	Activities -
6.) Area 6	Y	N	Activities -
7a.) Area 7a	Y	N	Activities -
7b.) Area 7b	Y	N	Activities -
8a.) Area 8a	Y	N	Activities -
8b.) Area 8b	Y	N	Activities -
8c.) Area 8c	Y	N	Activities -
9.) Area 9	Y	N	Activities -
10.) Area 10	Y	N	Activities -

(Enter area and activities which took place in that area)

(Enter one of the activities below for question 5)

1.) Sightseeing / Driving
2.) Picnicking
3.) Walk/Hike
4.) Camping
5.) Bird Watching
6.) Photography
7.) Bicycles
8.) Motor Cycles
9.) ATV
10.) 4-Wheel Drive
11.) Swimming
12.) Crawfishing
13.) Crabbing
14.) Bank Fishing
15.) Boat Fishing
16.) Catching Bait
17.) Boating and Skiing
18.) Jet Ski
19.) Dog Train / Play
20.) Radio Control Planes
21.) Socialize
22.) Horseback Riding
23.) Hunting
24.) Relaxing

6. Before the spillway flooded, what activities had you used the spillway for? How many times per year had you participated in this activity in the spillway?

1.) Sightseeing / Driving
2.) Picnicking
3.) Walk/Hike
4.) Camping
5.) Bird Watching
6.) Photography
7.) Bicycles
8.) Motor Cycles
9.) ATV
10.) 4-Wheel Drive
11.) Swimming
12.) Crawfishing
13.) Crabbing
14.) Bank Fishing
15.) Boat Fishing
16.) Catching Bait
17.) Boating and Skiing
18.) Jet Ski
19.) Dog Train / Play
20.) Radio Control Planes
21.) Socialize
22.) Horseback Riding

(Enter all which apply)
(Enter number of times per year user participated in activity)

7. How would you describe your experience this trip?

1.) Great	2.) Good	3.) OK	4.) Poor	5.) No Answer

(Enter number of response)

8. Are there any additional facilities you would like to see provided? What are they?

(Response with be categorized and coded and presented in Chapter 6)

9. Do you think the effects of flooding the spillway will change your future use of the spillway? Y / N How?
(Enter Yes or No)
(If yes then response will be categorized and coded)

10. Do you intend to resume your normal use of the spillway? When?

(Record response)

11. What is your zip code?

(Enter zip code. 99999=no data)

12. Do you have any additional comments?

(Response will be categorized and coded)

Coded Responses

Code	Additional Comments	Number of Comments
1	None	277
2	Appreciate the Ability to Use Spillway	38
3	Repair Roads/Trails	16
4	More Patrolling	12
5	Improve Access to other Parts of Spillway	11
6	Agrees With Opening	11
7	More Trash Cans	10
8	Cut Grass	7
9	Shade/Pavilion	7
10	Add More to Parks	6
11	Better/More Markings	6
12	Separate Areas for ATVs and Motorcycles	5
13	Boat Launch Need Repairs	5
14	Adequate Police Patrols	5
15	Add Campgrounds	5
16	More Tracks for ATVs	5
17	Channels Need Dredging	4
18	Build Fishing Pier	4
19	Running Water	3
20	Improve Website	3
21	Improved Crawfishing	2
22	Crabbing Returned to Normal	2
23	Better Fishing Since Spillway was Opened	1
24	More Convient Camping Permits	1
25	Happy to See Portable Bathrooms	1
26	Keep Horses off Bike Trail	1
27	Permanent Bathrooms	1
28	Boat Rentals	1
29	Lighting	1
30	Barbeque Pits	1
31	Separate Areas for Skiers and Fishermen	1
32	Open Truck Trails Again	1
33	Allow for Use at Night	1
34	Worse Crabbing	1

Source: G.E.C., Inc.