PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-30-R-32

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2006 Survey Report

Walter E. Long Reservoir

Prepared by:

Stephan J. Magnelia and Marcos J. De Jesus
Inland Fisheries Division
District 2C San Marcos, Texas

Robert L. Cook
Executive Director

Phil Durocher
Director, Inland Fisheries

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Walter E. Long Reservoir were surveyed in 2006 using electrofishing and in 2007 using gill nets. Anglers were surveyed from June 2004 to May 2005 with a creel survey. This report summarizes results of the surveys and contains a fisheries management plan for the reservoir based on those findings.

- **Reservoir Description:** Walter E. Long Reservoir is a 1,269-acre impoundment of Decker Creek, a tributary of the Colorado River, and is located on the northeast side of the city of Austin, Travis County, Texas. The dam was constructed in 1967 for supplying water to a power plant operated by the City of Austin. The reservoir has a drainage area of 9.3 square miles, a shoreline length of 16 miles, and a shoreline development index of 3.3. The reservoir lies within the Blackland Prairies Ecological Region.

- **Management history:** Important sport fish included largemouth bass, palmetto bass, catfish species and white bass. Palmetto bass were stocked from 2004-2006. Largemouth bass have been managed since 1993 with a 14- to 21-inch slot-length limit. Trap netting for white crappie was not performed due to historically low catch rates and the high cost/benefit ratio associated with collecting these data.

- **Creel Survey:** Angler catch rate for bank anglers at the city park was poor, although fishing effort was high. Submerged aquatic vegetation along the city park shoreline decreased bank angling efficiency and angler success. Boat angler catch rate was good.

- **Fish Community**
  - **Prey species:** Sunfishes, gizzard shad and threadfin shad were the dominant prey species.

  - **Catfishes:** Channel catfish were the dominant catfish species. Flathead catfish were present in low density.

  - **Temperate basses:** Palmetto and white bass were present. Palmetto bass were a popular sport fish. Keeper-size ($\geq$ 18 inches) palmetto bass were present.

  - **Largemouth bass:** Largemouth bass were abundant. Angler catch rate was good. Anglers seeking largemouth bass accounted for 40.6% of the directed fishing effort.

- **Management Strategies:** The reservoir should continue to be managed with existing harvest regulations. Palmetto bass stockings should continue to be requested, but at a reduced stocking rate. Aquatic vegetation along the city park shoreline should be treated to improve bank fishing access and catch. Length-at-age for largemouth bass should be determined with an extensive age and growth sample in 2010.

INTRODUCTION

This document is a summary of fisheries data collected from Walter E. Long Reservoir from 2004-2007. The purpose of the document is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other species of fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data is presented for comparison.

Reservoir Description

Walter E. Long Reservoir is a 1,269-acre stable-level impoundment of Decker Creek, a tributary of the Colorado River, and is located on the northeast side of the City of Austin, Travis County, Texas. The dam was constructed in 1967 for supplying water to a power plant operated by the City of Austin. The reservoir has a drainage area of 9.3 square miles, a shoreline length of 16 miles, and a shoreline development index of 3.3. The reservoir lies within the Blackland Prairies Ecological Region. The entire reservoir shoreline is owned by the City of Austin, limiting bank access to a city-operated park on the south shore. Shoreline access was excellent within the park boundaries, although submerged aquatic vegetation (Appendix G) limited bank angling access and success. A fishing pier was available in the park. A multi-lane, concrete boat ramp (3 boat lanes total) was located within the park, offering adequate boat access to the reservoir. No amenities specially designed for physically disabled persons were available. Other descriptive characteristics for Walter E. Long Reservoir are in Table 1.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Bonds and Magnelia 2003) included:

1. Monitor the largemouth bass population under the 14-to 21-inch slot length limit.
   Action: Fall electrofishing surveys were conducted from 2003 to 2006 to monitor the presence of bass in the 14- to 21-inch size range. A creel survey was conducted from June 2004 to May 2005 to assess angler catch, harvest and directed effort.
2. Annually stock palmetto bass.
   Action: Palmetto bass were stocked from 2004 to 2006.
3. Monitor the palmetto bass population with additional gill netting and a creel survey.
   Action: An additional gill netting survey was conducted in spring 2005 to assess the population. Increased effort was also expended in 2005 (25 net nights) and 2007 (15 net nights). A creel survey was conducted from June 2004 to May 2005 to assess directed angler effort, catch and harvest of this species.
4. Monitor aquatic plant coverage.
   Action: An aquatic vegetation survey was conducted each year since the last survey report during the peak (July-September) of the growing season.
5. Promote the sunfish fishery.
   Action: The sunfish fishery was promoted with news releases.

Harvest regulation history: Sportfishes in Walter E. Long Reservoir were managed with statewide regulations with the exception of largemouth bass (Table 2). From 1986 to 1993, largemouth bass were managed with a 14-inch minimum length limit. A 14- to 21-inch slot length limit was implemented on September 1, 1993 to: increase abundance of bass greater than 14 inches in length; increase angler catches of bass greater than 14 inches in length; and, re-direct harvest at individuals less than 14 inches in length.

Stocking history: Florida largemouth bass and palmetto bass were important species which were requested and/or stocked. A complete stocking history is in Table 3.

Aquatic vegetation/habitat history: The exotic plant hydrilla *Hydrilla verticillata* was present in this reservoir (Appendix H) along with a diverse group of native aquatic plant species. Summer total coverage estimates of all plant species in 2006 (7.0%) was similar to 2001 (7.6%). This was lower than estimates from the previous four years (2002=10.7%, 2003=16.4%, 2004=24.7%, 2005=17.6%) (Appendix C). Mean total coverage over the past five years was 15.3%. Hydrilla coverage in 2006 was low (<1%) and mean coverage since 2002 has only been 4.8%. In the past the City of Austin has facilitated several herbicide treatments (1989, 1993, 1996) to control hydrilla in the power plant intake area, along the city park shoreline and the area adjacent to the boat ramp. In recent years treatments for hydrilla haven't been necessary. Aquatic plants offered excellent fish habitat, especially for largemouth bass and sunfishes.

METHODS

Fishes were collected by electrofishing (1.0 hours at 12 5-min stations) and gill netting (15 net nights at 15 stations). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing and for gill nets as the number of fish per net night (fish/nn). All survey sites were randomly selected and all surveys were conducted according to the Fishery Assessment Procedures Manual (TPWD, Inland Fisheries Division, unpublished manual revised 2005). A one year creel survey was conducted from June 2004 to May 2005. Trap netting for white crappie was not performed due to historically low catch rates and the high cost/benefit ratio associated with collecting these data.

Sampling statistics (CPUE for various length categories), structural indices [Proportional Stock Density (PSD), Relative Stock Density (RSD)], and condition indices [relative weight (Wr)] were calculated for target fishes according to Anderson and Neumann (1996). Index of vulnerability (IOV) was calculated for gizzard shad (DiCenzo et al. 1996). Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE statistics and for creel statistics and SE was calculated for structural indices and IOV. Ages were determined for largemouth bass, white bass and palmetto bass using otoliths. Sample sizes were adequate to meet category 2 age-and-growth sampling design recommendations (TPWD, Inland Fisheries Division, unpublished manual revised 2005). A habitat survey has not been conducted since 1998. No large scale structural habitat changes have occurred in the interim. Genotype identification of F1 and Fx hybrid largemouth bass was omitted in 2006 due to high probability of misidentification resulting from low numbers of loci available for analysis.

RESULTS AND DISCUSSION

Habitat: Structural and littoral habitat consisted primarily of emergent vegetation (bulrush, S*cripus* spp.) (Table 4). Submerged, floating leaved and emergent aquatic vegetation provided good habitat for phytophilic fish species (Table 5, Appendix G). Aquatic vegetation coverage was below optimal for fish production. Total aquatic vegetation coverage within the range of 10 to 40% was considered optimal for growth and survival of phytophilic fish (Dibble et al. 1996) and for largemouth bass recruitment and standing crop (>20% total coverage) (Durocher et al. 1984).

Creel Survey: Total fishing effort for all species at Walter E. Long Reservoir was 94,870.5 hours (74.7 hours/acre) from June 2004 through May 2005. This level of fishing effort among Central Texas reservoirs was considered high. Thirty-three percent of the fishing effort was from bank anglers at the city park. Overall mean catch rate for all species targeted by bank and boat anglers was 0.02 and 0.52 fish/hour, respectively. While the catch rate for anglers fishing from boats was considered good, the bank angling catch rate was poor. Directed fishing effort by anglers was highest for black basses (40.6%), followed by anglers fishing for any species (30.7%), and palmetto bass (11.2%) (Table 6). Annual directed effort for largemouth bass was 30.3 hours/acre with the highest fishing effort occurring in the spring (March – May) (28%, 8.4 hours/acre) and fall quarters (September– October) (30.7%, 9.3 hours/acre). Almost all (96.3%) largemouth bass caught were released. Of the largemouth bass released 47.9% were less than 14 inches, 50.4% were from 14 to 21 inches and 1.7% exceeded 21 inches in length. Of the largemouth bass harvested 45.4% were from 14 to 21 inches (illegal harvest). Only 5.5% of the sub-slot bass caught by anglers were harvested. The low percentage of sub-slot harvest was similar to Lake Georgetown (14-to 18-inch slot length limit, 3.8% sub-slot harvest) (Magnelia and De Jesus, 2006) and Fayette County Reservoir (14- to 24-inch slot length limit, 3.1% sub-slot harvest) (TPWD, unpublished data). The angler catch rate for anglers targeting largemouth bass was: 0.61/hour in the spring quarter; 0.43/hour in the summer quarter (June – August); 0.65/hour in the fall quarter (September – November); and, 0.23 in the winter quarter (December – February). The spring quarter angler catch rate for largemouth bass in 1995, 18 months after implementation of the slot length limit, for anglers targeting largemouth bass was 0.48/hour (Terre and Magnelia 1996). Palmetto bass angling accounted for 11.2% (8.4 hours/acre) of all angling effort with 34.5% of the effort coming from bank anglers at the city park. Fishing effort for this species during each creel quarter was; spring (26.8%), summer (28.8%), fall (14.9%) and winter (29.5%). Of the palmetto bass caught 97.5% were released, with 6.8% of these fish exceeding the legal length (18 inches). Although few palmetto bass were harvested, 40% were less than 18 inches in length (illegal harvest). This harvest may have been due to difficulty identifying this species with white bass, which were also present in the reservoir and accounted for 2.6% of the directed fishing effort. Angler catch rate for palmetto bass was 0.32 fish/hour.

Economic Impact: An estimated total of $318,539 in direct expenditures related to fishing trips was made by anglers during the 12-month creel period (Table 7). About one third of this ($100,411) was expenditures from bank anglers fishing at the city park. Most of the anglers contacted at Walter E. Long Reservoir were from Travis, Hays, Williamson and Bastrop counties (96.2%).

Prey species: Electrofishing catch rates of gizzard shad, bluegill and redbreast sunfish were 32.0/h, 154.0/h, and 146.0/h, respectively. Threadfin shad, longear sunfish, green sunfish and redear sunfish were also available as forage. Index of vulnerability (IOV) for gizzard shad indicated that only 21.9% of gizzard shad were available to existing predators. Total CPUE of gizzard shad was considerably higher in 2006 compared to the 2002 survey (Figure 1). Total CPUE of bluegill in 2006 was lower than total CPUE from the survey in 2002, and size structure continued to be dominated by small individuals (Figure 2).

Catfishes: The gill net catch rate for channel catfish was 2.5/nn in 2007, which was similar to previous years (Figure 3). Individuals greater than 12 inches in length made up about 50% of the gill net catch, and some large channel catfish ($\geq$20 inches) were available. Flathead catfish were present in low density. Directed fishing effort for catfishes in general and channel catfish combined was 7.3 hours/acre, 9.8% of

the total fishing effort (Table 8). Angling effort was almost evenly divided between bank (53.6%) and boat anglers (46.4%).

White bass: Despite the lack of initial TPWD stockings and a major spawning tributary this reservoir has historically supported a low-density white bass population. Gill net catch rates have varied (range = 0/net night – 2.2/net night) since 1991, and reproductive success appeared to be inconsistent. White bass collected in 2003 came from one year class (1998) (Bonds and Magnelia 2003). In the 2005 gill net survey 95% of the white bass collected came from the 2003 year class. However, those collected in 2007 came from four different year classes (2001, 2002, 2003 and 2006;Figure 6), indicating reproduction has occurred almost annually. In 2005 the TPWD game warden assigned to Walter E. Long Reservoir commented that citations were commonly issued to anglers for harvesting sub-legal length hybrid striped bass misidentified as white bass. In 2005 the total gill net catch of white bass and palmetto bass was 37% and 63%, respectively (Appendix D). However, the gill net catch of *Morone* spp. less than 14 inches in length in 2005 was almost equal, 52% (N=55) white bass and 48% (N=50) palmetto bass (Appendix D). This almost equal split amongst smaller individuals may have made identification between the species by anglers difficult. In 2007 the proportion of palmetto bass in the population had increased (70%) and unlike 2005 the catch of individuals less than 14 inches in length was made up predominately (76%) of white bass (Appendix D). Harvest of small palmetto bass, misidentified as white bass, while an enforcement issue, didn't appear to be a fisheries management concern as catch-and-release was high for both species (white bass = 98.7%, palmetto bass = 97.5%).

Palmetto bass: The gill net catch rate of palmetto bass was 4.7/nn in 2007 (Figure 8), which was higher than previous years. Fifty-six percent of the adult palmetto bass sampled exceeded 18 inches, which was higher than 2005, but lower than 2003. Angler catch rate for this species was good (0.32 fish/hour; Table 10). Total annual mortality of palmetto bass age three and older (i.e., all legal size) based on catch curve regression analysis (Ricker 1975) during 2003, was calculated at only 28.3% (Bonds and Magnelia 2003). This low mortality may be due to voluntary catch-and-release of this species by anglers. Most of the palmetto bass caught were released (97.5%). Of the legal length ($\geq$18 inches) palmetto bass caught (N=792) only 17.9% were harvested. Body condition (Wr) was sub-optimal (<100), but higher than values from 2005. In 2007 palmetto bass reached legal length between age two and three (Figure 11; N=70, range 1-5 years), which was similar to the ecological area average (Prentice 1987). Palmetto bass angling accounted for 11.2% (8.4 hours/acre) of all angling effort with 34.5% of the effort coming from bank anglers at the city park. Directed fishing effort from the spring (March-May) 2005 quarter creel survey was 2.2 hours/acre, which was similar to directed fishing effort for this species documented in a spring quarter 1995 creel survey (1.5 hours/acre, (Terre and Magnelia 1996).

Largemouth bass: The reservoir contained a moderate to high-density largemouth bass population relative to bass populations in other Central Texas Reservoirs. The largemouth bass 2006 electrofishing catch rate for all sizes (233.0/hour; Figure 12) was higher than the reservoir average (174.6/hour) since the start of the slot length limit (September 1, 1993) and was similar to the 2005 total catch rate (253.0/hour). Total catch rates from these two surveys (2005 and 2006) were historic highs for the reservoir (Appendix E). The electrofishing catch rate for bass 14 inches (62/hour) was slightly above the average since the start of the slot length limit (60.5/hour $\pm$ 19.4). Pre-slot length limit mean electrofishing CPUE 14 was only 8.8/hour $\pm$ 4.0. Few bass greater than 21-inches in length were collected electrofishing (Figure 11). Relative weight (Wr) among most inch groups in 2006 was sub-optimal (<100), which was a recurring trend from previous surveys. Recurring sub-optimal body condition may have been indicative of high densities and intense intra-specific competition for forage. Largemouth bass collected in electrofishing surveys from 2002 to 2006 displayed a wide range of Wr values (62-120) (Appendix F). Total aquatic vegetation coverage probably influences year-to-year variability in mean relative weight (Appendix F), with an inverse relationship between total aquatic coverage and mean relative weight. Mean relative weight indices in 2006 for all individuals collected electrofishing was 94.8, which was an increase from 2005 (92.8) and 2004 (85.2) (Appendix F). Growth rates have historically exceeded (Bonds and Magnelia 2003) eco-region averages (Prentice 1987). Age and growth analysis from 2006 indicated individuals reached 14 inches by age 4, which was considered extremely slow growth for Central Texas.

However the age and growth sample in 2006 was small (N = 29, range 1 - 3 years). The previous age and growth sample (fall 2002) size was much greater (N = 160) and indicated individuals reached 14 inches by age-2, which was consistent with previous surveys (Bonds and Magnelia 2003). Almost all (96.3%) largemouth bass caught by anglers were released (Table 11). Only 5.5% of the sub-slot bass caught by anglers were harvested. The low percentage of sub-slot harvest was similar to Lake Georgetown (14-to 18- inch slot length limit, 3.8% sub-slot harvest) (Magnelia and De Jesus, 2006) and Fayette County Reservoir (14- to 24-inch slot length limit, 3.1% sub-slot harvest) (TPWD, unpublished data). The lack of sub-slot bass harvest on this reservoir was of little concern, because growth has been historically good (Bonds and Magnelia 2003) and recruitment into the protected slot appeared adequate to produce good angler catch rates for slot length bass (0.27 bass/hour). Florida bass have been stocked in multiple years, most recently in 1994 and 1995. Electrophoresis samples collected in 2006 indicated 84% of the population contained Florida largemouth bass alleles, and 17% of the sample were pure Florida bass (Table 12).

Fisheries management plan for Walter E. Long Reservoir, Texas

Prepared – July 2007

ISSUE 1: The palmetto bass fishery was popular with anglers, but angler harvest appeared to be low. Relative weights of palmetto bass and largemouth bass were sub-optimal (<100) and in some past samples have been poor (<90). This may have been an indication forage was not adequate for supporting high densities of both species and white bass. Angler harvest of all three species was low. In addition to high predator densities aquatic vegetation coverage may also reduce algal productivity and shad forage densities.

MANAGEMENT STRATEGY

1. Continue stocking palmetto bass, but at a reduced rate of 5/acre.

ISSUE 2: According to the TPWD game warden assigned to the reservoir there was confusion among anglers regarding identification of white bass and small (<14 inches) palmetto bass. Anecdotal reports indicated this has been a problem for many years on this reservoir. In some years the proportion of white bass and palmetto bass less than 14 inches in length was almost equal. White bass appeared to be reproducing almost annually. Because angler harvest of both species was low, illegal harvest of small palmetto bass did not appear to be hurting the population. However, anglers may harvest more white bass if they could be more confident identifying the species.

MANAGEMENT STRATEGIES

1. Make the Walter E. Long Park Manager aware that identification of these species was a problem for anglers.
2. Provide the Park Manager signage that provides information on key meristic differences between the species.

ISSUE 3: Bank fishing at the city park was popular, providing thirty-three percent of the total fishing effort. Catch rates for bank anglers were low (0.02 fish/hour). Channel catfish and palmetto bass were available and could be targeted by bank anglers, but fishing for these species was hindered due to submerged aquatic vegetation. Many complaints at this location concerning the submerged aquatic vegetation were received from bank anglers during creel survey interviews.

MANAGEMENT STRATEGIES

1. Continue annual aquatic vegetation surveys to document aquatic vegetation coverage along the park shoreline.
2. Request the City of Austin treat submerged aquatic vegetation along the City park shoreline as needed to improve bank fishing access.

ISSUE 4: The City Park was a popular bank fishing destination, but the mean catch rate for bank anglers was poor (0.02 fish/hour). Channel catfish and palmetto bass were abundant. These species could be targeted by bank anglers.

MANAGEMENT STRATEGY

1. Explore techniques for improving catch rates for bank anglers at the City park. A TPWD research project was proposed in 2007 that explores the use of fish attractors (underwater lights and bait blocks) for improving bank angling catch rates. If results of this study indicate attractors

improve bank angler catch rates approach the City about funding a bank angling fish attractor program.

ISSUE 5: Walter E. Long Reservoir supported a diverse aquatic plant community typified by between-year variability in total and individual plant coverage. Herbicide treatments have historically been utilized by the City of Austin to control plants, especially hydrilla. However, these plants offered excellent habitat for littoral fishes (e.g., largemouth bass and sunfishes) and major changes in plant coverage had the potential to impact fish populations. Monitoring information on aquatic vegetation coverage was valuable when interpreting fisheries data.

MANAGEMENT STRATEGY

1. Continue annual aquatic vegetation monitoring.

ISSUE 6: Age and growth data on largemouth bass collected in 2006 indicated growth was poor. This data was inconsistent with previous age and growth analyses. Total electrofishing catch rates for largemouth bass in 2005 and 2006 were at historic highs ($\geq$233 bass/hour). Slow growth may be indicative of overcrowding due to the restrictive slot length limit (mandatory release) and lack of sub-slot bass harvest (voluntary harvest).

MANAGEMENT STRATEGY

1. Collect an extensive (Category 3 or 4 sample, TPWD, Inland Fisheries Division, unpublished manual revised 2005) age-and-growth sample of largemouth bass in the 2010 electrofishing survey.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule included electrofishing in 2007 and/or 2008 and mandatory monitoring in 2010/2011 (Table 13). Additional electrofishing in 2007and/or 2008 is necessary to monitor the largemouth bass population. A gill netting survey in 2009 will be used to monitor the palmetto bass population. Trap net sampling for white crappie was permanently eliminated on this reservoir because of low historical trap net catches and low directed angler effort for this species.

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Table 1. Characteristics of Walter E. Long Reservoir, Texas.

Characteristic	Description
Year constructed	1967
Controlling authority	City of Austin
County	Travis
Reservoir type	Power cooling
Shoreline Development Index (SDI)	3.3
Conductivity	600 umhos/cm

Table 2. Harvest regulations for Walter E. Long Reservoir.

Species	Bag Limit	Length Limit (inches)
Catfish: channel catfish, hybrids and subspecies	25 (in any combination)	12 minimum
Catfish, flathead	5	18 minimum
Bass, white	25	10 minimum
Bass, palmetto	5	18 minimum
Bass: largemouth	5	14 – 21 slot
Crappie: white and black crappie, their hybrids and subspecies	25 (in any combination)	10 minimum

Table 3. Stocking history of Walter E. Long Reservoir, Texas. Life stages are fry (FRY), fingerlings (FGL), advanced fingerlings (AFGL), adults (ADL) and unknown (UNK). Life stages for each species are defined as having a mean length that falls within the given length range. For each year and life stage the species mean total length (Mean TL; in) is given. For years where there were multiple stocking events for a particular species and life stage the mean TL is an average for all stocking events combined.

Species	Year	Number	Life Stage	Mean TL (in)
Black crappie x White crappie	1987	50,851	FRY	1.0
	1993	120,800	FRY	0.9
	1996	101,794	FRY	0.9
	Total	273,445		
Blue catfish	1967	2,200	UNK	UNK
	Total	2,200		
Channel catfish	1967	39,050	AFGL	7.9
	1986	3,595	FRY	1.0
	Total	42,645		
Flathead catfish	1969	10		UNK
	1970	35		UNK
	Total	45		
Florida Largemouth bass	1979	15,078	FGL	2.0
	1980	20,290	FGL	2.0
	1988	52,078	FRY	1.0
	1994	122,316	FGL	1.3
	1994	1,977,457	FRY	0.7
	1995	121,022	FGL	1.4
	1995	982,908	FRY	0.7
	Total	3,291,149		
Green sunfish x redear sunfish	1969	12,500		UNK
	Total	12,500		
Palmetto Bass (striped X white bass hybrid)	1978	9,950	UNK	UNK
	1979	560,000	FRY	0.4
	1982	12,787	UNK	UNK
	1986	24,112	FRY	1.0
	1988	30,120	FRY	1.0
	1989	27,554	FGL	1.9
	1991	12,258	FGL	1.8
	1992	10,087	FGL	1.5
	1993	10,000	FGL	1.5
	1994	19,600	FGL	1.9
	1995	21,710	FGL	1.4
	1996	19,800	FGL	1.7

Species	Year	Number	Life Stage	Mean TL (in)
	1997	20,400	FGL	1.8
	1998	19,980	FGL	1.7
	1999	18,247	FGL	1.5
	2000	18,369	FGL	1.5
	2002	18,162	FGL	2.1
	2004	18,260	FGL	1.6
	2005	6,073	FGL	1.5
	2006	6,070	FGL	1.8
	2007	6,740	FGL	1.8
	Total	890,279		
Red drum	1974	600	UNK	UNK
	1975	33,300	UNK	UNK
	1981	146,500	UNK	UNK
	Total	180,400		

Table 4. Survey of littoral and physical habitat types, Walter E. Long Reservoir, Texas, 1998. A linear shoreline distance (miles) was recorded for each habitat type found. Surface area (acres) and percent of reservoir surface area was determined for each type of aquatic vegetation found in July, 2006.

Shoreline habitat type	Shoreline Distance		Surface Area	
	Miles	Percent of total	Acres	Percent of reservoir surface area
Bulrush	8.1	57		
Eroded bank	2.2	15		
Flooded terrestrial vegetation	2.0	14		
Rip rap	1.2	9		
Gravel	0.3	2		
Broken rock	0.3	2		
Concrete	<0.1	<1		
Native submerged vegetation			23.7	1.9
Native emerged vegetation			20.0	1.6
Native floating vegetation			32.0	2.5
Hydrilla			0.3	<1
Milfoil			4.0	0.3
Native submerged and hydrilla mixed			0.3	<1

Table 5. Aquatic plants observed during aquatic vegetation surveys in Walter E. Long Reservoir, Texas, July, 2006. Surface area (acres) and percent reservoir coverage were determined for each plant species.

Common Name	Scientific name	Acres	% coverage
American lotus	*Nelumbo lutea*	1.0	0.08
Bulrush	*Scripus* spp.	20.0	1.58
Chara	*Chara* spp.	0.3	0.02
Coontail	*Ceratophyllum demersum*	23	1.81
Pondweed	*Potamogeton* spp.	31	2.44
Hydrilla	*Hydrilla verticillata*	0.3	0.02
Milfoil	*Myriophyllum* spp.	4.0	0.31
Mixed 1*		0.3	0.02
Mixed 2**		0.4	0.03
	Total	80.0	6.31

*Coontail, chara, hydrilla, southern naiad (N*ajas* spp.)

**Chara, spikerush (E*leocharis* spp)., American lotus, cattail (T*ypha* spp).

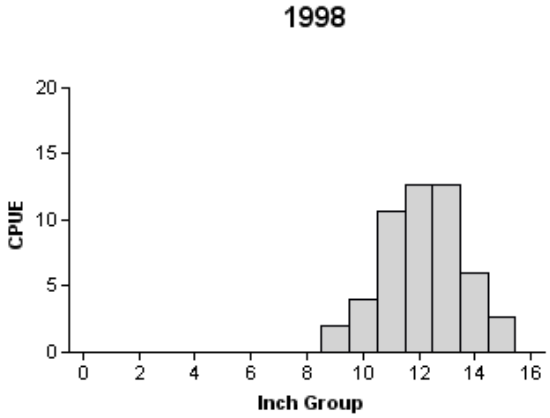
Table 6. Percent directed angler effort by species for Walter E. Long Reservoir, Texas, June, 2004 to May, 2005.

Species	Year
	2004/2005
Black basses	1.04
Crappies	0.69
Catfishes	5.60
Temperate basses (*Morone* spp.)	0.57
Panfishes (*Lepomis* spp.)	0.93
White bass	2.59
Palmetto bass	11.24
Bluegill	0.23
Redear sunfish	0.31
Largemouth bass	40.59
White crappie	0.65
Freshwater drum	0.48
Anything	30.73
Common carp	0.19
Channel catfish	4.13

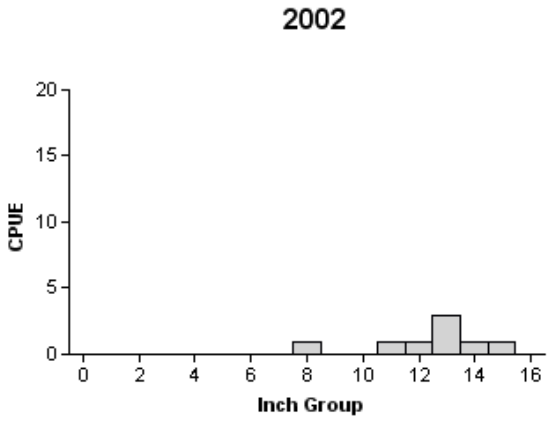
Table 7. Total fishing effort (h) for all species, total directed expenditures and expenditures for bank and boat anglers at Walter E. Long Reservoir, Texas, June 2004 to May 2005.

Creel Statistic	Year
	2004/2005
Total fishing effort	94,870
Total directed expenditures	$318,539
Bank fishing expenditures	$105,117
Boat fishing expenditures	$213,422

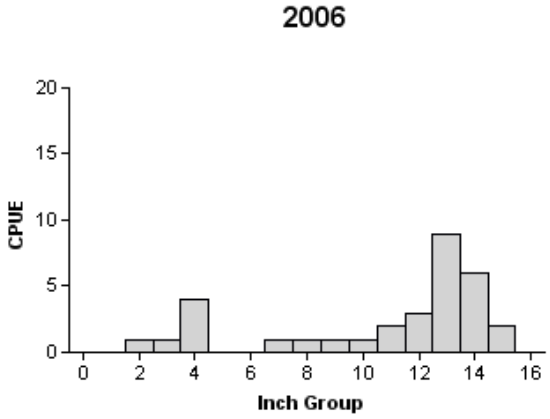
Gizzard Shad



Effort =	1.5
Total CPUE =	50.7(35; 76)
IOV =	0.0 (0)



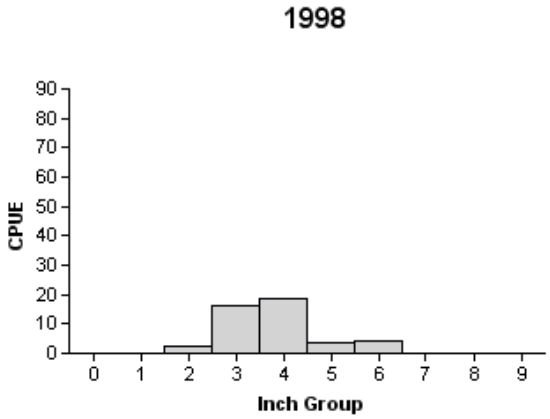
Effort =	1.0
Total CPUE =	8.0(53; 8)
IOV =	0.0 (0)



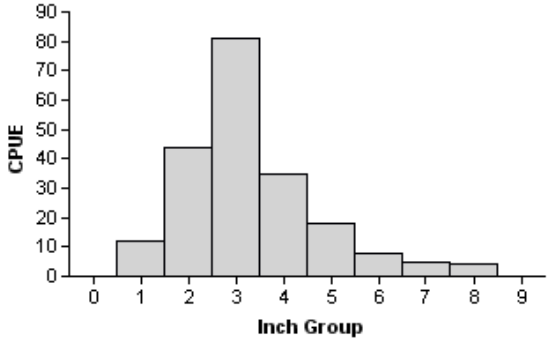
Effort =	1.0
Total CPUE =	32.0 (26; 32)
IOV =	21.9 (7)

Figure 1. Number of gizzard shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Walter E. Long Reservoir, Texas, 1998, 2002 and 2006.

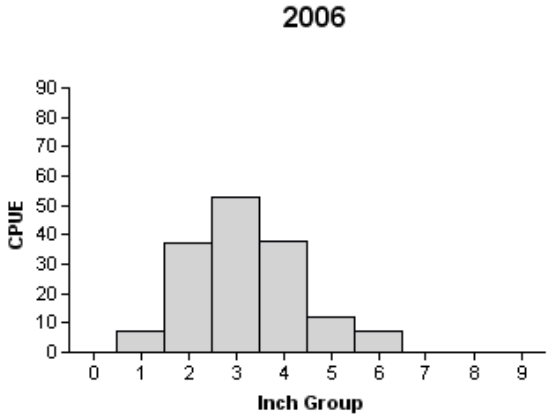
Bluegill



Effort = 1.5
Total CPUE = 44.7 (27; 67)
PSD = 10 (4.7)



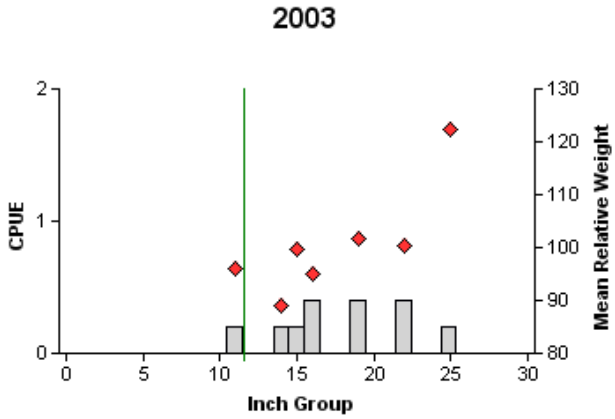
Effort = 1.0
Total CPUE = 207.0 (21; 207)
PSD = 11 (3.6)



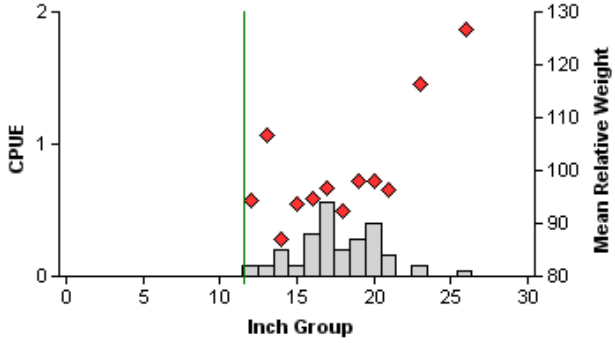
Effort = 1.0
Total CPUE = 154.0 (34; 154)
PSD = 6 (2.2)

Figure 2. Number of bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Walter E. Long Reservoir, Texas, 1998, 2002 and 2006.

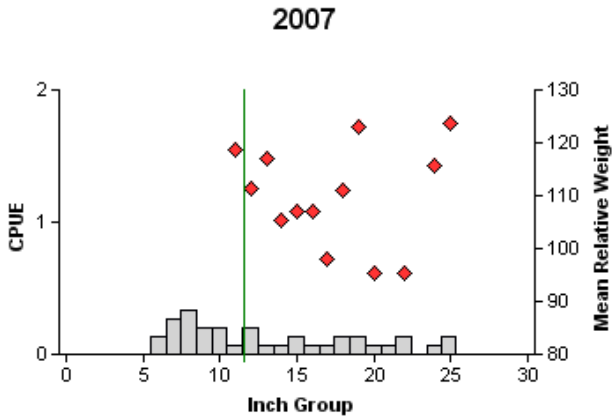
Channel Catfish



Effort = 5
Total CPUE = 2.0 (22; 10)
CPUE-12 = 1.8 (27; 9)
PSD = 70.0 (17.2)



Effort = 25
Total CPUE = 2.5 (24; 62)
CPUE-12 = 2.5 (24; 62)
PSD = 82 (7.0)



Effort = 15
Total CPUE = 2.5 (32; 38)
CPUE-12 = 1.3 (30; 20)
PSD = 62 (12.9)

Figure 3. Number of channel catfish caught per net night (CPUE), mean relative weight (diamonds) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Walter E. Long Reservoir, Texas, 2003, 2005 and 2007. Vertical lines are minimum length limit at the time of the survey.

Channel Catfish

Table 8. Creel survey statistics for channel catfish at Walter E. Long Reservoir from June 2004 through May 2005 where total catch per hour is for anglers targeting channel catfish and total harvest is the estimated number of channel catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year
	2004/2005
Directed effort (h)	3,923.68 (26)
Directed effort/acre	3.09 (26)
Total catch per hour	0.34 (118)
Total harvest	1,895 (45)
Harvest/acre	1.46 (45)
Percent legal released	9.6

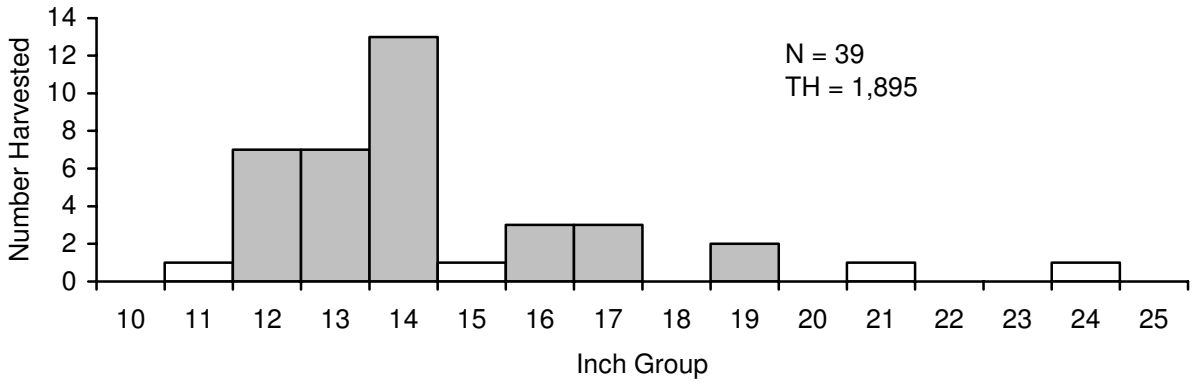
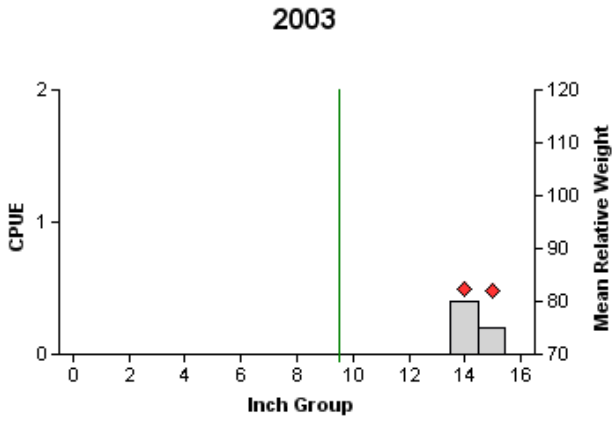
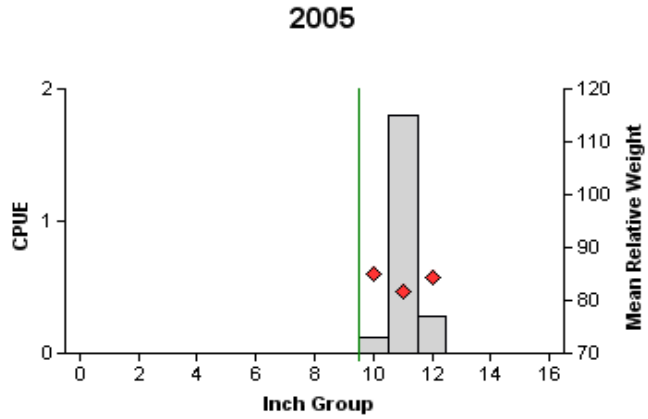


Figure 4. Length frequency of harvested channel catfish observed during creel surveys at Walter E. Long Reservoir, Texas, June 2004 through May 2005, all anglers combined. N is the number of harvested channel catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

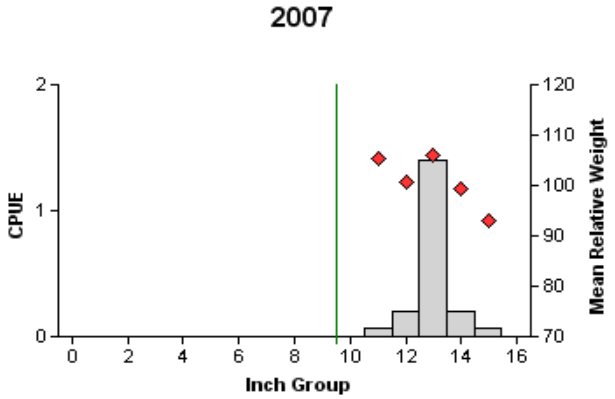
White Bass



Effort =	5
Total CPUE =	0.6 (41; 3)
CPUE-10 =	0.6 (41; 3)
RSD-10 =	100 (0)



Effort =	25
Total CPUE =	2.2 (23; 55)
CPUE-10 =	2.2 (23; 55)
RSD-10 =	100 (0)



Effort =	15
Total CPUE =	1.9 (27; 29)
CPUE-10 =	1.9 (27; 29)
RSD-10 =	100 (0)

Figure 5. Number of white bass caught per net night (CPUE) mean relative weight (diamonds) and population indices (RSE and N are in parentheses) for spring gill net surveys, Walter E. Long Reservoir, Texas, 2003, 2005 and 2007. Vertical lines represent the length limit at the time of the survey.

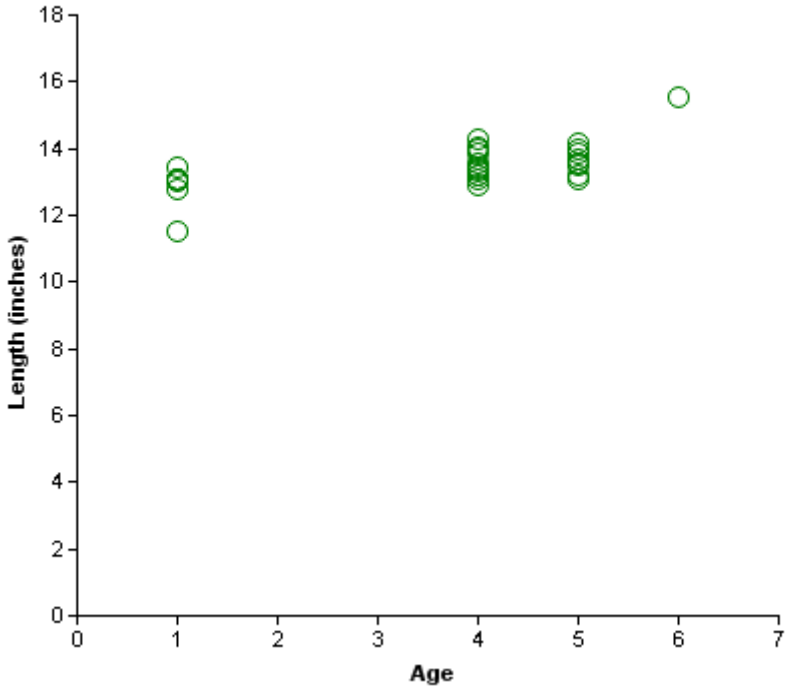


Figure 6. Length at age for white bass collected gill netting, Walter E. Long Reservoir, March 2007 (N = 29).

White Bass

Table 9. Creel survey statistics for white bass at Walter E. Long Reservoir from June 2004 through May 2005, where total catch per hour is for anglers targeting white bass and total harvest is the estimated number of white bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year
	2004/2005
Directed effort (h)	2,458.01 (35)
Directed effort/acre	1.89 (35)
Total catch per hour	0.22 (169)
Total harvest	29.84 (71)
Harvest/acre	0.02 (71)
Percent legal released	97.9

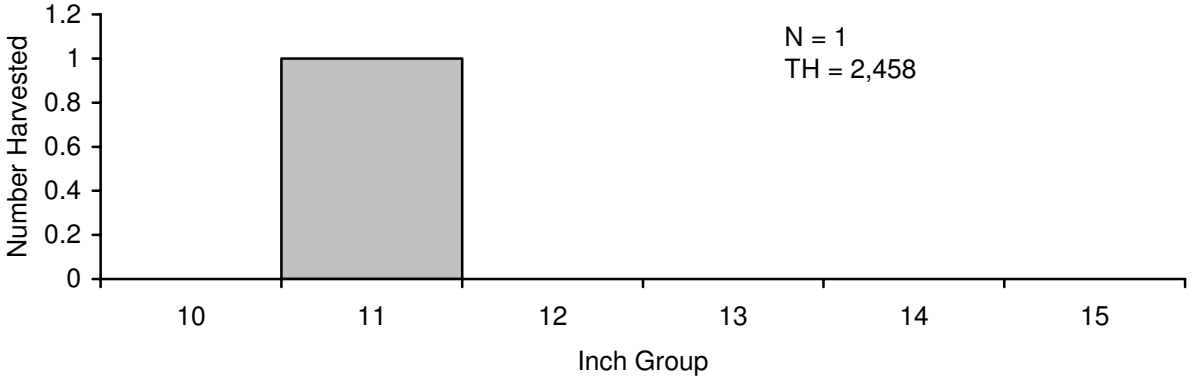
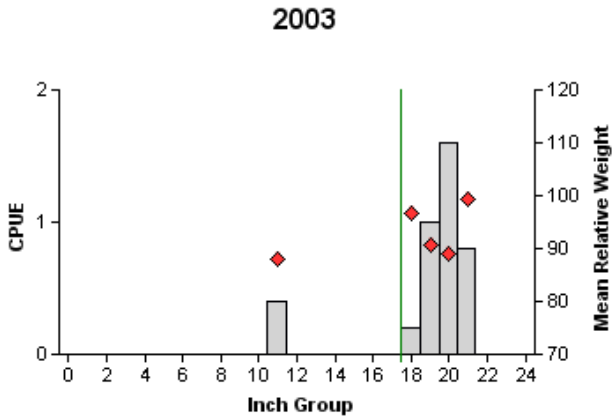
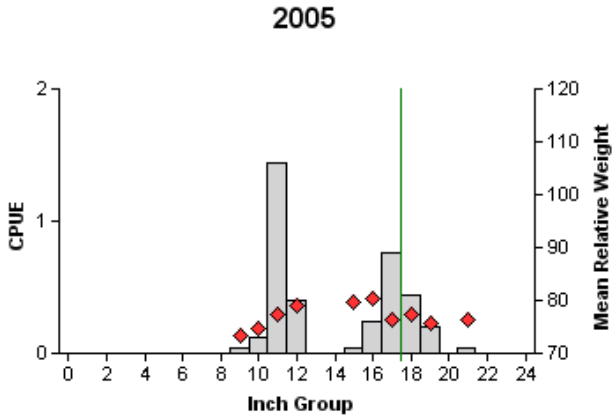


Figure 7. Length frequency of harvested white bass observed during creel surveys at Walter E. Long Reservoir, Texas, June 2004 through May 2005, all anglers combined. N is the number of harvested white bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

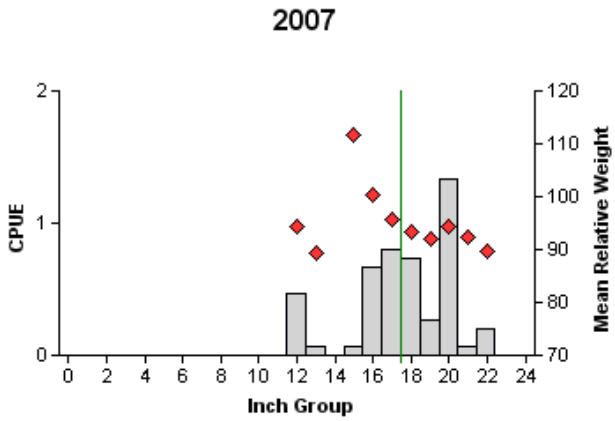
Palmetto Bass



Effort =	5
Total CPUE =	4.0 (37; 20)
CPUE-18 =	3.6 (32; 18)
RSD-18 =	90 (7.2)



Effort =	25
Total CPUE =	3.7 (28; 93)
CPUE-18 =	0.7 (40; 17)
RSD-18 =	18 (6.4)



Effort =	15
Total CPUE =	4.7 (25; 70)
CPUE-18 =	2.6 (29; 39)
RSD-18 =	56 (8.7)

Figure 8. Number of palmetto bass caught per net night (CPUE) mean relative weight (diamonds) and population indices (RSE and N are in parentheses) for spring gill net surveys, Walter E. Long Reservoir, Texas, 2003, 2005 and 2007. Vertical line represents length limit at the time of the survey.

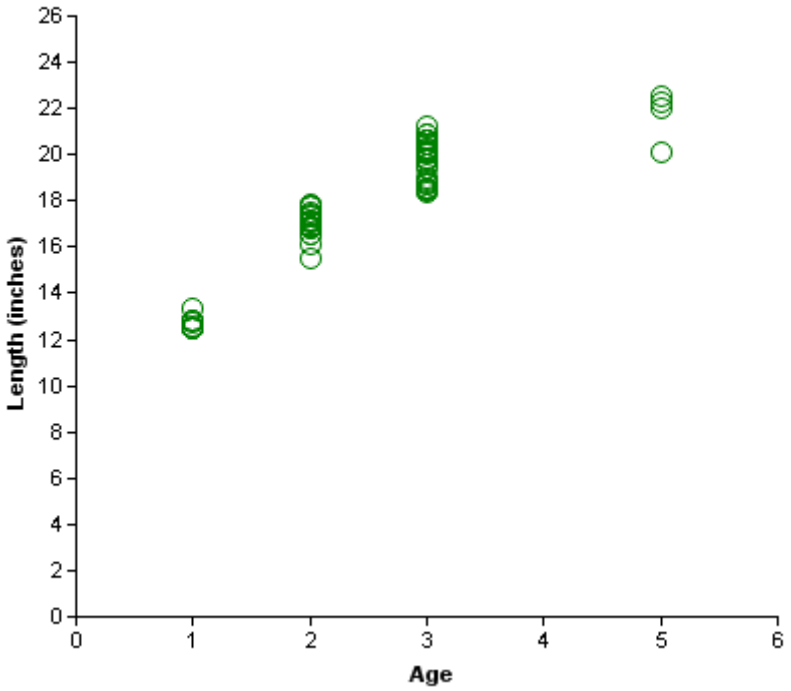


Figure 9. Length at age for palmetto bass collected gill netting, Walter E. Long Reservoir, March 2007 (N = 70).

Palmetto Bass

Table 10. Creel survey statistics for palmetto bass at Walter E. Long Reservoir from June 2004 through May 2005, where total catch per hour is for anglers targeting palmetto bass and total harvest is the estimated number of palmetto bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year
	2004/2005
Directed effort (h)	10,667.72 (20)
Directed effort/acre	8.41 (20)
Total catch per hour	0.32 (121)
Total harvest	235.99 (71)
Harvest/acre	0.18 (71)
Percent legal released	82.1

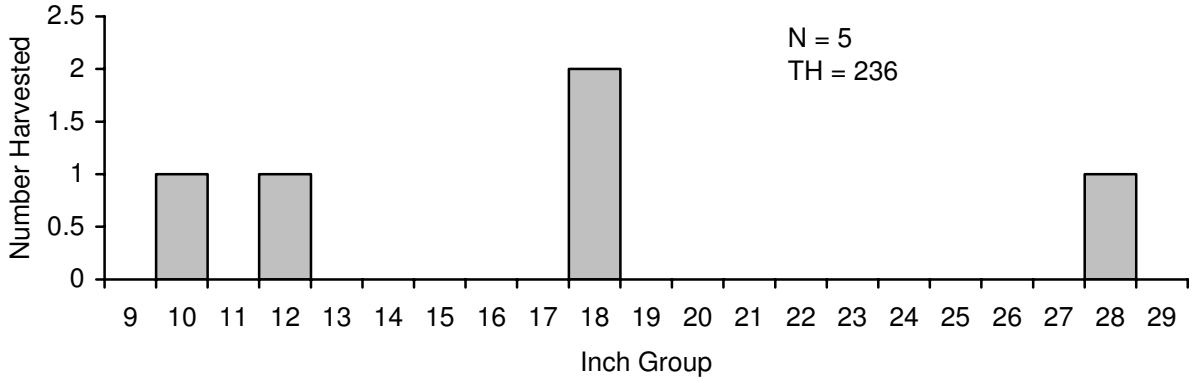
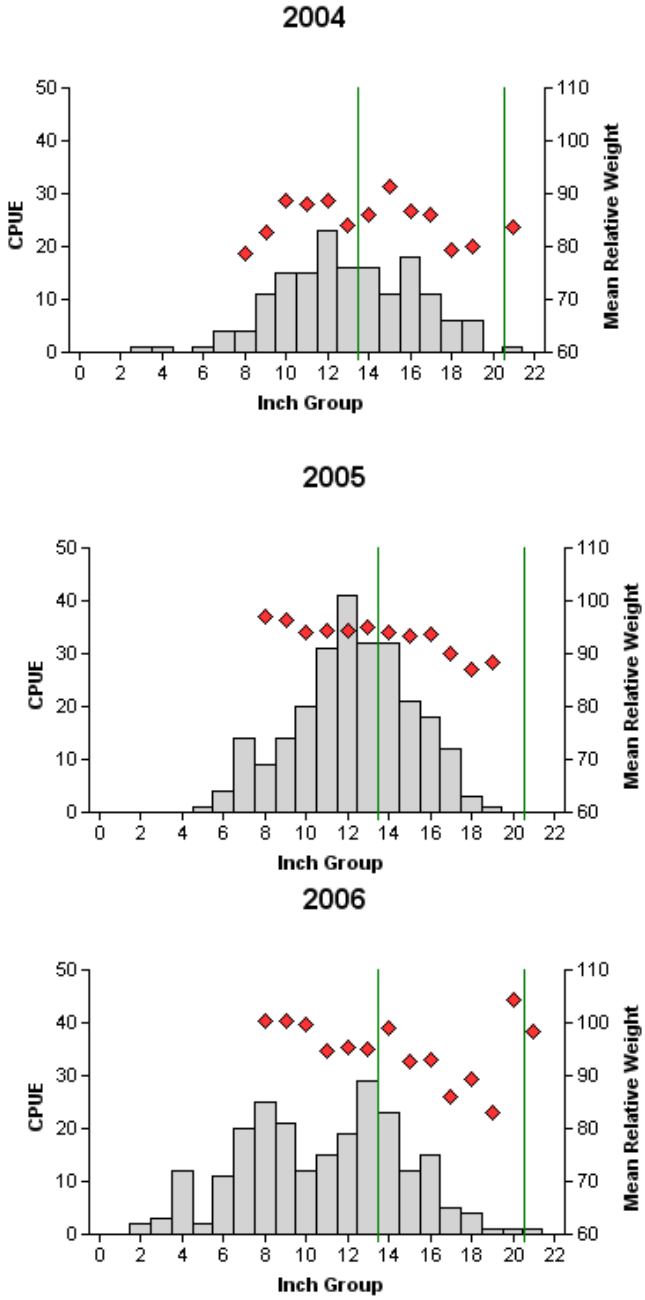


Figure 10. Length frequency of harvested palmetto bass observed during creel surveys at Walter E. Long Reservoir, Texas, June 2004 through May 2005, all anglers combined. N is the number of harvested palmetto bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Largemouth Bass



Effort =	1.0
Total CPUE =	160.0 (12; 160)
CPUE-14 =	69.0 (13; 69)
CPUE-21 =	1.0 (100; 1)
RSD-14 =	45 (3.2)

Effort =	1.0
Total CPUE =	253.0 (9; 253)
CPUE-14 =	87.0 (10; 87)
CPUE-21 =	0.0 (0; 0)
RSD-14 =	37 (3.7)

Effort =	1.0
Total CPUE =	233.0 (11; 233)
CPUE-14 =	62.0 (10; 62)
CPUE-21 =	1.0 (100; 1)
RSD-14 =	34 (3.6)

Figure 11. Number of largemouth bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Walter E. Long Reservoir, Texas, 2004, 2005 and 2006. Vertical lines represent the length limit at the time of the survey.

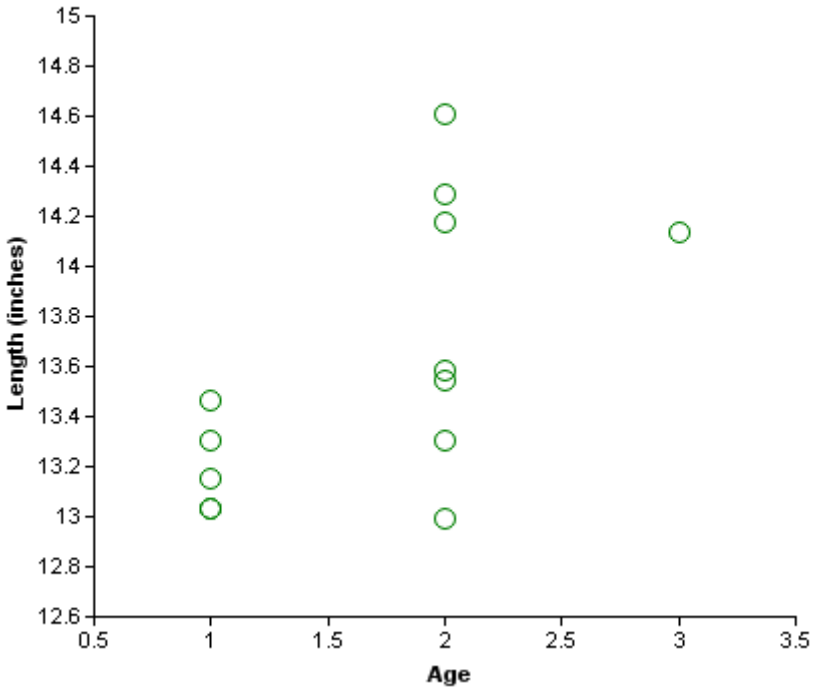


Figure 12. Length at age for largemouth bass collected electrofishing, Walter E. Long Reservoir, October 2006 (N = 14).

Largemouth Bass

Table 11. Creel survey statistics for largemouth bass at Walter E. Long Reservoir from June 2004 through May 2005 where total catch per hour is for anglers targeting largemouth bass and total harvest is the estimated number of largemouth bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year
	2004/2005
Directed effort (h)	38,504.30 (12)
Directed effort/acre	30.34 (12)
Total catch per hour	0.50 (29)
Total harvest	876.45 (40)
Total catch	23,707.57 (28)
Harvest/acre	0.68 (40)
Percent catch and release	96
Percent legal released	94.5
Percent sub-slot released	94.5
Total released	22,831.12 (30)
Total released sub-slot	10,930.50 (33)
Percent above-slot released	100
Total released above-slot	382.31 (46)

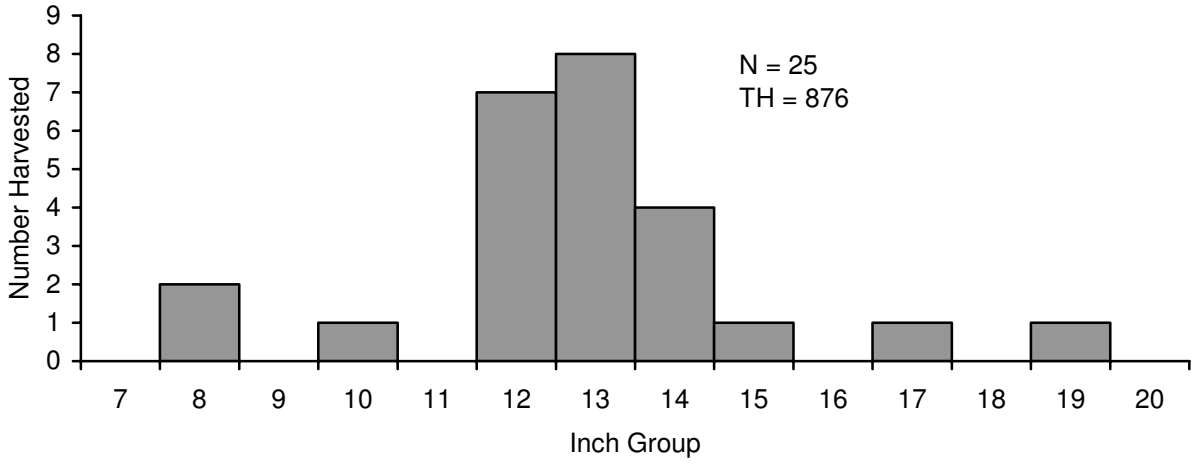


Figure 13. Length frequency of harvested largemouth bass observed during creel surveys at Walter E. Long Reservoir, Texas, June 2004 through May 2005, all anglers combined. N is the number of harvested largemouth bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Table 12. Results of genetic analysis of largemouth bass collected by fall electrofishing, Walter E. Long Reservoir, Texas, 2002 and 2006. FLMB = Florida largemouth bass, NLMB = Northern largemouth bass, F1 = first generation hybrid between a FLMB and a NLMB, Fx = second or higher generation hybrid between a FLMB and a NLMB.

		Genotype					
Year	Sample size	FLMB	F1	Fx	NLMB	% FLMB alleles	% pure FLMB
2002	29	8	9	12	0	71.7	27.6
2006	30	5			0	84.0	17.0

Table 13. Proposed sampling schedule for Walter E. Long Reservoir, Texas. Gill netting surveys are conducted in the spring, while electrofishing and trap netting surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

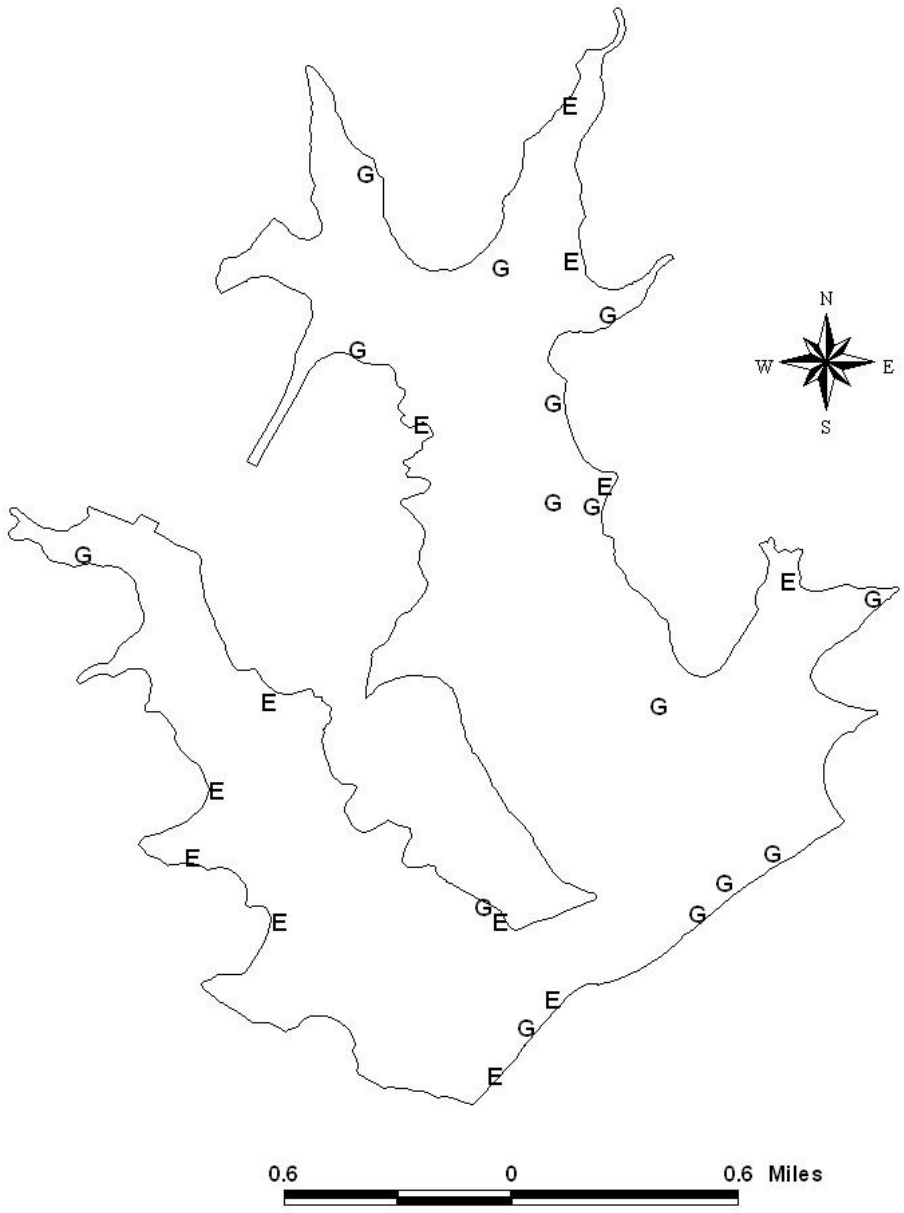
Survey Year	Electrofisher	Trap Net	Gill Net	Creel Survey	Report
Fall 2007-Spring 2008	A				
Fall 2008-Spring 2009					
Fall 2009-Spring 2010					
Fall 2010-Spring 2011	S		S		S

APPENDIX A

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Walter E. Long Reservoir, Texas, 2006-2007.

Species	Gill Netting		Electrofishing	
	N	CPUE	N	CPUE
Gizzard shad	265	17.7	32	32.0
Threadfin shad			28	28.0
Channel catfish	38	2.5		
Flathead catfish	3	0.2		
White bass	29	1.9		
Palmetto bass	70	4.7		
Redbreast sunfish			146	146.0
Green sunfish			4	4.0
Warmouth			7	7.0
Bluegill			154	154.0
Longear sunfish			1	1.0
Redear sunfish			102	102.0
Spotted sunfish			18	18.0
Largemouth bass			233	233.0
Blue tilapia			1	1.0

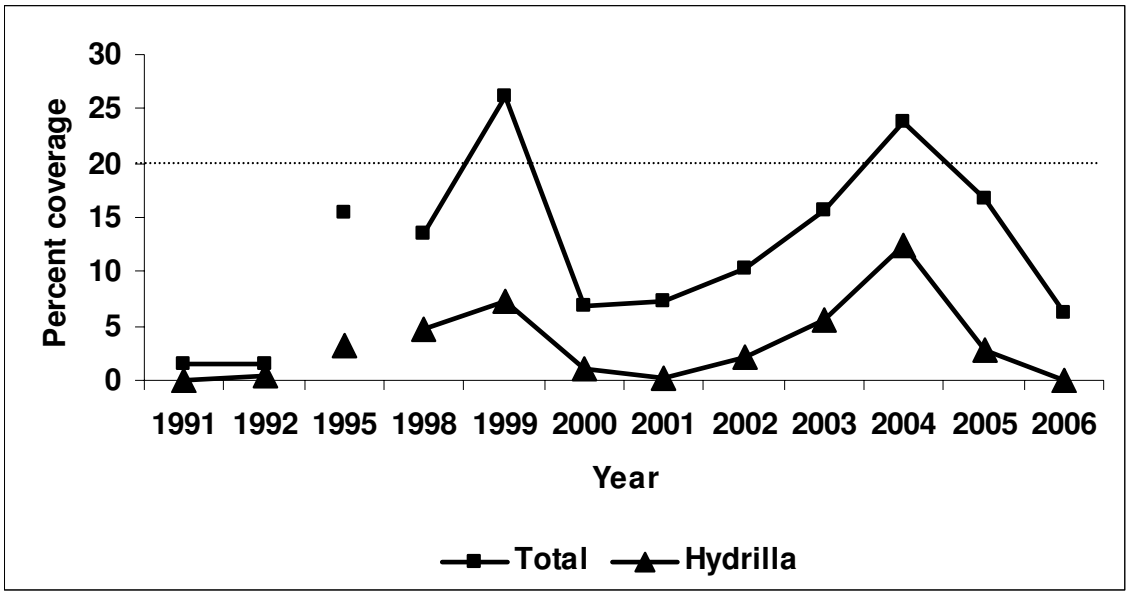
APPENDIX B



Location of sampling sites, Walter E. Long Reservoir, Texas, 2006-2007. Gill net and electrofishing stations are indicated by G and E, respectively.

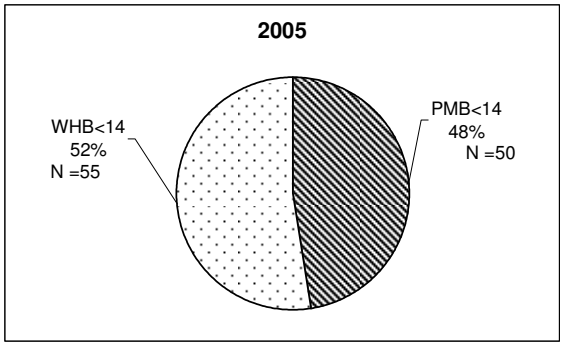
APPENDIX C

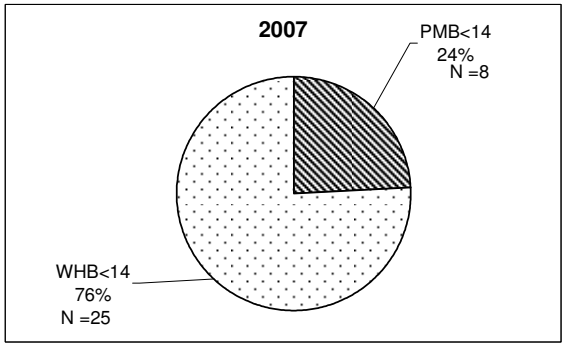
Percent total aquatic vegetation and hydrilla *Hydrilla verticillata* coverage 1991 to 2006 Walter E. Long Reservoir, TX. Total coverage includes all aquatic plant species. Total aquatic vegetation coverage within the range of 10 to 40% was considered optimal for growth and survival of phytophilic fish (Dibble et al. 1996) and for largemouth bass recruitment and standing crop (>20% total coverage) (Durocher et al. 1984). Herbicide treatments were facilitated by the City of Austin to control hydrilla in the power plant intake area, along the city park shoreline and the area directly around the city park boat ramp in 1993 and 1996. No herbicide treatments have been made since 1996.

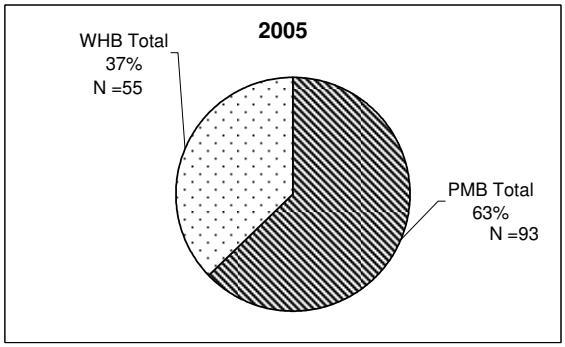


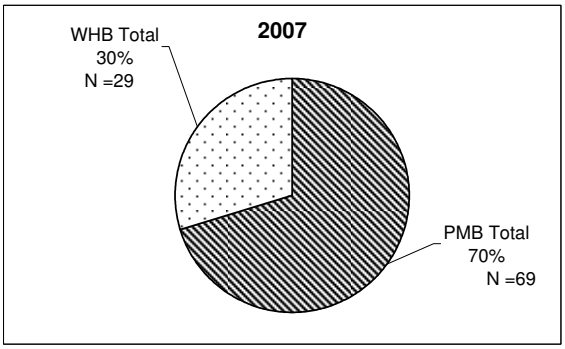
APPENDIX D

Percentage of individuals less than 14 inches in length (<14) and total catch percentage for palmetto (PMB) and white bass (WHB) collected in gill nets, Walter E. Long Reservoir, spring 2005 and 2007.



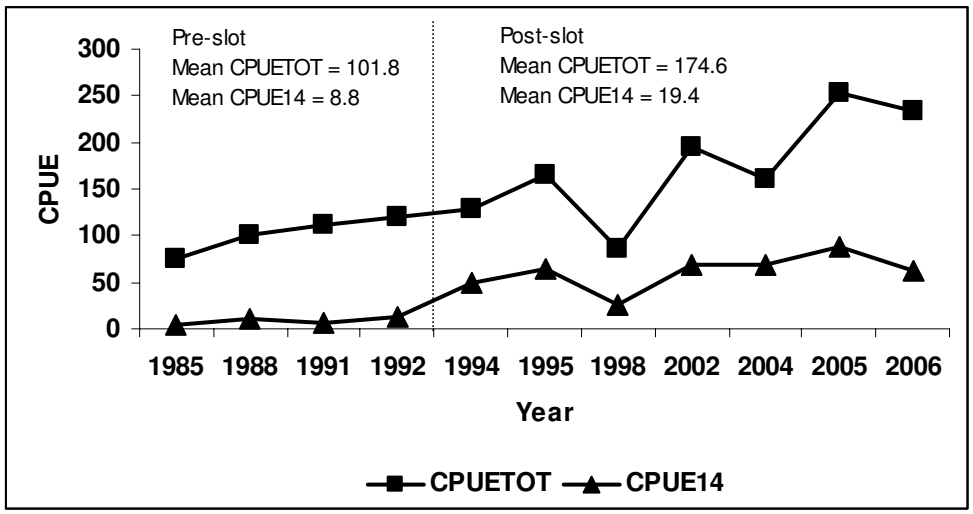






APPENDIX E

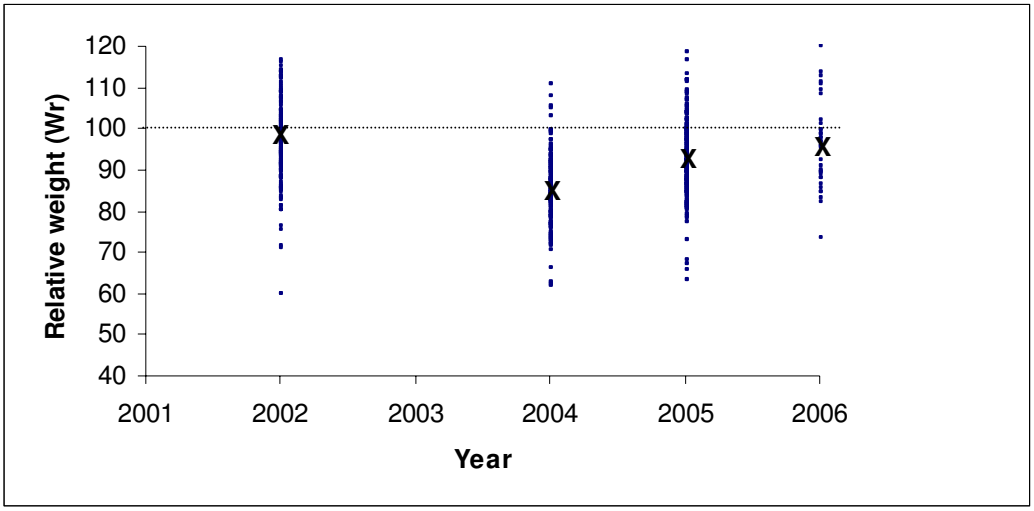
Total catch rate (CPUETOT) and catch rate of individuals longer than 14 inches (CPUE14) for largemouth bass collected in fall electrofishing surveys, Walter E. Long Reservoir 1985 to 2006. A slot length limit for largemouth bass was implemented on September 1, 1993 (vertical line). Mean electrofishing catch rates (pre and post slot length limit) are also included.

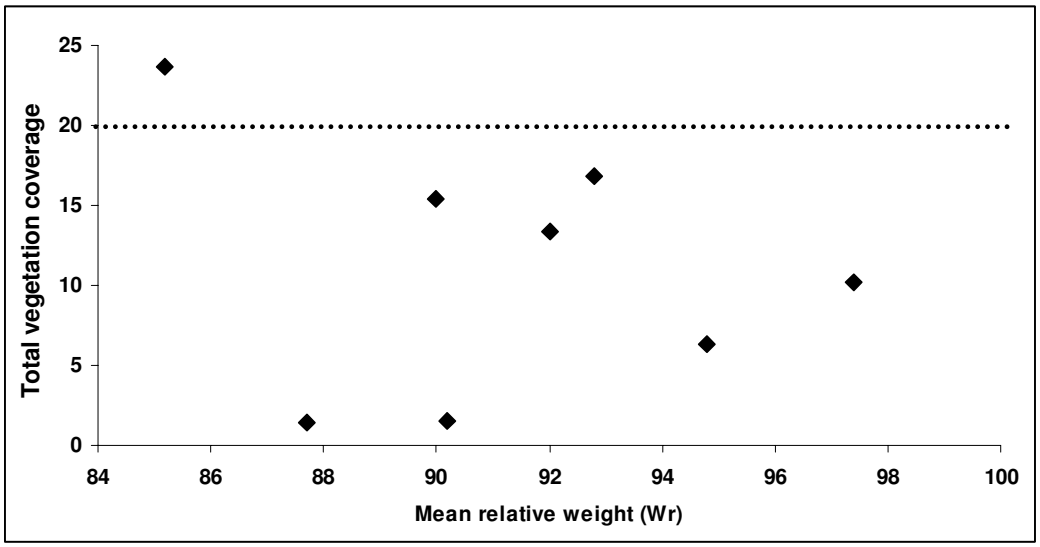


APPENDIX F

Upper figure - Distribution of relative weight (Wr) values for individual largemouth bass and mean relative weight (**X**) for all largemouth bass collected in fall electrofishing surveys Walter E. Long Reservoir, TX, 2002 and 2004 to 2006. A relative weight value of 100 is considered optimal.

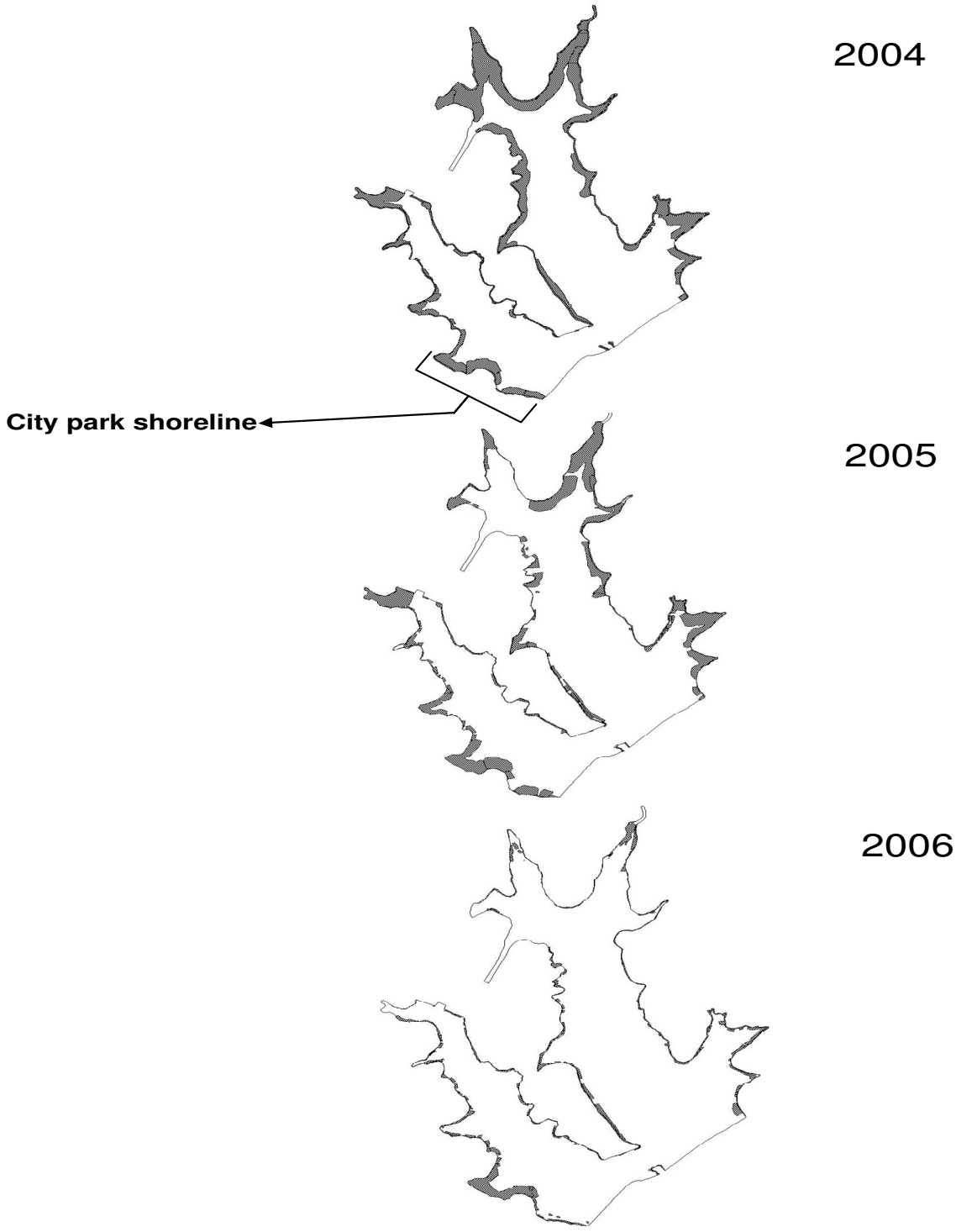
Lower figure – Plot of mean relative weight from all largemouth bass collected in fall electrofishing surveys and total aquatic vegetation coverage, Walter E. Long Reservoir 1991, 1992, 1995, 1998, 2002 and 2004-2006. Total aquatic vegetation coverage within the range of 10 to 40% was considered optimal for growth and survival of phytophilic fish (Dibble et al. 1996) and for largemouth bass recruitment and standing crop (>20% total coverage) (Durocher et al. 1984).





APPENDIX G

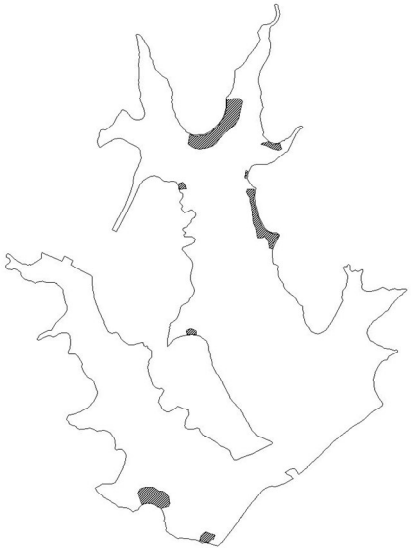
Location of aquatic vegetation (shaded areas) from aquatic vegetation surveys Walter E. Long Reservoir, September 2004, 2005 and 2006.



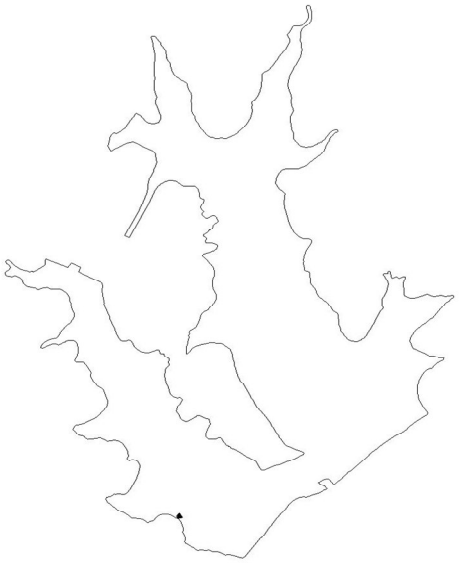
APPENDIX H

Location of hydrilla (shaded areas) from aquatic vegetation surveys Walter E. Long Reservoir, September 2004, 2005 and 2006. Hydrilla depicted is not intermixed with other species.

2004



2005



2006