

PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-2

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2011 Survey Report

**Calaveras Reservoir**

*Prepared by:*

John Dennis and Randy Myers  
Inland Fisheries Division  
District 1-D Office, San Antonio, Texas



Carter Smith  
Executive Director

Gary Saul  
Director, Inland Fisheries

July 31, 2012

2  
TABLE OF CONTENTS

Survey and management summary.....	3
Introduction.....	4
Reservoir description.....	4
Management history.....	4
Methods.....	5
Results and discussion.....	5
Fisheries management plan.....	8
Literature cited.....	10
Figures and tables.....	11-34
Reservoir characteristics (Table 1).....	11
Harvest regulations (Table 2).....	11
Stocking history (Table 3).....	12-14
Vegetation survey (Table 4).....	15
Habitat survey (Table 5).....	15
Total fishing effort (Table 6).....	15
Percent directed fishing effort (Table 7).....	15
Gizzard shad (Figure 1).....	16
Bluegill (Figure 2).....	17
Blue catfish (Figures 3-5, Table 8).....	18-21
Channel catfish (Figures 6-8, Table 8).....	18, 22-24
Palmetto bass (Figures 9-11, Table 9).....	25-27
Largemouth bass (Figures 12-13, Tables 10-11).....	28-30
Red drum (Figures 14-16, Table 12).....	31-33
Proposed sampling schedule (Table 13).....	34
Appendix A	
Map of 2011-2012 sampling locations.....	35
Appendix B	
Catch rates for all species from all gear types.....	36

## SURVEY AND MANAGEMENT SUMMARY

Fish populations were surveyed using electrofishing and gill nets during the 2007-2012 study period. An annual creel survey and a vegetation survey were also conducted. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir Description:** Calaveras Reservoir is a 3,110-acre power plant cooling reservoir located southeast of San Antonio. A near-constant water level was maintained by pumping from the San Antonio River during periods of low rainfall and runoff. Angler access and recreational facilities are managed and maintained by Thousand Trails Management Services and include two boat ramps, a handicapped accessible fishing pier, a fish cleaning station, and multiple picnic, camping, and restroom facilities. Both boat ramps were renovated in 2007. Aquatic plant coverage in the reservoir was <2% of the total surface area. Exotic blue tilapia and armored catfish populations have become well established in the reservoir.
- **Management History:** Important sport fishes included red drum, palmetto bass, and blue and channel catfishes. The red drum and palmetto bass populations were maintained by stocking, with palmetto bass stockings occurring every year since 2004 and red drum stockings every year since 1993 except 2005. Northern largemouth bass (NLMB) have been stocked to increase genetic diversity; however stocking success was short-lived. Hybrid and sub-adult white crappies were stocked to re-introduce the species to the reservoir; however a self-sustaining population was never established. Orangemouth corvina and Orangemouth corvina x speckled trout hybrids were stocked to provide an additional sport fish; however that program was discontinued. Angler harvest of all sport fishes, except largemouth bass and red drum, was regulated according to statewide size and daily bag limits. A minimum size limit of 18 inches and a 3-fish daily bag limit was implemented in 1990 for largemouth bass and harvest of red drum was restricted by a 3-fish daily bag and 20-inch minimum size limit.
- **Fish Community**
  - **Prey species:** Gizzard shad, threadfin shad, and bluegill were the primary prey species and are present in sufficient numbers and sizes for utilization by predators.
  - **Catfishes:** The reservoir contained abundant populations of channel and blue catfishes which supported a popular fishery. Blue catfish abundance is increasing.
  - **Palmetto bass:** Population abundance varied somewhat from year to year. However, the stockings have provided a consistently popular fishery for this species.
  - **Largemouth bass:** Population abundance remained low and this species supports a limited fishery.
  - **Red drum:** This introduced species supported a popular fishery and abundance increased markedly between 2007 and 2012.
- **Management Strategies:** Continue to stock palmetto bass and red drum to support these popular fisheries. Change largemouth bass minimum length limit from 18 inches to the statewide minimum length limit to 14 inches.

4  
INTRODUCTION

This document is a summary of Calaveras Reservoir fisheries data collected from 2007 to 2012. Its purpose 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 are presented with the current data for comparison.

### *Reservoir Description*

Calaveras Reservoir is a 3,110-acre power plant cooling reservoir located on Chupaderas and Calaveras creeks in the San Antonio River Basin. It was constructed in 1969 and is owned and operated by City Public Service Energy (Table 1). Thousand Trails Management Services regulates access to public facilities at the site. A near-constant water level was maintained by pumping from the San Antonio River during periods of low rainfall and runoff. Boat angler access was excellent with two multilane ramps which were renovated in 2007 using Texas Parks and Wildlife Department (TPWD) Boating Access Grant funds. Shoreline angler access is also excellent and includes a handicap accessible fishing pier. Blue tilapia and armored catfish were abundant.

### *Management History*

**Previous management strategies and actions:** Management strategies and actions from the previous survey report (Myers and Dennis 2007) included:

1. Conduct annual stockings of red drum (200/acre) and palmetto bass fingerlings (15/acre). Determine if the controlling authority would be willing to purchase additional palmetto bass and red drum fingerlings from private suppliers for stocking.  
**Action:** Palmetto bass fingerlings were stocked at the recommended rate (15/acre) in 2007, 2008 and 2009, and 8/acre in 2011 (Table 3). In 2010, 621,715 fry were stocked (Table 3). Red drum were stocked at or near the recommend rate (200/acre) in 2007, 2008, 2010, and 2011 and at 70/acre in 2009 (Table 3). The controlling authority was unable to purchase additional palmetto bass or red drum fingerlings due to budget constraints.
2. Conduct an additional electrofishing survey in 2009 to evaluate the effectiveness of the 18-inch minimum length limit for largemouth bass..  
**Action:** Electrofishing surveys were conducted in 2009. The largemouth bass population abundance continued to decline, despite special regulations for this species.

**Harvest regulation history:** Since impoundment, harvest of all sport fishes except largemouth bass and red drum was managed according to statewide regulations (Table 2). Largemouth bass were managed with a 14-18 inch slot limit with a 3-fish daily bag limit from 1981-1987. In 1988, the slot limit was changed to 14-21 inches. The slot limit was replaced in 1990 with an 18-inch minimum length limit. The bag limit was raised to 5 fish in 1995. Freshwater populations of red drum, including those in Calaveras Reservoir, are managed with a 20-inch minimum length and 3 fish daily bag limit. The maximum size limit utilized for saltwater populations is not used in freshwater populations or at Calaveras Reservoir.

**Stocking history:** Various species, including non-native fishes, have been stocked into the reservoir. Hybrid black-white crappie and sub-adult white crappie were stocked to re-introduce crappie to the reservoir. Orangemouth corvina and orangemouth corvina-speckled trout hybrids were stocked into the reservoir to provide an additional sport fish. Non-native fish and crappie stockings were discontinued because of low stocking success. During the last two decades red drum and palmetto bass were the primary species stocked. The complete stocking history is contained in Table 3.

**Vegetation/habitat history:** Structural habitat and aquatic vegetation in the reservoir has been sparse since impoundment. Aquatic vegetation has occurred in only shallow water shoreline areas.

**Water Transfer:** Calaveras Reservoir is used for power plant cooling and recreation. Water from this reservoir is currently not transferred to any other reservoir, but water is pumped into this reservoir from the San Antonio River to maintain adequate water levels to provide maximum cooling for the electricity generating units at the power plant.

## METHODS

All surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2011). Fishes were collected by electrofishing (1 hour at 12 5-minute stations) and gill netting (5 net-nights at 5 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). Sampling station locations are shown in Appendix A.

Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD), as defined by Guy et al. (2007)], and condition indices [relative weights ( $W_r$ )] 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 =  $100 \times \text{SE of the estimate/estimate}$ ) was calculated for all CPUE statistics and SE was calculated for structural indices and IOV.

Ages of the three largemouth bass collected were determined using otoliths.

Genetic analysis of largemouth bass was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2011).

Shoreline structural habitat and vegetation surveys were conducted in accordance with Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2011).

Creel survey sampling was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2011) from 6/1/2009 to 5/31/2010. Only boat anglers were surveyed.

## RESULTS AND DISCUSSION

**Habitat:** In 2011, bulrush was the predominant aquatic vegetation species present and covered 56 acres (Table 4). This is a large increase over the 5.1 acres of aquatic vegetation in 2007 (Myers and Dennis, 2008). Natural shoreline, consisting of clay, silt, or sand substrates, accounted for 78% of the shoreline length (Table 5) which was slightly below the estimated 91% in 2007. Cattails were also observed along the shoreline, but their occurrence was sparse.

**Creel:** Fishing effort expended by boat anglers was 150,566 h (Table 6). Catfish species and red drum were the most popular (38% and 37% of directed fishing effort, respectively), followed by 'anything' (19%), largemouth bass (4%), and palmetto bass (2%) in 2010 (Table 7). Catfish

species were the most sought after fish species in the 2000 and 2002 surveys, as well. Anglers targeting both red drum and palmetto bass were recorded as targeting 'anything'. Direct expenditures by boat anglers were \$756,654 (Table 6).

**Prey species:** Gizzard shad relative abundance was high in 2007 and 2009 (355 and 620 fish/h, respectively) and low in 2011 (86 fish/h; Figure 1). Gizzard shad IOV exceeded 95 in 2007 and 2009, but was only 52 in 2011 suggesting a decrease in the availability of shad as suitable prey for predator fishes (Figure 1). Threadfin shad were abundant as evidenced by a CPUE of 188 fish/h in 2011 (Appendix B). Bluegill abundance increased tremendously in 2011 compared to 2009 and 2007; CPUE ranging from 211 fish/h in 2007 to 181 fish/h in 2009 to 399 fish/h in 2011 (Figure 2). The bluegill population continued to be comprised primarily of fish  $\leq 4$  inches long (Figure 2).

**Blue catfish:** Relative abundance of blue catfish has steadily increased over the past three surveys from 8.0 fish/nn in 2008 to 9.2 fish/nn in 2010 to 16.6 fish/nn in 2010 (Figure 3), exceeding the historical average catch for this reservoir (Figure 4). Size structure has varied as shown by PSD ranging from 11 to 37 (Figure 3). The majority of fish collected were  $\geq 12$  inches in 2012 and in every other year since 2000 (Figure 4). Mean relative weights tended to increase as length increased (Figure 3). The angler catch rate of all catfishes, combined, by boat anglers was 1.25 fish/h and anglers harvested an estimated 1,446 blue catfish and released 13.4% of legal-sized catfishes caught (Table 8). Blue catfish up to 27 inches were harvested (Figure 5). The current blue catfish waterbody record is a 31 pound fish caught in 2005. The previous record was 28 pounds caught in 2003.

**Channel catfish:** Relative abundance remained high with gill net CPUEs of 33.0 fish/nn in 2010 and 2012 and 21.8 fish/nn in 2008 (Figure 6). The catch rate in 2012 exceeded the historical average, but the 2010 catch rate was below average (Figure 7). Size structure of the population improved as seen by PSDs increasing from 11 in 2008 to 19 in 2010 to 58 in 2012 (Figure 6). The majority of the fish collected in all samples since 1999 exceeded 12 inches (Figure 7). Mean relative weights were variable (Figures 6). Catfish provided a popular fishery at the reservoir. In 2010 boat anglers harvested 47,700 channel catfish (Table 8). Channel catfish up to 24 inches were harvested (Figure 8). The first waterbody record (and junior waterbody record) was set in March of 2006 at 1.625 pounds and has been broken four times since. The current waterbody record of 7.86 pounds was caught in January of 2011. The junior waterbody record has also been broken four times and is currently 4.12 pounds.

**Palmetto bass:** Relative abundance of palmetto bass varied greatly over the past three samples, from a high of 6.6 fish/nn in 2010 to a low of 0.6 fish/nn in 2012 (Figure 9). This was also the lowest catch rate since 1999 (Figure 10). The decline in the population might be attributable to missed stockings or increases in water temperatures at the reservoir. Angler catch rate was 0.68 fish/h in the 2010 creel survey which was down from 1.52 fish/h in 2002 but higher than the catch rate in 2000 (Table 9). Estimated angler harvest was 669 palmetto bass and 17.3% of legal-sized fish caught were released (Table 9). Fish up to 22 inches and as short as 14 inches were harvested (Figure 11). No waterbody record for palmetto bass exists.

**Largemouth bass:** Relative abundance declined during the report period from 39 fish/h in 2007 to 3 fish/h in 2011 (Figure 12). Population size structure comparisons cannot be made because of low sample sizes. With one exception (2005), the CPUE for largemouth bass has been below 40 fish/h since 1999 (Figure 13) and no fish  $\geq 18$  inches have been collected during standard electrofishing surveys (TPWD unpublished data). All three largemouth bass collected in 2011 were one year old. Florida largemouth bass genetic influence in the population remained high, with percent FLMB alleles at 90.7% in 2007 (Table 10). Directed effort was low (<6,000 hours/survey) and anglers caught 0.01-0.02 bass/h in the past three creel surveys. No largemouth bass were observed in the past two creel surveys (Table 11). The current waterbody record largemouth bass is 13 pounds and was caught in 1980.

**Red drum:** Relative abundance of red drum has steadily increased from 2.6 fish/nn in 2008 to 4.4 in 2010 to 5.8 fish/nn in 2012 (Figure 14) and is above the historical average catch rate (Figure 15). Size structure has improved with most of the drum collected in 2012 exceeding the 20-inch minimum length limit (Figure 14). Directed fishing effort for red drum was over 55,000 hours in 2010 (Table 12). Over 6,700 were harvested which was a dramatic increase over previous surveys and 22% of legally harvestable fish caught were released (Table 12). Fish up to 37 inches were harvested, and some illegal harvest was documented (Figure 16). The current waterbody record is a 30 pound fish caught in 2008.

## Fisheries Management Plan for Calaveras Reservoir, Texas

Prepared-July 2012

**ISSUE 1:** Red drum are a popular sport fishery and stocking is needed to sustain this species' population because they do not reproduce in the reservoir.

### MANAGEMENT STRATEGY

1. Annually stock red drum at 200 fingerlings/acre.

**ISSUE 2:** Palmetto bass are a popular sport fishery and stocking is needed to sustain this species' population because they do not reproduce in the reservoir. However the population seems to be declining. This could be from missing year classes from missed stockings, poor stocking success, or from the increased water temperatures.

### MANAGEMENT STRATEGY

1. Annually stock palmetto bass at 15 fingerlings/acre.
2. Monitor population trends with biennial gill netting to determine if stockings should continue.

**ISSUE 3:** The reservoir contains a poor largemouth bass population despite the special harvest regulations.

### MANAGEMENT STRATEGY

1. Recommend changes to largemouth bass regulations from the current 18-inch minimum length limit to a statewide 14-inch minimum length limit in 2013.

**ISSUE 4:** Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels (*Dreissena polymorpha*) can multiply rapidly and attach themselves to any available hard structure, restricting water flow in pipes, fouling swimming beaches and plugging engine cooling systems. Giant Salvinia (*Salvinia molesta*) and other invasive vegetation species can form dense mats, interfering with recreational activities like fishing, boating, skiing and swimming. The financial costs of controlling and/or eradicating these types of invasive species are significant. Additionally, the potential for invasive species to spread to other river drainages and reservoirs via watercraft and other means is a serious threat to all public waters of the state.

### MANAGEMENT STRATEGIES

1. Cooperate with the controlling authority to post appropriate signage at access points around the reservoir.
2. Contact and educate marina owners about invasive species, and provide them with posters, literature, etc... so that they can in turn educate their customers.
3. Educate the public about invasive species through the use of media and the internet.
4. Make a speaking point about invasive species when presenting to constituent and user groups.
5. Keep track of (i.e., map) existing and future inter-basin water transfers to facilitate potential invasive species responses.

**SAMPLING SCHEDULE JUSTIFICATION:**

Biennial gill net surveys (2013 and 2015) are needed to monitor the populations of palmetto bass and red drum.

## LITERATURE CITED

- Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2<sup>nd</sup> edition. American Fisheries Society, Bethesda, Maryland.
- DiCenzo, V. J., M. J. Maceina, and M. R. Stimert. 1996. Relations between reservoir trophic state and gizzard shad population characteristics in Alabama reservoirs. North American Journal of Fisheries Management 16:888-895.
- Guy, C. S., R. M. Neuman, D. W. Willis, and R. O. Anderson. 2007. Proportional size distribution (PSD): a further refinement of population size structure index terminology. Fisheries 32(7): 348.
- Myers, R. A., and J. A. Dennis. 2008. Statewide freshwater fisheries monitoring and management program survey report for Calaveras Reservoir, 2007. Texas Parks and Wildlife Department, Federal Aid Report F-30-R, Austin.

Table 1. Characteristics of Calaveras Reservoir, Texas.

Characteristic	Description
Year constructed	1969
Controlling authority	City Public Service Energy/Thousand Trails Management Services, Inc.
County	Bexar
Reservoir type	Tributary
Shoreline Development Index	5.96
Conductivity	1,932 $\mu\text{mhos/cm}$

Table 2. Fish harvest regulations for Calaveras Reservoir, Texas.

Species	Bag Limit	Minimum length limit (inches)
Catfish: channel and blue catfish, their hybrids and subspecies	25 (in any combination)	12
Catfish, flathead	5	18
Bass, palmetto	5	18
Bass, largemouth	5	18
Drum, red	3	20

Table 3. Stocking history of Calaveras Reservoir, Texas. Size categories are: FRY = <1 inch; FGL = 1-3 inches; and ADL = adults.

Species	Year	Number	Size
Threadfin shad	1969	3,000	ADL
Blue catfish	1969	20,000	FGL
	1970	4,580	FGL
	1973	19,596	FGL
	Total	44,176	
Channel catfish	1969	90,000	FGL
	1970	41,580	FGL
	1972	30,342	FGL
	2007	504	ADL
	2008	641	ADL
	2009	672	ADL
	2010	662	ADL
	2011	612	ADL
	Total	165,283	
Fathead minnow	1985	10,590	ADL
Striped bass	1971	50,000	FRY
Palmetto bass	1975	34,500	FGL
	1976	50,874	FGL
	1977	70,560	FGL
	1979	35,995	FGL
	1980	35,022	FGL
	1982	35,600	FGL
	1984	71,300	FGL
	1985	35,261	FGL
	1986	68,980	FGL
	1987	104,500	FGL
	1988	71,340	FGL
	1989	76,500	FGL
	1991	52,170	FGL
	1992	30,341	FGL
	1994	52,550	FGL
	1995	61,400	FGL
	1996	53,330	FGL
	1997	51,789	FGL
	1998	51,943	FGL
	1999	24,452	FGL
	2000	51,000	FGL
2002	26,240	FGL	
2004	46,716	FGL	
2005	46,643	FGL	
2006	569,569	FRY	
2007	46,997	FGL	
2008	46,042	FGL	
2009	47,000	FGL	
2010	621,715	FRY	
2011	25,300	FGL	
Total		2,650,296	

Table 3 continued. Stocking history of Calaveras Reservoir, Texas. Size categories are: FRY = <1 inch; FGL = 1-3 inches; and ADL = adults.

Species	Year	Number	Size
Green sunfish x redear sunfish	1969	13,500	FGL
	1970	48,500	FGL
	1971	38,575	FGL
	1972	52,000	FGL
	Total	152,575	
Largemouth bass	1969	36,500	FGL
	1973	4,400	FGL
	1987	10,707	FGL
	2003	32,653	FGL
	2005	34,502	FGL
Total	121,762		
Florida largemouth bass	1974	80,950	FGL
	1978	79,919	FGL
	1988	22,636	FGL
	1989	13,000	FRY
	1990	22,500	FRY
	1991	62,754	FRY
	1992	177,000	FGL
	1993	172,800	FGL
	1994	175,120	FGL
	1995	172,000	FGL
	1998	175,937	FGL
	1999*	100,910	FGL
	Total	1,255,526	
White crappie	1985	24,150	FGL
	1986	172,500	FGL
	1987	9,009	ADL
	2001	244	ADL
	2004	850	ADL
Total	206,753		
Black crappie	1969	10,000	FGL
White x black crappie	1993	172,887	FGL
	1994	174,490	FGL
	1995	172,830	FGL
	1997	78,434	FGL
Total	598,641		
Orangemouth corvina male x spotted sea trout female	1984	14,500	FGL
	1985	24,550	FGL
Total	39,050		
Orangemouth corvina female x spotted sea trout male	1986	36,485	FGL
Orangemouth corvina	1986	766,831	FGL
	1987	13	ADL
Total	766,844		

\* Denotes genetically marked

Table 3 continued. Stocking history of Calaveras Reservoir, Texas. Size categories are: FRY = <1 inch; FGL = 1-3 inches; and ADL = adults.

Species	Year	Number	Size	
Red drum	1984	27,575	FGL	
	1987	738,000	FGL	
	1989	2,700	FRY	
	1991	787,255	FGL	
	1993	385,026	FGL	
	1994	318,078	FGL	
	1995	349,693	FGL	
	1996	349,253	FGL	
	1997	305,159	FGL	
	1998	309,762	FGL	
	1999	433,350	FGL	
	2000	437,626	FGL	
	2001	455,813	FGL	
	2002	166,844	FGL	
	2003	607,487	FGL	
	2004	635,302	FGL	
	2006	2,309	ADL	
	2006	109,338	FRY	
	2006	582,245	FGL	
	2007	600,122	FGL	
	2008	773,708	FGL	
	2009	220,542	FGL	
	2010	655,141	FGL	
	2011	621,002	FGL	
		Total	9,668,418	

Table 4. Results of a vegetation survey conducted at Calaveras Reservoir, Texas, in August, 2011. Surface area coverage (acres) was estimated for each vegetation type for the 3,110 acres using 109 randomly selected sample points.

Vegetation type	Coverage	Percent	Lower 95% CL	Upper 95% CL
Open water	3054.0	98.2	95.7	100.0
Native emergent vegetation <sup>1</sup>	56.0	1.8	0.0	4.4

<sup>1</sup> bulrush

Table 5. Results of a structural habitat survey conducted at Calaveras Reservoir, Texas, in August, 2011. Linear distance (miles) was estimated for each habitat type for the 36.9 miles of shoreline using 98 randomly selected sample points.

Habitat type	Linear distance	Percent	Lower 95% CL	Upper 95% CL
Natural shoreline	28.6	77.6	68.0	85.4
Rocky shoreline	7.9	21.4	13.8	30.9
Bulkhead	0.7	2.0	0.3	7.2

Table 6. Total fishing effort (h) for all species and total direct angling expenditures by angler type (boat anglers = BT and bank anglers = BK) at Calaveras Reservoir, Texas. The 2000 creel was conducted from 12/1/1999 to 11/30/2001, the 2002 creel was conducted from 12/1/2001 5/31/2002 (six months), and the 2010 survey was conducted 6/1/2009 to 5/31/2010. Bank anglers were not surveyed in 2009-2010.

Creel Statistic	2000		2002		2010
	BT	BK	BT	BK	BT
Total angling effort	63,789	5,684	20,570	8,332	150,566
Total direct angling expenditures	\$202,901	\$15,663	\$70,134	\$17,469	\$756,654

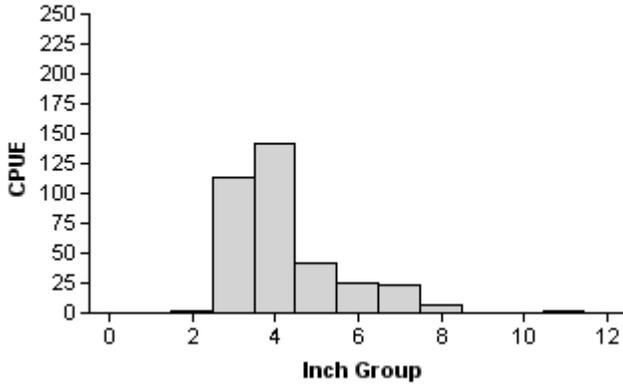
Table 7. Percent directed angler effort by species and angler type (BT = boat anglers and BK = bank anglers) for Calaveras Reservoir, Texas. The 2000 creel was conducted from 12/1/1999 to 11/30/2001, the 2002 creel was conducted from 12/1/2001 5/31/2002 (six months), and the 2010 survey was conducted 6/1/2009 to 5/31/2010. Bank anglers were not surveyed in 2009-2010. Anglers indicating they were fishing for both red drum and palmetto bass are recorded as targeting "Anything."

Species	2000		2002		2010
	BT	BK	BT	BK	BT
Catfish spp.	45	43	35	30	38
Palmetto bass	13	0	9	26	2
Largemouth bass	8	2	2	2	4
Red drum	9	4	21	0	37
Anything	23	50	33	42	19

# Gizzard Shad

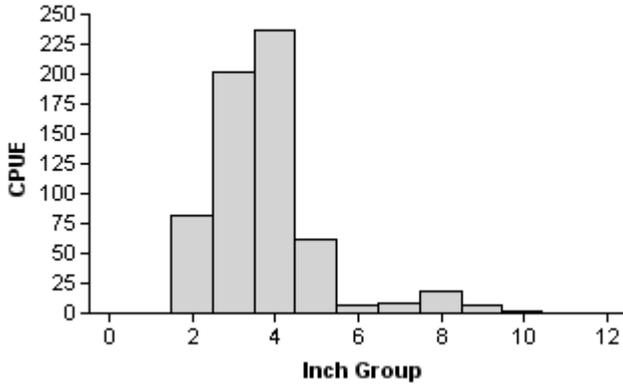
2007

Effort = 1.0  
 Total CPUE = 355.0 (24; 355)  
 IOV = 98 (1)



2009

Effort = 1.0  
 Total CPUE = 620.0 (56; 620)  
 IOV = 96 (3)



2011

Effort = 1.0  
 Total CPUE = 86.0 (24; 86)  
 IOV = 52 (5)

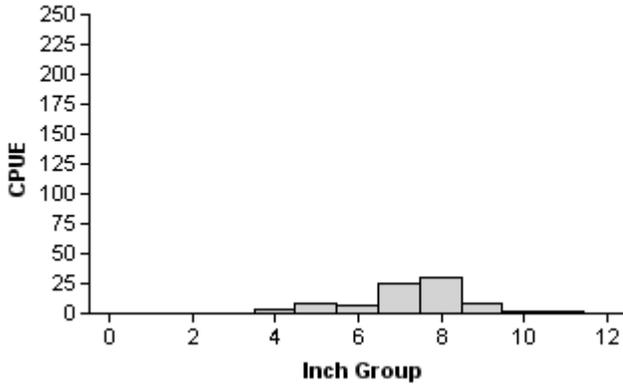
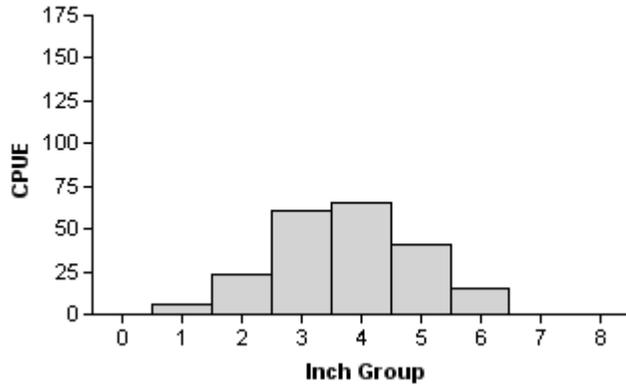
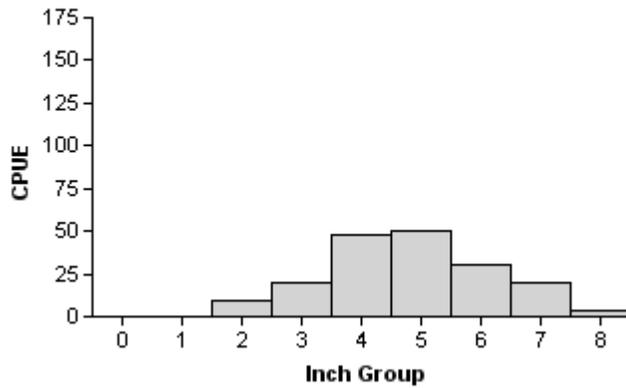


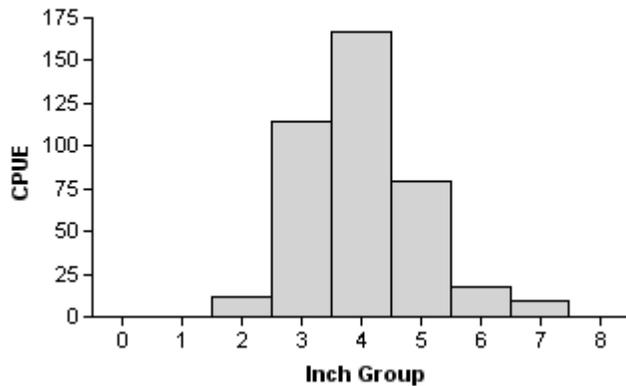
Figure 1. Number of gizzard shad caught per hour (CPUE) and population indices (RSE and N are in parentheses) for fall electrofishing surveys, Calaveras Reservoir, Texas, 2007, 2009, and 2011. RSE is used for CPUE values and SE is used for RSD and PSD values.

**Bluegill****2007**

Effort = 1.0  
 Total CPUE = 211 (29; 211)  
 Stock CPUE = 182 (29; 182)  
 PSD = 8 (2)

**2009**

Effort = 1.0  
 Total CPUE = 181 (27; 181)  
 Stock CPUE = 172 (27; 172)  
 PSD = 31 (9)

**2011**

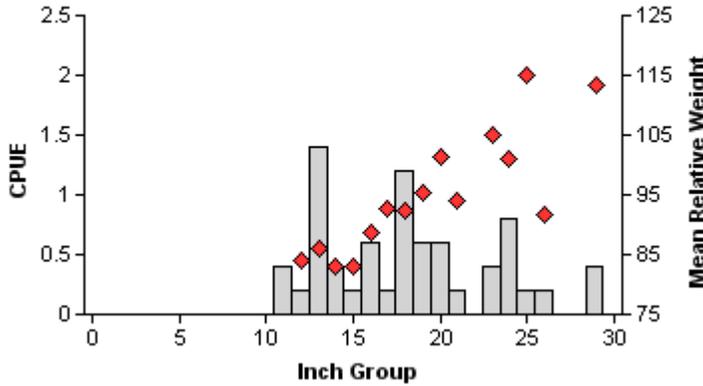
Effort = 1.0  
 Total CPUE = 399 (18; 399)  
 Stock CPUE = 387 (17; 387)  
 PSD = 7 (3)

Figure 2. Number of bluegill caught per hour (CPUE) and population indices (RSE and N are in parentheses) for fall electrofishing surveys, Calaveras Reservoir, Texas, 2007, 2009, and 2011. RSE is used for CPUE values and SE is used for PSD values.

# Blue Catfish

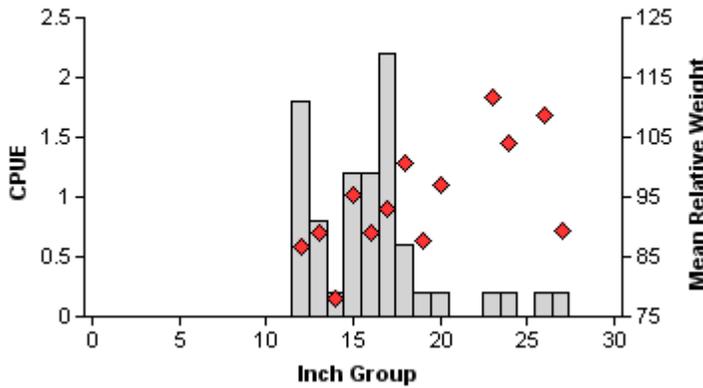
2008

Effort = 5.0  
 Total CPUE = 8.0 (17; 40)  
 Stock CPUE = 7.6 (17; 38)  
 PSD = 37 (8)



2010

Effort = 5.0  
 Total CPUE = 9.2 (34; 46)  
 Stock CPUE = 9.2 (34; 46)  
 PSD = 11 (4)



2012

Effort = 5.0  
 Total CPUE = 16.6 (31; 83)  
 Stock CPUE = 13.8 (23; 69)  
 PSD = 30 (5)

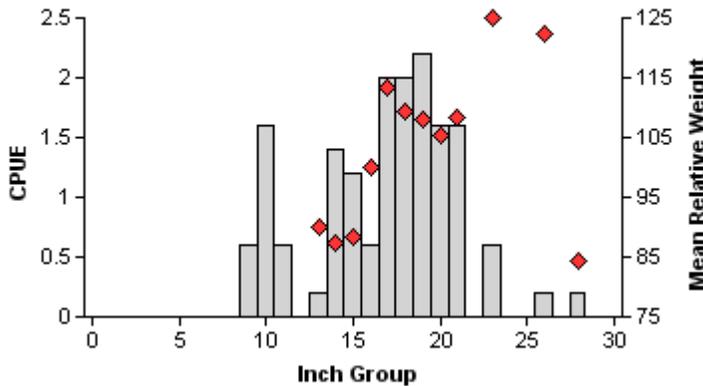


Figure 3. Number of blue catfish caught per net night (CPUE, bars) mean relative weight (diamonds) and population indices (RSE and N are in parentheses) for spring gill net surveys, Calaveras Reservoir, Texas, 2008, 2010, and 2012. RSE is used for CPUE values and SE is used for PSD values.

## Blue Catfish

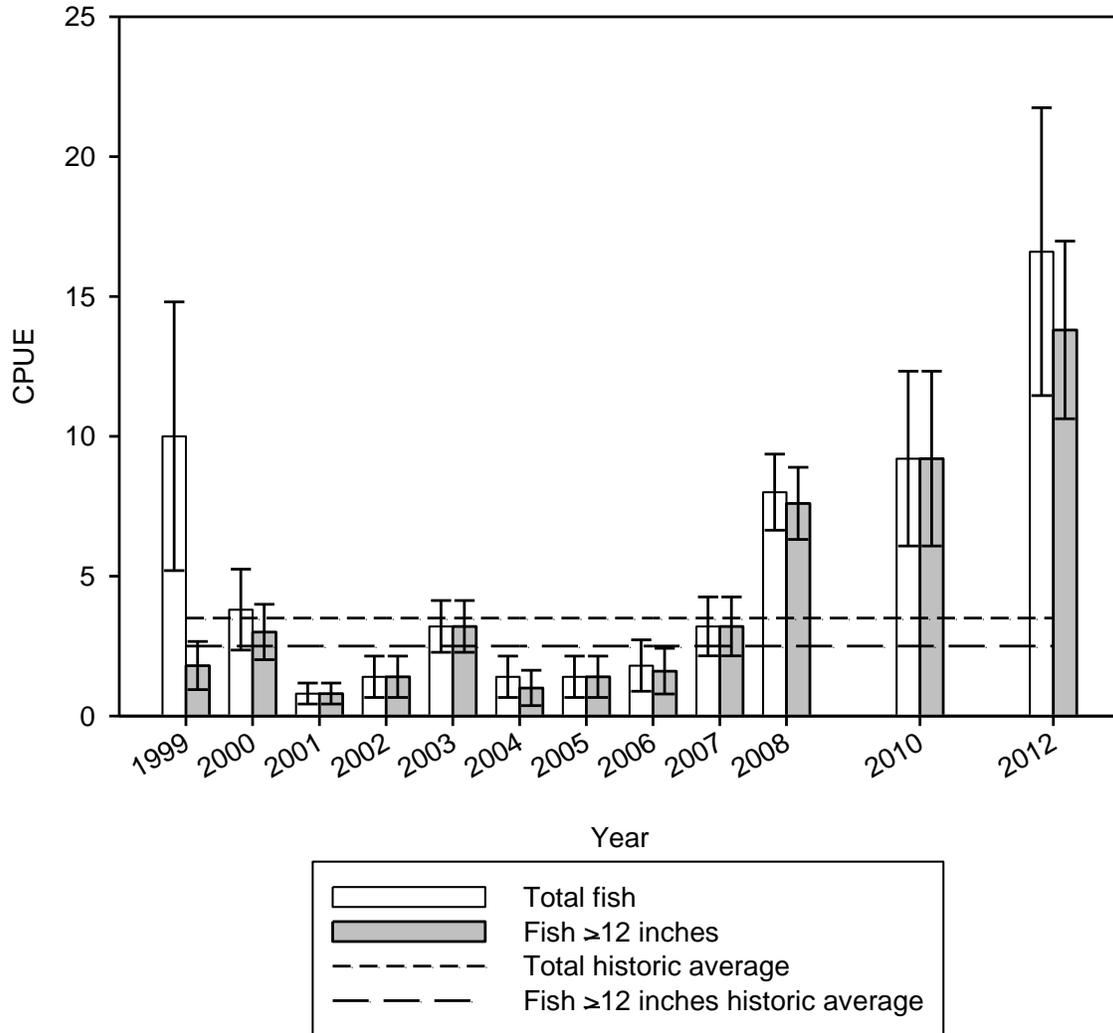


Figure 4. Total number of blue catfish and number  $\geq 12$  inches caught per net-night of gill net sampling (CPUE) since 1999, Calaveras Reservoir, Texas. Historic average CPUEs (represented by the dashed lines) were calculated using CPUEs determined prior to the current study period. The error bars represent  $\pm$  one standard error.

## Blue Catfish

Table 8. Summary creel results for catfishes at Calaveras Reservoir, Texas. The 2000 creel was conducted from 12/1/1999 to 11/30/2000 (12 months). The 2002 creel was conducted from 12/1/2001 to 5/31/2002 (6 months). The 2010 creel was conducted from 6/1/2009 to 5/31/2010 (12 months). Only data from boat anglers is presented. Angling effort was estimated for anglers specifically targeting these species. Total harvest and total catch estimates include catfishes caught by anglers targeting these species and by anglers targeting other species. HPUE and CPUE is the average number of fish harvested and caught, respectively, per one-hour angling effort by anglers targeting catfishes.

Creel statistic	2000	2002	2010
Angling effort (hours):			
Catfishes combined	28,894	7,182	56,704
Harvest (number of fish):			
Blue catfish	445	22	1,446
Channel catfish	13,810	4,259	47,542
Unidentified catfishes	0	0	4,637
Catfishes combined	14,255	4,281	53,625
Catch (number of fish):			
Blue catfish	514	22	1,446
Channel catfish	19,176	11,468	47,700
Unidentified catfish	0	0	21,468
Catfishes combined	19,690	11,490	70,614
Percent of legal-size fish released:			
Catfishes combined	2.0	16.6	13.4
HPUE:			
Catfishes combined	0.49	0.60	0.95
CPUE:			
Catfishes combined	0.68	1.60	1.25

# Blue Catfish

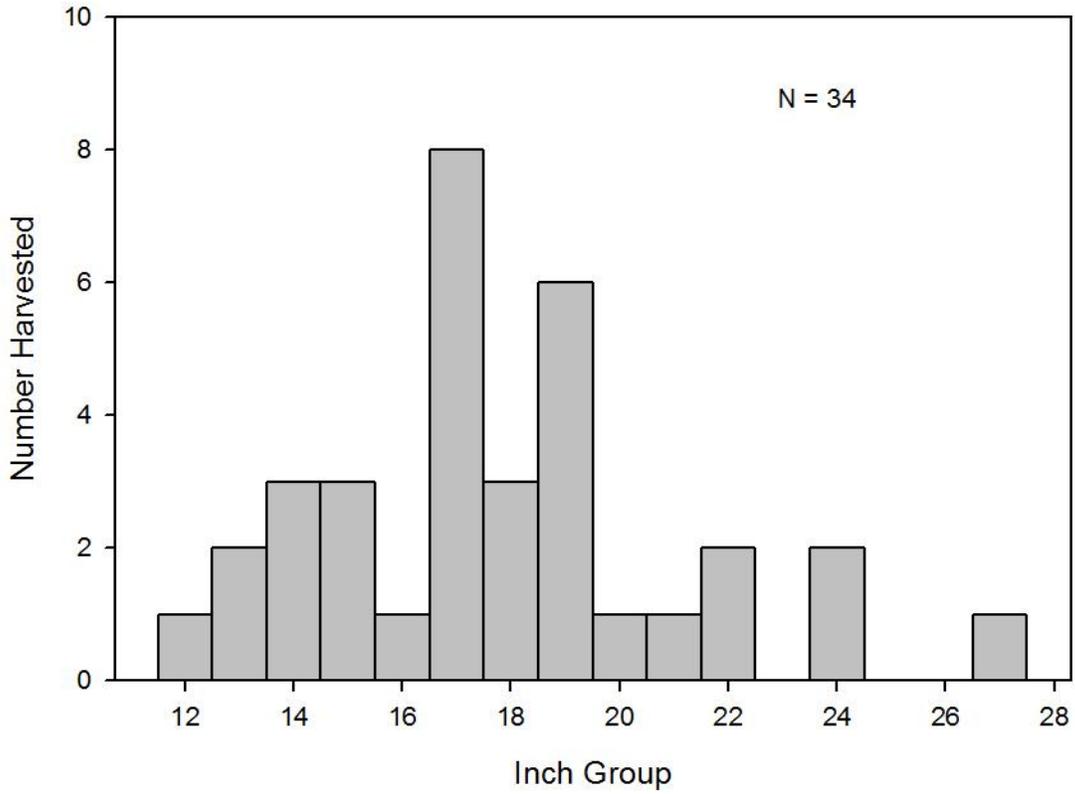
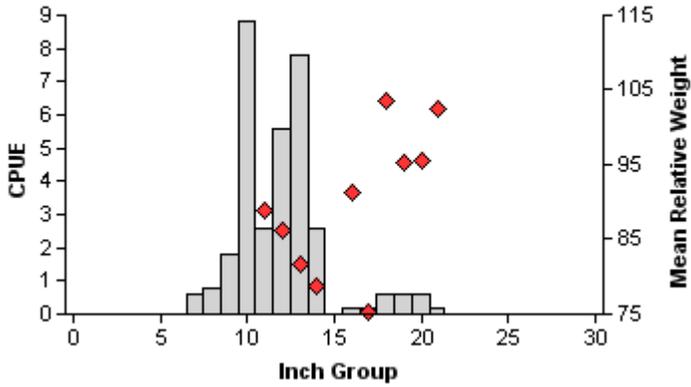


Figure 5. Length frequency of harvested blue catfish observed during creel surveys at Calaveras Reservoir, Texas, June 2009 through May 2010, all anglers combined. N is the number of harvested blue catfish measured during creel surveys.

# Channel Catfish

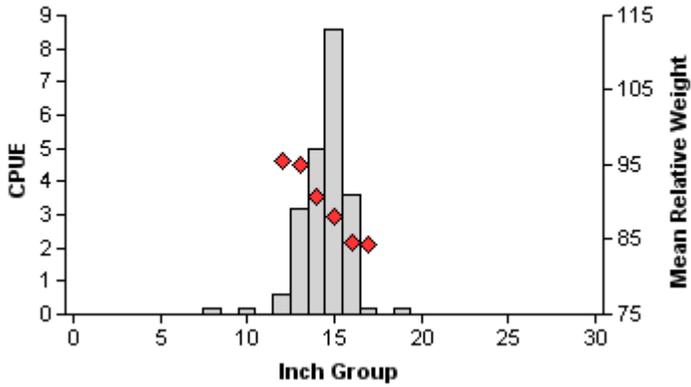
2008

Effort = 5.0  
 Total CPUE = 33.0 (27;165)  
 Stock CPUE = 21.0 (40; 105)  
 PSD = 11 (2)



2010

Effort = 5.0  
 Total CPUE = 21.8 (20; 109)  
 Stock CPUE = 21.4 (20; 107)  
 PSD = 19 (5)



2012

Effort = 5.0  
 Total CPUE = 33.0 (17; 165)  
 Stock CPUE = 32.4 (17; 162)  
 PSD = 58 (8)

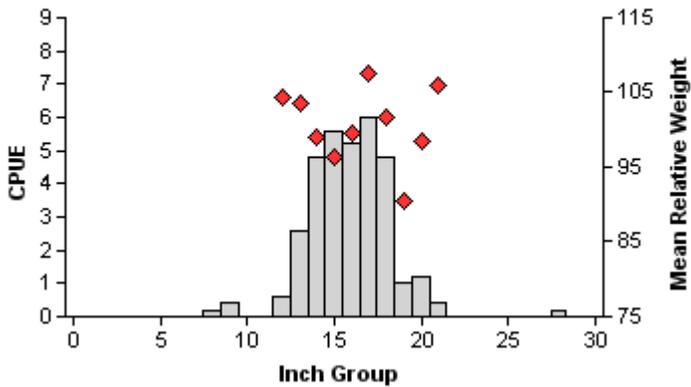


Figure 6. Number of channel catfish caught per net night (CPUE, bars) mean relative weight (diamonds) and population indices (RSE and N are in parentheses) for spring gill net surveys, Calaveras Reservoir, Texas, 2008, 2010, and 2012. RSE is used for CPUE values and SE is used for PSD values.

## Channel Catfish

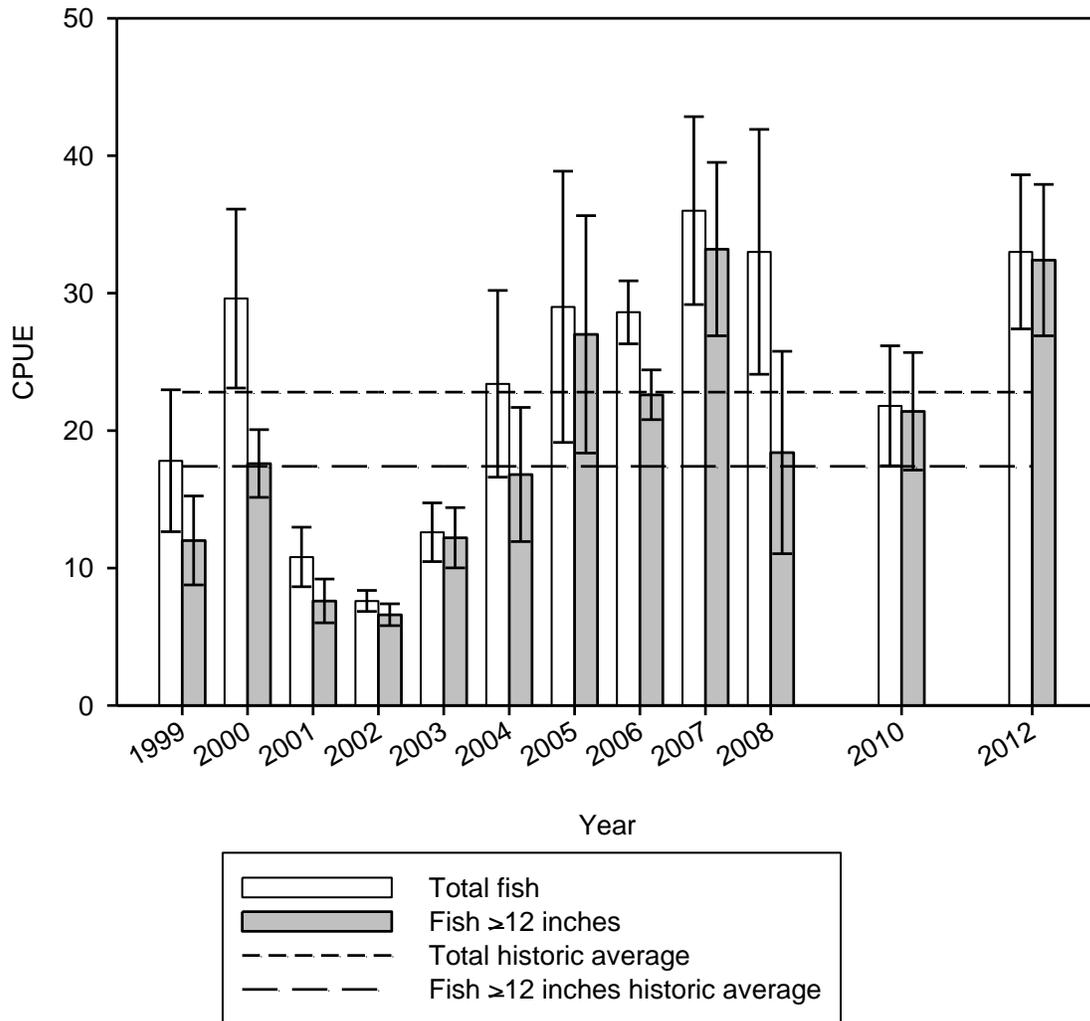


Figure 7. Total number of channel catfish and number  $\geq 12$  inches caught per net-night of gill net sampling (CPUE) since 1999, Calaveras Reservoir, Texas. Historic average CPUEs (represented by the dashed lines) were calculated using CPUEs determined prior to the current study period. The error bars represent  $\pm$  one standard error.

## Channel Catfish

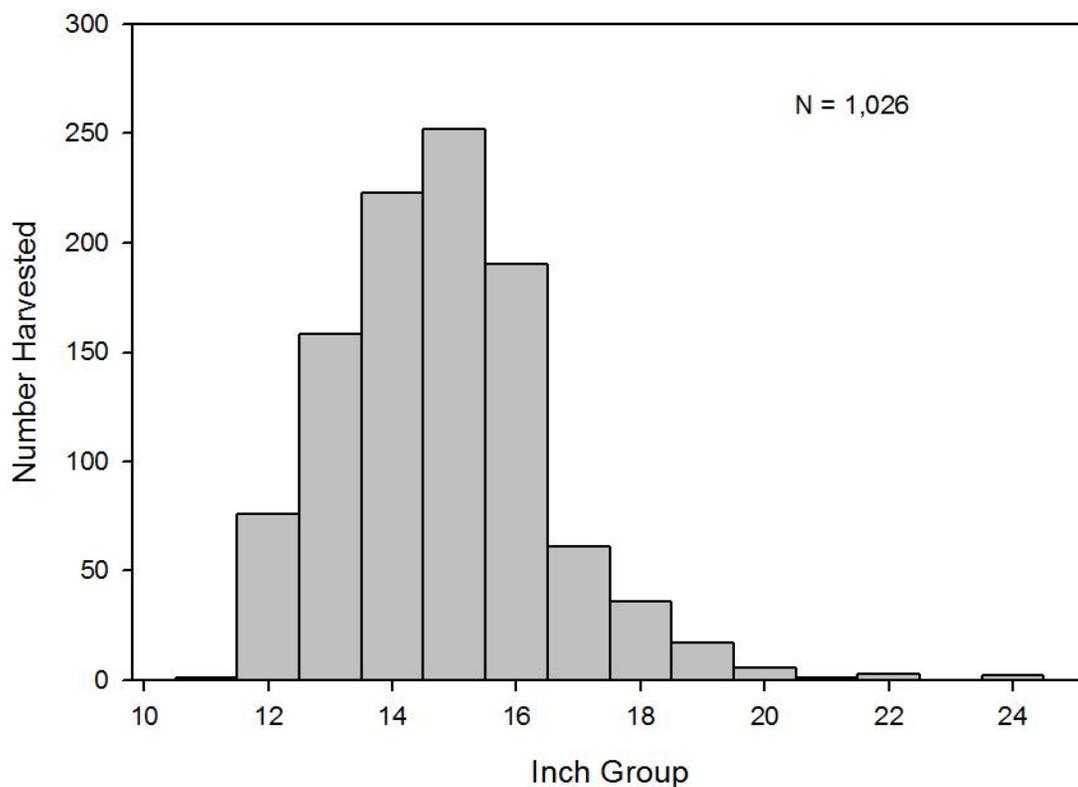


Figure 8. Length frequency of harvested channel catfish observed during creel surveys at Calaveras Reservoir, Texas, June 2009 through May 2010, all anglers combined. N is the number of harvested channel catfish measured during creel surveys.

# Palmetto Bass

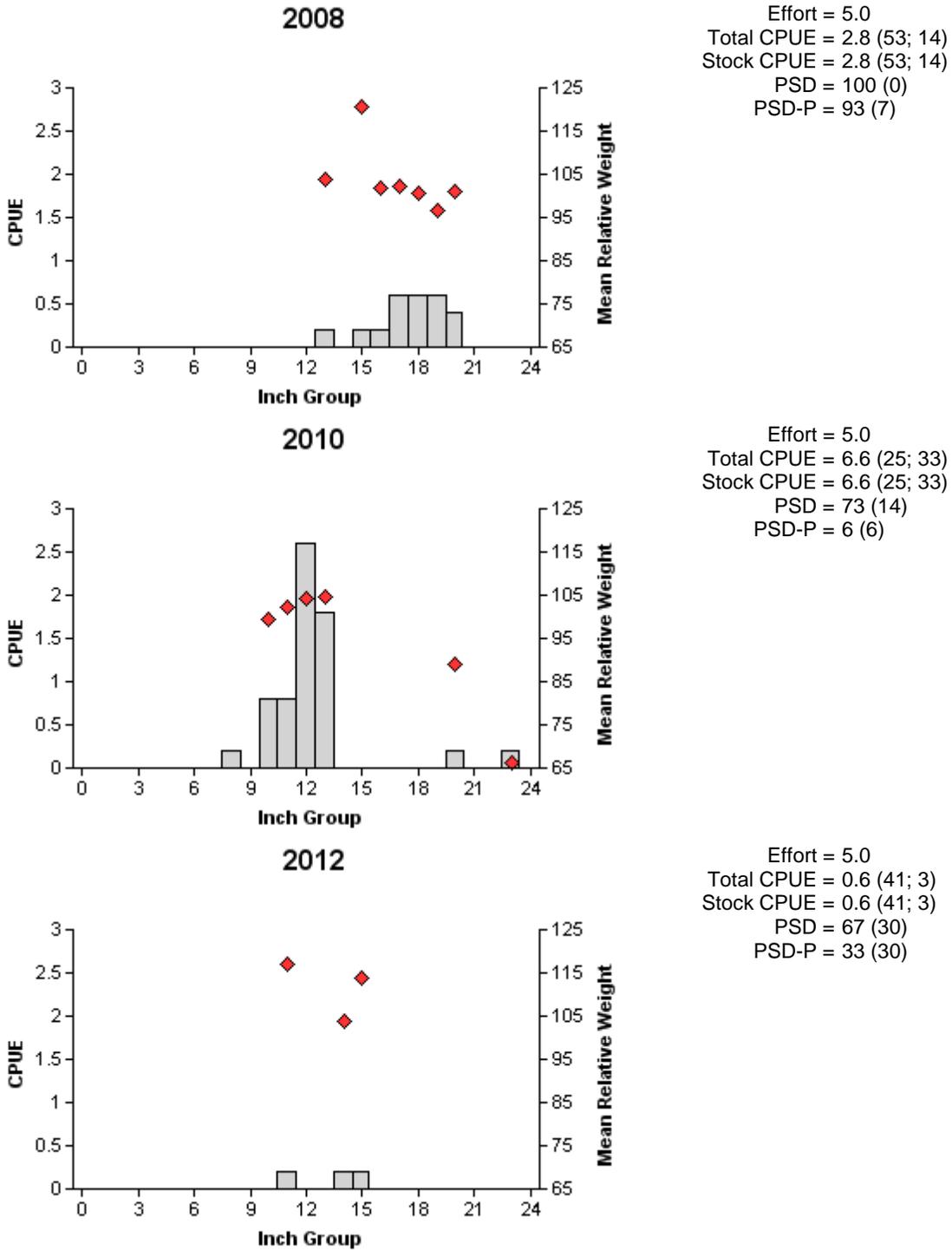


Figure 9. Number of palmetto bass caught per net night (CPUE, bars) mean relative weight (diamonds) and population indices (RSE and N are in parentheses) for spring gill net surveys, Calaveras Reservoir, Texas, 2008, 2010, and 2012. RSE is used for CPUE values and SE is used for RSD and PSD values.

## Palmetto Bass

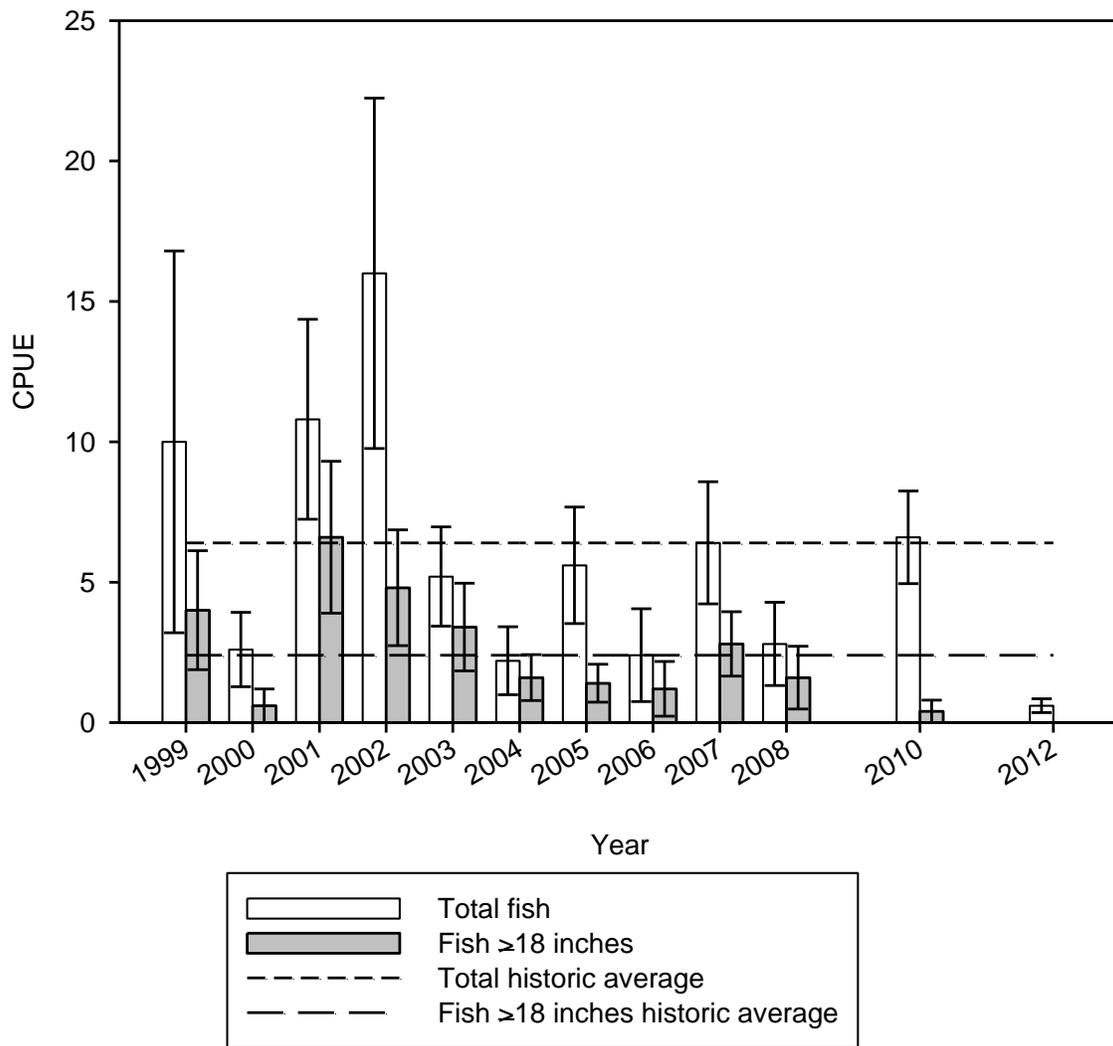


Figure 10. Total number of palmetto bass and number  $\geq 18$  inches caught per net-night of gill net sampling (CPUE) since 1999, Calaveras Reservoir, Texas. Historic average CPUEs (represented by the dashed lines) were calculated using CPUEs determined prior to the current study period. The error bars represent  $\pm$  one standard error.

## Palmetto Bass

Table 9. Summary creel results for palmetto bass at Calaveras Reservoir, Texas. The 2000 creel was conducted from 12/1/1999 to 11/30/2000 (12 months). The 2002 creel was conducted from 12/1/2001 to 5/31/2002 (6 months). The 2010 creel was conducted from 6/1/2009 to 5/31/2010 (12 months). Only data from boat anglers is presented. Angling effort was estimated for anglers specifically targeting this species. Total harvest and total catch estimates include palmetto bass caught by anglers targeting this species and by anglers targeting other species. HPUE and CPUE is the average number of fish harvested and caught, respectively, per one-hour angling effort by anglers targeting this species.

Creel statistic	2000	2002	2010
Angling effort (hours)	8,401	1,813	3,662
Total harvest (number of fish)	2,548	897	669
Total catch (number of fish)	3,518	2,762	2,472
Percent of legal-size fish released	0	0	17.3
HPUE	0.30	0.49	0.18
CPUE	0.42	1.52	0.68

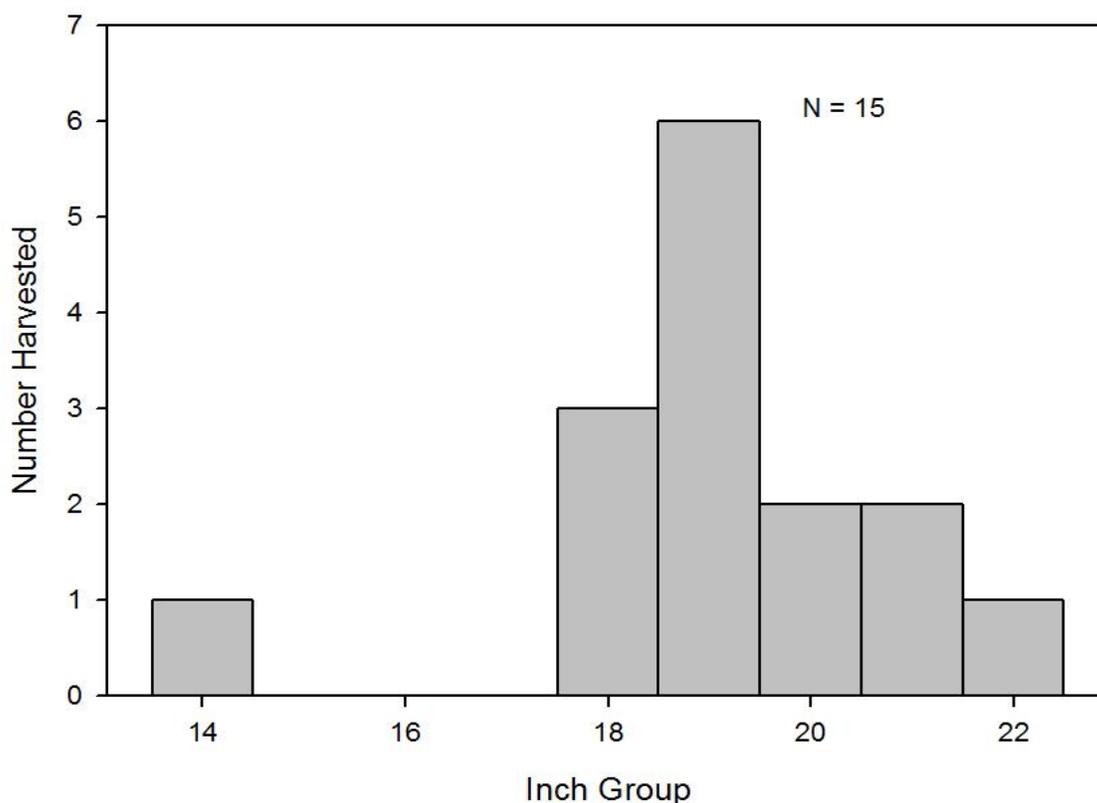
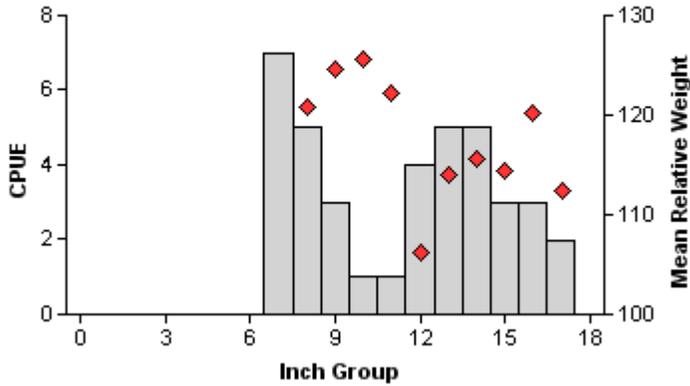


Figure 11. Length frequency of harvested palmetto bass observed during creel surveys at Calaveras Reservoir, Texas, June 2009 through May 2010, all anglers combined. N is the number of harvested palmetto bass measured during creel surveys.

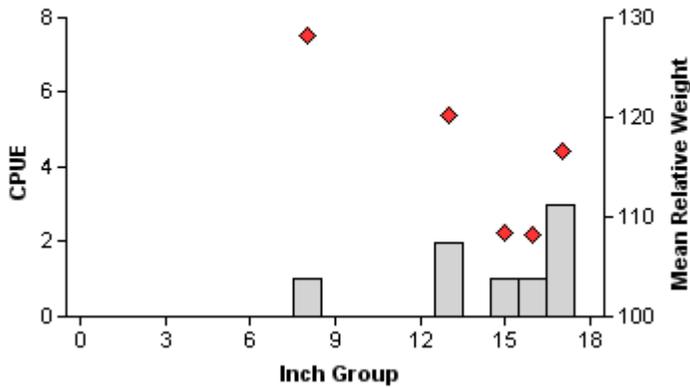
# Largemouth Bass

2007



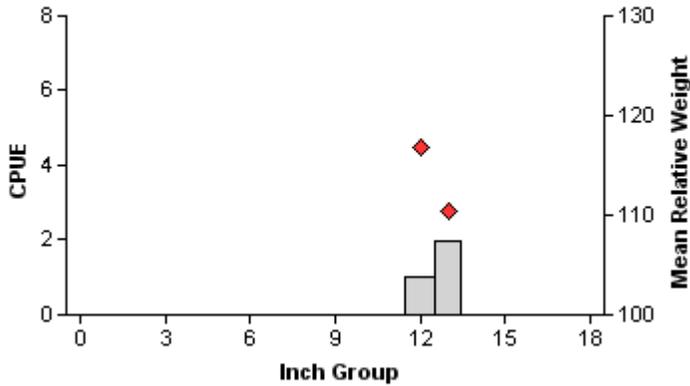
Effort = 1.0  
 Total CPUE = 39.0 (53; 39)  
 Stock CPUE = 32.0 (57; 32)  
 PSD = 69 (19)  
 PSD-P = 25 (5)

2009



Effort = 1.0  
 Total CPUE = 8.0 (75; 8)  
 Stock CPUE = 8.0 (75; 8)  
 PSD = 88 (4)  
 PSD-P = 62 (12)

2011



Effort = 1.0  
 Total CPUE = 3.0 (100; 3)  
 Stock CPUE = 3.0 (100; 3)  
 PSD = 100 (0)  
 PSD-P = 0 (0)

Figure 12. Number of largemouth bass caught per hour (CPUE, bars) mean relative weight (diamonds) and population indices (RSE and N are in parentheses) for fall electrofishing surveys, Calaveras Reservoir, Texas, 2007, 2009, and 2011. RSE is used for CPUE values and SE is used for RSD and PSD values.

## Largemouth Bass

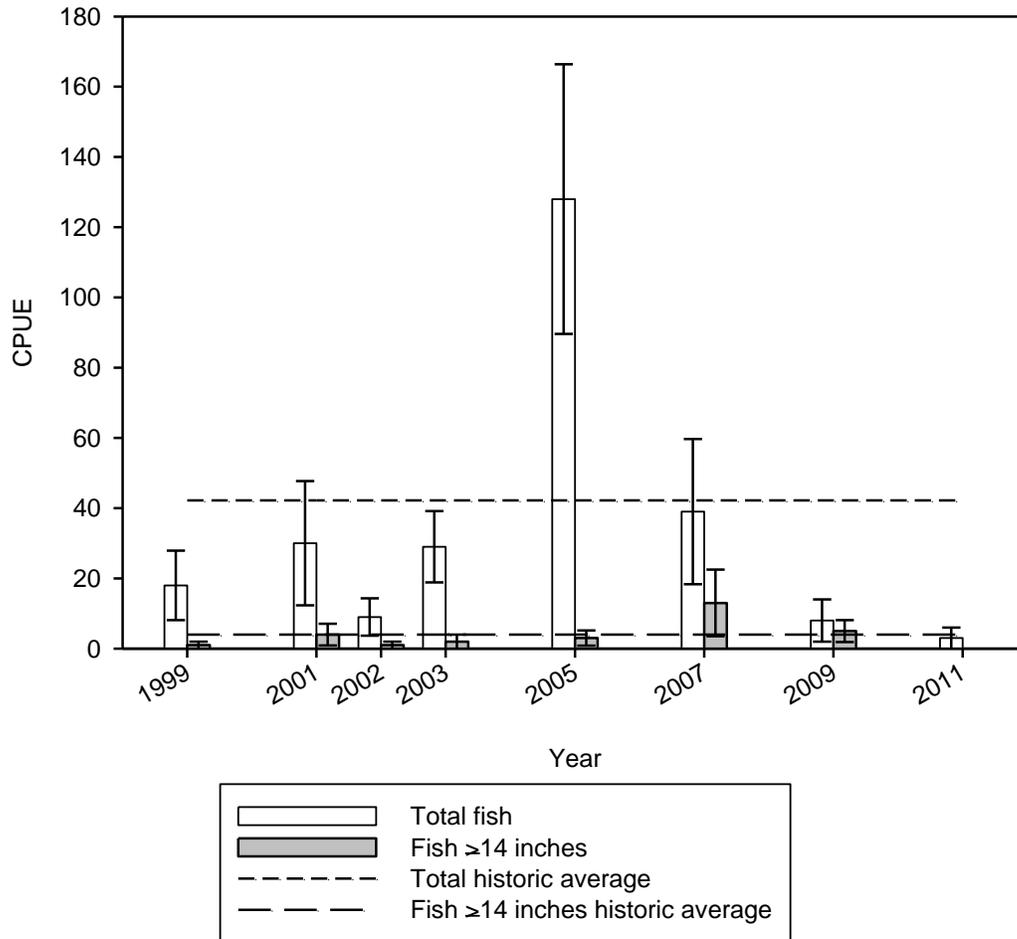


Figure 13. Total number and number >14 inches of largemouth bass caught per hour of electrofishing (CPUE) for nighttime fall surveys since 1999, Calaveras Reservoir, Texas. Historic average CPUEs (represented by the dashed lines) were calculated using CPUEs determined prior to the current study period. The error bars represent  $\pm$  one standard error.

Table 10. Results of genetic analysis of largemouth bass from Calaveras Reservoir, Texas. Intergrade fish are those with both Florida largemouth bass (FLMB) and northern largemouth bass (NLMB) genes. Genetic analysis procedures changed from electrophoresis to micro-satellite DNA in 2005. Thus, % FLMB genotype estimates made 2005 cannot be validly compared with previous estimates. Comparisons across years of % FLMB alleles values are valid. Both FLMB and NLMB bass have been stocked in the reservoir.

Year	Sample size	Number of fish by genotype			% FLMB alleles	% FLMB genotype
		FLMB	Hybrid	NLMB		
1998	30	29	1	0	99.2	96.7
1999	64	36	28	0	85.9	56.3
2001	23	20	3	0	93.5	87.0
2003	229	129	38	62	66.7	55.2
2007	30	12	18	0	90.7	40.0

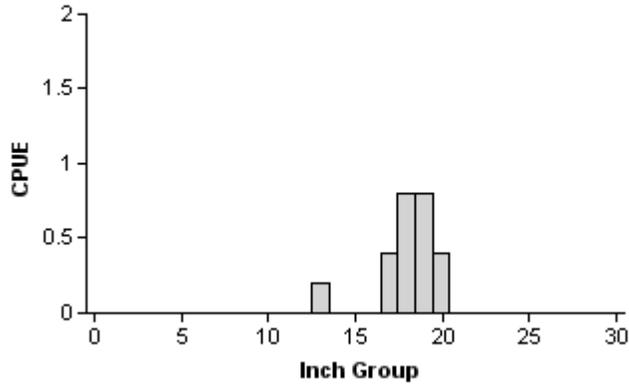
Table 11. Summary creel results for largemouth bass at Calaveras Reservoir, Texas. The 2000 creel was conducted from 12/1/1999 to 11/30/2000 (12 months). The 2002 creel was conducted from 12/1/2001 to 5/31/2002 (6 months). The 2010 creel was conducted from 6/1/2009 to 5/31/2010 (12 months). Only data from boat anglers is presented. Angling effort was estimated for anglers specifically targeting this species. Total harvest and total catch estimates include largemouth bass caught by anglers targeting this species and by anglers targeting other species. HPUE and CPUE is the average number of fish harvested and caught, respectively, per one-hour angling effort by anglers targeting this species.

Creel statistic	2000	2002	2010
Angling effort (hours)	4,981	495	5,995
Total harvest (number of fish)	48	0	0
Total catch (number of fish)	91	120	128
Percent of legal-size fish released	0	0	0
HPUE	0.01	na	na
CPUE	0.02	0.24	0.02

# Red Drum

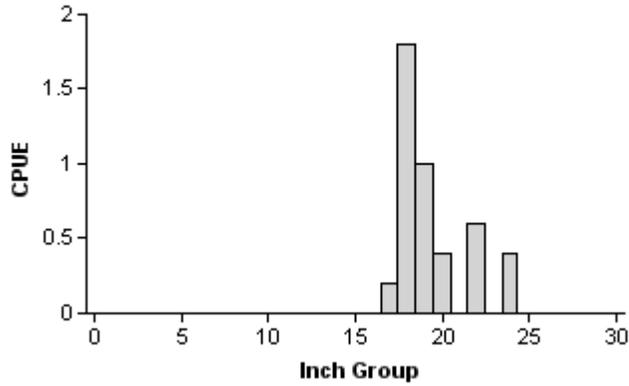
2008

Effort = 5.0  
 Total CPUE = 2.6 (81; 13)  
 Stock CPUE = 2.6 (81; 13)



2010

Effort = 5.0  
 Total CPUE = 4.4 (67; 22)  
 Stock CPUE = 4.4 (67; 22)



2012

Effort = 5.0  
 Total CPUE = 5.8 (83; 29)  
 Stock CPUE = 5.8 (83; 29)

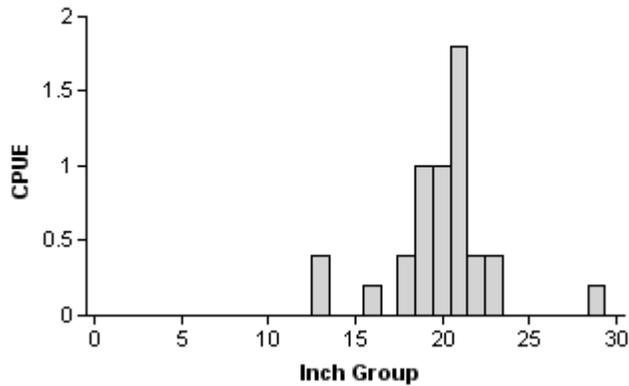


Figure 14. Number of red drum caught per net night (CPUE, bars) for spring gill net surveys, Calaveras Reservoir, Texas, 2008, 2010, and 2012. RSE and N are in parentheses.

## Red Drum

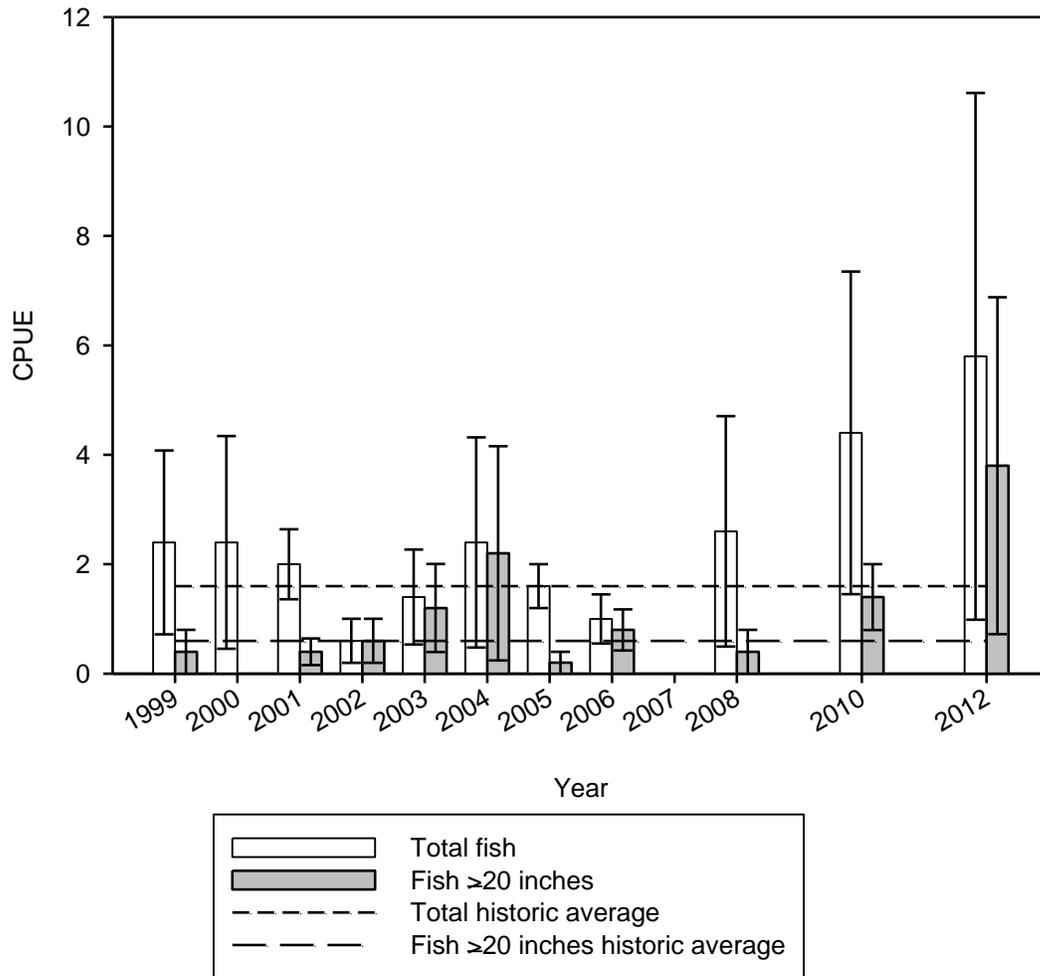


Figure 15. Total number of red drum and number  $\geq 20$  inches caught per net-night of gill net sampling (CPUE) since 1999, Calaveras Reservoir, Texas. Historic average CPUEs (represented by the dashed lines) were calculated using CPUEs determined prior to the current study period. The error bars represent  $\pm$  one standard error.

## Red Drum

Table 12. Summary creel results for red drum at Calaveras Reservoir, Texas. The 2000 creel was conducted from 12/1/1999 to 11/30/2000 (12 months). The 2002 creel was conducted from 12/1/2001 to 5/31/2002 (6 months). The 2010 creel was conducted from 6/1/2009 to 5/31/2010 (12 months). Only data from boat anglers is presented. Angling effort was estimated for anglers specifically targeting this species. Total harvest and total catch estimates include red drum caught by anglers targeting this species and by anglers targeting other species. HPUE and CPUE is the average number of fish harvested and caught, respectively, per one-hour angling effort by anglers targeting this species.

Creel statistic	2000	2002	2010
Angling effort (hours)	5,577	4,367	55,312
Total harvest (number of fish)	377	451	6,713
Total catch (number of fish)	815	1,458	20,746
Percent of legal-size fish released	0	0	21.9
HPUE	0.07	0.10	0.12
CPUE	0.15	0.33	0.38

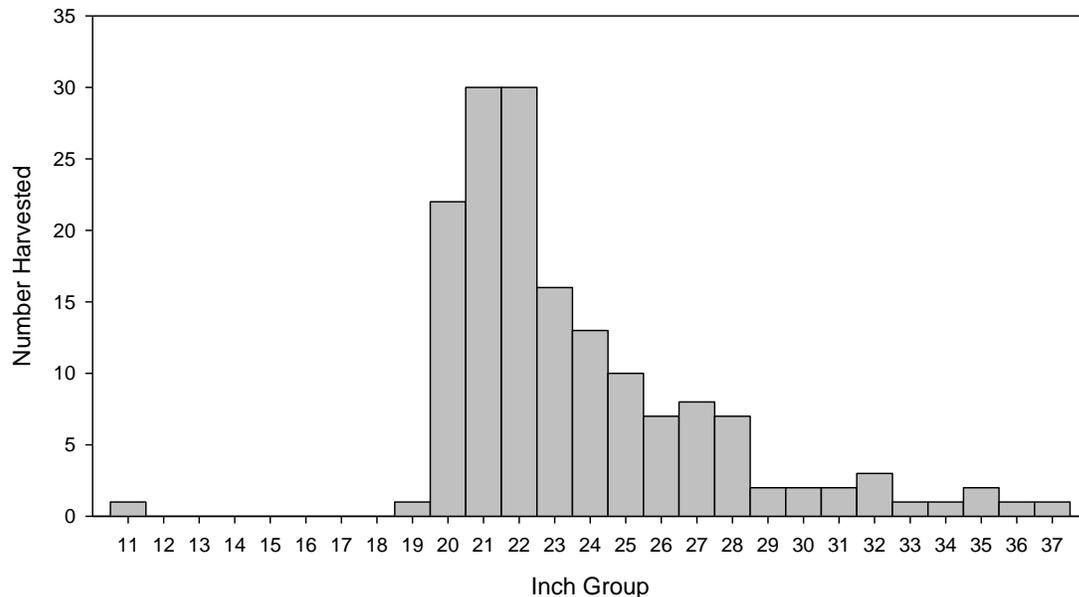


Figure 16. Length frequency of harvested red drum observed during creel surveys at Calaveras Reservoir, Texas, June 2009 through May 2010, all anglers combined. N is the number of harvested red drum measured during creel surveys.

Table 13. Proposed sampling schedule for Calaveras 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	Electrofishing	Gill Net	Creel Survey	Vegetation	Access	Report
Fall 2012-Spring 2013		A				
Fall 2013-Spring 2014			S			
Fall 2014-Spring 2015	S	S		S	S	S
Fall 2015-Spring 2016						

35  
Appendix A



Location of gill net (G) and electrofishing (E) sampling sites at Calaveras Reservoir, Texas, 2011-2012. Aerial photography is from 2008-2009 and is available on the Texas Natural Resources Information System (TNRIS) website.

**Appendix B**

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Calaveras Reservoir, Texas, 2011-2012.

Species	Gill Netting		Electrofishing	
	N	CPUE	N	CPUE
Gizzard shad			86	86.0
Threadfin shad			188	188.0
Blue catfish	83	16.6		
Channel catfish	165	33.0		
Palmetto bass	3	0.6		
Bluegill			399	399.0
Redear sunfish			13	13.0
Largemouth bass			3	3.0
Blue tilapia			17	17.0
Red drum	29	5.8		