

PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

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FEDERAL AID PROJECT F-30-R-32

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2006 Survey Report

Belton Reservoir

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July 31, 2007

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SURVEY AND MANAGEMENT SUMMARY

Belton Reservoir were surveyed in fall 2006 using a boat electrofisher, winter of 2006 with trap nets, and spring 2007 using gill nets. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir Description:** Belton Reservoir is a 12,385-acre impoundment located in Bell County, Texas. Mean and maximum water depths are 37 and 124 feet respectively, and the reservoir is classified as mesotrophic with secchi disk readings around 6 feet. Habitat features consisted mainly of bluffs, rocky shoreline, sandy beaches, and some standing timber.
- **Management history:** Important sport fish include white bass, palmetto bass, largemouth bass, smallmouth bass, white crappie, blue catfish, and channel catfish. The first and only creel survey for Belton was conducted from March 2003 through February 2004; these data are included in this report. The 2000 management plan documented low prey availability and recommended reducing palmetto bass stockings. In 2002, the management plan reduced the stocking rate of palmetto bass to 8 fish/acre. The reduced stocking rate will be re-evaluated in this report also.
- **Fish Community**
 - **Prey species:** Threadfin shad are present in the reservoir in low numbers. Electrofishing catch of gizzard shad was low and few were available as prey to sport fish (i.e., IOV =51). Electrofishing catch of bluegill was high, but few were over 6-inches in length. Longear, redear, warmouth, and green sunfish also contributed to the forage base.
 - **Catfishes:** The blue and channel catfish populations continue to grow slowly, and both hold fish in the quality size range for anglers. Flathead catfish were present in good numbers. Nearly one-fourth of all anglers fished for catfish.
 - **Temperate basses:** White bass and palmetto bass were well represented in the survey, and populations consist mainly of legal-sized individuals. Palmetto bass were typically in good condition, whereas white bass condition dropped steadily after reaching legal size. Less than 10% of anglers creeled were fishing for white and palmetto bass combined.
 - **Black basses:** Smallmouth bass catch rates have held steady and fair numbers of legal-size fish exist. Natural recruitment is occurring consistently. Largemouth bass catch rates were low, size structure remained good, and there are fair numbers of legal-sized fish in the population. Spotted bass were not collected during this survey. Nearly one-half of all angler effort at Belton was spent fishing for black bass.
 - **White crappie:** Catch rates of white crappie remain low, but size distribution is good. A few legal-sized crappies are available in the population for harvest. Nine percent of all angler hours were spent fishing for crappies.
- **Management Strategies:** Conduct general monitoring with trap nets, gill nets, and electrofishing surveys in 2010-2011. Monitor aquatic vegetation and extent of fishery/shoreline habitat with surveys in 2009/2010.

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INTRODUCTION

This document is a summary of fisheries data collected from Belton Reservoir in 2006-2007. 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 with the 2006-2007 data for comparison.

Reservoir Description

Belton Reservoir is located on the Leon River in Bell County, Texas. The reservoir was constructed in 1954 by the United States Army Corps of Engineers to serve as a source of municipal water and for flood control and is managed by the same agency. The reservoir has a maximum depth of 124.0 feet and an average depth of 37.0 feet. The 12,385-acre impoundment has a drainage area of 3,531 square miles, a storage capacity of 457,600 acre-feet, and a shoreline length of 136 miles. Water levels were low during 2006 electrofishing and trap net surveys and above conservation pool during 2007 gill net surveys. At time of sampling, fish habitat was primarily bluffs, rocky shoreline, sandy beaches, and some standing timber; little to no aquatic vegetation currently exists. Bank fishing is adequate and boat access is excellent with ten public boat ramps. There are no handicap-specific facilities (Table 1). Further information about Belton Reservoir and its facilities can be obtained by visiting the Texas Parks and Wildlife web page at www.tpwd.state.tx.us and navigating within the fishing link.

Management History

Previous management strategies and actions: Many district 2B management philosophies have changed since the 2002 Belton Reservoir Survey Report was created. Because of this, some management actions were not carried through as planned. Instead, additional sampling effort has been allocated to single reservoirs within the district each year. Management strategies and actions (where appropriate) from the previous survey report (Tibbs and Baird 2003) included:

1. Sample forage and palmetto bass every two years to document availability of prey and to monitor the sport fish population; re-evaluate the stocking rate of palmetto bass.
Action: The 1999 electrofishing sample observed low catch rates of gizzard shad and some sunfishes relative to previous surveys. It was not known whether the reduced catch was due to low water level or an actual decline in stocks. The 2002 management plan reduced the stocking rate of palmettos from 15 to 8 fish/acre until prey availability could be monitored longer. Catch rates during fall 2002 were back to normal, as was the water level. The additional electrofishing survey slated for 2004 was not conducted. However by fall 2006, water levels and catch rates of some prey species including gizzard shad, were low once again (Figure 1). The current thought is that sampling prey species in low water situations on Belton yields low catch rates, and that plenty of forage exists in the reservoir to support continued stockings of palmetto bass up to 15 fish/acre.
2. Sample blue catfish every two years with gill nets and stock at a rate of 25/acre in 2004.
Action: The additional gill net survey slated for 2005 was not conducted. Blue catfish stockings were requested in 2004, 2005, and 2006 but have not been fulfilled due to excessive hatchery demands.
3. Sample smallmouth bass every two years to evaluate natural reproduction.
Action: The additional electrofishing survey slated for 2004 was not conducted. Smallmouth bass are currently requested every year but have not been available from hatcheries. An electrofishing effort in spring 2007 to collect smallmouth bass brood stock was very successful. Nearly 150 individuals from 6 to 16 inches were collected in six hours of sampling. These data help to substantiate the extent of natural reproduction in the reservoir.
4. Sample largemouth bass every two years to evaluate the genetic composition of the

population.

Action: The additional electrofishing survey slated for 2004 was not conducted. Florida influence decreased from 2002, yet remains higher than average for the previous three surveys. Florida largemouth bass stockings will be requested if and when criteria are met.

Harvest regulation history: Sportfishes in Belton Reservoir are currently and have always been managed with statewide regulations (Table 2).

Stocking history: Smallmouth bass and palmetto bass are currently requested each year. Historical stockings of palmettos have been very consistent. Over one million palmetto bass *fry* were stocked in spring 2007. This change-up from fingerling to fry will be used to compare recruitment rates and help determine which stocking method is most productive to the fishery. Traditional fingerling stockings will resume in spring 2008 pending results of this comparison. Smallmouth bass stockings were fairly consistent from 1995 to 2000, but have not occurred since due to the loss of the hatchery brood stock by golden algae in 2001. The program is currently being rebuilt. Other recent and notable stockings were blue catfish in 1998 (25/acre) and Florida largemouth bass in 1995 (25/acre). The complete stocking history is in Table 3.

Vegetation/habitat history: Belton Reservoir supports little aquatic vegetation. Buttonbush has been observed along rocky shorelines during historical habitat surveys, and southern naiad has been observed more recently. There have been several reports of hydrilla in recent years, but none have been confirmed by TPWD surveys. Currently, no noxious vegetation exists in the reservoir.

A grass roots initiative began in 2006 by an angling group called Centex Bass hunters, in conjunction with Bass Anglers Sportsman's Society (BASS), Texas Parks and Wildlife Department (TPWD), and the U.S. Army Corps of Engineers (USACOE) aquatic research laboratory in Lewisville, to establish native aquatic vegetation in Belton Reservoir. Although funding contributions from 2006 fell short of expectations, native vegetation plantings are slated to begin in summer 2007.

METHODS

Fishes were collected by electrofishing (2 hours at 24 five-minute stations), gill netting (15 net nights at 15 stations), and trap netting (10 net nights at 10 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 and trap 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 (TPWD, Inland Fisheries Division, unpublished manual revised 2005).

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 for largemouth bass were determined from otoliths and followed procedures for the category II age and growth sample. Smallmouth and palmetto bass ages were also determined from otoliths and followed procedures for a category I age and growth sample. Source for water level data was the United States Geological Survey (USGS) website.

RESULTS AND DISCUSSION

Habitat: A habitat survey was last conducted in 1996 (DiCenzo 1997). Littoral zone habitat consisted primarily of bluffs, rocky shoreline, sandy beaches, and some standing timber. The 1996 survey results can be found in Table 4.

Creel: Directed fishing effort by anglers was highest for black bass (47.9%), followed by anglers fishing for catfishes (21.8%), anything (11.2%), and fourth, crappie (8.8%) (Table 5). Total fishing effort for all species at Belton Reservoir was 94,065 from March 2003 through February 2004, and anglers spent an estimated \$302,391 on direct expenditures. Belton experiences low use by anglers, with only 7.5 hours per acre of total fishing effort. Belton anglers harvested few illegal fish according to the creel.

Prey species: Electrofishing catch rates of bluegill and gizzard shad were 196.5/h and 70.5/h, respectively. Index of vulnerability (IOV) for gizzard shad was poor, indicating only 51% of gizzard shad were available as prey and lower than the IOV estimate (82.1%) in 2002. Total CPUE of gizzard shad was considerably lower in 2006 than in 2002 (Figure 2). Total CPUE of bluegill in 2006 was higher than that in 2002 and 2000, but population structure was similar; proportional stock density (PSD) was identical for the 2006 and 2002 survey (Figure 3). Redear sunfish were collected at a rate of 14.0/h and the majority of the population was of quality size with individuals up to 10 inches collected (Figure 4). Longear (46.0/h), green (24.0/h) and warmouth (2.0/h) sunfish also contributed to the forage base.

Blue catfish: The gill net catch rate of blue catfish was 1.7/nn in 2007, up slightly from the 2003 survey. Half of the population consists of quality size fish or larger and relative weights continue to be average (Figure 5). Observed harvest from March 2003 to February 2004 showed good angler compliance, and harvested fish ranged in length from 16 to 25 inches (Figure 6). No legal-sized blue catfish were released (Table 7).

Channel catfish: The gill net catch rate of channel catfish (2.9/nn) was higher than the 1.9/nn observed in 2003. All channel catfish collected were of legal size or better, with average condition (Figure 7). Total harvest and total harvest per acre showed channel catfish were caught twice as often as blue catfish (Tables 7 and 8). Legal sized channel catfish were harvested 100% of the time by anglers. Observed harvest from March 2003 to February 2004 showed good angler compliance and harvested fish ranged in length from 13 to 28 inches (Figure 8).

White bass: The gill net catch rate of white bass was 4.2/nn in 2007. Size structure of this species is weighted toward legal-sized fish (e.g., Stock CPUE = 4.2, PSD= 98, RSD-10= 98) (Figure 9). Condition decreased dramatically with increasing length group and may be indicative of competition with palmetto bass. Directed fishing effort, catch per hour, and total harvest for white bass was 2,889 h, 0.23 fish/h, and 1,775 fish, respectively, from March 2003 through February 2004 (Table 9). Anglers enjoyed harvesting white bass as no legal-sized fish were released according to creel data. Observed harvest from March 2003 to February 2004 showed good angler compliance, and harvested fish ranged in length from 10 to 15 inches (Figure 10).

Palmetto bass: The gill net catch rate of palmetto bass was 7.1/nn in 2007 (N=107), higher than any previous survey on record. Although some young fish were observed, most collected were approaching or exceeded the legal size of 18 inches (e.g., PSD=95, RSD-P= 93, RSD-18=73) (Figure 11). Palmetto bass were typically 14 inches at age two and 20 inches by age three (Figure 13). Relative weights averaged between 80 and 90 indicating good and consistent condition. Only 5% of anglers targeted palmetto bass specifically during 2003/2004, and total harvest (493) was low (Table 10). Anecdotal information obtained from several parties during the time of the creel indicated that hours creeled were probably missing the majority of palmetto bass anglers (i.e., dusk till dawn). Observed harvest from March 2003 to February 2004 showed good angler compliance, and harvested fish ranged in length from 19 to 25 inches (Figure 12). All legal-sized fish were harvested according to the creel data collected.

A gill net sample of palmetto bass this size from Belton had never been seen before spring 2007, so the opportunity was taken to research a couple of interesting topics: species identification via the tooth patch characteristic and a diet analysis.

Most taxonomic literature points to one major identifying trait to distinguish white bass from palmetto bass. A single tooth patch on the back of the tongue identifies a white bass while two distinct tooth patches

identify striped and palmetto bass. We examined all temperate bass from the 2007 sample and identified them based on the tooth patch characteristic (n=177). Fin clips were taken from all individuals less than 18 inches total length, and sent to San Marcos for proper genetic identification via microsatellite analysis. Stomach analysis were then performed on all palmetto bass (n=107).

Five out of 30 individuals identified as palmettos were confirmed to be white bass. Conversely, 5 of 63 individuals identified as whites were confirmed to be palmetto bass. There is obviously error associated with using the tooth patch as an identifying characteristic in temperate bass, and nearly 10% of stocked palmetto bass in Belton Reservoir will be mis-identified and possibly harvested as white bass according to these data.

Twenty-five of the 107 palmetto bass dissected had contents in their stomachs, and nine had preyed on more than 1 fish. Of the 25 stomachs, 52% of the contents were unidentifiable, 24% were identified as *Dorosoma* spp., 16% were *Lepomis* spp., 4% were *Catostomids*, and 4% were *Cyprinids*. As expected, the preferred prey item appeared to be *Dorosoma* spp. (i.e., gizzard and threadfin shad), however other species are being utilized as well.

Smallmouth bass: The electrofishing catch rate of smallmouth bass was 11.0/h in 2006, similar to the previous two surveys. These CPUEs compare favorably to those of the mid-1990s when smallmouth bass were being stocked at 15 fish/acre. Nearly 38% of stock-sized fish in the population were larger than 14 inches (Figure 14). Growth of smallmouth bass in Belton Reservoir was good; average age at 14 inches (13.5 to 14.5 inches) was 2.3 years (N = 13; range = 1 – 4 years) (Figure 16). Taking into consideration that all recruitment was natural, size structure and catch rate was very positive. However, condition of legal-sized fish and larger was poor (relative weight under 80) (Figure 14). Directed fishing effort, catch per hour, and total harvest for smallmouth bass was minimal from June 2003 through May 2004, as most anglers did not differentiate between largemouth and smallmouth during the creel (Table 11). Observed harvest showed good angler compliance, and harvested fish ranged in length from 14 to 21 inches (Figure 15). The percentage of legal-size fish released was 0.13, but many of the anglers creeled were tournament anglers, and tournament-released fish were considered harvested fish during this creel.

Largemouth bass: The electrofishing catch rate of largemouth bass was 64.0/h in 2006, and less than half the rate in 2002 (140.0/h). The PSD of 49 and RSD-P of 9 indicate a balanced population, and 19% of stock-sized fish in the sample were of legal size or larger (RSD-14) (Figure 17). Growth of largemouth bass in Belton Reservoir was good. Average age at 14 inches (13.0 to 15.0 inches) was 2.5 years (N = 15; range = 1 – 4 years). Florida largemouth bass genotypes decreased from 17% in 2002 to 7% in 2006 while Florida alleles remained similar (Table 13). Largemouth bass was the most sought after species in Belton during the 2003/2004 creel survey (Table 12). There was insignificant harvest of largemouth bass from March 2003 to February 2004, and harvested fish ranged in length from 13 to 23 inches illustrating some illegal harvest (Figure 18).

White crappie: The trap net catch rate of white crappie was 1.4/nn in 2006. This catch rate was higher than the previous two surveys, but still illustrates a low density population. Size structure was similar to the previous survey and remains good (e.g., PSD=46 and RSD-P=15). Mean relative weight was over 85 for all size classes in 2006 and was much lower than values observed in 2002 (Figure 19). White crappie were the third most popular species fished for by anglers according to directed effort, and had the highest total catch per hour among all sport fish on Belton Reservoir (Table 14). Size of harvested white crappie in 2003/2004 ranged from 10 to 14 inches in total length and harvest compliance was good (Figure 20).

Fisheries management plan for Belton Reservoir, Texas

Prepared – June 2007.

ISSUE 1: The spring 2007 palmetto bass survey had the highest catch rates for this species ever. Age and growth data showed that four year old fish dominated the sample. This is interesting because it correlates to the 2004 stocking year – a year in which fry (1,337,574) were stocked in addition to fingerlings (99,180). Over one million palmetto bass *fry* were stocked in spring 2007. This change-up from fingerling to fry will be used to compare recruitment rates and help determine which stocking method is most productive to the fishery.

MANAGEMENT STRATEGIES

1. Request fry stockings at 100 fish/acre in 2009 and 2011 and fingerling stockings at 15 fish/acre in 2008 and 2010.
2. Sample the reservoir in 2011 using gill netting to compare the recruitment of each method and determine most efficient stocking regime at that time. Continue this stocking regime pending results.

ISSUE 2: The most recent habitat survey on file for Belton reservoir is dated 1997.

MANAGEMENT STRATEGY

1. Conduct a thorough habitat/vegetation survey in 2009/2010.

ISSUE 3: TPWD hatcheries are currently rebuilding their smallmouth bass program after losing brood stock to golden algae. In spring 2007, 150 smallmouths from 6 to 16 inches in length were collected for hatchery use. Additionally, nearly two dozen fish larger than 16 inches were released back into the reservoir during sampling.

MANAGEMENT STRATEGIES

1. Continue to request smallmouth bass stockings at 25 fish/acre on an annual basis.
2. Continue spring time collection efforts for smallmouth bass to be used by hatcheries as brood stock when requested.

ISSUE 4: Creel data from 2003/2004 show largemouth bass are heavily utilized. Time constraints in 2006 prevented a comprehensive age and growth sample from being performed.

MANAGEMENT STRATEGY

1. Sample the reservoir (category 4 sample) in 2010 using electrofishing.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule includes habitat/vegetation survey in 2009/2010, and general sampling with electrofishing, trap netting, and gill netting in 2010/2011. A habitat survey is necessary because the 1997 survey is now obsolete.

LITERATURE CITED

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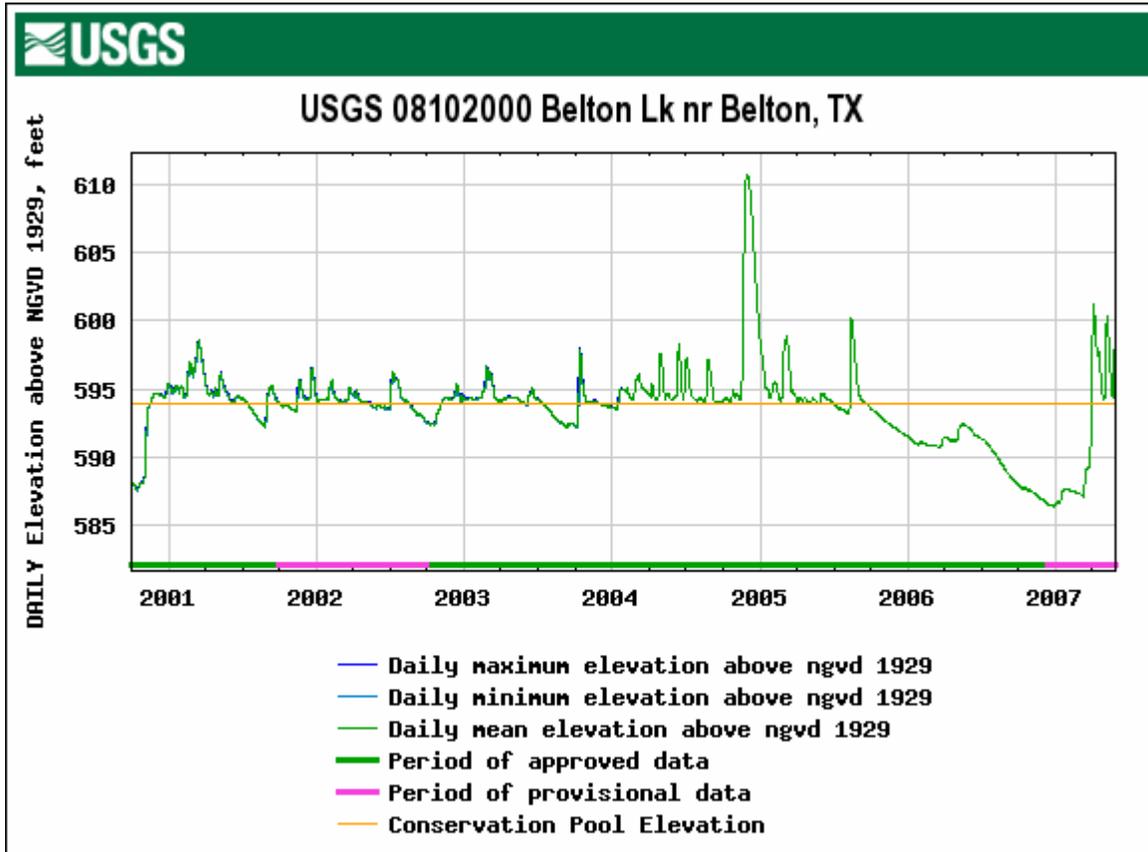


Figure 1. Daily water level elevations in feet above mean sea level (MSL) recorded for Belton Reservoir, Texas. From USGS Real-Time Water Data for Texas <http://waterdata.usgs.gov/tx/nwis/uv?>

Table 1. Characteristics of Belton Reservoir, Texas.

Characteristic	Description
Year Constructed	1954
Controlling authority	United States Army Corps of Engineers
Counties	Bell
Reservoir type	Mainstem
Shoreline Development Index (SDI)	8.8
Conductivity	370 umhos/cm

Table 2. Harvest regulations for Belton Reservoir.

Species	Bag Limit	Minimum-Maximum Length (inches)
Catfish: channel and blue catfish, their hybrids and subspecies	25 (in any combination)	12 - No Limit
Catfish, Flathead	5	18 - No Limit
Bass, White	25	10 - No Limit
Bass, Palmetto	5	18 - No Limit
Bass: largemouth and smallmouth	5	14 – No Limit
Crappie: white and black crappie, their hybrids and subspecies	25 (in any combination)	10 - No Limit

Table 3. Stocking history of Belton (Bell County), 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)
Blue catfish	1998	308,987	FGL	2.2
	Total	308,987		
Channel catfish	1971	44,000	AFGL	7.9
	Total	44,000		
Florida Largemouth bass	1989	307,142	FRY	0.8
	1991	357,741	FGL	1.2
	1995	308,552	FGL	1.2
	Total	973,435		
Largemouth bass	1967	4,600	UNK	UNK
	1969	350,000	FRY	0.7
	1970	100,000	UNK	UNK
	1972	225,000	UNK	UNK
	Total	679,600		
Palmetto Bass (striped X white bass hybrid)	1977	60,455	UNK	UNK
	1979	65,518	UNK	UNK
	1981	120,625	UNK	UNK
	1983	125,550	UNK	UNK
	1984	242,239	FGL	2.0
	1987	250,850	FRY	1.0
	1988	259,977	FRY	1.0
	1989	88,000	FGL	1.2
	1991	133,832	FGL	1.3
	1992	218,884	FGL	1.3
	1993	92,386	FGL	1.2
	1994	185,744	FGL	1.3
	1995	185,151	FGL	1.3
	1996	187,907	FGL	1.6
	1997	101,100	FGL	1.5
	1998	189,434	FGL	1.2
	1999	94,098	FGL	1.4
	2000	93,674	FGL	1.6
2002	94,200	FGL	1.8	
2004	99,180	FGL	1.6	
2004	1,337,574	FRY	0.4	
2005	124,081	FGL	1.7	
2006	123,337	FGL	1.8	

Species	Year	Number	Life Stage	Mean TL (in)
	2007	1,039,169	FRY	0.2
	Total	5,512,965		
Sauger	1985	54,113		1.5
	Total	54,113		
Smallmouth bass	1978	99,850	UNK	UNK
	1979	100,000	UNK	UNK
	1980	101,320	UNK	UNK
	1995	28,450	FGL	1.5
	1997	302,150	FGL	1.1
	1998	184,500	FGL	1.2
	1999	189,258	FGL	1.4
	2000	130,000	FGL	1.5
	Total	1,135,528		
Walleye	1973	493,000	FRY	0.2
	1974	327,000	FRY	0.2
	Total	820,000		

Table 4. Survey of littoral zone and physical habitat types, Belton Reservoir, Texas, 1996. A linear shoreline distance (miles) was recorded for each habitat type found.

Shoreline habitat type	Shoreline Distance		Surface Area	
	Miles	Percent of total	Acres	Percent of reservoir surface area
Cut bank	1.0	0.7	N/A	
Overhanging brush	5.0	3.7	N/A	
Dead trees/stumps	9.0	6.6	N/A	
Rock bluff	5.0	3.7	N/A	
Rocky or gravel	110.0	80.9	N/A	
Riprap	1.0	0.7	N/A	
Featureless	5.0	3.7	N/A	

Table 5. Percent directed effort by species or species group for Belton Reservoir, Texas, 2003 – 2004.

Species	% Effort
Catfishes	21.8
White bass	3.1
Palmetto bass	4.51
Black basses	47.9
Crappies	8.8
Anything	11.2

Table 6. Total fishing effort (h) for all species and total directed expenditures at Belton Reservoir, Texas, 2003 – 2004.

Total fishing effort (hours)	94,065.00
Total directed expenditures	\$302,391

Gizzard Shad

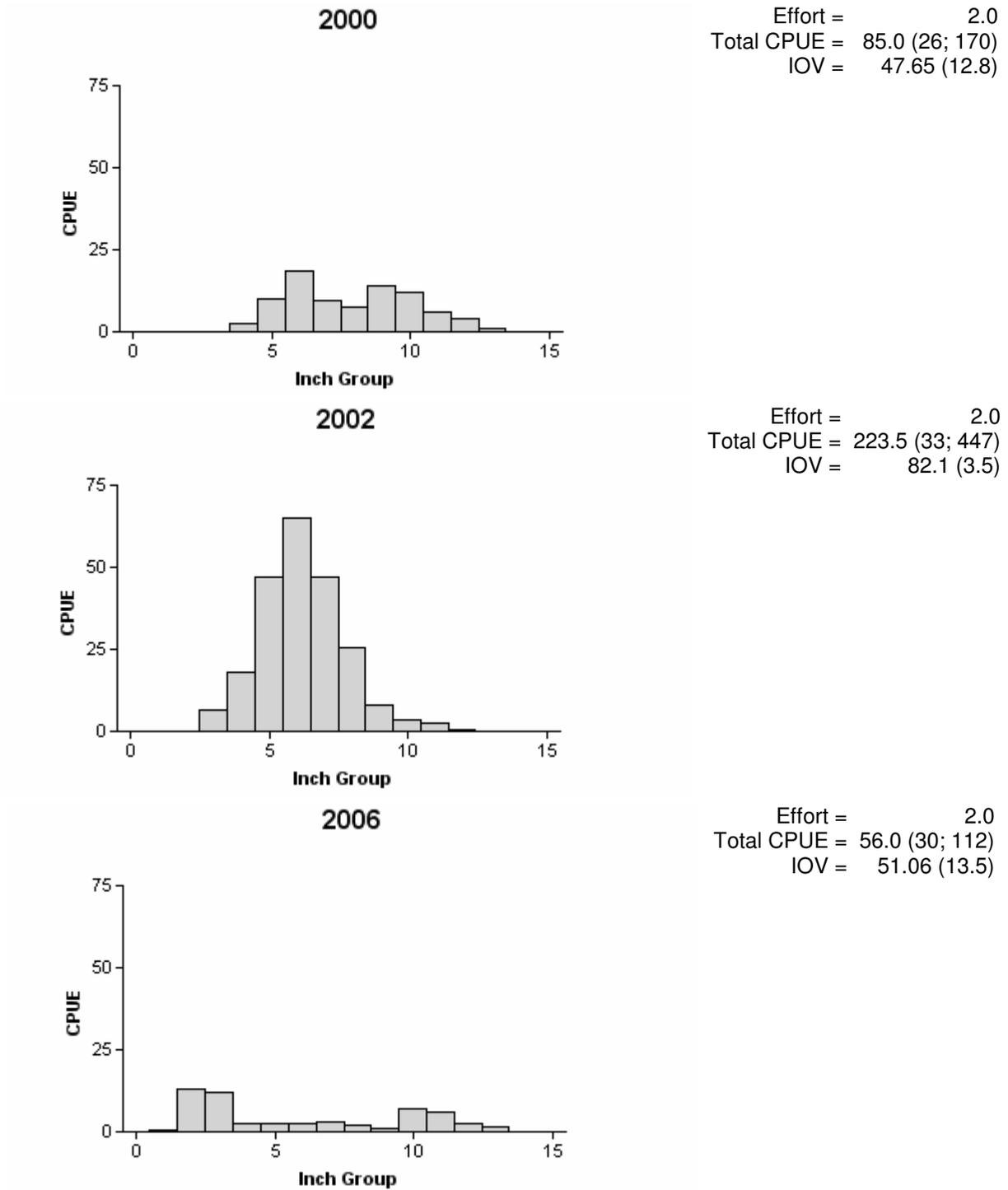
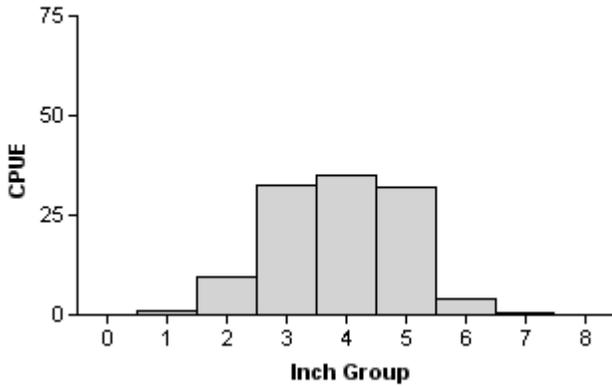


Figure 2. Number of gizzard shad caught per hour (CPUE) and population indices for fall electrofishing surveys, Belton Reservoir, Texas, 2000, 2002, and 2006.

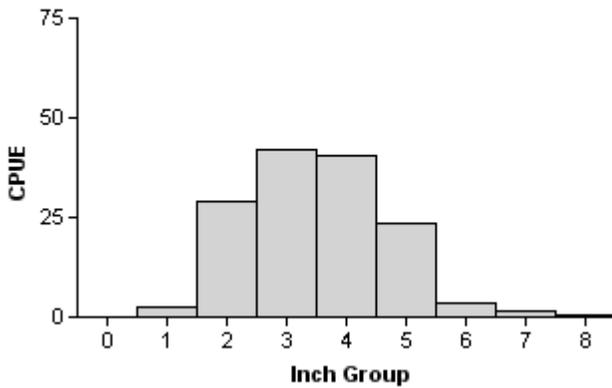
Bluegill

2000



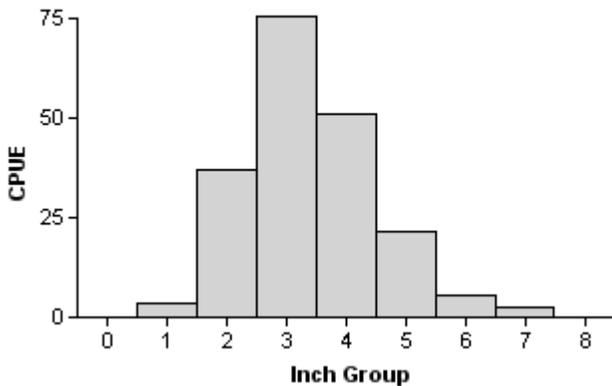
Effort = 2.0
 Total CPUE = 114.5 (16; 229)
 Stock CPUE = 104.0 (17; 208)
 PSD = 4 (1.2)

2002



Effort = 2.0
 Total CPUE = 143.0 (17; 286)
 Stock CPUE = 111.5 (15; 223)
 PSD = 5 (2.1)

2006



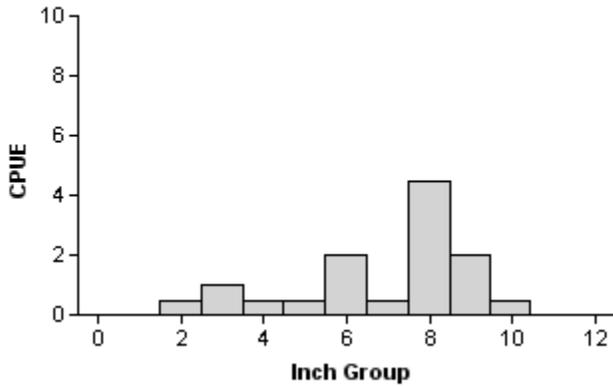
Effort = 2.0
 Total CPUE = 196.5 (28; 393)
 Stock CPUE = 156.0 (29; 312)
 PSD = 5 (1.9)

Figure 3. Number of bluegill caught per hour (CPUE) and population indices for fall electrofishing surveys, Belton Reservoir, Texas, 2000, 2002, and 2006.

Redear sunfish

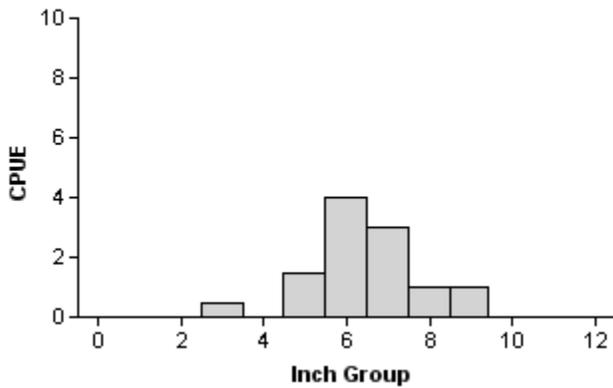
2000

Effort = 2.0
 Total CPUE = 12.0 (21; 24)
 Stock CPUE = 10.5 (21; 21)
 PSD = 71 (12.1)



2002

Effort = 2.0
 Total CPUE = 11.0 (21; 22)
 Stock CPUE = 10.5 (21; 21)
 PSD = 48 (13.0)



2006

Effort = 2.0
 Total CPUE = 13.5 (22; 27)
 Stock CPUE = 12.5 (24; 25)
 PSD = 68 (11.7)

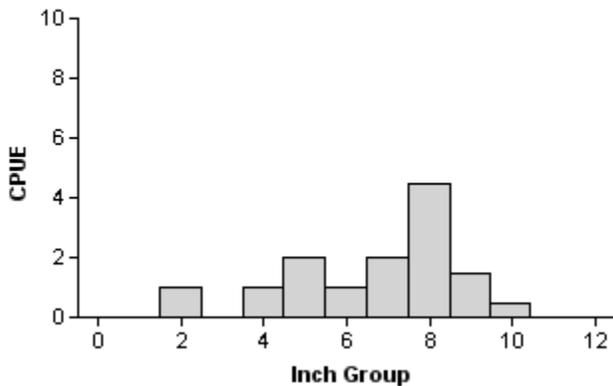


Figure 4. Number of Redear sunfish caught per hour (CPUE) and population indices for fall electrofishing surveys, Belton Reservoir, Texas, 2000, 2002, and 2006.

Blue Catfish

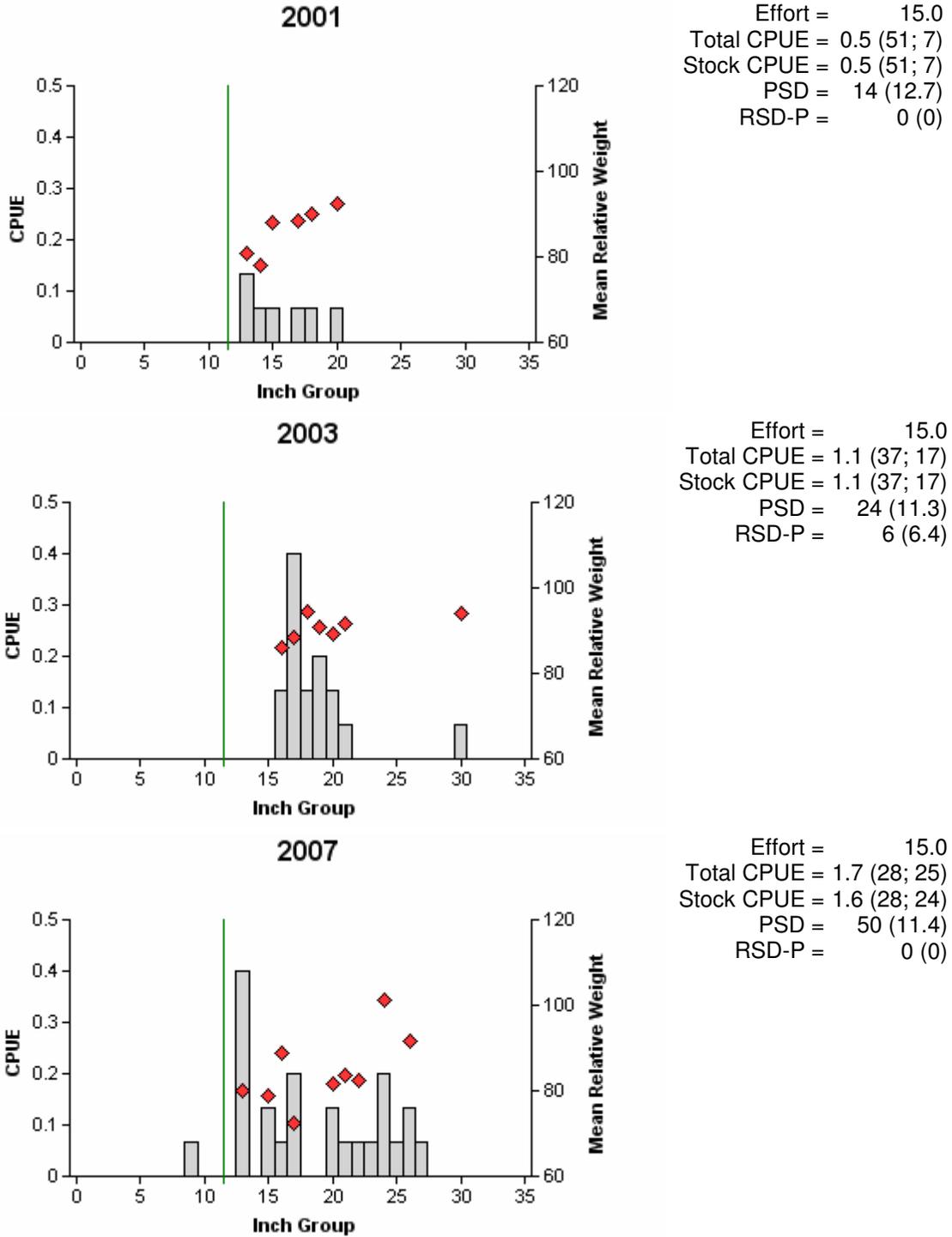


Figure 5. Number of blue catfish caught per net night (CPUE) and population indices for spring gill net surveys, Belton Reservoir, Texas, 2001, 2003, and 2007.

Blue Catfish

Table 7. Creel survey statistics for catfish at Belton Reservoir from March 2003 through February 2004, where directed effort (h), directed effort/acre, and total catch per hour is for anglers targeting *all* catfish species and total harvest and harvest/acre is the estimated number of blue catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Directed effort (h)	20,200 (26)
Directed effort/acre	1.63 (26)
Total catch per hour	0.17 (93)
Total harvest	1,473 (88)
Harvest/acre	0.12 (88)

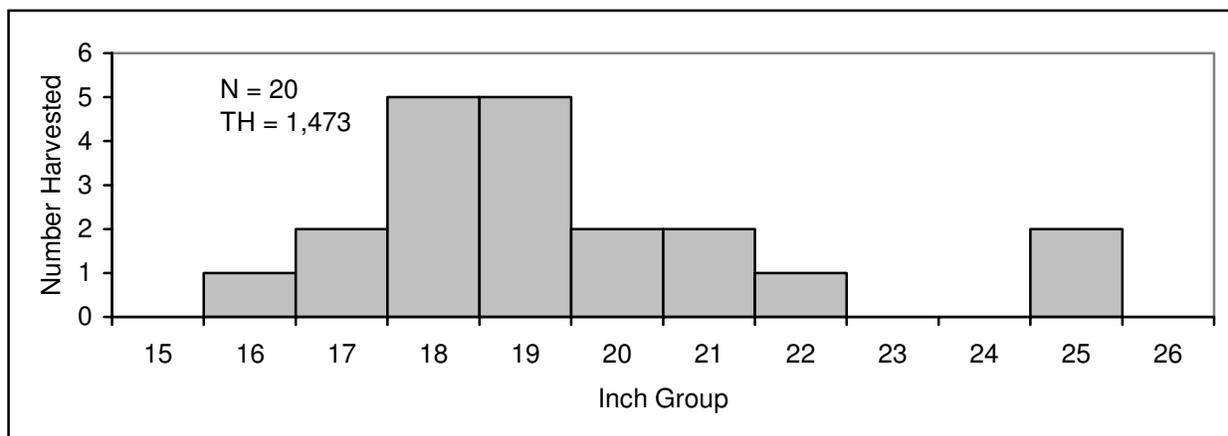
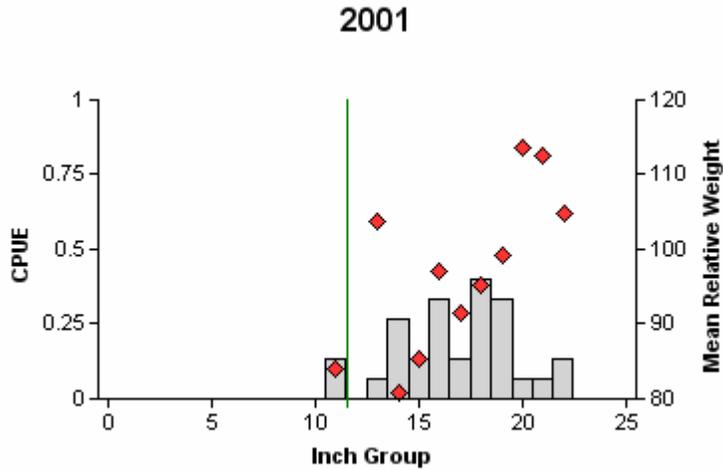
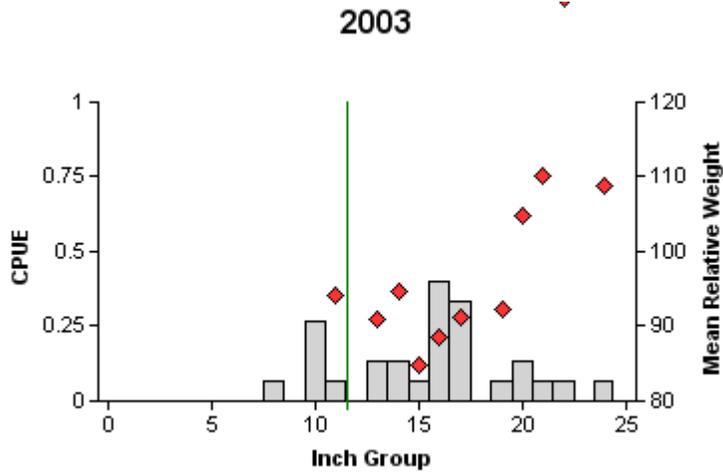


Figure 6. Length frequency of harvested blue catfish observed during creel surveys at Belton Reservoir, Texas, March 2003 through February 2004, all anglers combined. N is the number of harvested blue catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

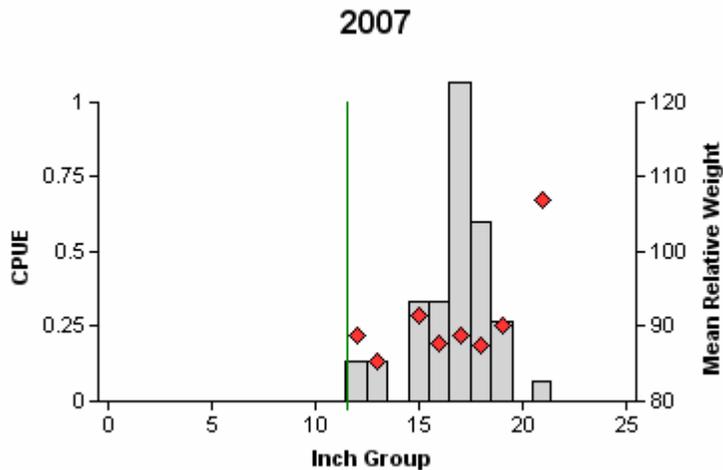
Channel Catfish



Effort = 15.0
 Total CPUE = 2.1 (19; 31)
 Stock CPUE = 2.1 (19; 31)
 PSD = 71 (10.2)
 RSD-P = 0 (0)



Effort = 15.0
 Total CPUE = 1.9 (23; 28)
 Stock CPUE = 1.5 (28; 23)
 PSD = 74 (9.3)
 RSD-P = 4 (4.4)



Effort = 15.0
 Total CPUE = 2.9 (22; 44)
 Stock CPUE = 2.9 (22; 44)
 PSD = 80 (7.1)
 RSD-P = 0 (0)

Figure 7. Number of channel catfish caught per net night (CPUE) and population indices for spring gill net surveys, Belton Reservoir, Texas, 2001, 2003, and 2007.

Channel Catfish

Table 8. Creel survey statistics for catfish at Belton Reservoir from March 2003 through February 2004, where directed effort (h), directed effort/acre, and total catch per hour is for anglers targeting *all* catfish species and total harvest and harvest/acre is the estimated number of channel catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Directed effort (h)	20,200 (26)
Directed effort/acre	1.63 (26)
Total catch per hour	0.17 (93)
Total harvest	2,911 (49)
Harvest/acre	0.24 (49)

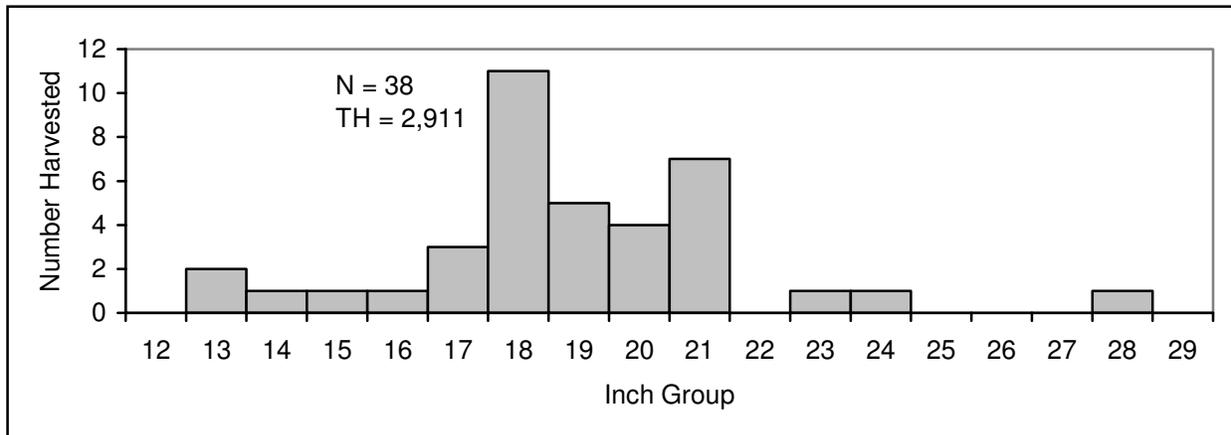


Figure 8. Length frequency of harvested channel catfish observed during creel surveys at Belton Reservoir, Texas, March 2003 through February 2004, all anglers combined. N is the number of harvested channel catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

White Bass

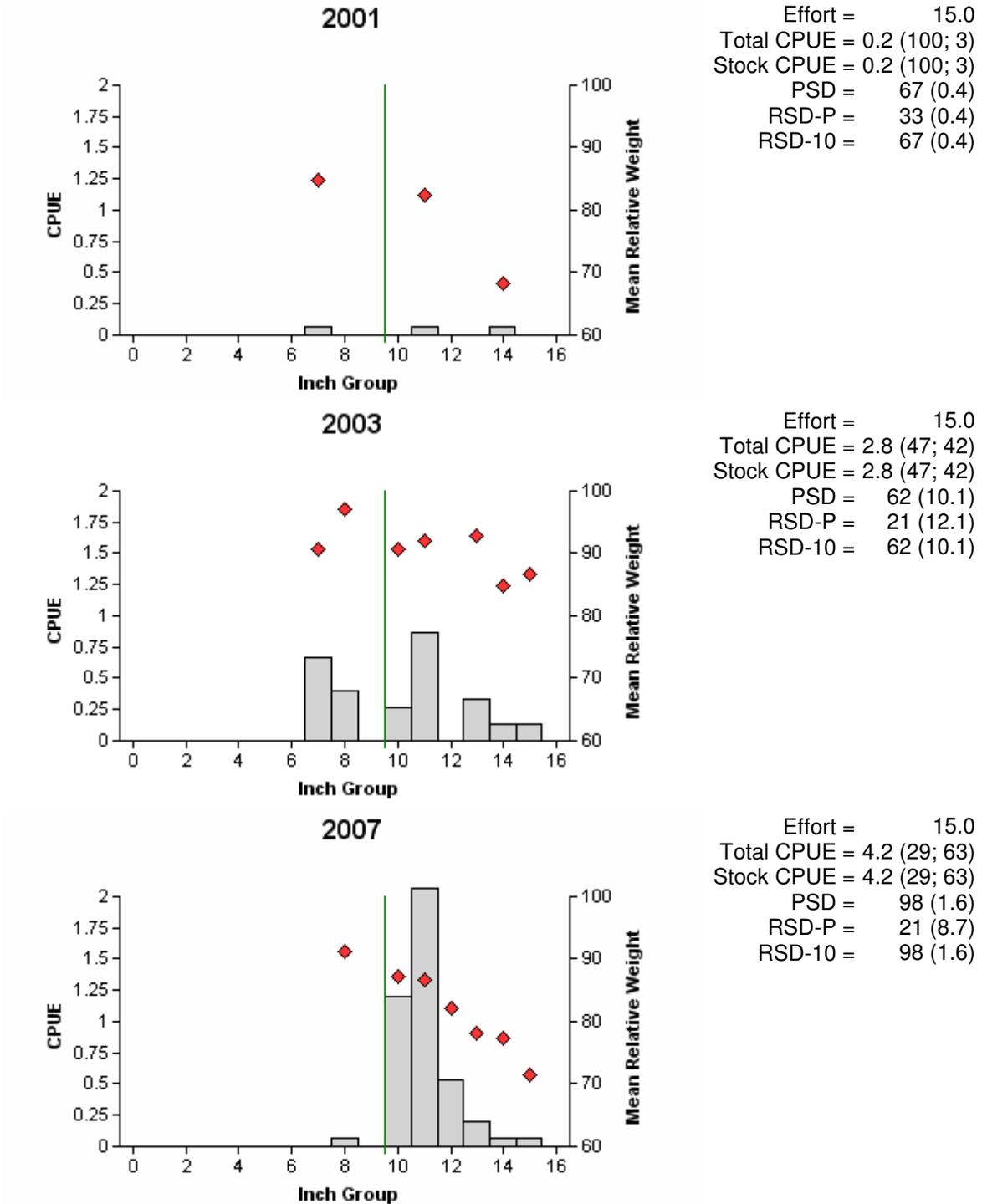


Figure 9. Number of white bass caught per net night (CPUE) and population indices for spring gill net surveys, Belton Reservoir, Texas, 2001, 2003, and 2007.

White Bass

Table 9. Creel survey statistics for white bass at Belton Reservoir from March 2003 through February 2004, 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.

Directed effort (h)	2,889 (41)
Directed effort/acre	0.23 (41)
Total catch per hour	0.23 (79)
Total harvest	1,775 (65)
Harvest/acre	0.14 (65)

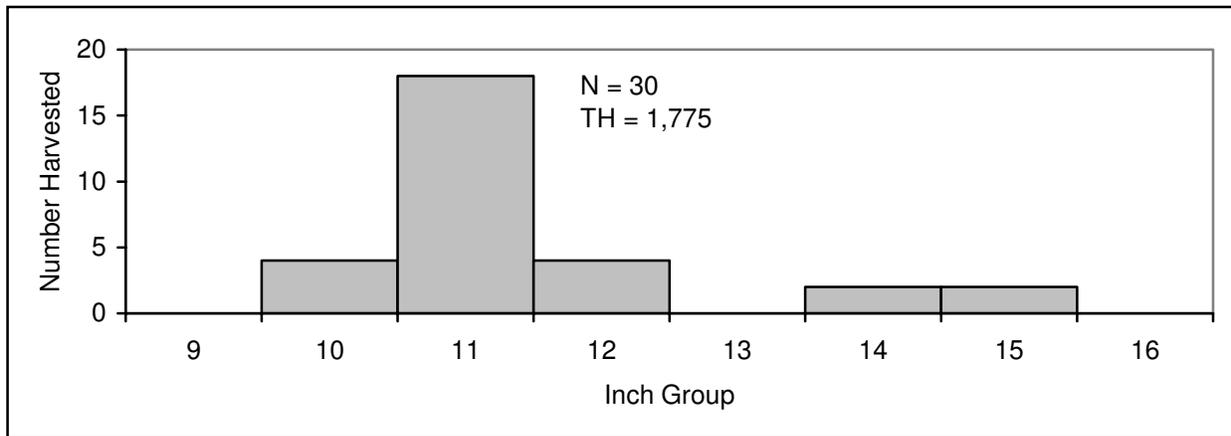
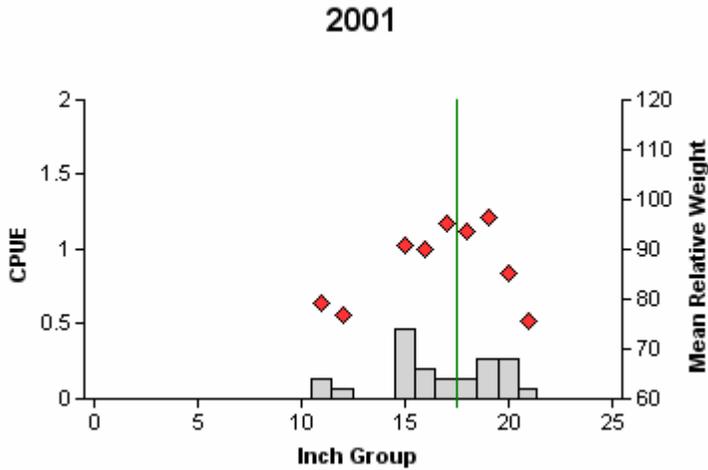
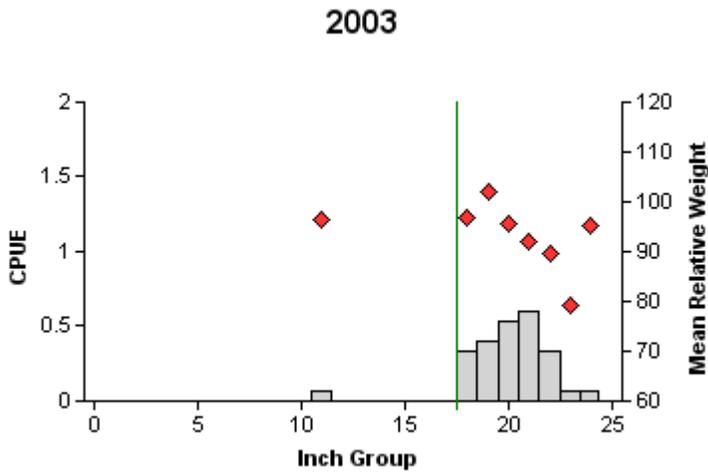


Figure 10. Length frequency of harvested white bass observed during creel surveys at Belton Reservoir, Texas, March 2003 through February 2004, all anglers combined. N is the number of harvested white bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

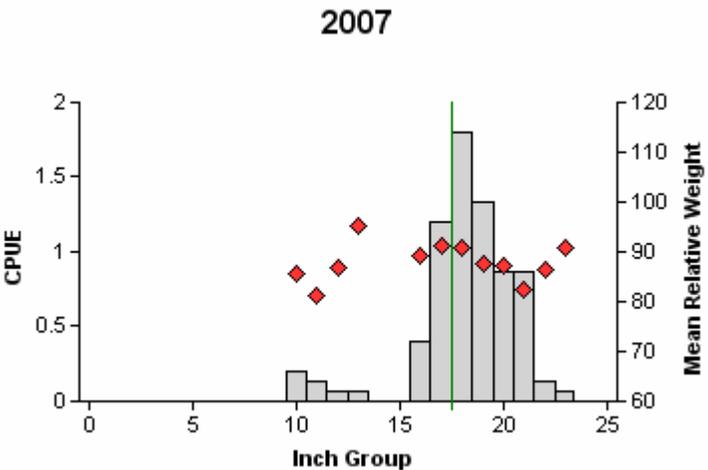
Palmetto Bass



Effort = 15.0
 Total CPUE = 1.7 (43; 26)
 Stock CPUE = 1.7 (43; 26)
 PSD = 92 (3.2)
 RSD-P = 88 (4.9)
 RSD-18 = 42 (9.5)



Effort = 15.0
 Total CPUE = 2.4 (42; 36)
 Stock CPUE = 2.4 (42; 36)
 PSD = 97 (2.6)
 RSD-P = 97 (2.6)
 RSD-18 = 97 (2.6)



Effort = 15.0
 Total CPUE = 7.1 (29; 107)
 Stock CPUE = 7.1 (29; 107)
 PSD = 95 (2.3)
 RSD-P = 93 (2.6)
 RSD-18 = 73 (7.9)

Figure 11. Number of palmetto bass caught per net night (CPUE) and population indices for spring gill net surveys, Belton Reservoir, Texas, 2001, 2003, and 2007.

Palmetto Bass

Table 10. Creel survey statistics for palmetto bass at Belton Reservoir from March 2003 through February 2004, 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.

Directed effort (h)	4,177 (36)
Directed effort/acre	0.34 (36)
Total catch per hour	0.06 (73)
Total harvest	493 (163)
Harvest/acre	0.03 (163)

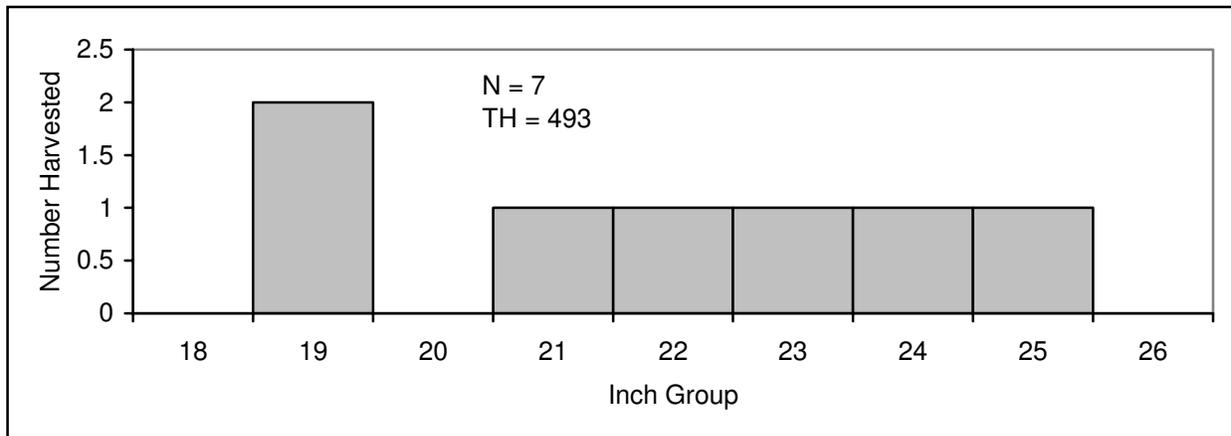


Figure 12. Length frequency of harvested palmetto bass observed during creel surveys at Belton Reservoir, Texas, March 2003 through February 2004, all anglers combined. N is the number of harvested palmetto bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

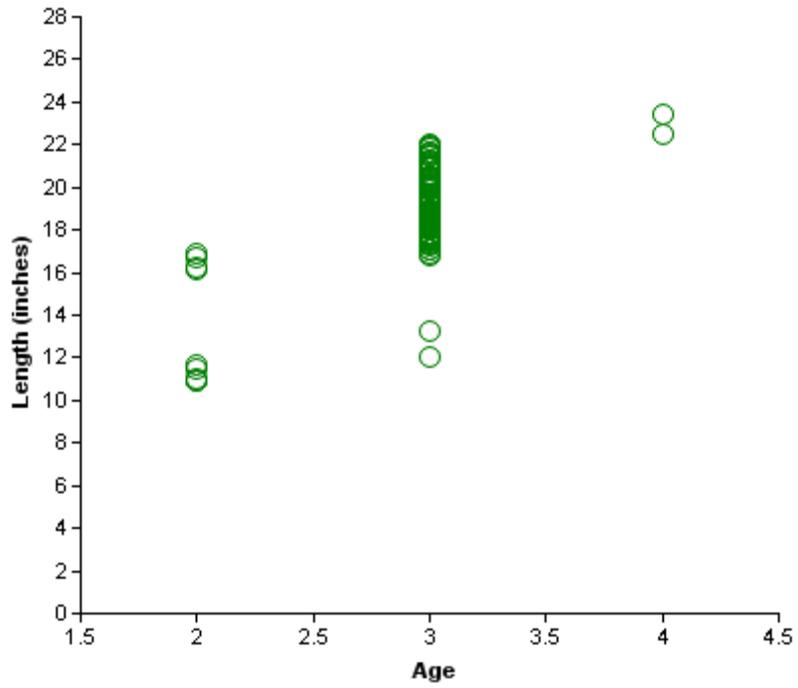


Figure 13. Length at age for palmetto bass collected from gill nets at Belton Reservoir, Texas, 2007.

Smallmouth Bass

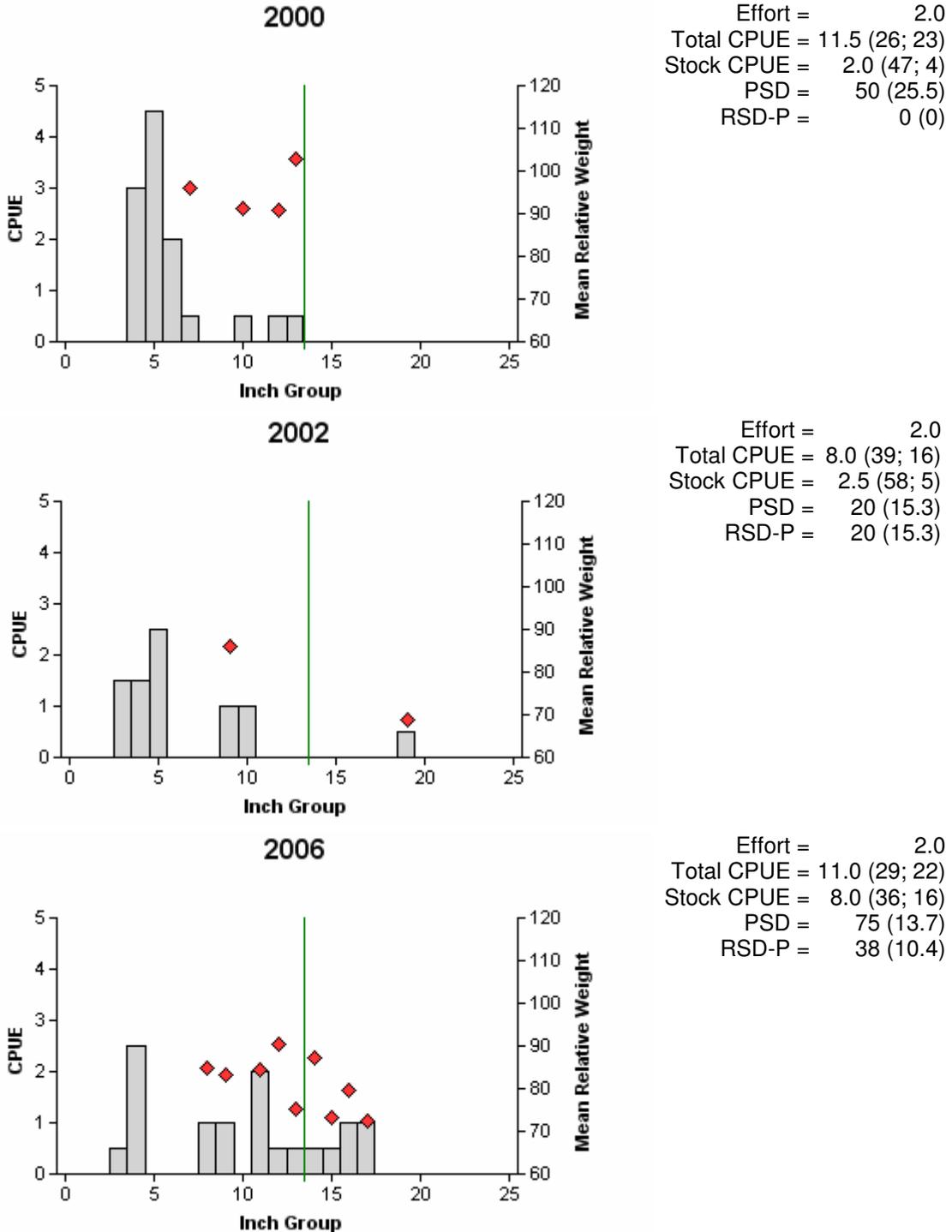


Figure 14. Number of smallmouth bass caught per hour (CPUE) and population indices for fall electrofishing surveys, Belton Reservoir, Texas, 2000, 2002, and 2006.

Smallmouth Bass

Table 11. Creel survey statistics for black basses at Belton Reservoir from March 2003 through February 2004, where directed effort (h), directed effort/acre, and total catch per hour is for anglers targeting *all* black bass species and total harvest and harvest/acre is the estimated number of smallmouth bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Directed effort (h)	44,396 (17)
Directed effort/acre	3.58 (17)
Total catch per hour	0.83 (20)
Total harvest	922 (83)
Harvest/acre	0.07 (83)

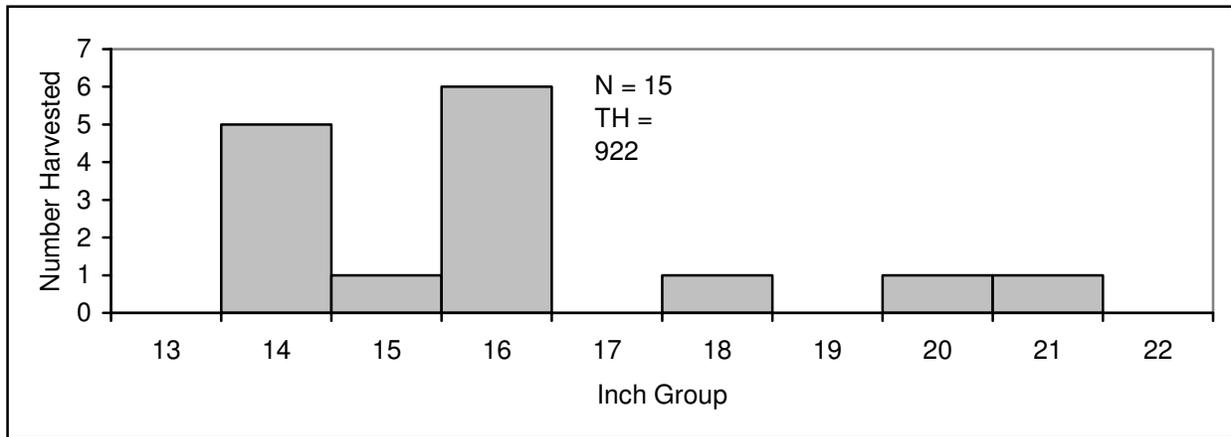


Figure 15. Length frequency of harvested smallmouth bass observed during creel surveys at Belton Reservoir, Texas, March 2003 through February 2004, all anglers combined. N is the number of harvested smallmouth bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

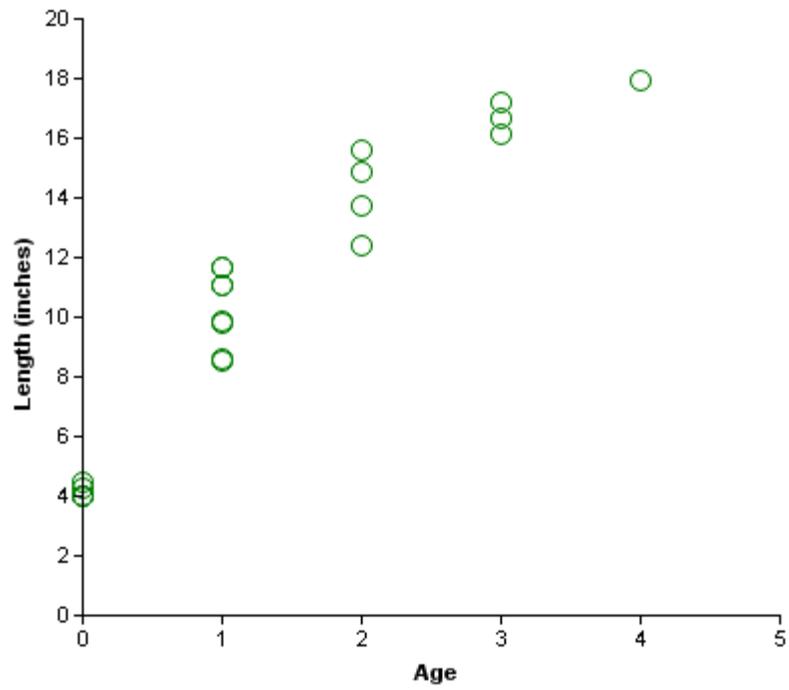


Figure 16. Length at age for smallmouth bass collected from electrofishing at Belton Reservoir, Texas, 2006.

Largemouth Bass

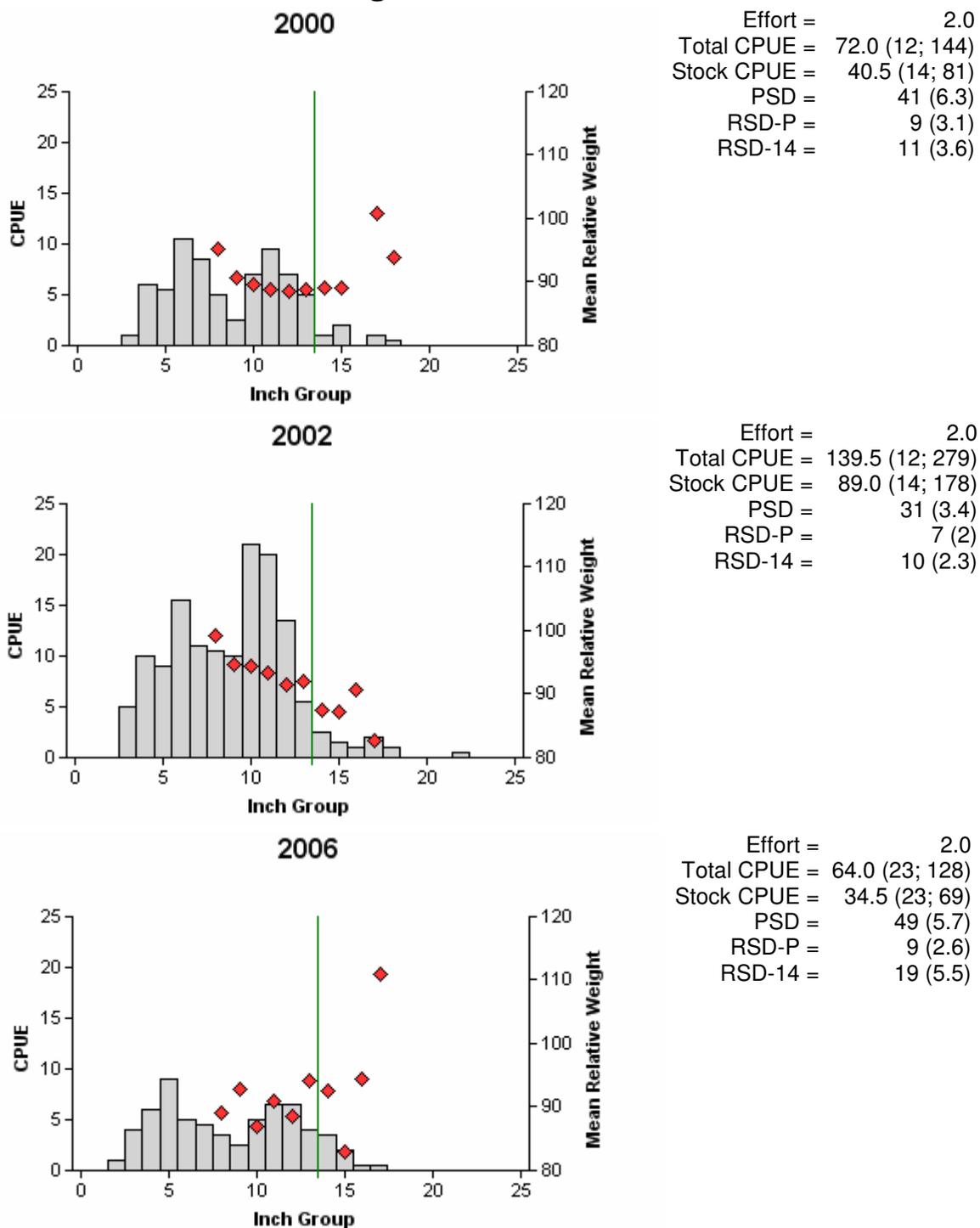


Figure 17. Number of largemouth bass caught per hour (CPUE) and population indices for fall electrofishing surveys, Belton Reservoir, Texas, 2000, 2002 and 2006.

Largemouth Bass

Table 12. Creel survey statistics for black basses at Belton Reservoir from March 2003 through February 2004, where directed effort (h), directed effort/acre, and total catch per hour is for anglers targeting *all* black bass species and total harvest and harvest/acre is the estimated number of largemouth bass harvested by all anglers. Relative standard errors (RSE) are in parentheses..

Directed effort (h)	44,396 (17)
Directed effort/acre	3.58 (17)
Total catch per hour	0.83 (20)
Total harvest	6,891 (34)
Harvest/acre	0.56 (34)

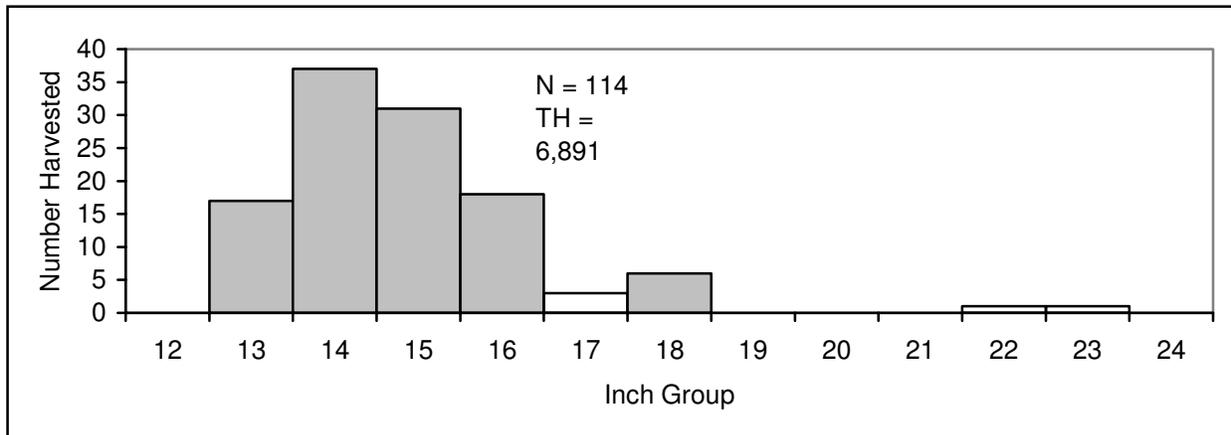


Figure 18. Length frequency of harvested largemouth bass observed during creel surveys at Belton Reservoir, Texas, March 2003 through February 2004, all anglers combined. N is the number of harvested largemouth bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Largemouth Bass

Table 13. Results of genetic analysis of largemouth bass collected by fall electrofishing, Belton Reservoir, Texas, 2000, 2002, and 2006. FLMB = Florida largemouth bass, NLMB = Northern largemouth bass, Hybrid = bass with both FLMB and NLMB alleles.

Year	Sample size	Genotype			% FLMB alleles	% Northern alleles
		%FLMB	%Hybrid	%NLMB		
2000	30	4	71	25	34	76
2002	30	17	80	3	57	43
2006	30	7	93	0	49	51

White crappie

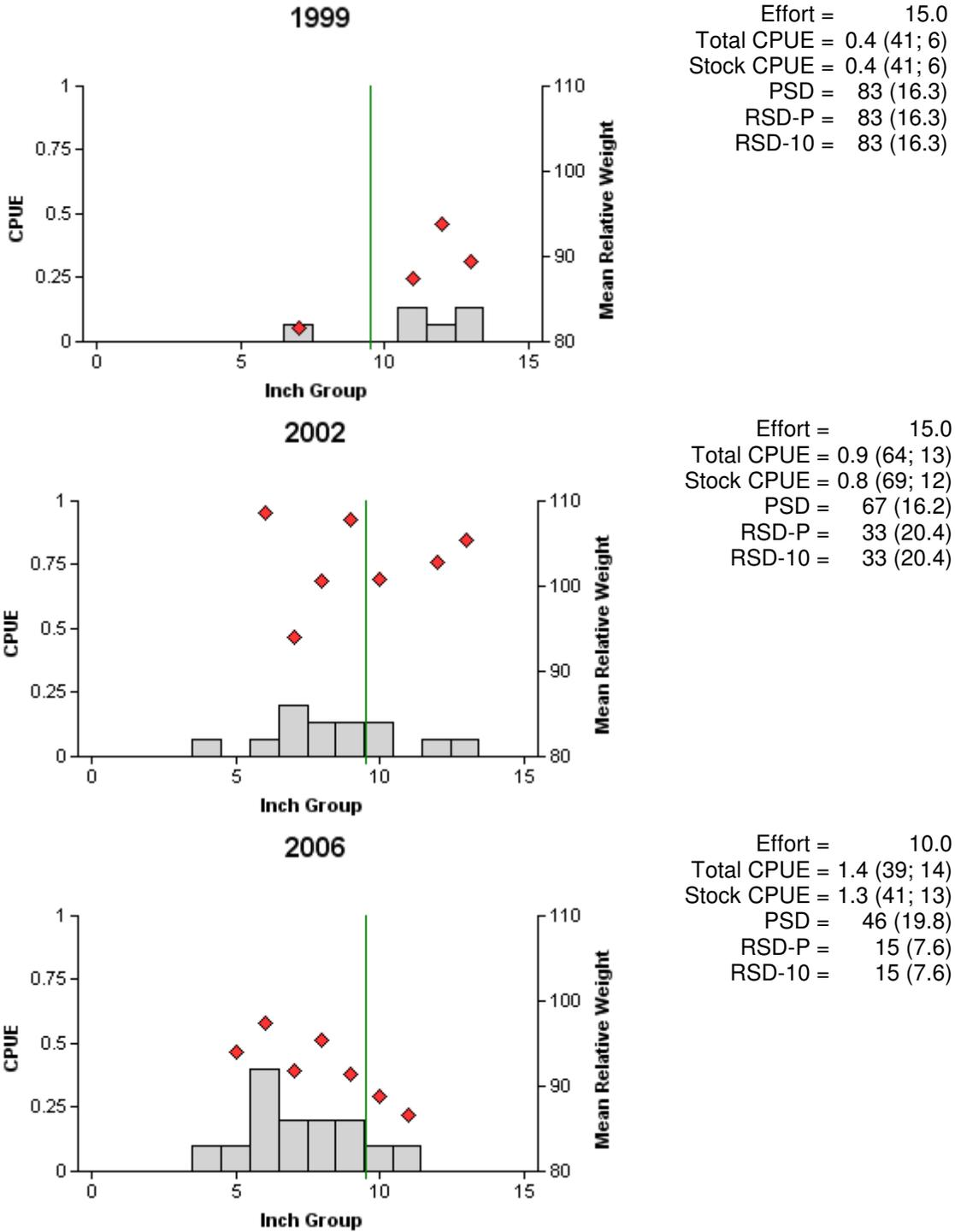


Figure 19. Number of white crappie caught per net night (CPUE) and population indices for fall trap net surveys, Belton Reservoir, Texas, 1999, 2002 and 2006.

White crappie

Table 14. Creel survey statistics for crappies at Belton Reservoir from March 2003 through February 2004, where directed effort (h), directed effort/acre, and total catch per hour is for anglers targeting *all* crappie species and total harvest and harvest/acre is the estimated number of white crappie harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Directed effort (h)	8,224 (26)
Directed effort/acre	0.66 (26)
Total catch per hour	1.38 (66)
Total harvest	4,384 (45)
Harvest/acre	0.35 (45)

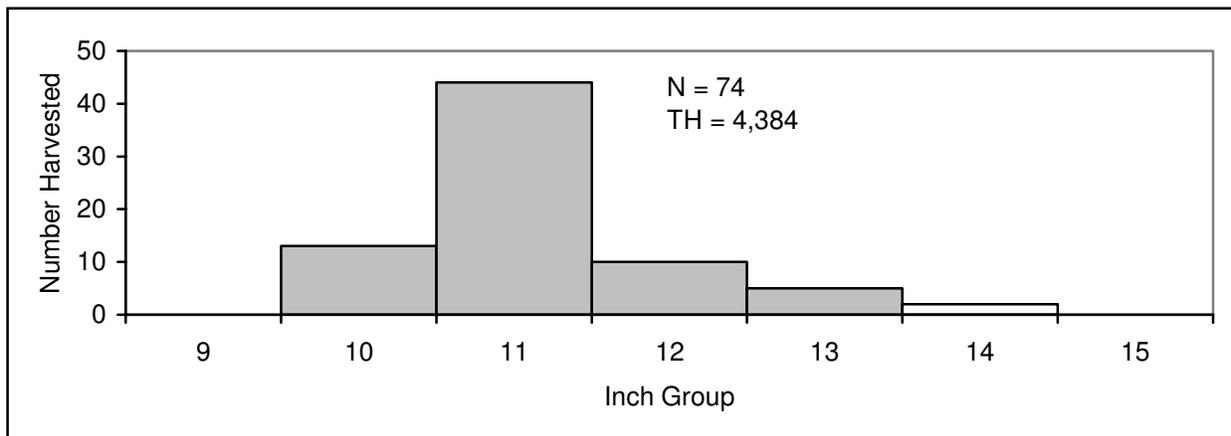


Figure 20. Length frequency of harvested white crappie observed during creel surveys at Belton Reservoir, Texas, March 2003 through February 2004, all anglers combined. N is the number of harvested white crappie observed during creel surveys, and TH is the total estimated harvest for the creel period.

Table 15. Proposed sampling schedule for Belton 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.

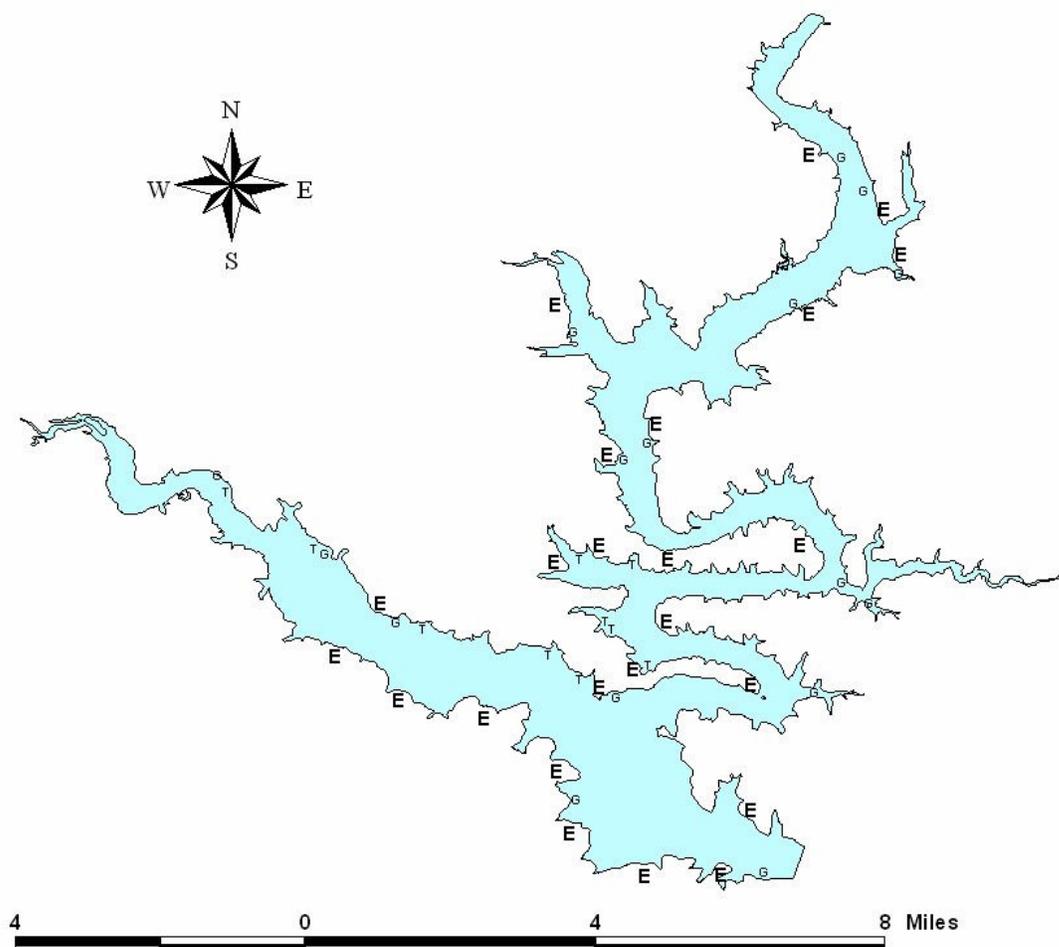
Survey Year	Electrofisher	Trap Net	Gill Net	Habitat Survey	Report
Fall 2007-Spring 2008					
Fall 2008-Spring 2009					
Fall 2009-Spring 2010				A	
Fall 2010-Spring 2011	S	S	S		S

APPENDIX A

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

Species	Gill Netting		Trap Netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Gizzard shad					141	70.5
Threadfin shad					49	24.5
Blue catfish	25	1.6				
Channel catfish	44	2.9				
Flathead catfish	8	0.5				
White bass	63	4.2				
Palmetto bass	107	7.1				
Redbreast sunfish						
Green sunfish					47	23.5
Warmouth					3	1.5
Bluegill					393	196.5
Longear sunfish					91	45.5
Redear sunfish					27	13.5
Smallmouth bass					22	11.0
Largemouth bass					128	64.0
White crappie			14	1.4		

APPENDIX B



Location of sampling sites, Belton Reservoir, Texas, 2006-2007. Trap net, gill net, and electrofishing stations are indicated by T, G, and E, respectively. Water level was low during fall and winter 2006, and near full pool during spring 2007.