

PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

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FEDERAL AID PROJECT F-30-R-33

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2007 Survey Report

**Cedar Creek Reservoir**

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## SURVEY AND MANAGEMENT SUMMARY

The Cedar Creek fish community was surveyed from June 2007-May 2008 using electrofisher, gill nets, and trap nets. A vegetation survey was conducted in September 2006. An access creel survey, conducted from June 2007-May 2008, collected angler use and harvest information. This report summarizes results of the surveys and contains a management plan based on those findings.

**Reservoir Description:** Cedar Creek Reservoir is a 32,623-acre impoundment of Cedar Creek, Texas, a tributary of the Trinity River. The reservoir was constructed by the Tarrant Regional Water District in 1965 to provide water for municipal and industrial use. Boat access is adequate, but public access for bank anglers is limited. There are no handicap-specific facilities. The habitat and aquatic vegetation survey, conducted at conservation pool, indicated poor habitat. Anglers expended approximately 272,047 hours of fishing effort and an estimated \$1,630,227 on direct expenditures during the annual creel period.

- **Management History:** Important sport fish include sunfishes, largemouth bass, white and palmetto basses, blue and channel catfishes, and white and black crappies. Largemouth bass stockings were conducted in 2004 and 2005. Supplemental gill net sampling for temperate basses and catfishes was conducted in 2006. A roving creel survey was conducted in 2007-2008.
- **Fish Community**
  - **Prey species:** Threadfin shad were present in the reservoir and electrofishing catch rate was lower than it was in previous surveys but was still very high. Gizzard shad catch rate was similar to that of past surveys and exhibited good size distribution. Catch rates of sunfishes  $\leq 4$  inches were much higher than it was in previous surveys.
  - **Catfishes:** Catfishes were the most sought after species group accounting for 41% of the directed angler effort. The catfish community was dominated by blue catfish, and gill net catch rates were high; although somewhat lower than past surveys. Channel catfish were present but occurred at much lower abundance than blue catfish.
  - **Temperate basses:** White bass and palmetto bass were the third most sought after species group and made up 9% of the directed fishing effort. Gill net catch rate of white bass is similar to that of past surveys with excellent size distribution. Gill net catch rate of palmetto bass was lower than it was in previous surveys (presumably due to low stocking rates in 2006 and 2007).
  - **Largemouth bass:** Largemouth bass was the second most sought after species (19% of the directed effort). Electrofishing catch rate of fish  $\leq 8$  inches was considerably above that of previous surveys and is likely due to high water conditions in 2007. Body condition of legal-length largemouth bass is excellent and suggests adequate prey.
  - **Crappie:** Directed effort for crappies was similar to that of temperate basses and accounted for 8% of the angler effort. Both white crappie and black crappie were present and trap net catches of white crappie were similar to that of past surveys. Black crappie catch rate was lower than it was in 1999 but similar to that of 2003. Both species show evidence of successful recruitment during high water conditions in 2007.
- **Management Strategies:** Continue annual stocking of Palmetto bass. Conduct supplemental gill netting in 2010 to monitor relative abundance, size distribution, and growth of palmetto bass and catfishes. Conduct second year of Florida largemouth bass stocking in 2009; conduct genetic analysis of bass population in 2011. Continue to offer technical assistance to the controlling authority in water hyacinth management and conduct an annual survey. Continue cooperating with the Cedar Creek Reservoir Watershed Protection Plan Steering Committee to develop best management practices to reduce nutrient loading and siltation.

## INTRODUCTION

This document is a summary of fisheries data collected from Cedar Creek Reservoir in 2007-2008. The purpose of this 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 are presented with the 2007-2008 data for comparison where appropriate.

### *Reservoir Description*

Cedar Creek Reservoir is a 32,623-acre impoundment of Cedar Creek, a tributary of the Trinity River. The reservoir was constructed by the Tarrant Regional Water District in 1965 to provide water for municipal and industrial use. Boat access is adequate, but bank angler access is limited because the majority of the lakeshore is privately owned. There are no handicap-specific facilities. Habitat is poor; less than 2% of the reservoir contained aquatic vegetation; 60% of the shoreline consisted of bulkhead and 35% is featureless. No submersed vegetation was detected during the vegetation survey. Water hyacinth (*Eichhornia crassipes*) continues to expand and now covers approximately 200 acres; alligator weed (*Alternanthera philoxeroides*) was the most abundant vegetation measured and occupies approximately 450 acres. Cedar Creek Reservoir is hyper-eutrophic with a mean TSI *chl-a* of 61.2 (Texas Commission on Environmental Quality 2002). Other descriptive characteristics for Cedar Creek Reservoir are found in Table 1.

### *Management History*

**Previous management strategies and actions:** Management strategies and actions from the previous survey report (Bister and Ott 2004) included:

1. Conduct stocking of Florida largemouth bass (*Micropterus salmoides floridanus*) during 2004 and 2005.  
**Action:** Stocking of 501,870 Florida largemouth bass fingerlings were conducted in 2004 with an additional 496,806 in 2005. Stocking was conducted in vegetated areas of Clear and Caney Creeks to afford the best survival.
2. Continue stocking palmetto bass (*Morone chrysops x M. saxatilis*) at 10/acre/year. Monitor palmetto bass population and catfish community with supplemental gill netting in spring 2006.  
**Action:** Supplemental gill netting was conducted in 2006. Fingerling stocking was conducted at the recommended rate in 2004 but at a reduced rate of 6.6/acre in 2005, 4.1/acre in 2006 and 5.2/acre in 2007 (due to limited availability); fry were stocked at 32.3/acre in 2007. A roving creel survey was conducted from June 2007 to May 2008 to monitor angler utilization.
3. Fishery could benefit from additional promotion.  
**Action:** Lake-specific regulation posters were provided to vendors of angling-oriented businesses serving the Cedar Creek Reservoir vicinity. Regulation posters were also provided to Tarrant Regional Water District to post at access sites. Outdoor writers around the reservoir were provided with news releases and information regarding the fishery.
4. Investigate with the controlling authority the possibility of native aquatic vegetation enhancement; continue monitoring of hydrilla (*Hydrilla Verticillata*) identified in 2003  
**Action:** No action on native vegetation enhancement; drought in 2005 and 2006 limited availability. A complete vegetation survey was conducted in 2007; hydrilla was not detected.

**Harvest regulation history:** Sport fishes in Cedar Creek Reservoir are currently managed with statewide harvest regulations (Table 2). Regulations have not changed since the last report in 2004.

**Stocking history:** Palmetto bass and Florida largemouth bass are the most frequently stocked species at Cedar Creek Reservoir. Palmetto bass fingerlings were first stocked in 1977. Stocking was temporarily discontinued from 1985 through 1990; annual stockings have continued since 1991 to maintain a fishery; however, stockings in 2005, 2006, and 2007 were at a reduced rate due to limited availability. Florida largemouth bass were initially stocked in 1976 and have been stocked periodically since then to enhance the trophy potential of the fishery. A complete stocking history is found in Table 3.

**Vegetation/habitat history:** Aquatic vegetation at Cedar Creek Reservoir has traditionally been scarce (occupying < 5% of the reservoir). This is due to a combination of moderately turbid water resulting from wind and wave action on highly erodeable soils and poor land use practices on the watershed. In 2003, hydrilla was detected in trace amounts and native aquatic vegetation (primarily emergent and floating-leaved) species occupied less than 5% of the reservoir area. Water hyacinth was detected in the fall following the 2003 habitat survey and was reported to the regulating authority but no system-wide control has been attempted. Drought conditions beginning in late 2005 through March 2007 followed by several floods during summer 2007 resulted in loss of most submersed aquatic vegetation. Flooding of marsh areas in the watershed above the reservoir resulted in rafts of alligator-weed (*Althernanthera philoxeroides*) washing into the reservoir during summer 2007. Many of these rafts persisted throughout the summer and became rooted in shallow water. Duckweed (*Lemna minor*) was the only native aquatic vegetation identified during the 2007 habitat survey; this floating species occupied < 0.1% of the reservoir. The physical habitat types have remained constant over the last decade; the rate of shoreline development has stabilized (Table 4).

In 2007, no vegetation control permits were issued by TPWD to individuals or subdivisions at Cedar Creek Reservoir; however, evidence of illegal treatment of water hyacinth and alligator-weed were observed during the vegetation survey.

## METHODS

Fishes were collected by electrofishing (2 hours at 24, 5-min stations), gill netting (14 net nights at 14 stations; *one net stolen*), and trap 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 and trap nets, as the number of fish per net night (fish/nn). A vegetation survey was conducted in August 2007; water level was at conservation pool (322 ft MSL) during sampling. A roving creel survey was conducted from June 2007 to May 2008. Survey consisted of 9 creel days per quarter (4 weekdays and 5 weekend days); angler counts and interviews were conducted in one of five possible spatial sections on each creel day. 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). For the 2007-2008 creel survey effort estimates based on monthly rather than quarterly day length average; estimates increased an average of 6.5%. Chlorophyll-a data was obtained from Texas Commission on Environmental Quality, 2002. Water level data were obtained from the United States Geological Survey web site (USGS 2008).

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. For white bass (*M. chrysops*), and largemouth bass (*Micropterus salmoides spp.*), ages were determined using otoliths from 13 specimens with lengths ranging from 9.4 to 10.9 inches for white bass and 13.1 to 15.9 inches for largemouth bass. For black crappie (*Pomoxis nigromaculatus*) ages were determined using otoliths from 10 specimens with lengths ranging from 9.6 to 11.9 inches. Microsatellite DNA analysis was used to determine largemouth bass genetic composition. Prior to 2005, genetic analysis was done by electrophoresis.

## RESULTS AND DISCUSSION

**Habitat:** A vegetation survey of the littoral zone was conducted in 2007. The only native species observed was duckweed occupying 16 acres (Table 4). Two prohibited exotic species (water hyacinth and alligator weed) were the only aquatic species occupying substantial area of the reservoir (197 and 448 acres respectively). Drought from mid 2005 through early 2007 followed by floods in summer 2007 (Figure 1) is the likely cause for the overall decrease in emergent vegetation from the previous survey in 2003 (Bister

and Ott 2004). The reservoir was at full pool (322 ft, MSL) during the 2007 habitat survey and bulkhead with boat docks made up the highest percentage (60%) of the structural habitat. However, this habitat type is of relatively low quality for littoral species (Trial et al. 2001, Radomski and Goeman 2001). Open water was abundant and was suitable for pelagic predators.

**Creel:** Directed effort was highest for anglers targeting catfishes (*Ictalurus spp.*), (41%), followed by anglers seeking largemouth bass (19%), (Table 5). Slightly more than half of the angling effort was by boat anglers with the remainder by bank anglers. The high proportion of bank anglers at Cedar Creek Reservoir was unusual and may have been influenced by frequent storms late into summer 2007 and again in spring 2008. Many of the bank anglers interviewed were fishing from their private boat slips and commented that the uncertain weather influenced their decision to fish from shore rather than their boat. Total fishing effort for all species at Cedar Creek Reservoir was 272,047 hours from June 2007 – May 2008 and is similar to the same period in 2003-2004 (Table 6). Direct expenditures by anglers during the current creel period were estimated to be \$1,526,730 and was approximately \$231,600 higher than the previous survey. Higher overall expenditures were likely related to increases in fuel costs.

**Prey species:** Both threadfin shad (*Dorosoma petenense*) and gizzard shad (*D. cepedianum*) were present in Cedar Creek Reservoir (Appendix A). The gizzard shad population was composed primarily of fish less than six inches in length (Figure 2); Index of Vulnerability (IOV) was high (88). Total electrofishing catch rate of gizzard and threadfin shad combined was ~900 fish/hour. Sunfish (*Lepomis spp.*) abundance was unusually high (> 406/hour). Bluegill (*L. macrochirus*) was the most abundant sunfish species; longear sunfish and redear sunfish (*L. megalotis* & *L. microlophus*) were also collected. The size distributions of sunfish were skewed toward fish <5 inches, thus primarily functioning as prey. Less than 0.1% of the angler effort was directed toward sunfishes during the 2007-2008 creel.

**Catfish:** Catfish accounted for approximately 41% of the total directed effort by rod-and-reel anglers on Cedar Creek and represents a higher proportion than reported in previous surveys (Table 5). Fishing effort from passive gears (trotline and jug line) were not determined but is believed to be substantial based on activity observed during creel surveys. Combined angler catch rate for channel catfish (*I. punctatus*) and blue catfish (*I. furcatus*) was 1.8/h and was similar to that of the previous survey (Table 7). However, number of catfishes harvested was ~ 1/3 of the previous survey. Because release of legal-length catfishes accounted for only 4% of the catch, it is likely that anglers were releasing many under-size fish. Cedar Creek reservoir supports an excellent blue catfish population. Gill netting in 2008 indicated a decrease in total blue catfish abundance (10.4/nn) compared to 2004 (16.9/nn) and 2006 (16.7/nn) (Figure 4) but was still very good. Decrease in relative abundance was primarily due to poor recruitment (possibly as a result of drought in 2005-2006) because catch rate of stock-size blue catfish was similar to historical data. Channel catfish continue to be less abundant than blue catfish and their catch rates have also fluctuated as a result of changes in recruitment. Poor year class strength in 2006 and possibly 2005 is evident in the size distribution.

**Temperate basses:** Temperate basses (*Morone spp.*) accounted for 9% of the total directed angling effort the third most sought after species group (Table 8). An estimated 22,288 angler hours was directed at this group during the 2007-2008 survey period an increase of 1/3 compared to the previous survey. Total angler catch rate (2.5/h) is similar to the previous survey but harvest (15,630 white bass and 1,598 palmetto bass) was less than 40% of previous results. Some of the decrease in harvest is likely related to voluntary release which was 56% of the legal-length white bass and 65% of the legal-length palmetto bass. White bass were collected up to 15 inches in length in gill nets and catch rate in 2008 (3.1/net night) was similar to previous surveys (2.8 in 2004 and 2.0 in 2006). Size distribution was good with 84% of the fish collected in gill nets ≥ the 10-inch legal length (Figure 7). Recruitment in 2007 appears to have been adequate; 11 of the 13 fish between 9.4 and 10.9 inches in length collected for age and growth were from the 2007 year class. Average age of white bass at 10 inches (9.4-10.9) was 1.2 years (N =13, range 1-3 years). Gill net catch rate of palmetto bass was the lowest in recent record (0.7/net night) (Figure 8). The low catch rate is reflective of the reduced stockings (4.0 and 5.2/acre) received in 2006 and 2007 respectively (Table 3). Too few palmetto bass (17.0-18.9") were collected to allow estimates of average age at legal length.

**Largemouth bass:** Angler catch rate of largemouth bass was slightly below that of previous surveys (0.6/hour in 2007-2008 versus 0.8/hr in 2003-2004) but was still good (Table 9). Directed effort toward largemouth bass (48,649 hours) has declined to less than 1/2 of the previous survey and now accounts for only 19% of the total effort (Table 5) and may be related to unusual weather conditions (as mentioned above) and/or increased fuel costs. Anglers targeting largemouth bass released 83% of the legal length fish caught; harvest was estimated to be only 8,777 fish. However, of the 55 harvested fish measured during the creel 53 were caught by live-release tournament anglers (Figure 11) so actual harvest may be far lower. Unusually high electrofishing catch rate (58.5/hr) of sub-stock (< 8 inch) fish is indicative of high year-class strength for the 2007 cohort (Figure 10). The strong year class is likely related to abundant rainfall and high water level late into summer 2007 (Figure 1). Stock-size ( $\geq 8$  inch) catch rate (21.5/hour) was similar to that of previous surveys. Size distribution (PSD) of largemouth bass was slightly below the target range of 40-70 but is similar to that of past surveys. Average age for largemouth bass at 14 inches (13.1-15.6) was 2.2 years ( $N = 13$ , range 1-4 years) and indicates good growth. Relative weight for most size classes of largemouth bass was  $\geq 100$ , and indicate excellent prey availability. The length frequency of harvested largemouth observed during the creel survey was similar to the size distribution in the electrofishing survey (Figure 11), suggesting that fish are harvested in proportion to their abundance. Cedar Creek Reservoir received embayment stockings of ~500,000 Florida largemouth bass fingerlings in 2004 and 2005 (Table 3). Allele frequency (43.5%) and the percentage of pure Florida strain largemouth bass in a sub-sample of the 2007 year-class (Table 10) were indicative of survival and reproduction from the embayment stockings.

**Crappie:** Crappie (*Pomoxis spp.*) declined from the third most sought after sport fish group in 2003-2004 to fifth in 2007-2008 accounting for only 8% of the directed effort (Table 5). Angler catch rate of crappie was 1.3/h and is similar to that of the previous survey but total harvest (20,267) is <30% of the previous survey (Table 12). Surprisingly, over 50% of the legal-length crappie caught were released; however, an estimated 10,799 white crappie (*P. annularis*) and 9,468 black crappie were harvested. Trap-net catch rate of white crappie in 2007 (3.6/nn) was higher than it was in 2003 but similar to that of the 1999 surveys (1.0 and 3.1/nn, respectively; Figure 12). The size distribution of white crappie in 2007 was skewed toward smaller fish resulting in a PSD of only 39 but showed evidence of successful 2006 and 2007 year classes. Relative weight was good ( $Wr \geq 100$ ) for most length classes. Trap-net catch rate of black crappie in 2007 (2.5/nn) was similar to that of the 2003 survey (2.1/nn), but lower than that of the 1999 survey (13.5/nn) (Figure 13). Similar to white crappie, black crappie body condition was good ( $Wr \geq 100$ ) for most size classes > 7.  $Wr$  for 5 and 6 inch class individuals is low (Table 4). Average age for black crappie at 10 inches (9.4-11.9) was 2.3 years ( $N = 10$ , range 2-4 years) and indicates normal growth.

## **Fisheries management plan for Cedar Creek Reservoir, Texas**

Prepared – July 2008

**ISSUE 1:** Florida largemouth bass fingerlings were stocked in 2004 and 2005 to increase Florida largemouth bass allele frequency. Allele frequency increased from 35.3 in 2003 to 43.5 in 2007 and percent pure Florida largemouth bass increased from 0 % to 3.3%. Stocking of 815,575 fingerlings was requested for FY 2008. Continued assessment will be necessary to document survival.

### **MANAGEMENT STRATEGY**

1. Conduct routine electrofishing to collect at least 30 age-0 or age-1 largemouth bass and assess the success of Florida largemouth bass stockings in fall 2011.

**ISSUE 2:** Annual stockings of palmetto bass (combined with natural recruitment of white bass) have developed an excellent fishery that is utilized by many anglers. Reduced stocking rates of palmetto bass in 2006 and 2007 have limited recruitment.

### **MANAGEMENT STRATEGIES**

1. Conduct annual stockings of palmetto bass at 10/acre.
2. Conduct additional gill netting in spring of 2009 to evaluate palmetto bass population characteristics.
3. Conduct harvest assessment of palmetto bass with a creel survey from June 2010-May 2011.

**ISSUE 3:** Water hyacinth was detected following the last habitat survey in 2003. To date, no system-wide management of water hyacinth has been conducted. This plant has the potential to be problematic enough to require treatment.

### **MANAGEMENT STRATEGIES**

1. Coordinate with the controlling authority to develop a system-wide management plan.
2. Coordinate with the controlling authority to provide technical assistance to waterfront subdivisions as requested.
3. Continue to review treatment plans as submitted.
4. Conduct annual species specific exotic species survey.
5. Conduct a comprehensive vegetation survey in 2011.

**ISSUE 4:** No submersed aquatic vegetation was detected in the 2007 habitat survey. Combined turbidity and increasing eutrophication of Cedar Creek Reservoir limit establishment of submersed native plants.

### **MANAGEMENT STRATEGIE**

1. Continue cooperating with the Cedar Creek Reservoir Watershed Protection Plan Steering Committee to develop best management practices to reduce nutrient loading and siltation.

### **SAMPLING SCHEDULE JUSTIFICATION:**

The proposed sampling schedule includes additional gill netting in 2010 and mandatory monitoring in 2011-2012 (Table 13). Conduct a routine electrofishing survey in 2011 to collect at least 30 age-0 or age-1 largemouth bass and assess the success of Florida largemouth bass stockings of 2008 and 2009. Optional gill netting in the spring of 2010 will provide additional trend data on the catfish and temperate bass fishery. An optional creel survey is recommended to supplement fish community data for the full survey in 2011-2012.



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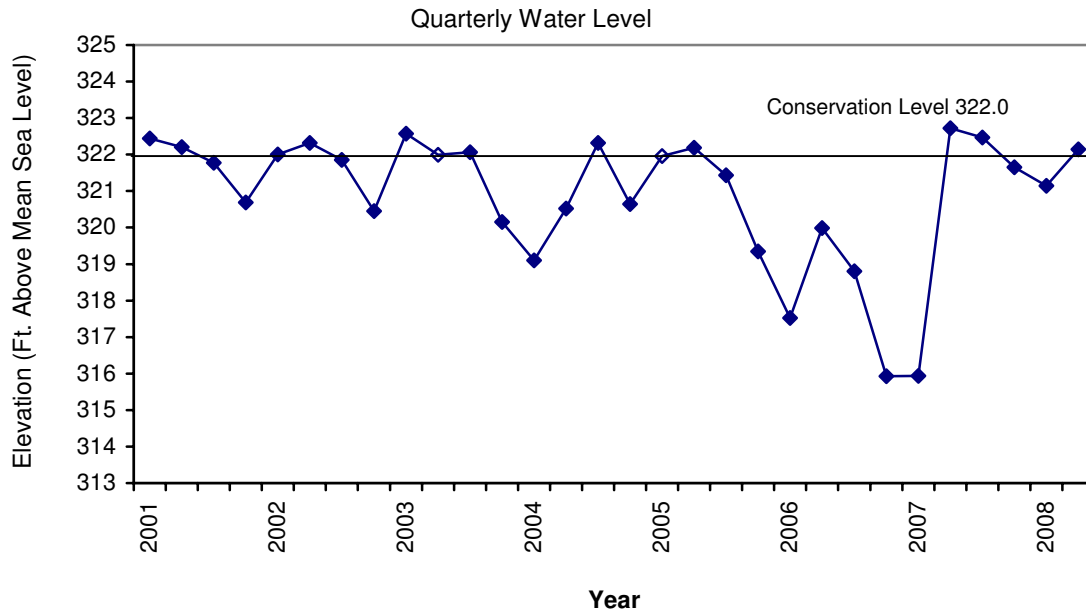


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Cedar Creek Reservoir, Texas. Horizontal line represents conservation level.

Table 1. Characteristics of Cedar Creek Reservoir, Texas.

Characteristic	Description
Year completed	1965
Controlling authority	Tarrant Regional Water District
Counties	Henderson (dam), Kaufman
Reservoir type	Water Supply
Shoreline Development Index (SDI)	1.9
Conductivity	280 umhos/cm

Table 2. Harvest regulations for Cedar Creek Reservoir, Texas.

Species	Bag Limit	Minimum-maximum length (inches)
Catfish: channel and blue, 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	5	14-No limit
Crappie: white and black, their hybrids and subspecies	25 (in any combination)	10-No limit

Table 3. Stocking history of Cedar Creek Reservoir, Texas. Size categories are: FRY <1 inch; FGL =1-3 inches; ADL = adult; UNK = unknown.

Species	Year	Number	Size
Threadfin shad	1984	<u>7,015</u> 7,015	ADL
Channel catfish	1966	7,600	UNK
	1973	<u>125</u> 7,725	UNK
Palmetto bass	1977	169,900	UNK
	1979	172,425	UNK
	1983	143,332	UNK
	1984	452,940	FGL
	1991	1,033,577	FRY
	1991	175,232	FGL
	1992	521,494	FGL
	1993	889,000	FRY
	1993	114,757	FGL
	1994	518,259	FGL
	1995	531,200	FGL
	1996	516,724	FGL
	1997	290,540	FGL
	1998	514,907	FGL
	1999	265,310	FGL
	2002	258,467	FGL
	2003	244,723	FGL
	2004	326,988	FGL
	2005	215,660	FGL
	2006	132,664	FGL
	2007	170,396	FGL
		<u>1,054,882</u> 8,713,377	
Largemouth bass	1966	<u>690,000</u> 690,000	UNK
Florida largemouth bass	1976	343,000	FGL
	1977	20,000	FGL
	1978	398,837	FGL
	1997	343,012	FGL
	1998	453,072	FGL
	1999	342,424	FGL
	2000	57,986	FGL
	2004	501,870	FGL
	2005	<u>496,806</u> 2,957,007	FGL
Walleye	1975	1,650,000	UNK
	1976	1,852,000	UNK
	1977	<u>2,100,000</u> 5,602,000	UNK

Table 4. Survey of littoral zone and physical habitat types, Cedar Creek Reservoir, Texas. Abiotic<sup>1</sup> habitat survey was conducted in 2003 (Bister and Ott 2004). Vegetation survey was conducted in 2007. 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.

Shoreline habitat type	Shoreline distance		Surface area	
	Miles	Percent of total	Acres	Percent of reservoir surface area
Bulkhead and boat dock <sup>1</sup>	198	60		
Eroded shoreline <sup>1</sup>	5	2		
Featureless shoreline & boat docks <sup>1</sup>	6	2		
Rip rap <sup>1</sup>	5	2		
Rocky shoreline <sup>1</sup>	0.5	<1		
Featureless <sup>1</sup>	116	35		
Duckweed			16	<0.1
Water hyacinth <sup>2</sup>			197	0.6
Alligator weed <sup>2</sup>			448	1.4

<sup>1</sup> Abiotic habitat features.

<sup>2</sup> Non native

Table 5. Percent directed angler effort by species for Cedar Creek Reservoir, Texas, June 2003-May 2004 and June 2007-May 2008.

Species	Year	
	2003-2004	2007-2008*
Temperate basses	6	9
Largemouth bass	35	19
Crappie spp.	18	8
Catfish spp.	32	41
Anything	9	23

Table 6. Total fishing effort (h) for all species and total directed expenditures at Cedar Creek Reservoir Texas, June 2003-May 2004 and June 2007-May 2008. 2007-2008 effort estimates based on monthly rather than quarterly day length average.

Creel Statistic	Year	
	2003-2004	2007-2008
Total fishing effort	293,662	272,047
Total directed expenditures	\$1,295,153	\$1,630,227

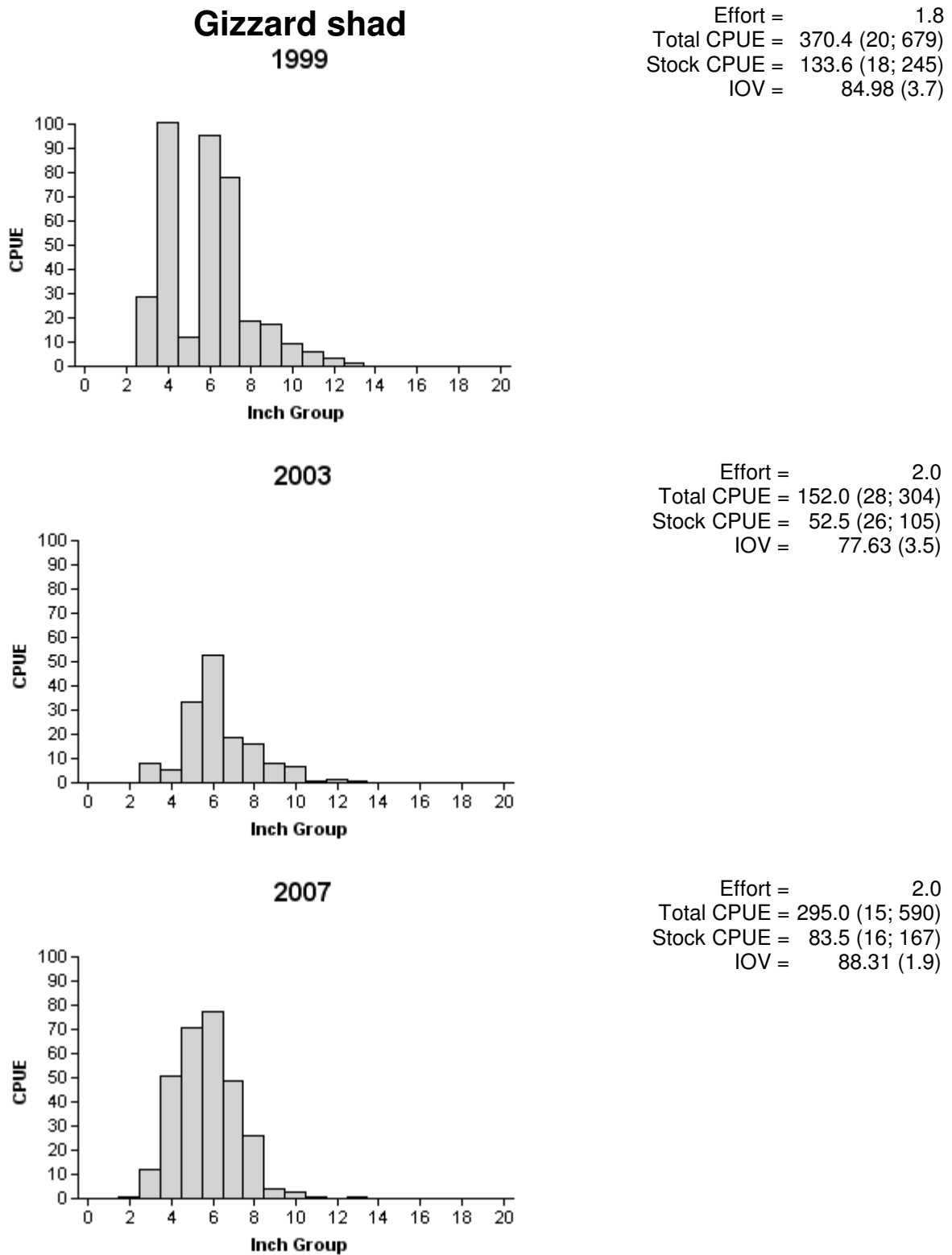
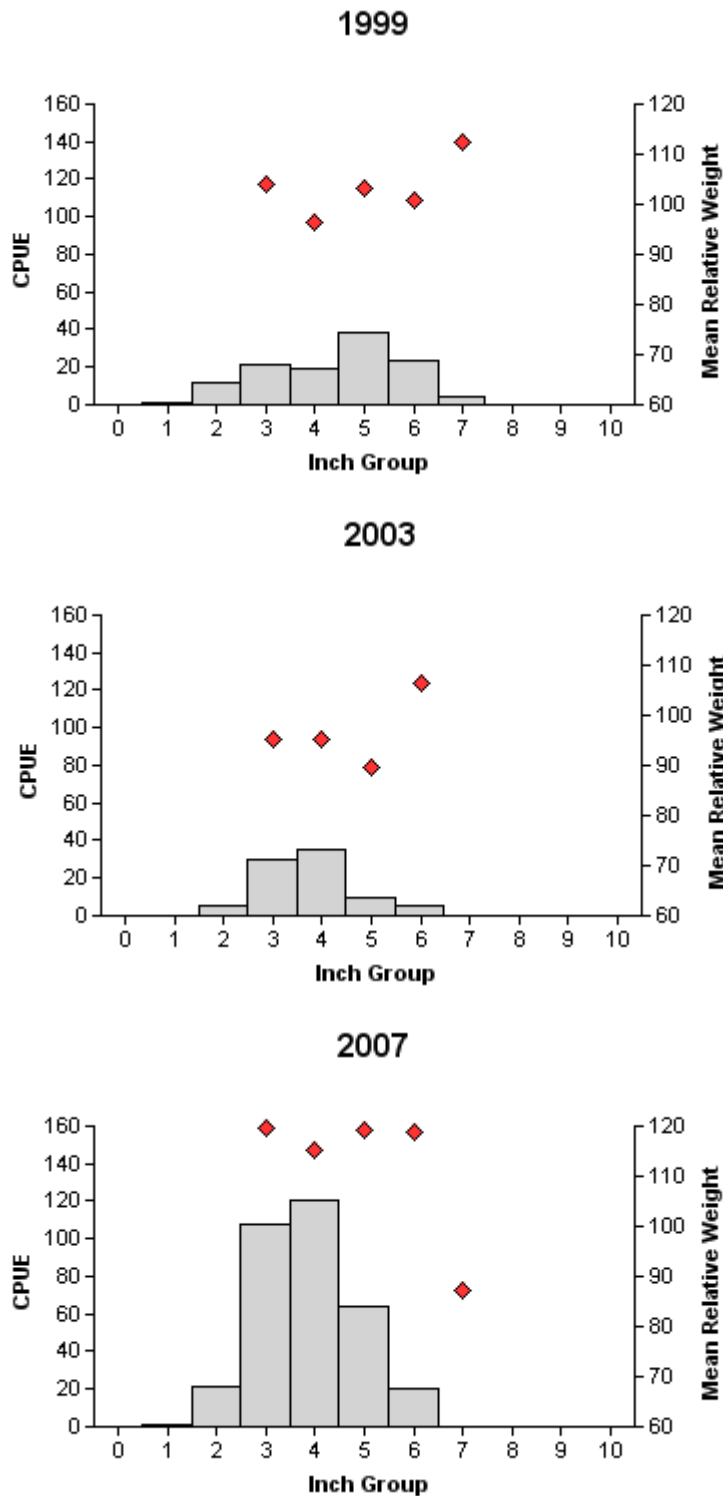


Figure 2. Number of gizzard shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Cedar Creek Reservoir, Texas, 1999, 2003, and 2007.

## Bluegill



Effort = 1.8  
 Total CPUE = 118.4 (37; 217)  
 Stock CPUE = 105.8 (41; 194)  
 PSD = 26 (9.3)

Effort = 2.0  
 Total CPUE = 86.0 (33; 172)  
 Stock CPUE = 80.5 (33; 161)  
 PSD = 6 (3.8)

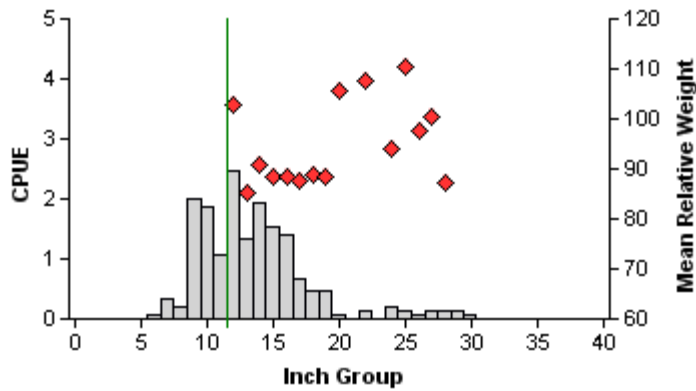
Effort = 2.0  
 Total CPUE = 336.5 (26; 673)  
 Stock CPUE = 313.5 (26; 627)  
 PSD = 7 (4.9)

Figure 3. Number of bluegill caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE are in parentheses) for fall electrofishing surveys, Cedar Creek Reservoir, Texas, 1999, 2003, and 2007.



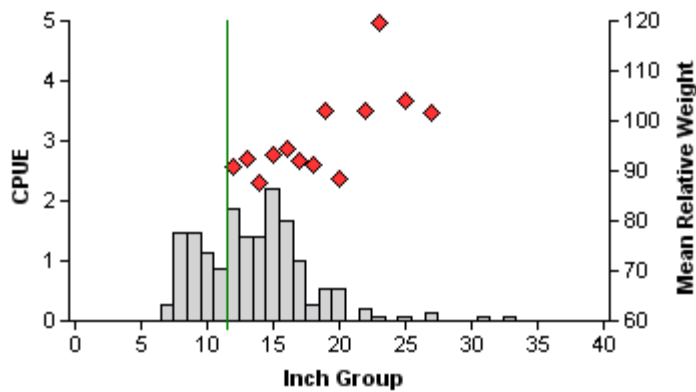
## Blue catfish

2004



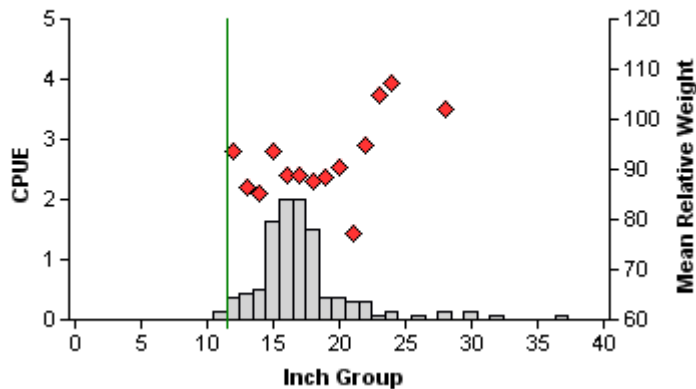
Effort = 15.0  
Total CPUE = 16.9 (33; 253)  
Stock CPUE = 11.3 (26; 170)  
PSD = 9 (3.4)  
RSD-P = 1 (0.6)

2006



Effort = 15.0  
Total CPUE = 16.7 (29; 250)  
Stock CPUE = 11.5 (26; 172)  
PSD = 10 (3.5)  
RSD-P = 1 (0.7)

2008



Effort = 14.0  
Total CPUE = 10.6 (20; 148)  
Stock CPUE = 10.4 (20; 146)  
PSD = 16 (4.2)  
RSD-P = 3 (1.3)

Figure 4. Number of blue catfish caught per net night (CPUE, bars), 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, Cedar Creek Reservoir, Texas, 2004, 2006, and 2008. Vertical line represents length limit at time of survey.

## Channel catfish

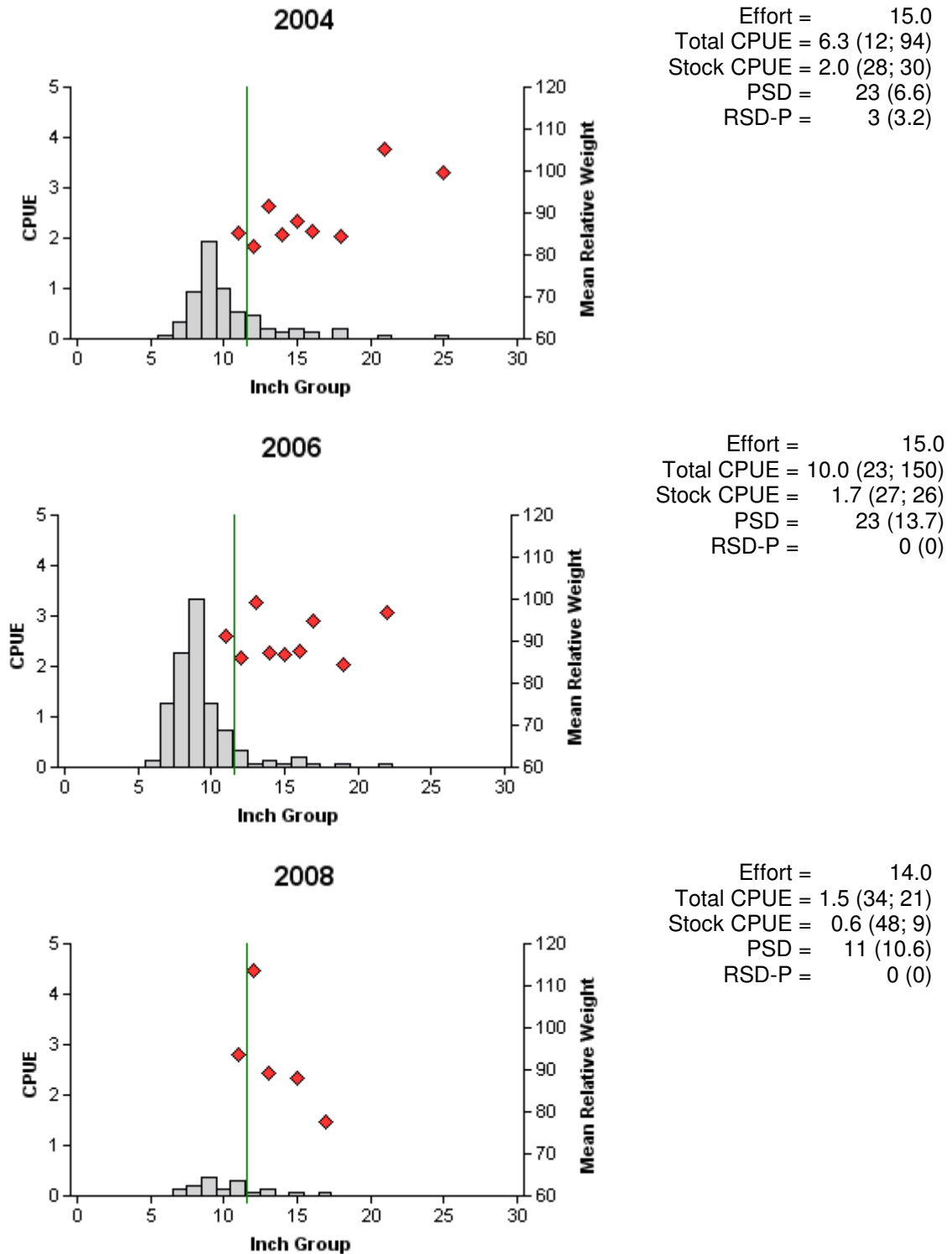


Figure 5. Number of channel catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Cedar Creek Reservoir, Texas, 2004, 2006, and 2008. Vertical line represents length limit at time of survey.

## Catfish

Table 7. Creel survey statistics for catfish at Cedar Creek Reservoir from June 2003-May 2004, and June 2007-May 2008, where total catch per hour is for anglers targeting all catfish and total harvest is the estimated number of catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses. 2007-2008 effort estimates based on monthly rather than quarterly day length average.

Creel Survey Statistic	Year	
	2003-2004	2007-2008
Directed effort (h)	94,171 (20)	127,776 (137)
Directed effort/acre	2.9 (20)	3.9 (137)
Total catch per hour	1.7 (47)	1.8 (52)
Total harvest	210,952 (88)	93,097 (31)
Channel catfish	68,031 (39)	34,526 (34)
Blue catfish	142,921 (49)	58,547 (30)
Harvest/acre	6.5 (88)	2.7 (31)
Channel catfish	2.1 (39)	1.1 (34)
Blue catfish	4.4 (49)	1.8 (30)
Percent legal released	0	12

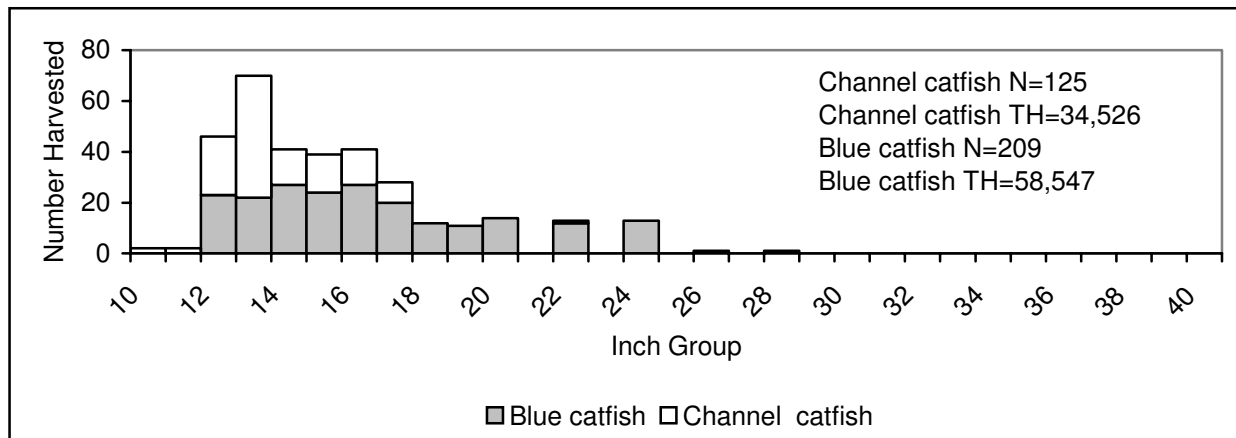


Figure 6. Length frequency of harvested blue and channel catfish observed during creel surveys at Cedar Creek Reservoir, Texas, June 2007-May 2008, all anglers combined. N is the number of harvested catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

## White bass

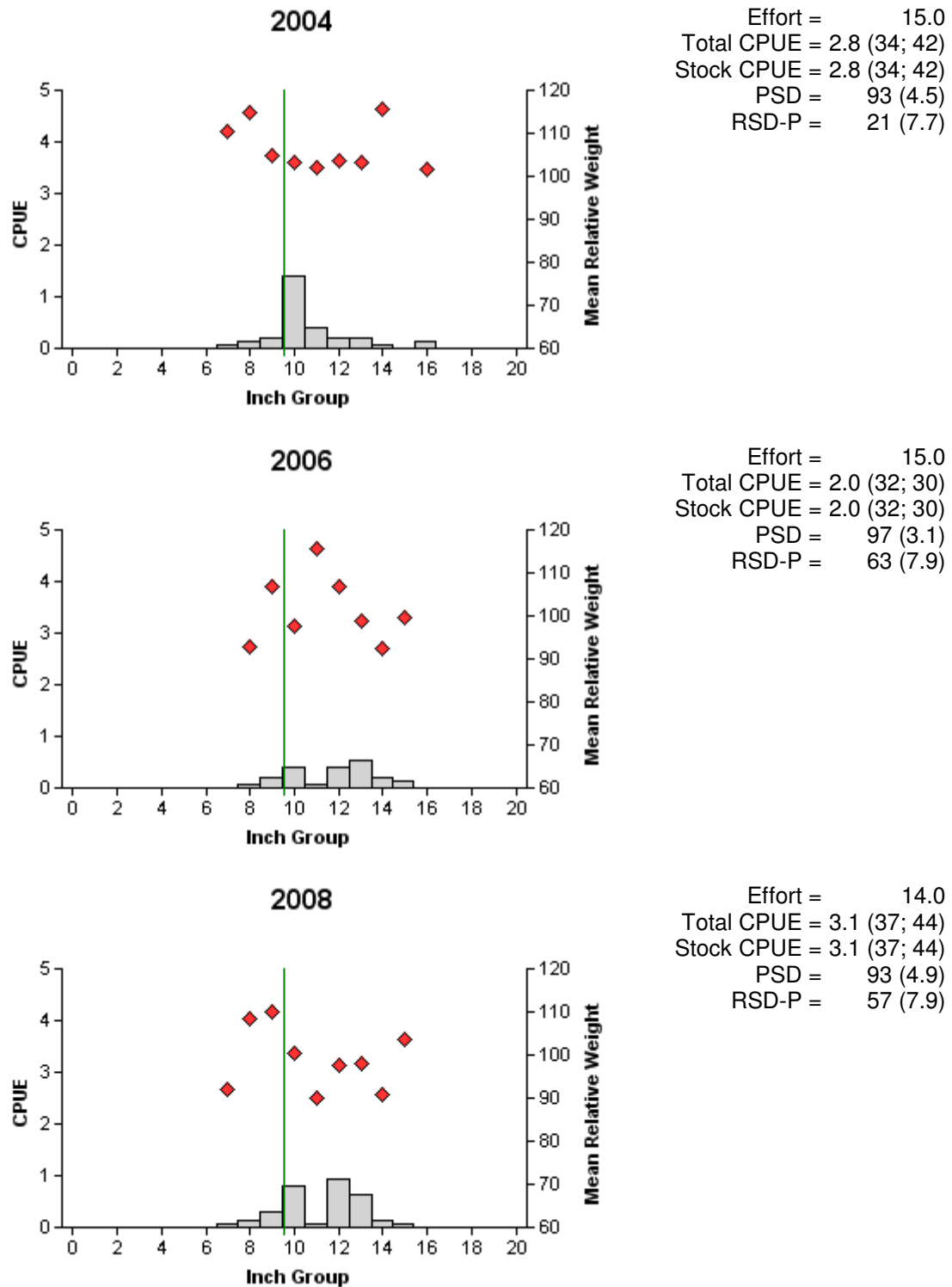


Figure 7. Number of white bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Cedar Creek Reservoir, Texas, 2004, 2006, and 2008. Vertical line represents length limit at time of survey.

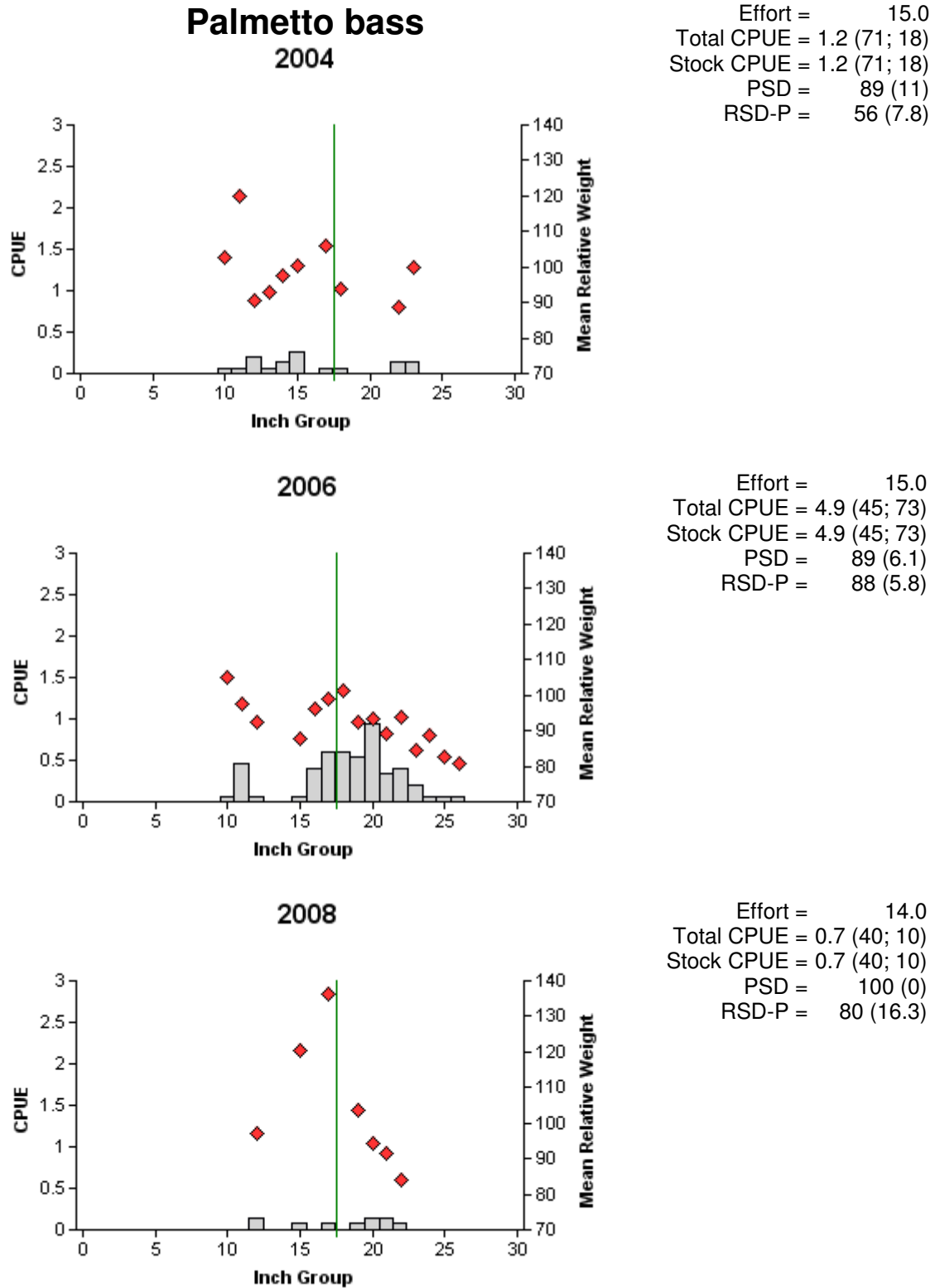


Figure 8. Number of palmetto bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Cedar Creek Reservoir, Texas, 2004, 2006, and 2008. Vertical line represents length limit at time of survey.

## Temperate basses

Table 8. Creel survey statistics for temperate basses<sup>1</sup> at Cedar Creek Reservoir from June 2003-May 2004, and June 2007-May 2008, where total catch per hour is for anglers targeting all temperate basses<sup>1</sup>, and total harvest is the estimated number of temperate basses<sup>1</sup> harvested by all anglers. Relative standard errors (RSE) are in parentheses. 2007-2008 effort estimates based on monthly rather than quarterly day length average.

Creel Survey Statistic	Year	
	2003-2004	2007-2008
Directed effort (h)	16,620 ( 45)	23,416 (37)
Directed effort/acre	0.5 ( 45)	0.7 (37)
Total catch per hour	2.6 ( 71)	2.5 (47)
Total Harvest	48,821 (97)	18,239 (58)
White bass	44,771 (78)	16,547 (46)
Palmetto bass	4,050 (306)	1,692 (172)
Total Harvest/acre	1.5 (97)	0.6 (58)
White bass	1.4 (78)	0.5 (46)
Palmetto bass	0.1 (306)	<0.1 (172)
Percent legal released		
White bass	na	56
Palmetto bass	na	65

<sup>1</sup> Excluding yellow bass

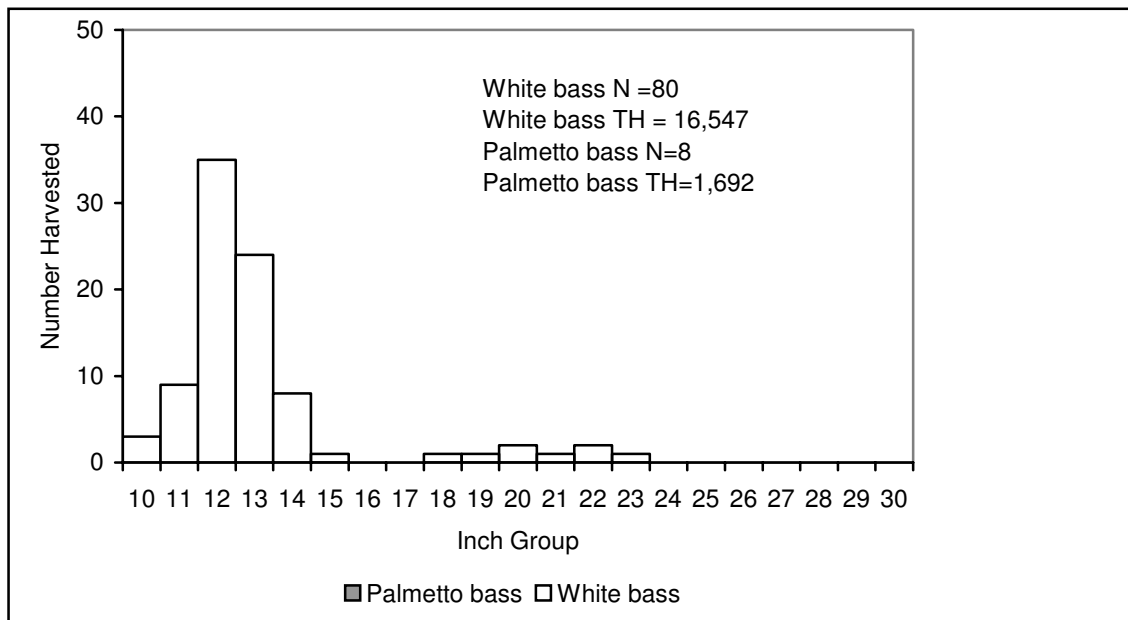
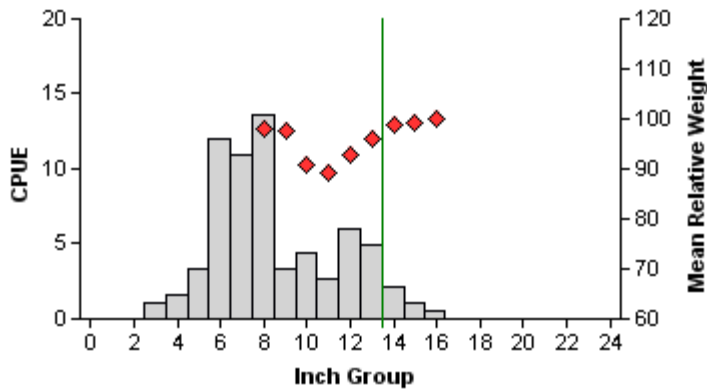


Figure 9. Length frequency of harvested white and palmetto bass observed during creel surveys at Cedar Creek Reservoir, Texas, June 2007-May 2008, all anglers combined. N is the number of harvested white and palmetto bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

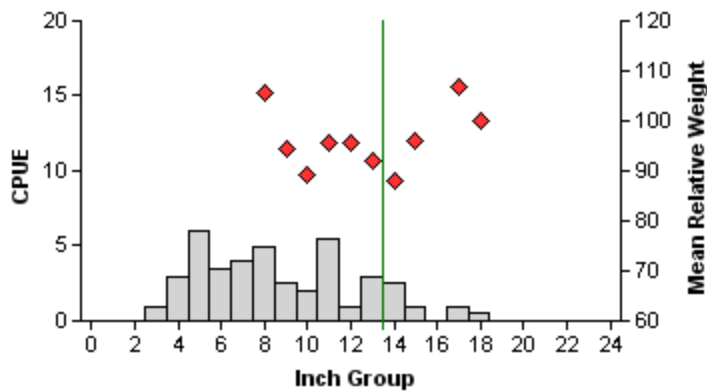
## Largemouth bass

1999



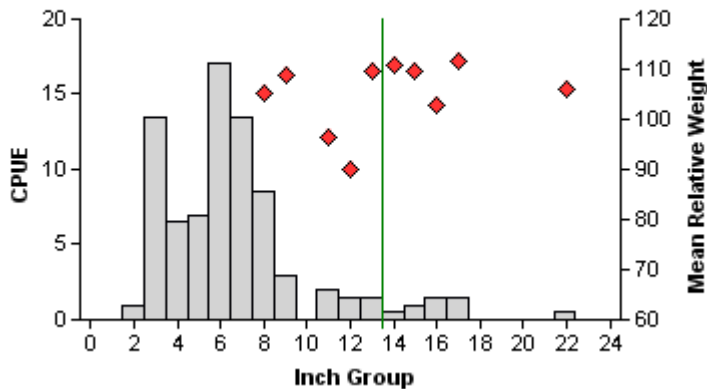
Effort = 1.8  
 Total CPUE = 67.6 (15; 124)  
 Stock CPUE = 38.7 (18; 71)  
 PSD = 38 (5.7)  
 RSD-P = 4 (2.7)

2003



Effort = 2.0  
 Total CPUE = 41.5 (19; 83)  
 Stock CPUE = 24.0 (23; 48)  
 PSD = 38 (6.9)  
 RSD-P = 10 (4.8)

2007



Effort = 2.0  
 Total CPUE = 80.0 (21; 160)  
 Stock CPUE = 21.5 (21; 43)  
 PSD = 37 (7.9)  
 RSD-P = 21 (5.8)

Figure 10. Number of largemouth bass caught per hour (CPUE, bars), mean relative weight (diamonds), (CPUE) and population indices (RSE and N for CPUE and SE are in parentheses) for fall electrofishing surveys, Cedar Creek Reservoir, Texas, 1999, 2003, and 2007. Vertical line represents length limit at time of survey.

## Largemouth bass

Table 9. Creel survey statistics for largemouth bass at Cedar Creek Reservoir from June 2003-May 2004 and June 2007-May 2008, 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. 2007-2008 effort estimates based on monthly rather than quarterly day length average.

Creel Survey Statistic	Year	
	2003-2004	2007-2008
Directed effort (h)	102,808 (19)	51,852 (25)
Directed effort/acre	3.2 (19)	1.6 (25)
Total catch per hour	0.8 (25)	0.6 (25)
Total harvest	35,611 (45)	8,777 (48)
Harvest/acre	1.1 (45)	0.3 (48)
Percent legal released	9*	83*

\* Includes fish held in live well for weigh in – eventual release rate is likely higher

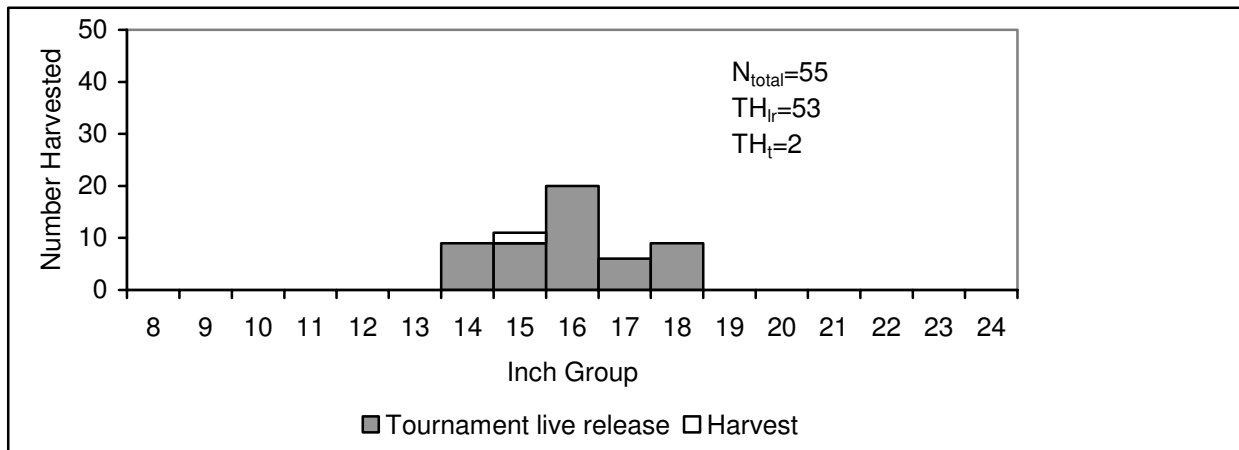


Figure 11. Length frequency of harvested largemouth bass observed during creel surveys at Cedar Creek Reservoir, Texas, June 2007–May, 2008 all anglers combined.  $N_{total}$  is the total number of largemouth bass observed during the angler creel survey.  $TH_{lr}$  is the number of largemouth bass observed during creel surveys in possession by tournament anglers with the intention of later release.  $TH_t$  is the number of harvested largemouth bass observed during creel surveys.



## Largemouth bass

Table 10. Results of genetic analysis of largemouth bass collected by fall electrofishing at Cedar Creek Reservoir, Texas, 1993, 1996, 1999, and 2003. In 2007 Microsatellite DNA analysis was used to determine largemouth bass genetic composition and results are not directly comparable to historic data; determination of integre status was unavailable. 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.

Year	Sample size	Genotype				% FLMB alleles	% pure FLMB
		FLMB	F1	Fx	NLMB		
1993	30	0	4	12	14	25.8	0
1996	30	2	9	11	8	38.3	6.7
1999	30	1	10	10	9	35.0	3.3
2003	30*	0	5	13	3	35.3	0
2007	30	1			2	43.5	3.3

\* Only 21 samples could be scored for genotype analysis. Percent FLMB alleles were based on sample size of 30.

## White crappie

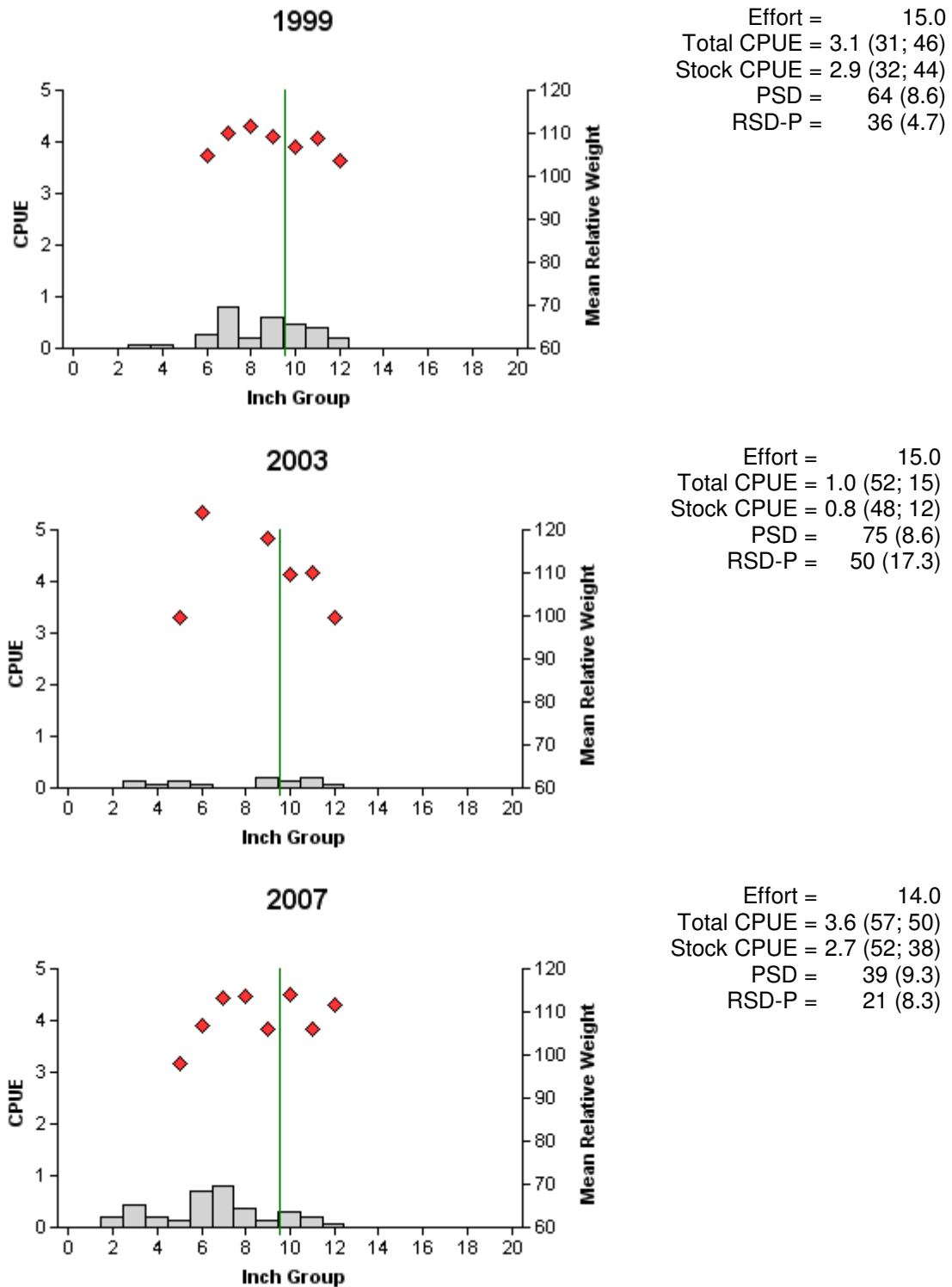
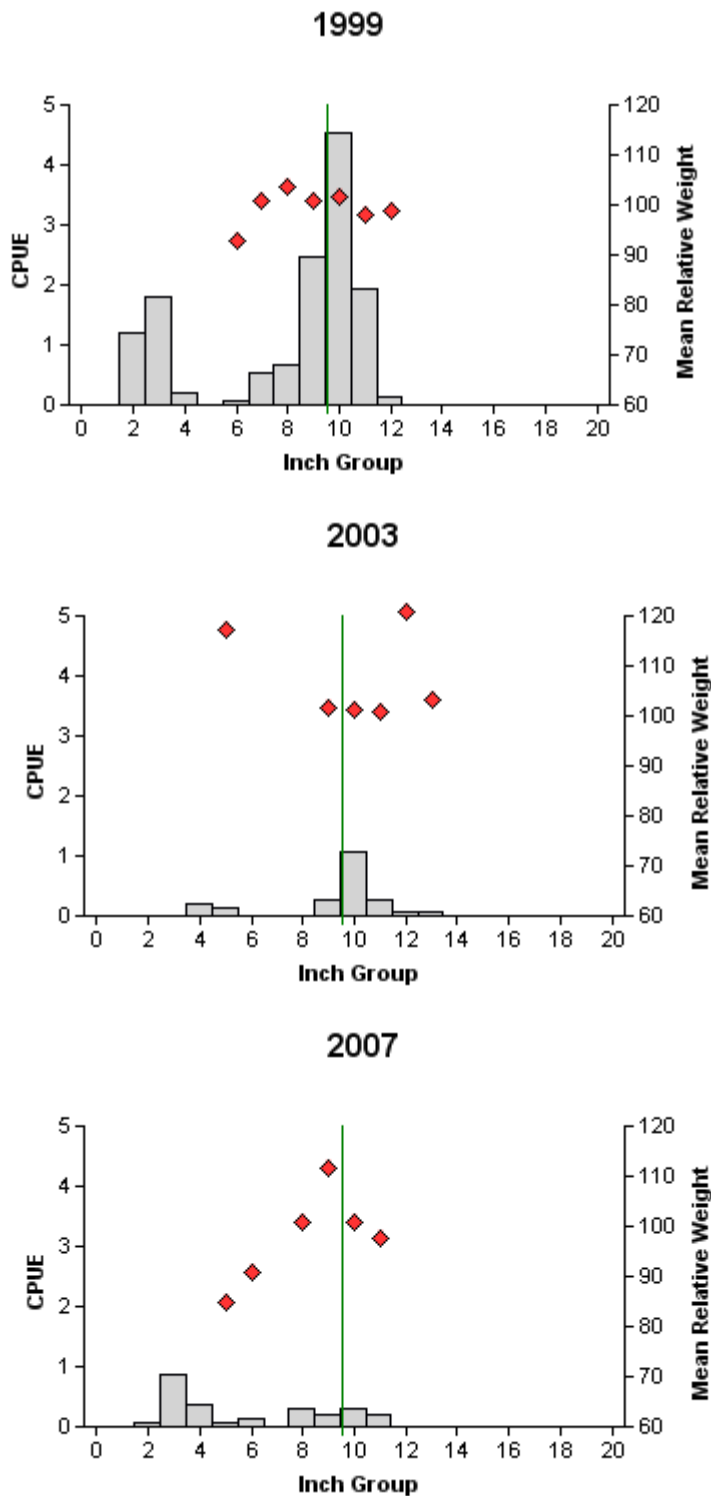


Figure 12. Number of white crappie caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap net surveys, Cedar Creek Reservoir, Texas, 1999, 2003, and 2007. Vertical line represents length limit at time of survey.

## Black crappie



Effort = 15.0  
 Total CPUE = 13.5 (24; 203)  
 Stock CPUE = 10.3 (21; 155)  
 PSD = 94 (2.6)  
 RSD-P = 64 (5.7)

Effort = 15.0  
 Total CPUE = 2.1 (57; 31)  
 Stock CPUE = 1.9 (53; 28)  
 PSD = 93 (3.8)  
 RSD-P = 79 (8.6)

Effort = 14.0  
 Total CPUE = 2.5 (44; 35)  
 Stock CPUE = 1.2 (33; 17)  
 PSD = 82 (8.4)  
 RSD-P = 41 (10.9)

Figure 13. Number of black crappie caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap net surveys, Cedar Creek Reservoir, Texas, 1999, 2003, and 2007. Vertical line represents length limit at time of survey.

## Crappie

Table 11. Creel survey statistics for crappie at Cedar Creek Reservoir from June 2003-May 2004 and June 2007-May 2008, where total catch per hour is for anglers targeting all crappie and total harvest is the estimated number of crappie harvested by all anglers. Relative standard errors (RSE) are in parentheses. 2007-2008 effort estimates based on monthly rather than quarterly day length average.

Creel Survey Statistic	Year	
	2003-2004	2007-2008
Directed effort (h)	52,780 (25)	22,781 (25)
Directed effort/acre	1.6 (25)	0.7 (25)
Total catch per hour	1.4 (51)	1.3 (68)
Total harvest	69,435 (70)	22,051 (79)
White crappie	34,830 (70)	11,578 (76)
Black crappie	34,604 (69)	10,473 (82)
Harvest/acre	2.2 (70)	0.7 (44)
White crappie	1.1 (70)	0.4 (76)
Black crappie	1.1 (69)	0.3 (82)
Percent legal released	<1	54

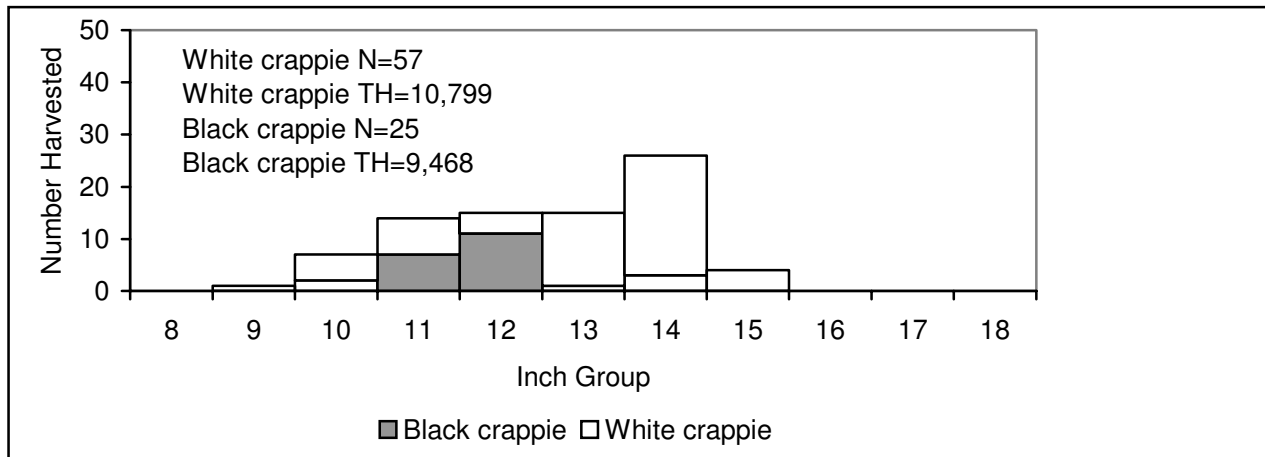


Figure 14. Length frequency of harvested white crappie and black crappie observed during creel surveys at Cedar Creek Reservoir, Texas, June 2007-May 2008, all anglers combined. N is the number of harvested white crappie and black crappie observed during creel surveys, and TH is the total estimated harvest for the creel period.

Table 13. Proposed sampling schedule for Cedar Creek 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.

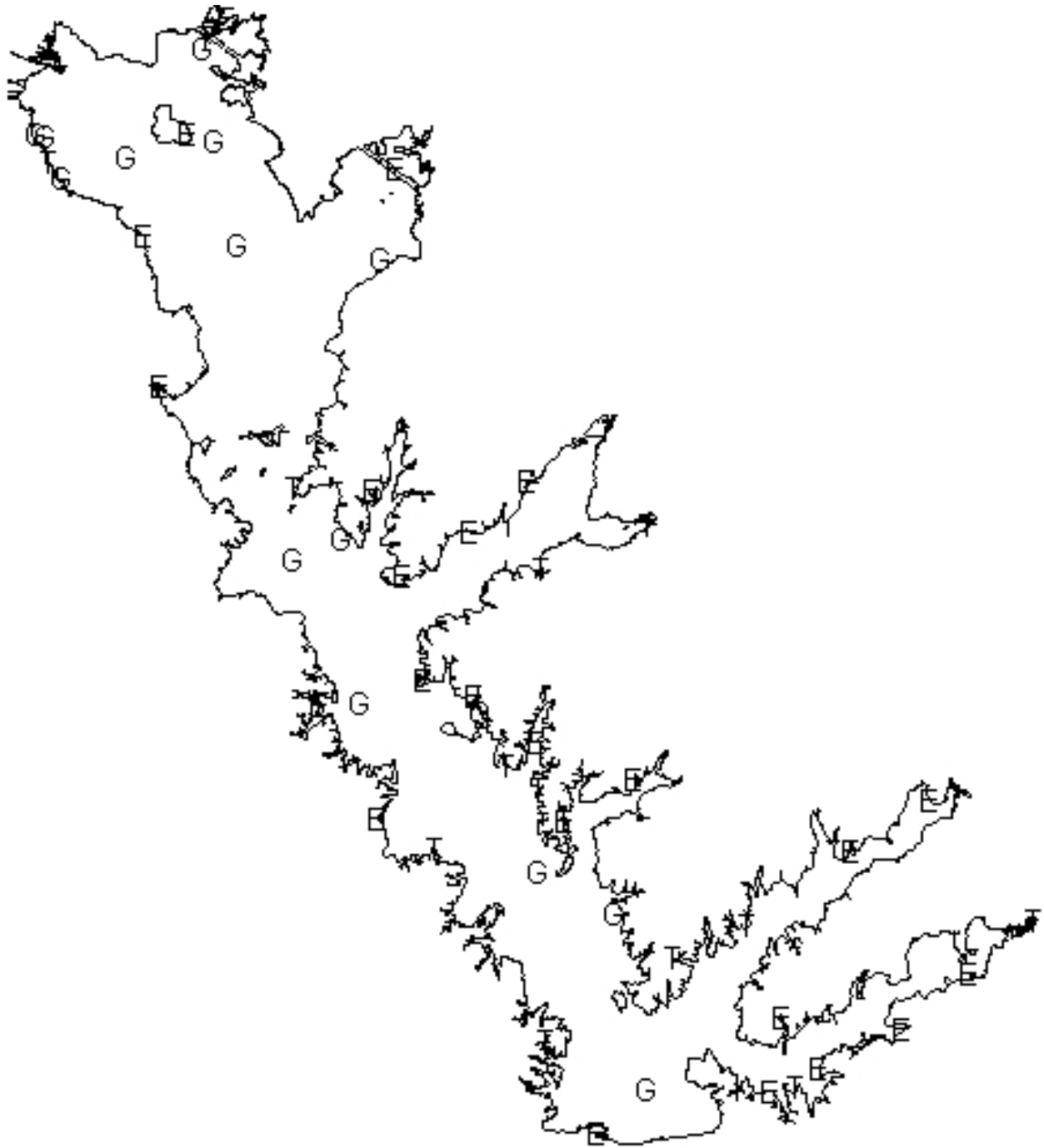
Survey Year	Electrofisher	Trap Net	Gill Net	Habitat	Creel	Report
2008-2009				A		
2009-2010			A	A		
2010-2011				A		
2011-2012	S	S	S	S	A	S

**APPENDIX A**

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Cedar Creek Reservoir, Texas, 2007-2008.

Species	Gill netting		Trap netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Gizzard shad					590	295.0
Threadfin shad					1,201	600.5
Blue catfish	148	10.6				
Channel catfish	21	1.5				
Flathead catfish	1	<0.1				
White bass	44	3.1				
Palmetto bass	10	0.7				
Warmouth					3	1.5
Bluegill					673	336.5
Longear sunfish					107	53.5
Redear sunfish					33	16.5
Largemouth bass					160	80.0
White crappie			50	3.6		
Black crappie			35	2.5		

## APPENDIX B



Location of sampling sites, Cedar Creek Reservoir, Texas, 2007-2008. Trap netting, gill netting, and electrofishing stations are indicated by T, G, and E, respectively.