PERFORMANCE REPORT

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STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2007 Survey Report

Canyon Reservoir

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Canyon Reservoir were surveyed in 2007 using electrofishing and in 2008 using gill nets. This report summarizes results of the surveys and contains a fisheries management plan for the reservoir based on those findings.

- **Reservoir Description:** Canyon Reservoir is an 8,308-acre impoundment of the Guadalupe River located in Comal County. It was constructed in 1964 by the U.S. Army Corp of Engineers (USACE) for purposes of flood control, water conservation and recreation. Canyon Reservoir has a drainage area of approximately 1,452 square miles and a shoreline length of 90.5 miles. The reservoir lies within the Edwards Plateau ecological area.

- **Management history:** Important sport fish include largemouth bass, striped bass, white bass and catfish species. Striped bass were introduced in 1973 and stocked until 1983, then restocked at a lower rate (5/acre) in 1989. White bass were managed under an experimental 12-inch minimum length limit. The regulation was rescinded in 2004 after analysis indicated environmental factors, not angler harvest, were probably more influential in determining white bass population density. Largemouth bass were present in the reservoir and have been managed under statewide regulations. Blue catfish were introduced in 1991 to provide enhanced catfish opportunities for anglers. The management plans from the 2003 survey report included documenting blue catfish reproduction by aging specimens collected in gill net samples; continued annual stockings of striped bass; and increasing or enhancing pier fishing opportunities.

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

  - **Catfishes:** Channel and blue catfish were equally abundant, but present in low densities; flathead catfish were present in even lower densities.

  - **Temperate basses:** Striped bass and white bass were present in the reservoir. A human consumption advisory was placed on striped bass in 2006, but limited consumption was allowed and the species still offered excellent catch-and-release opportunity. Legal-size (≥18 inches) striped bass were present. White bass abundance improved, probably the result of a strong 2007 year class.

  - **Black basses:** Largemouth bass were abundant. Smallmouth bass abundance has increased. Anecdotal reports of smallmouth bass catches from anglers are becoming more frequent and larger individuals were sampled during electrofishing surveys.

- **Management Strategies:** Annual striped bass stockings should continue to be requested at the present stocking rate of 5/acre. Efforts to improve or increase pier angler access sites should continue. Fish attractor sites should continue to be replenished with brush as needed.

INTRODUCTION

This document is a summary of fisheries data collected from Canyon Reservoir from 2007–2008. The purpose of the document is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other species of fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data is presented for comparison.

Reservoir Description

Canyon Reservoir is an 8,308-acre impoundment of the Guadalupe River located in Comal County. It was constructed in 1964 by the U.S. Army Corp of Engineers (USACE) for purposes of flood control, water conservation and recreation. Canyon Reservoir has a drainage area of approximately 1,452 square miles and a shoreline length of 90.5 miles. The reservoir lies within the Edwards Plateau ecological area. Boat angler access was excellent. Nineteen public boat ramps were available; one was newly constructed by Comal County in 2007. Seven USACE parks were available for bank anglers. Shoreline access at many of the parks was excellent. One public fishing pier was available at Cranes Mill Park, on the upper end of the reservoir. White bass anglers could access the Guadalupe River above the reservoir using the Rebecca Creek boat ramp. Other descriptive characteristics for Canyon Reservoir are in Table 1.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Magnelia and Bonds 2004) included:

1. Document natural reproduction by aging all blue catfish caught in gill net surveys.
   Action: Gill net surveys were conducted in 2006 and 2008. Blue catfish were collected during both surveys, but only otoliths from the 2008 survey sample were used for aging.
2. Monitor striped bass population density with gill net surveys, and continue annual stocking requests at 5/acre.
   Action: Striped bass were stocked from 2005 to 2008 and surveyed with gill nets in 2006 and 2008.
3. Continue distribution of a lake brochure to promote fishing opportunities. Annually update written brochures and information on the Inland Fisheries web page.
   Action: Lake brochures were distributed and the fishery was promoted via media outlets including the TPWD web page.
4. Make the controlling authority aware of the lack of fishing piers for bank and challenged anglers by fall 2004.
   Action: An effort was made to make controlling authorities aware of bank accessibility for challenged anglers. A new boat ramp facility was built with handicap access to the boat dock. A special study was proposed to enhance fishing opportunities at one existing fishing pier in cooperation with the USACE.

Harvest regulation history: Sport fishes in Canyon Reservoir have been managed with statewide regulations (Table 2). An experimental 12-inch minimum length limit on white bass was implemented on Canyon Reservoir (along with several other Texas reservoirs) in 1995. After thorough evaluation, the experimental regulation was rescinded in favor of the 10-inch, statewide minimum length limit in 2004.

Stocking history: Striped bass were an important species requested for regular stockings. Blue catfish were stocked in 1991-92. A complete stocking history is in Table 3.

- **Aquatic vegetation/habitat history:** No aquatic vegetation surveys were conducted in Canyon Reservoir due to the historical absence of aquatic vegetation. Shoreline composition was primarily vegetated bank, broken rock and rock bluff. Standing timber and marinas provided some cover for centrarchids.

METHODS

Fishes were collected by electrofishing (1.5 hours at 18 five-min stations) and gill netting (15 net nights at 15 stations). Catch per-unit-effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing and for gill nets as the number of fish per net night (fish/nn). All survey sites were randomly selected and all surveys were conducted according to the Fishery Assessment Procedures Manual (TPWD, Inland Fisheries Division, unpublished manual revised 2005).

Sampling statistics (CPUE for various length categories), structural indices [Proportional Stock Density (PSD), Relative Stock Density (RSD)], and condition indices [relative weight (Wr)] were calculated for target fishes according to Anderson and Neumann (1996). Index of vulnerability (IOV) was calculated for gizzard shad (DiCenzo et al. 1996). Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE statistics and for creel statistics and SE was calculated for structural indices and IOV. Ages were determined for largemouth bass, smallmouth bass, blue catfish, white bass and striped bass using otoliths. Sample sizes were adequate to meet category 2 age-and-growth sampling design recommendations (TPWD, Inland Fisheries Division, unpublished manual revised 2005). Source for water level data was the USACE web site.

RESULTS AND DISCUSSION

Habitat: In 2004, littoral zone habitat consisted primarily of vegetated bank, broken rock and rock bluff. Standing timber and marinas provided cover for centrarchids (Table 4). Submerged, floating and emergent aquatic vegetation were absent throughout the reservoir; hence aquatic vegetation coverage was below optimal for fish production (Durocher et al. 1984, Dibble et al. 1996). Fish in this reservoir relate mainly to topographical gradients or irregular contours found throughout the lake. A fish attractor project was initiated in 2005 to help concentrate cover seeking species and increase angler catch rates. Juniper tree (*Juniperus ashei*) and fabricated polyethylene fish attractors were installed at 19 sites in 2005, 13 sites in 2007 and 5 sites in 2008 for a total of 37 fish attractor sites throughout the lake (Appendix C). Global positioning system (GPS) coordinates were made available to the public (Appendix D), and direct observation through scuba diving revealed that largemouth bass and *Lepomis* sp. were attracted to these structures. Based on these observations, it was concluded that juniper tree attractors were more efficient at attracting centrarchids than polyethylene attractors (Magnelia et al. 2008, Southeastern Association of Fish and Wildlife Agencies, under review).

Prey species: Electrofishing catch rates of gizzard shad, bluegill and redbreast sunfish were 108.0/h, 198.0/h, and 362.7/h, respectively. Threadfin shad, redear sunfish, green sunfish and longear sunfish were also available as forage. Index of vulnerability (IOV) for gizzard shad indicated that 67.9% of gizzard shad were available to existing predators. Total CPUE of gizzard shad remained similar to the 2003 survey (116.7/h) (Figure 2). The 2007 survey revealed that redbreast sunfish replaced bluegill as the dominant sunfish species in Canyon Reservoir with the majority of the population dominated by small individuals (PSD = 17) (Figure 3). Total CPUE of bluegill in 2007 was 39% lower than total CPUE from the survey in 2003 (324.0/h), and size structure continued to be dominated by small individuals (PSD = 10) (Figure 4).

Blue catfish: Blue catfish gill net catch rate (1.3/nn) doubled in 2008 from 2006 survey (0.6/nn) (Figure 5). While abundance was low, all individuals sampled were ≥12 inches, and large individuals ≥30 inches were present. Aging from otoliths revealed that blue catfish are reproducing in Canyon Reservoir with individual ages ranging from 3 to 17 years (N = 13). Three of these individuals were from the original 1991 stocking. Sub-optimal condition was observed for most inch groups sampled by gill nets as relative weights generally remained below 100.

Channel catfish: The gill net catch rate for channel catfish was 1.2/nn in 2008, which was almost identical to the 2006 survey (1.1/nn) (Figure 6). Individuals >12 inches in length made up the majority (83%) of the gill net catch, and large channel catfish (≥20 inches) were present. Sub-optimal condition was observed for most inch groups sampled by gill nets as relative weights generally remained below 100; however, relative weights increased with length.

Flathead catfish: Flathead catfish were present in low density (0.6/nn) (Figure 7). Large individuals (>30 inches) were present. Sub-optimal condition was observed for most inch groups sampled by gill nets as relative weights generally remained below 100.

White bass: The gill net catch rate (4.1/nn) for white bass almost quadrupled in 2008 from previous surveys (Figure 8). This increase is indicative of a strong 2007 year class, which composed the entire age and growth sample (N = 13). White bass in Canyon Reservoir reached 10 inches by age-1 (Figure 9). Strong spring spawning migrations provide great angling opportunities for this species in the upper portion of the reservoir. This population has served as a broodstock source for TPWD's palmetto bass production in the past several years.

Striped bass: The gill net catch rate of striped bass was 1.8/nn in 2008, which almost doubled since the 2006 survey (1.0/nn) (Figure 10). Thirty-eight percent of the adult striped bass sampled exceeded 18 inches, which was lower than 2004 (91%); however, catch rates of individuals ≥18 inches remained the

same at 0.7/nn. The RSD-18 decrease reflected an increase in fish sampled between 11 and 13 inches relative to the previous survey. Body condition (Wr) was sub-optimal for most inch groups (range 70-100), while values dropped as the fish got larger. This pattern was evident in other central Texas reservoirs, such as Lake Buchanan, and may be the result of stress from elevated water temperature and low dissolved oxygen conditions during the summer months (Magnelia and De Jesus 2008). In 2008 striped bass reached legal length (18 inches) by their third growing season (Figure 11). In October 2006 the Texas Department of State Health and Human Services issued a fish consumption advisory for striped bass. Elevated mercury levels were detected and it was advised that consumption be limited to two 8-oz. portions for adults and two 4-oz. portions for children per month.

Smallmouth Bass: Electrofishing catch rate **(**12.7/h) in 2007 was almost double the 1999 value (6.7/h) (Figure 12). Thirteen percent of the adult individuals sampled in the survey were legal size (≥14 inches), and one individual sampled was 17 inches in length. Natural reproduction has been documented for the Guadalupe River basin since initial stocks were introduced in 1974 (TPWD, unpublished data). Age analysis in 2007 confirmed natural reproduction, as multiple year classes were collected (ages 0 – 4; N = 19), with most fish from the 2006 year class. Smallmouth bass reached 14 inches between two and three years of age (Figure 13). Relative weight (Wr) among most inch groups in 2007 was sub-optimal ranging between 80 and 90. Recent anecdotal reports indicate a much improved smallmouth bass fishery in Canyon Reservoir.

Largemouth bass: Largemouth bass electrofishing CPUE (113.3/h) dropped by almost half in 2007 from 2003 (203.3/h) (Figure 14). The 2003 survey revealed a strong 2002 year class due to extreme flood conditions in the reservoir. It also appeared that a strong year class was produced in 2007 as a result of high water level. At 113.3/h, largemouth bass abundance was good compared to historical averages (mean = 69.6/h) (Magnelia and Bonds 2004). The catch rate for legal-size fish remained almost identical at 12.7/h as quality-size bass proportions improved since 2003 as PSD and RSD-14 increased to 44% and 21%, respectively. However, these proportional increases were a result of a decrease in 8- to 10-inch bass, abundant during the 2003 survey. While condition (Wr) was still sub-optimal in 2007, relative weights improved from 2003 with most inch groups averaging above 90. Growth rates remained similar to the last survey. Individuals reached 14 inches between age 2 and 3 (N = 13), which was considered average growth for the Edwards Plateau eco-region (Prentice 1987) (Figure 15). Florida largemouth bass influence in the population dropped to 59% in 2007 from 72% in 2003, with no pure individuals sampled for either sub-species (Table 5). Largemouth bass have historically been the most sought after sport fish species in Canyon Reservoir (Magnelia and Bonds 2004).

Fisheries management plan for Canyon Reservoir, Texas

Prepared – July 2008

ISSUE 1: Striped bass are traditionally a harvest-oriented fishery for anglers. The striped bass fishery has been popular in Canyon, but angler interest may decline due to the consumption advisory. Since the advisory doesn't constitute a ban, fish can still be harvested as table fare. Mercury levels may only be hazardous in older year classes of striped bass. A study by TPWD staff is currently evaluating mercury levels in striped bass by age class.

MANAGEMENT STRATEGIES

1. Continue to request annual striped bass stockings at rates of 5/acre.
2. Continue to monitor striped bass abundance with gill net surveys.

ISSUE 2: A new boat ramp facility was built on the north shore of the lake, which provided good boat access for the physically challenged. Most of this reservoir is still void of good public fishing pier access. Catch rates at fishing piers are traditionally lower than for boat anglers.

MANAGEMENT STRATEGIES

1. Conduct a research study to evaluate the use of underwater light attractors for improving angler catch rates at the Canyon Lake Crane's Mill fishing pier.
2. Promote enhanced fishing opportunities at Crane's Mill Park fishing pier.

ISSUE 3: Largemouth bass are the reservoirs most sought after sport fish, but angler catch rates have traditionally been poor. The installation of fish attractors was successful at attracting largemouth bass and *Lepomis* sp. Anecdotal reports indicated this program was very popular with Canyon Lake anglers. Juniper trees are abundant along the reservoirs shoreline and are always available at no cost. Volunteers are readily available to provide labor for these types of projects.

MANAGEMENT STRATEGY

1. Continue to take advantage of the opportunities present to create fish attractor sites. When possible, coordinate efforts to create new sites or replenish existing sites.

ISSUE 4: Smallmouth bass abundance and size structure has improved in the reservoir. Reports of smallmouth catches are increasing and more media sources are promoting the lake as a good smallmouth destination.

MANAGEMENT STRATEGY

1. Conduct an additional bass-only electrofishing survey to monitor the smallmouth bass population in spring 2010.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule included mandatory monitoring in 2011/2012 (Table 6). An additional gill netting survey in 2010 will be used to monitor the striped bass population. An additional bass-only electrofishing survey will be used to monitor the smallmouth bass population in 2010. Trap net sampling for white crappie will resume in 2011 pending new procedures that incorporate stratified random sampling.

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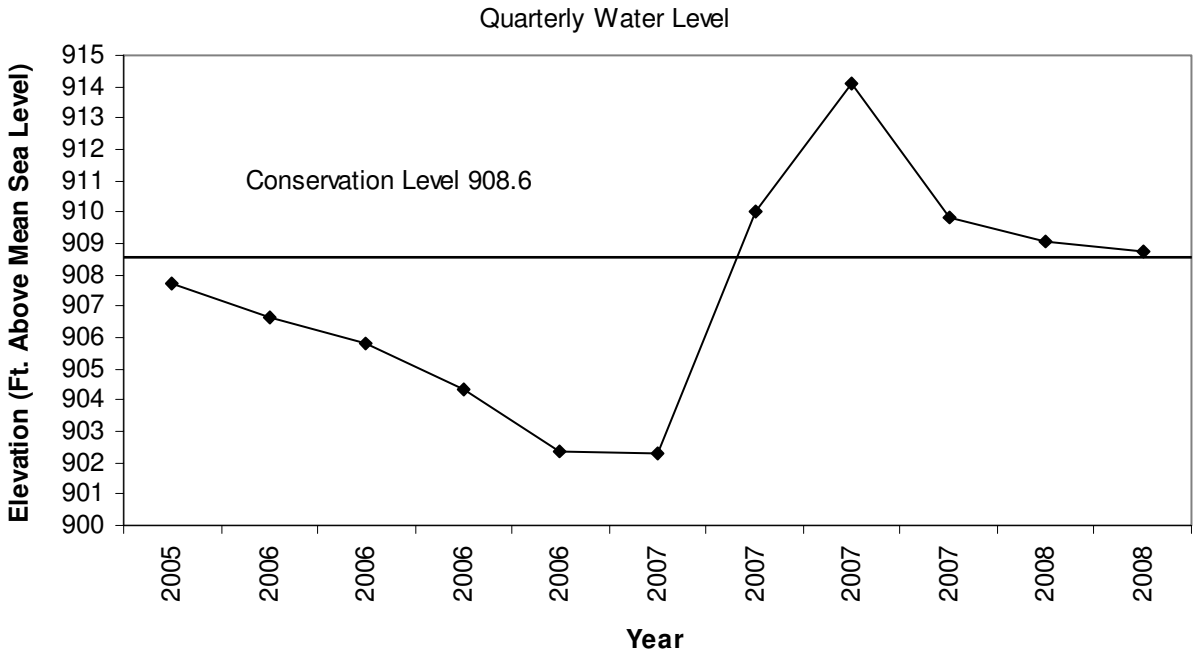


Figure 1. Mean quarterly water level elevations in feet above mean sea level (MSL) recorded for Canyon Reservoir, Texas.

Table 1. Characteristics of Canyon Reservoir, Texas.

Characteristic	Description
Year constructed	1964
Controlling authority	USACE
County	Comal
Reservoir type	Flood control, water conservation
Shoreline Development Index (SDI)	6.30
Conductivity	409 umhos/cm

Table 2. Harvest regulations for Canyon Reservoir.

Species	Bag Limit	Length Limit (inches)
Catfish: channel catfish, hybrids and subspecies	25 (in any combination)	12 minimum
Catfish, flathead	5	18 minimum
Bass, white	25	10 minimum
Bass, striped	5	18 minimum
Black Bass: largemouth, smallmouth, Guadalupe	5 (in any combination)	14 minimum*
Crappie: white and black crappie, their hybrids and subspecies	25 (in any combination)	10 minimum

*Guadalupe bass have no minimum length limit.

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

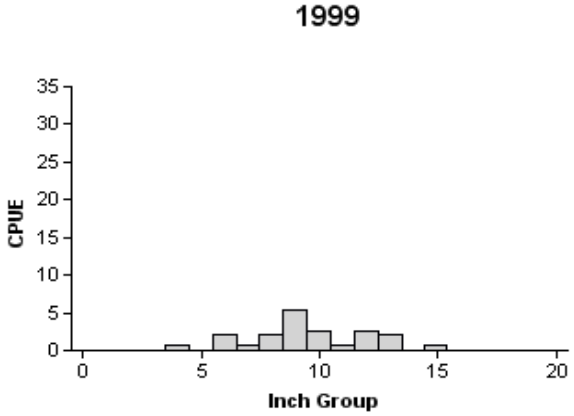
Species	Year	Number	Life Stage	Mean TL (in)
Black crappie	1967	5,000		UNK
	1988	57,446		1.0
	Total	62,446		
Blue catfish	1991	79,991	FGL	2.5
	1992	179,804	FGL	2.4
	Total	259,795		
Channel catfish	1966	19,200	AFGL	7.9
	Total	19,200		
Florida Largemouth bass	1987	34,320	FGL	2.0
	2008	407,962	FGL	1.7
	Total	442,282		
Largemouth bass	1987	30,380	FGL	2.0
	Total	30,380		
Smallmouth bass	1974	85,000	UNK	UNK
	1975	100,000	UNK	UNK
	1976	125,000	UNK	UNK
	1988	416,226	FRY	0.5
	1989	1,879	FGL	1.1
	1989	3,907	FRY	0.0
	Total	732,012		
Striped bass	1973	19,750	FGL	1.7
	1974	13,290	FGL	1.7
	1976	88,317	UNK	UNK
	1977	100,169	UNK	UNK
	1981	42,852	UNK	UNK
	1983	40,000	UNK	UNK
	1989	40,500	FRY	1.0
	1990	41,985	FGL	1.3
	1991	42,525	FGL	1.6
	1993	64,993	FGL	1.1
	1994	124,406	FGL	1.1
	1994	1,575,581	FRY	0.8
	1995	42,052	FGL	1.2
	1997	41,441	FGL	1.1
	1998	41,267	FGL	1.3

Species	Year	Number	Life Stage	Mean TL (in)
	1999	41,630	FGL	1.4
	2000	42,000	FGL	1.6
	2002	39,156	FGL	1.5
	2005	43,970	FGL	1.6
	2006	42,980	FGL	1.7
	2007	42,751	FGL	1.9
	2008	41,664	FGL	1.8
	Total	2,613,279		
Walleye	1965	500,000	FRY	0.2
	1973	1,068,920	FRY	0.2
	1974	371,080	FRY	0.2
	1981	4,370,000	FRY	0.2
	1984	3,925,000	FRY	0.2
	1985	48,910	FGL	2.0
	1985	17,203	FRY	0.6
	Total	10,301,113		
White crappie	1966	2,000	UNK	UNK
	1967	5,000	UNK	UNK
	Total	7,000		

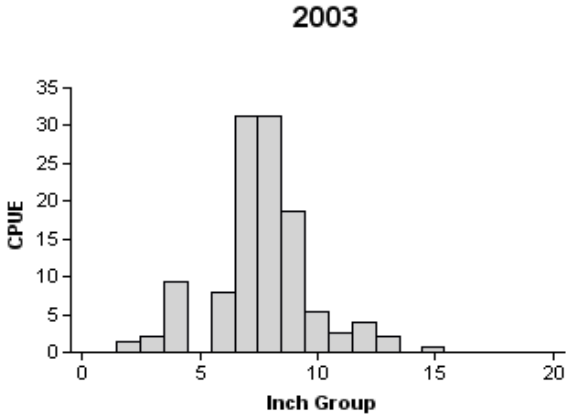
Table 4. Survey of littoral and physical habitat types, Canyon Reservoir, Texas, 2004. A linear shoreline distance (miles) was recorded for each habitat type found. No aquatic vegetation was present in Canyon Reservoir.

Shoreline habitat type	Shoreline Distance	
	Miles	Percent of total
Vegetated bank	33.5	40
Broken Rock	25.5	31
Rock bluff	17.5	21
Standing timber	3	4
Sandy bank	1.5	2
Rip rap	1	1
Marina	1	1
Concrete	0.1	<1

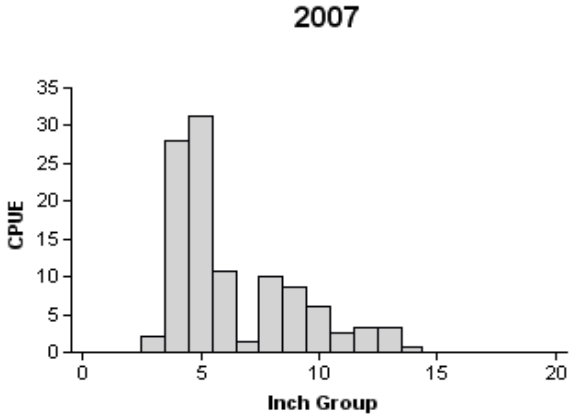
Gizzard Shad



Effort =	1.5
Total CPUE =	19.3 (43; 29)
IOV =	17.24 (6.8)



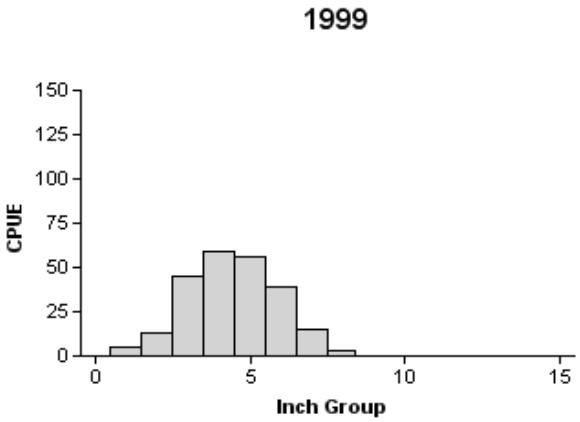
Effort =	1.5
Total CPUE =	116.7 (29; 175)
IOV =	44.57 (6.1)



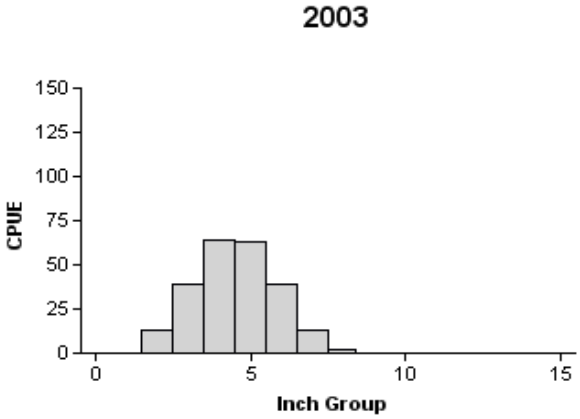
Effort =	1.5
Total CPUE =	108.0 (34; 162)
IOV =	67.9 (8.3)

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, Canyon Reservoir, Texas, 1999, 2003 and 2007.

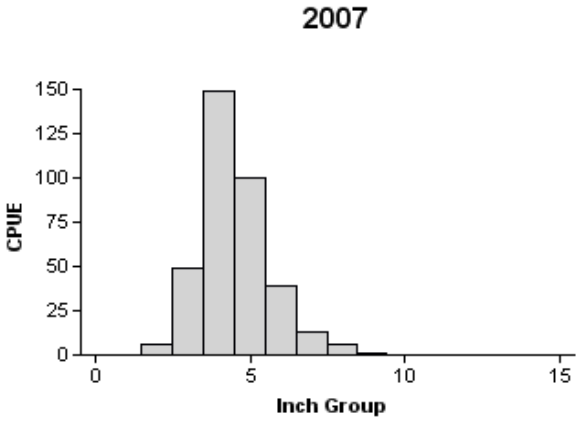
Redbreast Sunfish



Effort =	1.5
Total CPUE =	235.3 (18; 353)
PSD =	26 (4.9)



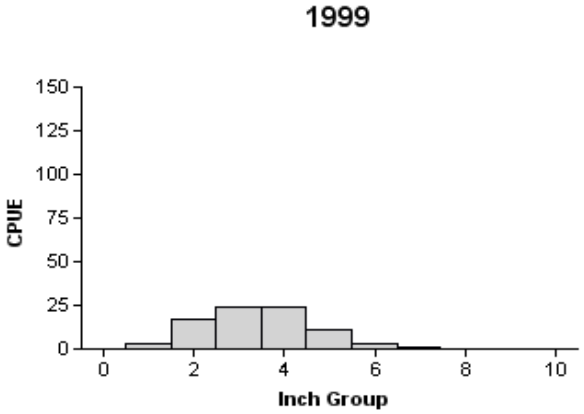
Effort =	1.5
Total CPUE =	234.0 (16; 351)
PSD =	25 (3.8)



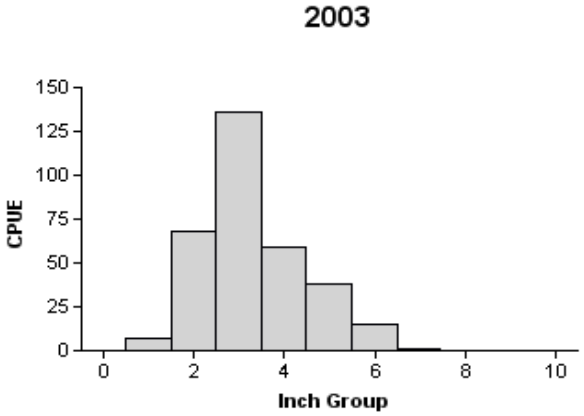
Effort =	1.5
Total CPUE =	362.7 (16; 544)
PSD =	17 (3.4)

Figure 3. Number of redbreast sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Canyon Reservoir, Texas, 1999, 2003 and 2007.

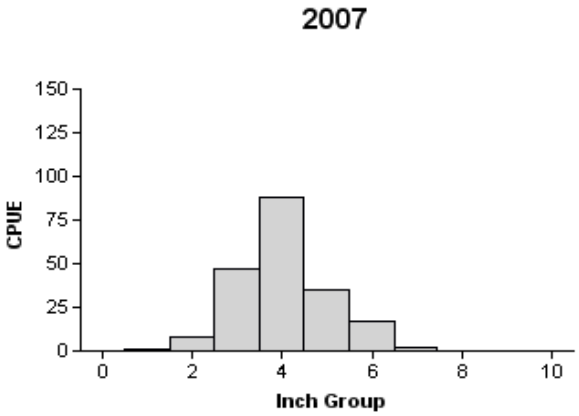
Bluegill



Effort =	1.5
Total CPUE =	83.3 (36; 125)
PSD =	5 (2.5)



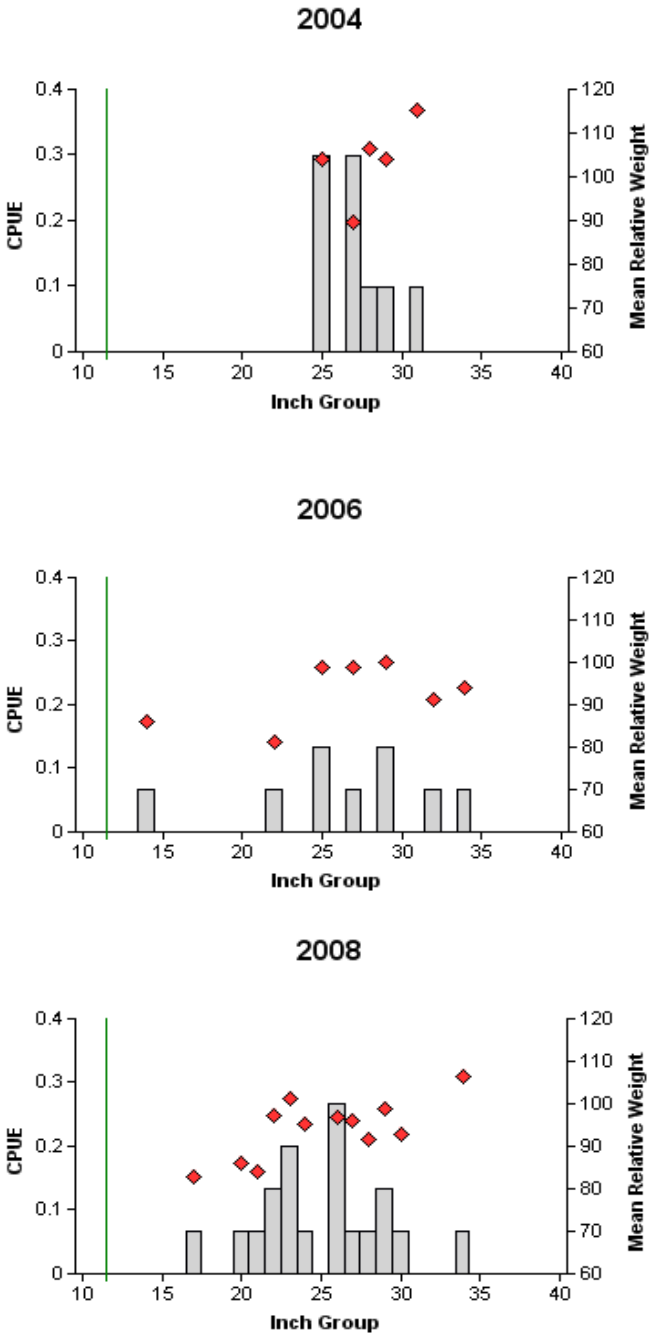
Effort =	1.5
Total CPUE =	324.0 (18; 486)
PSD =	6 (1.2)



Effort =	1.5
Total CPUE =	198.0 (33; 297)
PSD =	10 (1.4)

Figure 4. Number of bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Canyon Reservoir, Texas, 1999, 2003 and 2007.

Blue Catfish



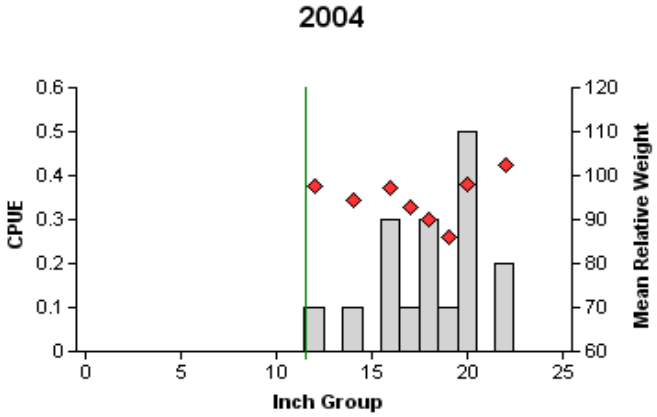
Effort =	10.0
Total CPUE =	0.9 (31; 9)
Stock CPUE =	0.9 (31; 9)
CPUE-12 =	0.9 (31; 9)
RSD-12 =	100 (0)

Effort =	15.0
Total CPUE =	0.6 (42; 9)
Stock CPUE =	0.6 (42; 9)
CPUE-12 =	0.6 (42; 9)
RSD-12 =	100 (0)

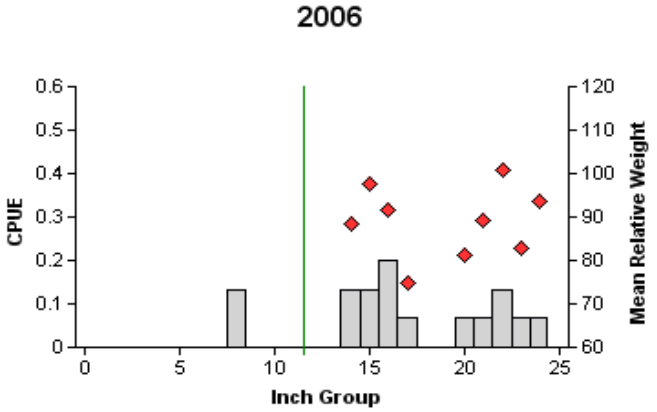
Effort =	15.0
Total CPUE =	1.3 (26; 19)
Stock CPUE =	1.3 (26; 19)
CPUE-12 =	1.3 (26; 19)
RSD-12 =	100 (0)

Figure 5. 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, Canyon Reservoir, Texas, 2004, 2006 and 2008. Vertical line represents minimum length limit at the time of the survey.

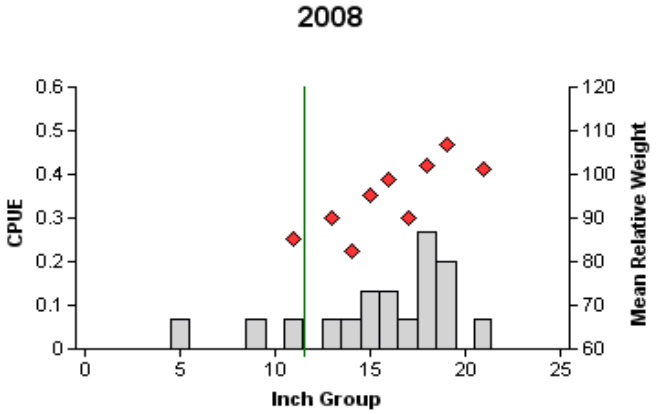
Channel Catfish



Effort =	10.0
Total CPUE =	1.7 (18; 17)
Stock CPUE =	1.7 (18; 17)
CPUE-12 =	1.7 (18; 17)
RSD-12 =	100 (0)



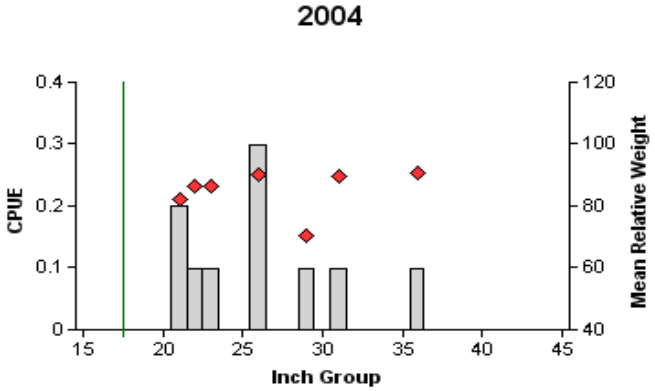
Effort =	15.0
Total CPUE =	1.1 (21; 16)
Stock CPUE =	0.9 (22; 14)
CPUE-12 =	0.9 (22; 14)
RSD-12 =	100 (0)



Effort =	15.0
Total CPUE =	1.2 (20; 18)
Stock CPUE =	1.1 (23; 16)
CPUE-12 =	1.0 (26; 15)
RSD-12 =	94 (6.4)

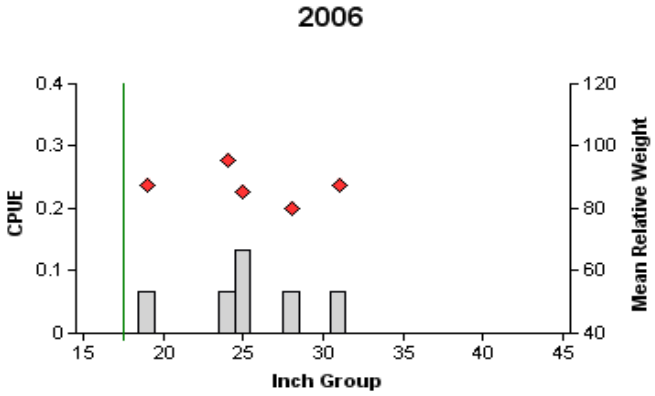
Figure 6. Number of channel catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Canyon Reservoir, Texas, 2004, 2006 and 2008. Vertical line represents minimum length limit at the time of the survey.

Flathead Catfish

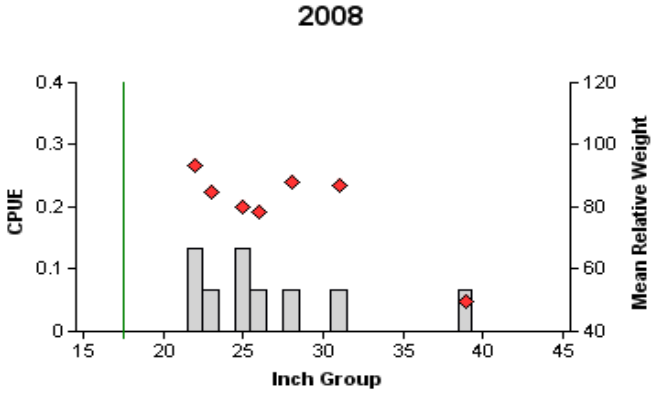


the survey.

Effort =	10.0
Total CPUE =	1.0 (30; 10)
Stock CPUE =	1.0 (30; 10)
CPUE-18 =	1.0 (30; 10)
RSD-18 =	100 (0)



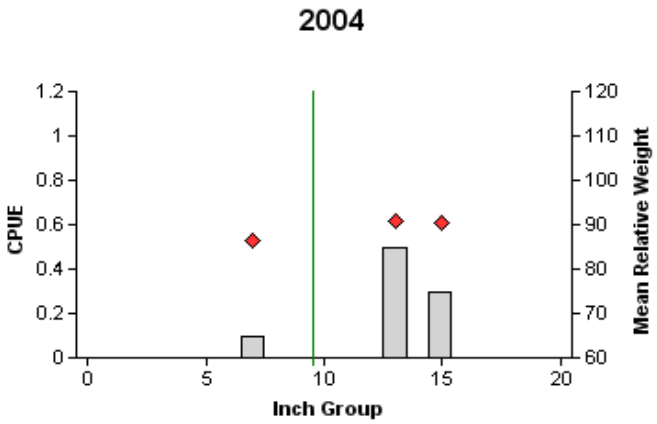
Effort =	15.0
Total CPUE =	0.4 (41; 6)
Stock CPUE =	0.4 (41; 6)
CPUE-18 =	0.4 (41; 6)
RSD-18 =	100 (0)



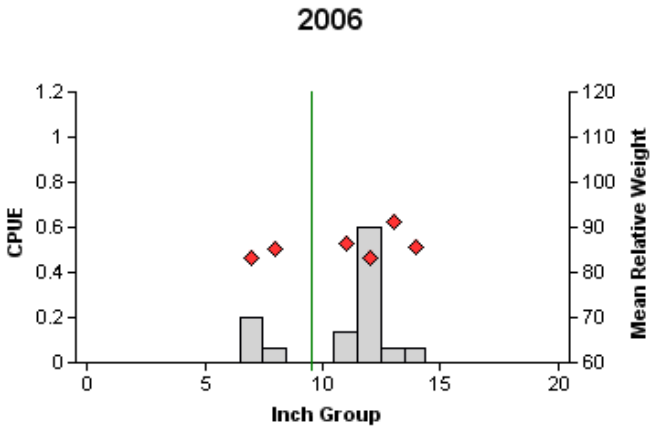
Effort =	15.0
Total CPUE =	0.6 (39; 9)
Stock CPUE =	0.6 (39; 9)
CPUE-18 =	0.6 (39; 9)
RSD-18 =	100 (0)

Figure 7. Number of flathead 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, Canyon Reservoir, Texas, 2004, 2006 and 2008. Vertical line represents the minimum length limit at the time of

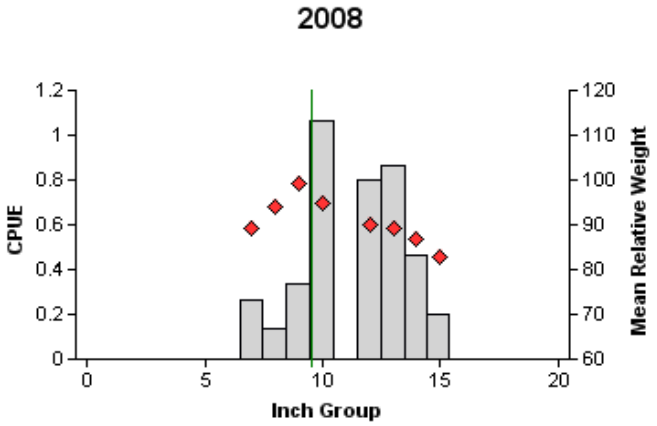
White Bass



Effort =	10.0
Total CPUE =	0.9 (42; 9)
Stock CPUE =	0.9 (42; 9)
CPUE-10 =	0.8 (45; 8)
RSD-10 =	89 (10.6)



Effort =	15.0
Total CPUE =	1.1 (42; 17)
Stock CPUE =	1.1 (42; 17)
CPUE-10 =	0.9 (49; 13)
RSD-10 =	76 (12.3)



Effort =	15.0
Total CPUE =	4.1 (30; 62)
Stock CPUE =	4.1 (30; 62)
CPUE-10 =	3.4 (29; 51)
RSD-10 =	82 (4.4)

Figure 8. 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, Canyon Reservoir, Texas, 2004, 2006 and 2008. Vertical line represents minimum length limit at the time of the survey.

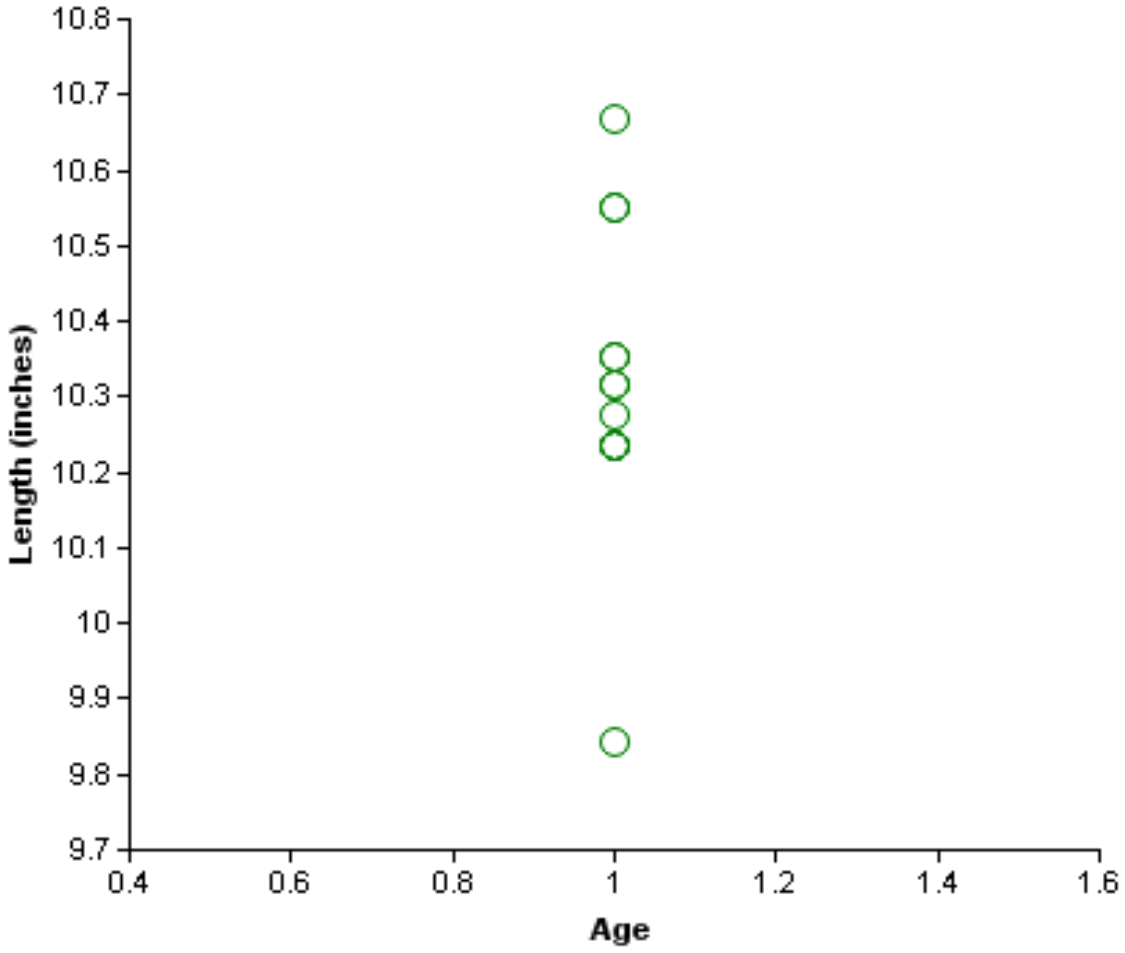
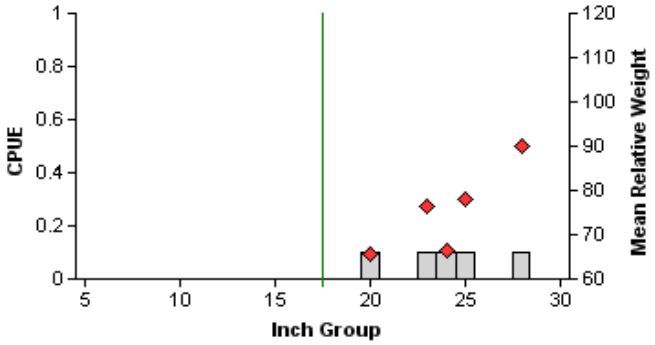


Figure 9. Length at age for white bass collected gill netting, Canyon Reservoir, February 2008 (N = 13).

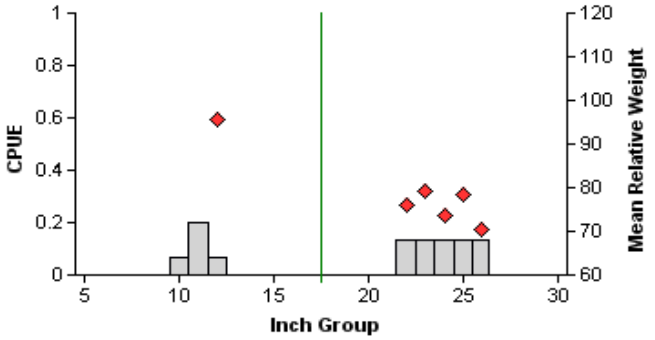
Striped Bass

2004



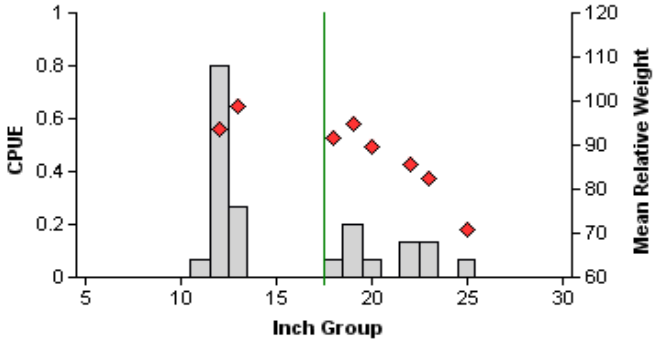
Effort =	10.0
Total CPUE =	0.5 (45; 5)
Stock CPUE =	0.5 (45; 5)
CPUE-18 =	0.5 (45; 5)
RSD-18 =	100 (0)

2006



Effort =	15.0
Total CPUE =	1.0 (24; 15)
Stock CPUE =	0.7 (31; 11)
CPUE-18 =	0.7 (35; 10)
RSD-18 =	91 (9.3)

2008



Effort =	15.0
Total CPUE =	1.8 (26; 27)
Stock CPUE =	1.7 (27; 26)
CPUE-18 =	0.7 (28; 10)
RSD-18 =	38 (9.5)

Figure 10. Number of striped 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, Canyon Reservoir, Texas, 2004, 2006 and 2008. Vertical line represents minimum length limit at the time of the survey.

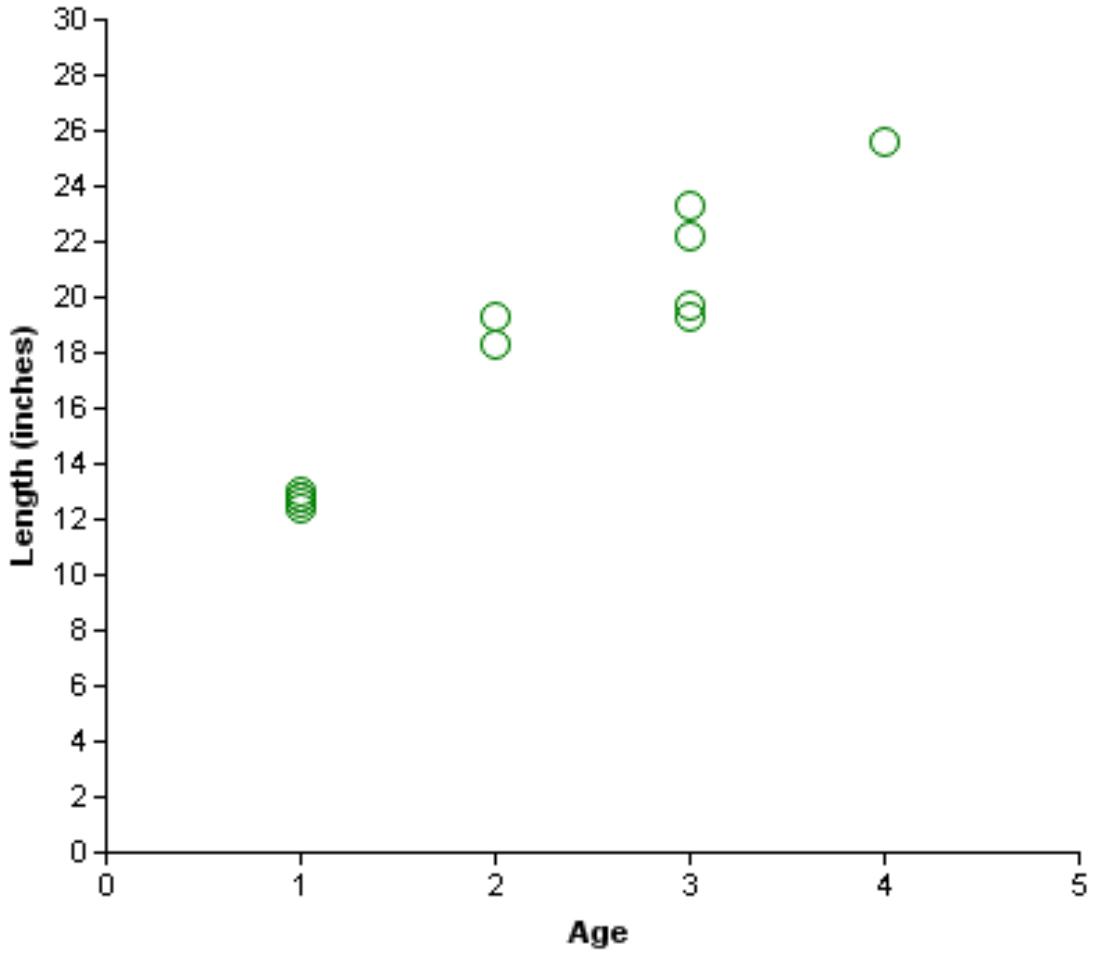
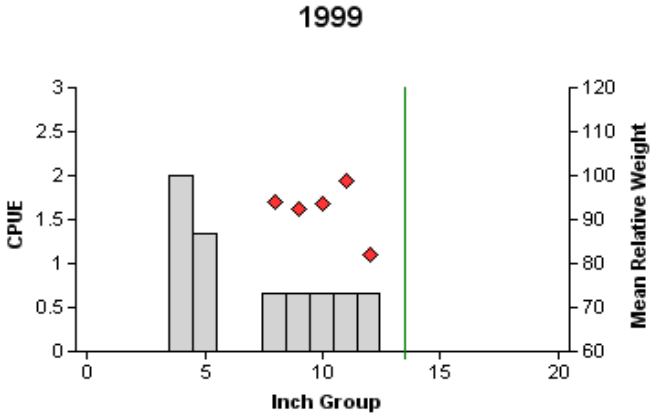
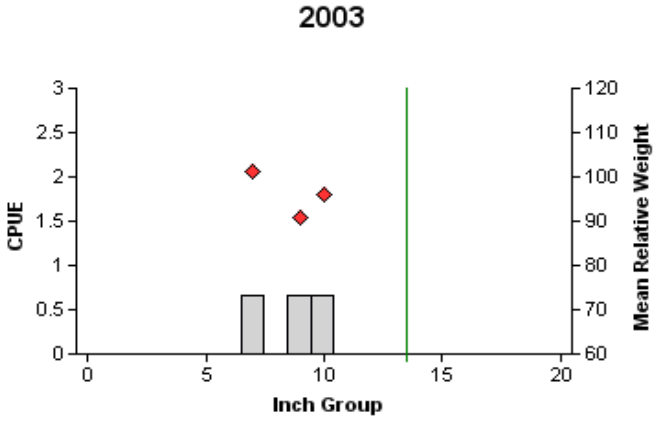


Figure 11. Length at age for striped bass collected gill netting, Canyon Reservoir, February 2008 (N = 12).

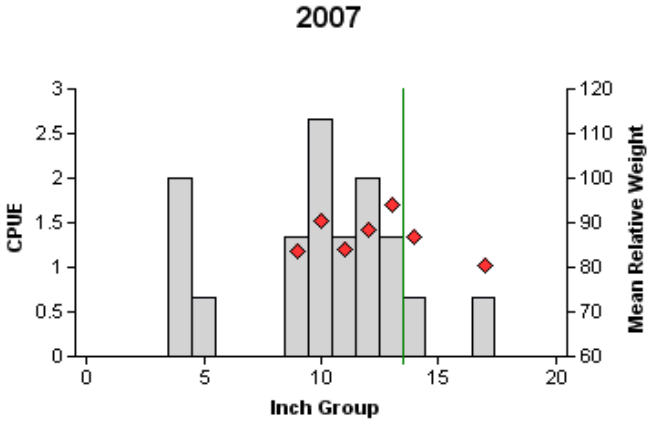
Smallmouth Bass



Effort =	1.5
Total CPUE =	6.7 (42; 10)
Stock CPUE =	3.3 (57; 5)
CPUE-14 =	0.0 (0; 0)
PSD =	40 (10.1)
RSD-14 =	0 (0)



Effort =	1.5
Total CPUE =	2.0 (54; 3)
Stock CPUE =	2.0 (54; 3)
CPUE-14 =	0.0 (0; 0)
PSD =	0 (59.4)
RSD-14 =	0 (0)



Effort =	1.5
Total CPUE =	12.7 (39; 19)
Stock CPUE =	10.0 (44; 15)
CPUE-14 =	1.3 (69; 2)
PSD =	60 (11.6)
RSD-14 =	13 (7.1)

Figure 12. Number of smallmouth bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Canyon Reservoir, Texas, 1999, 2003 and 2007. Vertical line represents minimum length limit at the time of survey.

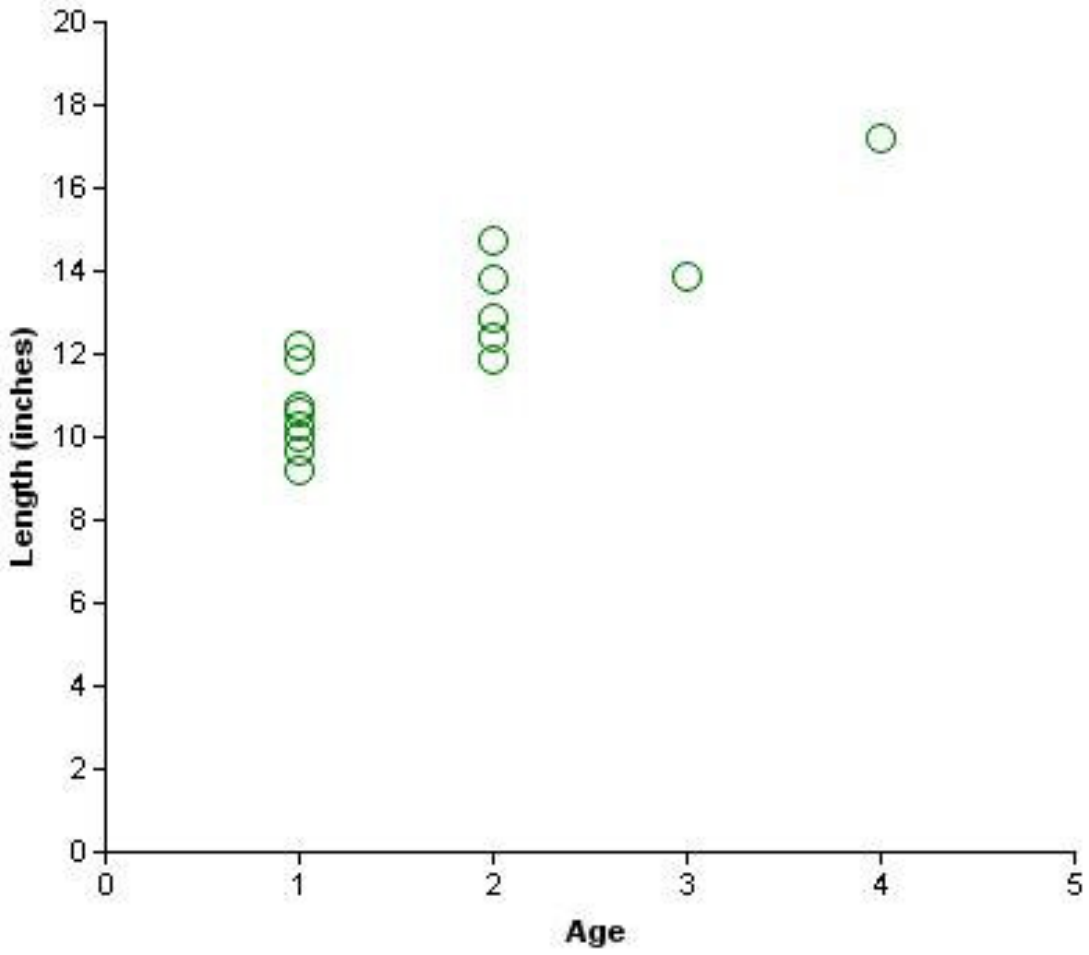
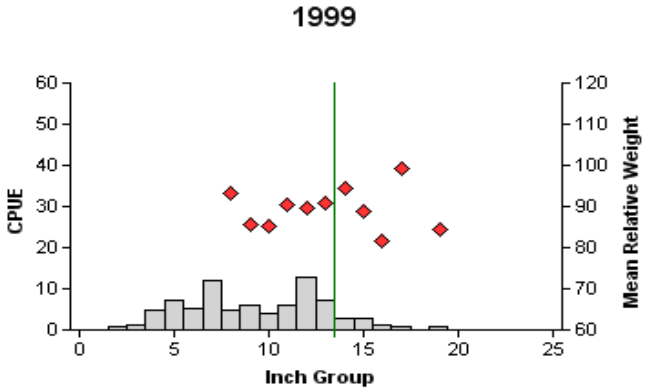
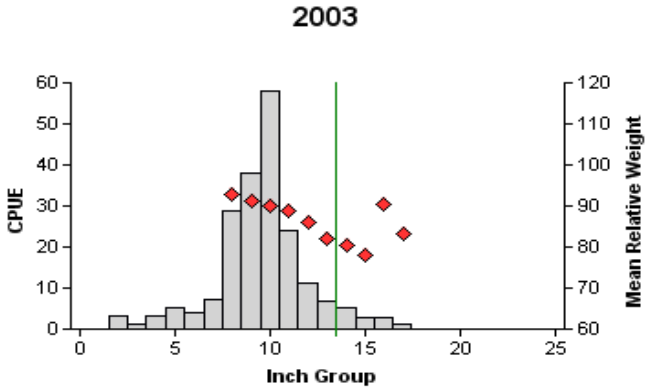


Figure 13. Length at age for smallmouth bass collected electrofishing, Canyon Reservoir, November 2007 (N = 19).

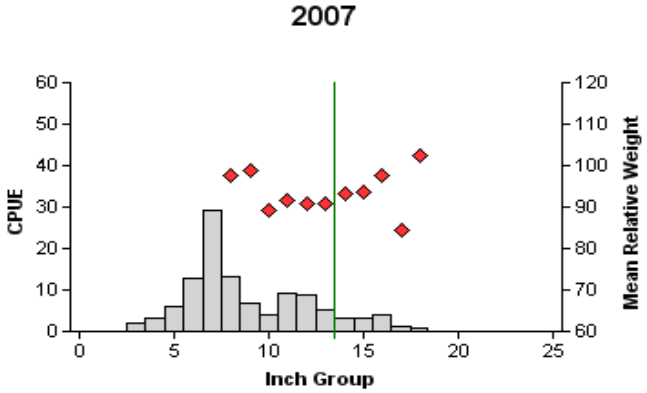
Largemouth Bass



Effort =	1.5
Total CPUE =	80.0 (15; 120)
Stock CPUE =	48.7 (17; 73)
CPUE-14 =	8.0 (34; 12)
PSD =	58 (6.2)
RSD-14 =	16 (5.1)



Effort =	1.5
Total CPUE =	203.3 (19; 305)
Stock CPUE =	178.7 (19; 268)
CPUE-14 =	12.0 (18; 18)
PSD =	17 (3.3)
RSD-14 =	7 (1.7)



Effort =	1.5
Total CPUE =	113.3 (15; 170)
Stock CPUE =	60.0 (18; 90)
CPUE-14 =	12.7 (26; 19)
PSD =	44 (6)
RSD-14 =	21 (3.7)

Figure 14. Number of largemouth bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Canyon Reservoir, Texas, 1999, 2003 and 2007. Vertical line represents minimum length limit at time of survey.

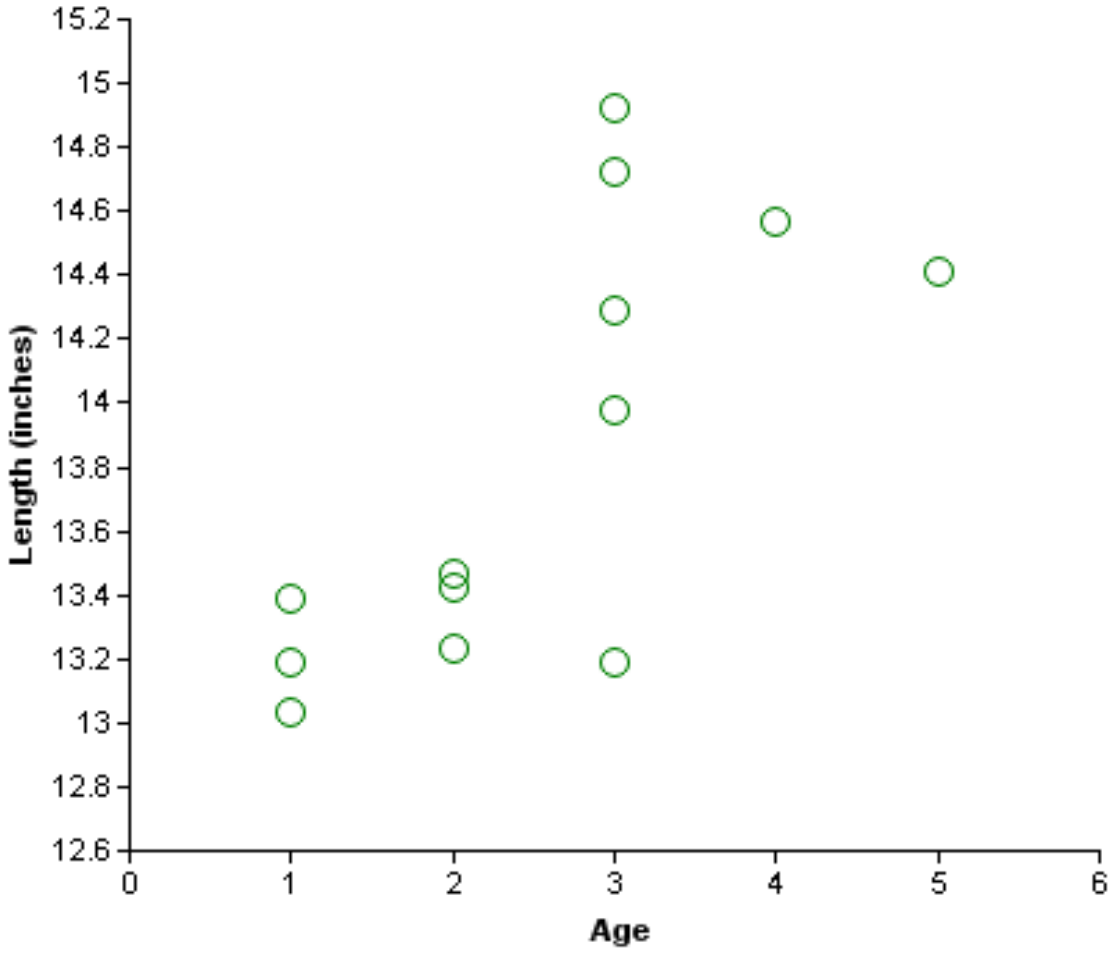


Figure 15. Length at age for largemouth bass collected electrofishing, Canyon Reservoir, November 2007 (N = 13).

Table 5. Results of genetic analysis of largemouth bass collected by fall electrofishing, Canyon Reservoir, Texas, 2007. FLMB = Florida largemouth bass, NLMB = Northern largemouth bass, Fx = hybrid between a FLMB and a NLMB of any generation.

		Genotype				
Year	Sample size	FLMB	Fx	NLMB	% FLMB alleles	% pure FLMB
2003	30	8	22	0	72	27
2007	30	0	30	0	59	0

Table 6. Proposed sampling schedule for Canyon Reservoir, Texas. Gill netting surveys are conducted in the spring, while electrofishing and trap netting surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

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

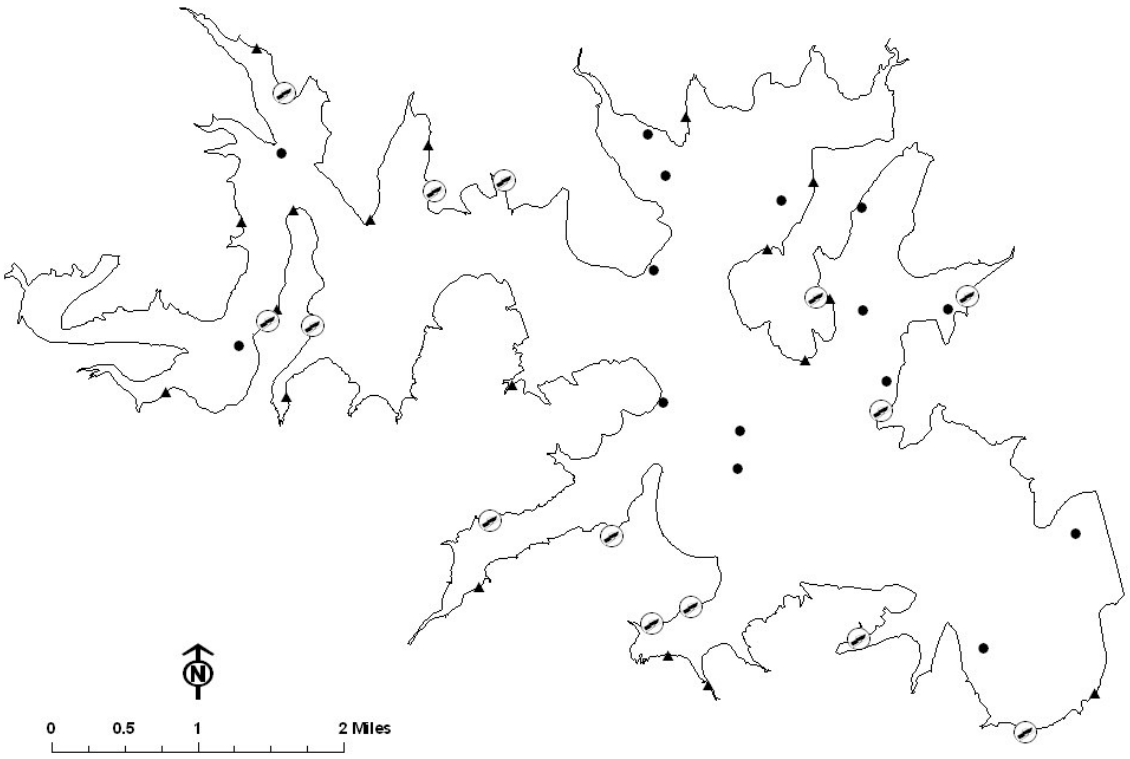
APPENDIX A

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

Species	Gill Netting		Electrofishing	
	N	CPUE	N	CPUE
Gizzard shad			162	108.0
Threadfin shad			52	34.7
Blue catfish	19	1.3		
Channel catfish	18	1.2		
Flathead catfish	9	0.6		
White bass	62	4.1		
Striped bass	24	1.5		
Bullhead minnow			8	5.3
Inland silverside			2	1.3
Blacktail shiner			27	18.0
Redbreast sunfish			544	362.7
Green sunfish			38	25.3
Warmouth			2	1.3
Bluegill			297	198.0
Longear sunfish			7	4.7
Redear sunfish			27	18.0
Smallmouth bass			19	12.7
Largemouth bass			200	133.3
Guadalupe bass			6	4.0
Logperch			11	7.3
Rio Grande cichlid			9	6.0

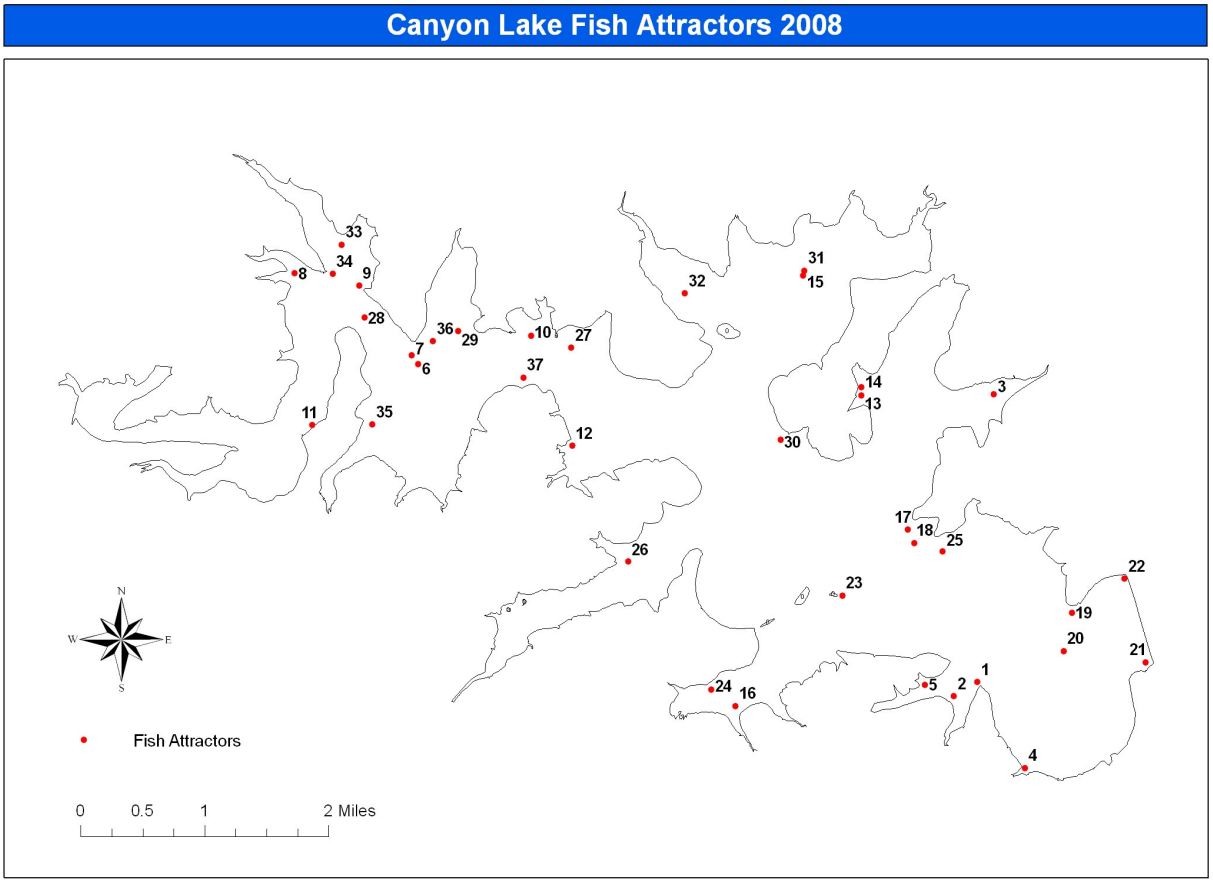
APPENDIX B

Location of sampling sites, Canyon Reservoir, Texas, 2007-2008. Gill net and electrofishing stations are indicated by ● and ▲, respectively. Public boat ramps are marked with boat icon.



APPENDIX C

Map of Canyon Reservoir with fish attractor locations. Attractors were installed in January 2005, 2006 and 2008. Juniper brush piles and plastic attractors were used at the sites.



APPENDIX D

GPS coordinates for Canyon Reservoir fish attractor locations. GPS coordinates are in degree decimal minutes. Attractors were installed or refurbished in January 2005 – 2008. Juniper brush piles, a.k.a. cedar trees (CT) and plastic artificial attractors (AFA) were used at the sites.

Site #	Latitude	Longitude	Description	Installed	Refurbished
1	N 29°51.697'	W -98°13.027'	N = 33 (AFA = 27; CT = 6)	2005	2006
2	N 29°51.597'	W -98°13.190'	N = 38 (AFA = 30; CT = 8)	2005	2006
3	N 29°53.707'	W -98°12.911'	N = 25 AFA	2005	
4	N 29°51.096'	W -98°12.693'	N = 39 (AFA = 32; CT = 7)	2005	2006
5	N 29°51.676'	W -98°13.394'	N = 37 (AFA = 31; CT = 6)	2005	2006
6	N 29°53.918'	W -98°16.949'	N = 42 (AFA = 34; CT = 8)	2005	2006
7	N 29°53.979'	W -98°16.994'	N = 48 (AFA = 38; CT = 10)	2005	2008
8	N 29°54.554'	W -98°17.814'	N = 43 (AFA = 35; CT = 8)	2005	2006
9	N 29°54.467'	W -98°17.361'	N = 48 (AFA = 38, CT = 10)	2005	2008
10	N 29°54.118'	W -98°16.157'	N = 30 (AFA = 23; CT = 7)	2005	2006
11	N 29°53.492'	W -98°17.690'	N = 15 AFA	2005	
12	N 29°53.347'	W -98°15.868'	N = 10 AFA	2005	
13	N 29°53.698'	W -98°13.840'	N = 5 AFA	2005	
14	N 29°53.756'	W -98°13.839'	N = 5 AFA	2005	
15	N 29°54.539'	W -98°14.247'	N = 38 (AFA = 30; CT = 8)	2005	2006
16	N 29°51.530'	W -98°14.722'	N = 25 CT	2005	
17	N 29°52.762'	W -98°13.514'	N = 25 CT	2005	
18	N 29°52.669'	W -98°13.467'	N = 25 CT	2005	
19	N 29°52.181'	W -98°12.362'	N = 4 CT	2007	
20	N 29°51.913'	W -98°12.422'	N = 7 CT	2007	
21	N 29°51.835'	W -98°11.844'	N = 5 CT	2007	
22	N 29°52.419'	W -98°11.994'	N = 5 CT	2007	
23	N 29°52.301'	W -98°13.973'	N = 5 CT	2007	
24	N 29°51.642'	W -98°14.892'	N = 5 CT	2007	
25	N 29°52.608'	W -98°13.269'	N = 3 CT	2007	
26	N 29°52.538'	W -98°15.475'	N = 10 CT	2007	
27	N 29°54.033'	W -98°15.873'	N = 10 CT	2007	
28	N 29°54.246'	W -98°17.323'	N = 13 CT	2007	
29	N 29°54.150'	W -98°16.668'	N = 17 CT	2007	
30	N 29°53.392'	W -98°14.405'	N = 10 CT	2007	
31	N 29°54.571'	W -98°14.239'	N = 7 CT	2007	
32	N 29°54.416'	W -98°15.077'	N = 5 CT	2007	
33	N 29°54.754'	W -98°17.483'	N = 10 CT	2008	
34	N 29°54.549'	W -98°17.547'	N = 10 CT	2008	
35	N 29°53.496'	W -98°17.268'	N = 10 CT	2008	
36	N 29°54.079'	W -98°16.844'	N = 10 CT	2008	
37	N 29°53.824'	W -98°16.209'	N = 10 CT	2008	