PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

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FEDERAL AID PROJECT F-221-M-2

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2011 Survey Report

Choke Canyon Reservoir

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SURVEY AND MANAGEMENT SUMMARY

Fish populations were surveyed using electrofishing (2008, 2009, 2010 and 2011), trap nets (2007, 2009 and 2011) and gill nets (2009, 2010, 2011 and 2012) to assess population trends for important sport fish communities. A creel survey was conducted during the survey period spanning 1 June 2008 to 31 May 2011. This report summarizes the results and contains a management plan for the reservoir based on those findings.

- **Reservoir description:** Choke Canyon is a 25,989-acre reservoir (averaged 19,975 acres in 2011-2012) located on the Frio River in the Nueces River Basin, approximately 80 miles south of San Antonio. Its main purposes are for water supply and recreation (angling and pleasure boating). The reservoir has a history of substantial water level fluctuations. The substrate is composed primarily of silt, sand, clay, and some gravel/rock. Littoral habitat consists of native aquatic vegetation, periodically flooded terrestrial vegetation, standing timber, and seasonally abundant water hyacinth and hydrilla.

- **Management history:** Important sport fish species include largemouth bass, blue and channel catfish, white bass, and white crappie. Recent management efforts have focused on control of nuisance aquatic vegetation, collecting catch and harvest statistics on important sport fish species, documenting catch of trophy largemouth bass, and supplementing the naturally occurring largemouth bass population through stockings in 2009 thru 2011. The district has worked with the city of Corpus Christi to develop and implement a water hyacinth control program. District staff conducted herbicide treatments on water hyacinth in 2008 (195 acres), 2009 (80 acres), 2010 (525 acres) and 2011 (45 acres). Staff annually monitored access areas where hydrilla could restrict use. Angler harvest of all sport fishes has been regulated according to statewide size and bag limits.

- **Fish Community**
  - **Prey species:** Gizzard shad and sunfishes (primarily bluegill and redear) formed the reservoirs forage base. Threadfin shad also contributed to the prey base. Population size structure for prey species was suitable to support sport fish populations.

  - **Catfishes:** Although channel catfish were present, the catfish community was predominately blue catfish. Flathead catfish were also present in the reservoir, but in low numbers. The blue catfish population continued to have high relative abundance and comprised a wide size-range of fish. Angling effort and total harvest of catfishes were substantially lower in 2010-2011 compared to 2008-2009 and 2009-2010.

  - **White bass:** Abundance and size structure of white bass was excellent in 2012. The majority of individuals collected were available for angler harvest.

  - **Largemouth bass:** Largemouth bass abundance remained high over the survey period. Largemouth bass were the most sought species in the reservoir and the population continued to provide excellent angling opportunities. Numerous trophy-sized largemouth bass were caught and documented in creel surveys and 7 ShareLunker fish were donated to TPWD since 2009. The lake record was broken in 2009 and now stands at 15.45 pounds.

  - **Crappie:** White crappie was the predominant crappie species and relative abundance, while low, was consistent with previous surveys. Angling effort and harvest dropped substantially in 2010-2011.

- **Management strategies:** Continue to manage sport fish populations under existing harvest regulations. Conduct creel survey to collect quantitative data on angler use. Continue to assist the city of Corpus Christi with the water hyacinth control program. Monitor access areas where hydrilla could restrict use. Stock Florida largemouth bass when water level increases.

INTRODUCTION

This document is a summary of fisheries data collected from Choke Canyon Reservoir in 2007-2012. The purpose of the document is to provide fisheries information and make management recommendations to protect and improve the sport fisheries. While information on other species of fishes was collected, this report deals primarily with major sport fish and important prey species. Management strategies and recommendations are included to address existing problems and/or opportunities. Historical data is presented with the 2011-2012 data for comparison.

Reservoir Description

Choke Canyon is a 25,989-acre reservoir located in the Nueces River Basin on the Frio River. The reservoir was constructed in 1982 and lies approximately 80 miles south of San Antonio. Its main purposes are for water supply and recreation. The reservoir has a history of substantial water level fluctuations (Figure 1). During the 2011-2012 sampling season the reservoir averaged 11 feet below conservation pool. Shoreline and boat access were adequate with six public boat ramps and plentiful shoreline angling availability. Handicap access was limited to the State Park Calliham Unit. Secchi disc measurements of water clarity ranged from 20 cm to 81 cm. The substrate was composed primarily of silt, clay, sand, and small rock. Littoral habitat consisted of timber stands, periodically flooded terrestrial vegetation, native aquatic vegetation, and seasonally abundant exotic vegetation. Native aquatic vegetation and hydrilla reestablished and became more widespread in the reservoir after refilling in 2002. Water hyacinth became established in 2006 and has been treated with herbicides annually since that time. Other descriptive characteristics of this reservoir are in Table 1.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Findeisen and Binion 2008) included:

1. Monitor hydrilla for access problems.

   Action: District staff annually monitored hydrilla. Hydrilla spread within the reservoir but never created boater or angler access problems.

2. Since 2006, water hyacinth has been a problem in the reservoir, occasionally restricting recreational use and impacting the quality of fish and wildlife habitat.

   Action: Water hyacinth surveys were conducted annually to monitor presence and distribution. District staff consulted the city of Corpus Christi on a vegetation management plan and took the lead on spray control operations. Water hyacinth was treated with herbicides in all years.

3. Anecdotal data suggested increased catch of trophy largemouth bass since the reservoir refilled in 2002. Standard creel surveys have not captured quantitative data on trophy largemouth bass catch, harvest and release.

   Action: Initiated a trophy largemouth bass database by adding creel survey question to record number of largemouth bass caught and released by weight-class (<4 pound, 4 – 6.99, 7 – 9.99, and ≥10).

Harvest regulation history: Sport fishes in Choke Canyon Reservoir have always been managed with statewide regulations (Table 2).

Stocking history: Florida largemouth bass (FLMB) fingerlings were stocked in the reservoir over a three

year period from 2009-2011 (1,184,463). This included two stockings of ShareLunker largemouth bass in 2009 (5,151) and 2010 (2,220). Prior to 2009, the most recent stocking of Florida largemouth bass occurred in 2003. Northern largemouth bass (NLMB) were stocked from 2003 to 2005 as part of a research project examining the potential for increasing northern largemouth bass alleles in reservoirs with high Florida largemouth bass genetics. Blue and channel catfish, striped bass and white crappie have been stocked in the past. A complete stocking history can be found in Table 3.

Vegetation/habitat management history: Historically, hydrilla infestations at boat ramps have been controlled with herbicides. However, over the current survey period, hydrilla has not negatively impacted boat and angler access. Isolated colonies of water hyacinth were found on the reservoir from 1998 through 2005. These colonies were initially removed by hand, however, in 2006, water hyacinth expanded and coverage was too great to mechanically remove and herbicide treatments were initiated. District staff conducted herbicide treatments on water hyacinth in 2008 (195 acres), 2009 (80 acres), 2010 (525 acres) and 2011 (45 acres).

Water Transfer: Choke Canyon Reservoir is primarily used for municipal/industrial water supply, recreation, and to a lesser extent, flood control. Fifty-eight acre-feet of water were released daily to downstream Lake Corpus Christi Reservoir. Intermittent larger releases of water were dependent on water level at Lake Corpus Christi. There was one permanent pumping station on the reservoir transferring water to the municipality of Three Rivers. There are currently no proposals to install additional pumping stations.

METHODS

Fishes were collected by electrofishing (2.0 hours at 24 5-minute stations), trap nets (15 net nights at 15 stations), and gill nets (15 net nights at 15 stations). Standard electrofishing surveys were conducted during night time and sample station selection was random for all gear types (except 2011 trap net survey – biologist selected) as prescribed by the Fishery Assessment Procedures (Texas Parks and Wildlife Department [TPWD], Inland Fisheries Division, unpublished manual revised 2011). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour of actual electrofishing (fish/h) and for gill and trap nets as the number of fish caught in one net set overnight (fish/nn). An aquatic vegetation survey was conducted in 2011. Mean age at length was calculated for largemouth bass between 13 – 15 inches total length in 2008 (N = 53), 2009 (N = 13), 2010 (N = 15) and 2011 (N = 13). A comprehensive 400 fish age and growth sample was collected in 2008. All fish collected for age and growth analysis were aged using otoliths. For 2008, mortality estimates were obtained by regressing *ln*(catch at age) against each age class and the slope of the line was used as an estimate of instantaneous mortality (*Z*). Survival (*S*) was calculated as $e^{(-Z)}$ and total annual mortality (*A*) was calculated as 1-*S*. Residuals from the catch curve were plotted by year class allowing inference into year class strength and recruitment dynamics (Maceina 1997; 2004).

Genetic analysis of largemouth bass was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2011). Micro-satellite analysis was used to determine genotype of individual fish from 2005 – 2011 and by electrophoresis for previous years.

Creel survey sampling was designed with unequal probabilities for boat ramp and time period selection on a quarterly basis with effort to maximize the number of catfish angler interviews per an ongoing catfish angling gear selection evaluation. Creel quarters were defined as: summer = June 1 through August 31; fall = September 1 through November 30; winter = December 1 through February 28; and spring = March 1 through May 31. Thirteen surveys were conducted per quarter (9 weekend days and 4 week days), totaling 52 creels per year running from 6/1/08 – 5/31/09, 6/1/09 – 5/31/10, and 6/1/10 – 5/31/11. Additional information was obtained from interviewed anglers including largemouth bass angler type and the weights of largemouth bass that were caught and released.

Sampling statistics (CPUE for various length categories) and structural indices [Proportional Size

Distribution (PSD) for various length categories, as defined by Guy et el. (2007)], and condition indices [relative weight (W_r)] were calculated for target fishes according to Anderson and Neumann (1996). Index of vulnerability (IOV) was calculated for gizzard shad according to DiCenzo et al. (1996). Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all catch statistics and standard error (SE) was calculated for structural indices and IOV. Source for water level data was the Nueces River Authority (NRA) website (http://www.nueces-ra.org/CP/CITY/day.php).

RESULTS AND DISCUSSION

Habitat: Littoral habitat consisted of natural shoreline and eroded banks, native submersed aquatic vegetation, exotic vegetation, and standing timber (Table 4). Total native vegetation coverage was 300 acres (1.4%) in 2011, a substantial decrease from 2,422 acres (9.6%) in 2007. Water stargrass and coontail were the most abundant native vegetation species in 2011. Total non-native vegetation coverage was 656 acres (3.1%) in 2011, substantially lower than the 4,127 acres (16.3%) in 2007. Hydrilla and water hyacinth were the only two exotic plants species observed during the vegetation survey and were present in 616 acres (2.9%) and 39.9 acres (< 1.0%) of water, respectively. Overall, substantial losses in vegetative habitat were observed over the survey period attributable to decreased water level.

Creel: Directed fishing effort by anglers in 2010-2011 was highest for largemouth bass (59.8%), followed by anglers fishing for catfish (32.7%), no species preference (2.8%) and blue catfish (2.7%), (Table 5). Total fishing effort for all species at Choke Canyon Reservoir was 222,710 h and anglers spent an estimated $2,601,509 on direct expenditures in 2010-2011 (Table 6). This represents a 27.0% and a 35.8% decrease in fishing effort (305,201 h) and direct expenditures ($4,052,758), respectively, from the 2009-2010 survey (Table 6).

Prey Species: Gizzard shad abundance remained stable but was relatively low over the survey period with an electrofishing catch rate of 59.5/h in 2011 (Figure 2). Population size structure of gizzard shad shifted to smaller sizes as evidenced by IOV increasing from 58 in 2009 to 89 in 2011; indicating the majority of individuals collected were of suitable size as forage to predator fishes. Threadfin shad CPUE in 2011 was 77.5/h, further contributing to the shad forage base (Appendix A). Bluegill and redear sunfish were relatively abundant in 2011. Electrofishing catch rate of bluegill in 2011 was 99.5/h, lower than values in 2009 (142.0/h) and 2010 (175.5/h) (Figure 3). Electrofishing CPUE of redear sunfish in 2011 was 95.0/h, lower than catches in 2009 (141.0/h) but similar to 2010 (98.0/h) (Figure 4). Both bluegill and redear sunfish populations were dominated by individuals < 6 in and should provide excellent forage to predator species. Sampling indicated some large sunfish were present thus providing added recreational value to anglers. Overall prey abundance was sufficient to maintain predator abundance, growth, and body condition.

Blue catfish: Abundance of blue catfish remained high over the survey period. The 2012 gill net catch rate for blue catfish was 30.7/nn, lower than collections in 2010 (42.5/nn) but higher than catches in 2011 (21.7/nn) (Figure 5). Proportional size distribution was low and remained similar (range: 12 – 14) over the period and indicated a blue catfish population comprised primarily of smaller individuals. Roughly 26% of the fish sampled were ≥ 12 in total length and available to angler harvest. Several (N = 17) quality-sized (≥ 20 in) individuals were collected and CPUE-20 was consistent across years (Figure 5). Condition of fish greater than 12 in total length remained consistent across years for most size classes and increased with increasing length (Figure 5). Directed effort and harvest decreased substantially in 2010-2011 compared to previous years (Table 7). Anglers most frequently harvested 13 – 17 in blue catfish (Figure 6). Average angler catch rate (#/h) was consistent in years 2009-2010 (1.12/h) and 2010-2011 (1.14/h); both higher than the 2008-2009 rate of 0.76/h (Table 7). Blue catfish continued to provide a valuable component to the sport fishery at the reservoir.

Channel catfish: Relative abundance of channel catfish was consistent and remained relatively low throughout the survey period (gill net CPUE range: 2.3/nn – 2.7/nn) (Figure 7). The sample was

dominated by smaller individuals and only one fish in the 2012 catch was legal size (≥ 12 in). Anglers only spent 188 h specifically targeting channel catfish and harvest was estimated at 2,862 fish in 2010-2011 (Table 8). Fish 12 – 14 in total length comprised the majority of harvest (Figure 8).

White bass: The gill net catch rate of white bass was 7.2/nn in 2012, considerably higher than rates in 2010 (1.2/nn) and 2011 (1.9/nn) (Figure 9). Legal length fish (≥ 10 in) constituted 91% of the sample in 2012. However, results from the 2012 survey should be viewed with caution as the sample was conducted earlier than normal and is likely coincident with the annual spawning run since the majority of fish sampled were collected in river sets. Directed fishing effort, angler catch per hour, and total harvest were low in 2009-2010 and 2010-2011 and substantially decreased from 2008-2009 (Table 9). Harvested fish ranged in length between 10 – 15 in (Figure 10).

Largemouth bass: The electrofishing catch rate of stock-length (≥ 8 in) largemouth bass was 241.0/h in 2011, considerably higher than 93.0/h in 2009 and 161.0/h in 2010 (Figure 11). Population size structure in 2011 was dominated by smaller individuals as indicated by low PSD (33). However, catch of legal-size and larger fish was excellent as evidenced by high CPUE-14 (41.0/h) and CPUE-18 (13.0/h) values (Figure 11). In 2011, relative weights of stock-size largemouth bass averaged 90 for most inch groups and increased for larger size classes. Mean age at legal length in 2011 was 2.4 years. Growth was considered good but has slowed throughout the survey period (Table 10). Total annual mortality (*A*) for the population was considered moderate, estimated at 0.41 in 2008 (Appendix G). Strong year classes were produced in 2003, 2004, and 2007 immediately following dramatic water level increases (Figure 1; Appendix G). Introgression of Florida largemouth bass genetics in the population has remained high over the past decade (%FLMB allele; mean =83, range: 78 – 89, N = 9). In 2011, 17% of the population had the Florida largemouth bass genotype (Table 11). Largemouth bass continued to be the most sought sport fish in the reservoir and represented 60% of all directed effort (Table 5). Directed effort, catch per hour, and total harvest for largemouth bass was 133,417 h, 0.56 fish/h, and 17,910 fish, respectively, from 1 June 2010 through 31 May 2011. In 2010-2011, total fishing effort declined considerably (34.4%) while harvest increased (6.7%) when compared to the 2009-2010 survey period (Table 12). Largemouth bass tournaments were an important component to the largemouth bass fishery at the reservoir. In 2009-2010 and 2010-2011, tournament anglers represented 29.9 and 22.7% of total fishing effort and 46.1 and 49.6% of the total catch, respectively (Table 12). The majority of legal largemouth bass caught were released, ranging from 66 – 74 percent (Table 12). Harvested fish ranged from 14 – 24 inches total length and the majority of observed harvest occurred in the 14 – 17 in size range (Figure 12). Over the creel survey periods, 292 largemouth bass weighing >10 lbs and 1,359 fish weighing between 7 and 10 lbs were caught and released by anglers. Further, seven ShareLunkers were donated to TPWD from 2009 through 2010 and the lake record was broken in 2009 and currently stands at 15.45 pounds.

White crappie: The trap net catch rate of white crappie was 2.1/nn in 2011, similar to 2007 (1.3/nn) and 2009 (1.8/nn) (Figure 13). Size structure of white crappie in 2011 indicated a balanced but limited population in terms of overall abundance. Directed effort, angler catch rate, and total harvest dropped substantially over the creel survey periods (Table 13). Angler compliance was excellent and harvested fish ranged in length between 10 – 14 in (Figure 14).

Fisheries management plan for Choke Canyon Reservoir, Texas.

Prepared – July 2012

Issue 1: The reservoir continues to be a popular destination for anglers. Collection of quantitative data such as angler effort, catch, and harvest is necessary to evaluate trends in angler oriented statistics.

MANAGEMENT STRATEGIES

1. Conduct an access point creel survey spanning 1 June 2013 through 31 May 2014.and 1 June 2015 through 31 May 2016
2. Maintain and continue to collect data for largemouth bass trophy database.

Issue 2: Choke Canyon is valued for its high quality largemouth bass fishery and for catches of trophy-size fish. From 2008 – 2011, 292 largemouth bass weighing >10 lbs and 1,359 fish weighing between 7 and 10 lbs were caught and released by anglers. It has produced a total of 13 ShareLunkers, seven of which were caught between 2009 and 2010. Further, the lake record was broken in 2009 and currently stands at 15.45 pounds.

MANAGEMENT STRATEGIES

1. When water level increases, request FLMB fingerlings for stocking to maintain a high level Florida bass introgression production of trophy fish.

Issue 3: Relative abundance and size structure of white bass is excellent providing anglers a high quality fishery. Directed effort and harvest of white bass decreased substantially from 2008/2009 estimates and has remained low.

MANAGEMENT STRATEGIES

1. Disseminate and publish local and statewide press releases regarding high quality white bass angling opportunities.
2. Continue to monitor the population with standard gill net surveys conducted annually.

Issue 4: Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, Giant Salvinia (*Salvinia molesta*) and other invasive vegetation species can form dense mats, interfering with recreational activities like fishing, boating, skiing and swimming. The financial costs of controlling and/or eradicating these types of invasive species are significant. Additionally, the potential for invasive species to spread to other river drainages and reservoirs via watercraft and other means is a serious threat to all public waters of the state. Exotic plants such as water hyacinth and hydrilla have historically been a severe problem, primarily in the upper end and tributaries of the reservoir. These exotic plants restrict recreational use and can impact the quality of fish and wildlife habitat restricting growth and colonization of native vegetation.

MANAGEMENT STRATEGIES

1. Cooperate with the controlling authority to post appropriate signage at access points around the reservoir.
2. Contact and educate marina owners about invasive species, and provide them with posters, literature,

etc… so that they can in turn educate their customers.
3. Educate the public about invasive species through the use of media and the internet.
4. Make a speaking point about invasive species when presenting to constituent and user groups.
5. Keep track of (i.e., map) existing and future inter-basin water transfers to facilitate potential invasive species responses.
6. Monitor water hyacinth and other exotic nuisance vegetation through vegetation surveys.
7. Revisit the water hyacinth control program and continue to cooperate with the city of Corpus Christi on all vegetation control activities.

SAMPLING SCHEDULE JUSTIFICATION

The proposed sampling schedule includes annual electrofishing and gill netting, biennial trap netting and mandatory monitoring in 2015/2016. A creel survey will be conducted in 2013/2014 and 2015/2016 to monitor catch and harvest of important sport fish species. A Federal Aid report will be prepared in 2016. A sampling schedule can be found in Table 14.

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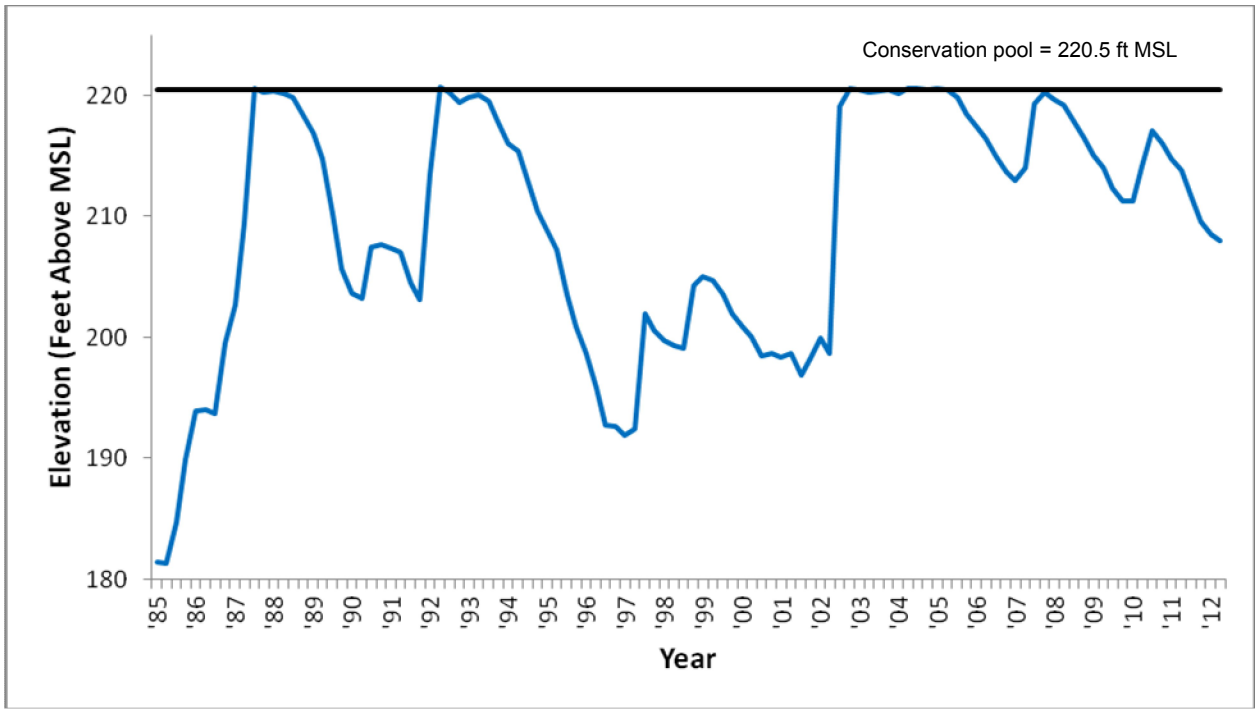


Figure 1. Mean quarterly water elevations in feet above mean sea level (MSL) recorded for Choke Canyon Reservoir, Texas, 1985 through May 2012.

Table 1. Characteristics of Choke Canyon Reservoir, Texas.

Characteristic	Description
Year constructed	1982
Controlling authority	City of Corpus Christi, Nueces River Authority, U.S. Bureau of Reclamation, TPWD (surrounding lands)
Counties	Live Oak, McMullen
Reservoir type	Mainstem
Shoreline Development Index	7.1
Conductivity (umhos/cm)	600
Access: Boat	Good – 6 public ramps
Bank	Adequate – 6 public ramp areas, 1 fishing jetty, Wildlife Management Area access, State Park shoreline access
Physically challenged	Adequate – Calliham State Park – concrete jetty Inadequate – South Shores State Park

Table 2. Harvest regulations for Choke Canyon Reservoir, Texas.

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, largemouth	5	14 – No Limit
Crappie: white and black crappie, their hybrids and subspecies	25 (in any combination)	10 – No Limit

Table 3. Stocking history at Choke Canyon Reservoir, Texas. Size categories are: FRY = ≤ 1.0 inch, FGL = 1-3 inches and ADL = adults.

Species	Year	Number	Size
Threadfin shad	1981	10,000	ADL
	1982	4,000	ADL
	1983	8,000	ADL
	Total	22,000	
Fathead minnow	1981	Unknown	ADL
	Total	Unknown	
Blue catfish	1982	98,800	FGL
	1983	102,088	FGL
	Total	200,088	
Channel catfish	1981	92,800	FGL
	1982	307,000	FGL
	1983	91,256	FGL
	Total	490,456	
Striped bass	1983	102,600	FGL
	Total	102,600	
Northern largemouth bass	2003	107,137	FGL
	2004	99,632	FGL
	2005	102,314	FGL
	Total	309,083	
Florida largemouth bass	1981	19,906	FGL
	1982	146,030	FGL
	1983	143,368	FGL
	1990	375,790	FRY
	1998	383,565	FGL
	2002	384,236	FGL
	2003	180,014	FGL
	2009	5,151	FGL
	2010	526,015	FGL
	2011	653,297	FGL
	Total	2,817,372	
White crappie	1992	148,294	FRY
	1993	33,380	FGL
	Total	181,674	

Table 4. Survey of littoral zone and physical habitat types, Choke Canyon Reservoir, Texas, 2011. A habitat survey was conducted in 2007 and linear shoreline distance (miles) was recorded for each habitat type for the entire reservoir. A vegetation survey was conducted in 2011. Surface area and percent of reservoir surface area were determined for each type of aquatic vegetation for the entire reservoir. Surface area estimates are based on the acreage of water containing a specific vegetation type not the total acreage of vegetation. The reservoir was 9 feet below conservation pool at the time of sampling (20,999 acres).

Habitat type	Shoreline Distance		Surface Area of Water with Vegetation	
	Miles	Percent of total	Acres	Percent of reservoir surface area
Shoreline habitat				
Rip-rap	1.3	0.7		
Eroded bank	30.5	16.9		
Rocky/gravel	1.5	0.8		
Natural	142.2	80.2		
Concrete	2.6	1.4		
Total	181.1	100		
Vegetation				
Native submersed vegetation			299.8	1.4
American pondweed			25.7	0.1
Coontail			64.7	<0.1
Water stargrass			202.8	1.0
Exotic vegetation			656.0	3.1
Water hyacinth			39.9	0.2
Hydrilla			616.1	2.9
Adjacent to shoreline				
Standing timber			2,563	9.9

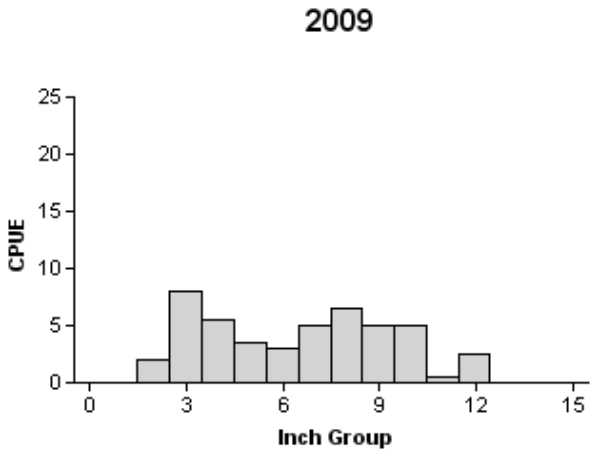
Table 5. Percent of total angling effort directed to individual sport fish species at Choke Canyon Reservoir, Texas, June 2008 through May 2011.

	Year		
Species	2008/2009	2009/2010	2010/2011
All catfish species	34.5	24.3	32.7
Blue catfish	7.1	4.7	2.7
Channel catfish	<1.0	<1.0	<1.0
Flathead catfish	-	<1.0	<1.0
White bass	3.2	<1.0	1.0
Largemouth bass	51.0	66.7	59.8
White crappie	2.2	<1.0	<1.0
Anything	1.7	2.1	2.8

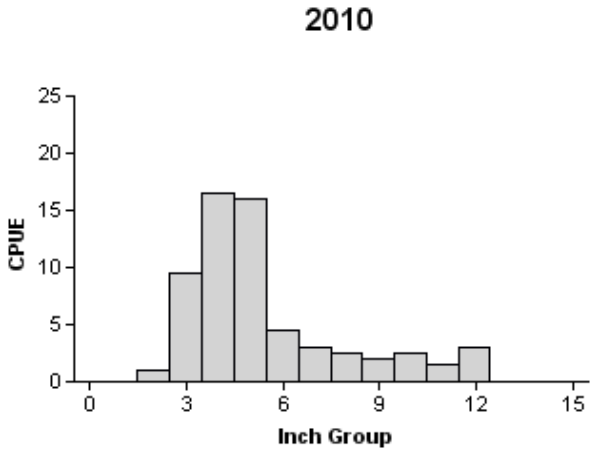
Table 6. Total angling effort for all species and total direct angling expenditures for Choke Canyon Reservoir, Texas, June 2008 through May 2011.

	Year		
Creel Statistic	2008/2009	2009/2010	2010/2011
Total fishing effort (h)	331,509	305,201	222,710
Total directed expenditures	$2,953,744	$4,052,758	$2,601,509

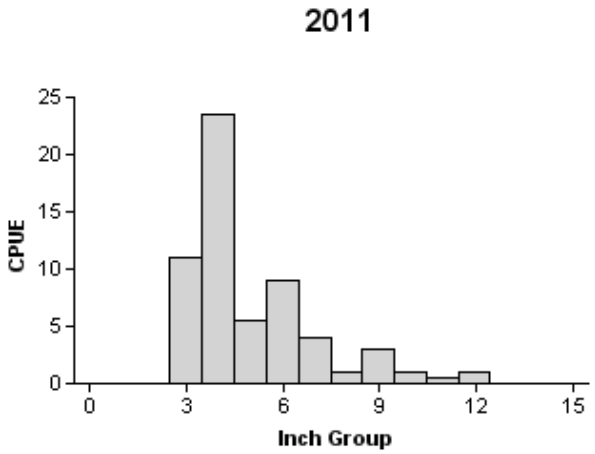
Gizzard shad



Effort = 2.0
Total CPUE = 46.5 (18; 93)
IOV = 58 (9)



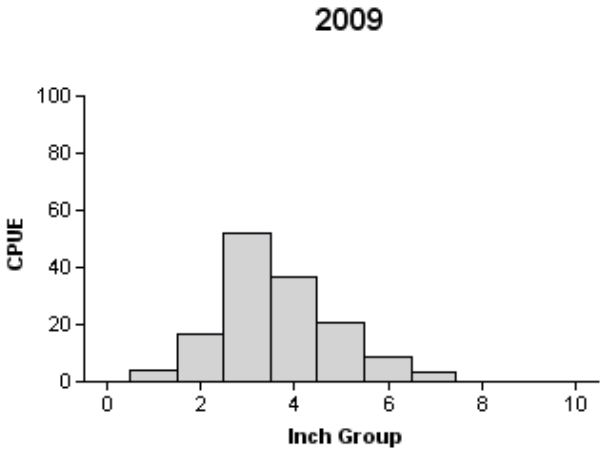
Effort = 2.0
Total CPUE = 62.0 (28; 124)
IOV = 80 (5)



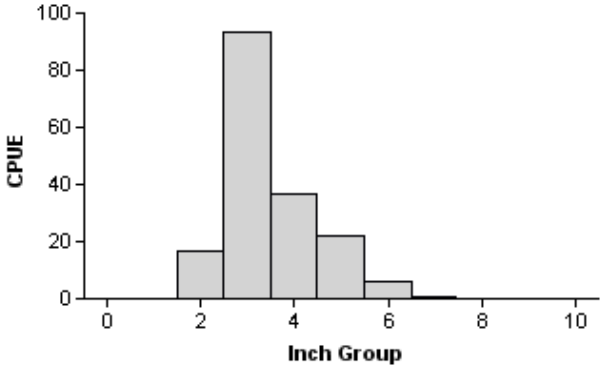
Effort = 2.0
Total CPUE = 59.5 (36; 119)
IOV = 89 (6)

Figure 2. Comparison of the number of gizzard shad caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Choke Canyon Reservoir, Texas, 2009, 2010, and 2011.

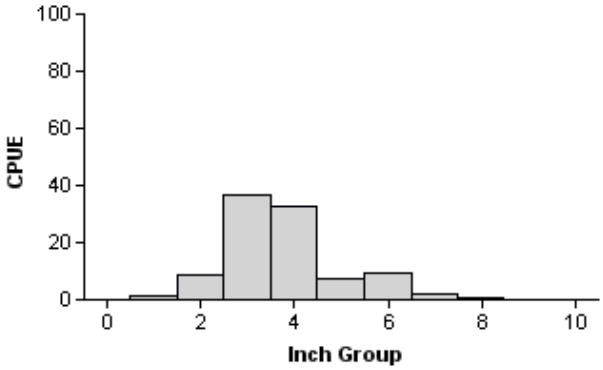
Bluegill



Effort = 2.0
Total CPUE = 142.0 (23; 284)
Stock CPUE = 121.5 (21; 243)
CPUE-6 = 12.5 (23; 25)
PSD = 10 (2)



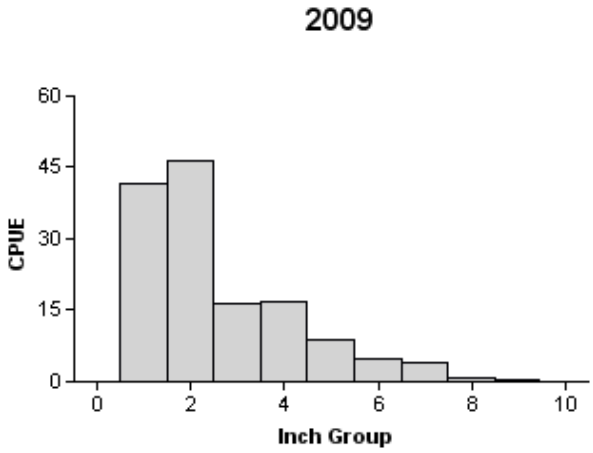
Effort = 2.0
Total CPUE = 175.5 (27; 351)
Stock CPUE = 159.0 (26; 318)
CPUE-6 = 7.0 (34; 14)
PSD = 4 (2)



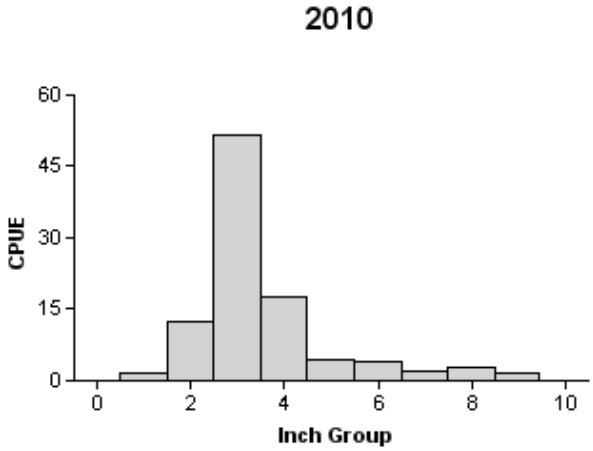
Effort = 2.0
Total CPUE = 99.5 (22; 199)
Stock CPUE = 89.0 (23; 178)
CPUE-6 = 12.0 (35; 24)
PSD = 13 (5)

Figure 3. Comparison of the number of bluegill caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Choke Canyon Reservoir, Texas, 2009, 2010, and 2011.

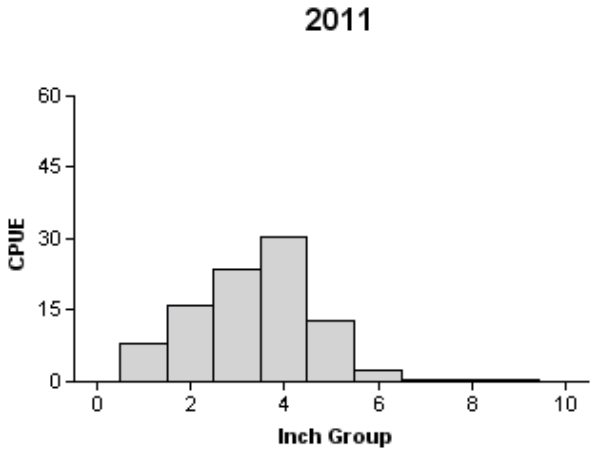
Redear sunfish



Effort = 2.0
Total CPUE = 141.0 (28; 282)
Stock CPUE = 36.5 (21; 73)
CPUE-6 = 10.5 (35; 21)
PSD = 15 (7)



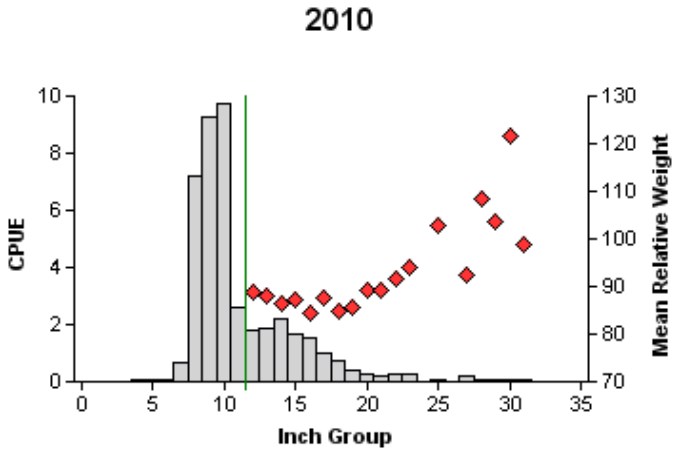
Effort = 2.0
Total CPUE = 98.0 (21; 196)
Stock CPUE = 32.5 (13; 65)
CPUE-6 = 10.5 (25; 21)
PSD = 20 (8)



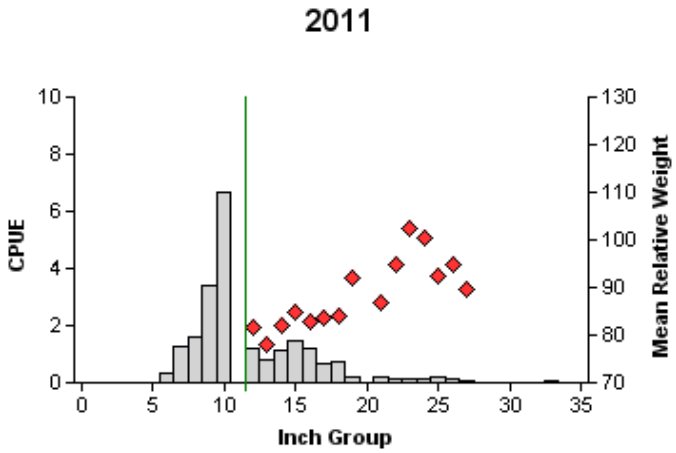
Effort = 2.0
Total CPUE = 95.0 (17; 190)
Stock CPUE = 47.5 (19; 95)
CPUE-6 = 4.0 (43; 8)
PSD = 3 (2)

Figure 4. Comparison of the number of redear sunfish caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Choke Canyon Reservoir, Texas, 2009, 2010, and 2011.

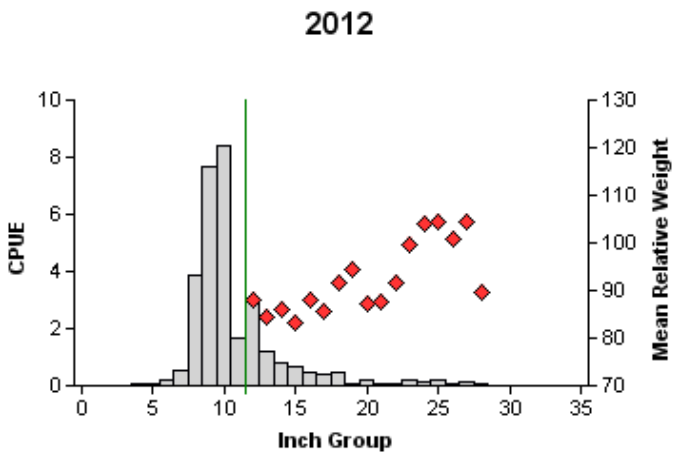
Blue catfish



Effort = 15.0
Total CPUE = 42.5 (14; 637)
Stock CPUE = 12.8 (9; 192)
CPUE-20 = 1.6 (26; 24)
PSD = 12 (3)



Effort = 15.0
Total CPUE = 21.7 (22; 326)
Stock CPUE = 8.5 (21; 127)
CPUE-20 = 1.1 (27; 16)
PSD = 13 (4)



Effort = 15.0
Total CPUE = 30.7 (18; 461)
Stock CPUE = 8.3 (13; 124)
CPUE-20 = 1.1 (26; 17)
PSD = 14 (4)

Figure 5. Comparison of the 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, Choke Canyon Reservoir, Texas, 2010, 2011, and 2012. Vertical lines denote 12-inch minimum length limit.

Blue catfish

Table 7. Creel survey statistics for blue catfish at Choke Canyon Reservoir from June 2008 through May 2011. Total catch per hour represents anglers targeting blue catfish and total harvest is estimated number of blue catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

	Year		
Creel Survey Statistic	2008/2009	2009/2010	2010/2011
Directed effort (h)	23,625 (21)	14,417 (20)	6,118 (29)
Directed effort/acre	1.02 (21)	0.68 (20)	0.26 (29)
Average angler catch rate (#/h)	0.76 (43)	1.12 (44)	1.14 (51)
Total harvest	147,420 (23)	115,596 (26)	38,366 (25)
Harvest/acre	6.34 (23)	5.43 (26)	1.65 (25)

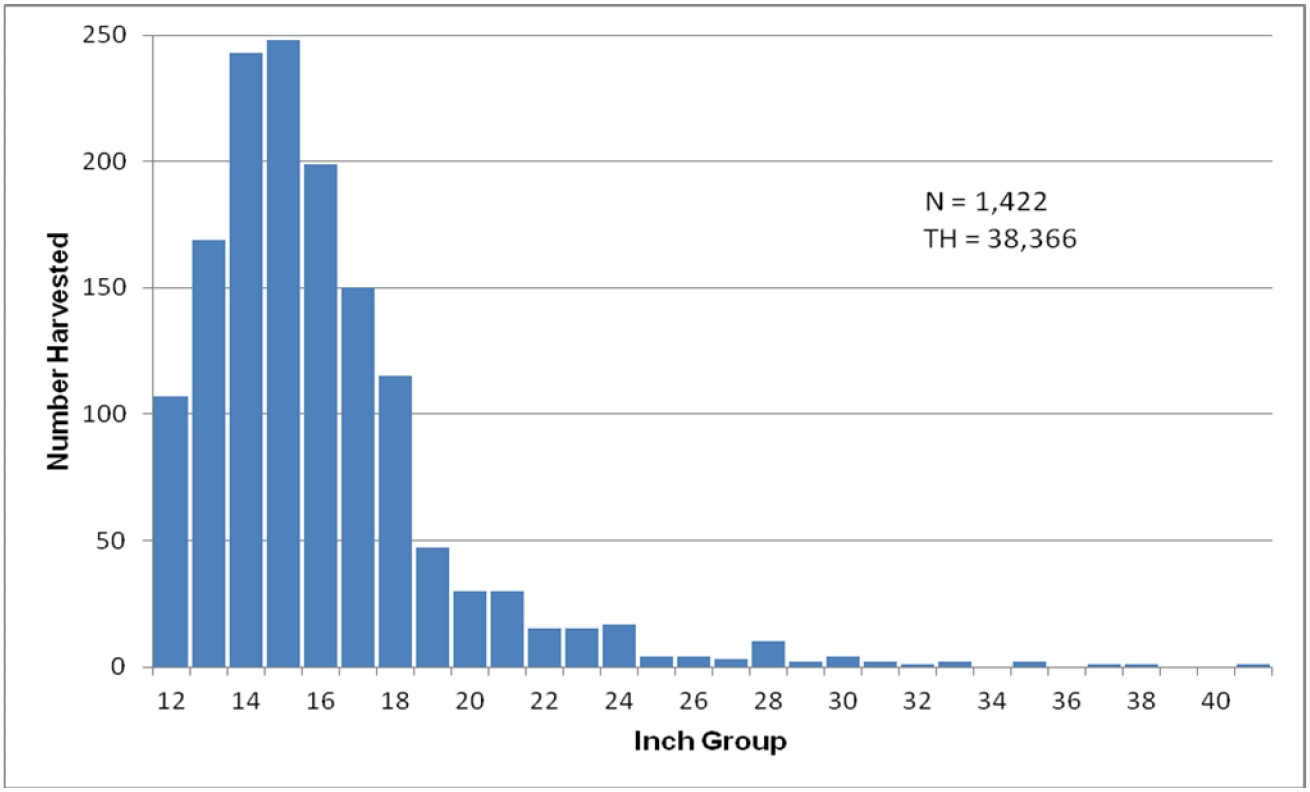
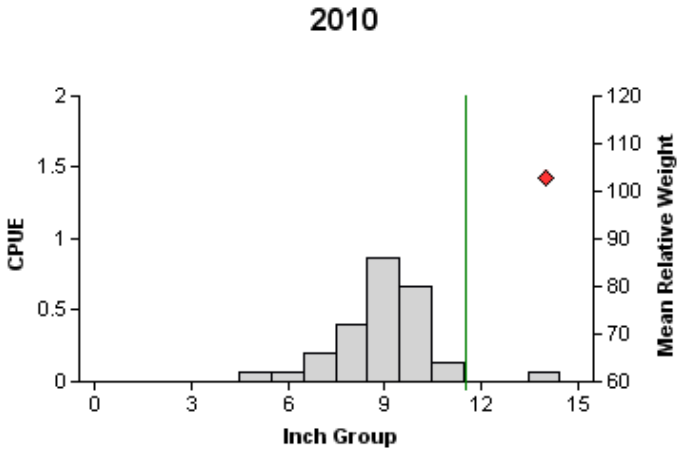
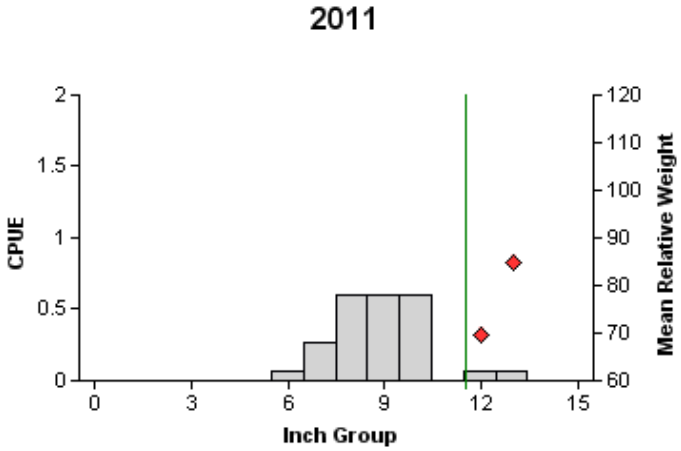


Figure 6. Length frequency of harvested blue catfish observed during creel surveys at Choke Canyon Reservoir, Texas, June 2010 through May 2011, all anglers combined. N is the number of harvested blue catfish observed during creel surveys and TH is the total estimated harvest for the creel period.

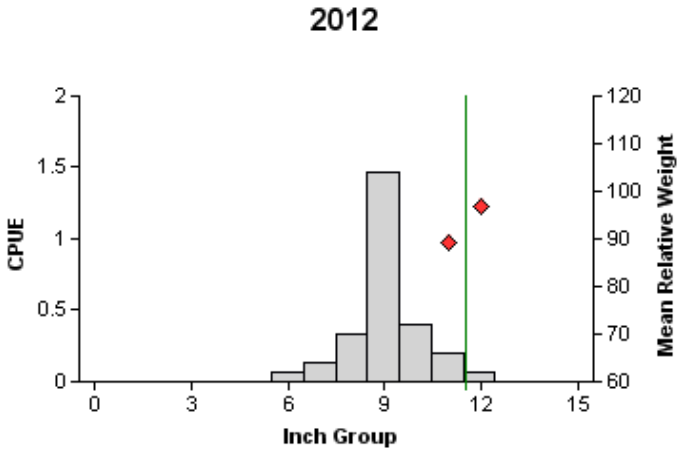
Channel catfish



Effort = 15.0
Total CPUE = 2.5 (30; 37)
Stock CPUE = 0.2 (72; 3)



Effort = 15.0
Total CPUE = 2.3 (27; 34)
Stock CPUE = 0.1 (100; 2)



Effort = 15.0
Total CPUE = 2.7 (30; 40)
Stock CPUE = 0.2 (56; 4)

Figure 7. Comparison of the 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, Choke Canyon Reservoir, Texas, 2010, 2011, and 2012. Vertical lines denote 12-inch minimum length limit.

Channel catfish

Table 8. Creel survey statistics for channel catfish at Choke Canyon Reservoir from June 2008 through May 2011. Total catch per hour represents anglers targeting channel catfish and total harvest is estimated number of channel catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

	Year		
Creel Survey Statistic	2008/2009	2009/2010	2010/2011
Directed effort (h)	192 (137)	292 (97)	188 (116)
Directed effort/acre	0.01 (137)	0.01 (97)	0.01 (116)
Average angler catch rate (#/h)	0.14 (***)	8.00 (***)	0.22 (50)
Total harvest	21,136 (29)	11,475 (40)	2,862 (44)
Harvest/acre	0.91 (29)	0.54 (40)	0.12 (44)

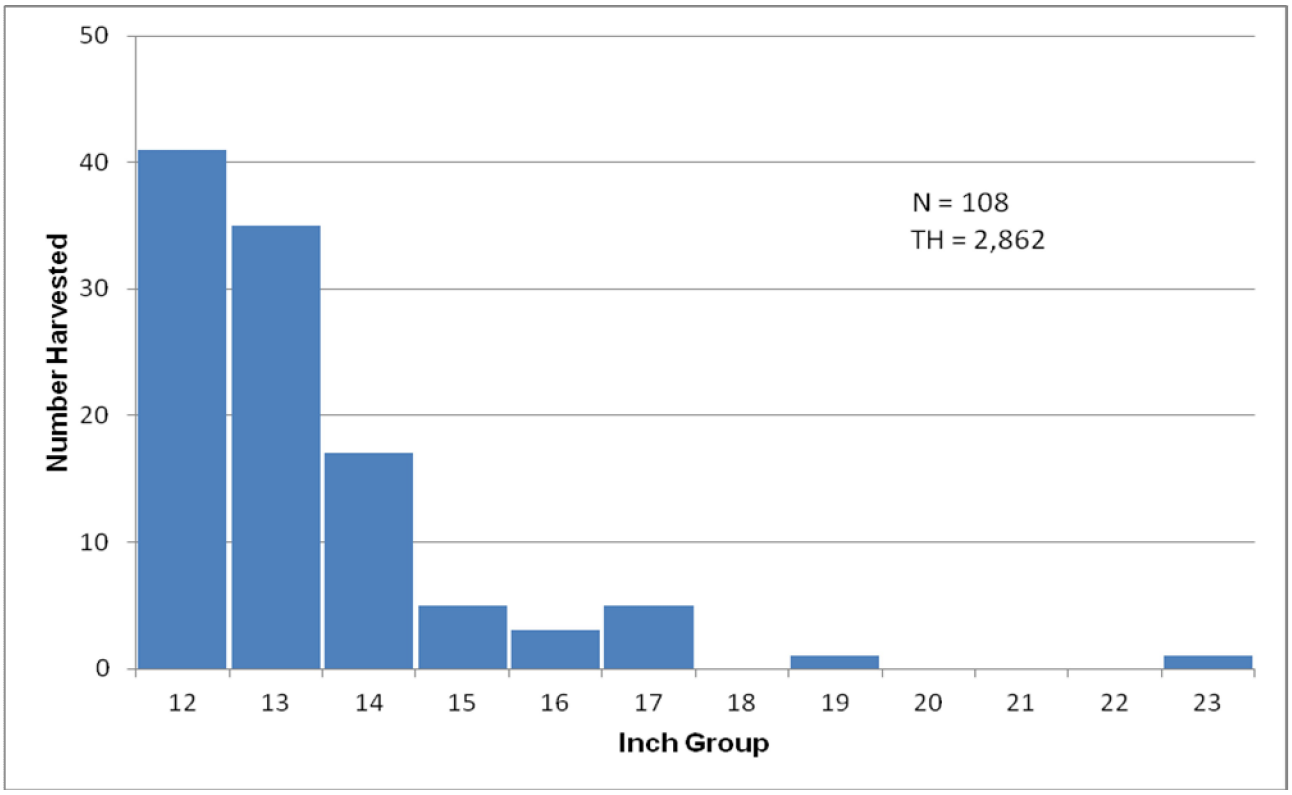
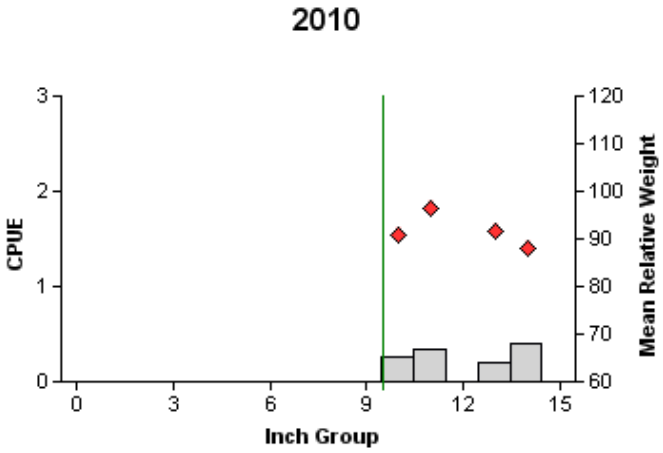
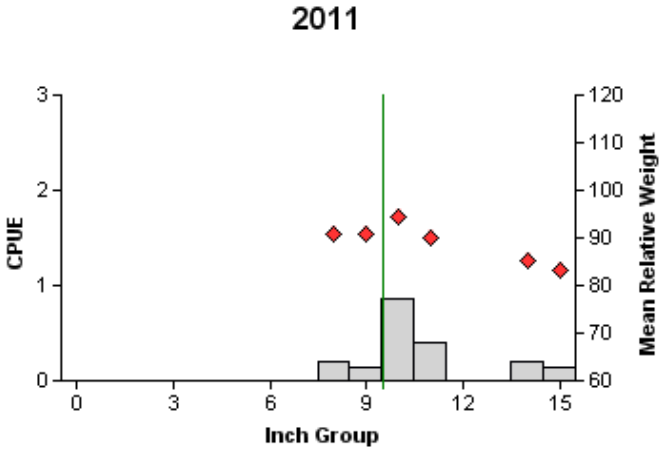


Figure 8. Length frequency of harvested channel catfish observed during creel surveys at Choke Canyon Reservoir, Texas, June 2010 through May 2011, all anglers combined. N is the number of harvested channel catfish observed during creel surveys and TH is the total estimated harvest for the creel period.

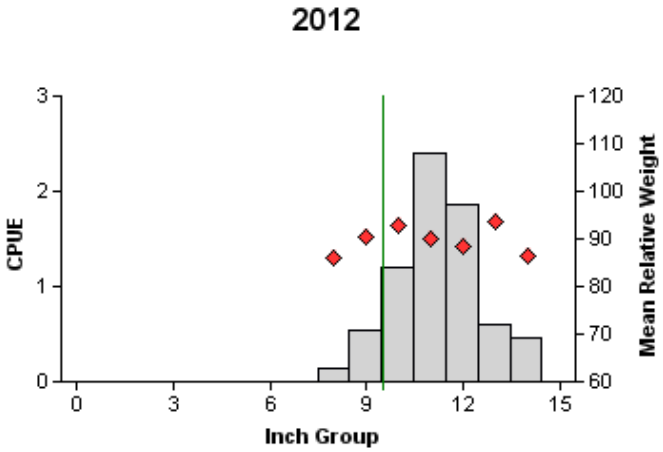
White bass



Effort = 15.0
Total CPUE = 1.2 (46; 18)
CPUE-10 = 1.2 (46; 18)
PSD = 100 (0)



Effort = 15.0
Total CPUE = 1.9 (42; 29)
CPUE-10 = 1.6 (42; 24)
PSD = 90 (6)



Effort = 15.0
Total CPUE = 7.2 (35; 108)
CPUE-10 = 6.5 (37; 98)
PSD = 98 (1)

Figure 9. Comparison of the number of white 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 spring gill net surveys, Choke Canyon Reservoir, Texas, 2010, 2011, and 2012. Vertical lines denote 10-inch minimum length limit.

White bass

Table 9. Creel survey statistics for white bass at Choke Canyon Reservoir from June 2008 through May 2011. Total catch per hour represents anglers targeting white bass and total harvest is estimated number of white bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

	Year		
Creel Survey Statistic	2008/2009	2009/2010	2010/2011
Directed effort (h)	10,523 (49)	1,372 (54)	2,128 (49)
Directed effort/acre	0.45 (49)	0.06 (54)	0.09 (49)
Average angler catch rate (#/h)	0.36 (53)	0.13 (15)	0.06 (43)
Total harvest	8,709 (70)	-	755 (189)
Harvest/acre	0.37 (70)	-	0.03 (189)

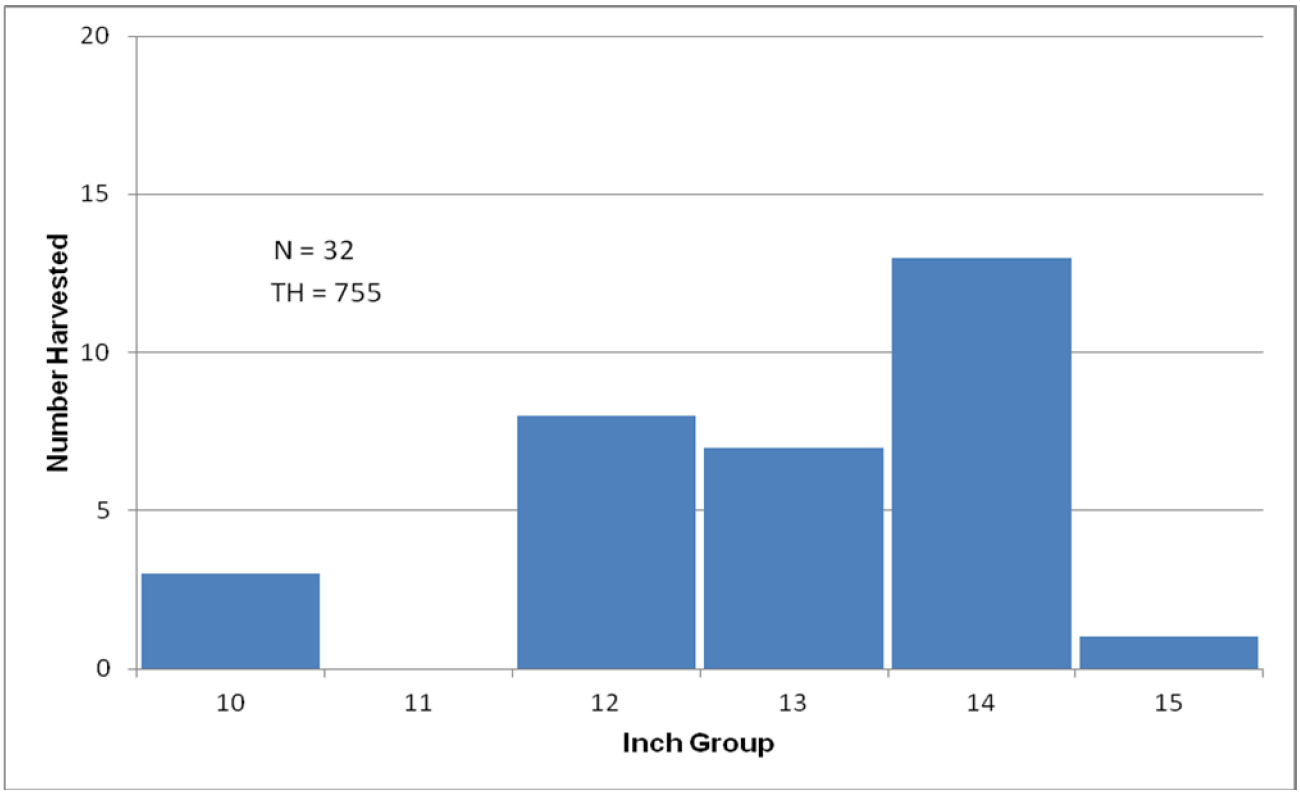
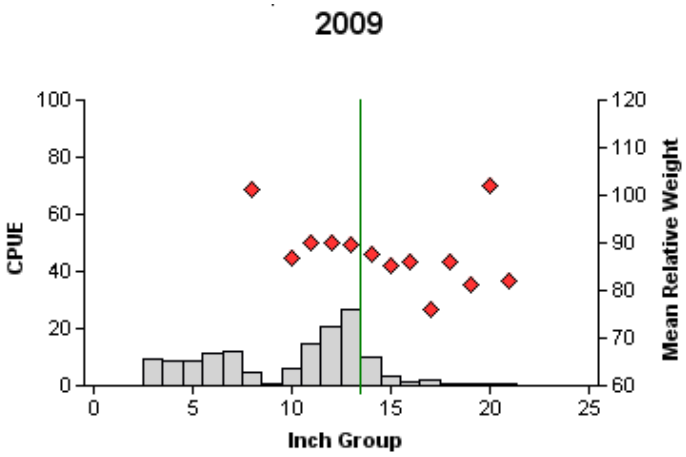
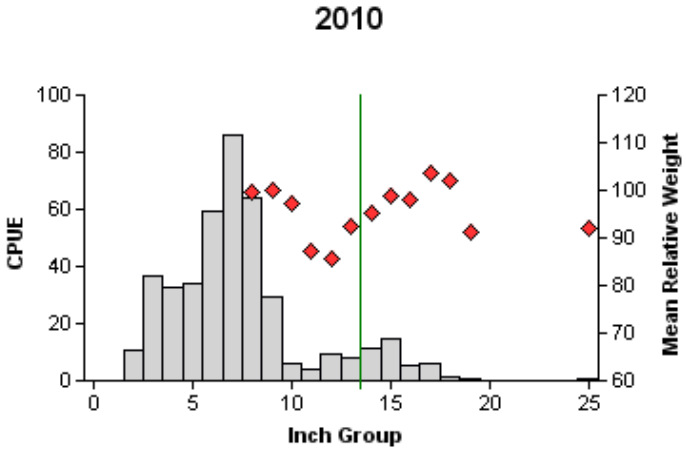


Figure 10. Length frequency of harvested white bass observed during creel surveys at Choke Canyon Reservoir, Texas, June 2010 through May 2011, all anglers combined. N is the number of harvested white bass observed during creel surveys and TH is the total estimated harvest for the creel period.

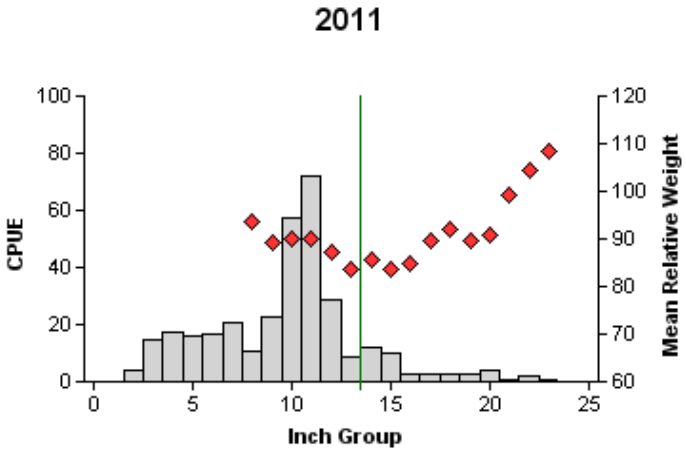
Largemouth bass



Effort = 2.0
Total CPUE = 144.0 (20; 288)
Stock CPUE = 93.0 (24; 186)
CPUE-14 = 19.5 (24; 39)
CPUE-18 = 2.5 (41; 5)
PSD = 72 (3)



Effort = 2.0
Total CPUE = 421.5 (15; 843)
Stock CPUE = 161.0 (14; 322)
CPUE-14 = 40.0 (16; 80)
CPUE-18 = 2.5 (50; 5)
PSD = 36 (5)



Effort = 2.0
Total CPUE = 330.5 (22; 661)
Stock CPUE = 241.0 (24; 482)
CPUE-14 = 41.0 (18; 82)
CPUE-18 = 13.0 (25; 26)
PSD = 33 (4)

Figure 11. Comparison of the 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, Choke Canyon Reservoir, Texas, 2009, 2010, and 2011. Vertical lines denote 14-inch minimum length limit.

Largemouth bass

Table 10. Mean age at legal length (14 in) for largemouth bass collected by fall electrofishing, Choke Canyon Reservoir. Standard deviations are in parenthesis.

Year	N	Age Range	Age-at-Length
2008	53	1 – 4	1.7 (0.79)
2009	13	1 – 3	2.0 (0.40)
2010	15	1 – 3	2.2 (0.77)
2011	13	1 – 4	2.4 (0.86)

Table 11. Results of genetic analysis of largemouth bass collected by fall electrofishing, Choke Canyon Reservoir, Texas, 2002 – 2007 and 2009 – 2011. FLMB = Florida largemouth bass, NLMB = Northern largemouth bass, F1 = first generation intergrade between a FLMB and NLMB, and Fx = second or higher generation intergrade between a FLMB and NLMB. Largemouth bass genetic composition was determined using electrophoresis from 2002 through 2004 and using micro-satellite DNA from 2005 through 2007 and 2009 through 2011.

		Genotype					
Year	Sample size	FLMB	F1	Fx	NLMB	% FLMB alleles	% NLMB alleles
2002	24	16	0	8	0	89	11
2003	30	17	0	13	0	87	13
2004	30	15	3	12	0	85	15
2005	30	15	1	60	0	78	22
2006	30	3	0	27	0	80	20
2007	30	8	0	22	0	83	17
2009	30	5	0	25	0	82	18
2010	30	3	0	27	0	80	20
2011	30	5	0	25	0	83	17

Largemouth bass

Table 12. Creel survey statistics for largemouth bass at Choke Canyon Reservoir from June 2008 through May 2011. Directed effort (hours) was estimated for anglers specifically targeting largemouth bass. Harvest, catch, and release estimates (total number of fish) include largemouth bass caught by anglers specifically targeting this species. Angler catch rate is the average number of fish harvested and caught, respectively, per one-hour angling effort by anglers targeting this species. Percent legal release is the percentage of legal-size fish (>14 inches) caught and released. Separate estimates are provided for tournament anglers (TO) and non-tournament anglers (NT) and TOT represents TO and NT combined.

	2008/2009			2009/2010			2010/2011		
Creel Statistic	NT	TO	TOT	NT	TO	TOT	NT	TO	TOT
Directed effort (h)	137,695	31,313	169,008	142,631	60,878	203,509	103,155	30,262	133,417
Total harvest	17,007		17,007	5,217	11,495	16,712	5,039	12,871	17,910
Harvest/acre			0.73			0.78			0.77
Total catch	91,138	20,405	111,543	79,615	67,975	147,590	41,859	41,216	83,075
Angler catch rate (#/h)			0.68			0.69			0.56
Release <14 in	41,978	10,405	52,383	41,077	41,917	82,994	15,083	15,053	30,136
Release ≥14 in	32,153	10,000	42,153	33,321	14,563	47,884	21,736	13,293	35,029
< 4 lbs			37,065			43,476			31,743
4-7 lbs			4,514			3,683			2,934
7-10 lbs			515			604			240
>10 lbs			59			121			112
Percent legal release			71.3			74.1			66.2

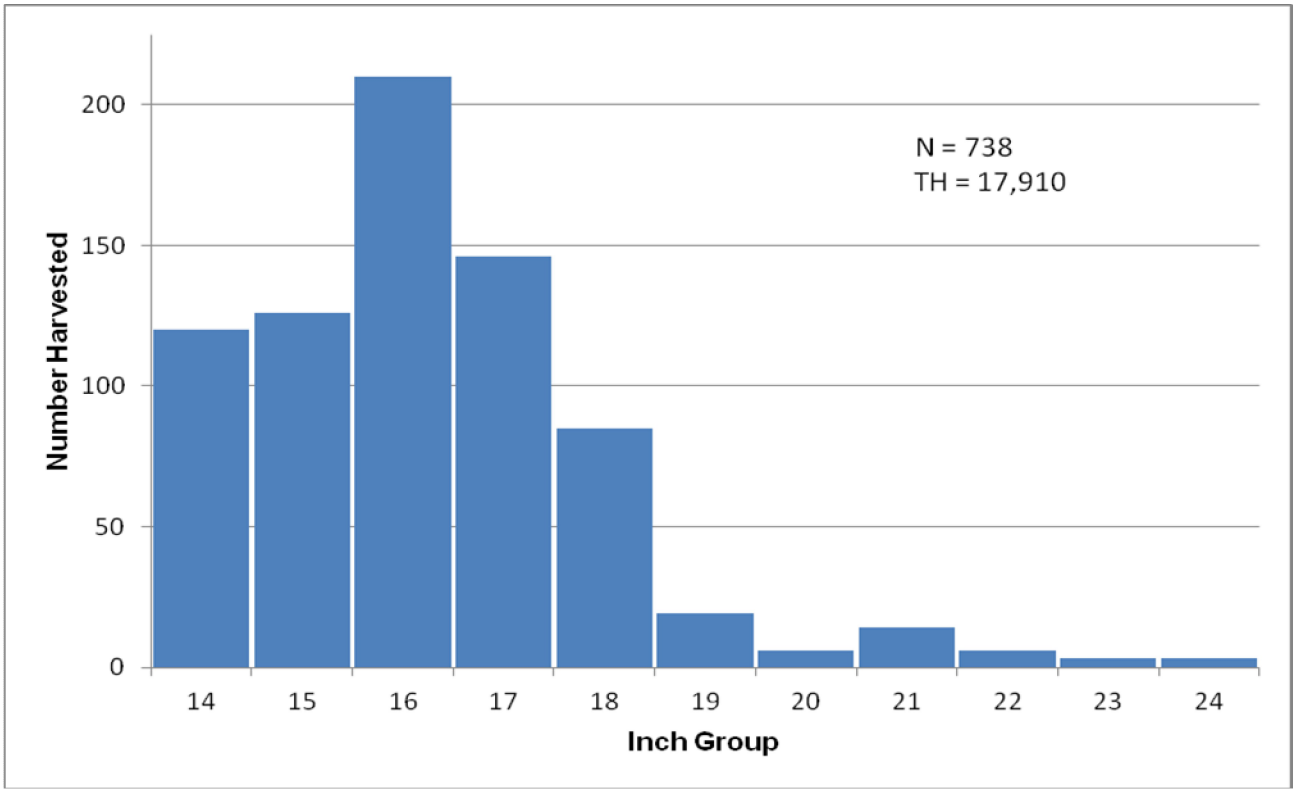
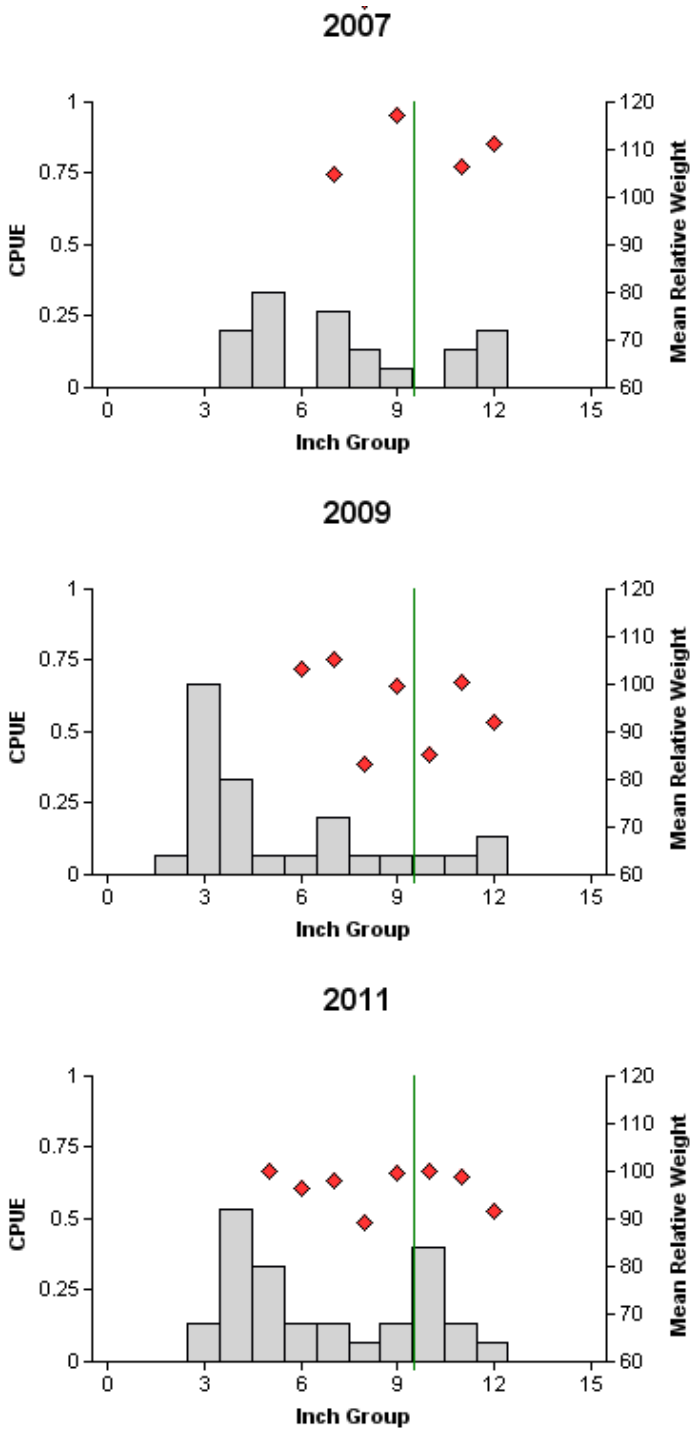


Figure 12. Length frequency of harvested largemouth bass observed during creel surveys at Choke Canyon Reservoir, Texas, June 2010 through May 2011, all anglers combined. N is the number of harvested largemouth bass observed and TH is the total estimated harvest for the creel period.

White crappie



Effort = 15.0
Total CPUE = 1.3 (38; 20)
Stock CPUE = 1.1 (35; 17)
CPUE-10 = 0.3 (48; 5)
PSD = 47 (14)

Effort = 15.0
Total CPUE = 1.8 (48; 27)
Stock CPUE = 0.7 (24; 11)
CPUE-10 = 0.3 (44; 4)
PSD = 55 (16)

Effort = 15.0
Total CPUE = 2.1 (35; 31)
Stock CPUE = 1.4 (35; 21)
CPUE-10 = 0.6 (42; 9)
PSD = 57 (8)

Figure 13. Comparison of the number of white crappie 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 fall trap net surveys, Choke Canyon Reservoir, Texas, 2007, 2009, and 2011. Vertical lines denote 10-inch minimum length limit. Biologist-selected sites were used in 2011 survey.

White crappie

Table 13. Creel survey statistics for white crappie at Choke Canyon Reservoir from June 2008 through May 2011. Total catch per hour represents anglers targeting white crappie and total harvest is estimated number of white crappie harvested by all anglers. Relative standard errors (RSE) are in parentheses.

	Year		
Creel Survey Statistic	2008/2009	2009/2010	2010/2011
Directed effort (h)	7,133 (29)	2,395 (40)	743 (65)
Directed effort/acre	0.31 (29)	0.11 (40)	0.03 (65)
Average angler catch rate (#/h)	0.99 (31)	0.62 (61)	0.04 (242)
Total harvest	16,567 (51)	3,850 (113)	612 (219)
Harvest/acre	0.71 (51)	0.18 (113)	0.03 (219)

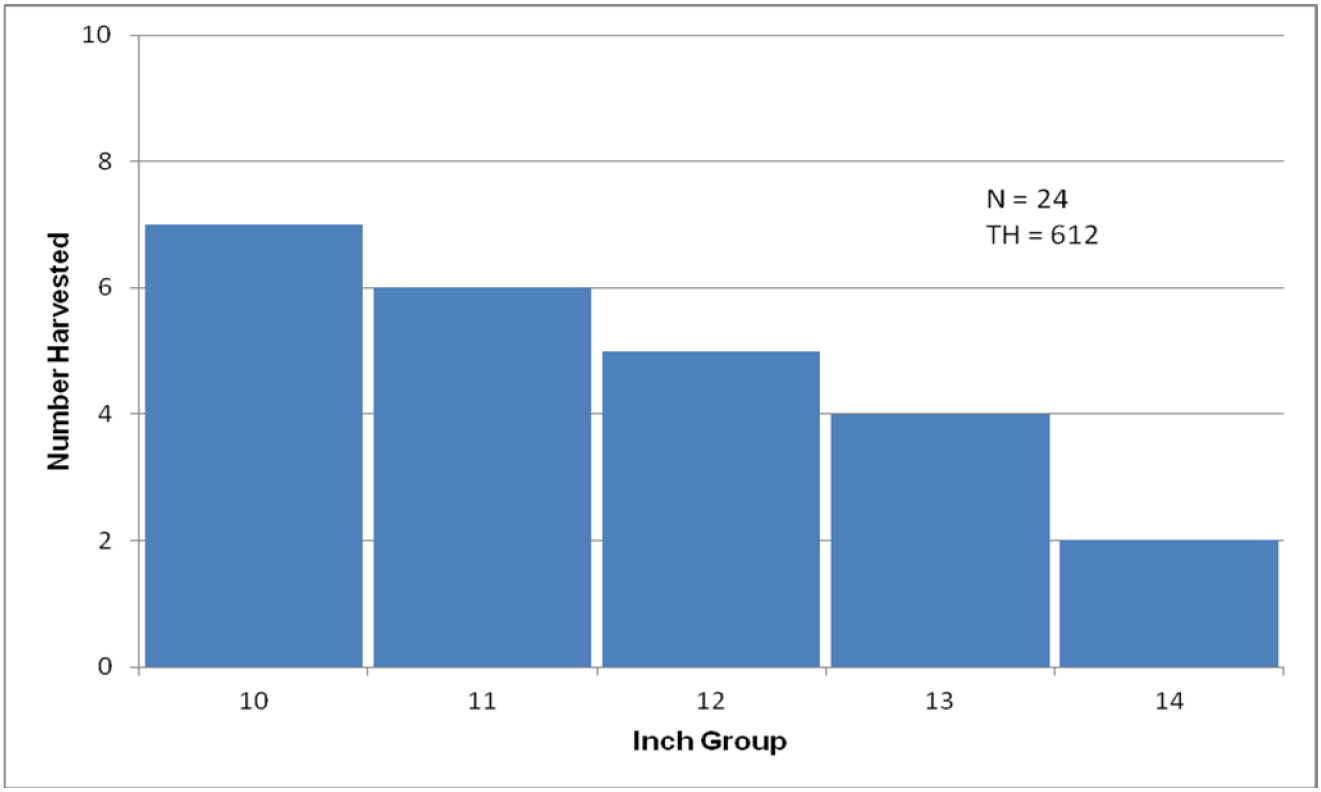


Figure 14. Length frequency of harvested white crappie observed during creel surveys a Choke Canyon Reservoir, Texas, June 2010 through May 2011, all anglers combined. N is the number of harvested white crappie observed during creel surveys and TH is the total estimated harvest for the creel period.

Table 14. Proposed survey schedule for Choke Canyon Reservoir, Texas. Creel surveys are conducted over a 12 month period with a total of 36 creel days. Trap net and electrofishing surveys are conducted in the fall, gill net surveys are conducted in the spring. Standard surveys are denoted by “S” and additional surveys denoted by “A”.

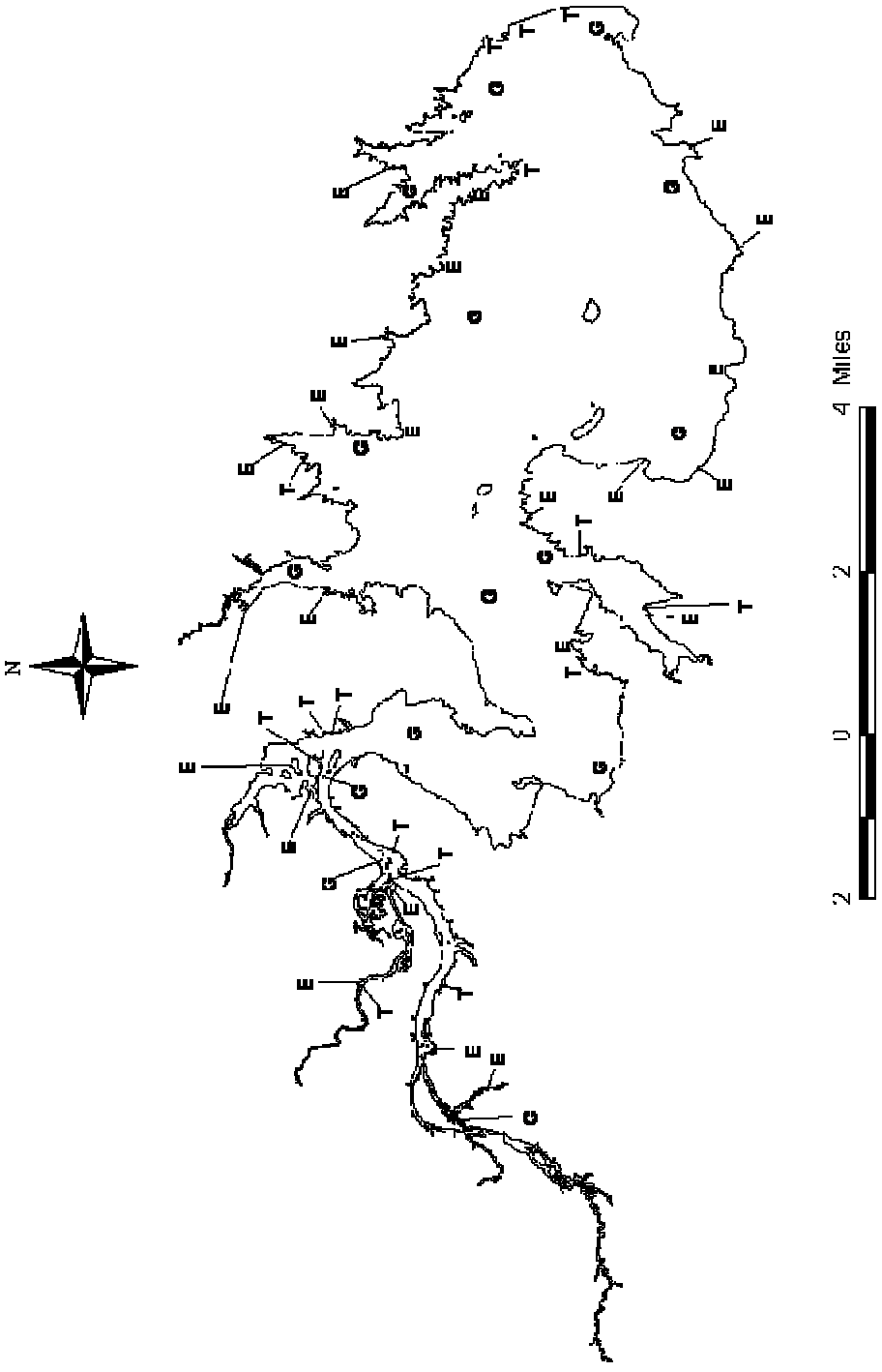
Survey year	Electrofishing	Trap Netting	Gill Netting	Vegetation Survey	Access Survey	Creel	Report
Fall 2012 – Spring 2013	A		A				
Fall 2013 – Spring 2014	A	A	A			A	
Fall 2014 – Spring 2015	A		A				
Fall 2015 – Spring 2016	S	S	S	S	S	S	S

APPENDIX A

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

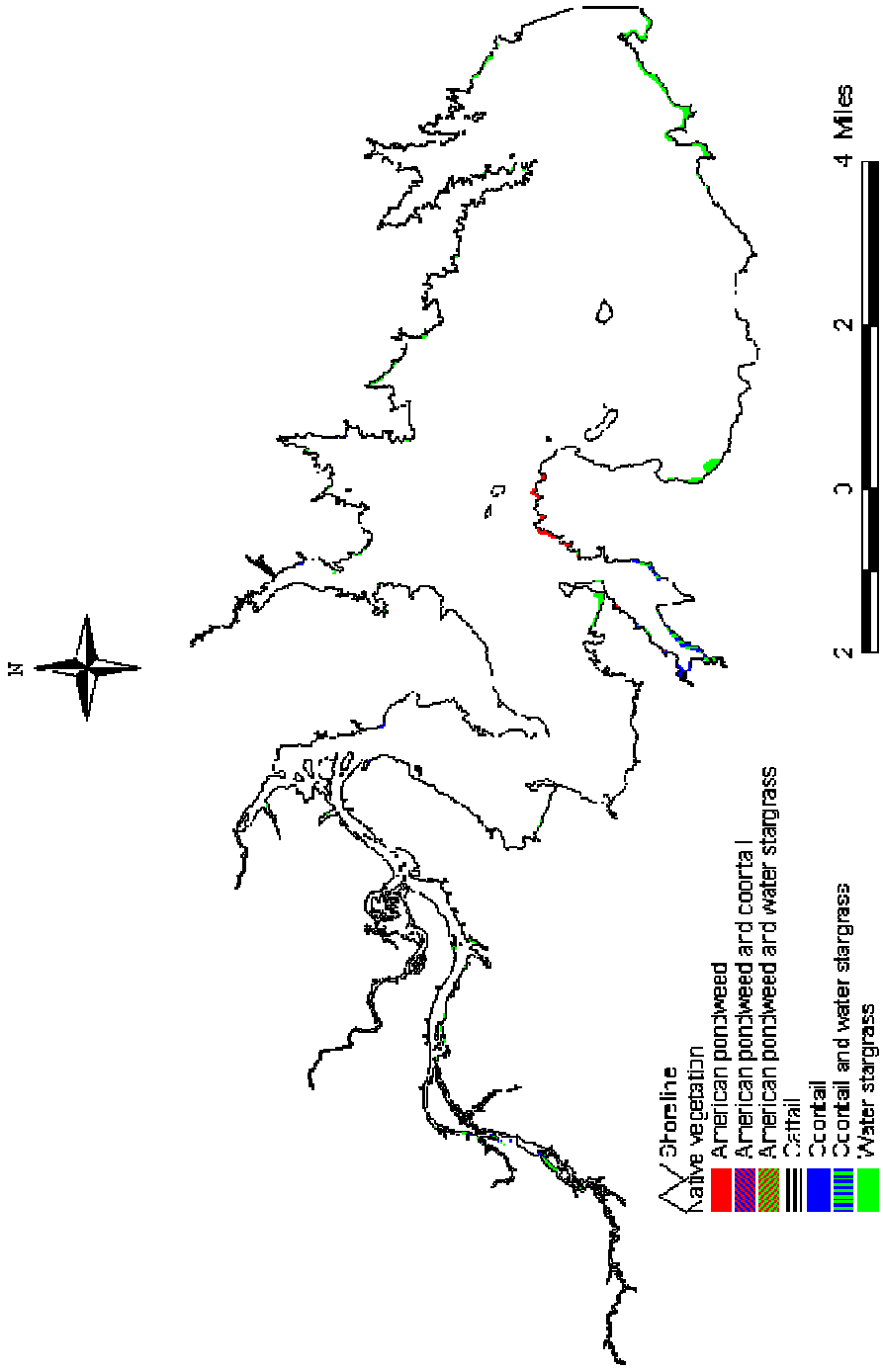
	Electrofishing		Gill Netting		Trap Netting	
Species	CPUE	N	CPUE	N	CPUE	N
Spotted gar			1.67	25	0.13	2
Longnose gar			3.67	55		
Alligator gar			0.07	1		
Gizzard shad	59.50	119	37.13	557		
Threadfin shad	77.50	155	0.07	1	0.40	6
Common Carp			13.60	204		
Bullhead minnow	14.00	28				
Inland silverside	18.00	36				
Smallmouth buffalo			16.27	244		
Blue catfish			30.73	461	0.13	2
Channel catfish			2.67	40	0.13	2
Flathead catfish			0.13	2	0.20	3
Mexican tetra	2.00	4				
White bass	0.50	1	7.20	108		
Warmouth	7.50	15	0.07	1	0.07	1
Bluegill	99.50	199	0.20	3	8.00	120
Longear sunfish	6.50	13			0.87	13
Redear sunfish	95.00	190				
Largemouth bass	330.5	661	1.73	26		
White crappie	4.00	8	3.53	53	2.07	31
Black crappie	1.50	3			0.20	3
Freshwater drum			14.00	210	0.33	5
Blue tilapia	3.50	7	0.07	1		

APPENDIX B



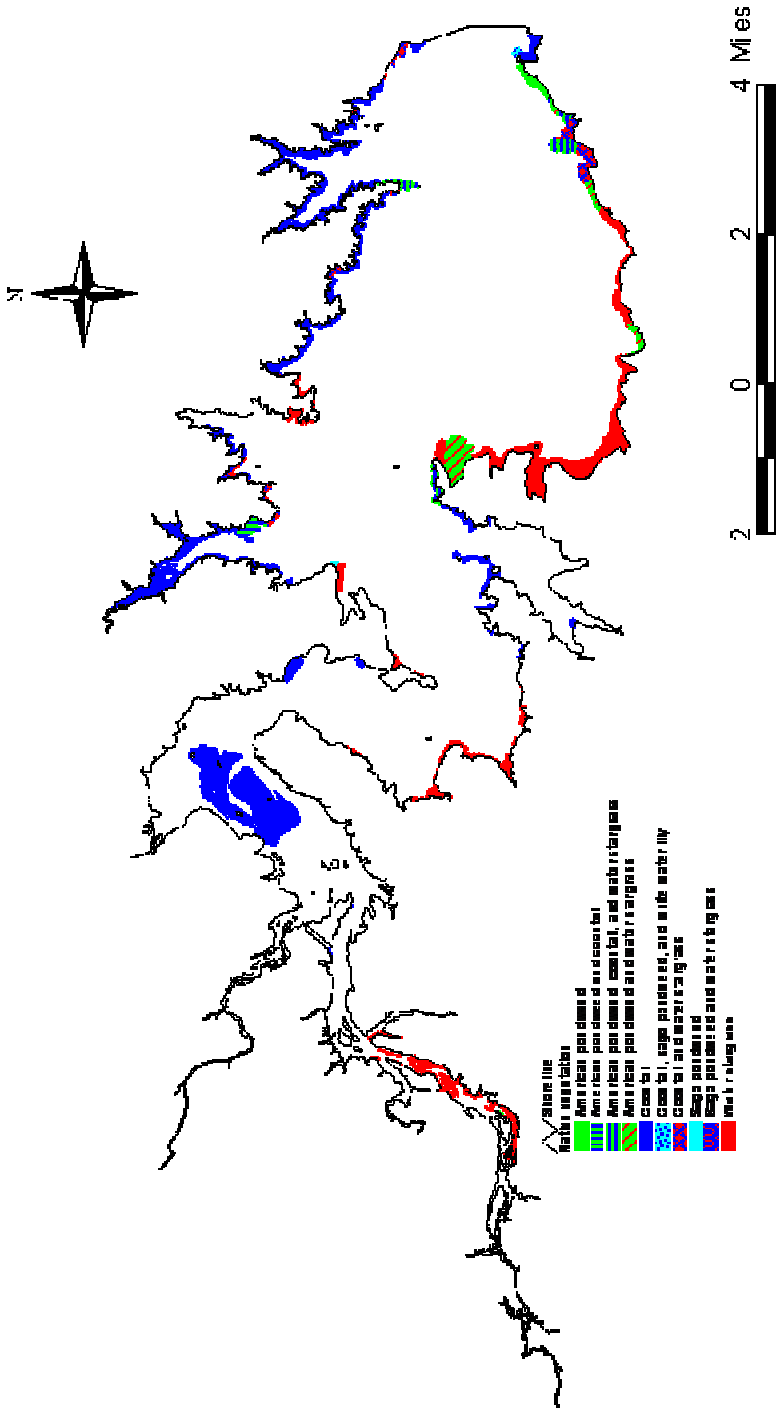
Location of sampling sites, Choke Canyon Reservoir, Texas, 2011-2012. Electrofishing, trap netting, and gill netting stations are denoted by E, T, and G, respectively.

APPENDIX C



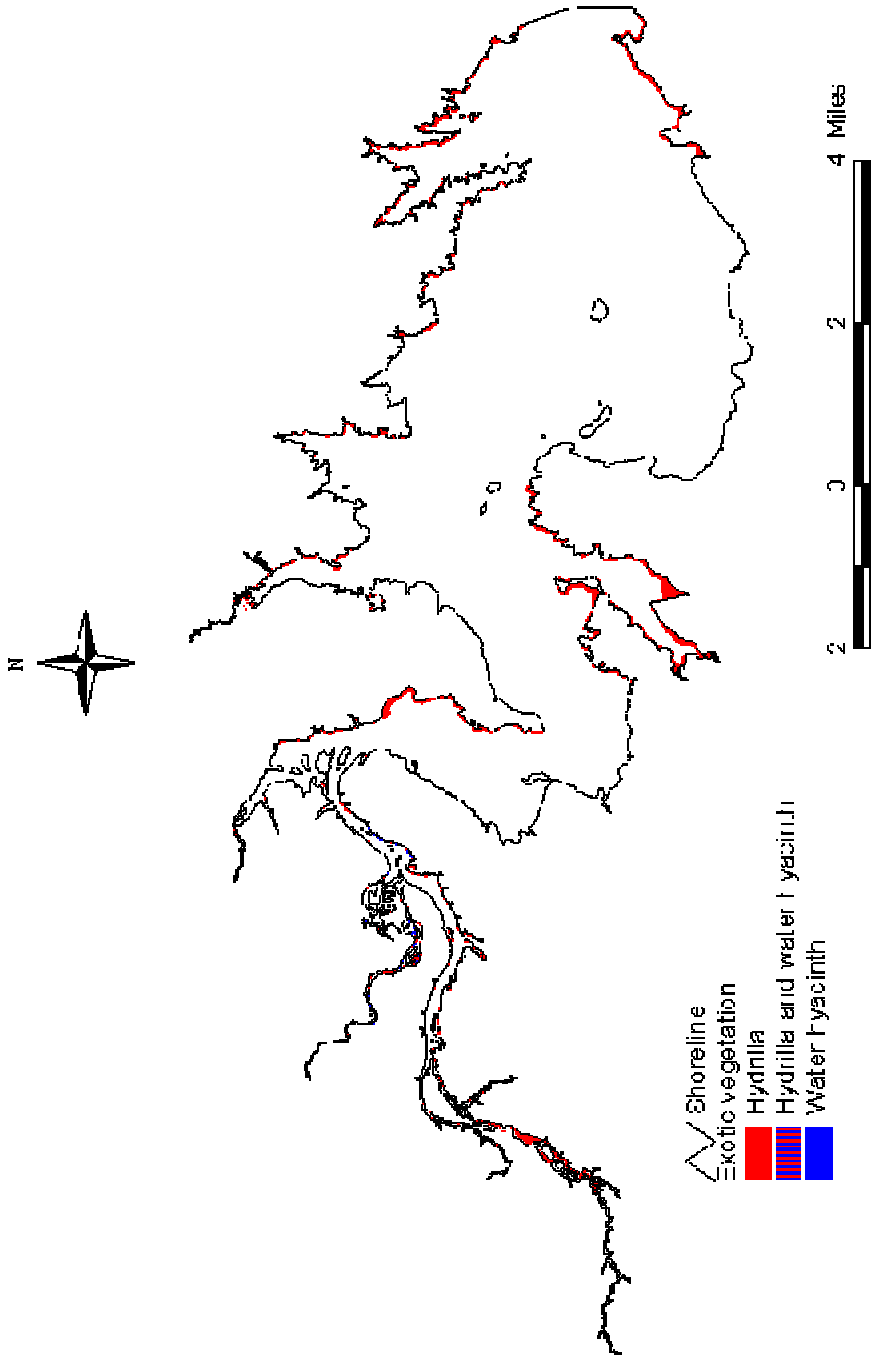
Map of native aquatic vegetation, Choke Canyon Reservoir, Texas, 2011.

APPENDIX D



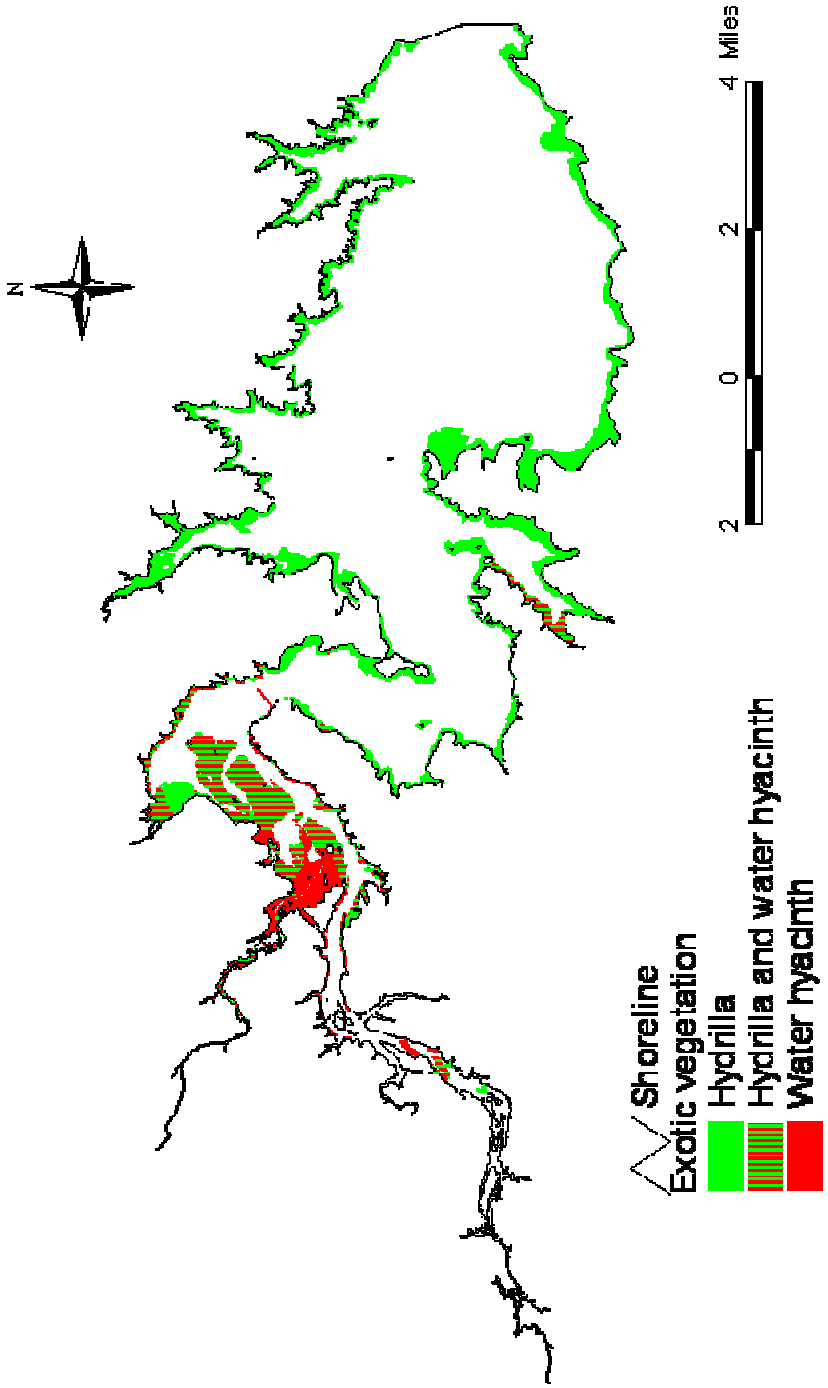
Map of native aquatic vegetation, Choke Canyon Reservoir, Texas, 2007.

APPENDIX E



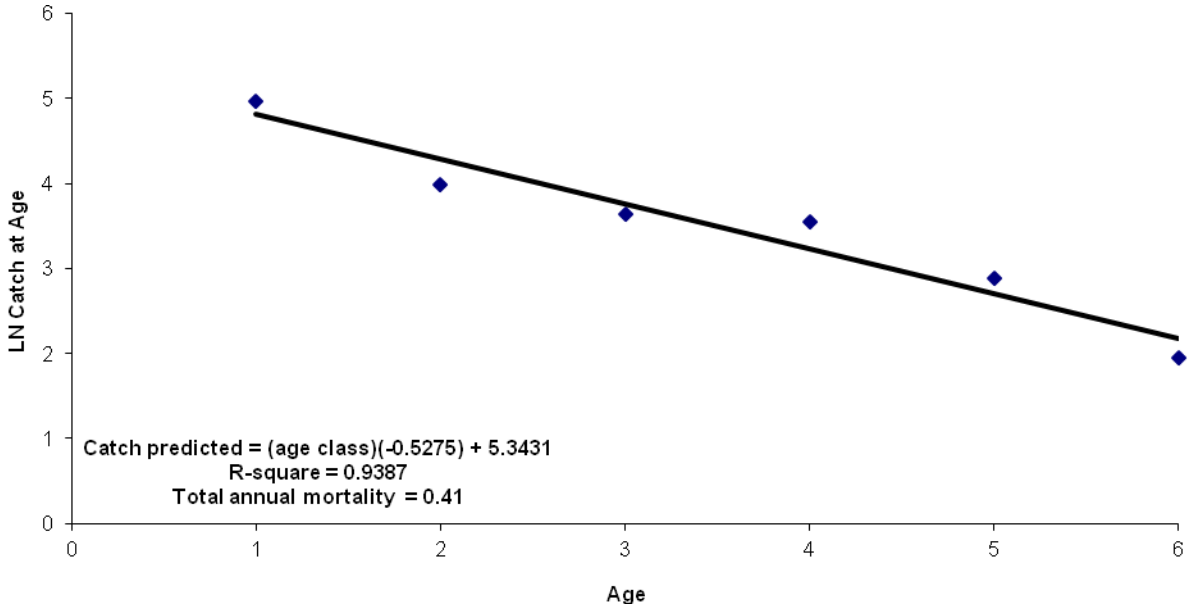
Map of exotic aquatic vegetation, Choke Canyon Reservoir, Texas, 2011.

APPENDIX F

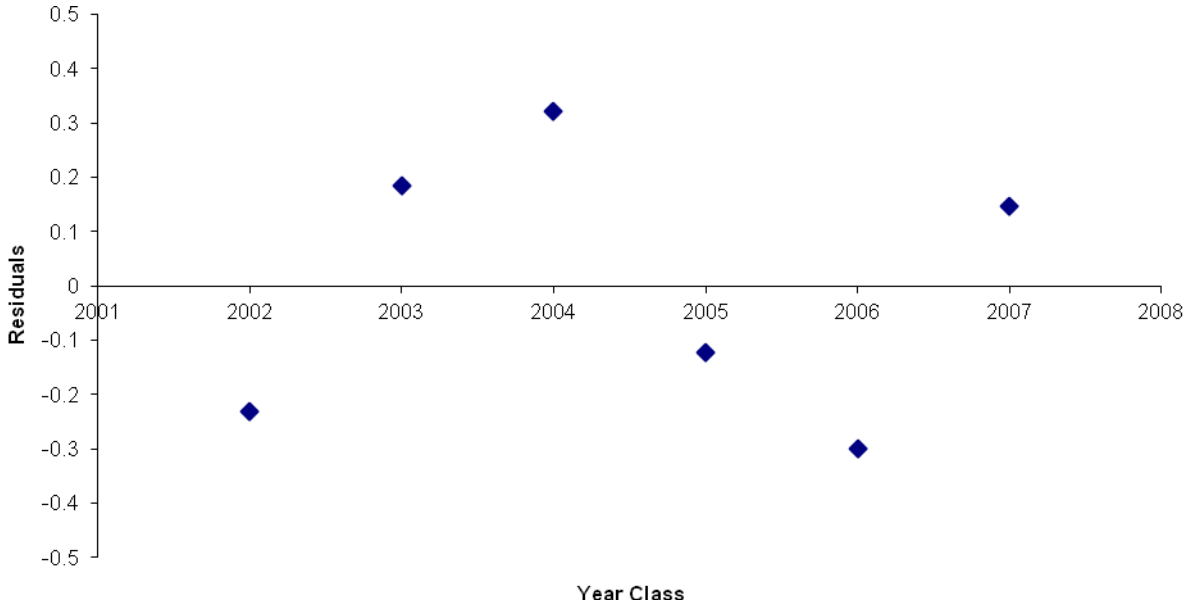


Map of exotic aquatic vegetation, Choke Canyon Reservoir, Texas, 2007.

APPENDIX G



Plot of largemouth bass catch curve to illustrate total annual mortality in 2008.



Plot of residuals from largemouth bass catch curve to illustrate varying year class strength. Points below the line represent relatively weak year classes and points above the line represent strong year classes.