PERFORMANCE REPORT

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INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2011 Survey Report

Ray Roberts Reservoir

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Ray Roberts Reservoir were surveyed in 2011 using an electrofisher and trap nets and in 2012 using gill nets. Habitat was surveyed in 2011. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir description:** Ray Roberts Reservoir is a 25,600-acre impoundment on the Elm Fork Trinity River north of Dallas-Fort Worth in Denton, Grayson, and Cooke Counties. Impacts of water level fluctuation below conservation elevation (632.5 feet above - mean sea level) between May, 2008 and April, 2012 were minimal. Despite the dewatering of some peripheral tributaries, boat launching facilities were never compromised throughout this reporting period. Ray Roberts Reservoir is moderately productive. Habitat features consisted mainly of flooded dead timber, rocky shoreline, native and non-native submerged vegetation, and riprap along the dam and railroad bridges.

- **Management history:** Important sport fish included blue and channel catfish, white bass, largemouth bass and white crappie. The management plan from 2008 included a recommendation to drop the 14- to 24-inch slot length limit, 5 fish daily bag limit for largemouth bass and implement the statewide 14-inch minimum length limit, 5 fish daily bag limit instead. Conduct a roving creel survey in the spring and summer of 2010 to monitor affects of the largemouth bass regulation change. In 2005 14,839 ShareLunker Florida largemouth bass fingerlings were stocked and 500,719 Florida largemouth bass fingerlings were stocked in 2011. Statewide fish harvest regulations apply to all sport fishes in Ray Roberts Reservoir.

- **Fish community**

  - **Prey species:** Threadfin shad continued to be present in the reservoir, but fewer numbers. Electrofishing catch of gizzard shad increased since 2007. Numbers of small gizzard shad declined providing only 40% of the population available as prey. Electrofishing catch of desirable prey-size bluegills was high.
  - **Catfishes:** Gill net catch of blue catfish was high, with well over one-half of the sampled population being of legal size and in good condition. Angler harvest was very low and recruitment was evident. Gill net catch of channel catfish continues to decline, while the catch rate of blue catfish continues to increase. Channel catfish were in good condition. Angler harvest was high with some noncompliance. Flathead catfish were present in the reservoir; but only one was collected.
  - **White bass:** Gill net catch of white bass was high with well over one-half the sample catch legal size and larger. Angler harvest was high. White bass were in fair condition.
  - **Black basses:** Although not stocked by TPWD, two lake-record smallmouth bass were caught by anglers in 2010 and 2011, and a sub-adult smallmouth bass showed up in our fall, 2011 electrofishing survey. Abundance of spotted bass more than tripled since 2003 with fish in good condition. While numbers dropped by one-half, largemouth bass were in good condition. Angler harvest of spotted and largemouth bass was low. Florida largemouth bass influence was high within the population.
  - **White crappie:** Abundance and body condition of white crappie were very good. One-third of the sample population was legal size and larger. Angler harvest was excellent.

- **Management strategies:** Conduct general monitoring with electrofisher, trap nets, and gill nets in 2015-2016. Conduct habitat/vegetation survey in 2015.

INTRODUCTION

This document is a summary of fisheries data collected from Ray Roberts Reservoir in 2011-2012. 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 are presented with the 2011-2012 data for comparison.

Reservoir Description

Ray Roberts Reservoir is a 25,600-acre impoundment on the Elm Fork Trinity River north of Dallas-Fort Worth in Denton, Grayson, and Cooke Counties. It was constructed in 1987 by the U.S. Army Corps of Engineers for municipal water supply, flood control and recreation. Ray Roberts Reservoir was borderline mesotrophic-eutrophic with a mean TSI chl-*a* of 45.92 (Texas Commission on Environmental Quality. 2011). Habitat at the time of sampling consisted of rocky shoreline, dead trees, and riprap. There were isolated patches of native and non-native submerged vegetation. Native aquatic plants present were American pondweed and muskgrass. Non-native aquatic plants consisted of Eurasian milfoil and hydrilla. Water level fluctuated from + 3 feet to – 5 feet (conservation elevation 632.5 ft-msl) in the reporting period from May, 2008 to April, 2012 (Figure 1). A few minor tributaries were dewatered during this reporting period, but access and facilities were never compromised. Public access consisted of eight sites, seven of which offered boat ramps, and there was angler access at eight bridge crossings. Pecan Creek Park, on the Elm Fork Trinity River arm is the only area on the reservoir offering free boat ramp access; all others charge $5.00 per person or $70.00 annual fee. Further information about Ray Roberts Reservoir and its facilities can be obtained by visiting the Texas Parks and Wildlife Department (TPWD) web site at www.tpwd.state.tx.us and navigating within the fishing link. Other descriptive characteristics for Ray Roberts Reservoir are in Table 1.

Management History

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

1. Recommended dropping the current largemouth bass “trophy” regulation of a 14- 24-inch slot length limit and five fish daily bag limit and replace with the statewide largemouth bass regulation of 14 inches and five fish daily bag limit.
   Action: Drop the 14- to 24-inch slot length limit five fish daily bag limit and replace with the statewide 14-inch minimum length limit and five fish daily bag limit. Change implemented September 1, 2009.
2. Recommended monitoring effects of the largemouth bass regulation change by conducting a roving creel survey during the fall of 2009 and spring of 2010.
   Action: A roving creel survey was conducted in the spring and summer of 2010 instead of fall of 2009 and spring of 2010 because not enough time had elapsed since implementation of the regulation change. Results from creel surveys are presented in Results and Discussion under Black Basses; Largemouth bass.

Harvest regulation history: The 14- to 24-inch slot length limit and 5 fish daily bag limit for largemouth bass was replaced with the statewide 14-inch minimum length limit and 5 fish daily bag limit September 1, 2009. Sportfishes in Ray Roberts Reservoir are currently managed with statewide regulations (Table 2).

Stocking history: The most recent stocking of Ray Roberts Reservoir occurred in 2012 when 20,000

ShareLunker fingerlings were stocked in the upper Isle du Bois Creek arm. A previous stocking of 14,839 ShareLunker fingerlings in 2005 also took place in the Isle du Bois Creek arm. In 2011 500,719 Florida largemouth bass fingerlings were stocked in the upper Isle du Bois Creek arm. A complete stocking history is included in Table 3.

Vegetation/habitat history: Flooding in 2007 precluded a habitat assessment; therefore, we used data from the 2003 survey (Hysmith and Moczygemba 2004). Historically flooded timber (dead trees and stumps) provided the bulk of pelagic habitat in Ray Roberts Reservoir. In 2003 native and non-native submerged vegetation occupied some 2,200 acres. A comprehensive survey of shoreline habitat littoral and pelagic habitat types was conducted in 2011 and revealed 94% natural shoreline and 6% rocky shoreline. There are 3,000 acres or 11% standing timber and stumps. Native and non-native submerged vegetation covered 9.5 acres (Table 4). Hydrilla and Eurasian watermilfoil continue to decline in coverage.

Water Transfer: Ray Roberts Reservoir is primarily used for municipal water supply, recreation and flood control. The Cities of Gainesville and Dallas operate one pumping station that provides 1 MGD (million gallons per day) to the City of Gainesville. There is no water pumped into Ray Roberts Reservoir.

METHODS

Fishes were collected by electrofishing (2 hours at 24 5-min stations), gill netting (15 net nights at 15 stations), 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 caught per net night (fish/nn). Survey sites were randomly selected. All surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2011).

Sampling statistics (CPUE for various length categories) and structural indices [Proportional Size Distribution (PSD)] as defined by Guy et al. (2007), 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 while standard error (SE) was calculated for structural indices and IOV. Ages for channel and blue catfish, white bass, largemouth bass, and white crappie were determined using Category 2 protocol according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2011). The manual specifies largemouth bass, but we adapted the protocol to include channel and blue catfish and white crappie.

Tissue samples from 30 age-0 largemouth bass were collected, preserved, and transported for genetic analysis according to Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2011).

A roving creel survey was conducted over a 6-month period from March, 2010 to August, 2010 to identify changes in angler behavior following the removal of the 14- to 24-inch slot length limit on largemouth bass. Interviews were conducted on 5 weekend days and 4 weekdays per quarter, to assess angler use and fish catch/harvest rate in accordance with the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2011). Results from a similar roving creel survey conducted in the summer of 2004 and spring of 2005 provided pre-regulation change data.

RESULTS AND DISCUSSION

Habitat: Habitat features consisted mainly of natural shoreline, dead trees and stumps, native and non-native submerged vegetation, and riprap along the dam and railroad bridges (Table 4). Standing dead

timber and stumps was the major habitat feature. Water level experienced fluctuations of + 3 feet to – 5 feet from May 2008 to April 2012 (Figure 1). Drought conditions existed during the summer of 2011, but impacts were minimal.

Creel Survey: Survey statistics for the 6-month creel survey are shown in Tables 5 and 6. The objective of this creel survey and significant results are presented in Previous Management Strategies and Actions.

Prey species: Electrofishing CPUE of gizzard shad and bluegill were 180.0/h and 119.5/h, respectively (Figures 2 and 3). Both species have provided an excellent prey base since 1995 (Appendix C). Gizzard shad abundance increased, but IOV declined 50% (Figure 2). Threadfin shad were less abundant; with a current electrofishing CPUE of 65.0/h compared to 339.0/h in 2007 (Appendix C). The bluegill population declined nearly 50% since 2007. However, electrofishing showed a preponderance of 3-inch and 4-inch bluegill, ideal size prey (Figure 3).

Catfishes: The gill net CPUE of blue catfish was 3.7/nn in 2012 (Figure 4) and the "catch-of-record" for Ray Roberts Reservoir (Appendix C). They occurred naturally in the Elm Fork Trinity River and flourished after the reservoir was impounded. Gill net catch rate of blue catfish has consistently increased over the past few surveys (Appendix C). In fact, they are becoming more abundant than channel catfish. Relative weight between 80 and 95 suggested good body condition for fish $\geq$ 12 inches and recruitment of legal-size fish was excellent. Blue catfish grew to 12 inches in 3 to 4 years (N = 5; range = 3 to 4 years) and 95% of the sample population was $\geq$ 12 inches. Total angler harvest was 444 blue catfish from 15 to 17 inches (Table 7; Figure 5).

The gill net CPUE of channel catfish was 2.3/nn in 2012, down from 5.5/nn in 2008 (Figure 6). Relative weights for channel catfish suggested good condition. The absence of channel catfish > 18 inches precluded comparison of relative weights of larger fish. Channel catfish grew to 12 inches in 4 to 6 years (N = 5; range = 3 to 7 years). Thirty-eight percent of the sample population was $\geq$ 12 inches. Anglers harvested 5,181 channel catfish from 13 to 18 inches (Table 8; Figure 7).

White bass: The 2012 gill net CPUE of white bass (10.4/nn) was the "catch-of-record" (Figure 8; Appendix C). Relative weight was consistently between 80 and 90 for all size groups which showed a slight improvement over previous year's samples. Recruitment was excellent and white bass grew to 10 inches in 1 year (N =13; range = 1 year); 34% of the sample population was $\geq$ 10 inches. Anglers harvested 8,772 white bass from 10 to 14 inches (Table 9; Figure 9).

Black basses: Although not stocked by TPWD, two lake-record smallmouth bass were caught by anglers in 2010 and 2011 and a 9-inch sub-adult showed up in our fall 2011 electrofishing survey. Apparently natural reproduction has occurred. The two angler-caught fish were in the 5 and 6 pound range. The electrofishing total CPUE of spotted bass was 53.5/h, an increase from 20.0/h in 2007 (Figure 10). This well exceeded previous catch rates, including a recent 11-year average (Appendix C). Relative weights declined slightly, but continue to indicate robust, healthy fish. Anglers harvested only 107 16-inch spotted bass (Table 10; Figure 11).

The electrofishing total CPUE of largemouth bass was 108.5/h less than half the CPUE of 2007 (227.0/h; Figure 12). Recruitment declined after 2007, as evidenced by the decline in Stock CPUE in 2011. The exceptionally high Stock/Total CPUE in 2007 was attributed to high water level. Reduced mean relative weights indicated that largemouth bass body condition had declined since 2007. On average, largemouth bass grew to legal size(14 inches) in 2 years (N=14; range 1 – 4 years); only 3.7% of the sample population was legal-size and larger which was no surprise since it was 5% in 2007 and 2.4% in 2003 (average of 12 surveys since 1988 = 11.36). CPUE-14 for the data depicted in Figure 12 supports the percent of the population legal-size and larger which represents that portion of the population vulnerable to harvest by anglers. It also represents that portion of the population made available to anglers through removal of the 14- inch to 24-inch slot length limit. During the spring and summer of 2010, anglers

harvested 11,185 largemouth bass from 12 to 22 inches (Table 11; Figure 13). There was some noncompliance with undersized fish harvest. Data from a roving creel survey conducted on Ray Roberts Reservoir in the summer of 2004 and spring of 2005 provided angler effort and harvest while the 14- inch to 24-inch slot length limit was in effect for largemouth bass (Appendix D). These data were compared to data from a similar roving creel survey conducted on Ray Roberts Reservoir during the spring and summer of 2010 (Appendix E) following implementation of the new regulation September 1, 2009. Directed angling effort for largemouth bass increased 42% (41,439 h to 59,016 h) during the spring of 2010. Total harvest of largemouth bass jumped from 2,247 before the change to 11,185 during the spring of 2010.

Genetic analysis of largemouth bass collected by electrofishing indicated Florida largemouth bass influence was 44.0% (Table 12), an increase since 2007 and may have reflected FLMB fingerling stocking in the spring of 2011.

White crappie: The trap net CPUE of white crappie was 30.7/nn, was the “catch-of-record” (Figure 14; Appendix C). Extremely high Stock CPUE supported excellent recruitment while high relative weights showed evidence of a healthy population (Figure 14). Thirty percent of the sample population was $\geq$ 10 inches and they reach legal size in 1 year (N = 13; range = 1 year). Anglers harvested 55,595 white crappie from 10 to 16 inches; most were 10 and 11 inches (Table 13; Figure 15).

Zebra mussels: Routine sampling (PCR analysis) of the waters of Ray Roberts Reservoir by the University of Texas at Arlington over the past several years have produced weak positive results for zebra mussel (*Dreissena polymorpha)* DNA. No zebra mussels were observed until July 17, 2012 when small zebra mussels were found at several locations around the lake. This was after a strong positive result was recorded from PCR analysis. Subsequent investigations found zebra mussels below the dam in the tailrace, which is the Elm Fork of the Trinity River.

Fisheries management plan for Ray Roberts Reservoir, Texas

Prepared – July 2012.

ISSUE 1: Although the current genetic analysis indicated the Florida largemouth bass influence was 44.0%, there were no pure Florida largemouth bass collected during this survey. Ray Roberts Reservoir has produced five ShareLunkers.

MANAGEMENT STRATEGY

1. Stock Florida bass fingerlings at the rate of 25/acre in 2013 to improve the Florida bass genotype occurrence in Ray Roberts Reservoir.
2. Conduct genetic sample of the largemouth population in 2014.

ISSUE 2: Although not stocked, smallmouth bass were collected during 2011 electrofishing samples to include a sub-adult. The status of the smallmouth bass population needs to be monitored. The largemouth bass population has a history of producing trophy bass and needs to be monitored after the regulation change of 2009.

MANAGEMENT STRATEGY

1. Conduct an electrofishing survey in the fall of 2014.

ISSUE 3: The sport fishery in Ray Roberts Reservoir, especially blue catfish, white bass, and white crappie has continued to improve. All three species produced “catches-of-record” during the recent fish stock assessment.

MANAGEMENT STRATEGY

1. Incorporate these improvements on the TPWD web site and publicize in appropriate media.

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

MANAGEMENT STRATEIES

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 the zebra mussel population as needed.
7. Include Lake Ray Roberts in the list of lakes where boaters must drain all water before leaving the lake.
8. Monitor hydrilla and Eurasian milfoil infestations.

SAMPLING SCHEDULE JUSTIFICATION:

Conduct general monitoring surveys in 2015 – 2016 with electrofishing, trap netting, and gill netting equipment. Additional electrofishing samples to monitor the smallmouth and largemouth bass populations as well as the forage base will be conducted in 2014. The invasive aquatic plants will be monitored annually. The zebra mussel population will be monitored as needed. Access and habitat surveys will also be conducted.

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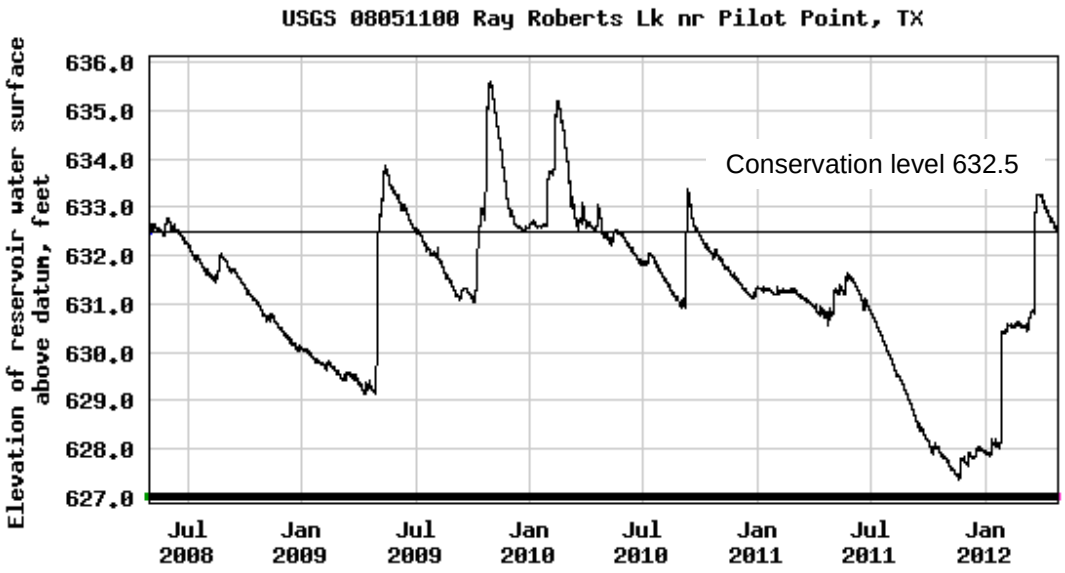


Figure 1. Daily mean average water level elevations in feet above mean sea level (MSL) recorded for Ray Roberts Reservoir (U.S. Geological Survey. 2012. USGS real time water data for USGS 08051100 Ray Roberts Lk near Pilot Point, Texas. http://waterdata.usgs.gov/nwis/dv), Texas, May 2008-April, 2012.

Table 1. Characteristics of Ray Roberts Reservoir, Texas.

Characteristic	Description
Year constructed	1987
Controlling authority	U. S. Army Corps of Engineers
Counties	Cooke, Denton, and Grayson
Reservoir type	Mainstream
Shoreline development index	8.63
Conductivity	316 µmhos/cm

Table 2. Harvest regulations for Ray Roberts Reservoir.

Species	Bag Limit	Length Limit (inches)
Catfish: channel and blue catfish, their hybrids and subspecies	25 (in any combination)	12 minimum
Catfish, flathead	5	18 minimum
Bass, white	25	10 minimum
Bass, spotted	5	No limit
Bass, largemouth and smallmouth	(in any combination)	14 minimum
Crappie: white and black crappie, their hybrids and subspecies.	25 (in any combination)	10 minimum

Table 3. Stocking history of Ray Roberts, 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)
Channel catfish	1986	50,004	AFGL	4.3
	Total	50,004		
Coppernose bluegill	1987	234,506	AFGL	2.0
	1987	110,002	FRY	1.0
	Total	344,508		
Florida Largemouth bass	1985	59,900	FRY	1.0
	1987	78	ADL	12.0
	1987	100,262	FRY	1.0
	1989	733,750	FRY	0.8
	1993	133,630	FGL	1.5
	1994	600,809	FGL	1.3
	2000	502,121	FGL	1.4
	2001	522,791	FGL	1.5
	2011	500,719	FGL	1.6
	Total	3,154,060		
ShareLunker Largemouth Bass	2005	14,839	FGL	2.1
	2012	15,285	FGL	1.9
	Total	30,124		
Threadfin shad	1985	1,200	AFGL	3.0
	Total	1,200		

Table 4. Survey of shoreline habitat and littoral and pelagic habitat types, Ray Roberts Reservoir, Texas, 2011. A linear shoreline distance (miles) and percent of total was recorded for each shoreline habitat type found. Surface area (acres) and percent of total was determined for each type of littoral and pelagic habitat type found.

	Shoreline distance		Surface area	
	Miles	% of total	Coverage (acres)	% of total
Shoreline habitat type				
Bulkhead	0.0	0.0		
Gravel	0.0	0.0		
Natural shoreline	195.0	94.0		
Rocky shoreline	12.0	6.0		
Littoral and pelagic habitat type				
Standing timber, stumps			3000.0	11
Native emergent[a]			<0.1	<0.1
Native submersed[b]			2.2	<0.1
Eurasian watermilfoil			6.0	<0.1
Hydrilla			1.3	<0.1
Open water			22,584.5	88.0
Piers, boat docks, marinas			6	<0.1

[a]American Pondweed
[b]Muskgrass

Table 5. Percent directed angler effort by species for Ray Roberts Reservoir, Texas, March 2010 - August 2010.

	Year
Species	2010
Channel catfish	3.3
White bass	2.7
Sunfishes	0.2
Largemouth bass	39.6
White crappie	37.9
Anything	16.2

Table 6. Total fishing effort (h) for all species and total directed expenditures at Ray Roberts Reservoir, Texas, March 2010 - August 2010.

	Year
Creel Statistic	2010
Total fishing effort	202,710h
Total directed expenditures	$1,449,582.00

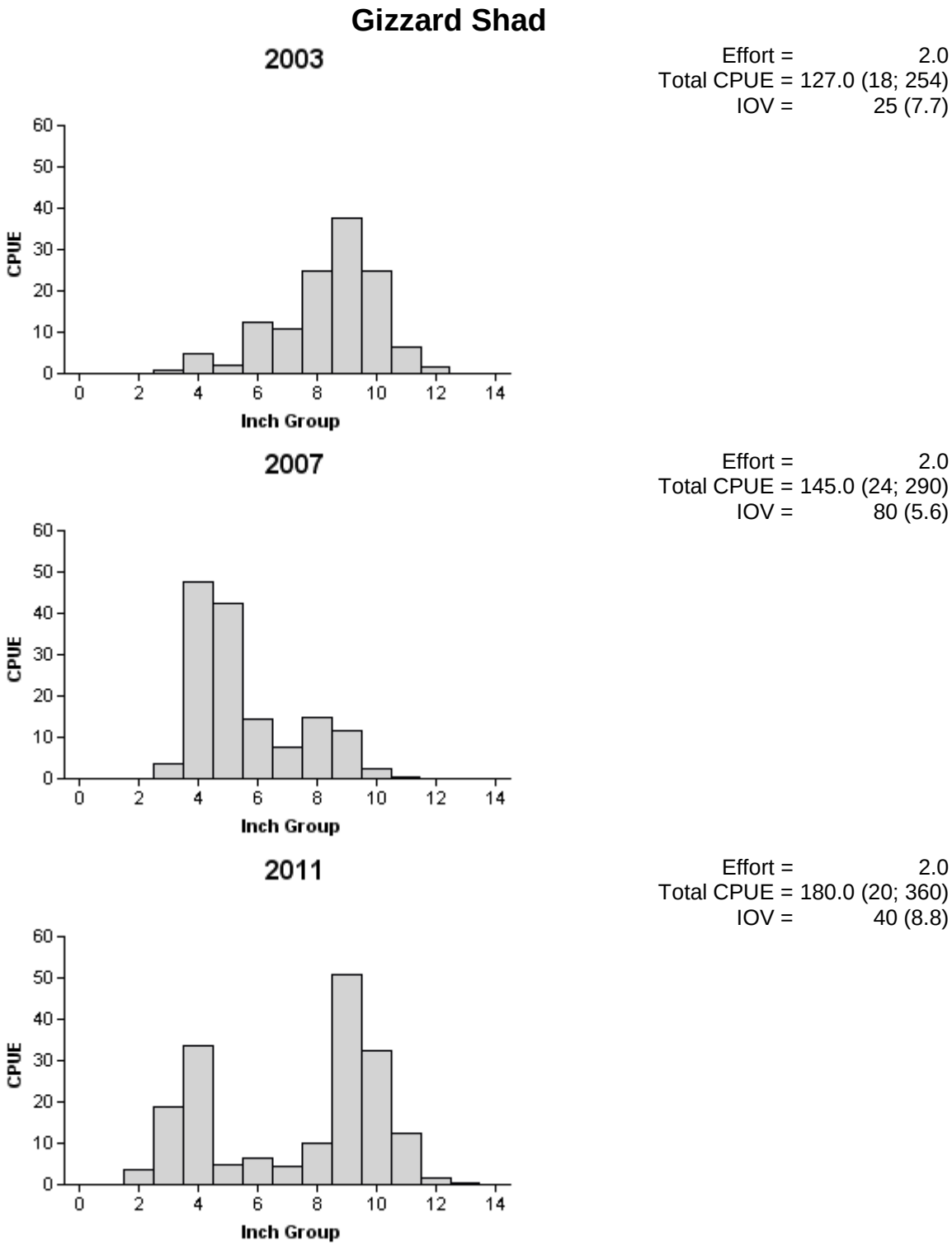


Figure 2. Number of gizzard shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Ray Roberts Reservoir, Texas 2003, 2007, and 2011.

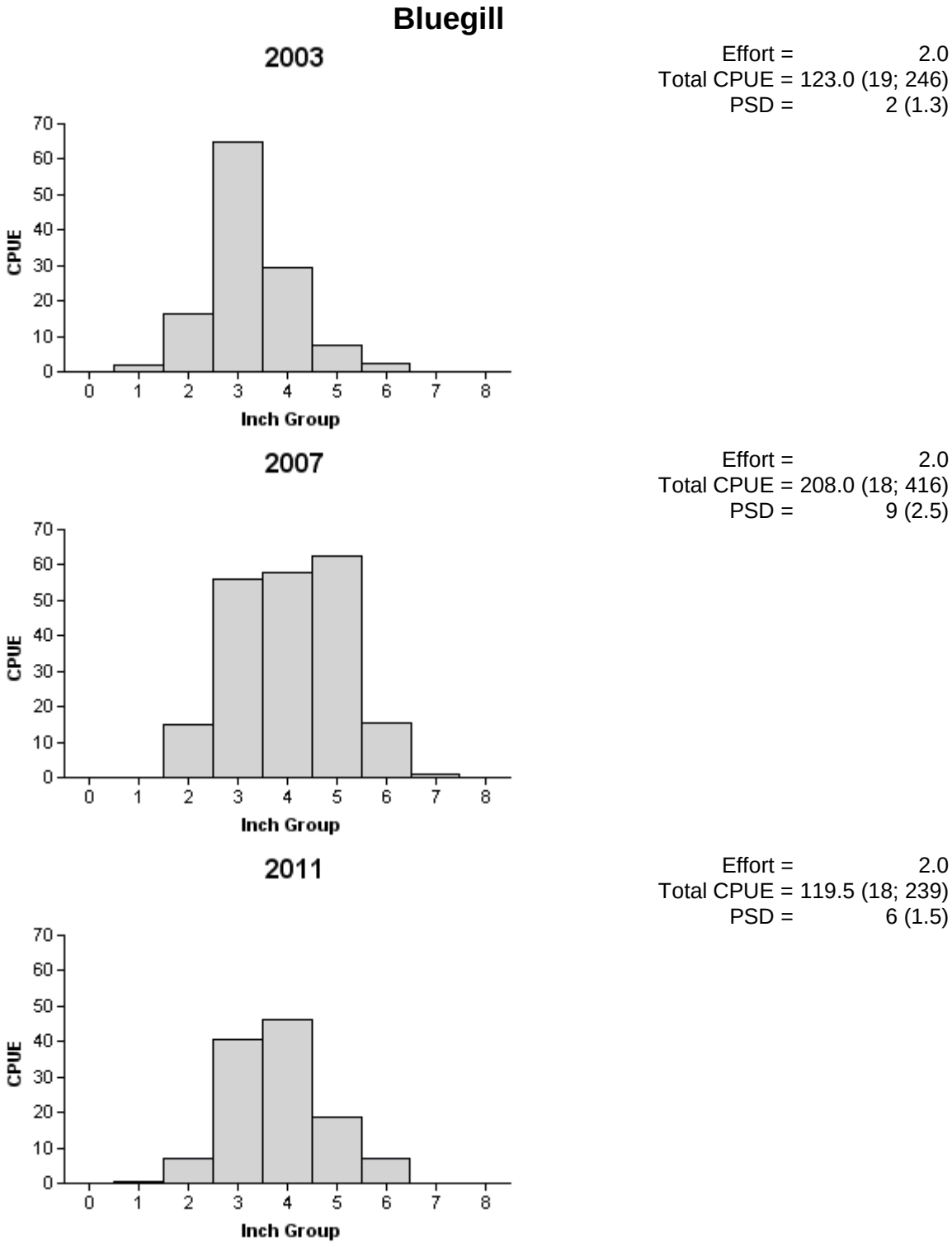


Figure 3. Number of bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Ray Roberts Reservoir, Texas, 2003, 2007, and 2011.

Blue Catfish

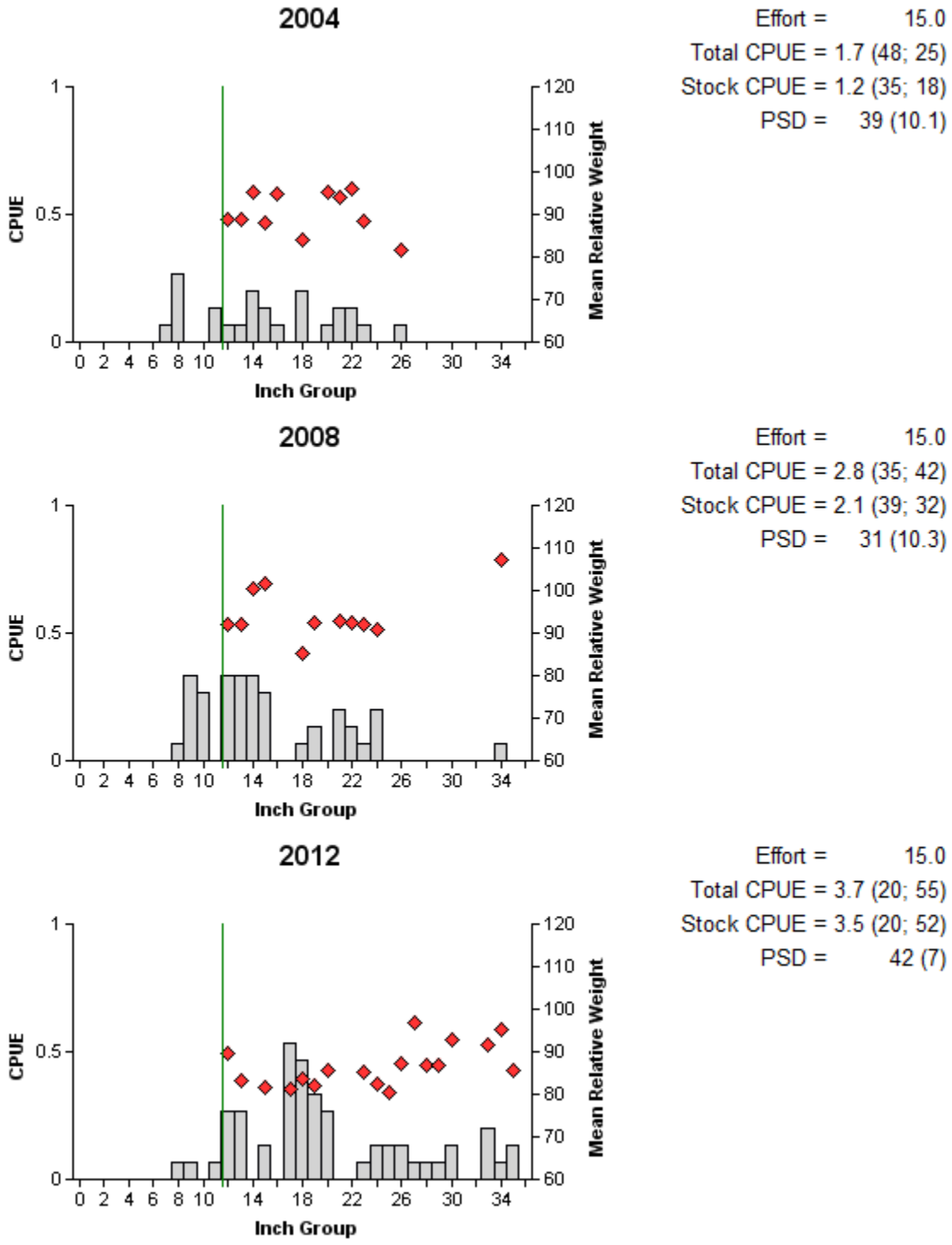


Figure 4. Number of blue catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Ray Roberts Reservoir, Texas, 2004, 2008, and 2012. Vertical lines represent length limit at time of collection.

Table 7. Creel survey statistics for blue catfish at Ray Roberts Reservoir from March 2010 – August 2010, where the total harvest is the estimated number of blue catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

	Year
Creel Survey Statistic	2010
Total harvest	444 (519)
Harvest/acre	0.02

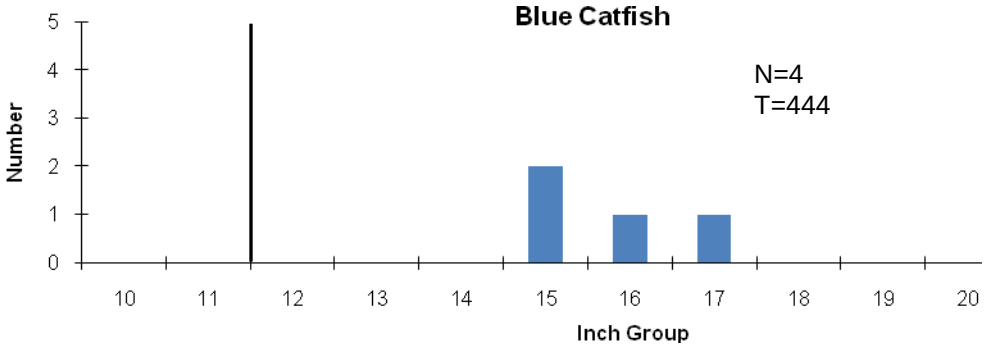


Figure 5. Length frequency of harvested blue catfish observed during creel surveys at Ray Roberts Reservoir, Texas, March 2010 through August 2010, all anglers combined. N is the number of harvested blue catfish observed during creel surveys, and T is the total estimated harvest for the creel period. Vertical line represents length limit at time of creel survey.

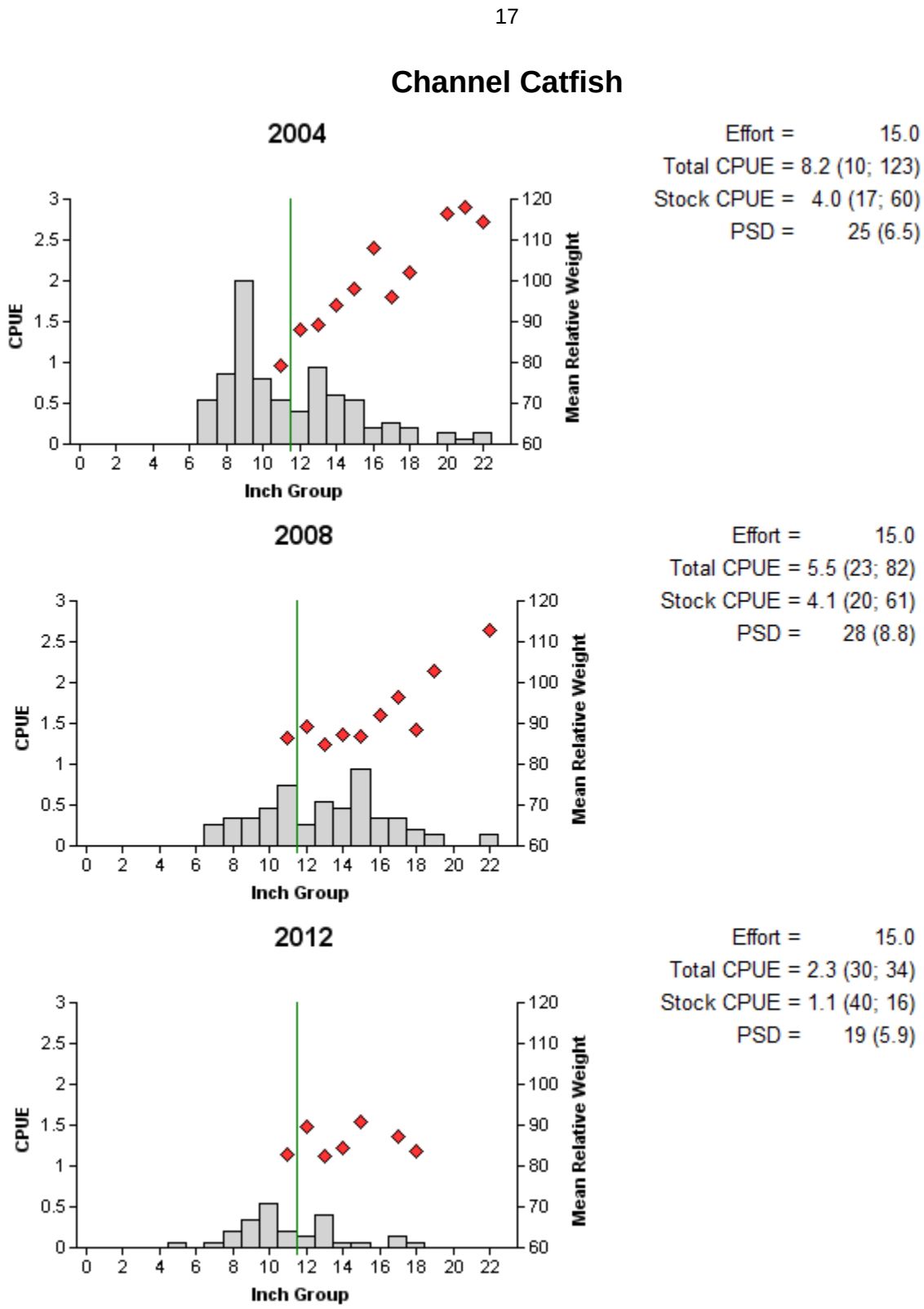


Figure 6. Number of channel catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Ray Roberts Reservoir, Texas, 2004, 2008, and 2012. Vertical lines represent length limit at time of collection.

Table 8. Creel survey statistics for channel catfish at Ray Roberts Reservoir from March 2010 – August 2010, where total catch per hour is for anglers targeting channel catfish and total harvest is the estimated number of channel catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

	Year
Creel Survey Statistic	2010
Directed effort (h)	6,637.24 (35)
Directed effort/acre	0.26
Total catch per hour	0.36 (111)
Total harvest	5,181 (60)
Harvest/acre	0.20

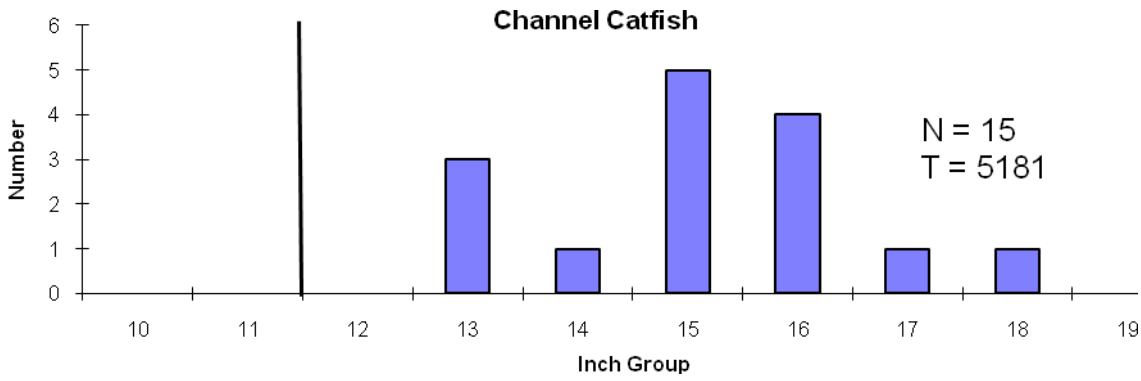


Figure 7. Length frequency of harvested channel catfish observed during creel surveys at Ray Roberts Reservoir, Texas, March 2010 through August 2010, all anglers combined. N is the number of harvested channel catfish observed during creel surveys, and T is the total estimated harvest for the creel period. Vertical line represents length limit at time of creel survey.

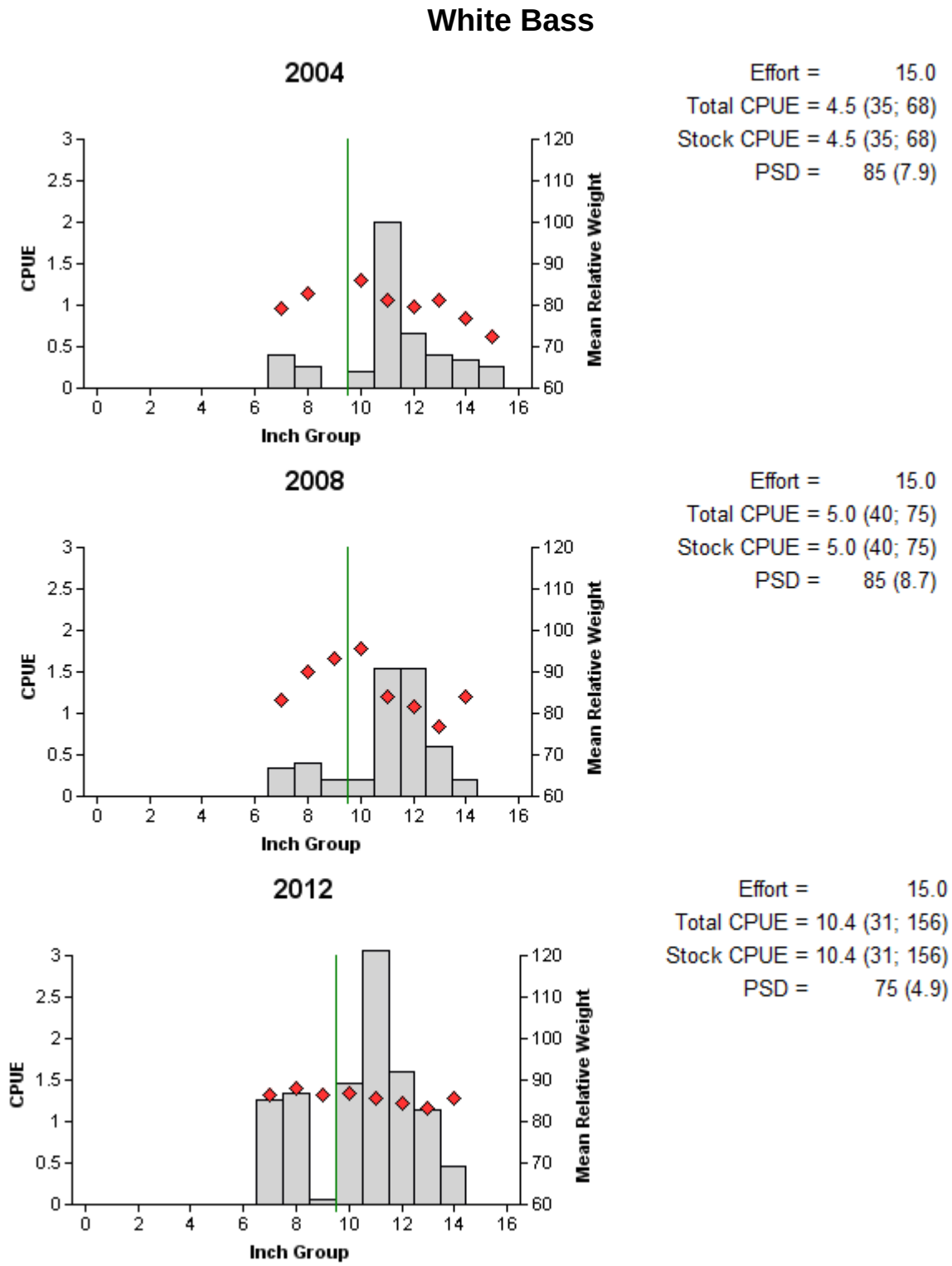


Figure 8. Number of white bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Ray Roberts Reservoir, Texas, 2004, 2008, and 2012. Vertical lines represent length limit at time of collection.

Table 9. Creel survey statistics for white bass at Ray Roberts Reservoir from March 2010 – August 2010, where total catch per hour is for anglers targeting white bass and total harvest is the estimated number of white bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

	Year
Creel Survey Statistic	2010
Directed effort (h)	5,555.53 (39)
Directed effort/acre	0.22
Total catch per hour	1.99 (70)
Total harvest	8,772 (50)
Harvest/acre	0.34

Figure 9. Length frequency of harvested white bass observed during creel surveys at Ray Roberts Reservoir, Texas, March 2010 through August 2010, all anglers combined. N is the number of harvested white bass observed during creel surveys, and T is the total estimated harvest for the creel period. Vertical line represents length limit at time of creel survey.

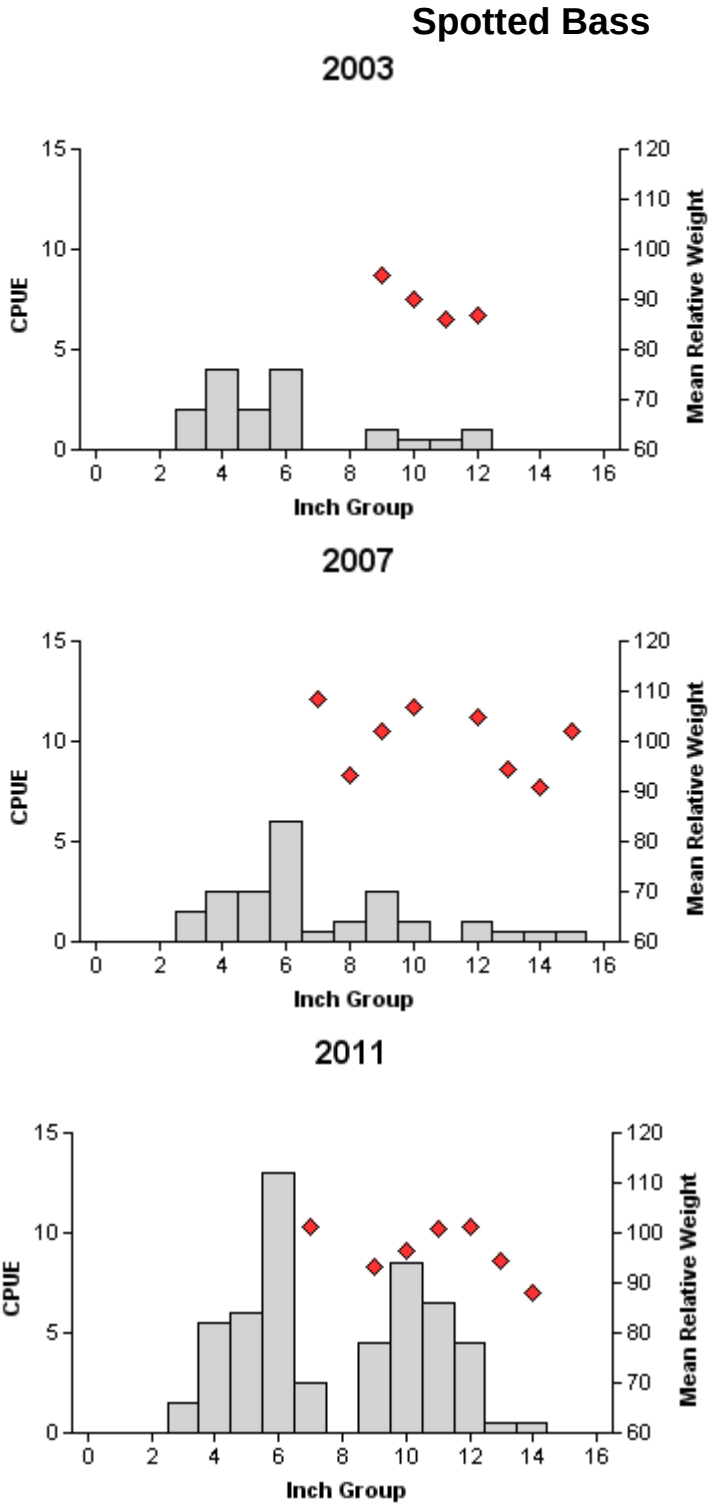


Figure 10. Number of spotted bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Ray Roberts Reservoir, Texas, 2003, 2007, and 2011.

Table 10. Creel survey statistics for spotted bass at Ray Roberts Reservoir from March 2010 – August 2010, where total catch per hour is for anglers targeting spotted bass and total harvest is the estimated number of spotted bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

	Year
Creel Survey Statistic	2010
Total harvest of spotted bass	107 (853)
Harvest/acre of spotted bass	0.004

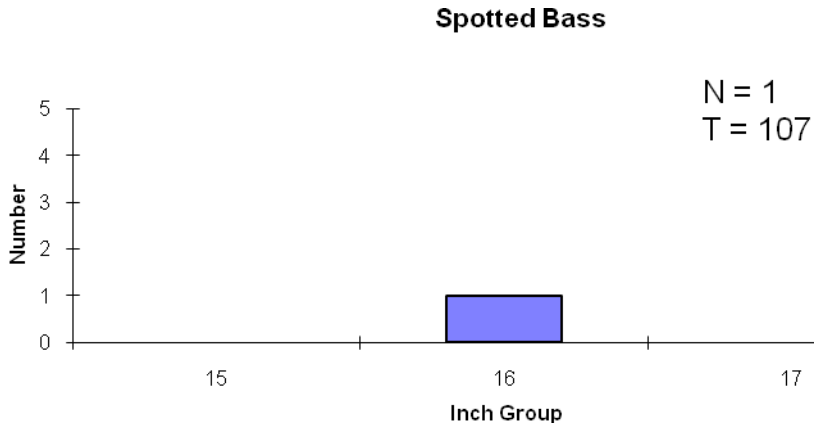


Figure 11. Length frequency of harvested spotted bass observed during creel surveys at Ray Roberts Reservoir, Texas, March 2010 through August 2010, all anglers combined. N is the number of harvested spotted bass observed during creel surveys, and T is the total estimated harvest for the creel period.

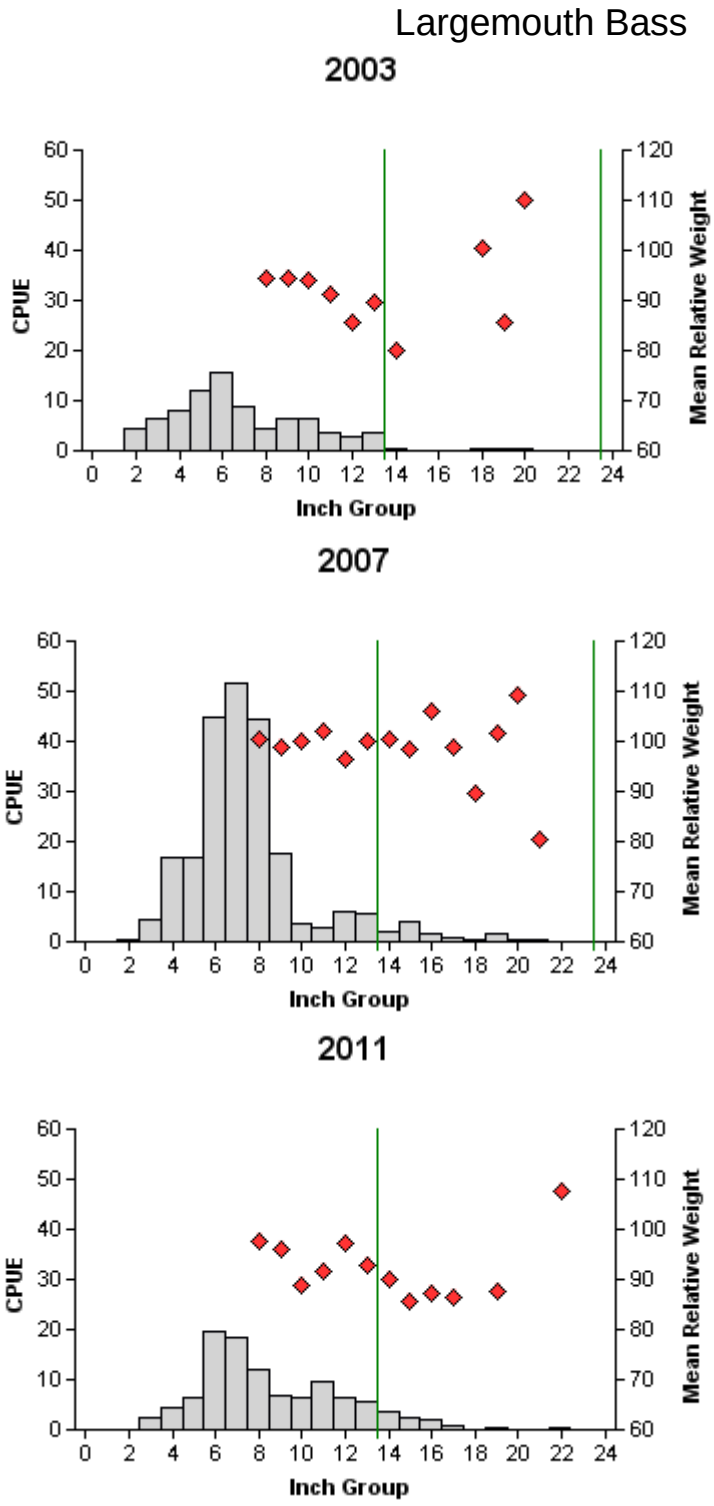


Figure 12. Number of largemouth bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Ray Roberts Reservoir, Texas, 2003, 2007, and 2011. Vertical lines represent length limit at time of collection.

Table 11. Creel survey statistics for largemouth bass at Ray Roberts Reservoir from March 2010 – August 2010, 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.

	Year
Creel Survey Statistic	2010
Directed effort (h)	80,306.28 (24)
Directed effort/acre	3.14
Total catch per hour	0.36 (14)
Total harvest	11,185.10 (36)
Harvest/acre	0.44

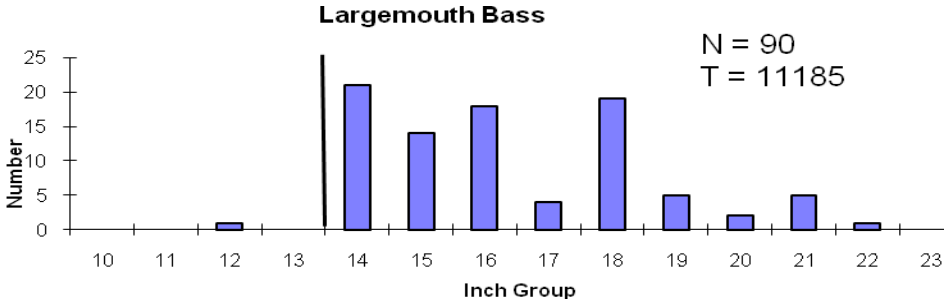


Figure 13. Length frequency of harvested largemouth bass observed during creel surveys at Ray Roberts Reservoir, Texas, March 2010 through August 2010, all anglers combined. N is the number of harvested largemouth bass observed during creel surveys, and T is the total estimated harvest for the creel period. Vertical line represent length limit at time of creel survey.

Table 12. Results of genetic analysis of largemouth bass collected by fall electrofishing, Ray Roberts Reservoir, Texas, 1990, 1992, 1994, 1998, 2000 – 2004, 2007, and 2011. FLMB = Florida largemouth bass, NLMB = Northern largemouth bass, Hybrids = cross between a FLMB and a NLMB.

		Genotype				
Year	Sample size	FLMB	Hybrids	NLMB	% FLMB alleles	% pure FLMB
1990	37	0	17	20	17.6	0.0
1992	30	0	9	21	15.0	0.0
1994	26	4	11	11	33.7	15.4
1998	40	4	27	9	40.0	10.0
2000	35	9	21	5	61.4	25.7
2001	40	24	13	3	78.8	60.0
2002	30	3	24	3	50.8	10.3
2003	30	5	24	1	56.7	16.7
2004	59	7	48	4	49.2	11.9
2007	30	0	28	2	37.3	0.0
2011	30	0	23	7	44.0	0.0

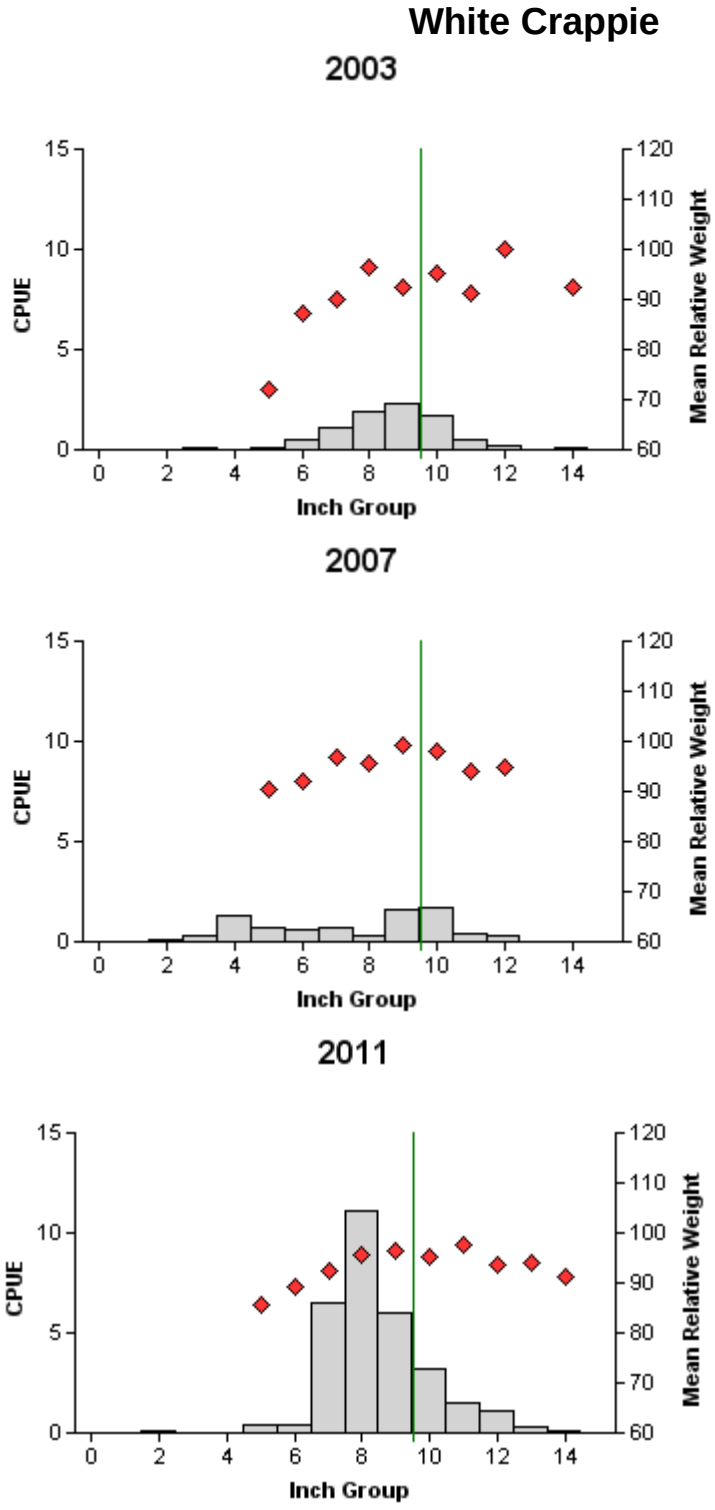


Figure 14. Number of white crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Ray Roberts Reservoir, Texas, 2003, 2007, and 2011. Vertical lines represent length limit at time of collection.

Table 13. Creel survey statistics for white crappie at Ray Roberts Reservoir from March 2010 – August 2010, where total catch per hour is for anglers targeting white crappie and total harvest is the estimated number of white crappie harvested by all anglers. Relative standard errors (RSE) are in parentheses.

	Year
Creel Survey Statistic	2010
Directed effort (h)	76,840.75 (15)
Directed effort/acre	3.00
Total catch per hour	2.34 (35)
Total harvest	55,595.00 (36)
Harvest/acre	2.17

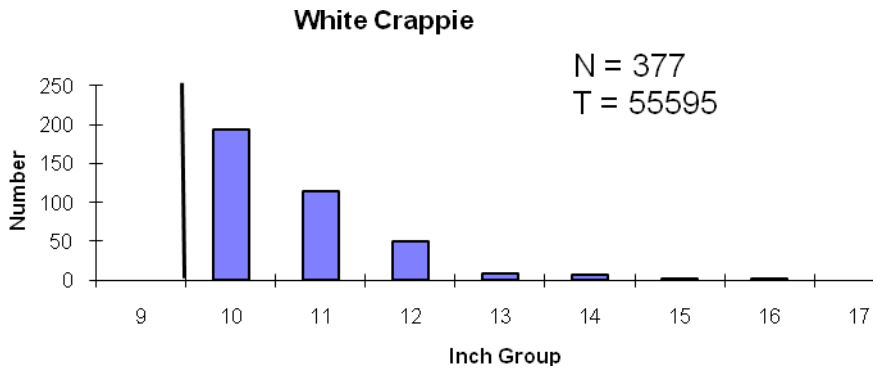


Figure 15. Length frequency of harvested white crappie observed during creel surveys at Ray Roberts Reservoir, Texas, March 2010 through August 2010, all anglers combined. N is the number of harvested white crappie observed during creel surveys, and T is the total estimated harvest for the creel period. Vertical line represents length limit at time of creel survey.

Table 14. Proposed sampling schedule for Ray Roberts Reservoir, Texas. Electrofishing and trap netting surveys are conducted in the fall, while gill netting surveys are conducted during the following spring. Additional survey denoted by A. Standard survey denoted by S.

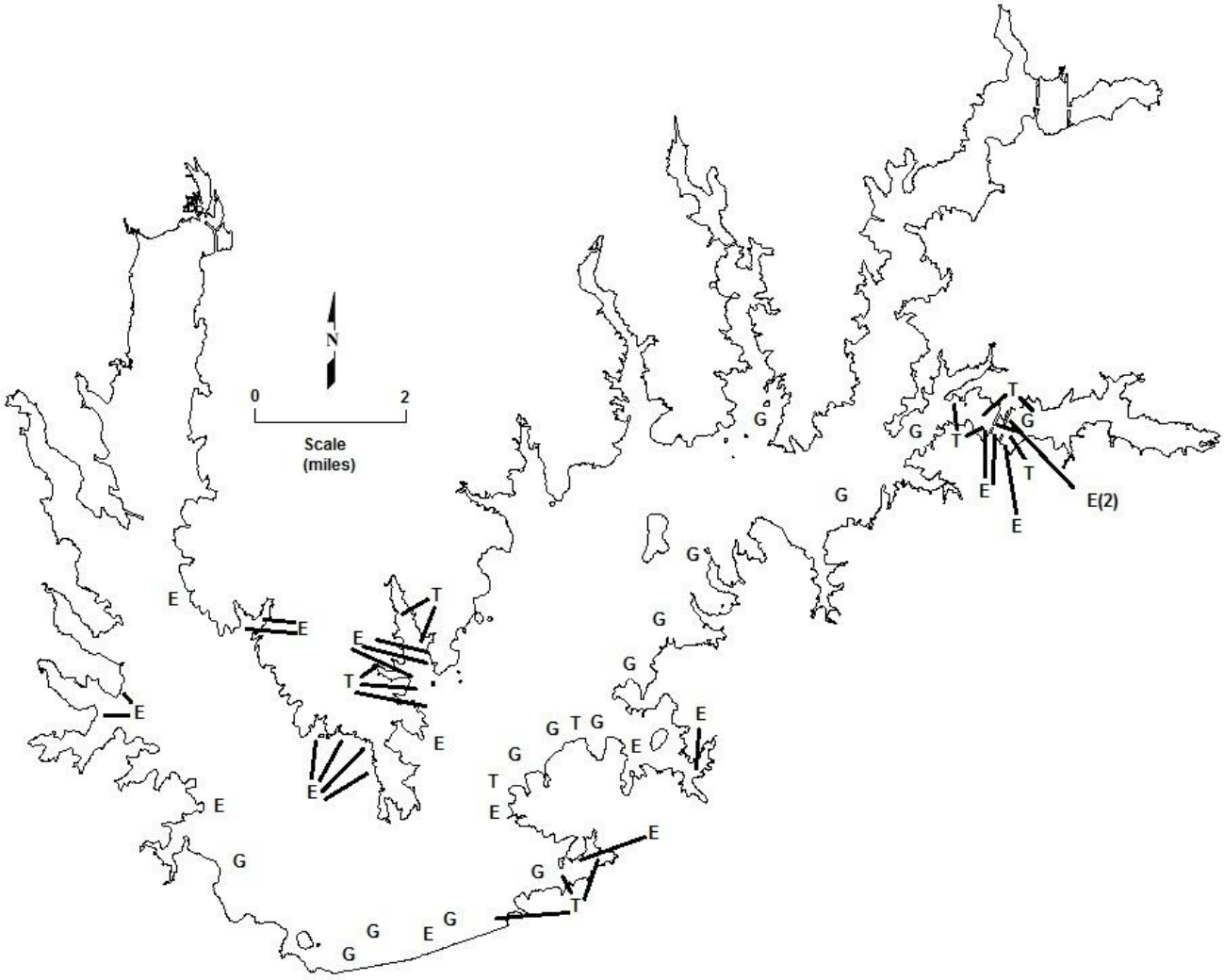
Survey Year	Electrofisher	Trap Net	Gill Net	Creel Survey	Vegetation Survey	Access Survey	Report
Fall 2012-Spring 2013					A		
Fall 2013-Spring2014	A				A		
Fall 2014-Spring 2015					A		
Fall 2015-Spring 2016	S	S	S		S	S	S

APPENDIX A

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

	Gill Netting		Trap Netting		Electrofishing	
Species	N	CPUE	N	CPUE	N	CPUE
Gizzard shad					360	180.0
Threadfin shad					130	65.0
Blue catfish	55	3.7				
Channel catfish	34	2.3				
Flathead catfish	1	0.1				
White bass	156	10.4				
Green sunfish					293	146.5
Warmouth					14	7.0
Orangespotted sunfish						
Bluegill					239	119.5
Longear sunfish					375	187.5
Redear sunfish					2	1.0
Smallmouth bass					1	0.5
Spotted bass					107	53.5
Largemouth bass					217	108.5
White crappie			460	30.7		
Black crappie			16	1.0		

APPENDIX B



Location of sampling sites, Ray Roberts Reservoir, Texas, 2011-2012. Trap netting, gill netting, and electrofishing stations are indicated by T, G, and E, respectively. Water level was 5 foot below conservation level for electrofishing and trap netting, and 2 foot below conservation level during gill netting.

APPENDIX C

Catch rates (CPUE) of targeted species by gear type for Ray Roberts Reservoir, Texas, 1995, 1998, 2000, 2001, 2002, 2003, 2004, 2007, 2008, 2011, and 2012.

		Year											
Gear	Species	1995[a]	1998[b]	2000[b,c]	2001[b,d]	2002[b,d]	2003[b]	2004[b]	2007[b,d]	2008[b]	2011[b]	2012[b]	**Avg**
Gill Net	Blue catfish	0.0	0.3					1.7		2.8		3.7	**1.7**
(fish/net night)	Channel catfish	6.0	4.5					8.2		5.5		2.3	**5.3**
	Flathead catfish	0.0	0.1					0.0		0.1		0.1	**0.1**
	White bass	5.8	3.3					4.5		5.1		10.4	**5.8**
Electrofisher	Gizzard shad	130.5	156.5				127.0		145.0		180		**147.8**
(fish/hour)	Threadfin shad	55.5	61.0				189.5		339.0		65		**142.0**
	Green sunfish	9.5	2.5				2.5		48.0		146.5		**41.8**
	Warmouth	7.5	12.0				5.5		33.0		7		**13.0**
	Orangespotted sunfish						1.0		3.0				**0.8**
	Bluegill	323.5	160.5				123.0		208.0		119.5		**186.9**
	Longear sunfish	49.5	42.0				77.5		254.5		187.5		**122.2**
	Redear sunfish	0.5	6.0				3.5		18.0		1		**5.8**
	Smallmouth bass	0.0	0.0	0.0	0.0	0.0	0.0		0.0		0.5		**0.1**
	Spotted bass	0.0	0.0	0.0	5.0	14.5	15.0		20.0		53.5		**13.5**
	Largemouth bass	168.5	77.5	48.0	108.5	57.5	85.0		227.0		108.5		**110.1**
Trap Net	White crappie	10.9	2.7	4.0			8.6		7.9		30.67		**10.8**
(fish/net night)	Black crappie	0.0	0.1	0.2			0.3		0.3		1.07		**0.3**

[a] All sampling stations for all gear were subjectively selected.
[b] All sampling stations for all gear were randomly selected.
[c] Bass and shad only electrofishing survey.
[d] Electrofishing survey was conducted using a Smith-Root 7.5 GPP (Gas Powered Pulsator). Electrofishing surveys prior to 2007 were conducted using a Smith-Root 5.0 GPP.

APPENDIX D

Quarterly creel survey statistics for largemouth bass at Ray Roberts Reservoir from June 2004 – May 2005, 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.

	Quarter			
Creel Survey Statistic	Summer (June-August)	Fall (September-November)	Winter (December-February)	Spring (March-May)
Directed effort (h)	35,618.28 (25)	36,208.79 (24)	5,799.31 (34)	41,439.10 (28)
Directed effort/acre	1.39	1.41	0.23	1.62
Total catch per hour	0.37 (23)	0.46 (18)	0.23 (73)	0.23 (26)
Total harvest	1,193 (95)	4195 (53)	0	2247 (113)
Harvest/acre	0.05	0.16	0.00	0.09

APPENDIX E

Quarterly creel survey statistics for largemouth bass at Ray Roberts Reservoir from March 2010 – August 2010, 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.

	Quarter	
Creel Survey Statistic	Spring (March-May)	Summer (June-August)
Directed effort (h)	59,016.36 (31)	21,289.92 (28)
Directed effort/acre	2.31	0.83
Total catch per hour	0.41 (13)	0.15 (32)
Total harvest	11,078 (64)	167 (260)
Harvest/acre	0.43	0.01