

PERFORMANCE REPORT

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INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2015 Fisheries Management Survey Report

Big Creek Reservoir

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Big Creek Reservoir were surveyed in 2015 using electrofishing and in spring 2016 using gill netting. An aquatic vegetation survey was conducted during summer 2015. Historical data are presented with the 2015-2016 data for comparison. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir description:** Big Creek Reservoir is a 520-acre impoundment located in Delta County, Texas, on Big Creek, a tributary of the South Sulphur River. The reservoir was constructed by the City of Cooper for municipal water supply. At conservation pool elevation, habitat consists primarily of featureless banks and the littoral area contains limited amounts of emergent aquatic plants. The invasive aquatic plant Eurasian watermilfoil has been found in the past.
- **Management History:** Important sport fish include Largemouth Bass, White Crappie, and Channel Catfish.
- **Fish community**
 - **Prey species:** Catch of Gizzard Shad was high. Other prey species collected were Longear Sunfish and Bluegill. Catch rates of sunfish species were low and potentially linked to profound changes in aquatic habitat resulting in increased water turbidity.
 - **Catfishes:** Channel Catfish were present in the reservoir. However, catch rates were much lower than they were in the 2012 survey. One Blue Catfish was collected during the spring 2016 survey but no Flathead Catfish were observed.
 - **Largemouth bass:** Catch of Largemouth Bass in fall 2015 was very low compared with previous surveys. Samples collected in fall 2015 showed little recruitment to the population.
 - **White Crappie:** White Crappie catch in spring 2016 was low with the fish collected being dominated by legally harvestable individuals. No assessment was made of crappie populations in previous reports due to lack of access from drought conditions.

Management strategies: Continue with standard monitoring using daytime electrofishing in 2019, and gill netting in 2020. Electrofishing during daytime will be employed due to high turbidity in the reservoir. If sufficient hoop nets can be acquired this method will be substituted for gill netting to sample Channel Catfish in 2019. Continue to monitor aquatic vegetation through a vegetation survey in 2019.

INTRODUCTION

This document is a summary of fisheries data collected from Big Creek Reservoir June 2015 through May 2016. 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 2015 - 2016 data for comparison.

Reservoir Description

Big Creek Reservoir is a 520-acre impoundment constructed in 1987 on Big Creek, a tributary of the South Sulphur River. The reservoir is located in Delta County approximately 15 miles north of Sulphur Springs, Texas, and is operated and controlled by the City of Cooper. Primary water use is for municipal water supply. Habitat at time of sampling consisted primarily of natural shoreline with a littoral area comprised of sparse native vegetation with limited quantities of standing timber. Other descriptive characteristics for Big Creek Reservoir are listed in Table 2.

Angler Access

Boater access consists of two public boat ramps although one has been inaccessible in recent years. Access via this ramp is periodically unavailable when lake elevation decreases as a result of drought. Bank angling access is available around the park area maintained by the city as well as from a fishing pier.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Storey 2012) included:

1. Monitor the Largemouth Bass population.
Action: Planned surveys to collect age and growth and genetics information in fall 2013 were not completed because there was no boat access to the reservoir due to low lake elevation created by drought. A fall Largemouth Bass-only electrofishing survey was conducted in 2015 but insufficient fish in the target length range were collected for age and growth and genetics assessment. An additional electrofishing trip was scheduled in spring 2016 to collect samples for genetic analysis and age and growth assessment but manpower constraints and prioritization of other projects made this unattainable.
2. Improve access facilities for anglers.
Action: The City of Cooper applied to TPWD's Boating Access Grant Program and received a grant in the amount of \$178,738 under the Sport Fish Restoration Grant Program with matching funds from the city of \$59,579 to accomplish improvements including resurfacing of the boat ramp parking area and access drive, bulkheading, renovation of the courtesy dock, dredging, lighting and signage. The total project is valued at \$238,317 and final financial and performance reports for the grant are due by May 29, 2017.

Harvest regulation history: Sport fishes in Big Creek Reservoir are currently managed with statewide regulations (Table 2).

Stocking history: Florida Largemouth Bass (FLMB) were initially introduced into Big Creek Reservoir in 1988 and stocked again in 1989, 1990 and 1998 through 2000, and again in 2007. Blue Catfish were introduced in 1988, and stocked twice more, but this species has not been found in fisheries sampling. Channel Catfish were introduced in 1989 and stocked again in 1991. The complete stocking history is

listed in Table 3.

Vegetation/habitat management history: No control efforts on aquatic vegetation have been necessary on Big Creek Reservoir, despite its history of abundant coverage of aquatic vegetation. Aquatic vegetation, consisting primarily of American lotus, exceeded 50% of reservoir surface area in 2007. The non-native species Eurasian watermilfoil has been documented in Big Creek Reservoir and it reached a peak level of 10% of reservoir surface area in 2003. In 2015 total coverage of less than 3% of the reservoir's surface area was observed and consisted exclusively of native emergent species.

Water transfer: No inter-basin transfers are known to exist.

METHODS

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Big Creek Reservoir (TPWD unpublished). Primary components of the OBS plan are listed in Table 1. All survey sites were randomly selected and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015)

Electrofishing – Largemouth Bass, were collected by daytime electrofishing (1 hour at 12, 5-min stations). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing.

Gill netting – Channel Catfish and White Crappie, were collected by gill netting (10 net nights at 10 stations). CPUE for gill netting was recorded as the number of fish caught per net night (fish/nn).

Statistics – Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD), terminology modified by Guy et al. 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 (DiCenzo et al. 1996). Standard error (SE) was calculated for structural indices and IOV. Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE statistics.

Habitat – A vegetation survey was conducted in 2015. Acreage estimates were assessed using the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

RESULTS AND DISCUSSION

Habitat: In 2003, total aquatic vegetative cover was estimated at 37% consisting primarily of American lotus (22%) and Eurasian watermilfoil (10%) (Storey and Myers 2004). By 2007, Eurasian watermilfoil had declined to 0.4% of reservoir surface area but total vegetative cover was 53% (Jubar and Storey 2008) and the plant community was dominated by American lotus (32%) with other native emergent species contributing a further 5%. At that time native submersed species accounted for 15%. However, in 2015 only native emergent vegetation was found in Big Creek Reservoir with total coverage of less than 3% of the reservoir's surface area.

Prey species: Electrofishing catch rate of Gizzard Shad in 2015 was high, 219.0/hr, and the index of vulnerability (IOV) of 95% indicated Gizzard Shad were readily available as prey to the lake's game fish (Figure 1). CPUE of sunfish species was low (Appendix A) likely due to poor aquatic habitat at the time of sampling characterized by decreased amounts of aquatic vegetation. Relative weights of most size classes of game fish exceeded 85, indicating favorable prey fish populations.

Catfish: The gill net CPUE of Channel Catfish (2.8/nn), was similar to that of 2008 (3.4/nn) but markedly lower than in 2012 (12.4/nn). Most of the fish collected in 2016 were legally harvestable (Figure 2). Body condition of Channel Catfish has apparently declined over time with relative weights of most size classes of fish in the range of 80-90 indicative of fair body condition. Recruitment is consistently low. Fish collected in the samples were outside of the target range for age and growth analysis. One 25-inch Blue Catfish was collected in gill net sampling.

Largemouth bass: Electrofishing catch rate of Largemouth Bass in fall 2015 was 14.0/hr which is much lower than it was in both 2009 (46.0/h) and 2007 (239.0/h) surveys. The majority of Largemouth Bass collected were of stock size or larger with a PSD of 70 (Figure 3). Body condition was variable likely as a result of the low numbers of fish collected. Neither age and growth nor genetic analyses were conducted as a result of inadequate sample sizes. Low lake elevations created by drought made it impossible to conduct sampling in fall 2011 and 2013. It is probable the decline in Largemouth Bass CPUE is related to changes in habitat since the lake used to have abundant coverage of aquatic vegetation. As recently as 2003, total vegetative cover represented 37% of reservoir surface area (Storey and Myers 2004) and by 2007 it had increased to 53% (Jubar and Storey 2008). The current lack of submersed aquatic species would seem to indicate a significant increase of water turbidity, a change which could negatively impact survival of Centrarchids like Largemouth Bass, White Crappie, and Bluegill.

Crappie: Both White and Black Crappie are present in Big Creek Reservoir, but no Black Crappie were captured during gill net sampling. Crappie populations were not sampled with trap nets because of previous inconsistent and low catches. Gill nets confirmed the presence of White Crappie. The catch rate was low, 1.9/nn, although body condition was good with relative weights above 90 for all size classes (Figure 4). The sample was dominated by legally-harvestable fish up to 15 inches in length but few small fish were collected, an indication of a potential recruitment limitation or a gear selectivity issue.

Fisheries management plan for Big Creek Reservoir, Texas

Prepared – July 2016

ISSUE 1: Aquatic vegetation in Big Creek Reservoir has experienced a significant decline in coverage in the past eight years. Total coverage increased from 37% of reservoir surface area in 2003 to 53% in 2007. The most recent vegetation survey conducted in 2015 documented vegetation coverage at 3%. Introduction of native emergent species has greatest likelihood of success because of relatively high water turbidity in Big Creek Reservoir.

MANAGEMENT STRATEGIES

1. Attempt to improve littoral habitat by planting American waterwillow harvested from District reservoirs. This species has a proven ability to establish colonies without the need for protection through the use of enclosure cages. Conduct annual plantings in spring/summer for three years beginning in 2017.

ISSUE 2: The Channel Catfish population in Big Creek Reservoir has shown little evidence of recruitment in gill netting surveys conducted since 2008. Abundance of the population has also fluctuated. Blue Catfish were stocked on three occasions between 1988 and 1991 but there is little evidence of stocking survival. Current low abundance of predators such as Largemouth Bass should increase their potential of survival and could result in the creation of an alternate fishery.

MANAGEMENT STRATEGIES

1. Stock Blue Catfish fingerlings (100/acre) in 2017 and 2018
2. Evaluate stocking success using low frequency electrofishing in 2019 and/or standard gill netting in 2020

ISSUE 3: Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels 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 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.

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.

Objective-Based Sampling Plan and Schedule for 2016-2020

Sport fish, forage fish, and other important fishes

Sport fish in Big Creek Reservoir include Largemouth Bass, White Crappie, and Channel Catfish although none of these species are currently abundant. Prey species have included Bluegill, Redear Sunfish, and Gizzard Shad and Threadfin Shad.

Low-density fisheries

Catfish: Stockings of both Blue and Channel Catfish have been conducted at Big Creek Reservoir and up until 2016 only Channel Catfish had been collected in gill net sampling. A single 25-inch Blue Catfish was collected in 2016. Channel Catfish have established a self-sustaining population although recruitment is poor and catch rates are variable. General monitoring trend data (without precision or sample size requirements) can be gathered for this species with a minimum effort of 10 randomly-selected gill net stations in spring 2020. If a sample of 13 fish in the length range 11 to 12.9 inches is collected they will be processed to calculate mean age at minimum length limit. Based on the most recent surveys, a sampling effort of between 20 – 25 gill nets would be required to obtain a target of 50 stock-sized fish at the 80th percentile. To collect a sample of stock-sized fish with an RSE-stock < 25 at the 80th percentile would require an effort of 15 net nights.

Baited hoop nets will be deployed between June-October 2019 to set 6 series (3 nets each) for a duration of two nights to determine if they are more effective at sampling the Channel Catfish population. Use of this alternative methodology has the potential to decrease mortality of all fish collected. OBS sampling criteria will target 50 stock-sized fish with an RSE-stock < 25 and 13 fish between 11 and 12.9 inches for aging. If baited-tandem hoop sampling is successful in attaining sampling criteria they will be used to substitute for gill nets in sampling Channel Catfish in the future.

Crappie: Both White Crappie and Black Crappie are present in Big Creek Reservoir. Catch per unit of effort from fall trap netting surveys in 1999, 2003, and 2007 were 25.4/nn, 16.8/nn, and 0.2/nn respectively. Trap net sampling was discontinued in 2007 because of the declining catches of Crappie. Bycatch of Crappie with spring gill netting in 2020 will be used to document the presence of these species.

Largemouth Bass: Big Creek Reservoir has historically produced trophy Largemouth Bass. The lake record (14.06 lb.) was caught in 1996, and a 13.19 lb. ShareLunker entry was caught in March 2000 although no recent catches of trophy fish have not been documented. Largemouth Bass have always been managed with the statewide 14-in MLL regulation. Trend data on CPUE, size structure, growth, and body condition have been collected since 1990, usually on a biennial basis during fall. Low lake elevations in 2011 and 2013 prohibited access. Catch per unit of effort from fall electrofishing surveys in 2001, 2003, 2006, 2007, and 2009 were 145.0/h, 142.0/h, 116.0/h, 239.0/h, and 46.0/h respectively. General monitoring trend data (without precision or sample size requirements) will be conducted during daytime hours in the fall every four years. A survey involving 12 randomly-selected 5-min electrofishing sites will be conducted in 2019.

Sunfish and Shad: Bluegill, Redear Sunfish, Gizzard Shad and Threadfin Shad have all been collected in the past, but recently Gizzard Shad have become the dominant prey species. Size structure and prey availability (IOV) of Gizzard Shad will be assessed through collection of a sample of 50 fish. No sampling criteria will be established for either Bluegill or Redear Sunfish due to recent declines in abundance of these populations. No additional effort beyond that necessary to sample Largemouth Bass will be expended on prey species.

Objective-based sampling plan components for Big Creek Reservoir, Texas for 2016 – 2020.

Gear/ target species	Survey objective	Metrics	Sampling objective
<i>Electrofishing 2019</i>			
<i>Fall - daytime</i>			
<i>(Effort = 12 stations)</i>			
Largemouth Bass	<i>Monitor trend in:</i> Abundance Size structure	CPUE – stock PSD, length frequency	
Bluegill	<i>Presence/Absence</i>		
Gizzard Shad	<i>Monitor trend in:</i> Size structure Prey availability	PSD, length frequency IOV	N ≥ 50 N ≥ 50
<i>Baited hoop nets 2019</i>			
<i>(Effort = 6 (x3) series x 2nn)</i>			
Channel Catfish	<i>Gear evaluation:</i> Abundance Size structure Age-and-growth	CPUE – stock PSD, length frequency Age at 12 inches	RSE ≤ 30 N ≥ 50 stock N = 13, 11.0 – 12.9 in
<i>Gill netting 2020*</i>			
<i>(Effort = 10-20nn)</i>			
Channel Catfish	<i>Monitor trend in:</i> Abundance Size structure Age-and-growth	CPUE – stock PSD, length frequency Age at 12 inches	N = 13, 11.0 – 12.9 in
White Crappie	<i>Presence/Absence</i>		

*Not necessary if hoop nets are successful in collecting channel catfish

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Table 1. Characteristics of Big Creek Reservoir, Texas.

Characteristic	Description
Year constructed	1987
Controlling authority	City of Cooper
Surface area	520 acres
Counties	Delta
Reservoir type	Tributary
Mean depth	12.0 ft.
Maximum depth	31.0 ft.
Shoreline Development Index (SDI)	3.52
Conductivity	160 μ mho / cm
Secchi disc range	1 – 2 ft.
Watershed area	11.7 mi ²

Table 2. Boat ramp characteristics for Big Creek Reservoir, Texas, August 2015. Reservoir elevation at time of survey was close to conservation pool elevation.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft msl)	Condition
Big Creek	33.39628 -95.69553	Y	12	UNK	Fill needs to be installed in area of “prop wash” to enable ramp to be used during drought conditions. This work is scheduled to be completed as a part of improvements to facilities that are currently being undertaken

Table 3. Harvest regulations for Big Creek Reservoir.

Species	Bag limit	Length limit (inches)
Catfish: Channel and Blue catfish, their hybrids and subspecies	25 (in any combination)	12-inch minimum
Catfish: Flathead	5	18-inch minimum
Bass: Largemouth	5	14-inch minimum
Crappie: White and Black crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum

Table 4. Stocking history of Big Creek Reservoir, Texas. Size categories are: FGL = 1-3 inches; AFGL = 8 inches, and ADL = adults.

Species	Year	Number	Size
Gizzard Shad	1988	60	ADL
	Total	60	
Threadfin Shad	1991	1,200	ADL
	Total	1,200	
Blue Catfish	1988	26,000	FGL
	1990	5,269	AFGL
	1991	26,135	FGL
	Total	57,404	
Channel Catfish	1989	13,000	FGL
	1991	13,000	FGL
	Total	26,000	
Coppernose Bluegill	1988	150,626	
	Total	150,626	
Florida Largemouth Bass	1988	54,057	FGL
	1988	625	AFGL
	1989	10,988	FGL
	1990	38,578	FGL
	1990	2,108	AFGL
	1998	52,894	FGL
	1999	51,960	FGL
	2000	4,500	FGL
	2007	123,860	FGL
	Total	339,570	
White Crappie	1988	26,000	FGL
	Total	26,000	

Table 5. Objective-based sampling plan components for Cooper Reservoir, Texas 2015 – 2016.

Gear/target species	Survey objective	Metrics	Sampling objective
<i>Electrofishing</i>			
Largemouth Bass	Abundance	CPUE – stock	RSE-stock ≤ 25
	Size structure	PSD, length frequency	$N \geq 50$ stock
	Age-and-growth	Age at 14 inches	$N = 13, 13.0 - 14.9$ in
	Genetics	% FLMB	$N = 30$, any age
Bluegill ^a	Abundance	CPUE – total	RSE ≤ 25
	Size structure	PSD, length frequency	$N \geq 50$
Gizzard Shad ^a	Size structure	PSD, length frequency	$N \geq 50$
	Prey availability	IOV	$N \geq 50$
<i>Gill netting</i>			
Channel Catfish	Abundance	CPUE – stock	RSE-stock ≤ 25
	Size structure	PSD, length frequency	$N = 50$
	Age-and-growth	Age at 12 inches	$N = 13, 11.0 - 12.9$ in
White Crappie	Abundance	Presence/ Absence	

^a No additional effort will be expended to achieve an RSE ≤ 25 for CPUE of Bluegill and Gizzard Shad if not reached from designated Largemouth Bass sampling effort. Instead, Largemouth Bass body condition can provide information on forage abundance, vulnerability, or both relative to predator density.

Table 6. Survey of aquatic vegetation at Big Creek Lake, Texas, August 2015. Surface area (acres) and percent of reservoir surface area were determined for each type of aquatic vegetation found.

Aquatic vegetation species	Surface Area	
	Acres	Percent of reservoir surface area
Native emergent		
Water primrose	2	<1
Smartweed	<1	<1
Giant bulrush	<1	<1
Total	3	<1

Gizzard Shad

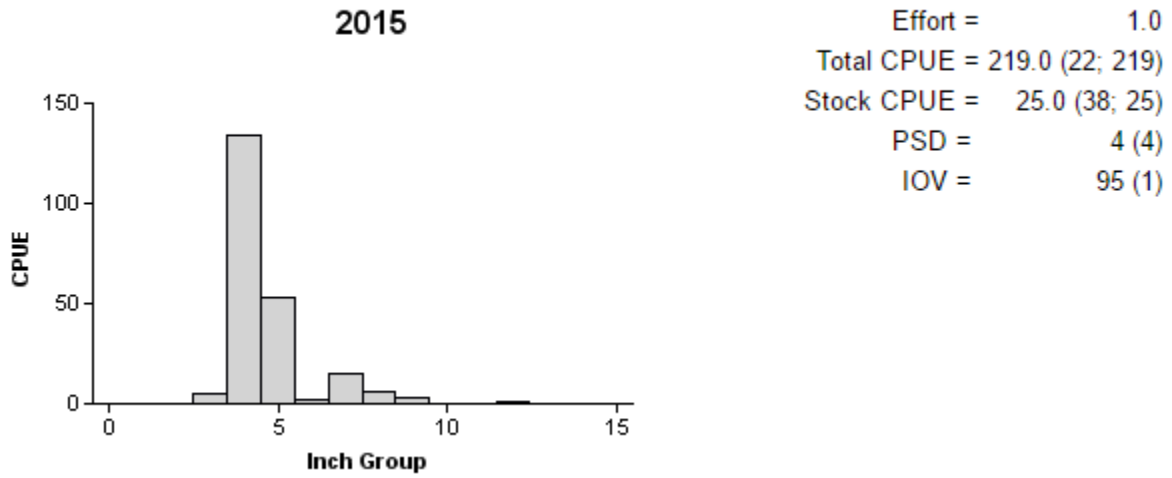


Figure 1. Number of Gizzard Shad caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing survey, Big Creek Reservoir, Texas, 2015.

Channel Catfish

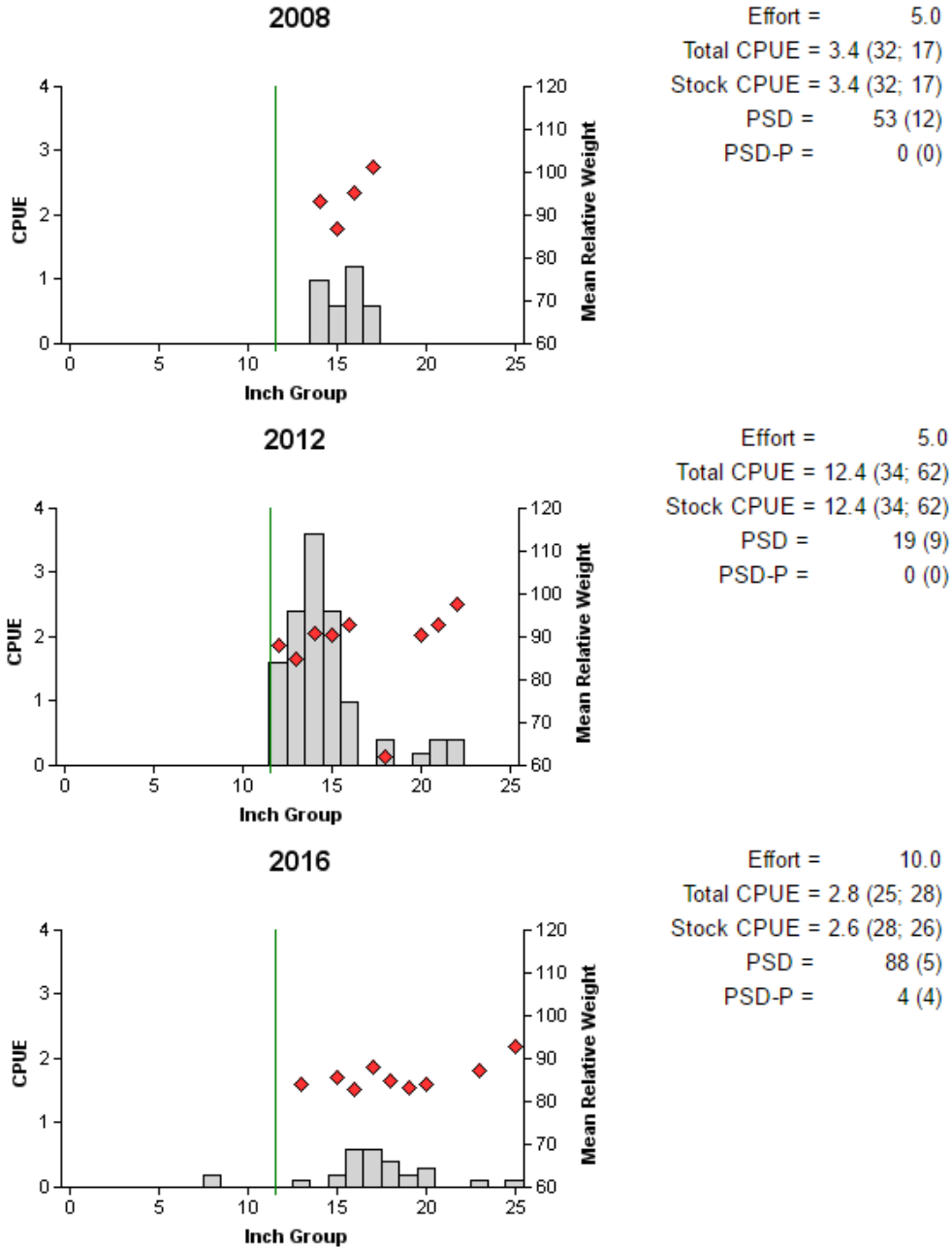


Figure 2. Number of Channel Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Big Creek Reservoir, Texas, 2008, 2012, and 2016. Vertical lines indicate minimum length limit at time of survey.

Largemouth Bass - Fall

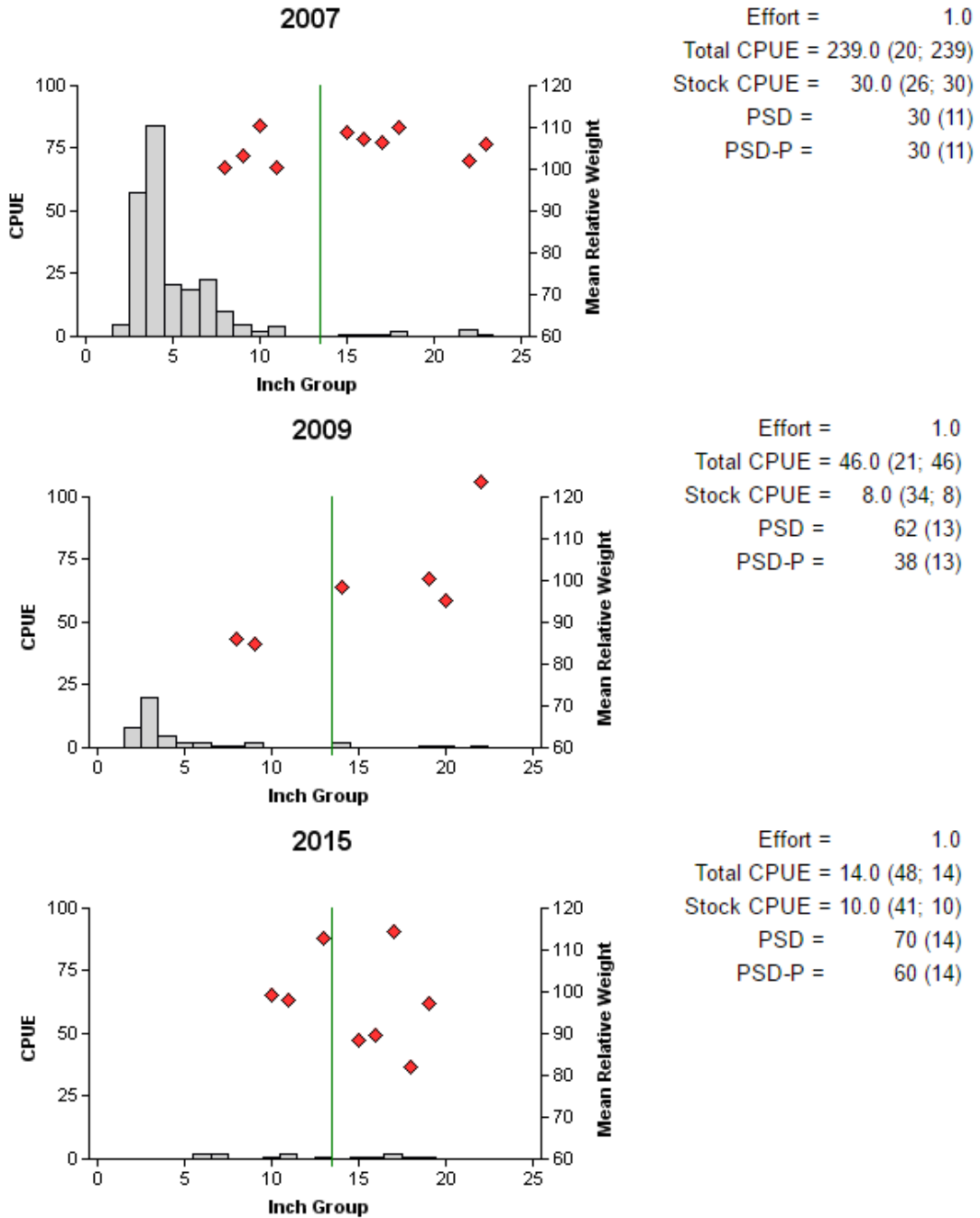


Figure 3. Number of largemouth bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Big Creek Reservoir, Texas, 2007, 2009, and 2015. The 2009 survey was bass-only. Vertical lines indicate minimum length limit at time of survey.

White Crappie - Spring

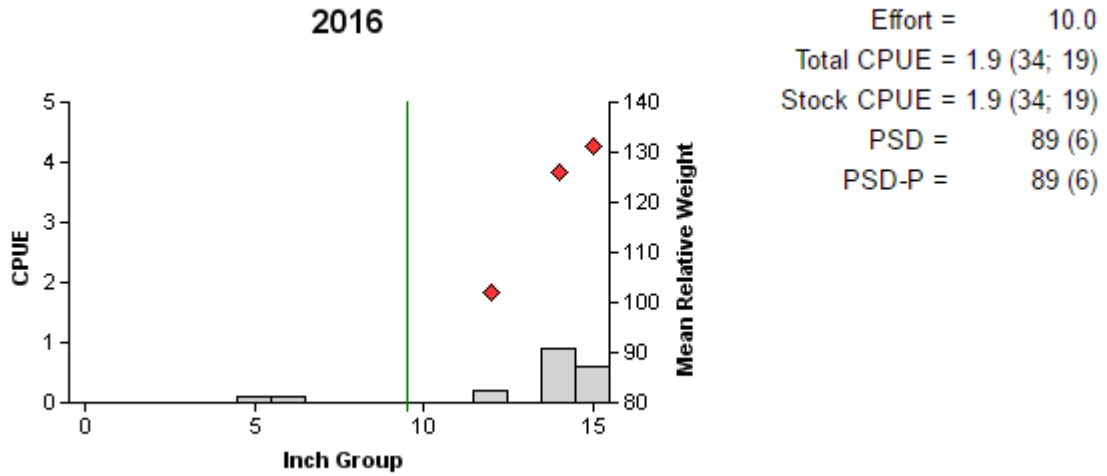


Figure 4. Number of White Crappie caught per net night (CPUE) and population indices (RSE and N are in parenthesis) for spring gill net survey, Big Creek Reservoir, Texas, 2016. Vertical line indicates minimum length limit at time of survey.

Table 7. Proposed sampling schedule for Big Creek Reservoir, Texas. Gill netting surveys are conducted in the spring, while electrofishing surveys are conducted in the fall. Standard surveys denoted by S and additional surveys denoted by A.

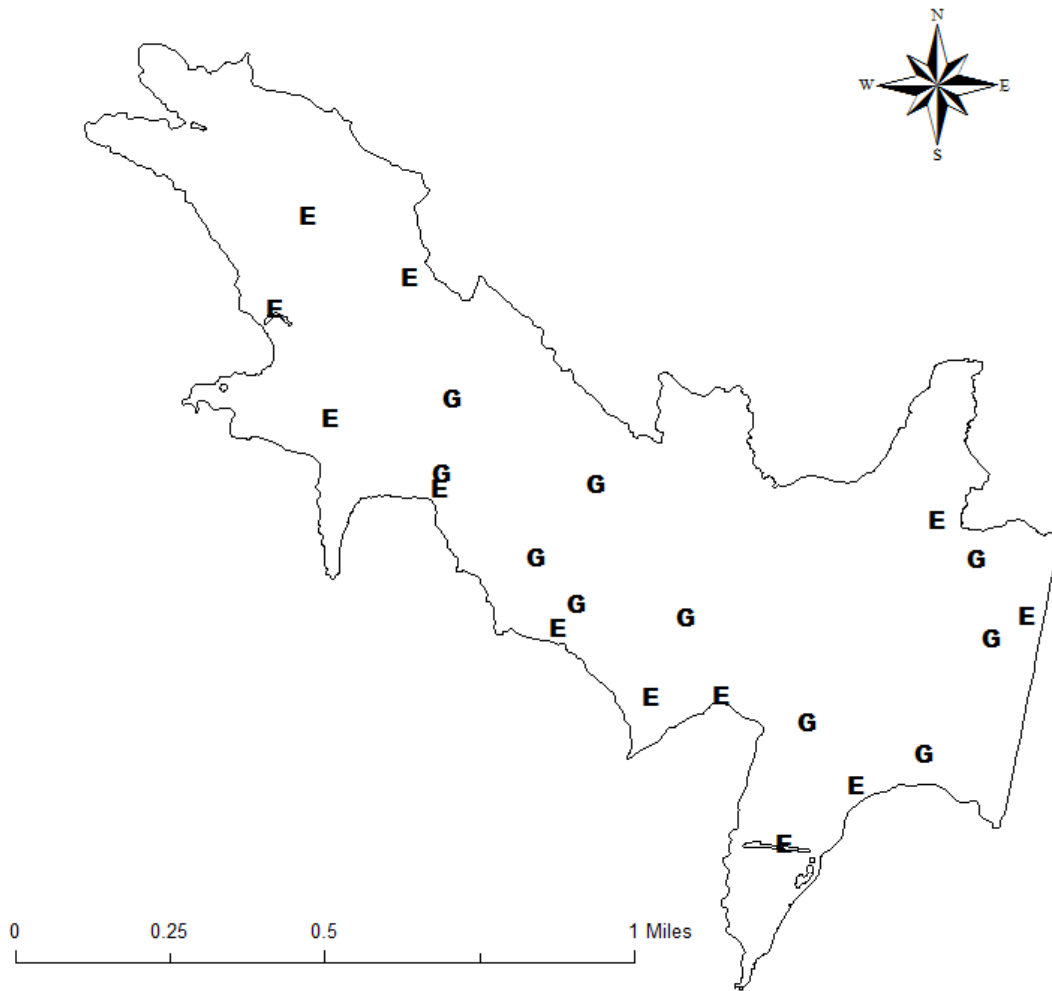
Survey Year	Vegetation	Access	Baited hoop nets	Electrofishing	Gill netting	Report
2016-2017						
2017-2018						
2018-2019						
2019- 2020	S	S	A	S	S	S

APPENDIX A

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Big Creek Reservoir, Texas, 2015-2016. Sampling effort was 10 net nights for gill netting and 1 hour for electrofishing.

Species	Gill Netting		Electrofishing	
	N	CPUE	N	CPUE
Gizzard Shad			219	21.9
Blue Catfish	1	0.1		
Channel Catfish	28	2.8		
Green Sunfish			1	1.0
Bluegill			3	3.0
Longear Sunfish			8	8.0
Largemouth Bass			14	14.0
White Crappie	19	1.9		

APPENDIX B



Location of fall 2015 electrofishing sites (E) and spring 2016 gill net sites (G), Big Creek Reservoir, Texas, 2015-2016. Lake elevation was at conservation pool elevation during sampling.