Cisco Reservoir

2019 Fisheries Management Survey Report

PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-4

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

Prepared by:

Natalie Goldstrohm, Assistant District Management Supervisor
and
Michael D. Homer Jr., District Management Supervisor

Inland Fisheries Division
Abilene District, Abilene, Texas

Carter Smith
Executive Director

Craig Bonds
Director, Inland Fisheries

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Survey and Management Summary

Fish populations in Cisco Reservoir were surveyed in 2017 and 2019 using electrofishing and trap netting and in 2019 using tandem hoop netting. Historical data are presented with the 2016-2020 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: Cisco Reservoir is a 1,050-acre impoundment constructed in 1928 on Sandy Creek, in the Brazos River Basin. The reservoir's functions are municipal water supply and recreation, and it is controlled by the City of Cisco. The reservoir has a history of extreme water level fluctuations. From 1999 to 2016, the water level fluctuated between 11 to 23 feet below conservation pool (CP). As of May 2016, the reservoir was full and has remained within 5 feet of CP. Fish habitat during the most recent survey consisted primarily of rock, flooded terrestrial vegetation, buttonbush, standing timber, and cattail. Boater access consisted of two public boat ramps. Bank fishing access was limited to the main boat ramp area.

Management History: Sport fish include Largemouth Bass, White Crappie, catfishes, and White Bass. Redbreast Sunfish and Redear Sunfish have historically been present. Attempts to establish a Smallmouth Bass population in the 1990s was unsuccessful. Florida Largemouth Bass were last stocked in 2020. Sport fish are managed with statewide harvest regulations.

Fish Community

- **Prey species:** Gizzard Shad, Threadfin Shad, Inland Silversides, and sunfish were present and available for sport fish. Relative abundance of prey species was fair. Few of the Gizzard Shad were of sizes that were available to sport fish. Bluegill was the most common prey species. Redbreast Sunfish were not observed during electrofishing; however larger Redear Sunfish were present in low relative abundance.
- **Catfishes:** Few catfish were sampled. However, Channel Catfish were present in low relative abundance. Flathead Catfish were present in the reservoir.
- **White Bass:** White Bass were present in the reservoir.
- **Largemouth Bass:** Catch rates of Largemouth Bass were fair with most of the fish sampled ≥ stock-length. The Largemouth Bass population was balanced with fish of legal length available to anglers. Mean relative weights were fair (W_r <90) to optimal (W_r >90). On average, it took 3.4 years for Largemouth Bass to reach 14 inches.
- **White Crappie:** White Crappie were present, but relative abundance was low. However, most fish sampled were of legal length. Mean age of 10-inch White Crappie was 2.0 years.

Management Strategies: A Largemouth Bass-only electrofishing survey will be conducted in fall 2021 and an electrofishing survey for Largemouth Bass and their prey items will be conducted in fall 2023. White Crappie will be surveyed in fall 2023 with trap netting to maintain long-term trend data. Flathead Catfish may be sampled using low-frequency electrofishing if time allows. Tandem hoop netting and gill netting will not be conducted in 2020-2024. Access and habitat surveys will be conducted in summer 2023. Florida Largemouth Bass stockings will be requested if suitable littoral habitat remains available. Inform the public of the threat and negative impact of invasive species.

Introduction

This document is a summary of fisheries data collected from Cisco Reservoir in 2016-2020. 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 fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2016-2020 data for comparison.

Reservoir Description

Cisco Reservoir is a 1,050-acre impoundment constructed in 1928 on Sandy Creek, in the Brazos River Basin. The reservoir is in Eastland County, approximately 5 miles north of the town of Cisco, and it is controlled by the City of Cisco. The reservoir was built primarily for municipal water supply and recreation. The reservoir has been subjected to extreme water level fluctuations. Cisco Reservoir experienced long periods of reduced water level broken by occasional heavy rain events. Recently, rain events raised the water level to Conservation Pool (CP) in 2016. Water level stayed at CP into 2017, then dropped to 5 feet below CP before filling in 2019 (Figure 1). Littoral habitat consists primarily of rock and some aquatic vegetation during higher water level. Other descriptive characteristics for Cisco Reservoir are in Table 1.

Angler Access

Cisco Reservoir has two public boat ramps. Additional boat ramp characteristics are located in Table 2. Bank fishing access is limited to the main boat ramp area.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Goldstrohm and Homer 2016) included:

1. Continue to monitor sport fishes and prey populations to determine trends in relative abundance, size structure, and body condition by conducting electrofishing for prey species and Largemouth Bass and trap netting for White Crappie.

   Action: A bass-only electrofishing survey was conducted in fall 2017 and an electrofishing survey for bass and prey fishes was conducted in fall 2019. Trap netting surveys were conducted in fall 2017 and 2019 for crappie. Length was collected on all target species for size structure and weight was collected on a sample of Largemouth Bass and White Crappie to determine body condition.

2. Stock Florida Largemouth Bass when suitable habitat is available.

   Action: Largemouth Bass were stocked in 2016 and 2020 when water level was near CP.

3. Continue to monitor Florida Largemouth Bass influence by collecting genetic samples from Largemouth Bass.

   Action: In 2017 and 2019, fin clips of Largemouth Bass were collected for genetic testing.

4. Investigate ways to improve fish habitat at low water level that would increase relative abundance of centrarchid species.

   Action: Since water level increased significantly, there was abundant habitat for centrarchid species. Fish habitat projects are still being considered.

5. Contact City of Cisco and discuss needed improvements that could be made to the main boat ramp and the boat dock.

Action: No ramp improvements have been made at this time. Boat ramps were accessible at the current water level. At current water level, parking at the main boat ramp was limited to < 5 vehicles and trailers.

6. Educate the public about the threats of invasive species.

   Action: Controlling authority has been notified about the threat of invasive species. Signs are posted and maintained that educate about the threat of invasive species. Media and internet post have been made about invasive species and invasive species was a talking point when presenting to constituents.

Harvest regulation history: All sport fish are regulated with statewide harvest regulations (Table 3).

Stocking history: Blue Catfish were stocked in 1980 and 2001. Over 100,000 Smallmouth Bass were stocked from 1984 to 1997 although no viable population became established. Florida Largemouth Bass were first stocked in 1991 and were most recently stocked in 2020. The complete stocking history is located in Table 4.

Vegetation/habitat management history: Prior to 2016, Cisco Reservoir had no directed management of vegetation or structural improvements to the reservoir. In 2016, City of Cisco and Still Waters Bass Club collaborated with Texas Parks and Wildlife Department to create 10, 10-tree brush piles by using recycled Christmas trees. The project was intended to increase structural fish habitat and increase angler catch rates in the reservoir. The GPS coordinates and a printable map of the brush piles sites were made accessible to the general public via the Texas Parks and Wildlife Department website and social media (Appendix C).

Water transfer: No interbasin 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 Cisco Reservoir (Goldstrohm and Homer 2016). Primary components of the OBS plan are listed in Table 5. All survey sites were randomly selected unless otherwise stated and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2017).

Electrofishing – Largemouth Bass, sunfishes, Gizzard Shad, and Threadfin Shad were collected by electrofishing (2 hours at 24, 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. Ages for Largemouth Bass (range 13.0 to 14.9 inches) were determined using otoliths from 14 Largemouth Bass in 2017 and 8 Largemouth Bass in 2019.

Trap netting – Crappie were collected using trap nets (10 net nights at 10 stations). CPUE for trap netting was recorded as the number of fish caught per net night (fish/nn). In 2017, ages for crappie (range 9.0 to 10.9 inches) were determined using otoliths from 10 White Crappie in 2017.

Tandem hoop nets – Channel Catfish were collected using 6 tandem hoop-net series at 6 stations. Stations were biologist selected stations and were not randomly selected. Nets were baited with soap and deployed for 2-night soak durations. CPUE for tandem hoop netting was recorded as the number of fish caught per tandem hoop net series (fish/series).

Genetics – Genetic analysis of Largemouth Bass was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2017). Micro-satellite DNA analysis was used to determine genetic composition of individual fish since 2005. Electrophoresis analysis was used prior to 2005.

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.

Habitat – In September 2019, structural habitat composition was determined by conducting a survey using the random point method assessing 75 random stations distributed along the shoreline. Vegetation data were also collected at these 75 sites. Additionally, a habitat survey was conducted during the same time at 150 random stations distributed throughout the reservoir. Habitat types and vegetation were identified at or below the waterline and marked as “1” for present or “0” for absent. Percent occurrence (% = [# stations present / total stations sampled] X 100) and associated 95% confidence intervals were calculated for structural habitat and habitat (AusVet 2020).

Water level – Source for water level data was the United States Geological Survey (USGS 2020).

Results and Discussion

Habitat: Structural habitat features consisted mainly of natural/featureless shoreline (48.0%) and rocky shoreline (42.7%). Docks (18.7%), bulkhead (8.0%), and rock bluff (1.3%) were also features that were present (Table 6). The reservoir is mainly open water (97.3%) with some flooded terrestrial brush (2.7%). No aquatic vegetation was recorded in the habitat survey conducted throughout the reservoir. Habitat in the shoreline survey was primarily flooded terrestrial brush (94.7%), common buttonbush (38.7%), standing timber (38.7%), cattail (18.7%), and black willow (13.3%). *Chara* spp., logs, and water primrose were present in less than 5% of the shoreline (Table 7). Water level at the time of surveys was 0.7 feet below CP.

Prey species: The prey base primarily consisted of Gizzard Shad, Threadfin Shad, and Bluegill. Catch rate of Gizzard Shad in 2019 (36.0/h) was similar to previous surveys in 2015 (36.0/h) and 2013 (40.0/h). Gizzard Shad IOV was 12 in 2019, which was lower than previous surveys in 2015 (37) and 2013 (22), indicating most fish were not available as prey (Figure 2). Threadfin Shad catch rate have continued to decrease in 2019 (2.5/h) down from 2015 (112.7/h) and 2013 (381.0/h). Bluegill CPUE in 2019 (47.0/h) declined from previous surveys conducted in 2015 (325.3/h) and 2013 (119.0/h; Figure 3). Size structure of Bluegill in 2019 was low (PSD=8) with most fish between 3-6 inches, which is similar to previous surveys. Most Bluegill were of adequate prey size for sport fish (Figure 3). No Redbreast Sunfish were sampled in 2019 although they were captured in high relative abundance in previous surveys (Figure 4). Sampling goals for Redbreast Sunfish for abundance and size structure were not met during sampling. In 2019, catch rate of Redear Sunfish declined to 2.5/h from 37.3/h in 2015 (Figure 5). There were limited stock-length Redear Sunfish (≥ 7 inches) sampled at Cisco Reservoir. Historically, some larger Redear and Redbreast sunfish (i.e., ≥7 inches) were present that could potentially provide a sunfish fishery if numbers increase. Redear Sunfish sampling goals for abundance and sample size were not met during sampling. Catch rates during the 2019 electrofishing survey may have been lower due to equipment malfunction during the first night of sampling of the two-night survey. Pulsator was not working correctly and was exchanged for a working unit on the second night of sampling. Issues with the pulsator during the first night of sampling (9 stations) likely resulted in fewer fish being sampled compared to the second night of sampling (15 stations). The first pulsator has since been fixed. The overall prey species abundance in the reservoir was sufficient to support existing predator species populations.

Channel Catfish: Channel Catfish were previously sampled using gill nets, but due to low catch rates the decision was made to use exploratory tandem hoop net sampling in 2019 (Goldstrohm and Homer 2016). Channel Catfish catch rates in tandem hoop nets were also low (0.3/series; Figure 6). Legal-length fish were present in low relative abundance.

Flathead Catfish: Flathead Catfish were previously sampled using gill nets, but due to low catch rates the decision was made to use exploratory low frequency electrofishing sampling in 2019 (Goldstrohm and Homer 2016), unfortunately because of travel restrictions during the COVID-19 pandemic, this sampling was not completed. Flathead Catfish were present in the reservoir and observed during hoop netting and electrofishing surveys.

White Bass: White Bass were present in the reservoir and sampled in the trap netting and electrofishing surveys. There were no surveys targeting White Bass during the study period.

Largemouth Bass: Total catch rate for Largemouth Bass was 27.0/h in 2019, which was lower than in 2015 (175.3/h; Figure 7). In addition to the standard sampling, an additional nighttime, bass-only electrofishing survey was completed in 2017 (63.7/h). Relative abundance of Largemouth Bass ≥ stock-length (≥ 8 inches) was higher in 2017 (59.1/h), during the bass-only electrofishing survey compared to standard surveys done in 2019 (22.5/h) and 2015 (34.0/h; Figure 7). Catch rates during the 2019 electrofishing survey may have been lower due to equipment malfunction during the first night of sampling of the two-night survey. Pulsator was not working correctly and was exchanged for a working unit on the second night of sampling. Issues with the pulsator during the first night of sampling (9 stations) likely resulted in fewer fish being sampled compared to the second night of sampling (15 stations). The first pulsator has since been fixed. The Largemouth Bass population remained balanced in 2017 (PSD=38), and 2019 (PSD=58) similar to 2015 (PSD=43). Sampling goal of collecting 50 fish ≥ stock-length was not met, but 45 fish ≥ stock-length were sampled. Mean relative weight values ranged from 70 to 90 for most inch groups in 2019 (Figure 7), suggesting condition was fair to optimal. Sampling goals of collecting 10 fish per inch group were not met. Only 8 fish between 13.0-14.9 inches were collected to determine age at legal length in 2019. Largemouth Bass reached legal length (14-inches) in 2.4 years on average in 2017 (N=14, range 2 – 4 years), quicker than in 2019, which took on average 3.4 years (N=8, range 2 – 4 years). Historically, there have been very few pure Florida Largemouth Bass in Cisco Reservoir. During the 2017 and 2019 electrofishing surveys, no pure Florida Largemouth Bass were sampled despite stocking in 2012 and 2016. All fish sampled in 2019 and most of the fish in 2017 were second or higher generation hybrid between a Florida Largemouth Bass and a Northern Largemouth Bass (Table 8). In

2019, 30 fin clip samples were collected during sampling, however one was not viable and was omitted from the analysis.

White Crappie: White Crappie catch rate was 0.4/nn in 2019 and decreased from 2.9/nn in 2017 and 2.7/nn in 2015 (Figure 8). In 2017 and 2019, White Crappie PSD was 96 and 100 respectively. The size structure in 2019 and 2017 was comprised only of fish ≥ stock-length (Figure 8). Growth rates of White Crappie have continued to increase since 1999 (Goldstrohm and Homer 2016). Additionally, all sampled White Crappie in 2017 reached legal length in 2.0 years (N=10), which is the fastest growth we have recorded for Cisco Reservoir. Sampling objectives for abundance, size structure, condition, and age and growth were not met for White Crappie.

Fisheries Management Plan for Cisco Reservoir, Texas

Prepared – July 2020

ISSUE 1: Largemouth Bass support the most popular fishery at Cisco Reservoir. Catch rates were significantly higher in 2015, during the lower water level period. An increase in their abundance was expected following an increase in water level and available habitat. However, catch rates have continued to decline substantially.

MANAGEMENT STRATEGIES

1. Continue to monitor Largemouth Bass and prey populations to determine trends in relative abundance, size structure, growth, Florida Largemouth Bass allele frequencies, and body conditions by conducting an electrofishing survey.
2. Request Florida Largemouth Bass at a rate of 1,000 per km of shoreline when aquatic vegetation and structural habitat is present along the shoreline.

ISSUE 2: Angler access for boaters could be improved. The boat dock is in need of repairs. Also, when Cisco Reservoir is at CP, there is limited parking at the main boat ramp.

MANAGEMENT STRATEGY

1. Contact the City of Cisco and discuss needed improvements that could be made to the main boat ramp and the boat dock and discuss the possible application to the Texas Parks and Wildlife Department boating access grant program.

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 (*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.

MANAGEMENT STRATEGIES

1. Cooperate with the controlling authority to post and maintain appropriate signage at access points around the reservoir.
2. Educate the public about invasive species through the use of media and the internet.
3. Make a speaking point about invasive species when presenting to constituent and user groups.
4. 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 (2020–2024)

Sport fish, prey fish, and other important fishes: Sport fishes in Cisco Reservoir include Blue Catfish, Channel Catfish, Flathead Catfish, White Bass, sunfishes, Largemouth Bass, and White Crappie. Known important prey fish are Gizzard Shad, Threadfin Shad, and Bluegill.

Low-density fisheries:

Blue Catfish: Blue Catfish were stocked into Cisco Reservoir in 1980 and 2001, and the population has been managed with the 12-inch minimum length limit (MLL) and 25-fish (in combination with Channel Catfish) daily bag limit. Blue Catfish in the reservoir have been monitored with periodic gill netting surveys. However, relative abundance of Blue Catfish has been low. No Blue Catfish were sampled in gill nets in 2016 and none have been observed during other sampling methods from 2016-2020. Relative abundance data suggest Blue Catfish are not abundant in the reservoir and support a small proportion of the overall catfish fishery. Presence/absence will be recorded during other sampling.

White Bass: White Bass were first discovered in the reservoir in 2004, and the population has since been managed with the statewide 10-inch MLL and 25-fish bag limit. The 2014-2015 creel survey results indicated that directed angling effort towards White Bass was the lowest of any species (1.0% of the directed angling effort). Gill net catch of White Bass have been low. Presence/absence will be recorded during other sampling.

Survey objectives, fisheries metrics, and sampling objectives

Prey species: Bluegill were the primary prey in Cisco Reservoir in 2019. Gizzard Shad and Threadfin Shad were also present and available as prey. Historically, some species of sunfishes (e.g., Redear Sunfish and Redbreast Sunfish) have provided an opportunity for anglers to catch larger sunfishes. However, number of larger sunfishes (≥ 7 inches) had declined in relative abundance likely due to fluctuating water level and reduced amount of littoral habitat. CPUE and size structure of prey species have been collected at least every four years with occasional biennial sampling. The survey objective for these species is to monitor for large-scale changes in relative abundance and size structure. Data will be collected for prey species during the fall 2023 electrofishing survey (Table 9). Sampling will be conducted at 18, 5-minute stations (1.5 hours total) in conjunction with Largemouth Bass sampling, and a target RSE ≤ 25 will be attempted for relative abundance data (i.e, CPUE-Total) for Gizzard Shad, Bluegill, Redbreast Sunfish, and Redear Sunfish. Prey availability (IOV) will be calculated for Gizzard Shad. At least 50 fish ≥ stock-length will be collected for size structure estimation (PSD) for Bluegill, Redbreast Sunfish, and Redear Sunfish. No additional effort will be conducted if objectives for prey species are not met during designated Largemouth Bass sampling. Instead, Largemouth Bass body condition can provide information on prey vulnerability to predation and prey relative abundance.

Channel Catfish: Channel Catfish are present in the reservoir and have been managed with the 12-inch MLL and a 25-fish (in combination with Blue Catfish) daily bag limit. The 2014-2015 creel survey results indicated that directed angling effort towards the catfishes group was 8.4% of the overall directed effort. Channel Catfishes have been monitored with gill netting surveys and tandem hoop net surveys. Channel Catfish relative abundance has been low. Due to the high number of gill net stations and tandem hoop net series needed to achieve a RSE ≤ 25 for CPUE-Total and CPUE-Stock (an estimated 20 net nights) Channel Catfish monitoring for presence/absence will be recorded during other sampling.

Flathead Catfish: Flathead Catfish were present in low abundance in the 2016 gill net survey and were captured in the 2019 tandem hoop net survey. The 2014-2015 creel survey results indicated that directed angling effort towards the catfishes group was 8.4% of the overall directed effort. Utility of low-frequency electrofishing to sample Flathead Catfish has not been evaluated at Cisco Reservoir and may yield better representation of individuals in the population than what has been observed during gill net sampling. Exploratory low-frequency electrofishing may be conducted by the summer of 2023 (Table 9), if timing

allows, to obtain baseline data for relative abundance, size structure, and body condition of Flathead Catfish. Sampling will be conducted at 20, 3-minute random shoreline stations. Data collected from this survey will aid in management of the population as well as could be used to market any existing fishery to anglers.

Largemouth Bass: Largemouth Bass are relatively abundant and support the most popular sport fishery in Cisco Reservoir (nearly 50% of angler directed effort based on 2014/2015 creel survey results; Goldstrohm and Homer 2016). Largemouth Bass are managed with the statewide 14-inch MLL and 5-fish daily bag limit. In the past, Largemouth Bass relative abundance has been variable. Continuation of electrofishing is necessary to monitor trends of Largemouth Bass relative abundance and size structure. Electrofishing will be conducted at 18 random, 5-minute stations in fall 2021 and fall 2023; the 2021 sampling event will be a bass-only sampling event (Table 9). A target RSE for CPUE-Total and CPUE-Stock of ≤ 25% will be attempted. A target of 50 fish ≥ stock-length will be sampled to achieve an estimate of size structure, and 5 fish per inch group ≥ stock-length will be measured and weighed for body condition. If desired level of precision (i.e., RSE) and other sampling objectives are not met for Largemouth Bass and if objectives can be attained feasibly, additional sampling up to 6, 5-minute stations may be added to improve data quality. Fin clips from a random sample of 30 Largemouth Bass will be collected for microsatellite DNA genetic analysis in 2023. Otoliths will be collected from 13 fish, 13.0-14.9 inches to assess age at legal length in 2023. If additional specimens are needed for genetics and/or age and growth additional daytime bass-only electrofishing may be conducted if deemed feasible.

White Crappie: White Crappie are present and have been managed under the statewide 10-inch MLL and 25-fish daily bag limit. The 2014-2015 creel results indicated that White Crappie support a popular, harvest-oriented fishery and that directed angling effort towards them was 20.3% (Goldstrohm and Homer 2016). Since White Crappie support a popular fishery, sampling should occur in 2023. Fall trap netting to maintain trend data will allow for determination of any large-scale changes in the crappie population (Table 9). Based on past data, to achieve a CPUE-Total and CPUE-Stock RSE ≤ 25, sampling at least 10 random stations will need to be conducted during fall 2023. A target of a 50 fish ≥ stock-length will be collected to monitor trends in size structure (PSD), and 5 fish per inch group ≥ stock-length (≥ 5 inches) will be measured and weighed to estimate body condition. Otoliths will be collected from 13 fish 9.0-10.9 inches to estimate age at legal length. No additional random stations will be sampled if objectives are not met.

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Tables and Figures

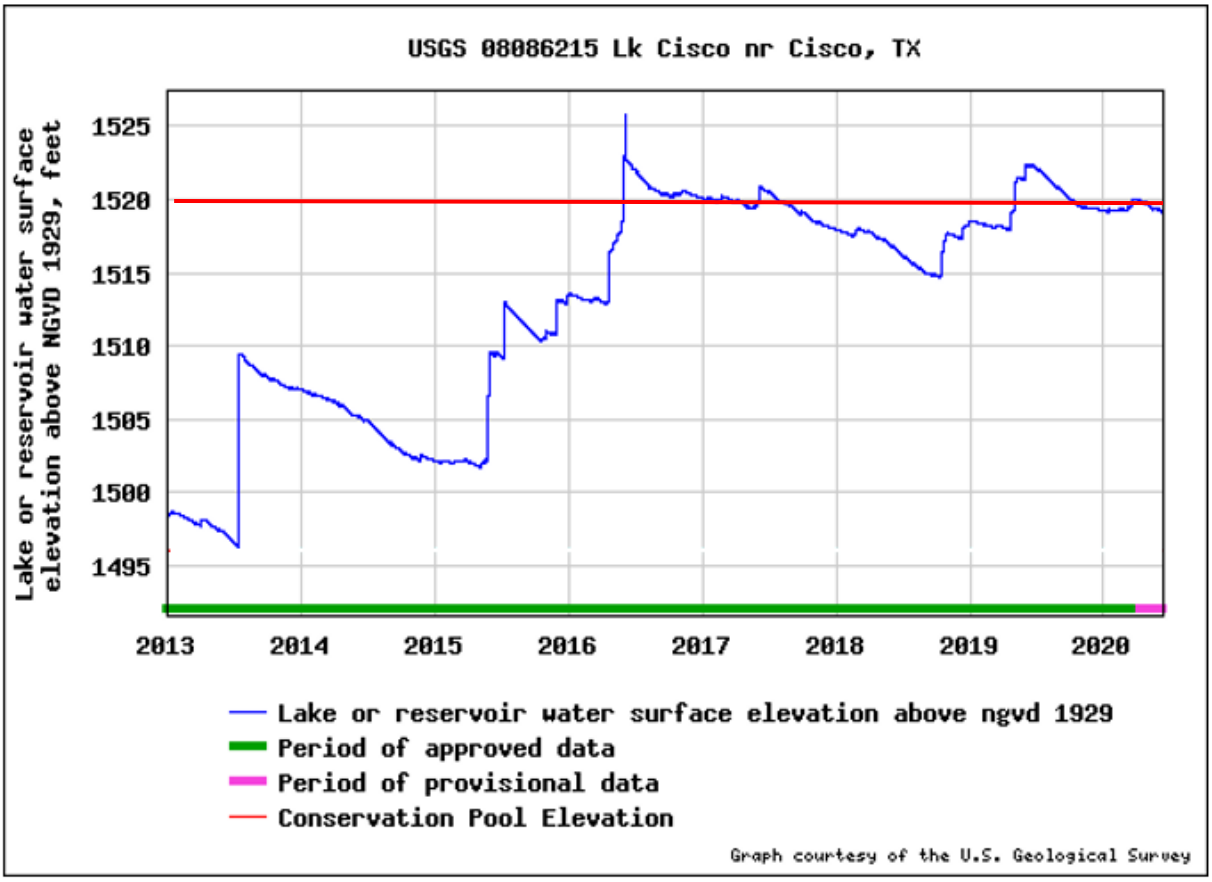


Figure 1. Daily water level data for Cisco Reservoir, Texas, August 2013- June 2020 (USGS 2020). NGVD 1929 refers to the National Geodetic Vertical Datum of 1929.

Table 1. Characteristics of Cisco Reservoir, Texas.

Characteristic	Description
Year constructed	1928
Conservation pool	1,520 feet above mean sea level
Maximum depth	1,457 feet above mean sea level
Controlling authority	City of Cisco
County	Eastland
Reservoir type	Tributary
River basin	Brazos River Basin
Shoreline Development Index	4.99
USGS 8-Digit HUC Watershed	12060105
Conductivity	310-336 µS/cm

Table 2. Boat ramp characteristics for Cisco Reservoir, Texas, September, 2019. Reservoir elevation at time of survey was 1,519.3 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Main Ramp	32.4374 -99.0018	Y	15	1,502	Accessible
Lake Shore Drive Ramp	32.4439 -99.0013	Y	5	1,496	Accessible

Table 3. Harvest regulations for Cisco Reservoir, Texas.

Species	Bag limit	Length limit
Catfish: Channel and Blue Catfish, their hybrids and subspecies	25 (in any combination)	12-inch minimum
Catfish, Flathead	5	18-inch minimum
Bass, White	25	10-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 Cisco Reservoir, Texas. FRY = fry; FGL = fingerling; ADL = adults; UNK = unknown.

Species	Year	Number	Size
Threadfin Shad	1983	2,100	UNK
	1984	1,000	UNK
	Total	3,100	
Blue Catfish	1980	26,030	UNK
	2001	2,604	FGL
	Total	28,634	
Channel Catfish	1970	60,000	UNK
	1979	16,350	UNK
	2000	1,240	FGL
	2001	18,874	FGL
	Total	96,464	
Palmetto Bass	1980	11,376	UNK
	1982	10,000	UNK
	Total	21,376	
Largemouth Bass	1970	100,000	UNK
Florida Largemouth Bass	1991	17,219	FGL
	1991	7,747	FRY
	1994	44,500	FGL
	1995	44,899	FGL
	2012	128,770	FGL
	2016	83,525	FGL
	2020	21,565	FGL
	Total	348,225	
Smallmouth Bass	1984	4,000	FGL
	1987	30	ADL
	1988	13	ADL
	1994	26,386	FGL
	1995	11,970	FGL
	1995	14,250	FRY
	1996	26,309	FGL
	1997	26,900	FGL
	Total	109,858	
Walleye	1981	2,000,000	UNK
	1983	2,887,000	UNK
	Total	4,887,000	

Table 5. Objective-based sampling plan components for Cisco Reservoir, Texas 2019–2020.

Gear/target species	Survey objective	Metrics	Sampling objective
Electrofishing			
Largemouth Bass	Abundance	CPUE–Total CPUE–Stock	RSE-Stock ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock
	Condition	W_r	10 fish/inch group (max)
	Age-and-growth	Age at 14 inches	N = 13, 13.0 – 14.9 inches
	Genetics	% FLMB	N = 30, any age
Bluegill, Redbreast Sunfish, Redear Sunfish[a]	Abundance	CPUE–Total	RSE ≤ 25
	Size structure	PSD, length frequency	N ≥ 50
Gizzard Shad [a]	Abundance	CPUE–Total	RSE ≤ 25
	Size structure	PSD, length frequency	N ≥ 50
	Prey availability	IOV	N ≥ 50
Trap netting			
Crappie	Abundance	CPUE–Total CPUE–Stock	RSE-Stock ≤ 25
	Size structure	PSD, length frequency	N = 50
	Condition	W_r	10 fish/inch group (max)
	Age-and-growth	Age at 10 inches	N = 13, 9.0 – 10.9 inches
Tandem hoop netting			
Channel Catfish	Abundance	Presence/Absence	Exploratory

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

Table 6. Survey of structural habitat types, Cisco Reservoir, Texas, September, 2019. Percent occurrence with lower and upper 95% confidence limits (CL) of shoreline structural habitat at 75 random sites. Water level at time of survey was 0.7 feet above conservation pool elevation.

Structural habitat type	Percent occurrence	Lower CL	Upper CL
Natural shoreline	48.0	37.1	59.1
Rocky shoreline	42.7	32.1	53.9
Bulkhead	8.0	3.7	16.4
Rock bluff	1.3	6.0	7.2
Docks	18.7	11.5	28.9

Table 7. Percent occurrence with lower and upper 95% confidence limits (CL) of structural habitat at 150 random sites throughout the reservoir and 75 sites along the shoreline in Cisco Reservoir, Texas, September, 2019. Water level at time of survey was 0.7 feet above conservation pool elevation.

	Throughout the Reservoir			Shoreline		
Habitat	Percent Occurrence	Lower CL	Upper CL	Percent Occurrence	Lower CL	Upper CL
Open Water	97.3	93.3	99.0	1.3	0.2	7.2
Flooded Terrestrial Brush	2.7	1.0	6.7	94.7	87.1	97.9
Common Buttonbush	0.0	0.0	0.0	38.7	28.5	50.0
Standing Timber	0.0	0.0	0.0	38.7	28.5	50.0
Cattail	0.0	0.0	0.0	18.7	11.5	28.9
Black Willow	0.0	0.0	0.0	13.3	7.4	22.8
Chara spp.	0.0	0.0	0.0	2.7	0.7	9.2
Logs	0.0	0.0	0.0	2.7	0.7	9.2
Water Primrose	0.0	0.0	0.0	1.3	0.2	7.2

Gizzard Shad

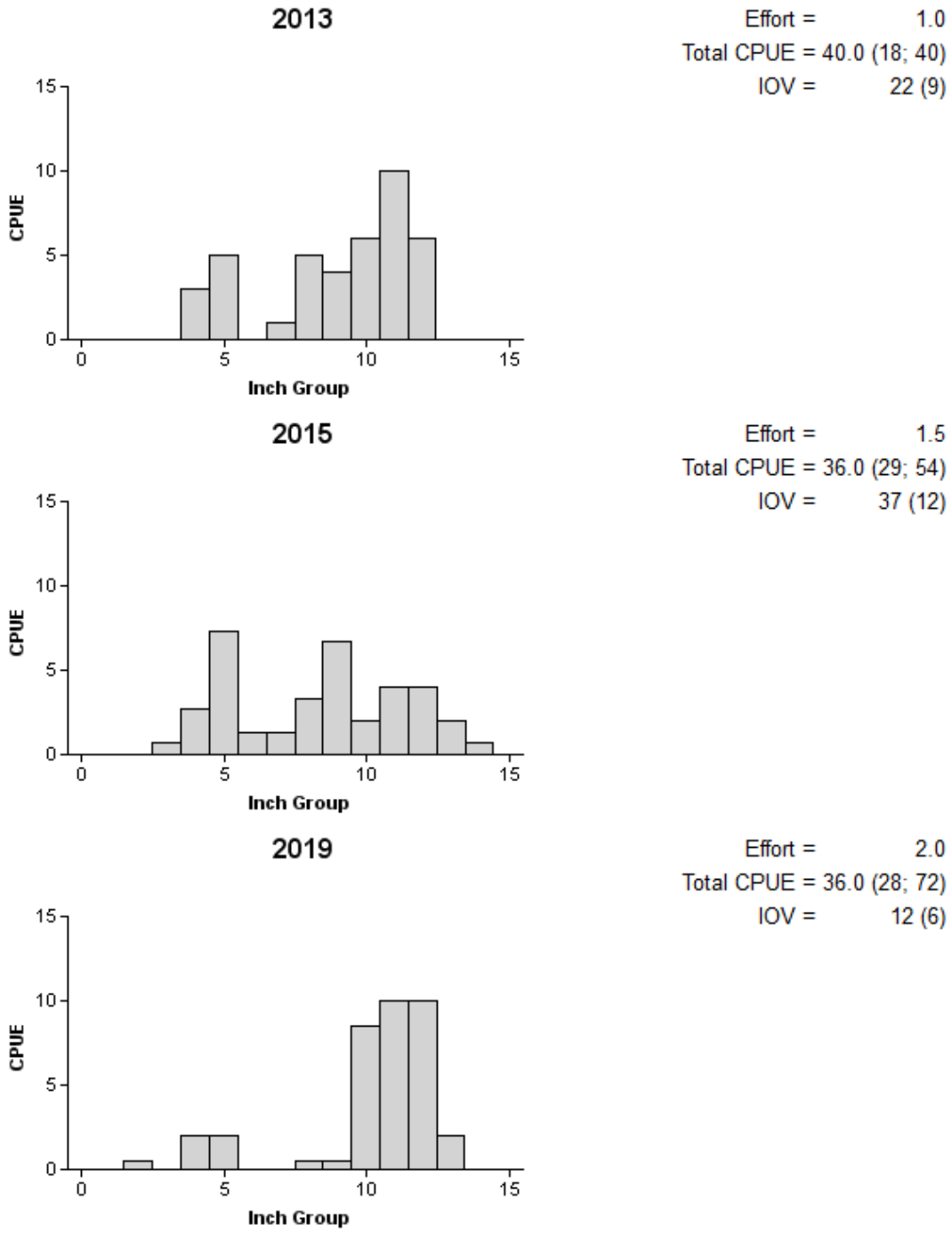


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Cisco Reservoir, Texas, 2013, 2015, and 2019.

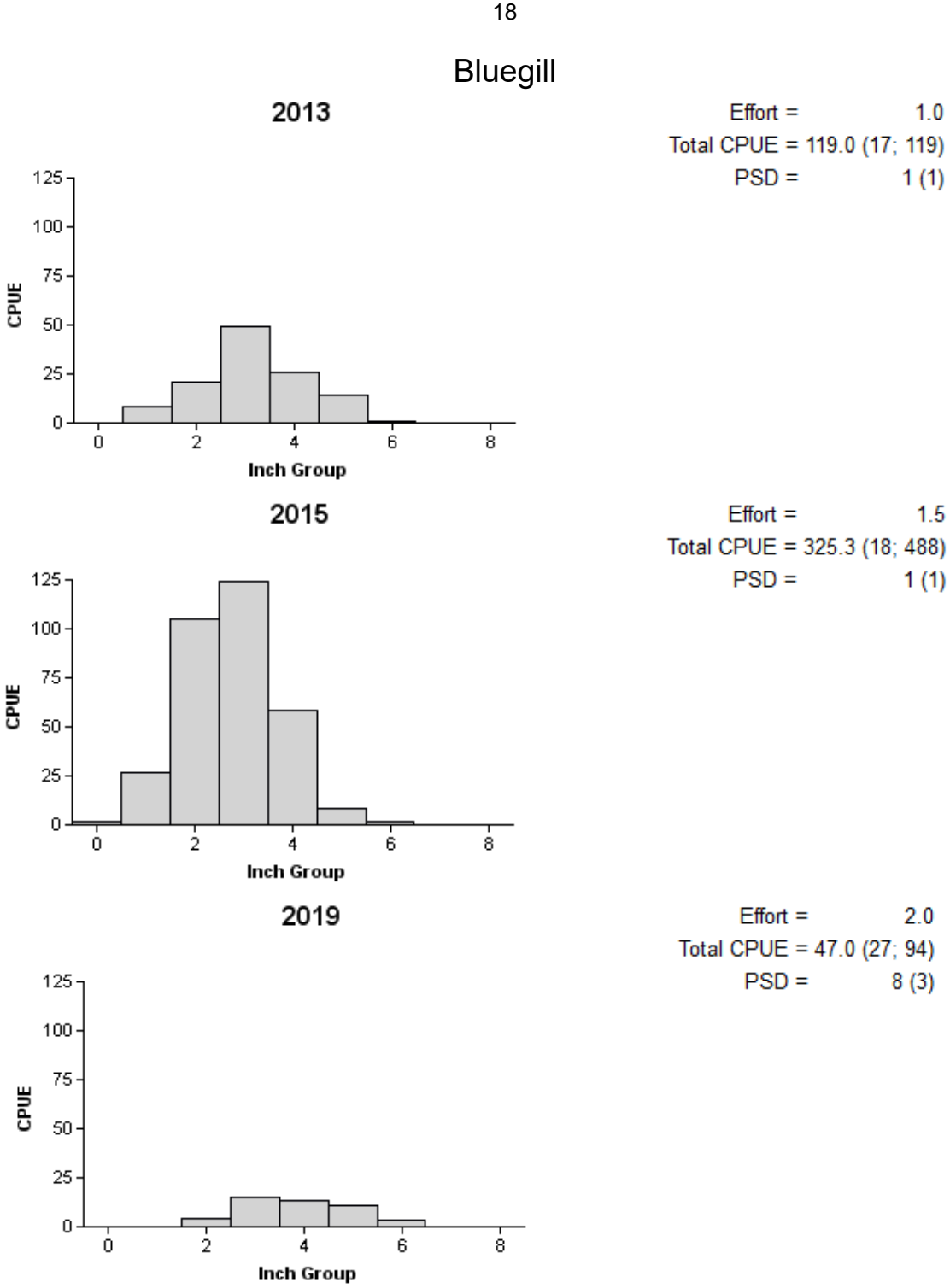


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Cisco Reservoir, Texas, 2013, 2015, and 2019.

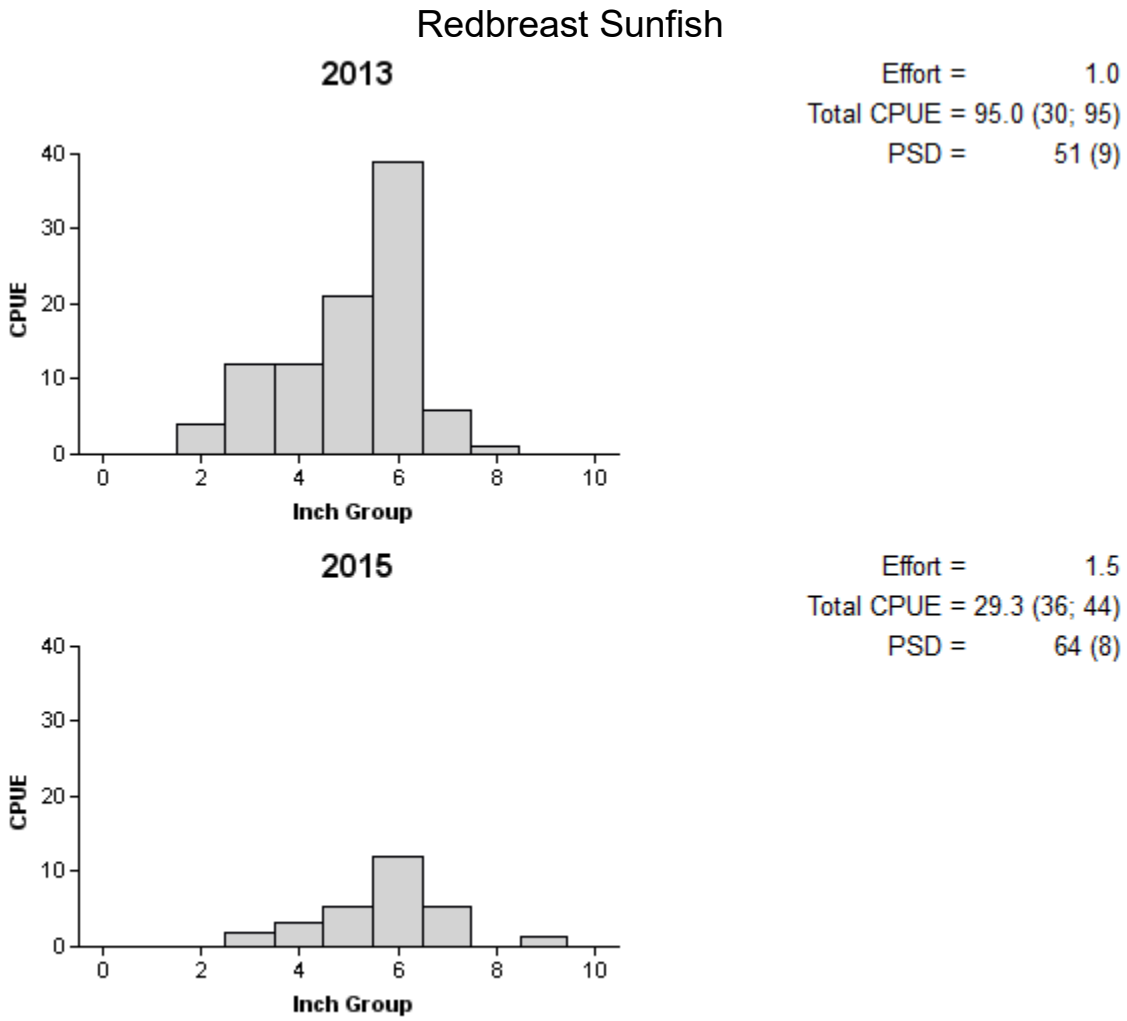


Figure 4. Number of Redbreast Sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Cisco Reservoir, Texas, 2013 and 2015. No Redbreast Sunfish were sampled in 2019.

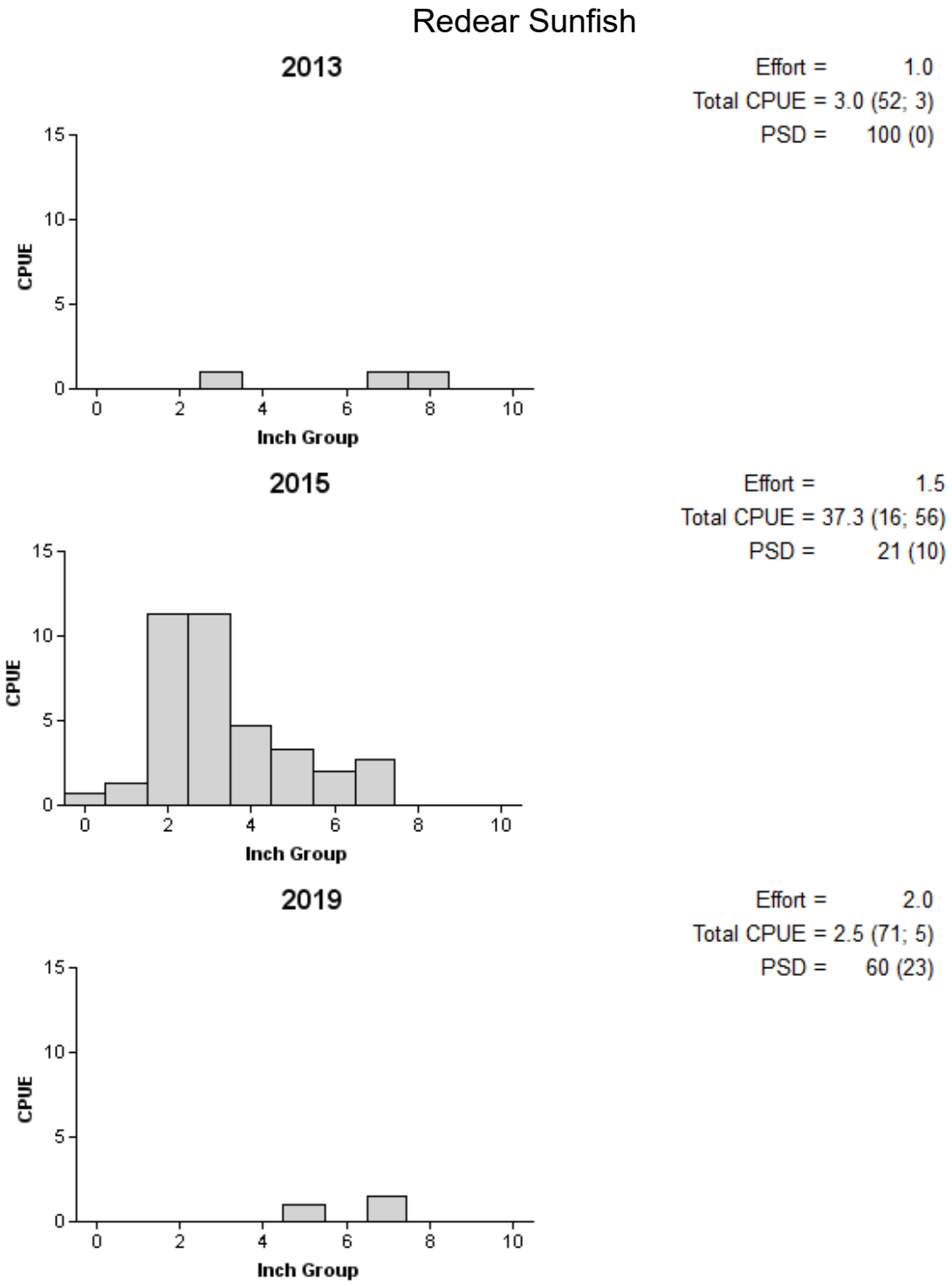


Figure 5. Number of Redear Sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Cisco Reservoir, Texas, 2013, 2015, and 2019.

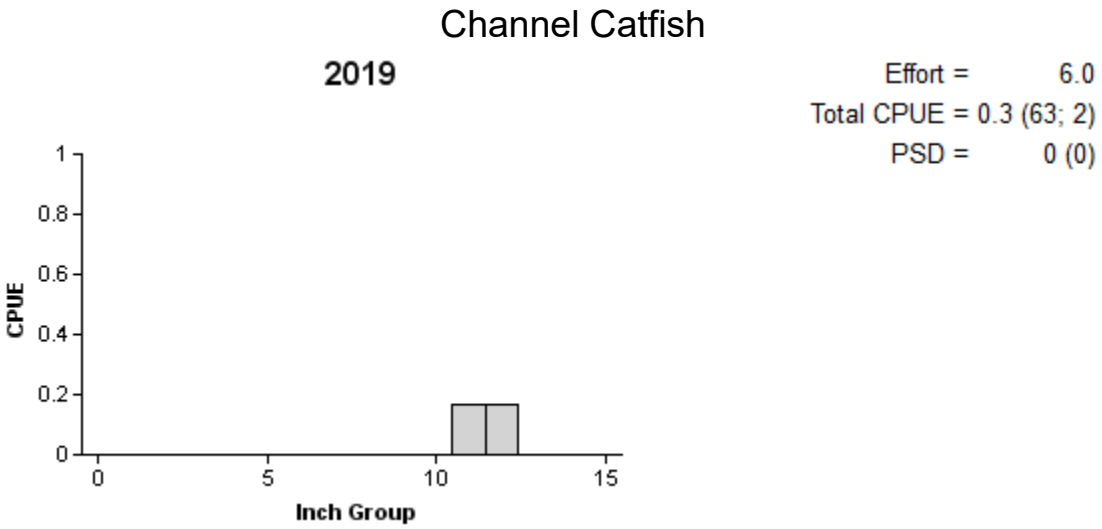


Figure 6. Number of Channel Catfish caught per series (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for tandem hoop net survey, Cisco Reservoir, Texas 2019.

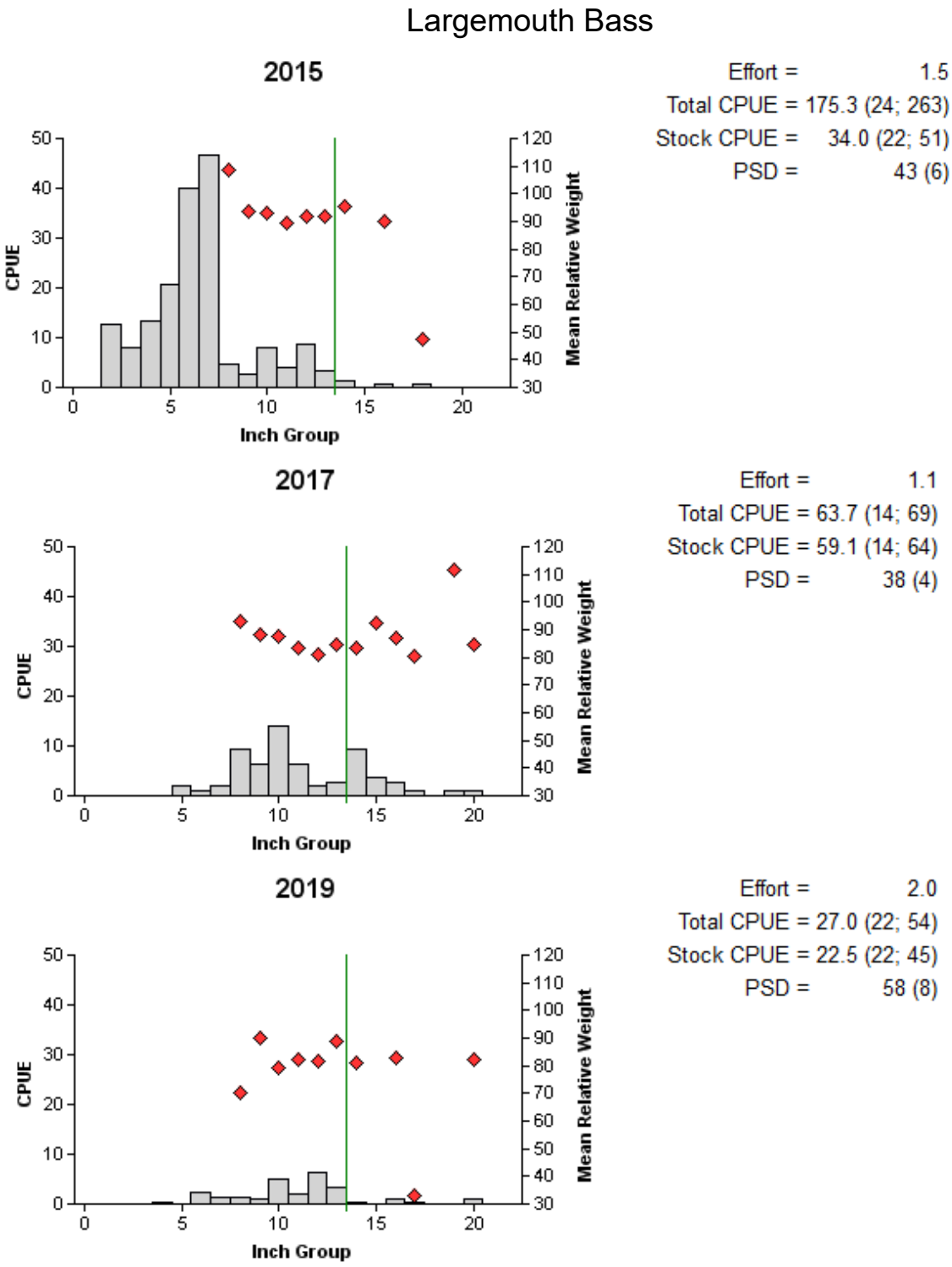


Figure 7. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Cisco Reservoir, Texas, 2015, 2017, and 2019. Sample collected in 2017 was a bass-only electrofishing survey. Vertical line indicates minimum length limit.

Table 8. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Cisco Reservoir, Texas, 1993-2019. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, F1 = first generation hybrid between a FLMB and a NLMB, Fx = second or higher generation hybrid between a FLMB and a NLMB. Genetic composition was determined by electrophoresis prior to 2005 and with micro-satellite DNA analysis since 2005.

Year	Sample size	Number of fish				% FLMB alleles	% FLMB
		FLMB	F1	Fx	NLMB		
1993	26	0	NA	4[a]	22	4.8	0.0
1996	27	1	NA	19[a]	7	37.0	3.7
1999	40	10	NA	28[a]	2	61.3	25.0
2005	30	1	NA	26[a]	3	45.5	3.3
2011	30	0	1	29	0	52.0	0.0
2015	30	0	0	30	0	56.0	0.0
2017	30	0	3	27	0	53.6	0.0
2019	29	0	0	29	0	57.8	0.0

[a] Determination of hybrid status not conducted.

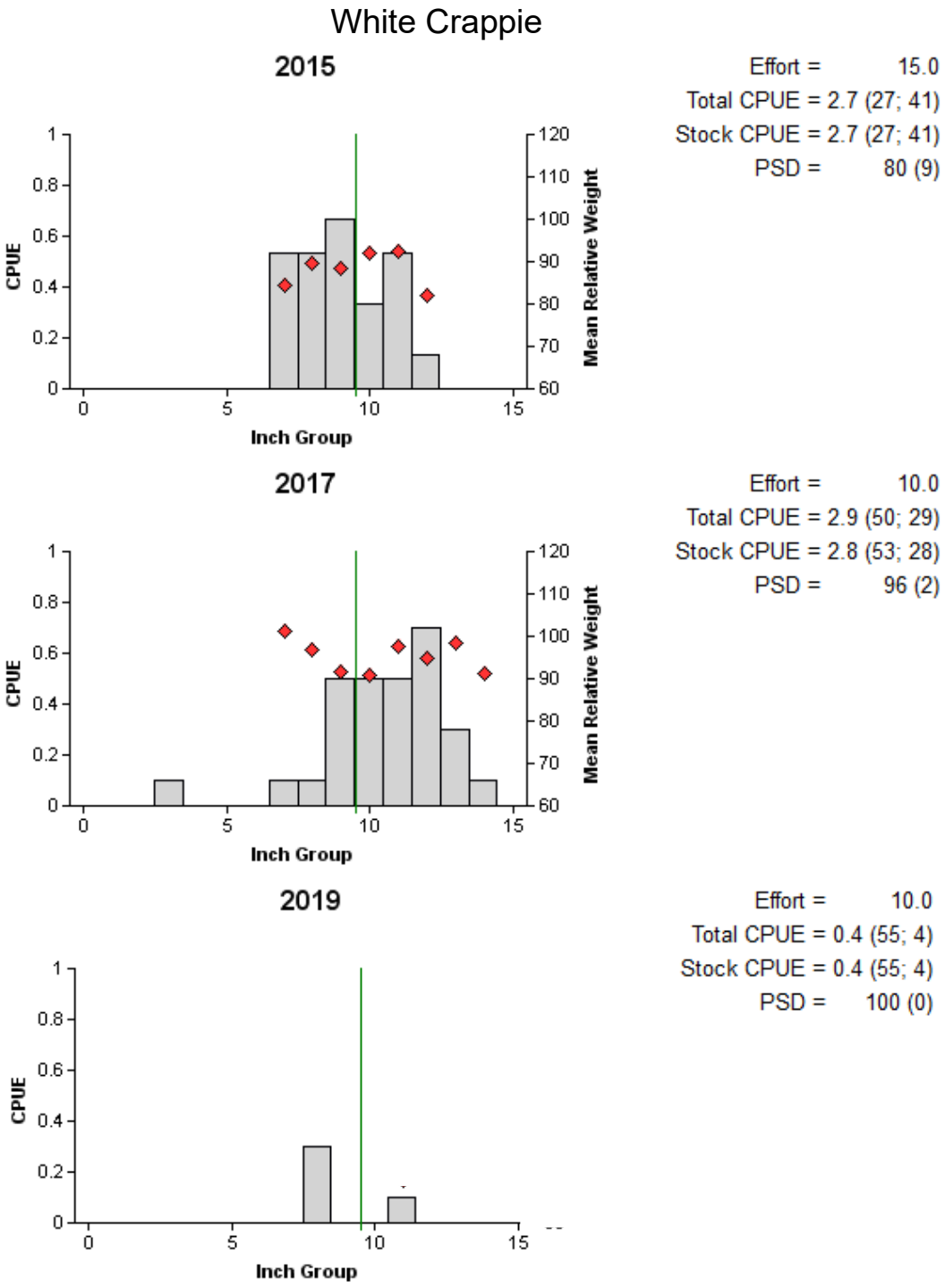


Figure 8. Number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Cisco Reservoir, Texas, 2015, 2017, and 2019. Vertical line indicates minimum length limit.

Proposed Sampling Schedule

Table 9. Proposed sampling schedule for Cisco Reservoir, Texas. Survey period is June through May. Low-frequency electrofishing surveys are conducted in spring to summer, while electrofishing and trap netting surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

	Survey year			
	2020-2021	2021-2022	2022-2023	2023-2024
Angler Access				S
Structural Habitat				S
Vegetation				S
Electrofishing – Fall		A*		S
Electrofishing – Low frequency			A	
Trap Netting				S
Report				S

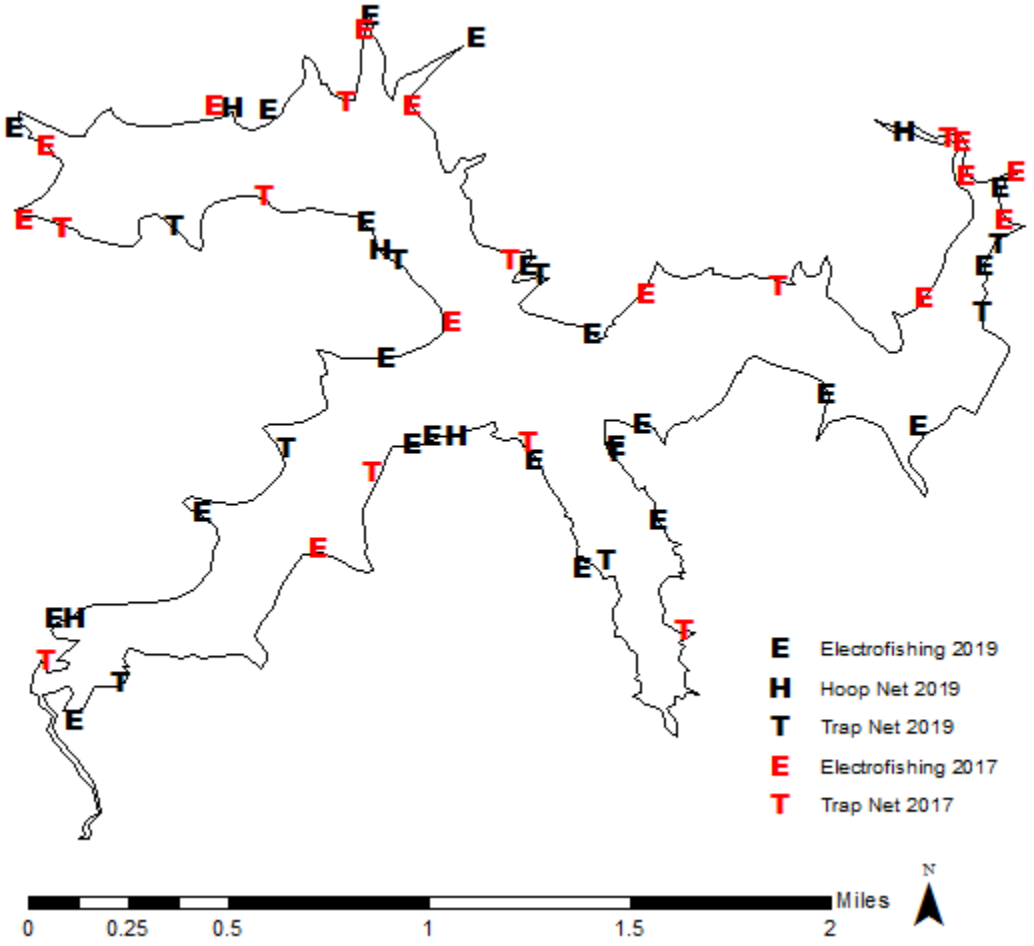
*Bass only electrofishing

APPENDIX A – Catch rates for all species from all gear types

Number (N) and catch rate (CPUE) (RSE in parentheses) of all target species collected from all gear types from Cisco Reservoir, Texas, 2019-2020. Sampling effort was 2 hours for electrofishing, 10 net nights for trap netting, and 6 net night for hoop netting.

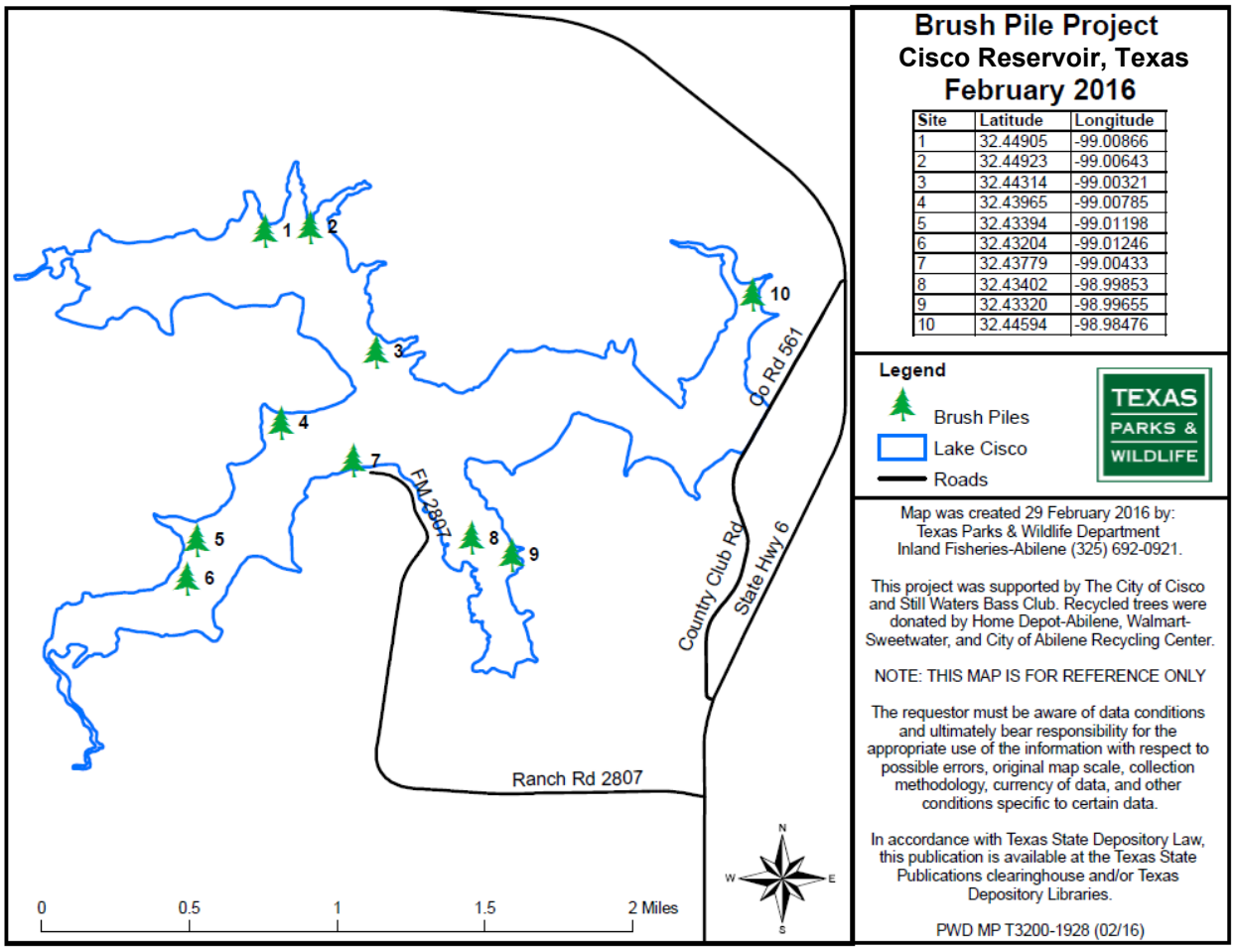
Species	Electrofishing		Trap Netting		Hoop Netting	
	N	CPUE(RSE)	N	CPUE(RSE)	N	CPUE(RSE)
Gizzard Shad	72	36.0 (28)				
Threadfin Shad	5	2.5 (50)				
Inland Silverside	3	1.5 (55)				
Channel Catfish					2	0.3 (63)
Green Sunfish	6	3.0 (50)				
Bluegill	94	47.0 (27)				
Longear Sunfish	53	26.5 (29)				
Redear Sunfish	5	2.5 (71)				
Largemouth Bass	54	27.0 (22)				
White Crappie			4	0.4 (55)		

APPENDIX B – Map of sampling locations



Location of sampling sites, Cisco Reservoir, Texas, 2017-2019. Trap net, hoop net, and electrofishing stations are indicated by T, H, and E, respectively. Water level was near full pool at time of sampling.

APPENDIX C – Map of brush pile locations



Map and coordinates of the winter 2016 brush pile habitat project locations at Cisco Reservoir. The project was conducted in collaboration with the City of Cisco and Still Waters Bass Club. Brush piles were constructed with donated and recycled trees in groupings of 10 trees.

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