

Leon Reservoir

2018 Fisheries Management Survey Report

PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-3

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

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Survey and Management Summary

Fish populations in Leon Reservoir were surveyed in fall 2016 with bass-only electrofishing, in 2018 by electrofishing and trap netting, and in spring 2019 by gill netting. Historical data are presented with the 2015-2019 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: Leon Reservoir has a surface area of 1,756 acres, and it was constructed in 1954 by impounding the Leon River. The reservoir is in Eastland County, roughly seven miles south of the City of Eastland, and it is controlled by the Eastland County Water Supply District. Leon Reservoir is used for flood control, municipal and industrial water supply for the City of Eastland, and for recreation. Heavy rainfall in 2015 refilled and flooded the reservoir, though water level dropped five feet below conservation pool by summer 2018. Fall 2018 rainfall refilled the reservoir to full pool.

Management History: Sport fish in the reservoir include Largemouth Bass, White Crappie, Black Crappie, Channel Catfish, Flathead Catfish, and White Bass. Hydrilla was first documented in the 2010 vegetation survey and was mechanically removed in one northeastern cove; additional areas containing miniscule patches of hydrilla were not treated. From 2014-2018, hydrilla was monitored annually, and it did not cause any access problems. The most recent stocking (Florida Largemouth Bass) occurred in 2019.

Fish Community

- **Prey species:** Gizzard Shad, Threadfin Shad, Bluegill, and Longear Sunfish comprised most of the forage base for the predator assemblage. Redear Sunfish, Green Sunfish, and Warmouth were also present. Size structures and relative abundance of prey species appeared suitable to support sport fish populations.
- **Catfishes:** Channel Catfish and Flathead Catfish were present in the reservoir. Total catch of Channel Catfish has fluctuated since 2011 but has increased overall. In 2019, the sample was dominated by legal-length fish. One Flathead Catfish was collected during the 2019 gill net survey. Channel Catfish appeared to be adequately reproducing and the population should provide good fishing opportunities.
- **White Bass:** Since 2011, total catch and catch rates of legal White Bass have fluctuated in gill netting surveys. All fish in the 2019 sample were \geq stock-length. The population appeared to produce ample quality-length fish to be used by anglers.
- **Largemouth Bass:** Largemouth Bass relative abundance fluctuated from 2014-2018. Catch of legal-length fish increased compared to previous surveys. Like previous surveys, most individuals captured in the surveys from 2014-2018 had suboptimal body condition (mean relative weights ≤ 90). Mean age at legal length in 2016 was 2.0 years and 2.7 years in 2018. Prevalence of Florida Largemouth Bass alleles have increased since 2006 which may be a result of recent stockings.
- **Crappie:** Both White Crappie and Black Crappie were present in the reservoir, but White Crappie have traditionally been more abundant. Total combined catch of White and Black Crappie has been low and has substantially declined since 2014. Catches of legal-length (i.e., ≥ 10 in.) individuals were low, and rates were similar between the 2016 and 2018 surveys. The reduced catch suggested recruitment of cohorts was poor since the prior survey. Body conditions of crappie were adequate (mean relative weights > 90).

Management Strategies: Electrofishing will be conducted to monitor Largemouth Bass and prey in fall 2022. Trap netting will be used in fall 2022 to monitor White Crappie and Black Crappie. Hoop netting will be conducted during summer 2022 to monitor Channel Catfish. Presence/absence of White Bass will be documented in other surveys.

Introduction

This document is a summary of fisheries data collected from Leon Reservoir during 2015-2019. 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. Management strategies are included to address existing problems and/or opportunities. Historical data are presented with the 2015-2019 data for comparison.

Reservoir Description

Leon Reservoir has a surface area of 1,756 acres, and it was constructed in 1954 by the impoundment of the Leon River within the Brazos River Basin (Kemp et al. 2016). The reservoir is in Eastland County, roughly seven miles south of the City of Eastland, and it is controlled by the Eastland County Water Supply District (ECWSD). Leon Reservoir provides flood control, municipal and industrial water supply for the City of Eastland, as well as recreation. Leon Reservoir was eutrophic based on Carlson's Trophic State Index for chlorophyll-a (TSI Chl-a) with a TSI Chl-a of 56.0 (Texas Commission on Environmental Quality 2018). Heavy rainfall in 2015 refilled and flooded the reservoir, though water level dropped about five feet below conservation pool by summer 2018. From fall 2018 to spring 2019, the reservoir was at full pool (Figure 1). Other descriptive characteristics for Leon Reservoir are in Table 1.

Angler Access

Boater access consisted of three public boat ramps. Chock-a-Block Ramp was usable during the entire survey period. The primary public boat ramp at the Leon Reservoir Dam was unusable for a brief period because of low water level. However, a low-water ramp on a section of shoreline close to the dam ramp was made available by ECWSD to allow boater access to the reservoir. A portion of the reservoir was closed from public access because of a breach in Farm-to-Market 2461 and the dam. Bank fishing and handicapped access were restricted to the areas around boat ramps and the LaMancha Resort. Additional boat ramp characteristics are in Table 2.

Management History

Management strategies and actions from the previous survey report (Homer and Goldstrohm 2015) included:

1. Conduct a bass-only electrofishing survey to obtain a Category III age and growth sample to determine if stunting was occurring. If stunting was ruled out and trophy-length potential was identified, request biennial stockings of Florida Largemouth Bass (FLMB) fingerlings from 2016-2020 at a rate of 1,000/shoreline km to increase FLMB introgression and trophy potential.

Action: Largemouth Bass were surveyed in 2016 and 2018, but a Category III was not obtained. Category II samples were collected in 2016 and 2018 instead, and the means of age at 14.0 inches were like other district reservoirs at approximately 2.0 years old. Florida Largemouth Bass fingerlings were stocked in 2018 to increase growth potential of individuals in the population.

2. Collect various Largemouth Bass tournament data to monitor the fishery.

Action: Local bass clubs were contacted multiple times during the survey period to request access to weigh-in data. Only two clubs responded, and data sets were incomplete. Communications with these clubs are still on-going.

3. Promote the underutilized White Bass fishery through press releases and outreach events.

Action: The reservoir's fisheries were promoted through various popular press articles.

4. Continue to monitor hydrilla coverage annually by circumnavigation of the reservoir perimeter and georeferenced locations where hydrilla was present, maintained communication with Eastland County Water Supply District regarding hydrilla coverage in the reservoir, and provided and maintained adequate signage to inform reservoir users of invasive species presence and TPWD's Clean, Drain, and Dry protocols.

Action: Exotic vegetation surveys were conducted during summer 2015-2018. Signs displaying Clean, Drain, and Dry rules were posted at each of the public boat ramps.

5. Educate the public about invasive species with media and the internet. Make a speaking point about invasive species when presenting to constituents.

Action: Multiple popular press articles were written during the survey period. Also, interviews were conducted with local media to discuss the threats of invasive species, and multiple presentations were a given to bass clubs and other groups.

Harvest regulation history: Sport fish in Leon Reservoir have always been managed with statewide harvest regulations (Table 3).

Stocking history: While Leon Reservoir has been stocked with a variety of species since its impoundment, Florida Largemouth Bass have been the most frequently stocked. Florida Largemouth Bass were last stocked in 2018 and 2019. ShareLunker Largemouth Bass fingerlings were also stocked in 2019. A complete stocking history is presented in Table 4.

Vegetation/habitat management history: Hydrilla was first documented in 2010 but was limited to the northeast section of the reservoir near the LaMancha Resort. The hydrilla was mechanically removed in one cove bordering the resort. However, additional areas containing isolated patches of hydrilla were not treated. Since its discovery, hydrilla has not presented access problems at the reservoir. Exotic salt cedar and giant reed have also been documented at the reservoir during the survey period, but no actions have been taken to control them.

Water transfer: No interbasin transfers are known to exist.

Methods

Surveys were conducted in accordance with the objective-based sampling (OBS) plan for Leon Reservoir (TPWD, Inland Fisheries Division, unpublished). Primary components of the OBS plan are listed in Table 5. All survey sites were randomly selected, and 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 night-time 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. Ages for Largemouth Bass 13.0 to 14.9 inches were determined by using otoliths from 14 randomly selected fish in 2016 and 15 randomly selected fish in 2018.

Trap netting – White and Black 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). Additional fish were collected by experimental gill nets and were used for age estimation. Ages for White Crappie 9.0 to 10.9 inches were estimated by using otoliths collected from fish collected during the fall 2018 survey.

Gill netting – Channel Catfish and White Bass were collected by gill netting (5 net nights at 5 stations). CPUE for gill netting was recorded as the number of fish caught per net night (fish/nn). Ages for Channel Catfish were determined by using otoliths from 14 fish 9.0 to 10.9 inches. Additional White Crappie were collected to improve the age and growth estimation sample, and ages were estimated for fish ranging 9.0-12.2 inches; only fish 9.0-10.9 inches were used in the calculation for mean age at legal length.

Genetics – Genetic analysis of Largemouth Bass was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015). Micro-satellite DNA analysis was used to determine genetic composition of individual fish since 2005 through 2018 and by electrophoresis for previous years.

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 – Exotic vegetation surveys were conducted annually from 2015–2018 to monitor hydrilla coverage. A structural habitat and vegetation surveys were conducted in summer 2018 by using the random point method (TPWD, Inland Fisheries Division, unpublished manual revised 2015). The survey was conducted by selecting 96 random points throughout the reservoir. Ninety additional random stations were selected along the shoreline to include vegetation and structural shoreline habitat for a total of 186 random stations; shoreline stations were analyzed separately. Plants and structural habitat types 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 (Allto Consulting 2019) for native and exotic plant species and structural habitat types.

Water level – Source for water level data was the United States Geological Survey (USGS 2019).

Results and Discussion

Habitat: Hydrilla, a Tier III invasive species, was surveyed annually from 2015-2018, and it was detected in only 2015 and 2016 in sparse coverage in a cove close to LaMancha Resort in the northeastern portion of the reservoir. Introduced salt cedar and giant reed were also observed during the hydrilla surveys, but they were in few isolated locations and in low densities. During the summer 2018 survey, structural habitat present consisted primarily of natural shoreline, rocky shoreline, boat docks, rocky bluffs, and piers (Table 6). Most areas surveyed were featureless, yet most vegetation found throughout the reservoir and the shoreline was standing timber, bulrush, and inundated terrestrial vegetation (Table 7).

Prey Species: The prey fish community was dominated by Gizzard Shad, Threadfin Shad, Bluegill, and Longear Sunfish. Gizzard Shad catch rates fluctuated from 223.0/h in 2012 to 671.0/h in 2014 to 450.0/h in 2018 (Figure 2). Index of Vulnerability increased since 2012, and most individuals were adequate prey size for sport fishes. Threadfin Shad were the second-most captured fish in the 2018 survey, and the catch rate was 305.0/h, nearly five times the rate observed in 2014 (65.0/h). Catch rate of Bluegill decreased from 383.0/h in 2012 to 251.0/h in 2014. In 2018, Bluegill catch rate was 278.0/h (Figure 3). From 2012-2018, size ranges of Bluegill in the electrofishing surveys were mostly represented by fish 1-6 inches TL, and PSDs were low ($PSD \leq 11$), indicating that most fish were smaller than quality-length. Longear Sunfish catch rate fluctuated from none caught in the 2010 and 2012 surveys to 265.0/h in 2014 to 149.0/h in 2018 (Figure 4). Size ranges of Longear Sunfish in the surveys were comprised mostly of fish 2-5 inches TL. According to the recent survey, an ample prey base existed for sport fish.

Channel Catfish: From 2011 to 2019, Channel Catfish catch rates in spring gill netting surveys fluctuated from 9.0/n in 2011 to 8.2/n in 2015 to 14.8/n in 2019 (Figure 5). Catch rates of legal-length fish fluctuated from 7.4/n in 2011 to 5.0/n in 2015 to 11.8/n in 2019. Size structure as PSD varied from 65 in 2011 to 13 in 2015 to 81 in 2019. In 2019, fish ranged from 7-27 inches, and most fish in the sample were 15-20 inches. Mean relative weights were fair to excellent ($W_r = 94-144$) and mostly increased with length. The Channel Catfish survey data suggest that the population had ample reproduction and produced quality fish to support catfish angling opportunities.

White Bass: White Bass during this survey period were monitored in conjunction with objective-based sampling for Channel Catfish. Catch rates for White Bass fluctuated from 5.4/nn in 2011 to 12.4/nn in 2015 and to 6.4/nn in 2019 (Figure 6); all fish caught in these samples were \geq stock-length (i.e., 6 inches). Catch rates of legal fish varied from 4.8/nn in 2011 to 11.0/nn in 2015 to 6.0/nn in 2019. While anglers seldom target White Bass (Homer and Goldstrohm 2015), the population has produced large fish to be utilized.

Largemouth Bass: Total catch rates for Largemouth Bass fluctuated slightly from 158.0/h in 2014 to 196.0/h in 2016 to 157.0/h in 2018; catch rates of stock-length fish also fluctuated similarly (Figure 7). Catch of legal-length fish increased from 7.0/h in 2014 to 26.0/h in both 2016 and 2018. Proportional Size Distribution for Largemouth Bass increased during the survey period from 21 to 67. Mean relative weights were poor for most inch groups ($W_r = 84-115$). Prevalence of the Florida Largemouth Bass genetic strain in samples increased from 9.0% in 1992 to 45.0% in 2014 (Table 8). In 2018, prevalence of the Florida Largemouth Bass strain was like the 2014 sample. Overall, the prevalence of Florida Largemouth Bass alleles increased by 12.3% since 2006, likely attributed to stockings in 2012 and 2018. However, the number of pure Florida Largemouth Bass in genetics samples has been consistently low since 1995. Largemouth Bass at legal length (i.e., 14 inches TL) collected for age estimation in fall 2016 had a mean age of 2.0 years and ranged from 1-4 years, and fish collected in 2018 had a mean age of 2.7 years and ranged from 2-3 years (Figure 8). Despite the suboptimal body conditions of most fish, growth to legal length was adequate.

Crappie: From 2012-2018, catch rates for both White and Black Crappie fluctuated, though White Crappie have been the most dominant in the trap net surveys (Figure 9). Total catch rates for combined White and Black Crappie increased slightly from 14.0/nn in 2012 to 19.5/nn in 2014, then the rate decreased to 4.0/nn in 2018. Catches of legal-length White and Black Crappie were low during the 2012-2018 surveys, and the catch rate decreased from 3.4/nn to 1.7/nn. Sampling in 2018 did not meet the target number of stock-length fish to give the desired level of precision for PSD. Despite low catch, presence of sub-stock Crappie suggests that reproduction has occurred recently, though recruitment may have been poor. White and Black Crappie in the 2018 survey ranged from 3-14 inches TL and mean relative weights of individuals \geq stock-length were adequate to excellent ($W_r = 88-110$). Ages of White Crappie collected for age estimation ($N=18$) ranged from 9-14 inches TL and were 1-5 years old (Figure 10). Fish at legal length ($n=5$) had a mean age of 2.6 years old.

Fisheries Management Plan for Leon Reservoir, Texas

Prepared – July 2019

ISSUE 1: The first 13.0-lbs. ShareLunker Legacy Largemouth Bass (#581) for Leon Reservoir was caught in spring 2019. The catch of the ShareLunker has demonstrated that Leon Reservoir can produce trophy Largemouth Bass. However, body conditions have been poor, and continuation of periodic fingerling stockings are important for Florida Largemouth Bass genetic introgression into the population for improved growth potential. Reduction in the stocking rate may serve as an optimal strategy to reduce intraspecific competition and minimize any effects to growth and body conditions.

MANAGEMENT STRATEGY

1. If water level and available habitat are appropriate, Florida Largemouth Bass fingerlings will be requested to be stocked once at reduced a rate of 500/shoreline km during 2020-2023.

ISSUE 2: Hydrilla exists in Leon Reservoir, and it has been historically monitored annually. The invasive species has not caused access issues since its introduction, and it has been in low coverage and density. Monitoring is costly in time and resources, and traditional surveying frequency can be reduced substantially.

MANAGEMENT STRATEGIES

1. Stop annual surveys unless high or problematic coverage is reported to TPWD.
2. Conduct a hydrilla survey in combination with the vegetation survey in summer 2022.

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 appropriate signage at access points around the reservoir.
2. Educate local businesses and the controlling authority about invasive species by providing them with posters, literature, etc.... so that they can (in turn) educate others.
3. Educate the public about invasive species with 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 (2019-2023)

Sport fish, forage fish, and other important fishes: Sport fishes in Leon Reservoir include Channel Catfish, Flathead Catfish, Largemouth Bass, and White Crappie. Known important forage species include Gizzard Shad, Threadfin Shad, and sunfishes, particularly Bluegill and Longear Sunfish.

Low-Density Fisheries: White Bass, Flathead Catfish, and Smallmouth Buffalo are present in the reservoir, but they do not support popular fisheries. Anglers reported directing 0.8% of the overall fishing effort towards White Bass at Leon Reservoir, whereas anglers have not reported any specific effort towards Flathead Catfish or Smallmouth Buffalo. White Bass have traditionally been co-targeted with Channel Catfish during spring gill netting surveys. Future monitoring for White Bass and Flathead Catfish will be conducted while monitoring Channel Catfish during gill net surveys, but no specific objectives will be set for them. Black Crappie are present in the reservoir, but White Crappie have been much more abundant in monitoring surveys and likely support most of the fishery. Therefore, monitoring for Black Crappie will be in conjunction with trap netting for White Crappie. Data for Black Crappie will be aggregated to the White Crappie data and be reported as combined catch-per-unit-effort (CPUE). Presence/absence of the low-density species will also be documented while conducting other objective-based monitoring.

Survey objectives, fisheries metrics, and sampling objectives

The sampling schedule is detailed in Table 9.

Prey species: Gizzard Shad, Threadfin shad, Bluegill, Longear Sunfish, and other sunfishes comprise most of the prey community in Leon Reservoir. Prey species will be monitored by night-time electrofishing conducted during fall 2022. Sampling will occur at 12 randomly selected 5-minute stations for a duration of 1.0 hour. Total catch-per-unit-effort (CPUE) will be determined for prey species with no target level of precision. A sample of ≥ 50 Gizzard Shad will be attempted to generate a length frequency distribution and evaluate Index of Vulnerability. A sample of ≥ 50 stock-length Bluegill will be attempted to determine Proportional Size Distribution (PSD). If other sunfishes are sampled with ≥ 50 stock-length fish, PSD may be calculated. If sampling objectives are not achieved, no additional sampling will be conducted unless additional sampling is necessary to achieve unfulfilled objectives for Largemouth Bass monitoring.

Channel Catfish: Channel Catfish support a small fishery at the reservoir, which anglers spent 5.5% of the total directed effort targeting them in the March-August 2013 creel survey. Channel Catfish have reached quality length at the reservoir, and the population can offer constituents a great fishery. Channel Catfish have been managed by the statewide 12-inch minimum length limit (MLL) and 25 fish (in combination with Blue Catfish) daily bag limit. Traditional monitoring for Channel Catfish has been achieved with spring gill netting surveys with an effort of five net nights, and the last survey was conducted during 2019. Except for the most recent survey in 2019, most gill netting surveys have not produced samples ≥ 50 stock-length Channel Catfish. Two exploratory tandem hoop netting surveys were conducted in 2010 and 2014, and catch rates increased from 2.5/tandem series (Effort=4; RSE=76; N=10) to 5.0/tandem series (Effort=9; RSE=45; N=45). Even during the recent period of prolonged drought that occurred in 2011-2015, the quality of the Channel Catfish fishery did not appear to have any decline since 2010. Continuation of monitoring efforts is important to monitor trends in relative abundance, sizes, and body conditions. Data will be used to ascertain future management objectives and to promote fisheries to constituents. Gill netting has been used traditionally and has produced better

precision of relative abundance data than tandem hoop netting. To continue using tandem hoop netting will require more evaluation to determine if it will serve as a viable alternative for monitoring Channel Catfish at the reservoir. Therefore, Channel Catfish will be monitored by both tandem hoop netting and gill netting. Exploratory tandem hoop netting will be conducted by deploying eight series at randomly selected site within 4-12 ft. depths to avoid setting in anoxic conditions. No specific targets will be set for relative abundance data, size structure, or body conditions. Gill netting will be conducted during spring 2023 by deploying gill nets among five randomly selected stations. There will be no target level of precision for relative abundance estimates. Should ≥ 50 stock-length fish be collected, PSD will be calculated and reported. Mean relative weight will also be calculated and reported should ≥ 5 fish per inch group \geq stock length be attained. No additional sampling will be conducted to improve sample size.

Largemouth Bass: Largemouth Bass support the most popular fishery at the reservoir, and anglers reported allocating 86.2% of the overall directed fishing effort towards them in the March-August 2013 access creel survey. The reservoir is also one of the most popular Largemouth Bass tournament reservoirs in the TPWD Inland Fisheries - Abilene District. Largemouth Bass have been managed by the statewide 14-inch MLL and 5-fish daily bag limit. Previous monitoring for Largemouth Bass has been achieved with night-time electrofishing with 1.0 hour of sampling effort and has often yielded desirable sampling precision of $RSE \leq 25$ for CPUE-Total and Stock CPUE estimates. Mean relative weights for Largemouth Bass at Leon Reservoir have often been poor to fair, and stunting was a management concern for some time. Though, age samples were collected during fall 2016 and 2018 to estimate growth near or at legal length (13.0-14.9 inches) and mean age at legal-length were comparable to other local reservoirs. Given the recreational importance of this fishery, periodic monitoring is necessary for maintaining trend information for Largemouth Bass to inform anglers on the status of the fishery, to assess success of stocking efforts, and to reassess and refine management strategies. Thus, sampling will be conducted at 12, 5-minute randomly selected stations for a total of 1.0 hour during fall 2022. Relative abundance (CPUE-Total, Stock CPUE, and CPUE-14) will be calculated, and target precision of CPUE-Total and Stock CPUE will be $RSE \leq 25$. A sample of ≥ 50 stock-length fish will be collected to evaluate size structure as PSD. A sample of ≥ 5 fish per inch group $>$ stock length will be measured and weighed to evaluate body conditions (i.e., relative weights). Continuation of genetics monitoring is necessary to assess stocking performance and Florida strain genetic introgression into the population. Fin clips will be taken from a random sample of 30 fish to assess allele frequency of both the Florida and Northern Largemouth Bass strains. Should sampling objectives not be achieved, up to one hour of additional sampling may be conducted.

Crappie: Black and White Crappie support the second-most popular fishery at the reservoir, which anglers reported allocating 6.5% of the overall fishing effort in the March-August 2013 creel survey targeting crappie. Both White and Black Crappie have been managed by the statewide 10-inch MLL and 25-fish daily bag limit. Historical monitoring of both crappie species has been achieved by conducting trap netting during late fall mostly every four years with a common effort of 10 net nights. However, catch rates have been variable. Fluctuations in the relative abundance of crappie may be attributed to variations in habitat availability because of water level fluctuations as well as sampling effectiveness. Continuation of trap netting is necessary to monitor trends in crappie relative abundance, size structure, and body conditions. Trend data will be used to provide current information regarding the status of the fishery to constituents and reassess and refine management strategies. To monitor crappie, trap netting will be conducted during late fall 2022 at 10 randomly selected stations. Relative abundance (CPUE-Total, Stock CPUE, and CPUE-10) will be calculated for both species combined. Target precision for CPUE-Total of crappie will be $RSE \geq 30$; no target RSE will be attempted for Stock CPUE and CPUE-10. Given the

historically low relative abundance of Black Crappie, no target precision will be attempted for their relative abundance estimates. At least 50 stock-length crappie (combined) will be collected to evaluate size structure as PSD. To assess body conditions (i.e., mean relative weights), ≥ 5 crappie per represented inch group \geq stock-length will be attempted to be weighed. No additional trap nets will be set to improve data precision.

Creel: A creel survey will not be conducted during the 2019-2023 monitoring cycle.

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Tables and Figures

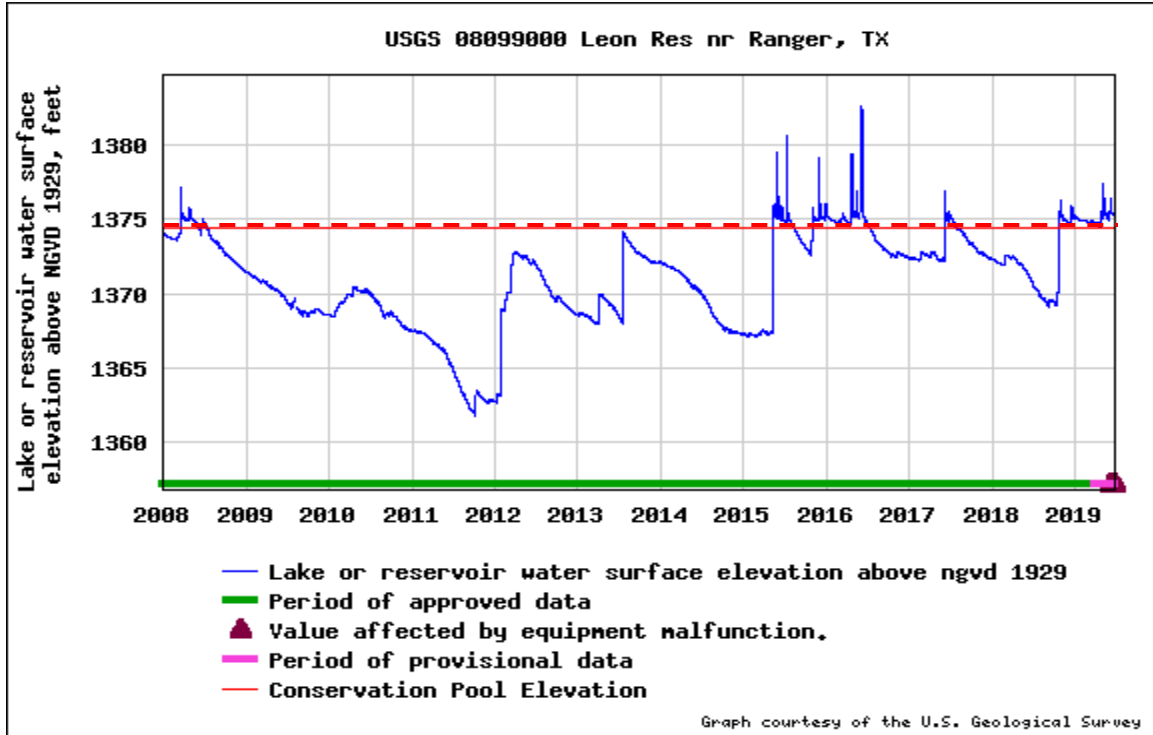


Figure 1. Daily water level elevations in feet above mean sea level (MSL) recorded for Leon Reservoir, Texas, January 2008- June 2019 (USGS 2019). The dashed line indicates the conservation pool elevation.

Table 1. Characteristics of Leon Reservoir, Texas.

Characteristic	Description
Year constructed	1954
Controlling authority	Eastland County Water Supply District
County	Eastland
Reservoir type	Mainstream, Leon River
Surface Area (acres)	1,756
Conservation Pool Level (ft. above mean sea level)	1,375
River Basin	Brazos River
USGS 8-Digit HUC Watershed	12070201 (Leon)
Carlson's Trophic State Index	50.82

Table 2. Boat ramp characteristics for Leon Reservoir, Texas, June 2019. Reservoir elevation at time of survey was at conservation pool elevation.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft.)	Condition
Chock-a-Block	32.363183° -98.723665°	Y	20	1,363	Accessible
Dam Ramp (main)	32.364629° -98.676099°	Y	8	1,368	Accessible
Dam Ramp (low water)	32.366274° -98.677170°	Y	6	Unknown	Inaccessible; inundated

Table 3. Harvest regulations for Leon 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 Leon Reservoir, Texas. FRY= >1 in.; FGL = fingerling; ADL = adults.

Species	Year	Number	Size
Shad, Threadfin	1984	1,000	ADL
Bass, Florida Largemouth	1975	40,500	FGL
	1975	40,000	FGL
	1977	80,000	FGL
	1986	75,500	FRY
	1994	79,500	FGL
	2008	152,156	FGL
	2012	175,182	FGL
	2018	159,832	FGL
	2019	50,622	FGL
	Total	853,292	
Bass, Largemouth	1969	146,000	FGL
	1970	50,000	FGL
	Total	196,000	
Bass, ShareLunker Largemouth	2019	13,496	FGL
Northern Pike x Muskellunge	1976	1,500	FGL
Bass, Palmetto (Striped x White Bass Hybrid)	1976	15,763	FGL
	1978	15,875	FGL
	1980	16,000	FGL
	Total	47,638	

Table 5. Objective-based sampling plan components for Leon Reservoir, Texas 2018–2019.

Gear/Target Species	Survey Objective	Metrics	Sampling Objective
<i>Electrofishing</i>			
Gizzard Shad	Relative Abundance	CPUE–Total	RSE≤25
	Size Structure	Length frequency	N≥50
	Prey Availability	IOV	N≥50
Bluegill	Relative Abundance	CPUE-Total	RSE≤25
	Size Structure	Length Frequency, PSD	N≥50 stock-length
Largemouth Bass	Relative Abundance	CPUE-Total, Stock CPUE, CPUE-14	RSE≤25 (CPUE-Total and Stock CPUE); Practical Effort for CPUE-14
	Size Structure	Length Frequency, PSD	N≥50 stock-length
	Body Conditions	W_r	N≥5 fish/ inch group
	Genetics	Allele Frequencies for FLMB and NLMB	N=30 (random)
	Age and Growth	Age at legal length	N=13, 13.0-14.9 inches
<i>Gill netting</i>			
Channel Catfish	Relative Abundance	CPUE-Total, Stock CPUE, CPUE-12	RSE≤25 (CPUE-Total and Stock CPUE); Practical Effort (CPUE- 12)
	Size Structure	Length Frequency, PSD	N≥ 50 stock-length; Practical Effort
	Body Conditions	W_r	Practical effort
<i>Trap netting</i>			
Crappie	Relative Abundance	CPUE–Total, CPUE– Stock, CPUE-10	RSE≤25 (CPUE-Total and Stock CPUE); Practical Effort (CPUE- 10)
	Size Structure	Length Frequency, PSD	N≥50 stock-length
	Body Conditions	W_r	N≥5 fish/inch group
	Age and Growth	Age at Legal Length	N=13, 9.0-10.9 inches

Table 6. Percent (%) occurrence and associated 95% confidence intervals (parentheses) for structural habitat types throughout the reservoir and along the shoreline encountered during the summer 2018 habitat survey, Leon Reservoir, Texas. Water level at time of survey was approximately 6 ft. below conservation pool level.

Habitat Type	% Shoreline
Bridge	1.1 (± 2.2)
Gravel (GRSH)	2.2 (± 3.0)
Boat Ramp	3.3 (± 3.7)
Bulkhead (BULK)	7.8 (± 5.5)
Rock Bluff (ROBL)	18.9 (± 8.1)
Boat Dock/Pier (PIDO)	25.6 (± 9.0)
Rocky Shoreline (ROSH)	27.8 (± 9.3)
Natural Shoreline (NASH)	43.3 (± 10.2)

Table 7. Percent (%) occurrence and associated 95% confidence intervals (parentheses) for vegetation types throughout the reservoir (96 points) and along the shoreline (90 points) encountered during the summer 2018 vegetation survey, Leon Reservoir, Texas. Water level at time of survey was approximately 6 ft. below conservation pool level.

Habitat type	% of Entire Reservoir	% Shoreline
Woody Debris/Logs	<1.0	3.3 (± 3.7)
Flatsedge	2.2 (± 2.9)	1.1 (± 2.2)
Flooded Terrestrial Vegetation	2.2 (± 2.9)	12.2 (± 6.8)
Waterwillow	3.3 (± 3.6)	8.9 (± 5.9)
Bulrush	8.7 (± 5.6)	23.3 (± 8.7)
Standing Timber	34.8 (± 9.5)	30.0 (± 9.5)
Open Water/Featureless	57.6 (± 9.9)	40.0 (± 10.2)

Gizzard Shad

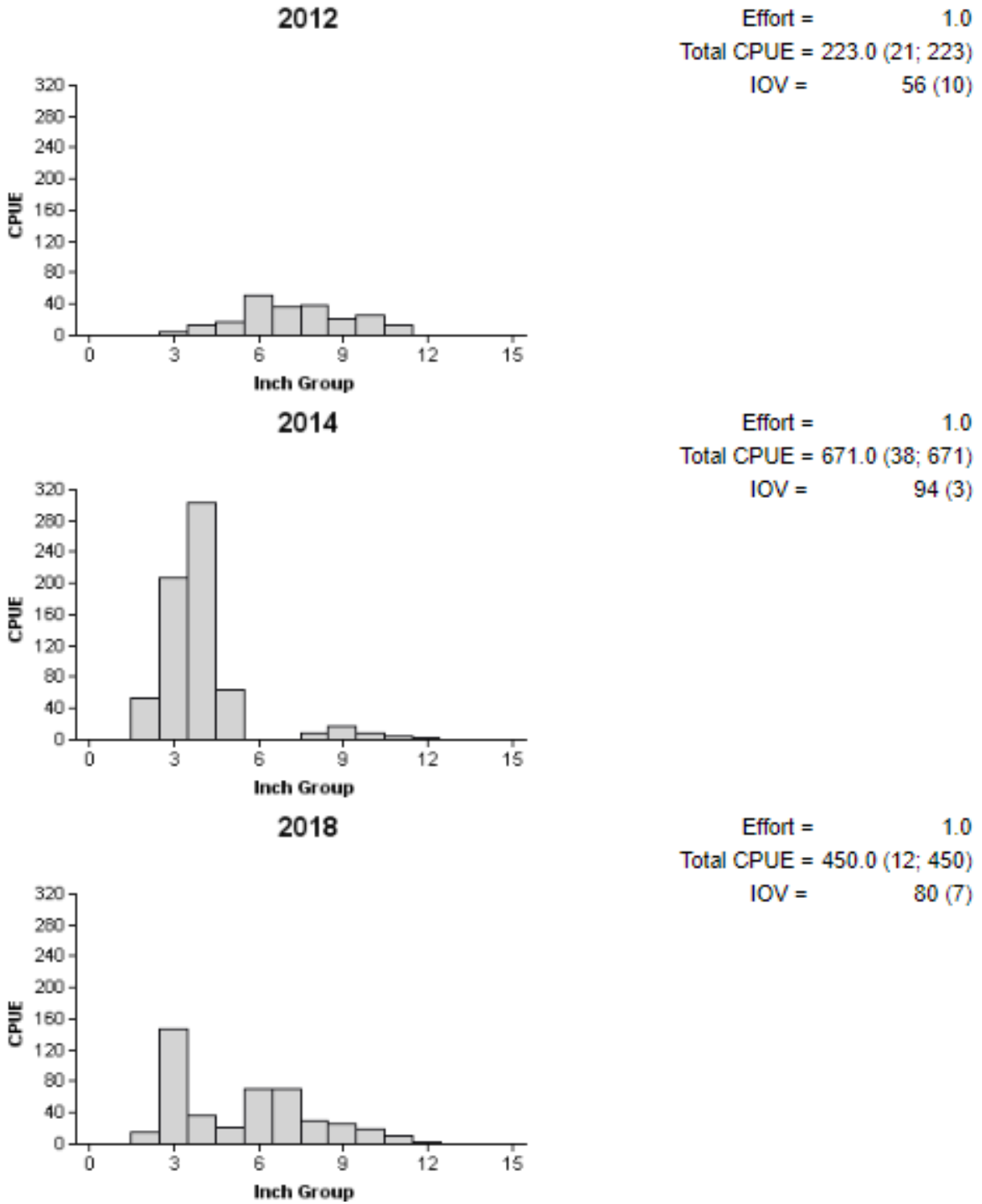


Figure 2. Number of Gizzard Shad caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Leon Reservoir, Texas, 2012, 2014, and 2018.

Bluegill

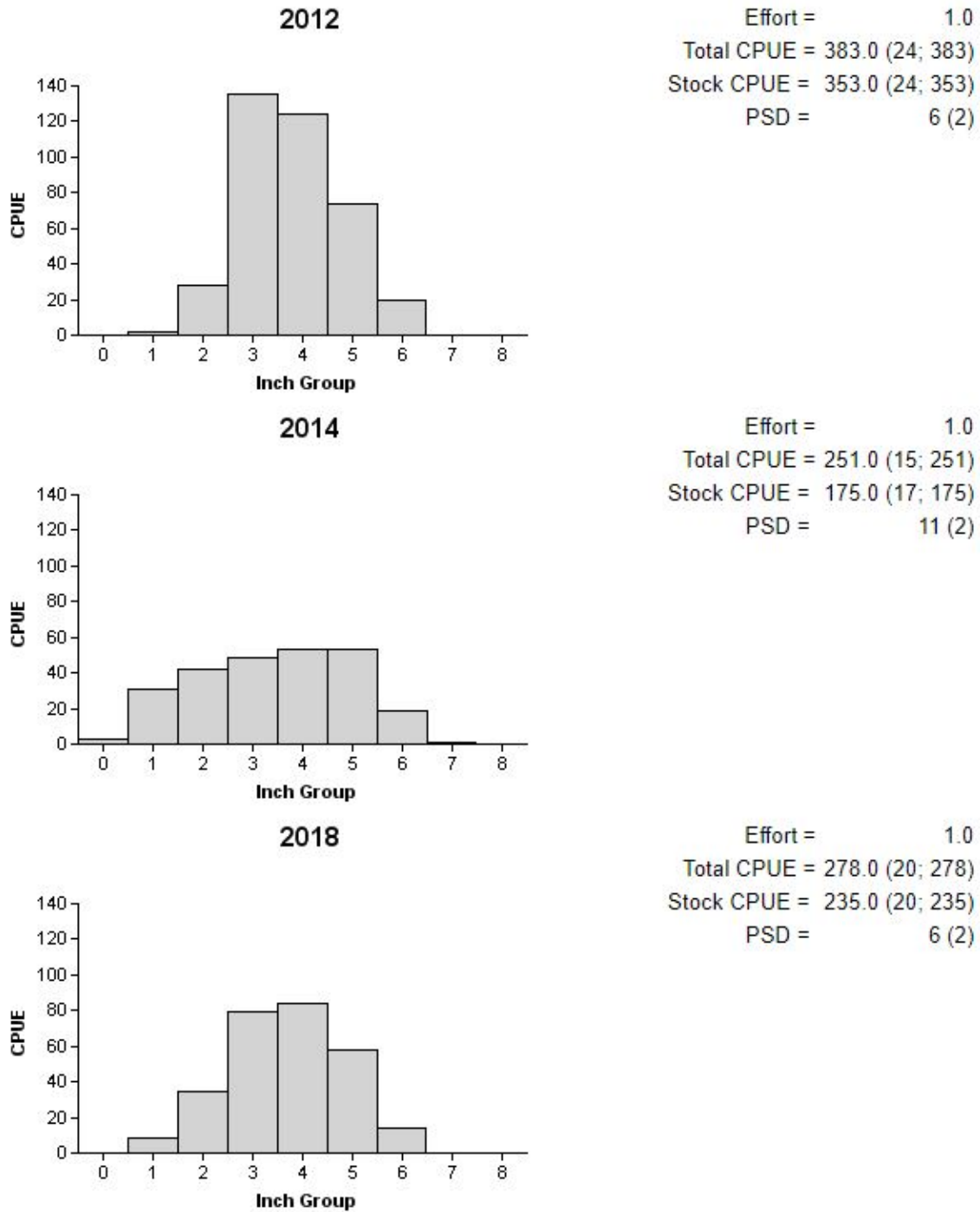
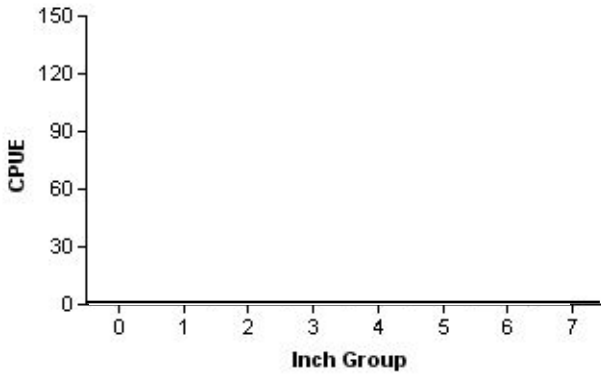


Figure 3. Number of Bluegill caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for PSD are in parentheses) for fall electrofishing surveys, Leon Reservoir, Texas, 2012, 2014, and 2018.

Longear Sunfish

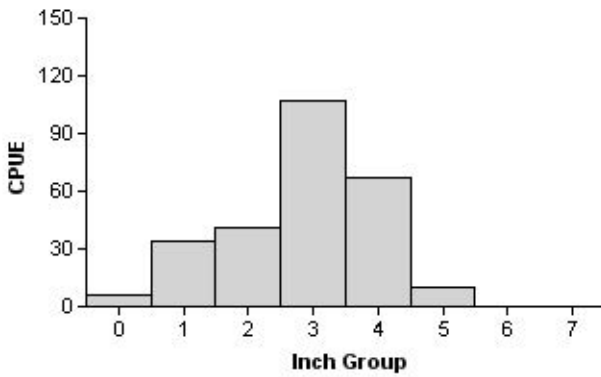
2012

Effort = 1.0
 Total CPUE = 0.0 (0; 100)



2014

Effort = 1.0
 Total CPUE = 265.0 (29; 265)



2018

Effort = 1.0
 Total CPUE = 149.0 (24; 149)

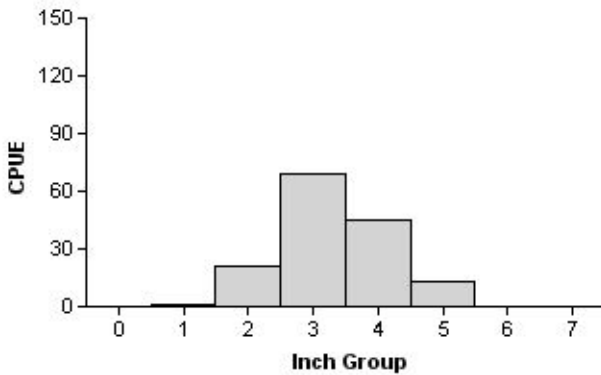


Figure 4. Number of Longear Sunfish caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for PSD are in parentheses) for fall electrofishing surveys, Leon Reservoir, Texas, 2012, 2014, and 2018. Longear Sunfish were not caught in 2012.

Channel Catfish

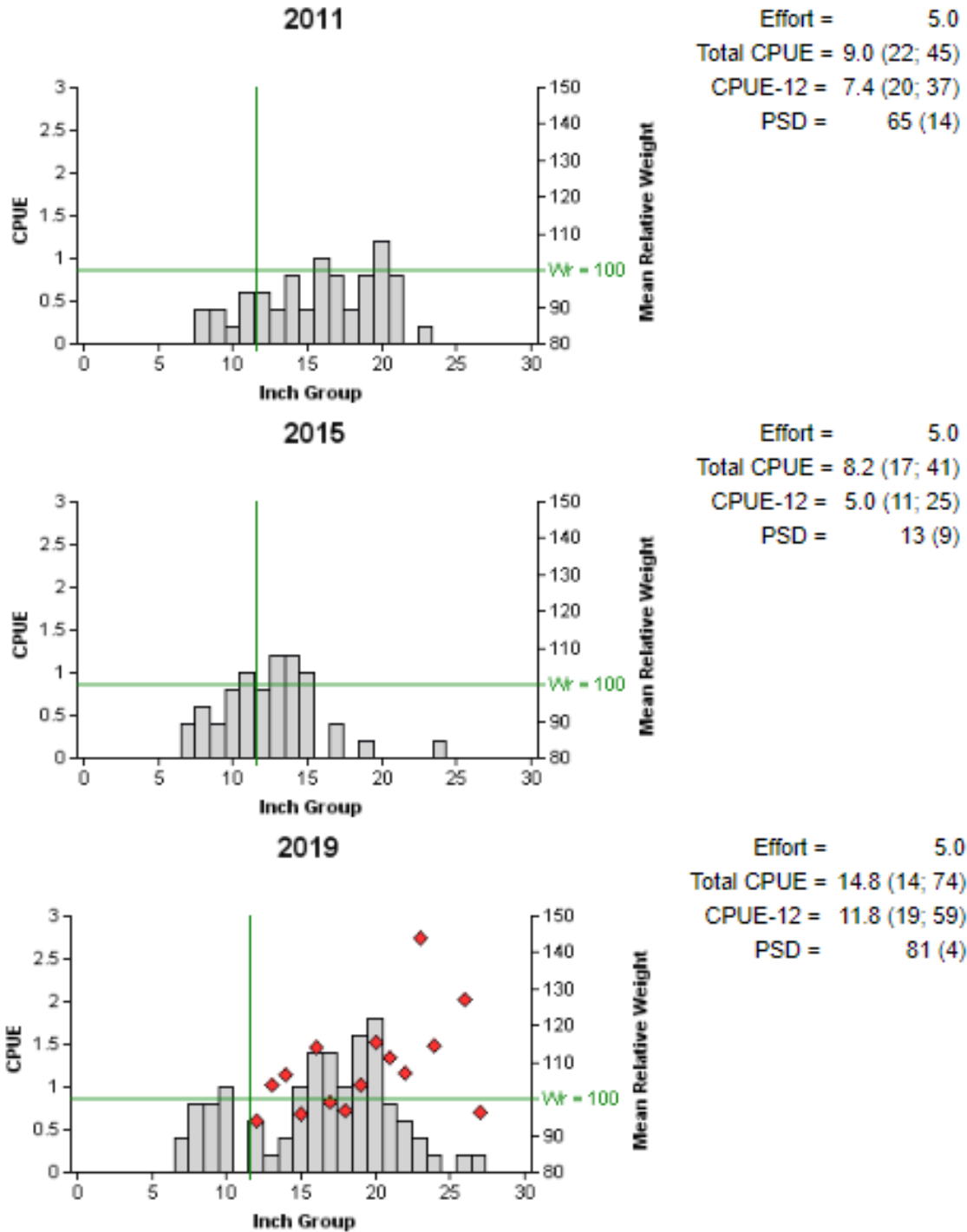


Figure 5. Number of Channel Catfish caught per net night (CPUE, bars), population indices (RSE and N for CPUE and SE for PSD are in parentheses) and mean relative weights (diamonds) for spring gill netting surveys, Leon Reservoir, Texas, 2011, 2015, and 2019. The vertical line denotes the minimum length limit, and the horizontal line represents relative weight at 100.

White Bass

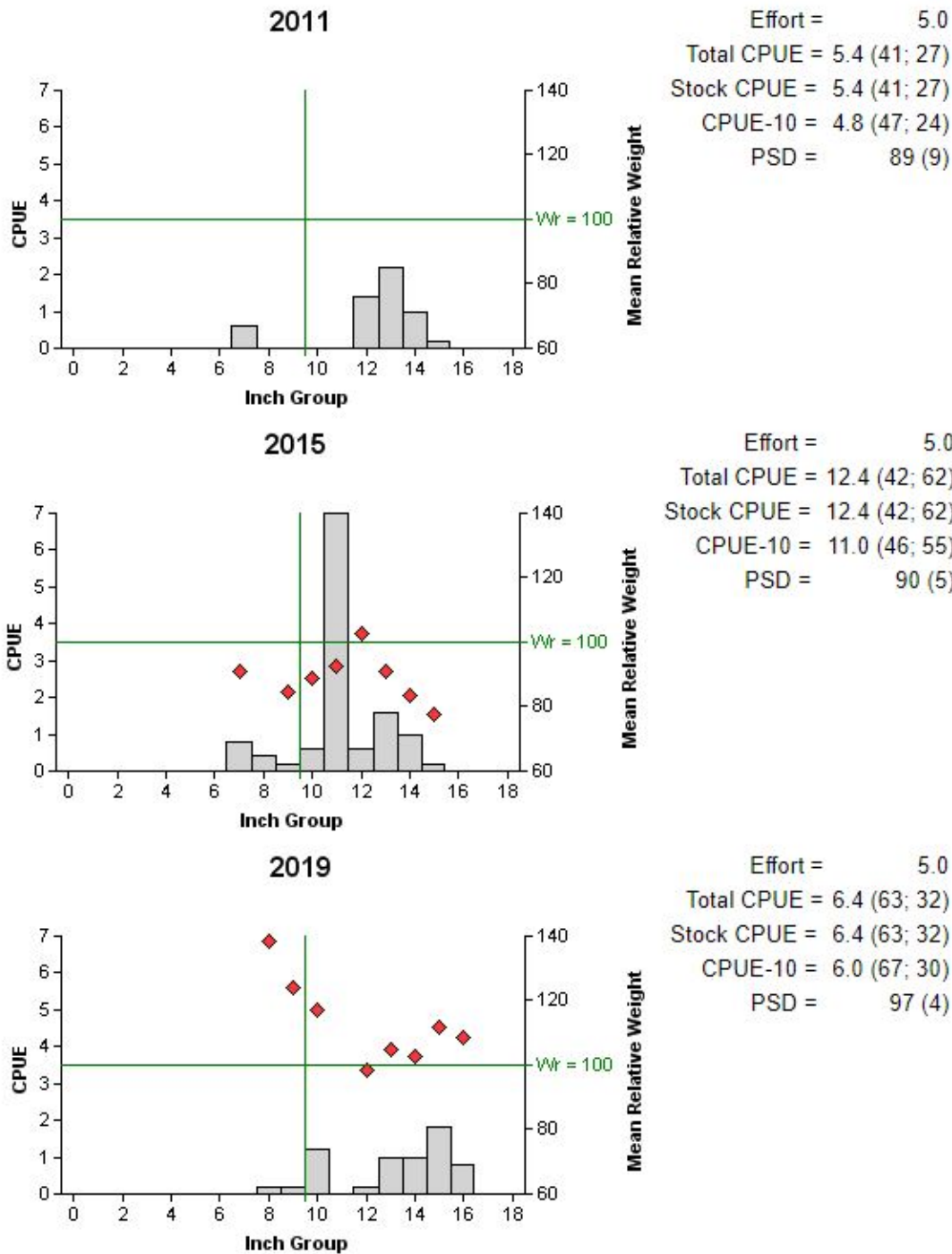


Figure 6. Number of White Bass caught per net night (CPUE, bars), population indices (RSE and N for CPUE and SE for PSD are in parentheses) and mean relative weights (diamonds) for spring gill netting surveys, Leon Reservoir, Texas, 2011, 2015, and 2019. The vertical line denotes the minimum length limit, and the horizontal line represents relative weight at 100.

Largemouth Bass

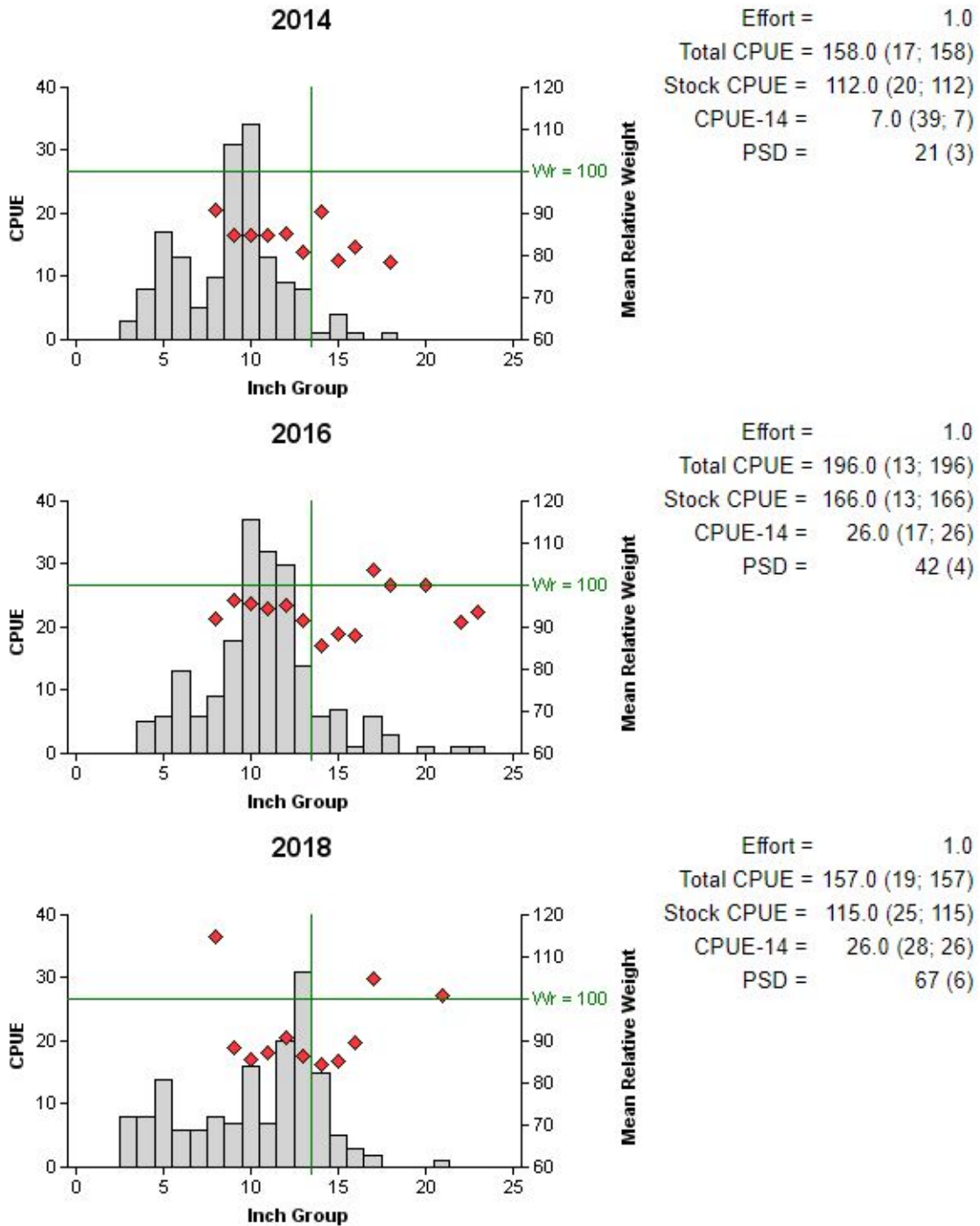


Figure 7. Number of Largemouth Bass caught per hour (CPUE, bars), population indices (RSE and N for CPUE and SE for PSD are in parentheses) and mean relative weights (diamonds) for fall electrofishing surveys, Leon Reservoir, Texas, 2014, 2016, and 2018. The vertical line denotes the minimum length limit, and the horizontal line represents relative weight at 100.

Largemouth Bass

Table 8. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Leon Reservoir, Texas, 1992-2018. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB. Genetic composition was determined by micro-satellite DNA analysis from 2005 to 2018 and by electrophoresis for previous years.

Year	Sample Size	Number of Fish			% FLMB Alleles	%FLMB
		FLMB	Intergrade	NLMB		
1992	30	0	12	18	9.0	0.0
1995	30	1	16	13	26.7	3.3
2000	30	1	16	13	20.8	3.3
2002	49	2	36	11	34.7	4.1
2004	32	1	22	9	28.0	3.1
2006	394	0	337	57	29.3	0.0
2014	30	1	29	0	45.1	3.3
2016	30	0	25	5	39.4	0.0
2018	30	1	28	2	41.6	3.3

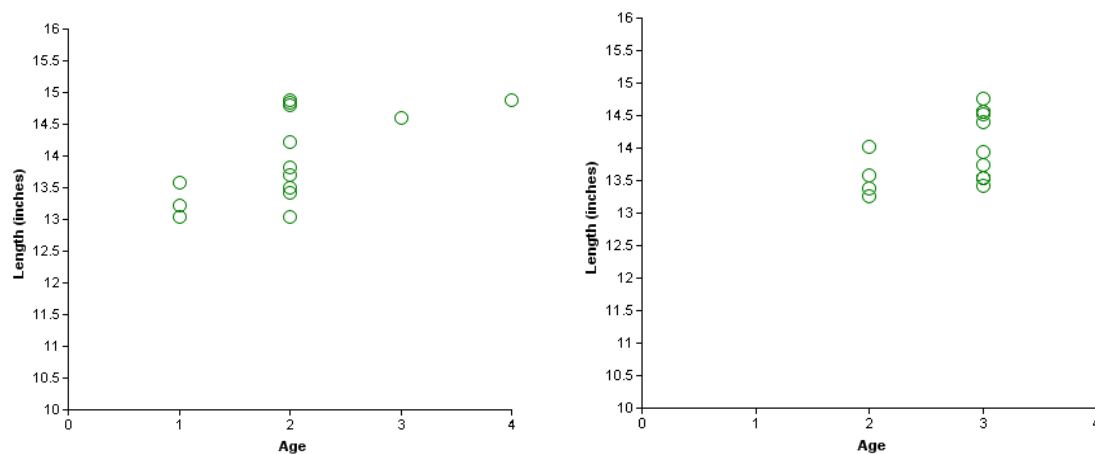


Figure 8. Length at age distributions of Largemouth Bass collected during the 2016 (left; N=14) and 2018 (right; N=15) fall electrofishing surveys.

Crappie

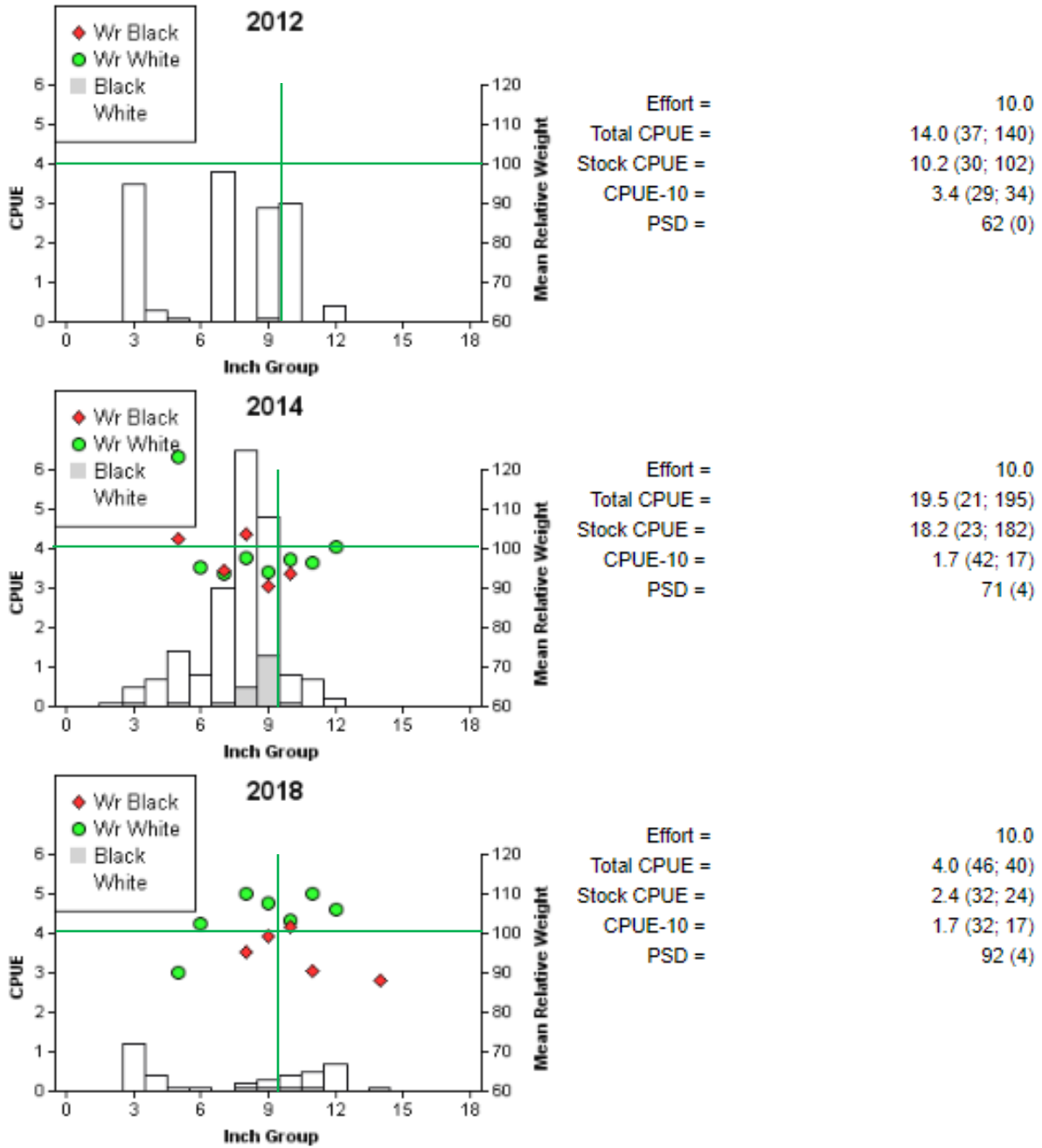


Figure 9. Crappie caught per net night (CPUE, bars), population indices (RSE and N for CPUE and SE for PSD are in parentheses) and mean relative weights for White (green circles) and Black Crappie (red diamonds) caught in fall trap netting surveys, Leon Reservoir, Texas, 2012, 2014, and 2018. Vertical line denotes the 10-inch minimum length limit, and the horizontal line represents relative weight at 100.

Crappie

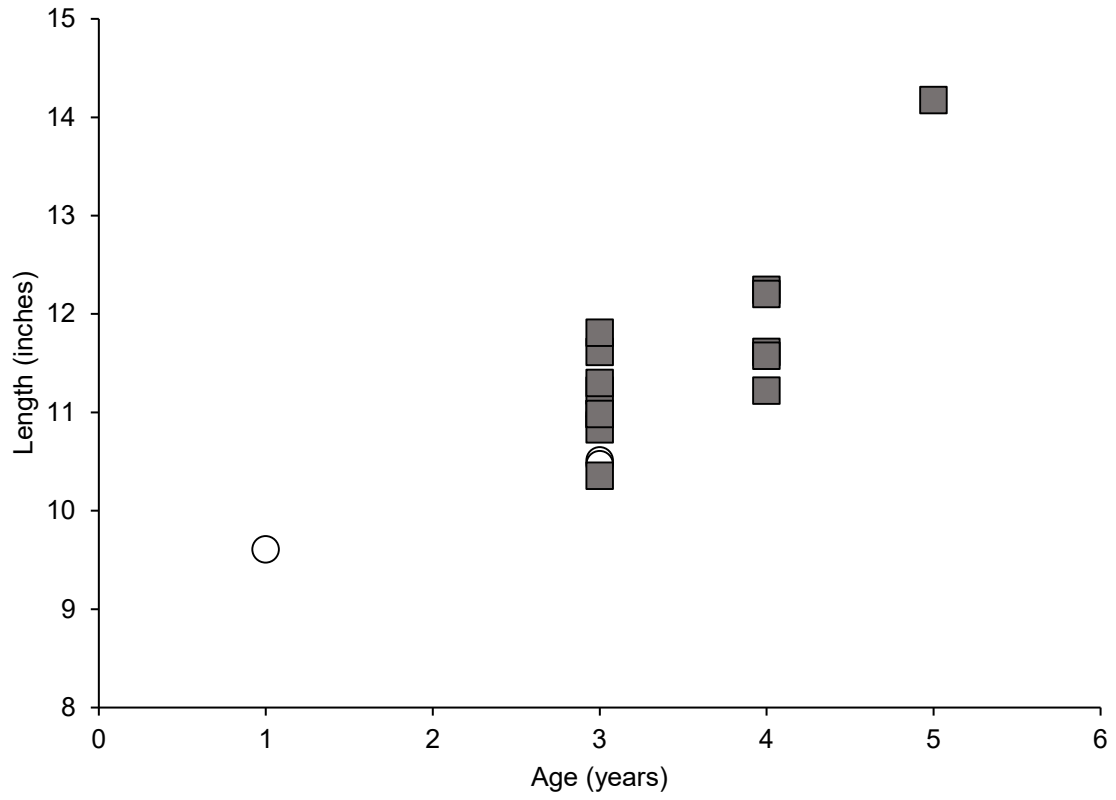


Figure 10. Length at age distribution for White Crappie collected during 2018 fall trap netting (white circles; N=4) and 2019 spring gill netting surveys (gray squares; N=13); only five fish were 9.0-10.9 inches TL.

Proposed Sampling Schedule

Table 9. Proposed sampling schedule for Leon Reservoir, Texas. Survey period is June through May. Electrofishing and trap netting surveys are conducted in the fall. Standard survey denoted by S.

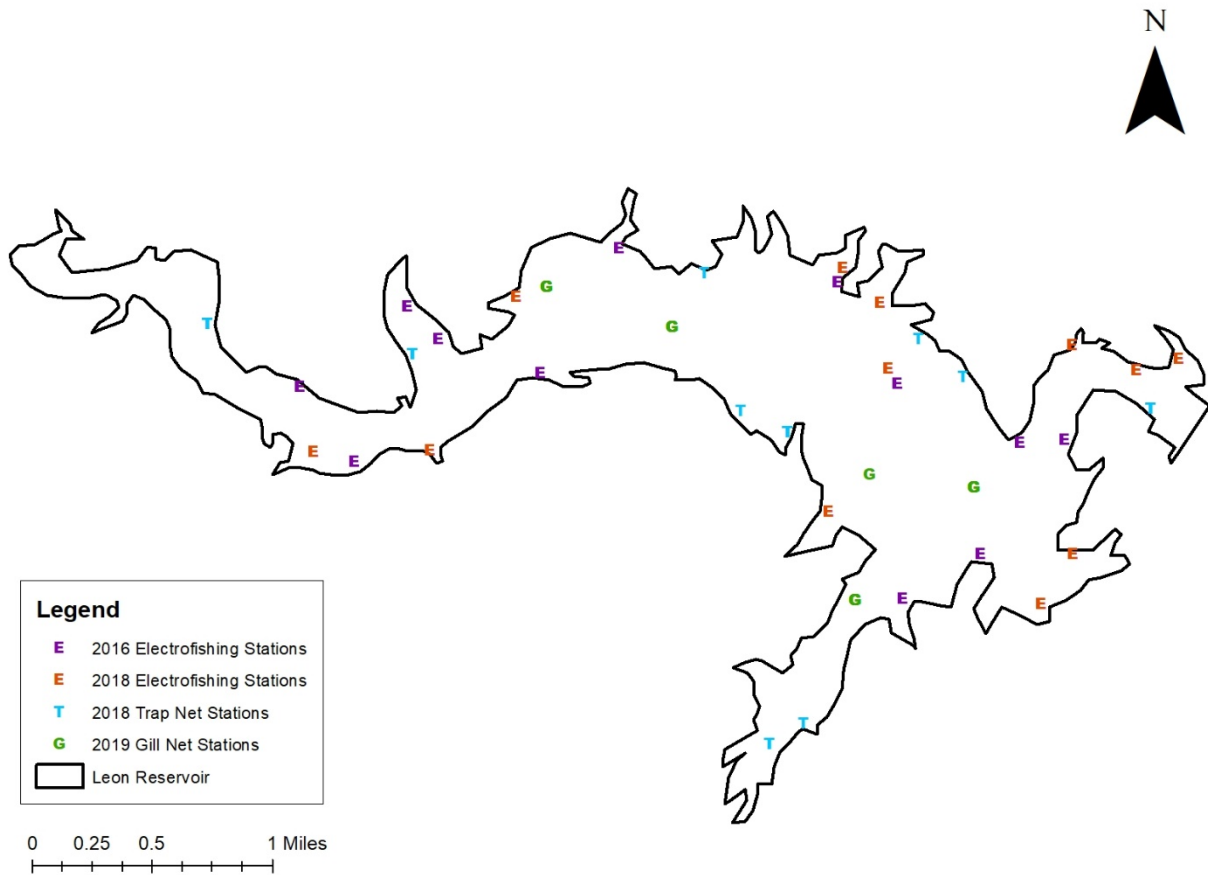
	Survey year			
	2019-2020	2020-2021	2021-2022	2022-2023
Angler Access				S
Vegetation				S
Electrofishing – Fall		A		S
Trap netting				S
Gill netting				S
Baited tandem hoop netting				S
Report				S

Appendix A

Number (N) and catch per unit effort (CPUE; RSE in parentheses) of all target species collected from all gear types from Leon Reservoir, Texas, 2018-2019. Sampling effort was one hour for fall electrofishing, 10 net nights for fall trap netting, and five net nights for spring gill netting.

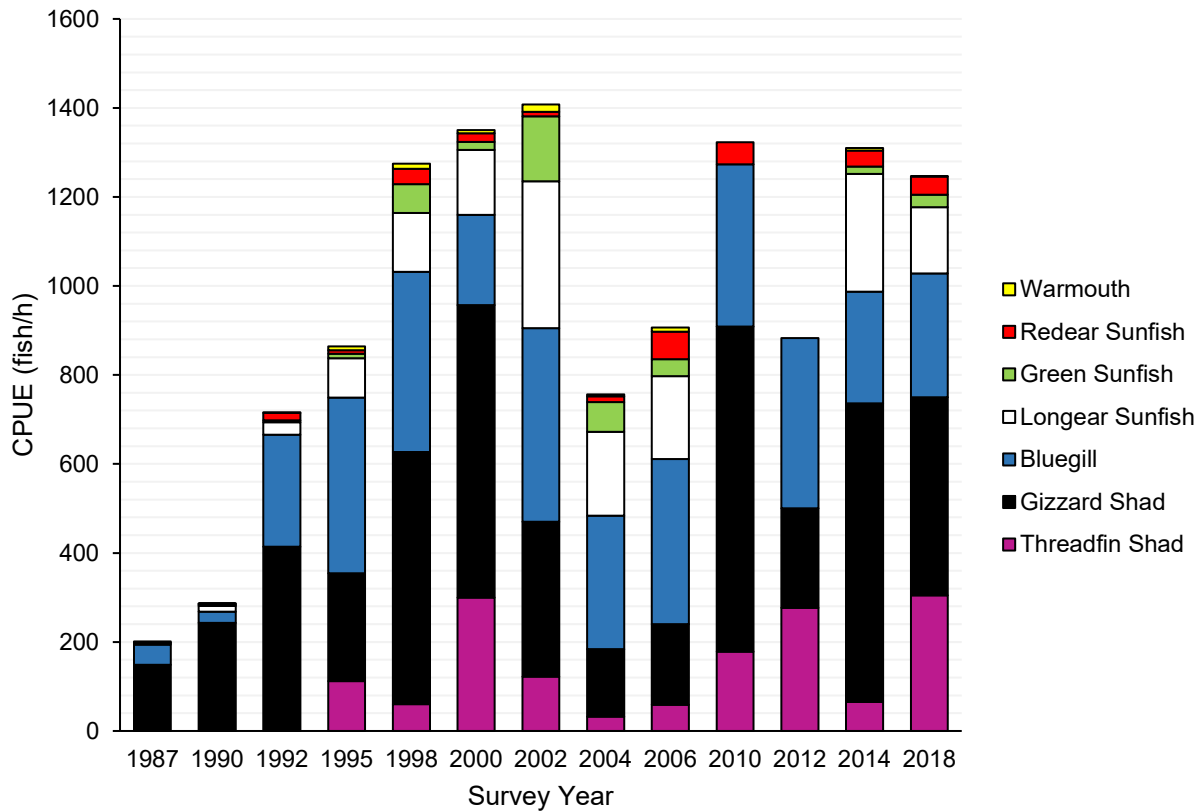
Species	Electrofishing		Trap Netting		Gill Netting	
	N	CPUE	N	CPUE	N	CPUE
Gizzard Shad	450	450.0 (12)				
Threadfin Shad	305	305.0 (57)				
Channel Catfish					74	14.8 (14)
Flathead Catfish					1	0.2 (100)
White Bass					32	6.4 (63)
Green Sunfish	28	28.0 (27)				
Warmouth	1	1.0 (100)				
Bluegill	278	278.0 (20)				
Longear Sunfish	149	149.0 (24)				
Redear Sunfish	41	41.0 (38)				
Largemouth Bass	157	157.0 (19)				
White Crappie			35	3.5 (50)	14	2.8 (26)
Black Crappie			5	0.5 (45)	2	0.4 (61)

Appendix B



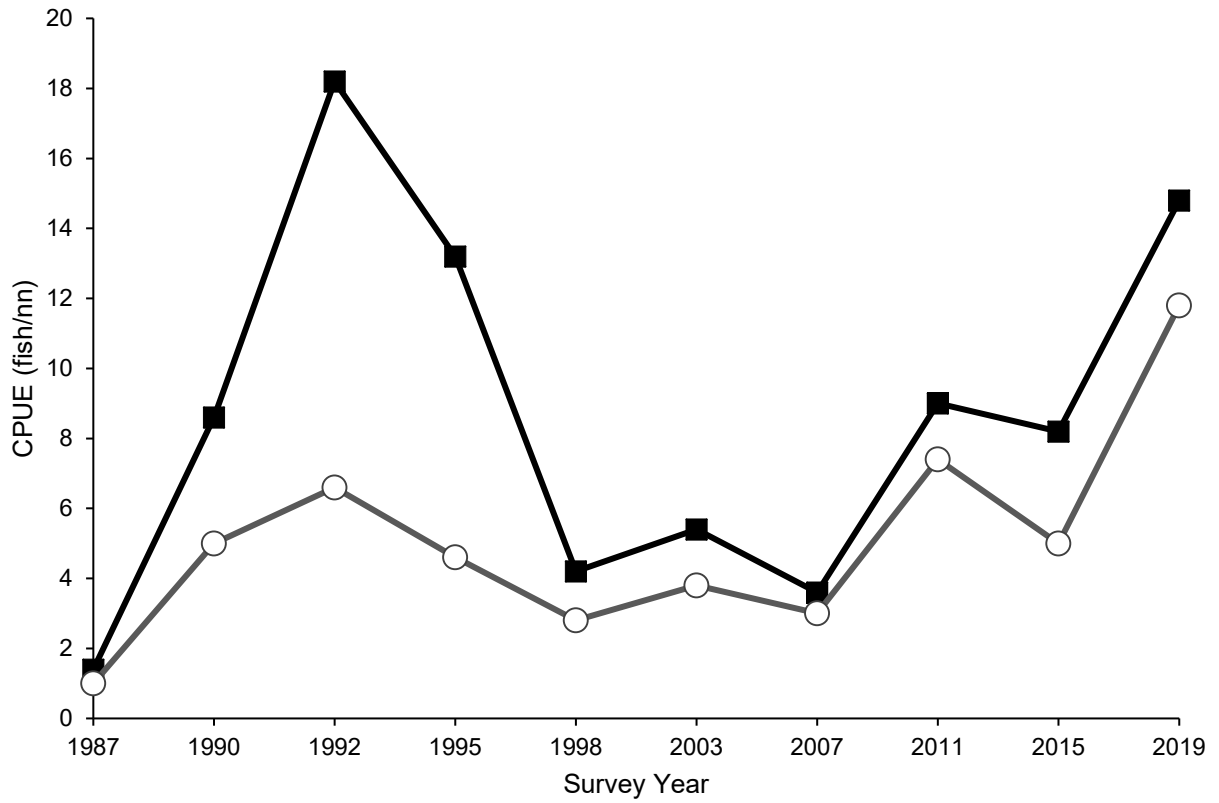
Locations of electrofishing (E), trap netting (T), and gill netting (G) stations at Leon Reservoir, Texas, 2016, 2018, and 2019.

Appendix C



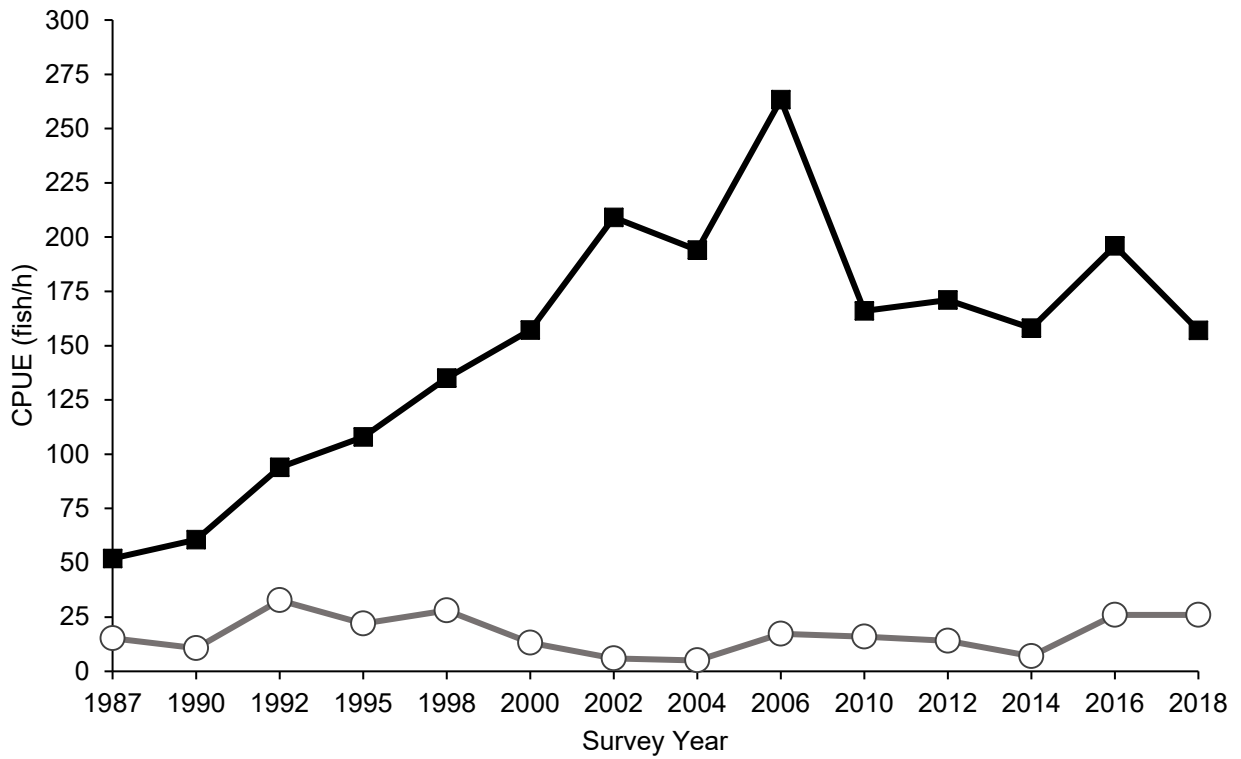
Cumulative catch per hour (CPUE) of important prey fish species sampled during fall electrofishing surveys at Leon Reservoir, Texas, 1987-2018.

Appendix D



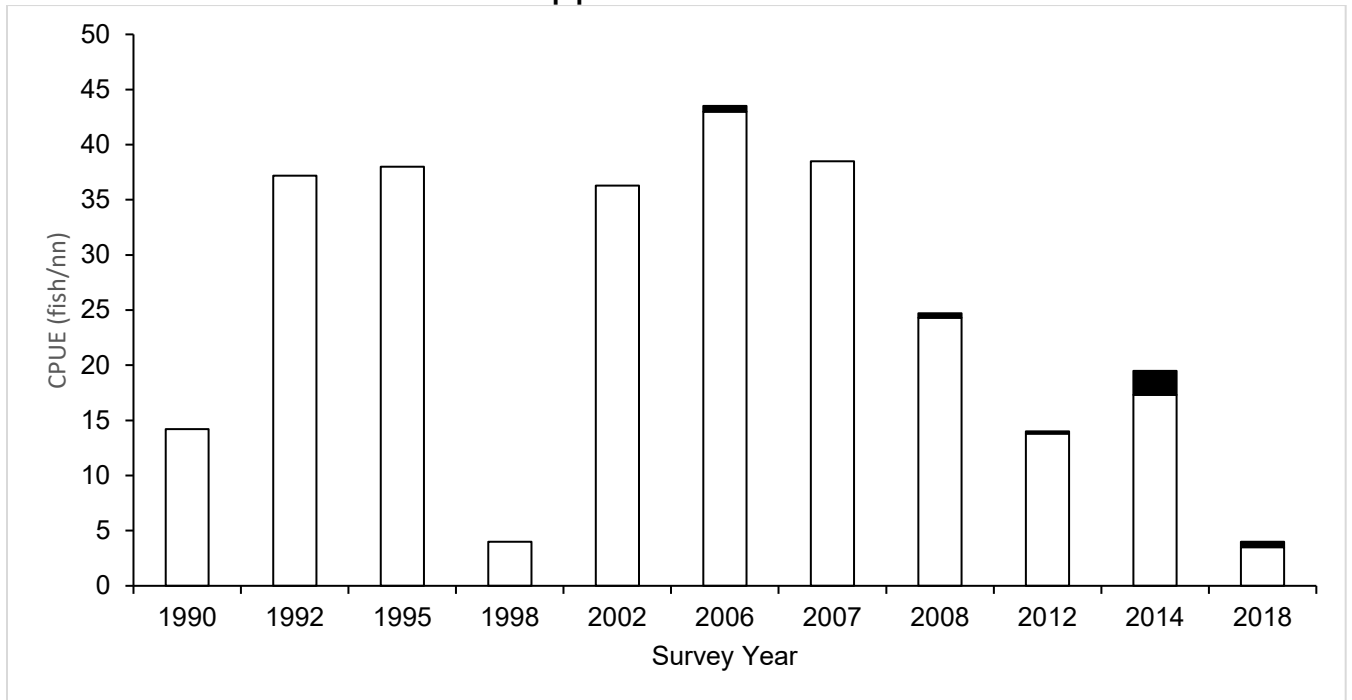
Total catch per net night (CPUE-Total; black squares) and catch rates of legal-length (CPUE-12; hollow circles) Channel Catfish surveyed during spring gill netting surveys, Leon Reservoir, 1987-2019.

Appendix E



Total catch-per-unit-effort (CPUE; black squares) and catch rates of legal Largemouth Bass (CPUE-14; hollow circles) during fall electrofishing surveys, Leon Reservoir, Texas, 1987-2018.

Appendix F



Catch per net night (CPUE) for White Crappie (white bars) and Black Crappie (black bars) sampled during fall trap netting surveys, Leon Reservoir, 1990-2018. Black Crappie were not sampled during the 2007 survey and those prior to 2006.



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