Caddo Lake

2017 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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Contents

Survey and Management Summary

Fish populations in Caddo Lake were surveyed in 2017 using electrofishing and dual-cod trap netting, and in 2018 using tandem hoop netting. Anglers were surveyed from June 2017 through May 2018 with a creel survey. Historical data are presented with the 2017-2018 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: Caddo Lake is a 27,472-acre lake on Big Cypress Creek located in the Cypress Creek Basin approximately 20 miles northeast of Marshall, in Harrison and Marion Counties, Texas and Caddo Parish, Louisiana: 12,712 acres lie in Texas. Habitat features consist of bald cypress wetlands and a complex aquatic plant community including the invasive species giant salvinia, water hyacinth, crested floating heart, and hydrilla.

Management History: Important sport fishes include Largemouth Bass, Bluegill, Redear Sunfish, and crappies. The management plan from the 2013 survey report included the need for nuisance aquatic vegetation monitoring, Largemouth Bass supplemental stocking, and the need to investigate alternative sampling approaches in the presence of giant salvinia. Largemouth Bass were managed with a 14- to 18-inch slot-length limit. Efforts to control nuisance aquatic plants on the lake continued.

Fish Community

- **Prey species:** Threadfin Shad and Gizzard Shad were present in the reservoir. However, few Gizzard Shad were available as prey to most sport fish. Bluegill and Redear Sunfish electrofishing catch rates were moderate.
- **Catfishes:** We utilized tandem hoop nets baited with soap to survey the Channel Catfish population instead of traditional gill netting. Fish were collected from 9-20 inches, which was similar to previous gill netting surveys. Tandem hoop nets should be a reliable method for conducting future Channel Catfish population surveys while minimizing bycatch of non-target species.
- **Black Bass:** Largemouth Bass abundance and size structure have improved over recent surveys, and Spotted Bass were present but negligible. More Largemouth Bass were collected within the protected slot-length (14-18 inches) than the previous two surveys. Largemouth Bass had moderate growth (age at 14 inches long was 2.8 years), and average body condition indicated adequate prey availability in the lake. Almost 70% of angling effort was directed toward black basses. However, fishing effort during the 2017/2018 angler survey was much less than in 2009/2010. This difference is likely due to the excessive coverage of giant salvinia that inhibited boat travel and covered many areas of the Texas side of Caddo Lake.
- **Crappie:** White and Black Crappie were collected using dual cod trap nets during fall 2017 and tandem hoop nets baited with soap during spring 2018. Hoop nets have been successful surveying crappie in other reservoirs and is also used to survey Channel Catfish. This alternative method will be evaluated for future use to monitor crappie populations in Caddo Lake.

Management Strategies: Continue stocking Florida Largemouth Bass to support the high-quality bass fishery at Caddo Lake. Conduct invasive aquatic plant surveys annually, and continue management of giant salvinia and other invasive aquatic vegetation. Continue to work with stakeholder groups on invasive species management issues.

Introduction

This document is a summary of fisheries data collected from Caddo Lake (Texas side only) in 2017-2018. 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 2017-2018 data for comparison.

Reservoir Description

Caddo Lake is a 27,472-acre natural lake—of which 12,712 acres are in Texas—on Big Cypress Creek in the Cypress Creek Basin approximately 20 miles northeast of Marshall, Texas in Harrison and Marion Counties, Texas, and Caddo Parish, Louisiana. Principal tributaries include Big Cypress Creek, Big Cypress Bayou, Little Cypress Creek, Black Cypress Bayou, Jeems Bayou, and Harrison Bayou. Littoral area (depth < 15 feet) accounts for 95% of the lake. Annual average rainfall in the watershed is 44.8 inches. The lake was initially formed when water backed-up from a log jam in the Red River. The log jam sustaining the lake was removed in the late 1800s to facilitate navigation on the Red River, which contributed to the de-watering of Caddo Lake. In 1912, the U. S. Army Corps of Engineers (USACE) constructed a low-water dam near Mooringsport, Louisiana, to maintain water levels in an effort to return navigational commerce between Mooringsport and Jefferson, Texas. The dam was modified in the 1940s and again in the 1960s to increase water levels. Entities responsible for activities on Caddo Lake include the USACE for permitting issues (e.g., dredging or boat house installation) and the Cypress Valley Navigation District for the maintenance of boat roads. Average monthly water levels are shown in Figure 1. The current conservation pool elevation is 168.5 ft above mean sea level.

Approximately 7,000 acres of water, wetlands, and riparian areas at Caddo Lake were purchased by the Texas Nature Conservancy in 1991 and given to the Texas Parks and Wildlife Department (TPWD) for utilization as a wildlife management area (WMA). In 2000, the U. S. Fish and Wildlife Service (USFWS) acquired the U.S. Army Installation (formerly known as the Longhorn Ammunition Plant) and the 8,000-acre tract will be managed as a wildlife preserve. The bottomland hardwood and cypress wetland habitats present in Caddo Lake are the largest of their kind in Texas. This unique natural resource received recognition by the Ramsar Convention as a wetland of international importance in 1993. Upstream reservoir construction beginning in the late 1950s was designed for flood control and municipal water sources and has altered the hydrology in the Lower Cypress River Basin, negatively impacting the ecology of Caddo Lake.

Caddo Lake supports a diverse aquatic plant community, which includes native and non-native species. High densities of aquatic macrophytes can reduce water quality for fishes during summer and fall, as well as presenting major management problems and concerns. A survey of aquatic vegetation during summer 2017 revealed 5,313 acres of giant salvinia, 28 acres of waterhyacinth, and 1,802 acres of hydrilla. Giant salvinia continues to create problems for navigation and recreational use in many areas of the lake. Other descriptive characteristics for Caddo Lake are listed in Table 1.

Angler Access

Caddo Lake has ten public boat ramps on the Texas side; however, most are privately owned and require a launch or day-use fee. The F. R. Camp Road ramp located on the Caddo Lake WMA is for canoe, kayak, or small boats only. Boat ramp accessibility may be limited in some areas due to infestations of giant salvinia, especially in the fall when plant coverage is at its highest. Additional boat ramp characteristics are listed in Table 2. Shoreline access is limited to the public boat ramp areas and the fishing pier located at Caddo Lake State Park.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Wright and Bister 2014) included:

1. Caddo Lake continues to experience problems with excessive growth of aquatic vegetation, especially giant salvinia, water hyacinth, and hydrilla. Continued management of invasive aquatic plants is necessary to maintain boater access, protect native aquatic plants, and improve quality habitat available for fish.

   Action: Annual invasive vegetation surveys were conducted to monitor the coverage of invasive species and evaluate treatment efforts. District staff worked with stakeholders to develop and implement strategies to manage nuisance aquatic vegetation including continued maintenance of signage at boat ramps and marinas to inform boaters about exotic plants and their threat to Caddo Lake.

2. Giant salvinia coverage has impacted fish population sampling efforts during fall electrofishing and trap netting.

   Action: Fall electrofishing was conducted during daytime to assess Largemouth Bass size structure and growth. Spring electrofishing was cancelled during 2016 because of flooding. During spring 2018, electrofishing was attempted but high water and colder than average spring temperatures resulted in extremely low catches of Largemouth Bass; the survey was abandoned after 1 hour of sampling. Baited tandem hoop nets were used to sample Channel Catfish and crappie during spring 2018.

3. Continue to manage the trophy Largemouth Bass fishery at Caddo Lake.

   Action: Florida Largemouth Bass fingerlings have been stocked most recently in 2015 and 2017 as recommended in the last fisheries management plan.

Harvest regulation history: Sport fishes in Caddo Lake are currently managed with special regulations for black bass, catfishes, White Bass, and crappie (Table 3). Largemouth Bass were managed with a 10-inch minimum-length limit (MLL) and 10-fish daily bag from 1975-1987, a 12-inch MLL and 10-fish daily bag from 1988-1990, a 14-inch MLL 8-fish daily bag from 1991-1992, and a 14- to 18-inch slot-length limit (SLL) and 3-fish daily bag from 1993-1994. The current harvest regulation for Largemouth Bass is a 14- to 18-inch SLL and a 5-fish daily bag implemented in 1995. On September 1, 2011 Texas and Louisiana unified harvest regulations for boundary waters, including Caddo Lake. Blue Catfish and Channel Catfish, which had been managed with a 12-inch MLL and a 25-fish daily bag, changed to no MLL and 50-fish daily bag, of which no more than 5 may be over 20 inches. The daily bag limit for Flathead Catfish increased from 5 to 10 while the 18-inch length limit remained unchanged. White Bass and crappie have no MLL and a 25-fish daily bag. Effective July 1, 2014 boaters are required to drain all water from boats, live wells, and bait buckets when leaving the reservoir to prevent the spread of invasive aquatic species. Personally-caught live bait cannot be transported from the reservoir where the fish were caught. Current regulations are found in Table 3.

Stocking history: Florida Largemouth Bass were introduced into Caddo Lake in 1981 and 1982. By the early 1990s, a trophy Largemouth Bass fishery developed at the lake. To maintain and enhance this trophy fishery, Florida Largemouth Bass were again stocked from 1994 – 2000. These stockings were part of a research project that evaluated the contribution of stocked fish to the resident Largemouth Bass population. To further enhance the trophy potential of the Largemouth Bass fishery, Florida Largemouth Bass were stocked in 2006, 2007, 2009, 2010, 2011, 2013, 2015, and 2017. In spring 2014, 36 Paddlefish implanted with radio transmitters were stocked at the Caddo Lake State Park boat ramp as part of a USFWS research project. An additional 11 Paddlefish were stocked in the Big Cypress Bayou in the city of Jefferson, approximately 15 river miles above the highway 43 bridge boundary for Caddo Lake. Subsequent Paddlefish stockings have occurred as part of the USFWS project. The complete stocking history is listed in Table 4.

Water transfer: Caddo Lake is primarily used for municipal water supply, recreation, and to a lesser extent, flood control. No interbasin water transfers exist.

Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Caddo Lake (TPWD unpublished). Primary components of the OBS plan are listed in Table 5. 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, sunfishes, Gizzard Shad, and Threadfin Shad were collected by electrofishing (2 hours at 24, 5-min stations) during daytime hours. 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 were determined using otoliths from 13 randomly-selected fish (range 13.0 to 14.8 inches).

Dual-cod trap netting – Crappie were collected using dual-cod trap nets (10 net series at 10 stations). Nets were deployed for 2-night soak durations. CPUE for dual-cod trap netting was recorded as the number of fish caught per net series (fish/series). Ages for crappie were determined using otoliths from 12 randomly-selected fish (range 9.0 to 10.8 inches).

Tandem hoop nets – Channel Catfish and crappie were collected using 10 tandem hoop-net series at 10 stations. 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).

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 and creel statistics.

Creel survey – An annual roving creel survey was conducted from June 2017 through May 2018. Angler interviews were conducted on 5 weekend days and 4 weekdays per quarter to assess angler use and fish catch/harvest statistics in accordance with the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Habitat – Vegetation surveys were conducted in 2014–2017 to monitor coverage of invasive plants. Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Water level – Source for water level data was the United States Army Corps of Engineers (USACE 2018).

Results and Discussion

Habitat: Littoral zone structural habitat consisted primarily of cypress trees and natural shoreline, but due to the complexity of the lake's shorelines and cypress tree breaks we did not attempt to measure these habitats for this report. Native vegetation covered 3.3% of the lake's surface area compared to 56.4% coverage by non-native vegetation (Table 6). Giant salvinia has remained the most dominant invasive species in the lake and has received the most treatment effort. Crested floating heart is the newest aquatic invasive species in Caddo Lake. It was discovered in 2014 and is being managed with herbicide treatments.

Giant salvinia was first detected on the Louisiana side of the lake in 2006. By the time the infestation was detected, there was at least 300 acres present in the Jeem's Bayou arm of the lake. Immediate actions involving herbicide treatments were conducted in an attempt to reduce the level of giant salvinia in this area. Despite attempts by TPWD and LDWF, as well as efforts from local stakeholder groups, giant salvinia migrated to the Texas side of the lake during the winter of 2006/2007 and continued to expand in the spring of 2007. A separate introduction was discovered at a private boat ramp on the upper end of the lake on the Texas side in 2007. A 2007 vegetation survey of the Texas side estimated the presence of 100 acres of giant salvinia. This plant continued to expand its coverage to more areas of the lake, and by 2008, coverage had increased to 1,092 acres. By 2009, 3,228 acres of giant salvinia was estimated on the Texas side. However, an extended flood and freezing conditions during the winter of 2009/2010 drastically reduced the coverage of giant salvinia. A survey of the plant in March 2010 estimated at least a 95% reduction in coverage since the September 2009 survey, leaving an estimated 161 acres in isolated areas. By 2012, giant salvinia coverage had again increased to 1,370 acres and, combined with a mild winter, grew rapidly to 6,000 acres in 2013. A cold winter in 2013/2014 greatly reduced giant salvinia coverage although many immature plants remained present in most parts of the lake. By late summer 2014, giant salvinia coverage had increased to over 2,400 acres. Even with herbicide treatments and giant salvinia weevil releases, plant coverage continued to increase in subsequent years. Coverage had increased to over 5,300 acres in 2017, despite treatment of over 9,000 acres by TPWD. We had documented reduction of plants where giant salvinia weevils were released by TPWD in Pine Island Pond. Efforts to control giant salvinia weevils by the Caddo Biocontrol Alliance in Willowson Woodyard were also showing signs of weevil population growth and impact to plants. However, another cold winter in 2017/2018 reduced the amount of salvinia to minimal amounts. Most of the giant salvinia in weevil release areas was reduced to the point that it was unclear of the impact on weevils that had survived the winter. Future sampling will be required to determine any weevil presence from previous releases.

Water hyacinth was discovered in Caddo Lake in the 1940s and, until recently, some active form of control has been required to keep the population in check. Water hyacinth coverage was estimated at 3,700 acres in 2007, 1,350 acres in 2008, and 1,740 acres in 2009. However, the increase in giant salvinia caused water hyacinth coverage to decrease dramatically over the past few years. Despite the suppression by giant salvinia, water hyacinth needs to be monitored for possible increases in coverage that may warrant control efforts as giant salvinia mats are reduced by herbicide application and biocontrol efforts.

Hydrilla was first reported on Caddo Lake in 1993. In 1996, hydrilla had expanded to 575 acres and by 1997 was estimated to cover over 5,000 acres. At that time, the infestation was concentrated in the deeper portion of the lake. From available records, hydrilla declined by 2000 and was reduced to non-problematic levels by 2001. Records do not reflect any chemical treatments targeting hydrilla on Caddo Lake during this period. Surveys in 2004 documented isolated hydrilla populations on Caddo Lake in shallow, more remote areas less frequented by resource users. The 2005 survey indicated that hydrilla covered 2,500 acres. From 2009 to 2012, hydrilla coverage hovered around 4,000 acres; however, coverage dropped to 1,269 acres in 2013 due to shading by giant salvinia. Hydrilla coverage has remained around 2,000 acres over the last several years.

Creel: The angler creel survey conducted from June 2017 through May 2018 only included the Texas side of the lake. Directed fishing effort by anglers was highest for black bass (69.8%), followed by anglers fishing for crappie (19.8%, Table 7). Total fishing effort for all species and direct expenditures at Caddo Lake has greatly declined since the last creel survey in 2009/2010 (Table 8). This is most likely related to the expansive coverage of giant salvinia during the creel survey period. The distance traveled by anglers, by ZIP Code, is reported in Appendix C.

Prey species: Daytime electrofishing catch rates of Gizzard Shad and Threadfin Shad were 54.5/h and 24.5/h, respectively. Index of Vulnerability (IOV) for Gizzard Shad was low, indicating only 6% of Gizzard Shad were available to existing adult predators (Figure 2). Total CPUE of Bluegill in 2017 (63.5/h) was slightly lower than from the survey in 2015 (75.5/h), but was higher than the 2013 survey (35.5/h) (Figure 3). Nearly 50% of Caddo Lake was covered by giant salvinia and likely had a negative effect on sampling gear efficiency. Redear Sunfish were present at larger sizes than Bluegill and were available to anglers (Figure 4). Directed angling effort toward sunfishes was only about 10% of total angling effort during the 2009/2010 creel survey (Table 9).

Channel Catfish: In an effort to sample the Channel Catfish population with minimal bycatch of non-target species, tandem hoop nets baited with soap were used to survey Channel Catfish in spring 2018. Hoop nets caught a total of 70 Channel Catfish and 53 stock size fish (Figure 5). These results provide sufficient data to assess relative abundance and population size structure. Hoop nets caught fish from 9-20 inches, which was similar to ranges previously reported by Bister and Brice (2010). There was no harvest of Channel Catfish documented in the 2017/2018 creel survey and little directed fishing effort for Channel Catfish showed a minimal catfish fishery (Table 10).

Black Bass: Fall electrofishing has been conducted during daylight hours since 2013 because giant salvinia coverage has prohibited nighttime electrofishing. Spotted Bass were present in Caddo Lake but abundance was low (Appendix A). The electrofishing catch rate of stock-length Largemouth Bass was 38.5/h in 2017, which was an increase from previous years (31.5/h in 2015 and 20.5/h in 2013). Population size structure has also improved over the past three surveys. Growth of largemouth bass in Caddo Lake was moderate: average age at 14 inches (13.0-14.8 inches) was 2.8 years (N = 13; range = 2 – 4 years). Body condition in 2017 was moderate (Wr above 95) for most size classes of fish (Figure 6). Directed fishing effort for black bass tournament anglers in the most recent creel survey was 6,961 h, which was similar to the 2009/2010 survey (7,604 h). However, directed effort by non-tournament anglers was much less in 2017/2018 (39,702 h) than 2009/2010 (66,175 h). The catch per hour of largemouth bass has increased from 0.6/h in 2009/2010 to 0.9/h in 2017/2018. Throughout the survey, 55% of legal-size fish caught were released (Table 11). There was good compliance with harvest regulations during the survey period (Figure 7). Electrofishing was attempted during spring 2018 but water levels were high and water temperatures were cold. After 1 hour of sampling only a few fish had been collected and the remaining hour of the survey was abandoned.

Crappie: Previous trap netting surveys have displayed low catch rates even though a popular crappie fishery exists at Caddo Lake. We investigated alternative sampling methods to improve the catch of crappies in our population surveys. During fall 2017, dual-cod trap nets were utilized and caught both White and Black Crappie (1.2/series and 3.3/series, respectively; Figures 8 and 9). Tandem hoop net series were used during spring 2018 and only caught Black Crappie (3.5/series) (Figure 10). Growth of Black Crappie was moderate. Average age at 10 inches (9.0-10.8 inches) was 3.2 years (N = 12; range 3-4 years). Directed angling effort toward crappie was lower in 2017/2018 (13,251 h) compared to 2009/2010 (33,587 h) (Table 12). This was a consistent trend with other targeted species and is attributed to the excessive abundance of giant salvinia during the majority of the creel survey period. Angling catch rate of crappie was similar in 2017/2018 (1.76/h) compared to the previous survey (1.87/h) (Table 12), but total harvest was lower. This was a function of lower angling effort toward crappie. The harvest of Black Crappie was higher than White Crappie (Figure 11).

Fisheries Management Plan for Caddo Lake, Texas

Prepared – July 2018

ISSUE 1: Caddo Lake continues to experience problems associated with excessive growth of aquatic vegetation, especially giant salvinia. The composition of invasive species has shifted in recent years from one dominated by water hyacinth to one dominated by giant salvinia. Currently, the threat from giant salvinia is the focal point of most management efforts. Local stakeholders formed the Caddo Biocontrol Alliance and operate a giant salvinia weevil rearing facility near the lake to supplement giant salvinia weevil efforts by TPWD. Crested floating heart continues to spread and has been managed with herbicide treatments. Continued management of invasive aquatic plants on Caddo Lake is necessary to maintain boater access, protect native aquatic plants, and protect quality habitat available for fish.

MANAGEMENT STRATEGIES

1. Conduct annual aquatic vegetation survey to estimate coverage of problematic species, monitor trends, and evaluate effectiveness of treatment efforts.
2. Continue to work with Caddo Lake stakeholders to help develop strategies to manage nuisance aquatic vegetation.
3. Continue to maintain signage at boat ramps and marinas to inform boaters about exotic plants and their threats to Caddo Lake.

ISSUE 2: An excellent trophy Largemouth Bass fishery has developed following the introduction of Florida Largemouth Bass in the early 1980s. Modification of harvest regulations and changes in angler attitudes toward catch-and-release fishing have contributed to the development of this trophy fishery. One-hundred twenty-two Largemouth Bass ≥ 10 pounds were entered into the Bass Life Associates (BLA) Trophy Replica Program from 2006-2013. The lake has produced nine Largemouth Bass that were donated to the Toyota ShareLunker Program between 1990 and 2017. The current lake record Largemouth Bass is 16.17 pounds set in 2010. Continued stocking of Florida Largemouth Bass is necessary to maintain the trophy fishery.

MANAGEMENT STRATEGY

1. Stock Florida Largemouth Bass at 1,000 fish/km of shoreline semi-annually in 2019 and 2021.

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. 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. Effective July 1, 2014 boaters are required to drain all water from boats, live wells, and bait buckets when leaving the reservoir to prevent the spread of invasive aquatic species. Personally-caught live bait cannot be transported from the reservoir where the fish were caught. Bighead Carp have been documented in the Big Cypress Bayou in the past; however, subsequent investigations could not document their presence. Bighead Carp abundance is low enough to not cause any issues at this time.

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 (2018–2022)

Sport fish, forage fish, and other important fishes

Sport fishes in Caddo Lake include White Crappie, Black Crappie, Channel Catfish, Blue Catfish, Flathead Catfish, Spotted Bass, and Largemouth Bass. Known important forage species include Bluegill, Redear Sunfish, Gizzard Shad, and Threadfin Shad. The proposed sampling schedule to meet the following OBS Plan can be found in Table 13. Sampling will be conducted on the Texas side of the lake.

Low-density fisheries

Even though Spotted Bass, Blue Catfish, Channel Catfish and White Bass are present in Caddo Lake, few fish have been collected during previous surveys. In addition, angler creel surveys in 2002/2003, 2009/2010, and 2017/2018 indicated very little directed effort for these species.

Survey objectives, fisheries metrics, and sampling objectives

Black Bass: Black bass were most sought by anglers in angler creel surveys at Caddo Lake. Largemouth Bass are managed with a 14-to-18-inch slot-length limit and a daily bag limit of 8 fish (in combination with Spotted Bass), of which no more than 4 may be Largemouth Bass 18 inches or longer. Traditionally, trend data on relative abundance, size structure, and condition have been collected every 2 years during fall nighttime electrofishing surveys with 2 hours of effort at 24, 5-minute stations. However, electrofishing has been conducted during daylight hours since 2013 due to excessive giant salvnia coverage. These data have been sufficient to calculate population metrics and meet sampling objectives. Continuation of data collection during the fall is desirable to maintain trend data on Largemouth Bass growth and size structure. Surveys will continue to be conducted during daylight hours. Continued sampling every 2 years with fall daytime electrofishing will be sufficient to determine large-scale changes in the Largemouth Bass population that may spur further investigation.

Sampling objectives for Largemouth Bass will include size structure (PSD and length frequency), growth (mean age at 14 inches using a sample size of 13 fish between 13.0 and 14.9 inches), and condition (mean Wr using lengths and weights from 10 fish per inch group).

During fall 2019 and 2021, we will select 24 random 5-min stations to electrofish during daylight hours. Sampling during the day will allow for easier navigation in the presence of large giant salvinia mats as well as give us the ability to move a site from an unsuitable location (i.e., unable to reach because of salvinia) to one that can be efficiently sampled. We will sample a minimum of 12 stations throughout the lake, but sampling will continue at random sites until 50 stock-size fish are collected for size structure and length frequency and 13 fish are collected between 13.0 and 14.9 inches for age and growth analysis.

Crappie: Trap net catch rates of crappies have ranged from 0.5 to 5.7/nn for White Crappie and 0.6 to 3.1/nn for Black Crappie from 1998 to 2009. Although trap nets have displayed low catch rates over time, a popular crappie fishery exists. Directed fishing effort for crappie was 23.9% of total fishing effort from June 2009 through May 2010, and 19.8% in the latest creel survey in 2017/2018.

During this most recent survey period we used alternate sampling gears in an attempt to improve the catch of crappies for better population assessment. Dual-cod trap netting in fall 2017 caught a similar number of fish compared to baited tandem hoop nets in spring 2018. While these survey methods are not directly comparable, because spring hoop nets are also used to collect Channel Catfish we will continue to assess the effectiveness of using baited hoop nets for crappie sampling in spring 2022.

Our sampling objective will be to collect 50 stock-size fish (White and Black Crappie combined) with an RSE of CPUE-S ≤ 25 to establish baseline data on size structure (PSD and length frequency), relative abundance, mean relative weight (10 fish per inch group), and growth (13 fish between 9.0 and 10.9 inches). We will set 10 baited tandem hoop net series in random locations, with a soak time of 2 nights.

Channel Catfish: Even though Channel Catfish have been listed as a low-density fishery. We will collect population data from fish collected using baited tandem hoop nets during spring 2022 as per crappie sampling methods above.

Forage Fish: Trend data on relative abundance and size structure of sunfish, Gizzard Shad and Threadfin Shad have been collected every 2 years. Continuation of sampling, as per Largemouth Bass sampling above, will allow for monitoring of large-scale changes in sunfish and shad relative abundance and size structure. No additional effort will be expended beyond effort necessary to achieve Largemouth Bass objectives. Instead, Largemouth Bass body condition can provide information on forage abundance.

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Tables and Figures

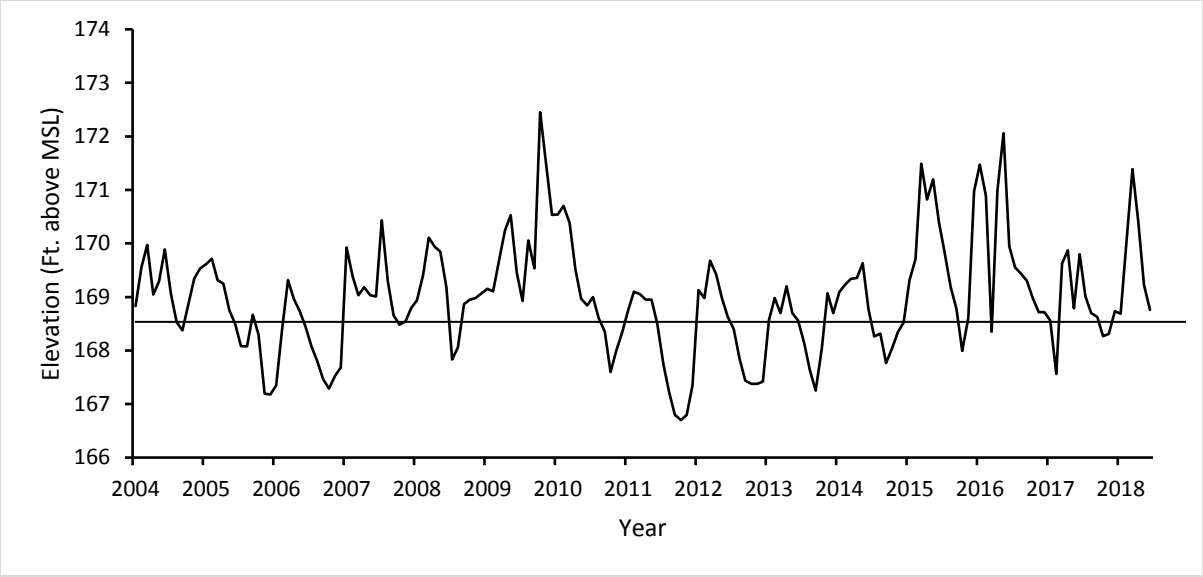


Figure 1. Monthly water level elevations in feet above mean sea level (MSL) recorded for Caddo Lake, Texas and Louisiana. Conservation level is 168.5 ft.

Table 1. Characteristics of Caddo Lake, Texas and Louisiana.

Characteristic	Description
Year Formed	Early 1800s (natural formation)
Year Restored	1912 low-water dam constructed with modifications in the 1940s and 1960s
Controlling authority:	
Permitting	US Army Corps of Engineers
Maintenance of boat roads	Cypress Valley Navigation District
Counties/Parishes	Harrison and Marion Counties, Texas Caddo Parish, Louisiana
Reservoir type	Restored natural lake
Surface Area	27,472 Acres (12,712 acres Texas side)
Shoreline Development Index (SDI)	8.9
Drainage Area	2,700 Square Miles
Conductivity	140 umhos/cm

Table 2. Boat ramp characteristics for Caddo Lake, Texas, June, 2018. Reservoir elevation at time of survey was near full pool. This list includes only ramps on the Texas side of Caddo Lake.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft.)	Condition
Highway 43 Bridge	32.69624 -94.18807	Y	15	162	Excellent. No access issues
Caddo Lake State Park	32.69372 -94.17568	Y	20	161	Excellent. No access issues
F.R. Camp Rd. (Caddo Lake WMA)	32.73906 -94.16644	Y	10	N/A	Excellent, canoe and kayaks only
Pine Needle Lodge	32.74539 -94.16729	Y	10	N/A	Adequate, privately operated
Shady Glade Marina	32.71274 -94.12067	Y	20	164	Adequate, privately operated
Johnson's Ranch	32.70762 -94.11851	Y	15	158	Adequate, privately operated
Cripp's Camp	32.70262 -94.12218	Y	30	N/A	Adequate, privately operated
Tucker's Camp	32.67269 -94.09593	Y	10	166	Adequate, privately operated
Collier's Launch	32.66910 -94.04472	Y	10	163	Adequate, privately operated
Potter's Point	32.70272 -94.07063	Y	15	162	Adequate, privately operated

Table 3. Harvest regulations for Caddo Lake, Texas and Louisiana.

Species	Bag limit	Length limit
Catfish: Channel and Blue Catfish, their hybrids and subspecies	50[a] (in any combination)	None
Catfish, Flathead	10	18-inch minimum
Bass, White	25	None
Bass, Largemouth	8[b]	14- to 18-inch slot
Bass: Spotted	8[b]	None
Crappie: White and Black Crappie, their hybrids and subspecies	25 (in any combination)	None

[a] No more than 5 may be 30 inches or longer

[b] Daily bag for Largemouth Bass and Spotted Bass = no more than 8 fish in any combination, of which no more than 4 may be Largemouth Bass 18 inches or longer.

Table 4. Stocking history of Caddo Lake, Texas. FGL = fingerling; AFGL = advanced fingerling; ADL = adults.

Species	Year	Number	Size
Blue Catfish	1988	17	ADL
	Total	17	
Channel Catfish	1991	9,000	FGL
	Total	9,000	
Florida Largemouth Bass	1981	317,215	FGL
	1981	94,000	FRY
	1982	500,550	FGL
	1994	448,955	FGL
	1994	429,093	FRY
	1995	650,534	FGL
	1995	116,000	FRY
	1996	210,700	FGL
	1996	76,518	FRY
	1997	268,000	FGL
	1998	673,167	FGL
	1999	670,925	FGL
	2000	683,264	FGL
	2006	500,582	FGL
	2007	501,110	FGL
	2009	706,319	FGL
	2010	500,434	FGL
	2011	500,790	FGL
	2013	691,408	FGL
	2015	256,506	FGL
	2017	339,454	FGL
	Total	8,901,376	
ShareLunker Largemouth Bass	2009	3,408	FGL
	2010	2,166	FGL
	2011	32,037	FGL
	Total	5,574	
Paddlefish	1992	12,970	
	1994	2,460	
	1998	12,254	
	2014	47[a]	AFGL
	2014	2,007	FGL
	2016	600[b]	FGL
	Total	28,338	

[a] Eleven of these Paddlefish were stocked in the Big Cypress Bayou at the city of Jefferson, approximately 15 river miles above the highway 43 bridge boundary for Caddo Lake.

[b] Approximately half of these fish were stocked in the Big Cypress Bayou at the city of Jefferson, approximately 15 river miles above the highway 43 bridge boundary for Caddo Lake.

Table 5. Objective-based sampling plan components for Caddo Lake, Texas 2017–2018.

Gear/target species	Survey objective	Metrics	Sampling objective
Electrofishing - Fall			
Largemouth Bass	Abundance	CPUE–Stock	RSE-Stock ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock
	Age-and-growth	Age at 14 inches	N = 13, 13.0 – 14.9 inches
	Condition	W_r	10 fish/inch group (max)
Electrofishing - Spring			
Largemouth Bass	Abundance	CPUE–Stock	RSE-Stock ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock
Dual-cod trap netting			
Crappie	Size structure	PSD, length frequency	N = 50
	Age-and-growth	Age at 10 inches	N = 13, 9.0 – 10.9 inches
	Condition	W_r	10 fish/inch group (max)
Tandem hoop netting			
Channel Catfish	Abundance	CPUE–stock	RSE-Stock ≤ 25
	Size structure		N ≥ 50 stock

[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, Caddo Lake, Texas, 2014–2017. Surface area (acres) is listed with percent of total reservoir surface area in parentheses. Surveys were conducted only on the Texas side of the lake. Native plants were not surveyed in 2014–2016.

Vegetation	2014	2015	2016	2017
Native submersed				110 (0.9)
Native floating-leaved				281 (2.2)
Native emergent				25 (0.2)
Non-native				
Giant salvinia (Tier II)*	2,405 (18.9)	2,840 (22.3)	4,943 (38.9)	5,313 (41.8)
Hydrilla (Tier III)*	1,843 (14.5)	2,256 (17.7)	2,356 (18.3)	1,802 (14.2)
Alligatorweed (Tier III)*	493 (3.9)		152 (1.2)	28 (0.2)
Waterhyacinth (Tier III)*	20 (0.2)	51 (0.4)	162 (1.3)	28 (0.2)
Crested floating heart (Tier II)*	Present	Present	Present	2 (0.02)

*Tier I is immediate response, Tier II is active management, Tier III is watch status

Table 7. Percent directed angler effort by species for Caddo Lake, Texas, 2002/2003, 2009/2010, and 2017/2018. Survey periods were from 1 June through 31 May.

Species	2002/2003[a]	2009/2010	2017/2018
Black bass	46.7	52.6	69.8
Sunfishes	21.9	21.1	5.1
Anything	16.9	1.9	4.1
Crappie	11.4	23.9	19.8
Catfish	1.6	0.5	0.9
Temperate bass	1.4	0	0.3
Chain pickerel	0.1	0	0

[a] Creel survey conducted on both Texas and Louisiana side of lake

Table 8. Total fishing effort (h) for all species and total directed expenditures at Caddo Lake, Texas, 2002/2003, 2009/2010, and 2017/2018. Survey periods were from 1 June through 31 May. Relative standard error is in parentheses.

Creel statistic	2002/2003[a]	2009/2010	2017/2018
Total fishing effort	303,369	140,292	73,595 (22)
Total directed expenditures	$1,119,841	$788,363	$464,904 (54)

[a] Creel survey conducted on both Texas and Louisiana side of lake.

Gizzard Shad

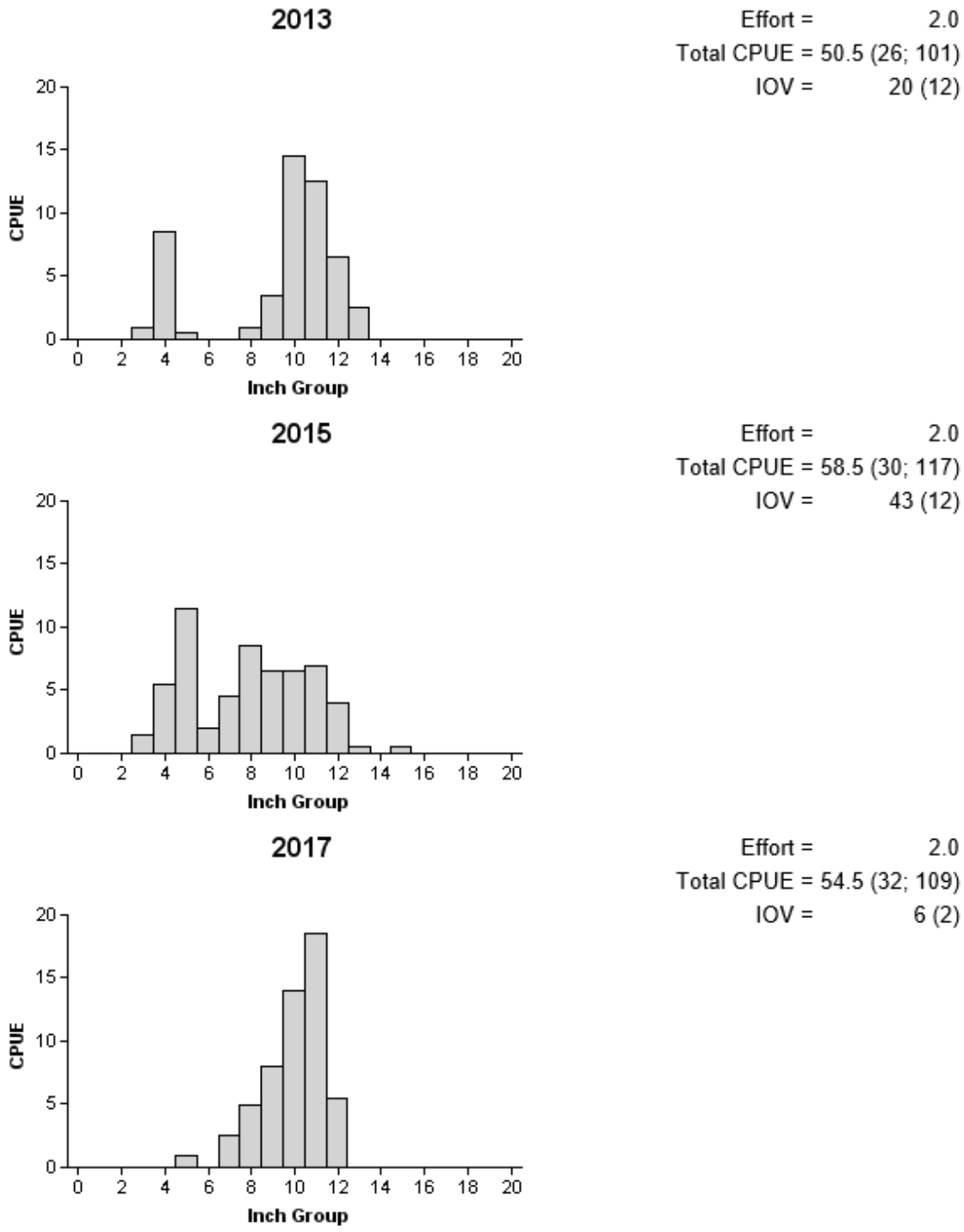


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall daytime electrofishing surveys, Caddo Lake, Texas, 2013, 2015, and 2017.

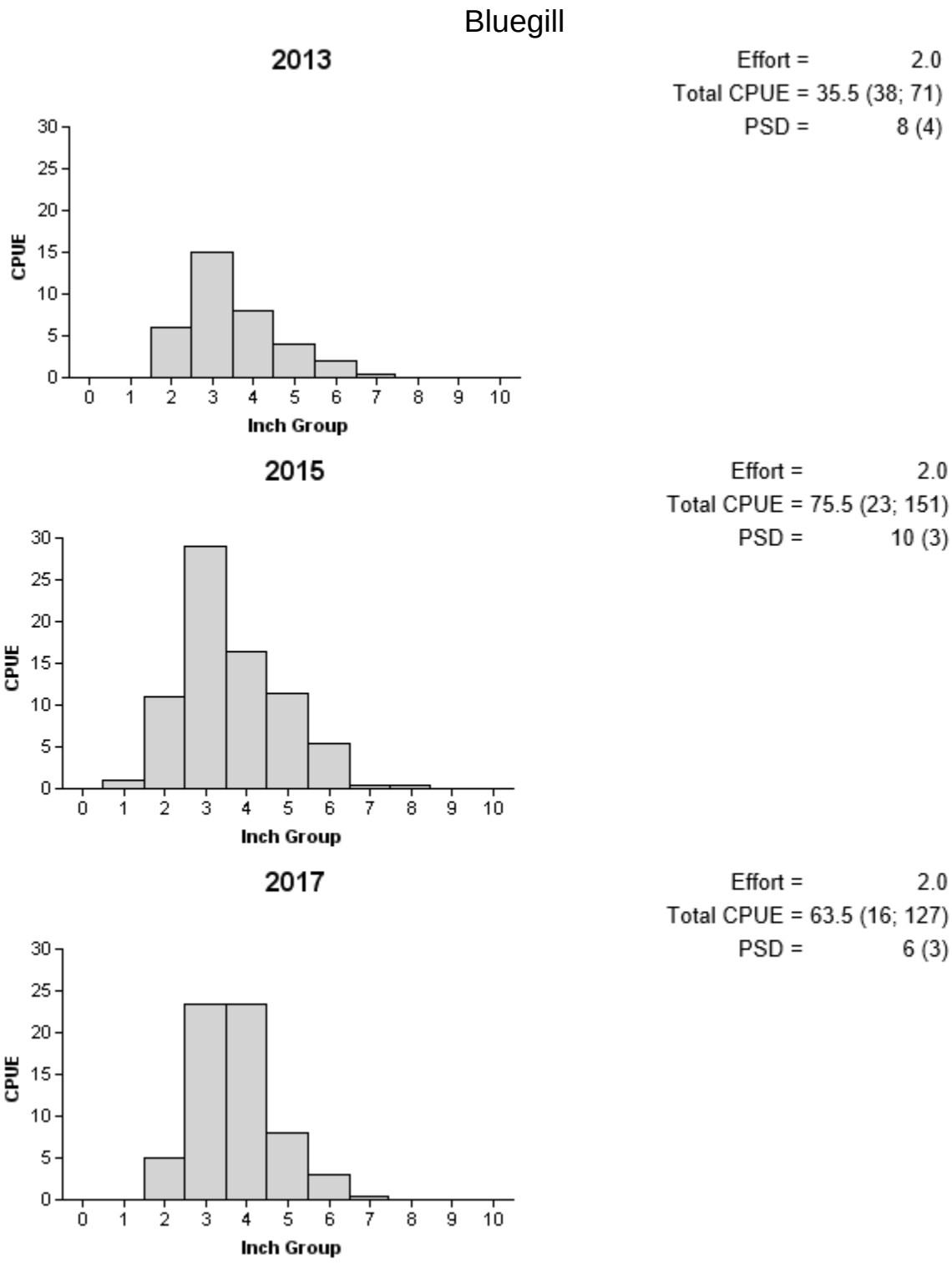


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall daytime electrofishing surveys, Caddo Lake, Texas, 2013, 2015, and 2017.

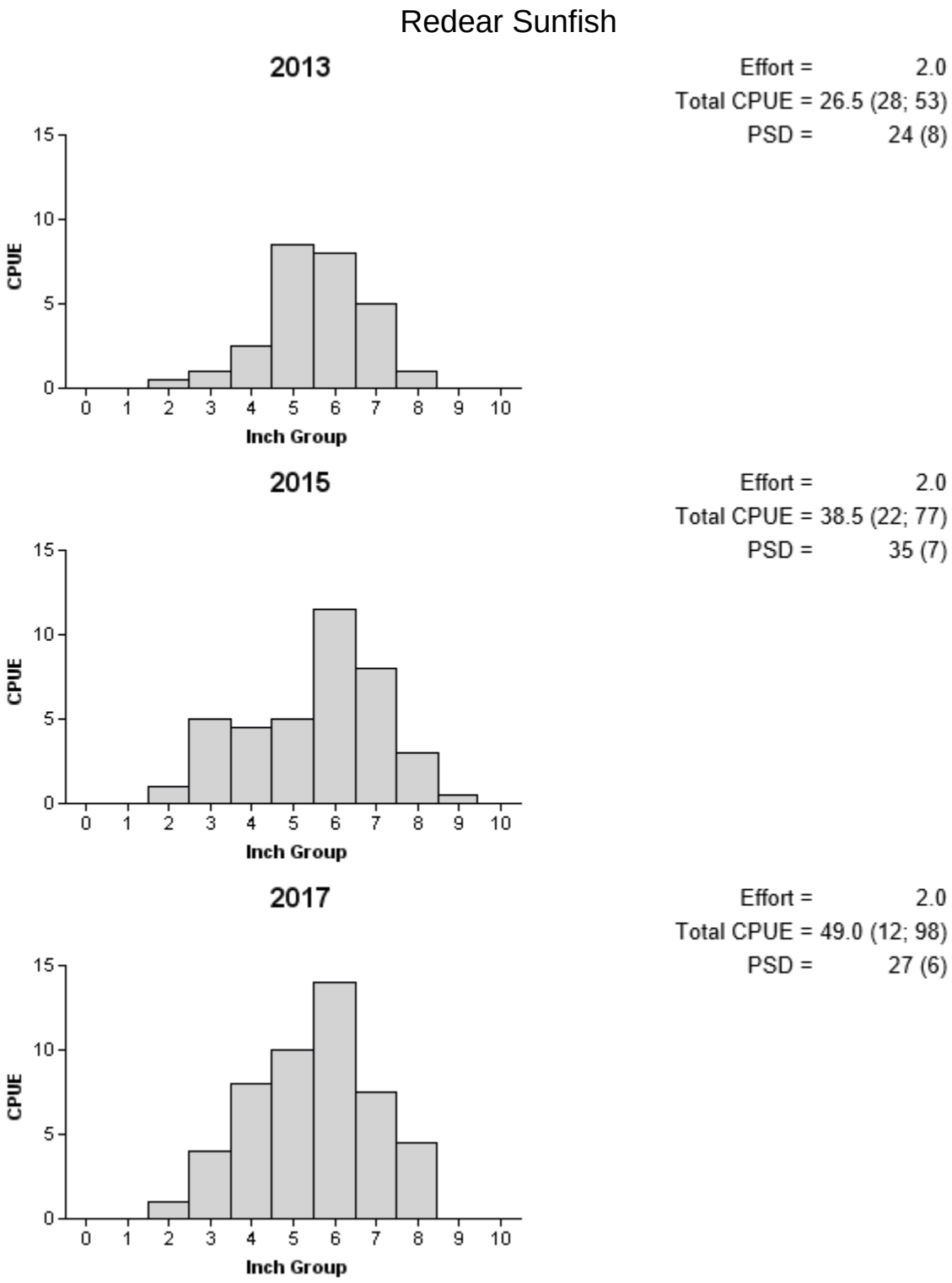


Figure 4. Number of Redear Sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall daytime electrofishing surveys, Caddo Lake, Texas, 2013, 2015, and 2017.

Table 9. Creel survey statistics for sunfishes at Caddo Lake, Texas, from June 2002 through May 2003, June 2009 through May 2010, and June 2017 through May 2018. Total catch per hour is for anglers targeting sunfish and total harvest is the estimated number of sunfish harvested by all anglers. Relative standard errors (RSE) are in parentheses

Creel Survey Statistic	Year		
	2002/2003 [a]	2009/2010	2017/2018
Surface area (acres)	12,712	12,712	12,712
Directed effort (h)	66,658 (22)	29,571 (30)	3,430 (50)
Directed effort/acre	2.43 (22)	2.33 (30)	0.27 (50)
Total catch per hour	8.57 (34)	5.3 (24)	0.3 ([b])
Total harvest	327,860 (54)	145,883 (52)	461 (141)
Sunfish (unidentified)	91,153 (44)	12,244 (88)	0
Warmouth	6,879 (298)	17,195 (75)	0
Bluegill	190,699 (40)	76,109 (38)	461 (141)
Longear sunfish	414 (1,674)	0	0
Redear sunfish	37,887 (65)	39,723 (45)	0
Spotted sunfish	828 (1,182)	612 (943)	0
Harvest/acre (Total)	12 (54)	11.5 (52)	0.4 (141)
Percent legal released	53	38	67

[a] Creel survey conducted on both Texas and Louisiana side of lake

[b] Unable to calculate RSE.

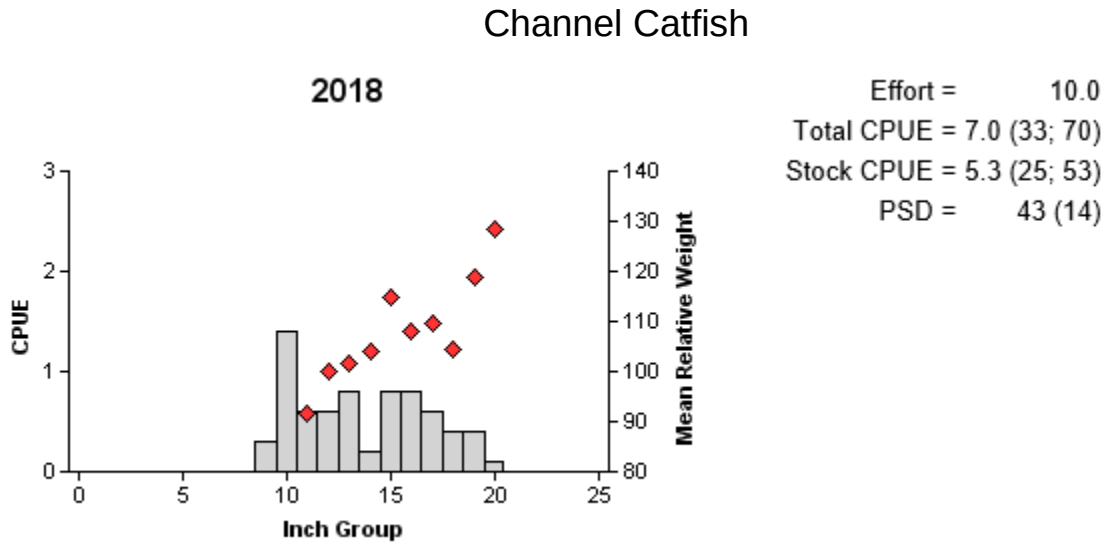


Figure 5. Number of Channel Catfish caught per tandem hoop net series (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring tandem hoop-net surveys, Caddo Lake, Texas, 2018.

Table 10. Creel survey statistics for Channel Catfish at Caddo Lake, Texas, from June 2002 through May 2003, June 2009 through May 2010, and June 2017 through May 2018. Total catch per hour is for anglers targeting Channel Catfish and total harvest is the estimated number of Channel Catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2002/2003 [a]	2009/2010	2017/2018
Surface area (acres)	12,712	12,712	12,712
Directed effort (h)	4,743 (51)	732 (126)	597 (114)
Directed effort/acre	0.17 (51)	0.06 (126)	0.05 (114)
Total catch per hour	0.36 (0)	0[b]	0[b]
Total harvest	22,055 (90)	4,714 (166)	0
Harvest/acre	0.80 (90)	0.37 (166)	0
Percent legal released	20	15	100

[a] Creel survey conducted on both Texas and Louisiana side of lake.

[b] No Channel Catfish were reported caught by anglers targeting Channel Catfish.

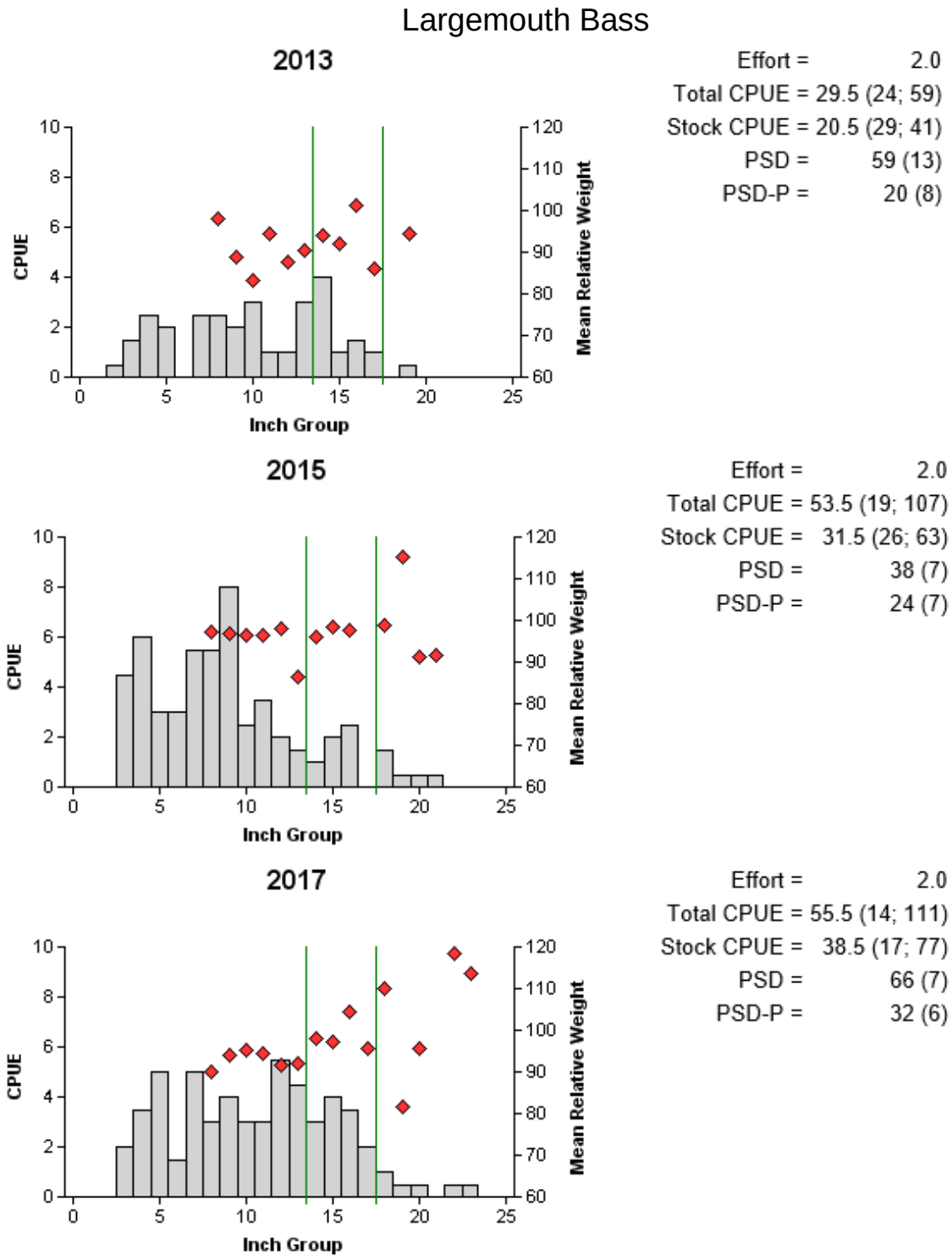


Figure 6. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall daytime electrofishing surveys, Caddo Lake, Texas, 2013, 2015, and 2017. Vertical lines indicate slot length limit.

Table 11. Creel survey statistics for Largemouth Bass at Caddo Lake, Texas, from June 2002 through May 2003, June 2009 through May 2010, and June 2017 through May 2018.. Harvest is partitioned by the estimated number of fish harvested by non-tournament anglers and the number of fish retained by tournament anglers for weigh-in and release. The estimated number of fish released by weight category is for anglers targeting Largemouth Bass. Relative standard errors (RSE) are in parentheses.

Statistic	2002/2003 [a]	2009/2010	2017/2018
Surface area (acres)	12,712	12,712	12,712
Directed angling effort (h)			
Tournament	NA	7,604 (38)	6,961 (44)
Non-tournament	NA	66,175 (27)	39,702 (25)
All black bass anglers combined	141,532 (12)	73,779 (26)	46,663 (25)
Angling effort/acre	5.7 (12)	5.8 (26)	3.7 (25)
Catch rate (number/h)	0.7 (33)	0.6 (26)	0.9 (46)
Harvest			
Non-tournament harvest	26,061 (76)	12,611 (66)	1,936 (71)
Harvest/acre	0.9 (76)	1.0 (66)	0.2 (71)
Tournament weigh-in and release	NA	0 [b]	0 [b]
Release by weight			
<4.0 lbs			28,919 (72)
4.0-6.9 lbs			2,367 (83)
7.0-9.9 lbs			204 (137)
≥10.0 lbs			0
Percent legal released (non-tournament)	74	77	55

[a] Creel survey conducted on both Texas and Louisiana side of lake.

[b] No Largemouth Bass were observed held for weigh-in and release during interviews of tournament anglers.

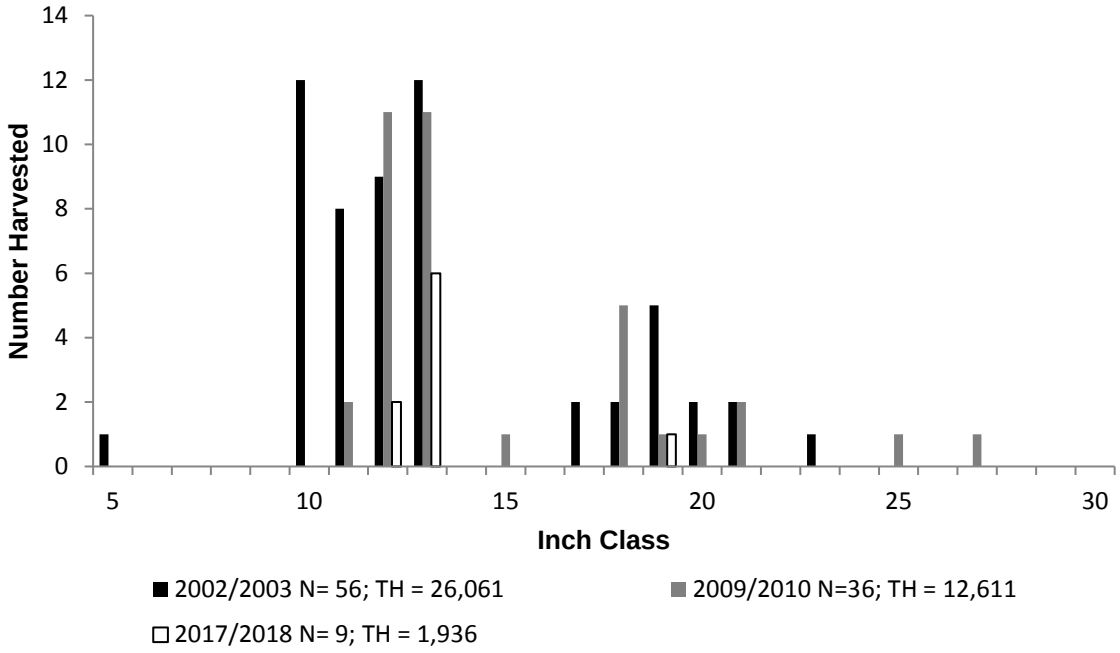


Figure 7. Length frequency of non-tournament harvested Largemouth Bass observed during creel surveys at Caddo Lake, Texas, June 2002 through May 2003 (whole lake), June 2009 through May 2010 (Texas side), and June 2017 through May 2018 (Texas side), all anglers combined. N is the number of harvested Largemouth Bass observed during creel surveys, and TH is the estimated non-tournament harvest for the creel period.

White Crappie

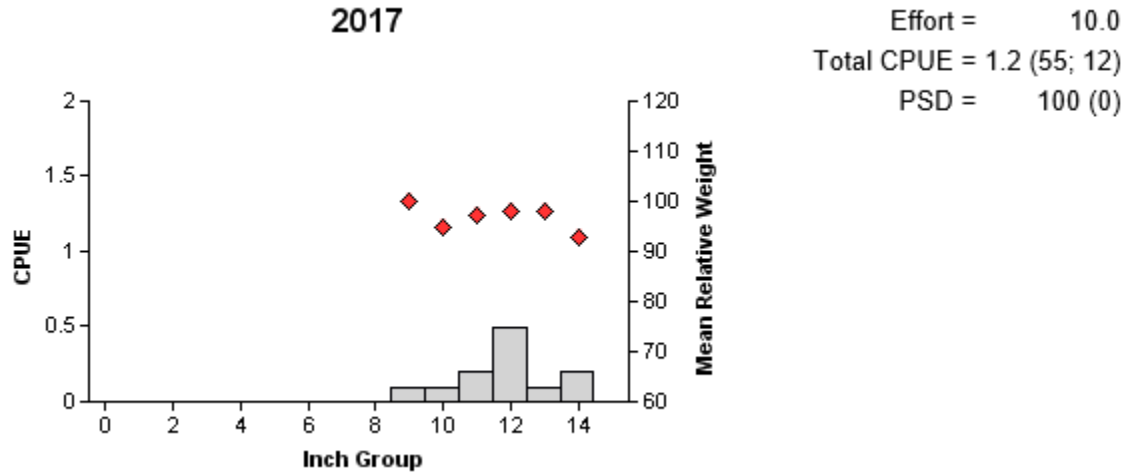


Figure 8. Number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall dual-cod trap netting surveys, Caddo Lake, Texas, 2017.

Black Crappie

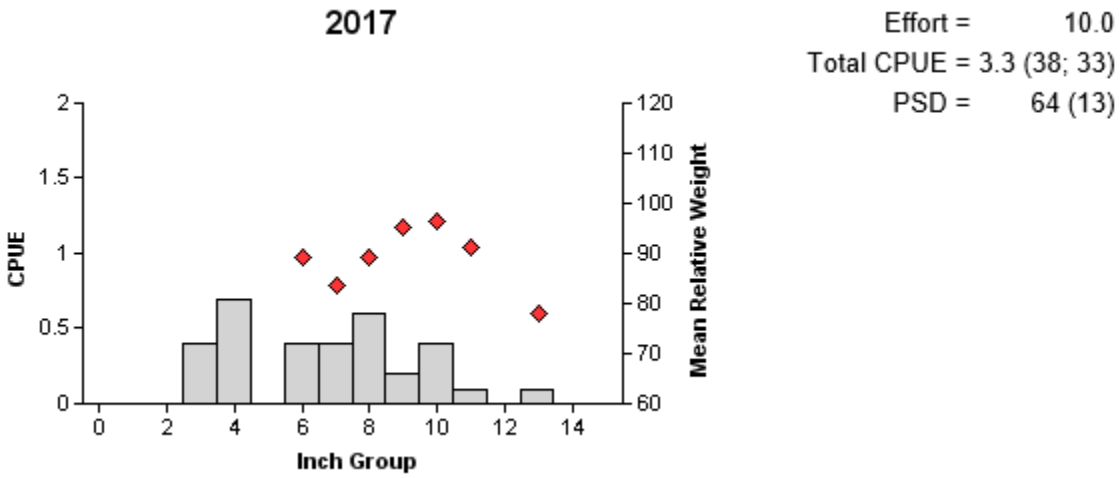


Figure 9. Number of Black Crappie caught per net series (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall dual-cod trap netting surveys, Caddo Lake, Texas, 2017.

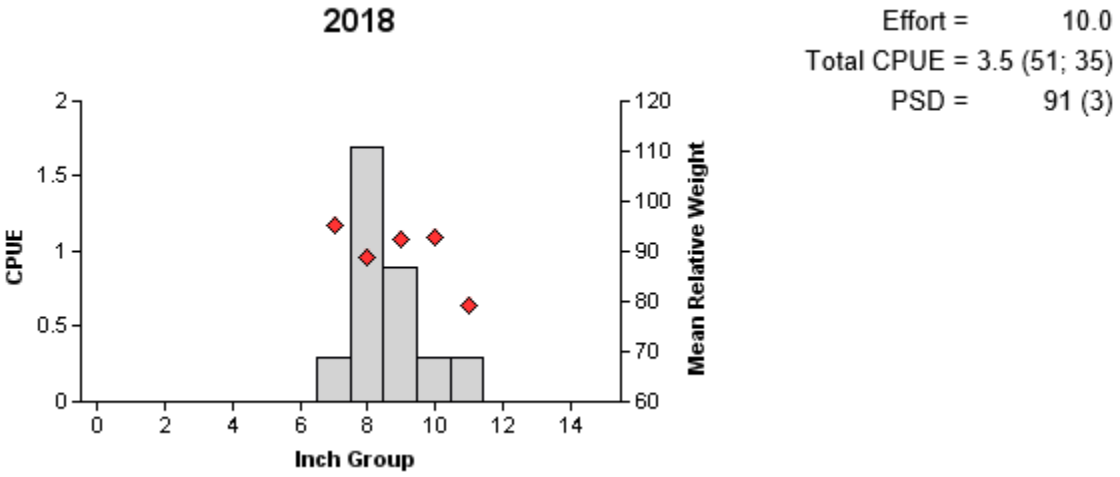


Figure 10. Number of Black Crappie caught per net series (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring tandem hoop netting surveys, Caddo Lake, Texas, 2018.

Table 12. Creel survey statistics for crappie at Caddo Lake, Texas, from June 2002 through May 2003, June 2009 through May 2010, and June 2017 through May 2018. Total catch per hour is for anglers targeting crappie and total harvest is the estimated number of crappies harvested by all anglers. Relative standard errors (RSE) are in parentheses

Creel Survey Statistic	Year		
	2002/2003[a]	2009/2010	2017/2018
Surface area (acres)	12,712	12,712	12,712
Directed effort (h)	34,680 (22)	33,587 (30)	13,251 (39)
Directed effort/acre	1.40 (22)	2.64 (30)	1.04 (39)
Total catch per hour	2.88 (42)	1.87 (20)	1.76 (44)
Total harvest	85,082 (77)	40,367 (56)	14,622 (46)
Crappie (unidentified)	46,970 (39)	0	0
White crappie	31,834 (114)	13,162 (75)	4,836 (53)
Black crappie	6,279 (166)	27,205 (47)	9,786 (43)
Harvest/acre	3.44 (77)	3.18 (56)	1.15 (46)
Percent legal released	N/A[b]	0	36.0

[a] Creel survey conducted on both Texas and Louisiana side of lake.

[b] Because Louisiana did not regulate crappie harvest with a length limit, this statistic could not be calculated.

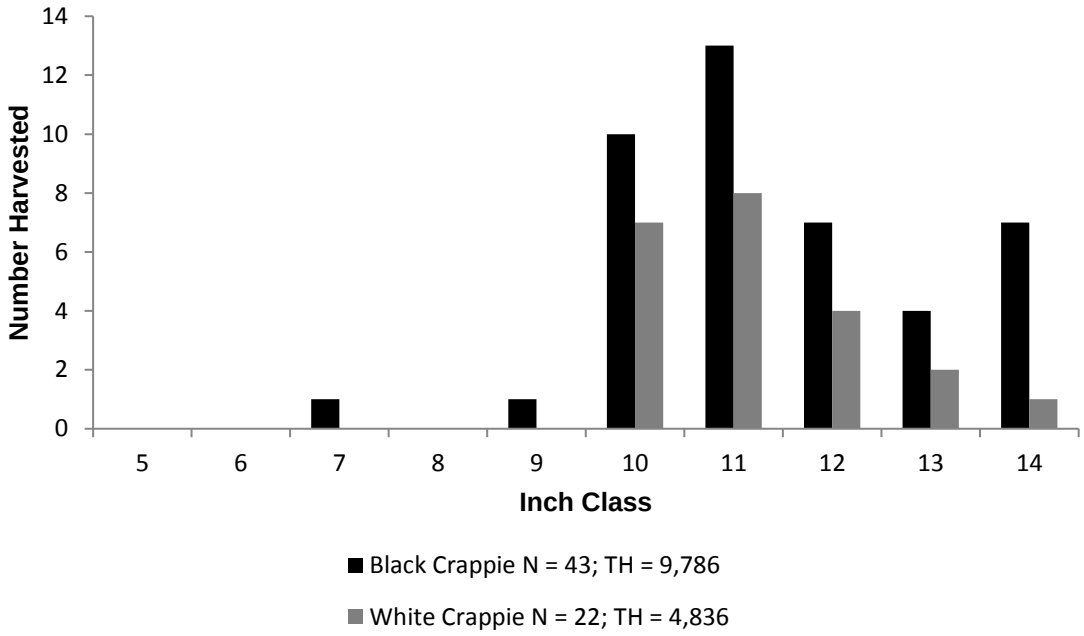


Figure 11. Length frequency of harvested Black Crappie and White Crappie observed during creel surveys at Caddo Lake, Texas, June 2017 through May 2018, all anglers combined. N is the number of harvested crappie observed during creel surveys, and TH is the total estimated harvest for the creel period.

Proposed Sampling Schedule

Table 13. Proposed sampling schedule for Caddo Lake, Texas. Survey period is June through May. Tandem hoop-netting surveys are conducted in the spring, while electrofishing surveys are conducted in the spring and fall. Standard survey denoted by S and additional survey denoted by A.

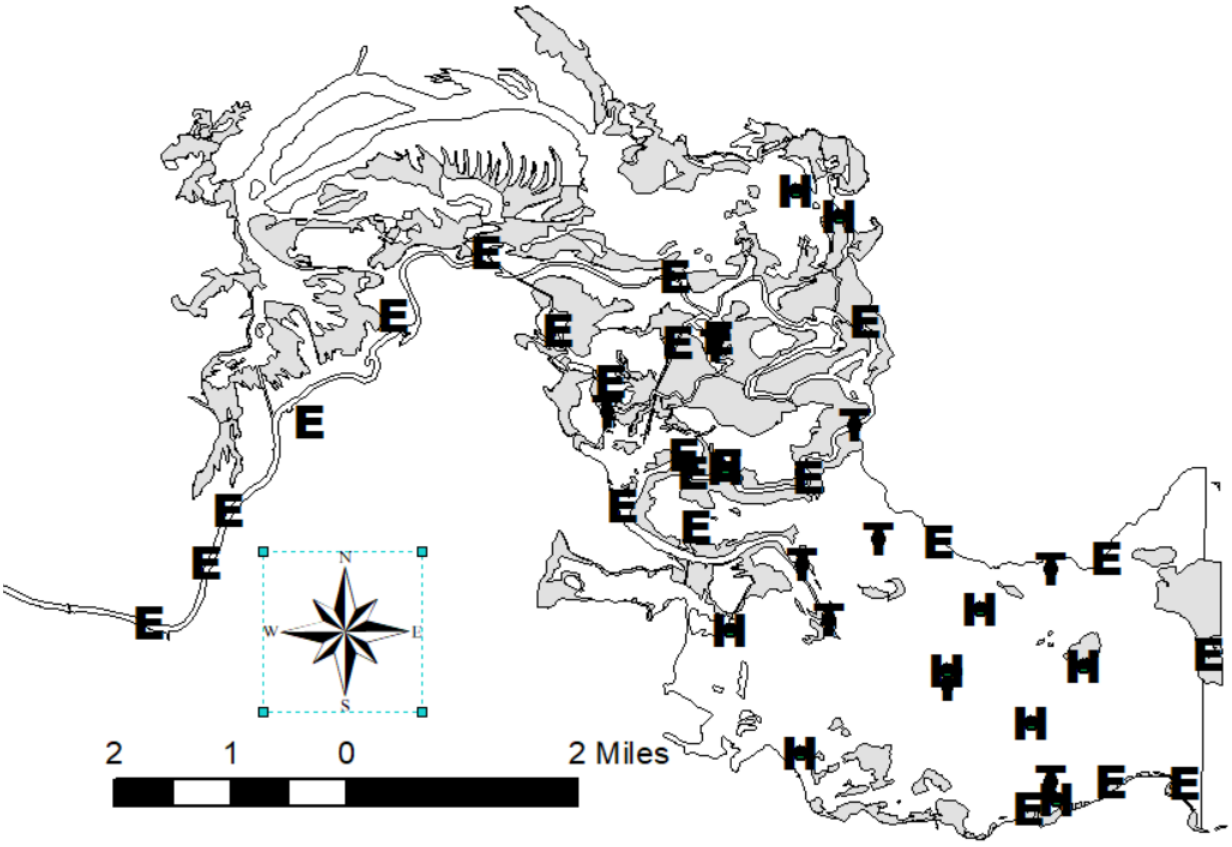
	Survey year			
	2018-2019	2019-2020	2020-2021	2021-2022
Angler Access				S
Structural Habitat				S
Vegetation	A	A	A	S
Electrofishing – Fall		A		S
Electrofishing – Spring		A		A
Baited tandem hoop netting				A
Report				S

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 Caddo Lake, Texas, 2017-2018. Sampling effort was 10 net series for tandem hoop netting, 10 net series for dual-cod trap netting, and 2 hours for electrofishing.

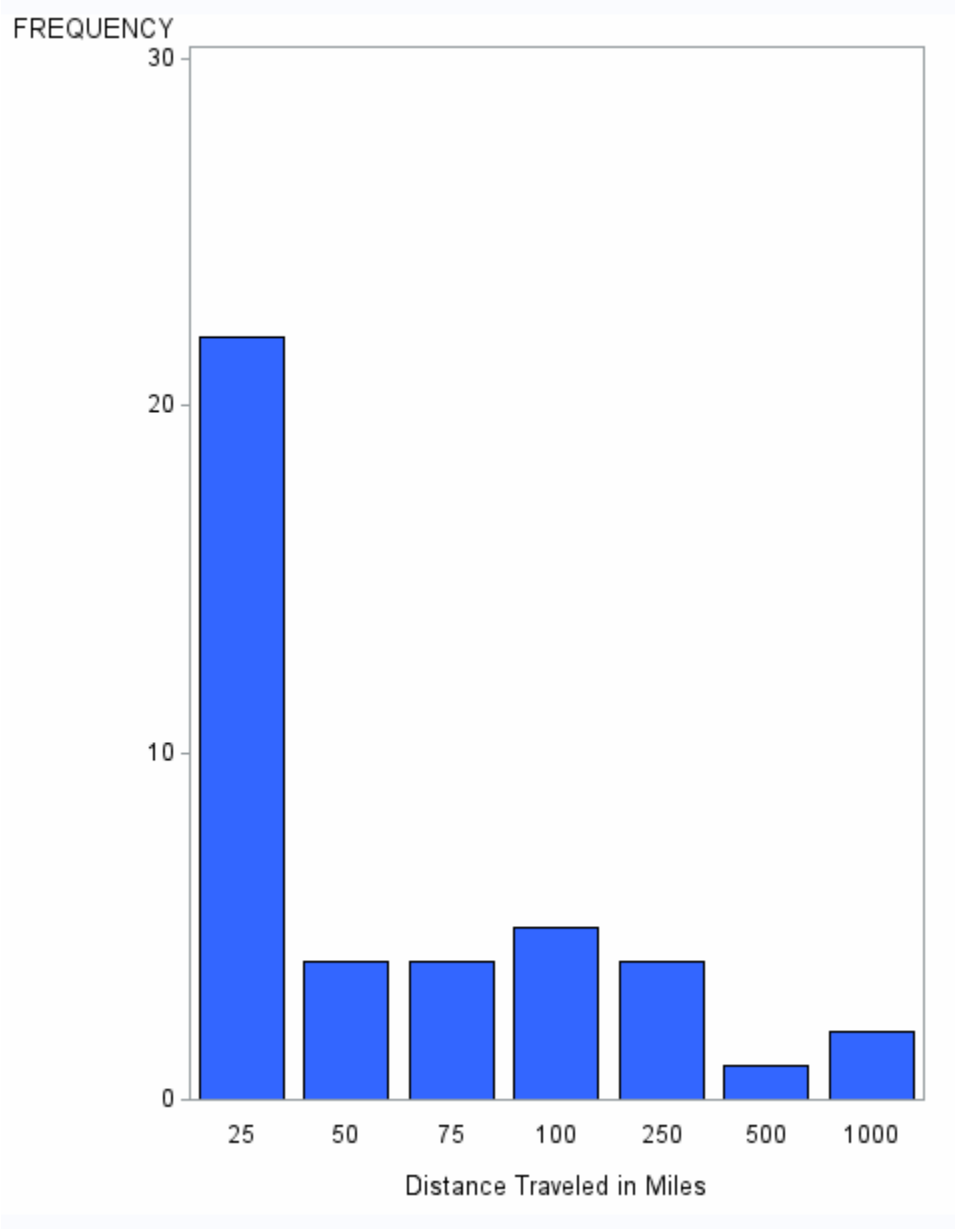
Species	Hoop Netting		Dual-Cod Trap Netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Gizzard Shad					109	54.5 (32)
Threadfin Shad					49	24.5 (36)
Channel Catfish	70	7.0 (33)				
Flathead Catfish	2	0.2 (67)				
Warmouth					2	1.0 (69)
Bluegill					127	63.5 (16)
Longear Sunfish					12	6.0 (38)
Redear Sunfish					98	49.0 (12)
Spotted Bass					32	16.0 (23)
Largemouth Bass					111	55.5 (14)
White Crappie			12	1.2 (55)		
Black Crappie	35	3.5 (51)	33	3.3 (38)		

APPENDIX B – Map of sampling locations



Location of sampling sites, Caddo Lake, Texas, 2017-2018. Dual-cod 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 – reporting of creel ZIP code data



Distance traveled, by ZIP code, of anglers that were interviewed at Caddo Lake, Texas, during the June 2017 through May 2018 creel survey.

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