

Pat Cleburne Reservoir

2019 Fisheries Management Survey Report

PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-4

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

Prepared by:

John Tibbs, District Management Supervisor
and
Michael S. Baird, Assistant District Management Supervisor

Inland Fisheries Division
Waco District, Waco, Texas

Carter Smith
Executive Director

Craig Bonds
Director, Inland Fisheries



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Survey and Management Summary

Fish populations in Pat Cleburne Reservoir were surveyed in 2019 using electrofishing and trap nets and in 2020 using gill nets. Historical data are presented with the 2019-2020 data for comparison. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

Reservoir Description: Pat Cleburne Reservoir is a 1,568-acre impoundment located on the Nolan River within the Brazos River Basin, Johnson County. Water level has been within 4 feet of conservation pool (733.5 above mean sea level [MSL]) since 2016. Habitat features consisted of natural shoreline, rocky shoreline and limited boat docks and piers. There is extensive shore access for anglers.

Management History: Important sport fish include Largemouth Bass, Channel and Blue Catfish, White Bass and White Crappie. Sport fish have always been managed with statewide regulations. The management plan from the 2012 survey report included conducting vegetation and physical habitat surveys and publicizing the reservoir's angling opportunities. Structural habitat was surveyed during 2012. Full aquatic vegetation surveys have been completed every four years. Several fishing and angling articles have been released to local television and radio stations highlighting Pat Cleburne Reservoir opportunities since that time. The management plan from the 2016 report recommended deploying fish attractors and working with the City of Cleburne to purchase Sunshine bass fry from the private market. Crappie condos were installed in 2016 and PVC cube structures in 2017. The City of Cleburne purchased Sunshine Bass fry in 2017, 2018, and 2019 and Palmetto Bass fry were stocked in 2017. Blue catfish were stocked in 2017 and 2018. Appropriate signage has been posted at access points to try and prevent the spread of invasive species into the reservoir.

Fish Community

- **Prey species:** Threadfin and Gizzard Shad catch rates were the highest ever recorded in the reservoir, and most Gizzard Shad were available as prey to sport fish. Other forage species included Bluegill, Longear Sunfish, Redear Sunfish, and Green Sunfish.
- **Catfishes:** Blue Catfish and Channel Catfish catch rates were much improved over the previous two surveys. Body condition was good for both species.
- **Temperate Basses:** The White Bass catch rate was above the historical high for the species, and body condition was excellent. Hybrid striped bass were stocked for the first time in 2017 and a fishable population of legal-length fish is present. Catch rates were low relative to other hybrid fisheries in the district, but this is a new fishery and condition was excellent.
- **Largemouth Bass:** Largemouth Bass catch rates were reduced from previous surveys but legal-sized fish were caught in much higher numbers. Body condition was good.
- **White Crappie:** White Crappie were present in the reservoir in low numbers. The catch rate was reduced from 2015 but similar to 2011.

Management Strategies: Continue managing sport fishes at Pat Cleburne Reservoir with statewide regulations. Continue collaborating with the City of Cleburne to stock Sunshine bass fry from the private market. Maintain invasive species signage and inform the public about the negative impacts of aquatic invasive species. Conduct access and vegetation surveys in summer 2023, and general monitoring surveys with electrofishing and gill net surveys in 2023 and 2024.

Introduction

This document is a summary of fisheries data collected from Pat Cleburne Reservoir in 2019-2020. The purpose of the document is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented for comparison.

Reservoir Description

Pat Cleburne Reservoir is a 1,568-acre impoundment of the Nolan River within the Brazos River Basin, Johnson County, and is located within the City of Cleburne. It is owned and operated by the City of Cleburne and primary water uses include municipal water supply and recreation. The reservoir has a drainage area of 100 square miles, a storage capacity of 26,008 acre-feet, and a shoreline length of 15.3 miles. Maximum depth is 33.5 feet. Pat Cleburne Reservoir is eutrophic with a TSI *chl-a* of 59.54 (Texas Commission on Environmental Quality, unpublished data). Habitat at time of sampling was dominated by natural shoreline, rock shoreline and limited boat docks and piers. Littoral vegetation is dominated by common buttonbush, American water-willow and smartweed. Water level has been within 4 feet of conservation pool (733.5 above mean sea level [MSL]) since 2016. The water level was 2.5' below conservation pool during the 2019 electrofishing survey, 3.0' below conservation pool during the 2019 trap net survey, and 1.5' below conservation pool during the 2020 gill net survey (Figure 1). Other descriptive characteristics for Pat Cleburne Reservoir are in Table 1.

Angler Access

Pat Cleburne Reservoir has four public boat ramps (Nolan River, West, East and South-east Ramps) and several private boat ramps. The East Ramp by the golf course is the best for larger craft. The other ramps are seldom used for launching anything other than small watercraft (Table 2). Much of Pat Cleburne Reservoir's shoreline is accessible to anglers, including the Nolan River area via Buddy Stewart Park, and the lower east side of the reservoir.

Management History

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

1. Construct and deploy fish attractors in the best habitats within the reservoir.

Action: A total of 25 bamboo crappie condos were built in 2016 with the help of the Baylor Tri-Beta Biology Honor Society and deployed in two locations near the dam. A total of 40 rectangular PVC structures were deployed in four locations with ten at each. Coordinates and a map were made available on the TPWD website. These efforts were showcased on Facebook and in numerous discussions with anglers.

2. Investigate the possibility of a private purchase of Hybrid Striped Bass (Sunshine Bass) by the City of Cleburne.

Action: The City of Cleburne purchased Sunshine Bass fry in 2017, 2018, and 2019 and assisted with stocking by delivering them from Love Field Airport. An additional stocking of Palmetto Bass was stocked in 2017 as a control to determine relative success. Stocking success was evaluated with the 2020 gill net survey using genetic data.

3. Cooperate with the City of Cleburne to post appropriate invasive species signage at access points throughout the reservoir. Educate the public about invasive species. Make a speaking

point about invasive species when presenting to constituent and user groups. Keep track of (i.e., map) all existing and future interbasin water transfer routes to facilitate potential invasive species responses.

Action: Invasive species signage was posted at Pat Cleburne Reservoir access points during summer 2013 and have been maintained as needed. District biologists have made a speaking point about invasive species, how to prevent their spread, and potential effects on Pat Cleburne Reservoir while speaking to anglers over the past several years. Interbasin water transfers will be updated as needed.

Harvest Regulation History: Sport fishes in Pat Cleburne Reservoir have always been managed with statewide regulations. The current harvest regulations are listed in Table 3.

Stocking History: Pat Cleburne Reservoir was stocked with Blue Catfish and hybrid striped bass during the period covered by this report. The complete stocking history is in Table 4.

Water Transfer: Pat Cleburne Reservoir is primarily used for municipal water supply and recreation. The City of Cleburne has the only raw water intake structure on the reservoir, which serves the adjoining 20 MGD treatment plant. The City also transfers water to Pat Cleburne Reservoir from Lake Aquilla via a 31-mile pipeline. There is an indirect reuse line in the planning stages with no other additional water transfers being considered.

Reservoir capacity: Pat Cleburne Reservoir was impounded in 1964. Original plans calculated the reservoirs capacity at conservation pool (733.5 feet above MSL) to be 25,560 acre-feet with a surface area of 1,545 acres. Two volumetric surveys have been conducted by the Texas Water Development Board (TWDB) on Pat Cleburne Reservoir since impoundment; one in 1998 and one in 2008. The 1998 survey found a volume of 25,730 acre-feet and a surface area of 1,558 acres, whereas the 2008 survey found a volume of 26,008 acre-feet and a surface area of 1,568 acres at conservation pool elevation. Since both surveys report capacities greater than the original volume of the lake, no estimated sedimentation rate could be determined, and none is presumed to have occurred up to the time of the 2008 report.

Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Pat Cleburne Reservoir (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 2019).

Electrofishing – Largemouth Bass, sunfishes, Gizzard Shad and Threadfin Shad were collected by electrofishing (0.75 hour at 9, 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.

Trap netting –White Crappie were collected using trap nets (5 net nights at 5 stations). Catch per unit of effort for trap netting was recorded as the number of fish caught per net night (fish/nn).

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

Genetics – Genetic analysis of Largemouth Bass and all hybrid striped bass and White Bass was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2019). Micro-satellite DNA analysis was used to determine genetic composition of individual fish from 2005 to present, 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). Palmetto bass PSD was calculated according to Dumont and Neely (2011). Index of vulnerability (IOV) was calculated for Gizzard Shad (DiCenzo et al. 1996). Standard error (SE) was calculated for structural indices and IOV. Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE statistics.

Habitat – The 2012 structural habitat surveys were conducted according to Tibbs and Baird (2012). Vegetation surveys were conducted using an adaptation of the point method during 2015 and 2019 (TPWD, Inland Fisheries Division, unpublished manual revised 2019). Points were randomly generated on the shoreline and averaged a minimum of one point per shoreline mile. Aquatic vegetation has always been found close to the shore in Pat Cleburne Reservoir, so stratifying the random points to exclude deep-water areas increased precision and resulted in better data.

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

Results and Discussion

Habitat: Pat Cleburne Reservoir is a moderately turbid reservoir with a secchi range from two to four feet. The last structural habitat survey estimated 13.8 miles (90.2%) of natural shoreline, 1.5 miles (9.8%) of rock shoreline and trace amounts of bulk headed shoreline (Tibbs and Baird 2012). Littoral zone habitat in summer 2019 was dominated by Water willow and Buttonbush (Table 6).

Prey species: Threadfin and Gizzard Shad were collected by electrofishing at catch rates of 390.7/h and 1,805.3/h respectively in 2019, both well above their historical averages (Figure 2 and Appendices A and B). The IOV for Gizzard Shad was excellent, and 93% of individuals were available as prey to sport fish. Other forage species collected were Bluegill (112.0/h), Longear Sunfish (74.7/h), Redear Sunfish (6.7/h), and Green Sunfish (1.3/h) (Figures 3 and 4; Appendices A and B). Sunfish seldom reach preferred size classes in Pat Cleburne Reservoir, and few anglers actively seek them.

Catfishes: Blue Catfish were collected from gill nets at 1.8/nn in 2020, much improved over the previous two samples (Figure 5; Appendices A and B). We did not reach our OBS goal of 50 stock size fish. Although we did not collect any age samples, recent recruitment was observed, and it appeared as though the 2017 and 2018 stockings were represented in the size structure graph. Body condition, expressed as mean W_r , was good and increased with fish size.

Channel Catfish were collected from gill nets at 11.4/nn in 2020 which is very close to the historic high catch rate in 1996 (Figure 6; Appendices A and B). Our OBS goal of 50 stock size fish was easily reached. The PSD for Channel Catfish was 56, with recruitment evident as well as large numbers of legal-length fish. Body condition was good and improved with increasing length.

Flathead Catfish were not collected in 2020, but historical data are still included in Appendices A and B.

Catfish were the most sought-after species group in the creel reported in the previous management report (Tibbs and Baird, 2016), so these catch rate improvements are welcome to see.

Temperate Bass: White Bass were collected with gill nets at a catch rate of 20.6/nn in 2020, a tremendous improvement over the previous two surveys and well above the historical average (Figure 7; Appendix A and B). The PSD for White Bass was 83, with some recruitment evident and large numbers of legal fish to catch. White Bass reached the minimum length limit by age one or two (Figure 8). Body condition was excellent and much improved over previous surveys.

Hybrid striped bass in the form of Palmetto Bass and Sunshine Bass fry were stocked in 2017 (Table 4). Subsequently, only Sunshine bass fry were stocked in 2018 and 2019. A catch rate of 0.8/nn was observed during the 2020 gill netting survey and body condition was excellent across length categories

(Figure 9; Appendix A and B). Genetic samples were collected from all temperate bass to ensure accurate identification of hybrid striped bass and their associated strains. This was done because a previous survey on Belton Reservoir comparing field-identified temperate bass to genetic samples found that 10 of 93 were incorrectly identified. This indicates that use of the tongue patch to differentiate between hybrid striped bass and White Bass isn't 100% accurate (Baird and Tibbs, 2007). A total of 8 fish were confirmed as hybrids by genetics in the Pat Cleburne sample, with the rest confirmed as White Bass. All Palmetto Bass were 3 years old, and easily identifiable; Sunshine Bass were all 1 year old and difficult to differentiate with certainty from White Bass of similar size (Figure 10). It is possible that morphometrics of the tongue patch may differ between Palmetto and Sunshine Bass.

Largemouth Bass: Largemouth Bass were collected by electrofishing at 142.7/h in 2019 (Figure 9 and Appendices A and B). The OBS goal for this species was reached. Proportional size distribution (60) improved from the previous surveys and catch rates of legal-length fish increased as well. Body condition was good. Largemouth Bass genetics analyzed in 2015 showed fair Florida influence (35%; Table 7).

White Crappie: White Crappie were collected from trap nets at 0.8/nn in 2019, similar to the 2011 survey but reduced from 2015 (Figure 10 and Appendices A and B). The OBS goal for this species was not reached. Crappie catch rates have been low in the reservoir for the past 20 years. Efforts to place fish attractors since the last report have focused on providing better fishing for the small subset of crappie anglers identified in the last creel survey.

Black Crappie were not collected during the 2020 survey, but are still included in Appendices A and B.

Fisheries management plan for Pat Cleburne Reservoir, Texas

Prepared – July 2020

ISSUE 1: The management plan in 2016 presented a case for partnering with the City of Cleburne to stock commercially available Sunshine Bass fry. This approach was necessary because demand for hybrid striped bass from our hatchery system already exceeds supply most years and existing reservoir fisheries have priority. The partnership has already been successful in creating a low-density hybrid striped bass fishery, and this fishery is expected to get better as additional hybrid striped bass recruit to legal size.

MANAGEMENT STRATEGIES

1. Share report with the City of Cleburne and continue advocating for private purchase of fry. Cost for each year of stocking has been \$500 to deliver 100k fry (64/acre) from Keo Fish Farms in Arkansas to Love Field in Dallas.
2. Since Sunshine Bass were only documented as recruiting one year out of three stocked, increase stocking rate if possible, and have the fish delivered in at least two bags and stock them in at least two areas of the reservoir. This spreads out the risk due to packaging errors as well as localized issues with stocking site choice and may result in more frequent recruitment events.
3. If the city isn't willing or indicates that they can't continue financing these efforts indefinitely, look for additional partners to fund current stocking rates or increase them to 100/acre
4. Collect genetics and age and growth data on all stock-size hybrid striped bass collected during 2024 gill netting.

ISSUE 2: 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 City of Cleburne to maintain appropriate signage at access points around the reservoir.
2. Educate the public about invasive species.
3. Make a speaking point about invasive species when presenting to constituent and user groups.
4. Keep track of (i.e., map) existing and future inter-basin water transfers to facilitate potential invasive species responses.

Objective Based Sampling Plan and Schedule 2020-2024

Sport fish, forage fish, and other important fishes

Survey data suggest important sport fishes in Pat Cleburne Reservoir include Largemouth Bass, Channel and Blue Catfish, Hybrid Striped Bass, White Bass and White Crappie. Important forage fishes include Gizzard Shad, Threadfin Shad, Bluegill, and Longear Sunfish. The proposed sampling schedule (Table 8) lists electrofishing, trap netting and gill netting surveys planned for the next four years.

Low-density fisheries

Spotted Bass, Flathead Catfish and Black Crappie occur in low abundance in Pat Cleburne Reservoir and are generally caught incidentally to other targeted species. We will continue collecting and reporting data for these species and upgrade their status if appropriate.

Survey objectives, fisheries metrics, and sampling objectives

Fall Electrofishing: This survey will be used to evaluate Largemouth Bass, and the primary forage species (Gizzard Shad, Threadfin Shad, Bluegill Sunfish and Longear Sunfish). Recent creel survey data show Largemouth Bass are the third most sought-after species on Pat Cleburne Reservoir, and their popularity with recreational anglers justifies sampling time and effort. The goal of the 2023 electrofishing survey would be general monitoring of trend data to characterize the Largemouth Bass population and make comparisons with historical and future data. Collecting ≥ 50 stock-length fish during fall 2023 will allow us to calculate proportions (i.e., size structure indices) with an 80% confidence interval. If the goal is not attained in 12 stations, and catch rates indicate that collecting the proposed number of fish is reasonable, sampling will continue at pre-determined random stations until the target is reached. Since the forage species survey objectives are only exploratory, additional sampling will not be necessary beyond that which is done for Largemouth Bass.

Winter trap netting: Recent creel survey data show White Crappie are sought-after and harvested in Pat Cleburne Reservoir although trap net catch rates are generally low. The goal of the 2023 survey would be to conduct an exploratory survey for this species. Five randomly selected trap netting stations will be sampled overnight during winter 2023.

Spring Gill Netting: This survey would be used to evaluate catfishes and temperate basses. Collecting a minimum of 50 stock-length fish for each species during spring gill netting will allow us to calculate proportions (i.e., size structure indices) with an 80% confidence interval. Ten randomly selected gill net stations will be sampled in spring 2024. If the goal for a species isn't attained, and catch rates indicate that collecting the proposed number of fish is reasonable, sampling will continue at pre-determined random stations until the target is reached. Collect genetic tissue and otoliths from all stock-length hybrids present in the sample to determine how often stockings result in recruitment.

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Tables and Figures

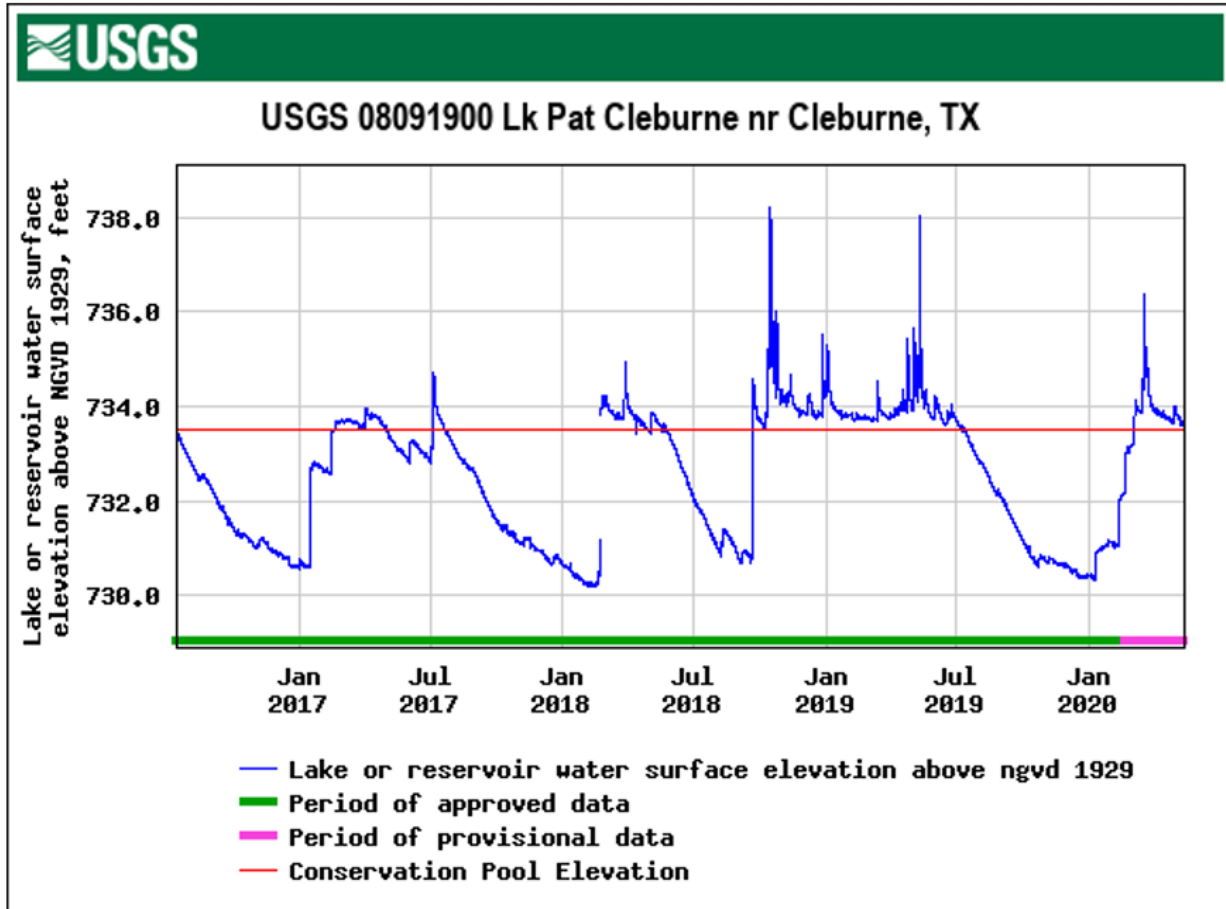


Figure 1a. Daily mean water levels for Pat Cleburne Reservoir from July 15, 2016 through May 12, 2020. NGVD 1929 refers to the National Geodetic Vertical Datum of 1929. Conservation pool level (red line) is 733.5 feet above MSL. Figure from the USGS website.

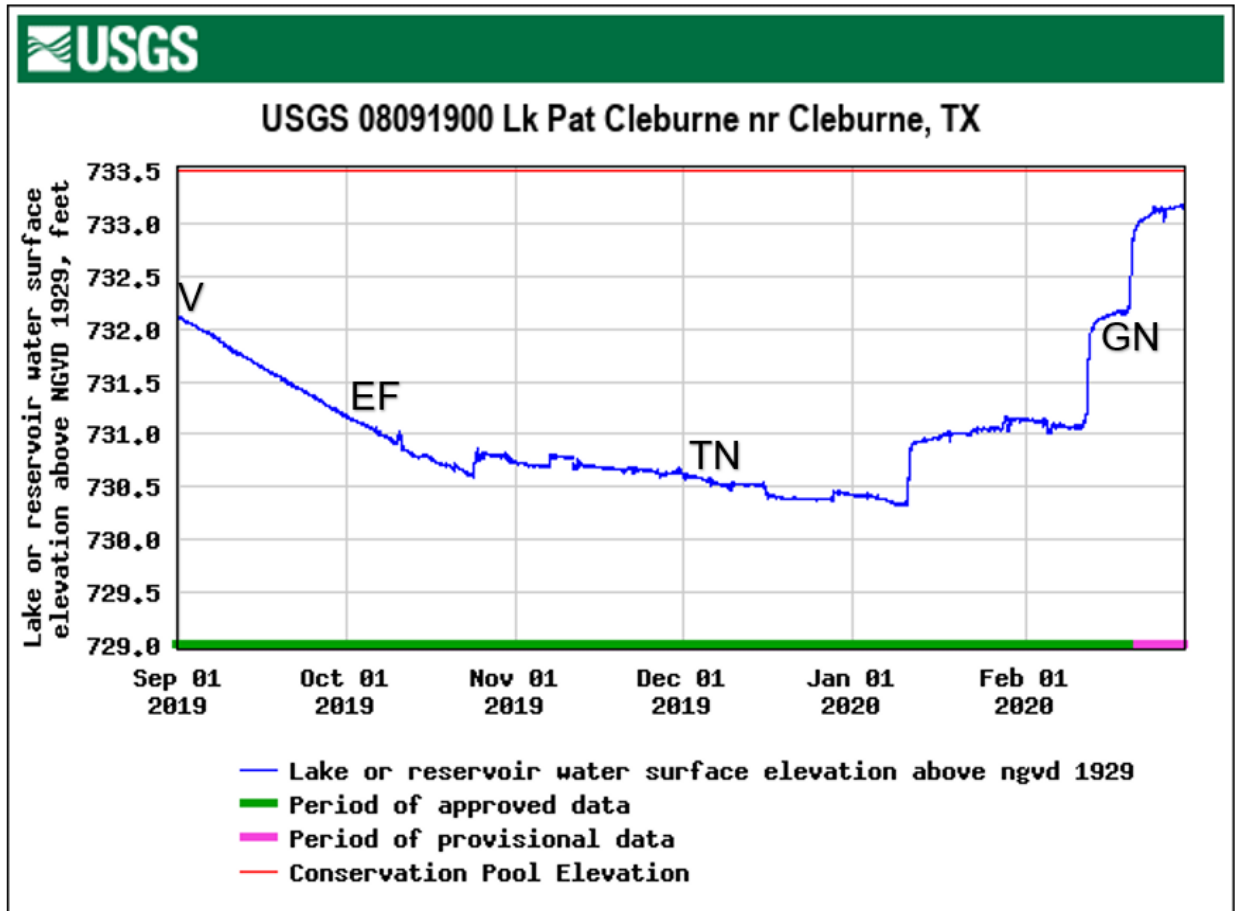


Figure 1b. Daily mean water level elevations in feet above mean sea level (MSL) recorded for Pat Cleburne Reservoir, Texas, September 2019 through February 2020. NGVD 1929 refers to the National Geodetic Vertical Datum of 1929. Conservation pool level (red line) is 733.5 feet above MSL. Scheduled surveys are indicated by V (vegetation), EF (electrofishing), TN (trap nets) and GN (gill nets).

Table 1. Characteristics of Pat Cleburne Reservoir, Texas 2016 - 2020.

Characteristic	Description
Year Constructed	1964
Controlling authority	City of Cleburne
County	Johnson
Reservoir type	Tributary
Shoreline Development Index (SDI)	1.6
Conductivity	320 umhos

Table 2. Boat ramp characteristics for Pat Cleburne Reservoir, Texas, September 2019. Reservoir elevation at time of survey was 732.1 feet above MSL (1.4 feet below conservation pool).

Boat ramp	Latitude/Longitude (dd)	Parking capacity (N)	Condition
East Ramp	32.304095/-97.422440	18	Good
West Ramp	32.300566/-97.437423	14	Narrow
Nolan River Ramp	32.325982/-97.447815	6	Good
SE Ramp	32.294766/-97.416414	12	Good

Table 3. Harvest regulations for Pat Cleburne Reservoir, 2016 - 2020.

Species	Bag Limit	Minimum-Maximum Length (inches)
Catfish: Channel Catfish, Blue Catfish, their hybrids and subspecies	25 (in any combination)	12 - No Limit
Catfish, Flathead	5	18 - No Limit
Bass, White	25	10 - No Limit
Hybrid Striped Bass	5	18 - No Limit
Bass, Largemouth	5 ^a	14 - No Limit
Bass, Spotted	5 ^a	No Limit
Crappie: White Crappie, Black Crappie, their hybrids and subspecies	25 (in any combination)	10 - No Limit

^a Daily bag for Largemouth Bass and Spotted Bass = 5 in any combination.

Table 4. Stocking history of Pat Cleburne Reservoir, Texas. Life stages are fingerlings (FGL), advanced fingerlings (AFGL), adults (ADL) and unknown (UNK). Life stages for each species are defined as having a mean length that falls within the given length range. For each year and life stage the species mean total length (Mean TL; in) is given. For years where there were multiple stocking events for a particular species and life stage the mean TL is an average for all stocking events combined.

Species	Year	Number	Life Stage	Mean TL (in)
Blue Catfish	2017	15,723	FGL	2.2
	2018	39,182	FGL	2.5
	Total	54,905		
Channel Catfish	1990	15,723	FGL	2.5
	1998	39,182	AFGL	8.6
	Total	54,905		
Flathead Catfish	1982	18	UNK	UNK
	Total	18		
Florida Largemouth Bass	1992	154,689	FGL	1.0
	1995	155,332	FGL	1.3
	Total	310,021		
Largemouth Bass	1971	50,000	UNK	UNK
	1980	235	UNK	UNK
	Total	50,235		
Sunshine Bass (Striped x White bass hybrid)	2017	100,000	FRY	UNK
	2018	100,000	FRY	UNK
	2019	100,000	FRY	UNK
	Total	300,000		
Palmetto Bass (Striped x White bass hybrid)	2017	105,233	FRY	0.2
	Total	105,233		

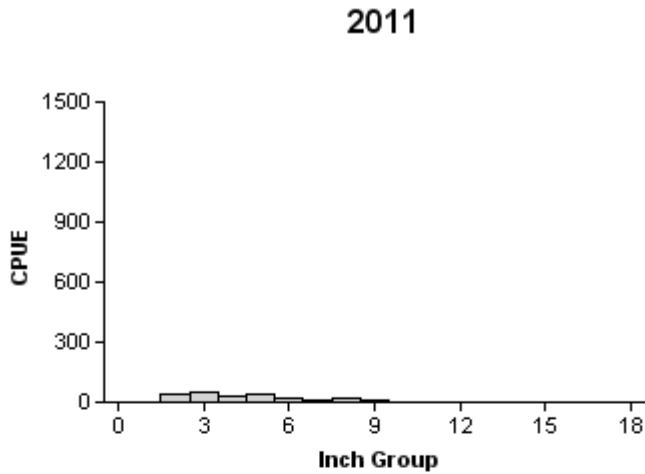
Table 5. Objective-based sampling plan components for Pat Cleburne Reservoir, Texas 2019 – 2020.

Gear/target species	Survey objective	Metrics	Sampling objective
<i>Electrofishing</i>			
Largemouth Bass	Abundance	CPUE-Stock	RSE-Stock ≤ 25
	Size structure	PSD, length frequency	$N \geq 50$ stock
Bluegill	Exploratory	Presence/Absence	Practical Effort
Longear Sunfish	Exploratory	Presence/Absence	Practical Effort
Gizzard Shad	Exploratory	Presence/Absence	Practical Effort
Threadfin Shad	Exploratory	Presence/Absence	Practical Effort
<i>Trap Nets</i>			
White Crappie	Exploratory	Presence/Absence	Practical Effort
<i>Gill Nets</i>			
Channel Catfish	Abundance	CPUE-Stock	RSE-Stock ≤ 25
	Size Structure	PSD, length frequency	$N \geq 50$ stock
	Condition	W_r	10/inch group (max)
Blue Catfish	Abundance	CPUE-Stock	RSE-Stock ≤ 25
	Size Structure	PSD, length frequency	$N \geq 50$ stock
	Condition	W_r	10/inch group (max)

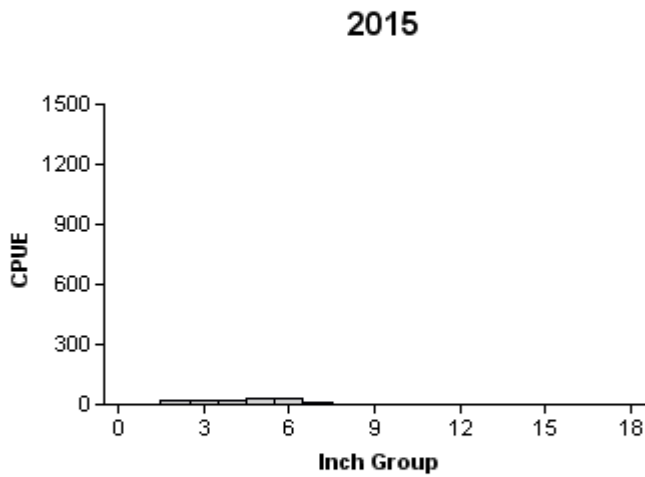
Table 6. Survey of aquatic vegetation, Pat Cleburne Reservoir, Texas, 2015 and 2019. The percent of randomly selected points where species occurred is listed for 2015 and 2019. Water level was within two feet of conservation pool at the time of both surveys.

Vegetation	2015	2019
American water willow (<i>J. americana</i>)	64% (16 of 25)	60% (15 of 25)
Bulrush (<i>Scirpus</i> spp.)	4% (1 of 25)	12% (3 of 25)
Common buttonbush (<i>C. occidentalis</i>)	76% (19 of 25)	52% (13 of 25)
Cattail (<i>Typha</i> spp.)	0% (0 of 25)	4% (1 of 25)
Smartweed (<i>P. hydropiperoides</i>)	16% (4 of 25)	12% (3 of 25)
American lotus (<i>N. lutea</i>)	4% (1 of 25)	0% (0 of 25)
Sword plant (<i>Echinodorus</i> spp.)	4% (1 of 25)	0% (0 of 25)
Giant reed (<i>A. donax</i>)	4% (1 of 25)	0% (0 of 25)

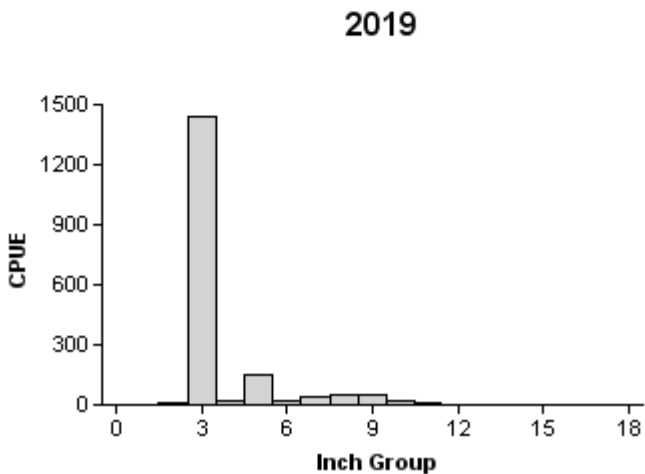
15
Gizzard Shad



Effort = 1.0
 Total CPUE = 241.0 (31; 241)
 Stock CPUE = 54.0 (30; 54)
 IOV = 83 (5)



Effort = 1.0
 Total CPUE = 141.0 (43; 141)
 Stock CPUE = 16.0 (50; 16)
 IOV = 94 (3)



Effort = 0.8
 Total CPUE = 1,805.3 (30; 1354)
 Stock CPUE = 169.3 (19; 127)
 IOV = 93 (3)

Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Pat Cleburne Reservoir, Texas, 2011, 2015 and 2019.

Bluegill

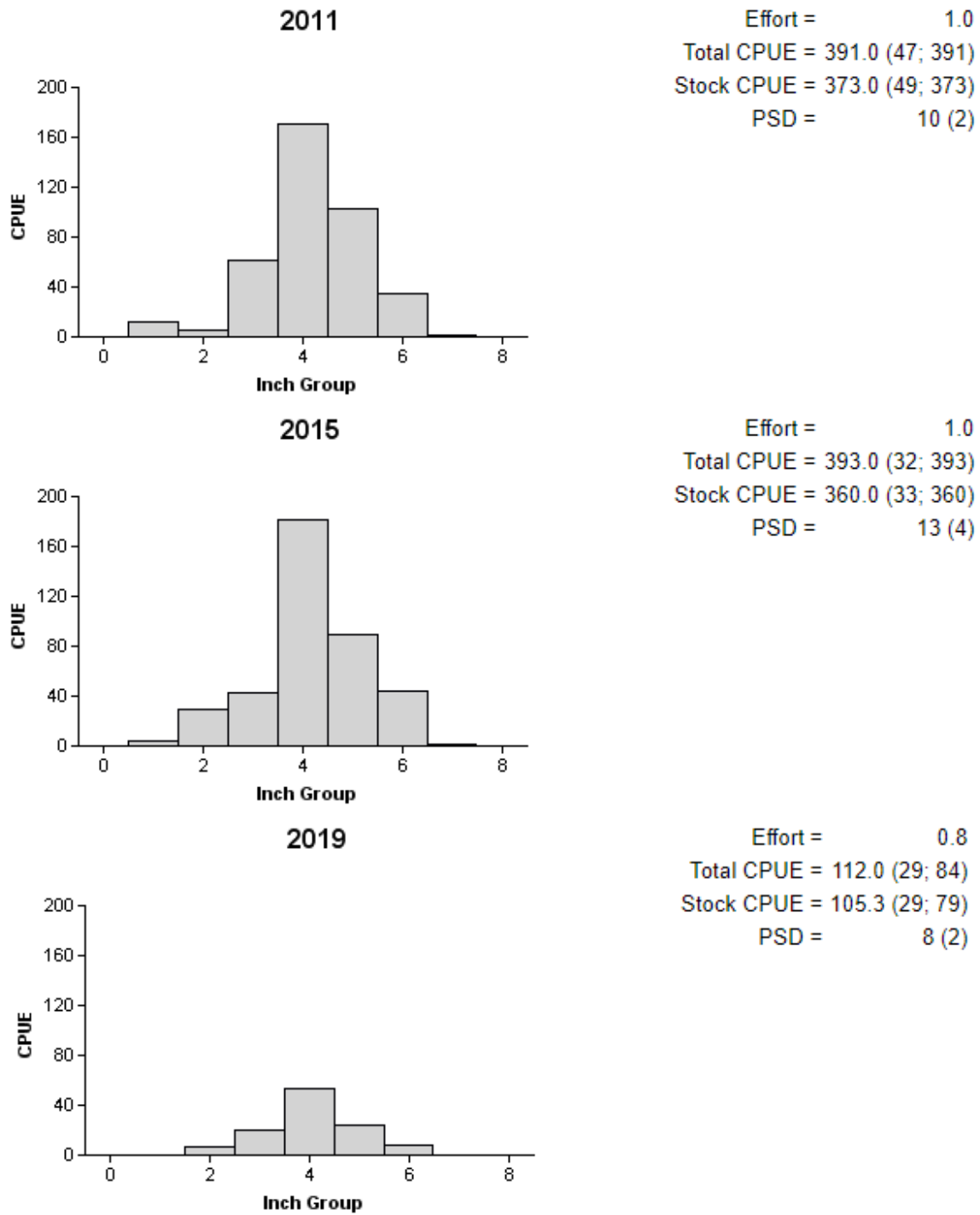
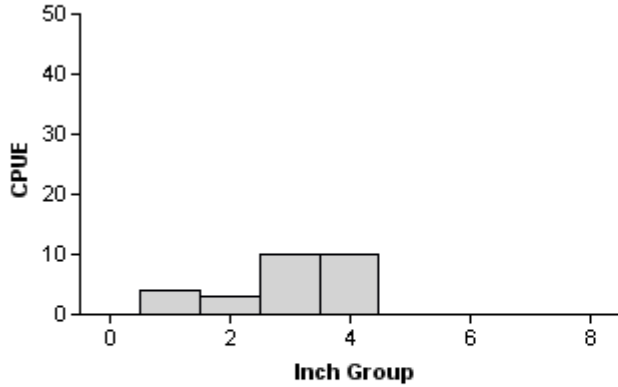


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Pat Cleburne Reservoir, Texas, 2011, 2015 and 2019.

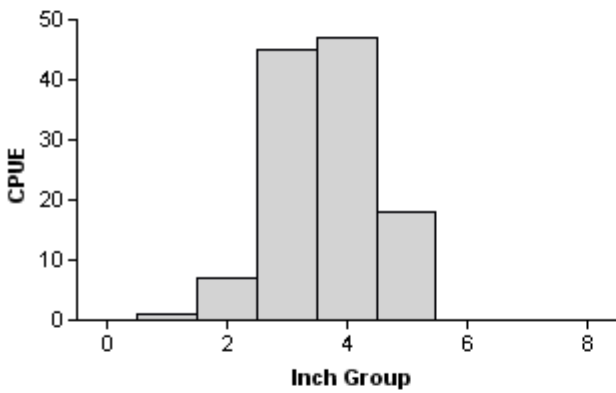
Longear Sunfish

2011



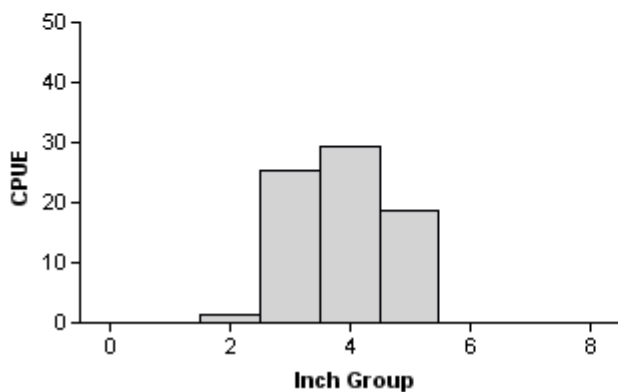
Effort = 1.0
 Total CPUE = 27.0 (38; 27)
 Stock CPUE = 27.0 (38; 27)
 PSD = 100 (0)

2015



Effort = 1.0
 Total CPUE = 118.0 (40; 118)
 Stock CPUE = 118.0 (40; 118)
 PSD = 100 (0)

2019



Effort = 0.8
 Total CPUE = 74.7 (52; 56)
 Stock CPUE = 74.7 (52; 56)
 PSD = 100 (0)

Figure 4. Number of Longear Sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Pat Cleburne Reservoir, Texas, 2011, 2015 and 2020.

Blue Catfish

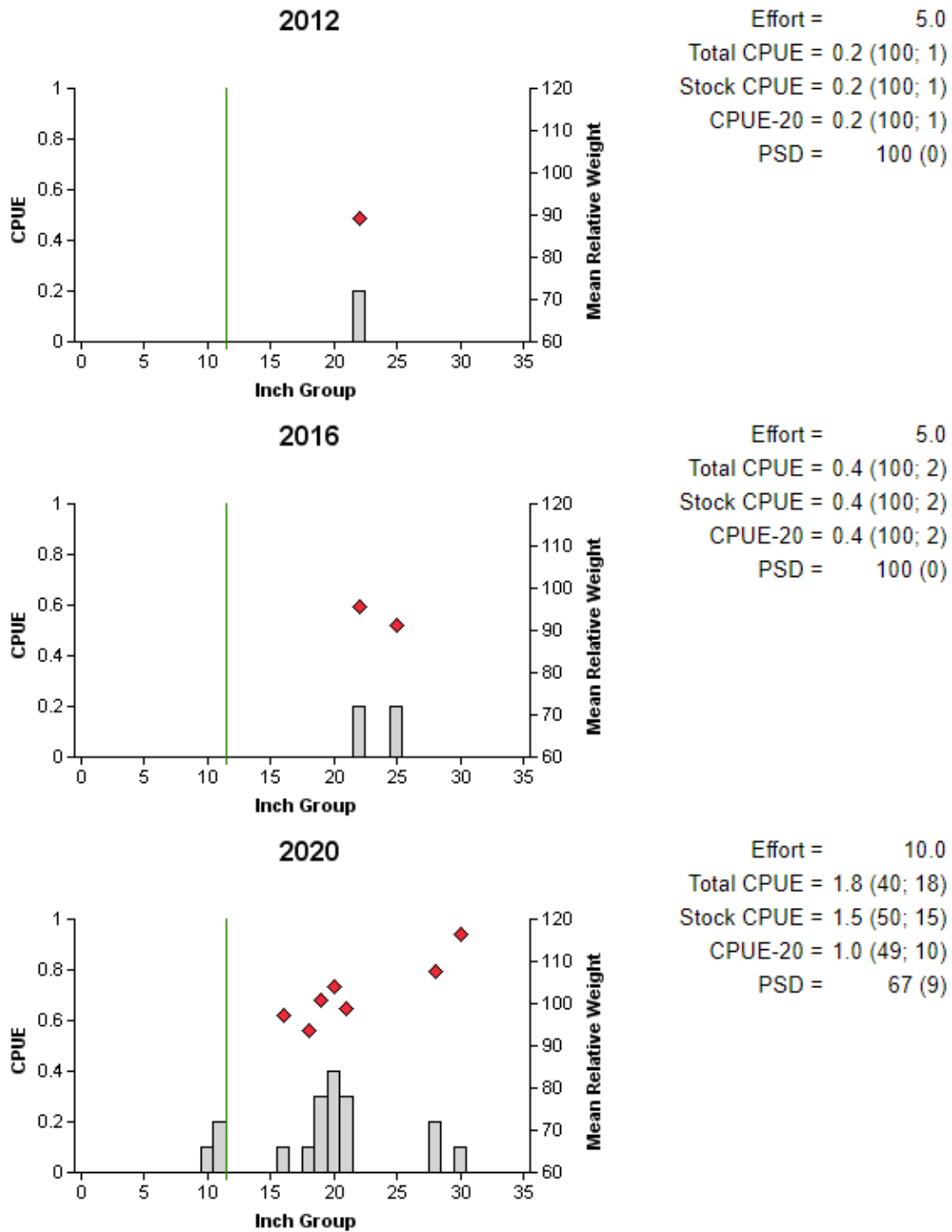


Figure 5. Number of Blue Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Pat Cleburne Reservoir, Texas, 2012, 2016 and 2020. The vertical line represents the minimum length limit.

Channel Catfish

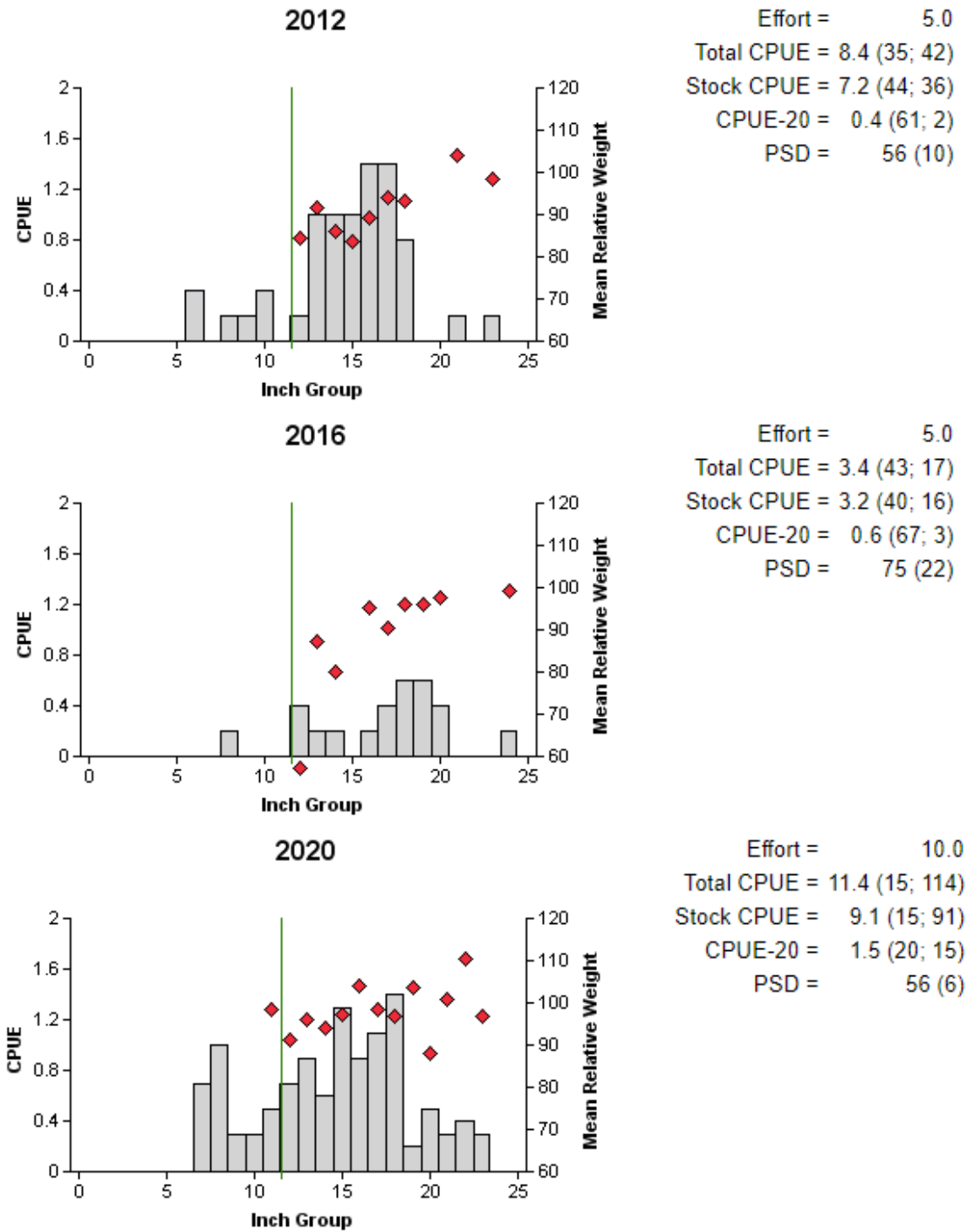


Figure 6. Number of Channel Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Pat Cleburne Reservoir, Texas, 2012, 2016 and 2020. The vertical line represents the minimum length limit.

White Bass

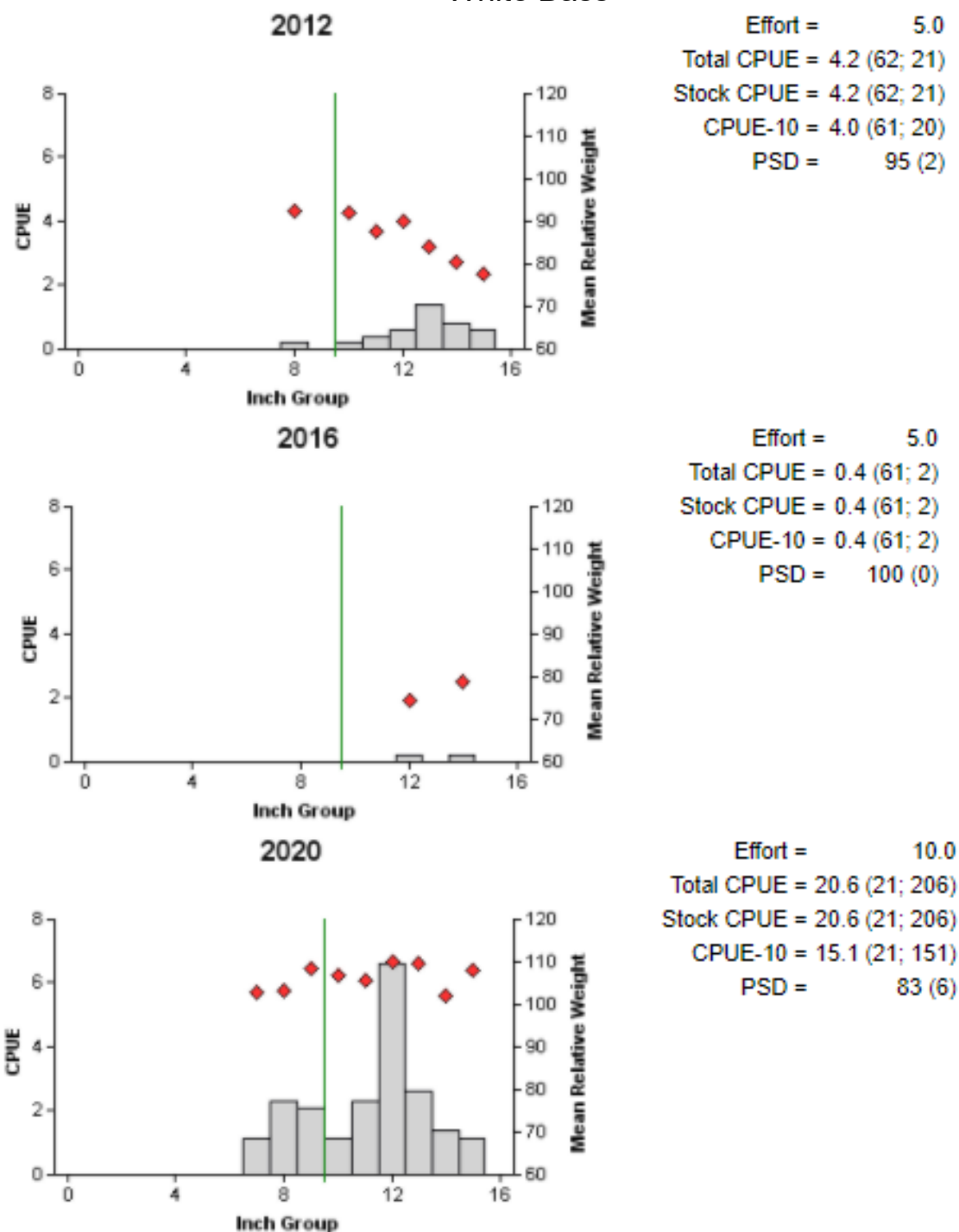


Figure 7. Number of White Bass caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Pat Cleburne Reservoir, Texas, 2012, 2016 and 2020. The vertical line represents the minimum length limit.

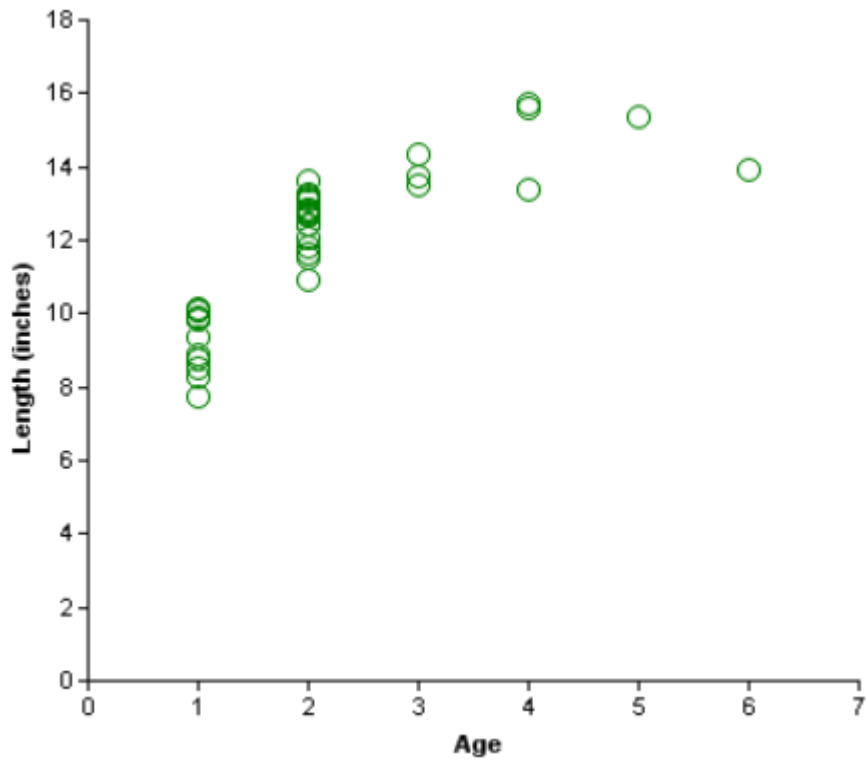


Figure 8. Length at age for White Bass ($n = 39$) collected by gill netting, Pat Cleburne Reservoir, Texas, 2020. Only a subset of the total sample were aged and all were genetically verified to be White Bass.

Hybrid Striped Bass

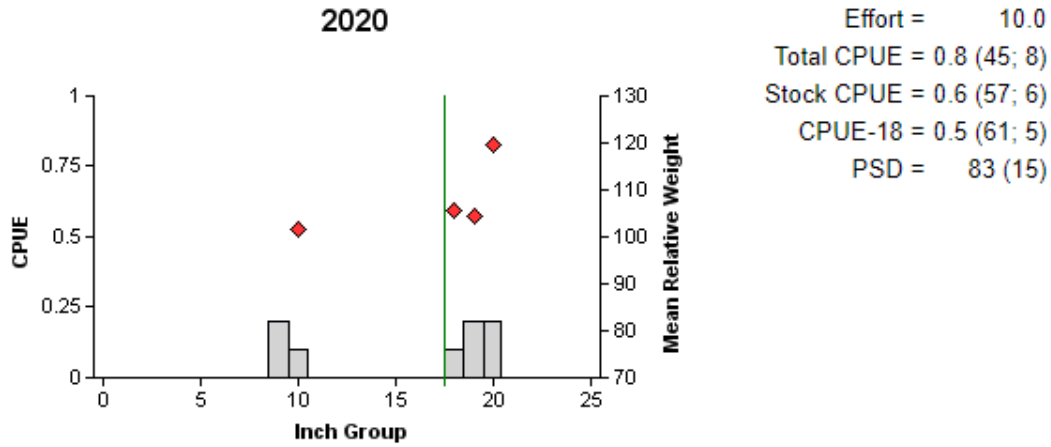


Figure 9. Number of Hybrid Striped Bass caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Pat Cleburne Reservoir, Texas, 2020. The vertical line represents the minimum length limit.

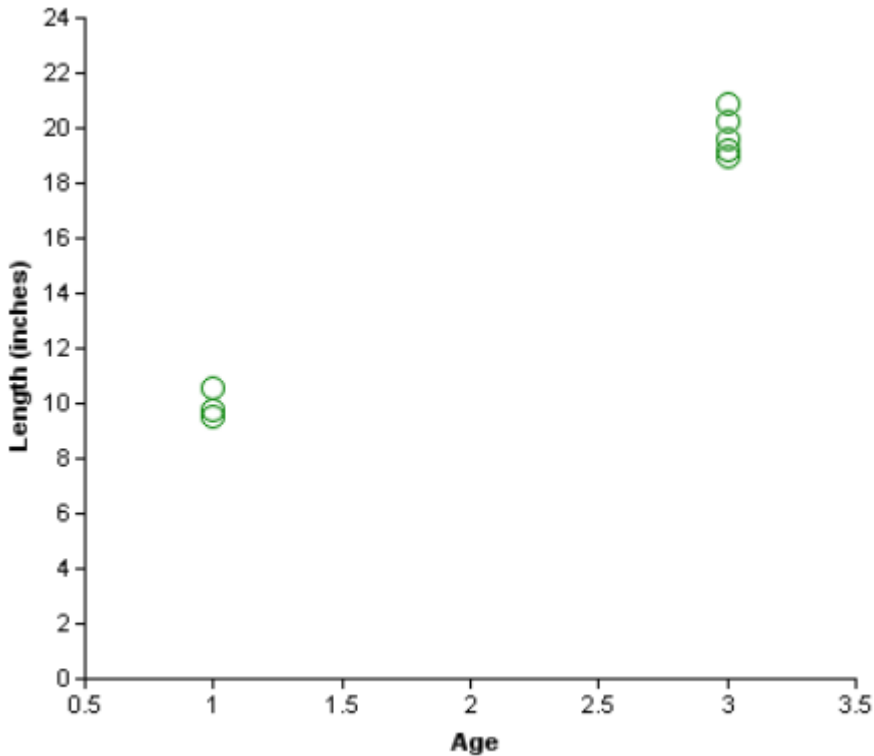


Figure 10. Length at age for Hybrid Striped Bass (n = 8) collected by gill netting, Pat Cleburne Reservoir, Texas, 2020. All hybrids were aged and all were genetically verified to be Palmetto (Age 3) or Sunshine (Age 1).

Largemouth Bass

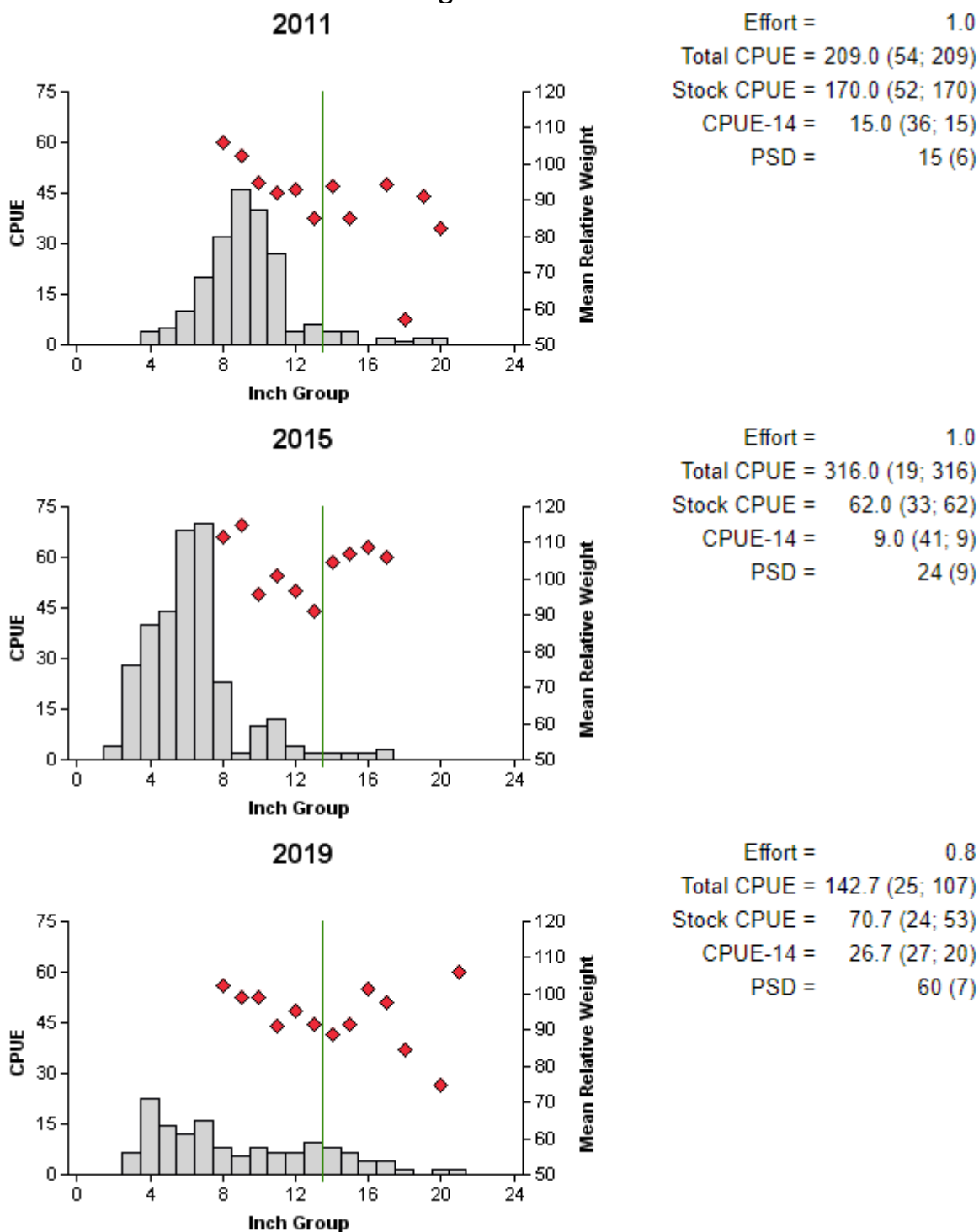


Figure 11. Number of Largemouth Bass caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Pat Cleburne Reservoir, Texas, 2011, 2015 and 2019. The vertical line represents the minimum length limit.

Largemouth Bass

Table 7. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Pat Cleburne Reservoir, Texas, 2003, 2007 and 2015. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB. Genetic composition was determined by electrophoresis prior to 2005 and with micro-satellite DNA analysis since 2005.

Year	Sample size	Number of fish			% FLMB alleles	% FLMB
		FLMB	Hybrid	NLMB		
2003	30	3	21	6	44	3
2007	30	0	24	6	37	0
2015	30	0	26	4	35	0

25
White Crappie

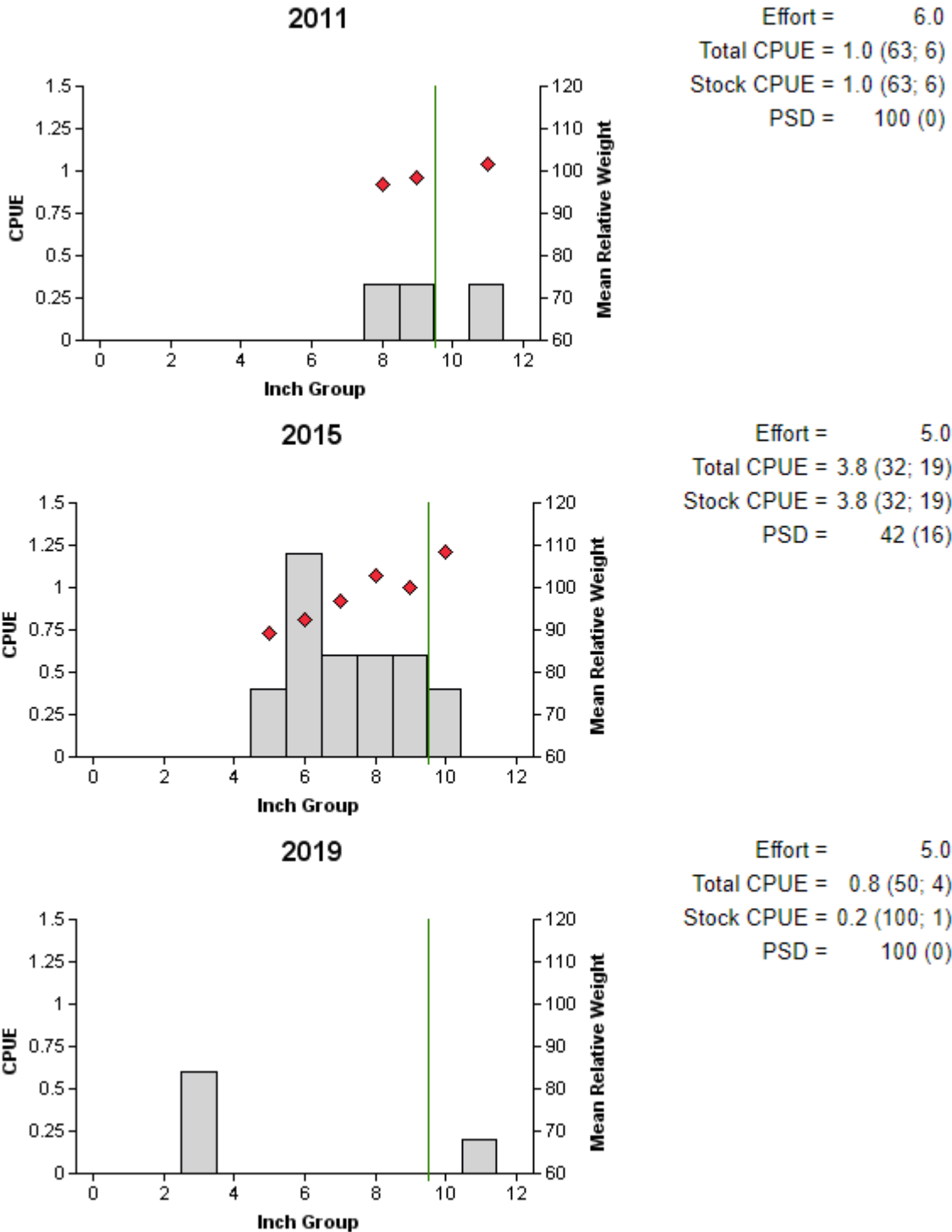


Figure 12. Number of White Crappie caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap net surveys, Pat Cleburne Reservoir, Texas, 2011, 2015 and 2019. The vertical line represents the minimum length limit.

Proposed Sampling Schedule

Table 8. Proposed sampling schedule for Pat Cleburne Reservoir, Texas. Survey period is June through May. Gill netting surveys are conducted in the spring, while electrofishing and trap netting surveys are conducted in the fall and winter. Standard survey denoted by S and additional survey denoted by A.

	Survey Year			
	2020-2021	2021-2022	2022-2023	2023-2024
Vegetation				S
Access				S
Electrofishing				S
Trap Net				S
Gill Net				S
Report				S

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

Number (N), relative standard error (RSE) and catch rate (CPUE) of all target species collected from all gear types from Pat Cleburne Reservoir, Texas, 2019-2020.

Species	Gill Netting		Trap Netting		Electrofishing	
	N/RSE	CPUE	N/RSE	CPUE	N/RSE	CPUE
Gizzard Shad					1354/30	1805.3
Threadfin Shad					293/26	390.7
Blue Catfish	18/4	1.8				
Channel Catfish	114/15	11.4				
White Bass	206/21	20.6				
Hybrid Striped Bass	8/45	0.8				
Green Sunfish					1/100	1.3
Bluegill					84/29	112.0
Longear Sunfish					56/52	74.7
Redear Sunfish					5/44	6.7
Largemouth Bass					107/25	142.7
White Crappie	11/32	1.1	4/50	0.8		
Black Crappie	14/37	1.4				

APPENDIX B – Historical catch rates for targeted species by gear type

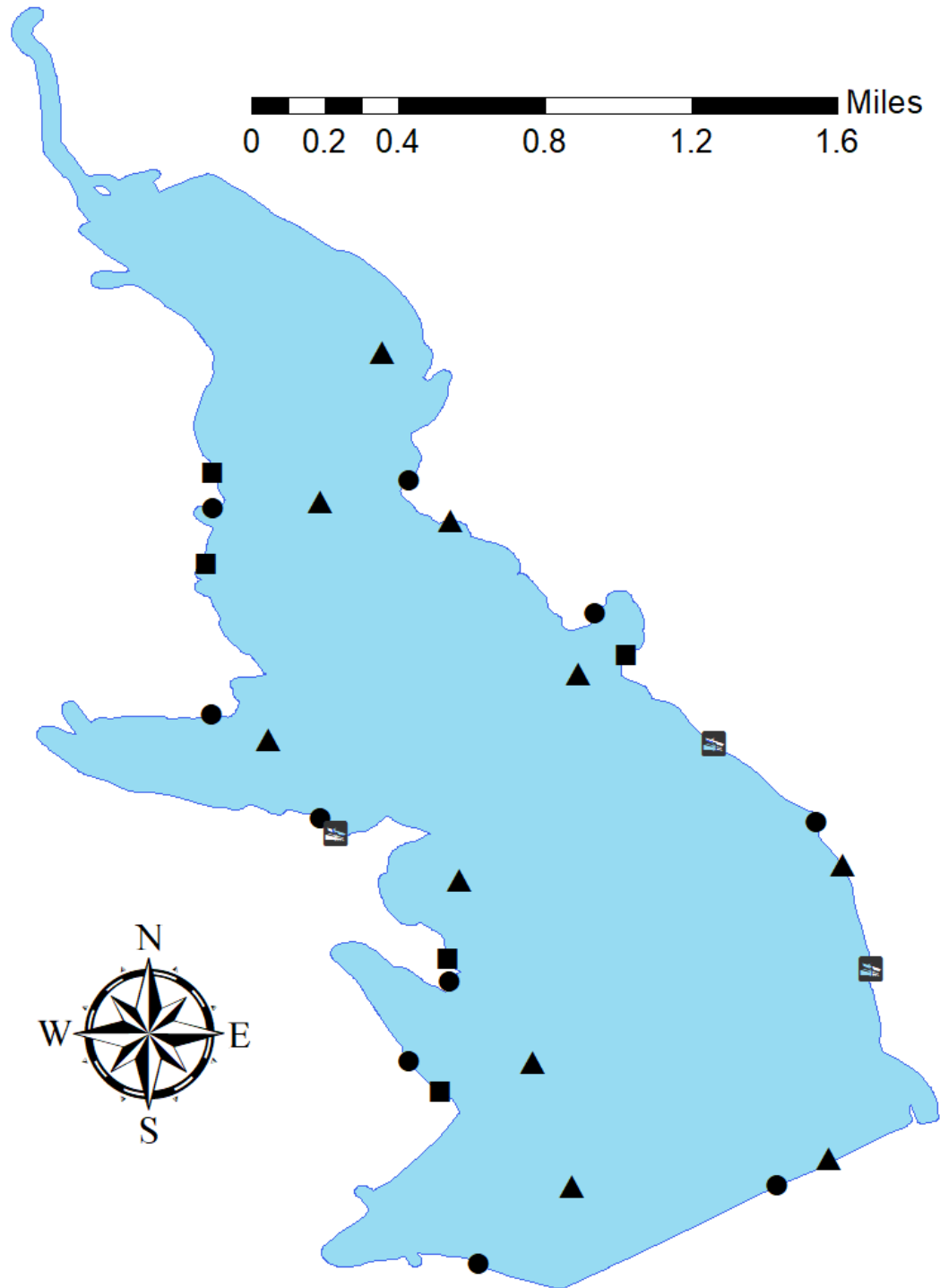
Historical catch rates (CPUE) of targeted species by gear type for standard surveys on Pat Cleburne Reservoir, Texas, 1991 to present. Surveys prior to 1996 utilized biologist-selected stations while those after 1996 utilized randomly selected stations. Electrofishing stations utilized a 5.0 Smith-Root GPP (Gas Powered Pulsator) through 2010, after which a 7.5 Smith-Root GPP was used. Objective based sampling began in 2015. Species averages are in bold. Dashes represent no data collection.

Year	Electrofishing							
	Bass		Shad			Sunfish		
	Largemouth	Gizzard	Threadfin	Bluegill	Longear	Green	Warmouth	Redear
1991	7.0	1357.0	0.0	12.0	4.0	3.0	0.0	0.0
1993	106.0	699.0	183.0	93.0	18.0	1.0	5.0	11.0
1996	63.0	217.0	15.0	89.0	47.0	13.0	1.0	14.0
1997	-	-	-	-	-	-	-	-
1999	228.0	14.0	0.0	77.0	33.0	1.0	1.0	0.0
2000	-	-	-	-	-	-	-	-
2003	178.0	320.0	20.0	913.0	163.0	5.0	3.0	60.0
2004	-	-	-	-	-	-	-	-
2007	188.0	299.0	265.0	492.0	65.0	18.0	5.0	19.0
2008	-	-	-	-	-	-	-	-
2011	209.0	241.0	344.0	391.0	27.0	1.0	1.0	69.0
2012	-	-	-	-	-	-	-	-
2015	316.0	141.0	91.0	393.0	118.0	3.0	5.0	25.0
2019	142.7	1805.3	390.7	112.0	74.7	1.3	--	6.7
Avg.	159.7	565.9	145.4	285.8	61.1	5.1	3.0	22.7

APPENDIX B – Continued

Year	Gill nets					Trap nets	
	Catfish		Temperate Bass			Crappie	
	Blue	Channel	Flathead	Hybrid	White	White	Black
1991	21.6	5.8	0.4		1.2	93.0	0.2
1993	2.6	6.0	2.2		1.6	39.0	0.0
1996	3.6	11.8	0.2		14.2	11.0	0.0
1997	-	-	-		-	-	-
1999	4.0	3.4	0.4		8.8	5.5	0.0
2000	-	-	-		-	-	-
2003	-	-	-		-	3.0	0.0
2004	2.8	3.5	0.3		18.3	-	-
2007	-	-	-		-	1.0	0.0
2008	5.4	7.6	0.0		9.0	-	-
2011	-	-	-		-	1.0	1.0
2012	0.2	8.4	0.2		4.2	-	-
2016	0.4	3.4	0.0		0.4	3.8	0.0
2020	1.8	11.4	0.0	0.8	20.6	0.8	0.0
Avg.	4.7	6.8	0.5	0.8	8.7	17.6	0.1

APPENDIX C – Map of sampling locations



Location of sampling sites, Pat Cleburne Reservoir, Texas, 2019-2020. Electrofishing, trap netting and gill netting stations are indicated by circles, squares, and triangles respectively. Water level was within 3' of full pool at time of sampling.



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