PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

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FEDERAL AID PROJECT F-221-M-6

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2015 Fisheries Management Survey Report

Pat Cleburne Reservoir

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TABLE OF CONTENTS

Survey and Management Summary 1

Introduction 2

Reservoir Description 2

Angler Access 2

Management History 2

Methods 3

Results and Discussion 4

Fisheries Management Plan 6

Objective Based Sampling Plan 2016-2020 7

Literature Cited 8

Figures and Tables 9-28
- Water Level (Figure 1) 9
- Reservoir Characteristics (Table 1) 10
- Boat Ramp Characteristics (Table 2) 10
- Harvest Regulations (Table 3) 10
- Stocking History (Table 4) 11
- Objective Based Sampling Plan Components for 2015-2016 (Table 5) 12
- Structural Habitat Survey (Table 6) 13
- Aquatic Vegetation Survey (Table 7) 13
- Percent Directed Angler Effort per Species (Table 8) 13
- Total Fishing Effort and Fishing Expenditures (Table 9) 14
- Gizzard Shad (Figure 2) 15
- Bluegill (Figure 3) 16
- Longear Sunfish (Figure 4) 17
- Blue Catfish (Figures 5 and 6; Table 10) 18
- Channel Catfish (Figures 7 and 8; Table 11) 20
- White Bass (Figures 9 and 10; Table 12) 22
- Largemouth Bass (Figures 11 and 12; Tables 13 and 14) 24
- White Crappie (Figures 13 and 14; Table 15) 27
- Proposed sampling schedule (Table 16) 29

Appendix A
- Catch Rates for all Species from all Gear Types 30

Appendix B
- Historical Catch Rates for Targeted Species by Gear Type 31

Appendix C
- Map of 2015-2016 Sampling Locations 33

SURVEY AND MANAGEMENT SUMMARY

Fish populations in Pat Cleburne Reservoir were surveyed in 2015 using electrofishing and trap nets and in 2016 using gill nets. Historical data are presented with the 2015-2016 data for comparison. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir Description:** 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 7.7 feet of conservation pool (733.5 above mean sea level [MSL]) since 2011. The water level was 3' below conservation pool during the 2015 electrofishing survey, near conservation pool during the 2015 trap net survey, and 2' above conservation pool during the spring gill net survey. Habitat features consisted of natural shoreline, rocky shoreline and limited boat docks and piers.

- **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 2007 survey report recommended contacting the City of Cleburne and urging them to clean-up the boat ramp area. Although the area improved over the next few years, it is now closed to the public. The management plan from the 2012 survey report included conducting vegetation and physical habitat surveys and publicizing the reservoir's angling opportunities. Full aquatic vegetation and structural habitat surveys were conducted during 2011 and 2012. Several fishing and angling articles have been released to local television and radio stations highlighting Pat Cleburne Reservoir opportunities since that time. The most recent fish stocking was advanced fingerling Channel Catfish in 1998. Recent management efforts include cooperating with the controlling authority to post appropriate signage at access points to try and prevent the spread of the invasive zebra mussel into the reservoir.

- **Fish Community**
  - **Prey species:** Threadfin and Gizzard Shad were present in the reservoir in fair numbers, and most Gizzard Shad were available as prey to sport fish. Other forage species included Bluegill, Longear Sunfish, Redear Sunfish, Warmouth and Green Sunfish.
  - **Catfishes:** Blue Catfish and Channel Catfish were important sport fish in the reservoir, yet their catch rates were below historical averages. Condition was generally good for both species. Catfishes were the most sought-after sport fish in the reservoir.
  - **White Bass:** White Bass were thought to be an important sport fish in Pat Cleburne Reservoir; however, only 5% of anglers sought this species during fall 2015. White Bass catch rate was well below the historical average for the species, and body condition was poor.
  - **Largemouth Bass:** Largemouth Bass were abundant in the reservoir and the catch rate for this species far exceeded the historical average. Recent recruitment appeared to be excellent. Body condition was generally excellent. Twenty-five percent of anglers sought this species during fall 2015.
  - **White Crappie:** White Crappie were present in the reservoir in low numbers. Body condition improved with increasing size. Nearly 8% of anglers targeted White Crappie.

Management Strategies: Continue managing sport fishes at Pat Cleburne Reservoir with statewide regulations. Maintain invasive species signage and inform the public about the negative impacts of aquatic invasive species. Conduct access and vegetation surveys in summer 2019, and general monitoring surveys with electrofishing and gill net surveys in 2019 and 2020.

INTRODUCTION

This document is a summary of fisheries data collected from Pat Cleburne Reservoir in 2015-2016. The purpose of the document is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2015-2016 data for comparison.

Reservoir Description

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 eight feet of conservation pool (733.5 feet above mean sea level [MSL]) since 2011. The water level was within three feet of conservation pool during the 2015 and 2016 surveys (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. These ramps are seldom used for launching anything other than small water craft (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 2012) included:

1. Conducting a supplemental electrofishing survey during fall 2013 to monitor the Largemouth Bass population and stagnant PSD-14 values. Pending the outcome of this sample, consider conducting a tier II or higher age and growth evaluation during fall 2015.
   Action: The fall 2013 electrofishing survey was not completed due to low water levels and associated access issues. The initiation of an OBS plan on Pat Cleburne Reservoir re-focused our efforts on collecting more basic fisheries data for the reservoir, such as determining Pat Cleburne Reservoir's most important sport fishes and the extent they are utilized. An angler creel survey was performed instead of additional Largemouth Bass age and growth work during 2015.
2. Releasing one or more news articles showcasing the excellent Channel Catfish angling opportunities on Pat Cleburne Reservoir and updating the Texas Parks and Wildlife Department's website to reflect the most recent fish species data for Pat Cleburne Reservoir.
   Action: The web page for Pat Cleburne Reservoir was updated in August 2012, and a news article was released to local newspapers in 2013 showcasing Pat Cleburne Reservoir's Channel Catfish fishery.
3. Cooperating with the City of Cleburne to post appropriate invasive species signage at access points throughout the reservoir. Educate the public about invasive species through the use of media and the internet. 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. 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 constituent groups such as the Central Texas Flyrodders, Legacy Outfitters and Brazos River Sportsman's Club over the past several years. Interbasin water transfers are a permanent fixture in this report now, and will be updated appropriately.

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 has not been stocked since 1998, when Channel Catfish were stocked at a rate of 25 fish per acre. 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 2015).

Electrofishing – Largemouth Bass, sunfishes, Gizzard Shad and Threadfin Shad were collected by 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.

Trap netting – Trap netting was not originally in the OBS plan for Pat Cleburne Reservoir; however, preliminary angler information collected during the 2015 fall quarter creel survey suggested White Crappie might be an important sport fish sought by anglers in the reservoir. 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 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).

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 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). 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.

Creel survey – A fall quarter roving creel survey was conducted in 2015. The creel survey period was September through November. Angler interviews were conducted on 5 weekend days and 4 weekdays during the 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 – The 2011 structural habitat and vegetation surveys were conducted according to Tibbs and Baird (2012). Vegetation surveys were conducted using an adaptation of the point method during 2015 (TPWD, Inland Fisheries Division, unpublished manual revised 2015). 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 2016).

RESULTS AND DISCUSSION

Habitat: Pat Cleburne Reservoir is a moderately turbid reservoir with a secchi range from two to four feet. The most recent habitat survey results can be found in Table 6. A full vegetation survey conducted during summer 2015 found dominant shoreline vegetation to be common buttonbush (*Cephalanthus occidentalis*), American water willow (*Justicia americana*) and smartweed (*Polygonum hydropiperoides*) (Table 7).

Creel: The fall 2015 creel is the first angler creel survey to be conducted on Pat Cleburne Reservoir. Directed fishing effort was highest for catfish spp. (32.7%), anglers seeking anything (29.0%) followed by Largemouth Bass (24.9%); crappie spp. and White Bass were also directly sought by anglers (Table 8). Total directed expenditures were nearly $200,000 and total angler effort was 11,662 hours for the fall quarter (Table 9).

Prey species: Threadfin and Gizzard Shad were collected by electrofishing at catch rates of 91.0/h and 141.0/h respectively in 2015, both well below their historical averages (Figure 2 and Appendices A and B). The IOV for Gizzard Shad was excellent, and 94% of individuals were available as prey to sport fish (Figure 2). Other forage species collected were Bluegill (393.0/h), Longear Sunfish (118.0/h), Redear Sunfish (25.0/h), Warmouth (5.0/h) and Green Sunfish (3.0/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 0.4/nn in 2016; this catch rate equates to only 2 collected individuals, and is one of the lowest catch rates on record (Figure 5; Appendices A and B). This particularly low catch rate for Blue Catfish prevented us from obtaining our OBS goal of 50 stock size fish. No recent recruitment was documented (Figure 5). Body condition, expressed as mean *Wr*, was good for the two collected individuals (Figure 5). Blue Catfish anglers were harvest-oriented as no legal-sized fish were released, and observed harvest showed good angler compliance (Table 10; Figure 6).

Channel Catfish were collected from gill nets at 3.4/nn in 2016; this catch rate equates to 17 collected individuals, and was also well below the historical average (Figure 7; Appendices A and B). Although historical data suggested collecting 50 stock size Channel Catfish would be likely, spring gill netting results were poor and our OBS goal was not reached. The PSD for Channel Catfish (defined as the percentage of 11-inch and longer individuals which are also 16-inches and longer) was high (i.e., 75) and suggested the population was unbalanced with a high proportion of larger fish (Figure 7). Body condition improved with increasing length (Figure 7). Channel Catfish anglers were harvest-oriented as no legal-sized fish were released, and observed harvest showed good angler compliance (Table 11; Figure 8).

Flathead Catfish were not targeted during the 2015-2016 OBS surveys, but are still included in Appendices A and B.

Catfishes were the most sought-after sport fish in the reservoir with a combined directed fishing effort for Channels and Blues of 3,816.6 hours (Tables 10 and 11). The total estimated harvest for Blue and Channel Catfish was 839 and 100 respectively for the creel survey period (Tables 10 and 11; Figures 6 and 8).

White Bass: White Bass were collected with gill nets at a catch rate of 0.4/nn in 2016; this equates to only 2 collected individuals, and was well below the historical average (Figure 9; Appendix A and B). Although historical data suggested collecting 50 stock size White Bass would be easy, spring gill netting results were poor and our OBS goal was not reached. The PSD for White Bass has remained high over the past three surveys, possibly indicating low recruitment and/or high mortality of smaller fish. Sampled White Bass were harvestable size, and body condition was fair (Figure 9). White Bass were sought by 5% of anglers with a directed fishing effort of 598.6 hours (Table 12). The total estimated harvest for this species was 5,034.6 – second highest during the creel survey period (Table 12). White Bass anglers were harvest oriented as few legal-sized fish were released, and observed harvest showed good angler compliance (Figure 10).

Largemouth Bass: Largemouth Bass were collected by electrofishing at 316.0/h in 2015 and this is the highest catch rate on record for the species in the reservoir (Figure 11 and Appendices A and B). The OBS goal for this species was reached. The PSD for Largemouth Bass is defined as the proportion of 8-inch and longer individuals which are also 12-inches and longer within the population. Proportional size distribution (24) improved slightly from the previous survey, but remained low. Given monitoring and recent creel survey data, this was likely due to the harvest of legal-sized bass (Figures 11 and 12; Table 13). Body condition was excellent (Figure 11). Largemouth Bass were sought by 24.9% of anglers with a directed fishing effort of 2,899.9 hours and a total estimated harvest of 839.1 (Table 13). Largemouth Bass anglers were unusually harvest oriented as only 5.9% of legal-sized fish caught were released; observed harvest during the creel survey showed good angler compliance (Figure 12). Largemouth Bass genetics analyzed in 2015 showed fair Florida influence (35%; Table 14).

White Crappie: White Crappie were collected from trap nets at 3.8/nn in 2015; this catch rate was well below the historical average for the species (Figure 13 and Appendices A and B). The OBS goal for this species was reached. Trap netting was not originally in the OBS plan; however, preliminary angler information from the 2015 fall quarter creel survey suggested White Crappie might be an important sport fish sought by anglers; results for this species are considered exploratory only. The PSD was fair (42) in 2015 indicating a balanced population of small and large fish (Figure 13). Few sampled fish were of harvestable size and none were observed in the memorable category (12 inches) or above (Figure 13). Body condition was excellent and improved dramatically with length (Figure 13). Although White Crappie were only sought by 7.7% of anglers during fall 2015, they were the most harvested species according to creel survey data (Table 15; Figure 14).

Black Crappie were not targeted during the 2015-2016 OBS surveys, but are still included in Appendices A and B.

Fisheries management plan for Pat Cleburne Reservoir, Texas

Prepared – July 2016

ISSUE 1: The upper quarter of Pat Cleburne Reservoir is shallow and devoid of useable fish habitat, and habitat in the remaining portion of the reservoir is limited.

MANAGEMENT STRATEGIES

1. Construct and deploy fish attractors in the best habitats within the reservoir.
2. Add fish attractor map and coordinates to TPWD website for Pat Cleburne Reservoir.
3. Release a news article describing the location(s) and benefits of the fish attractors to the fishery.

ISSUE 2: Over one-third of Pat Cleburne Reservoir's anglers are targeting White Bass or anything that will bite. 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. Given that the historical average gill net catch rate of White Bass has been good in Pat Cleburne Reservoir, the reservoir is fed directly by the Nolan River, and the reservoir has a large pelagic area for its size, it might make an excellent urban Hybrid Striped Bass fishery. If developed, this fishery could be targeted by anglers from Cleburne, Glenrose, Whitney, Burleson and the DFW metroplex alike. The relatively small size of the reservoir would limit the number of Hybrid Striped Bass needed for stocking. However, the fact that the reservoir has never been stocked with Hybrid Striped Bass, means it would be low on the TPWD stocking priority list.

MANAGEMENT STRATEGIES

1. Investigate the possibility of a private purchase of Hybrid Striped Bass (Sunshine Bass) by the City of Cleburne.
2. If funding is secured, recommend a stocking rate of 10/acre and issue a stocking permit. Evaluate stocking success during regularly scheduled gill netting.

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

Objective Based Sampling Plan and Schedule 2016 - 2020

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, White Bass and White Crappie. Important forage fishes include Gizzard Shad, Threadfin Shad, Bluegill, and Longear Sunfish. The proposed sampling schedule (Table 16) lists electrofishing, trap netting and gill netting surveys planned for the next four years.

Low-density fisheries

Spotted Bass, White 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 2019 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 2019 will allow us to calculate proportions (i.e., size structure indices) with an 80% confidence interval. A minimum of 12 randomly selected electrofishing stations will be sampled. If the goal is not 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. 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. The goal of the 2019 survey would be to conduct an exploratory survey for this species. Five randomly selected trap netting stations will be sampled overnight during winter 2019.

Spring Gill Netting: This survey would be used to evaluate catfishes, as recent creel survey data show this is the most sought-after group in Pat Cleburne Reservoir. Collecting a minimum of 50 stock-length fish for each species during spring 2020 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 2016. 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.

LITERATURE CITED

Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

DiCenzo, V. J., M. J. Maceina, and M. R. Stimpert. 1996. Relations between reservoir trophic state and Gizzard Shad population characteristics in Alabama reservoirs. North American Journal of Fisheries Management 16:888-895.

Guy, C. S., R. M. Neumann, D. W. Willis, and R. O. Anderson. 2007. Proportional size distribution (PSD): a further refinement of population size structure index terminology. Fisheries 32(7): 348.

Tibbs, J. and M. S. Baird. 2012. Statewide freshwater fisheries monitoring and management program survey report for Pat Cleburne Reservoir, 2011. Texas Parks and Wildlife Department, Federal Aid Report F-221-M-1, Austin.

United States Geological Society (USGS). 2016. National water information system: Web interface. Available: http://waterdata.usgs.gov/tx/nwis (July 2016).

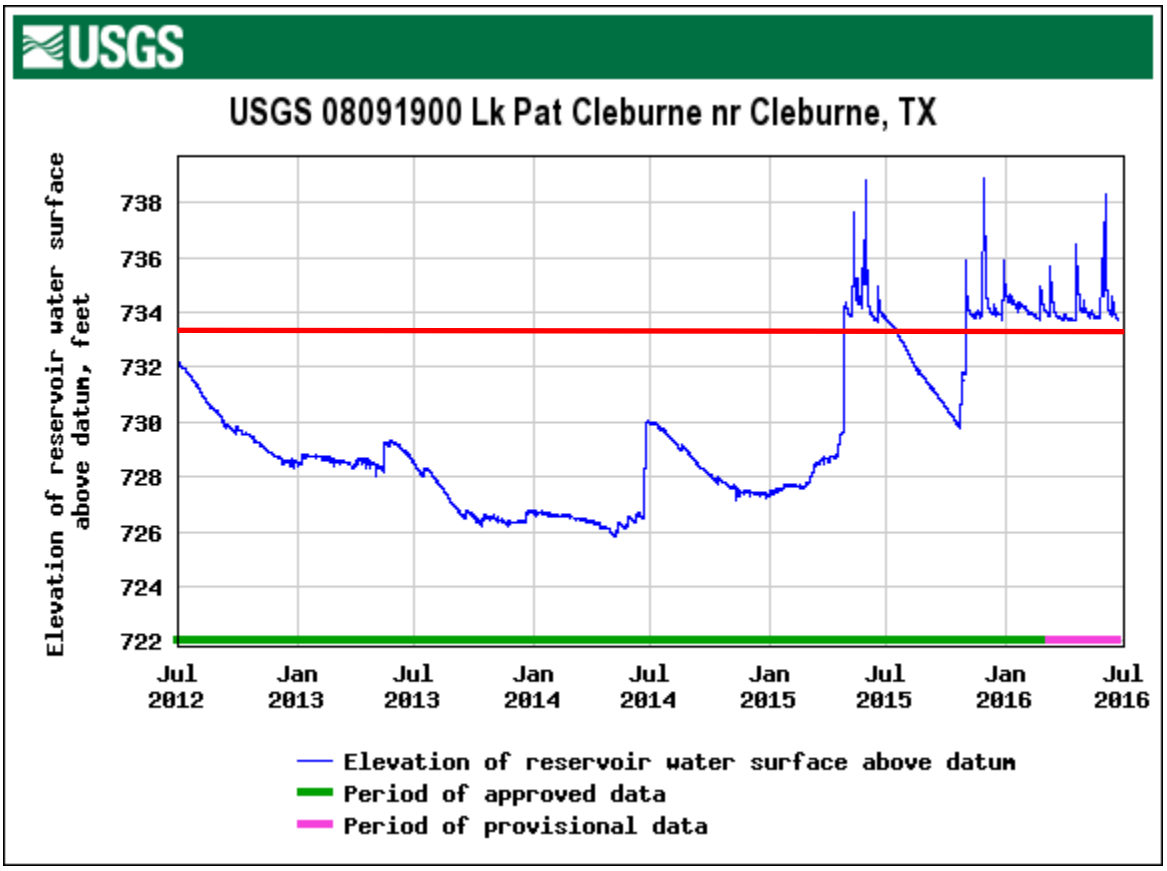


Figure 1. Daily mean water levels for Pat Cleburne Reservoir from July 1, 2012 through July 1, 2016. Conservation pool level (red line) is 733.5 feet above MSL. Figure from the USGS website.

Table 1. Characteristics of Pat Cleburne Reservoir, Texas 2015 - 2016.

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, July, 2015. Reservoir elevation at time of survey was 732.9 feet above MSL (0.6 feet below conservation pool).

Boat ramp	Latitude Longitude (dd)	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
East Ramp	32.304095/-97.422440	18	726	Good
West Ramp	32.300566/-97.437423	14	728	Narrow, obstacles
Nolan River Ramp	32.325982/-97.447815	6	728	Good
SE Ramp	32.294766/-97.416414	12	726	Good

Table 3. Harvest regulations for Pat Cleburne Reservoir, 2015 - 2016.

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
Bass, Largemouth	5	14 – No limit
Bass, Spotted	5 (in any combination)	No Limit
Crappie: White Crappie, Black Crappie, their hybrids and subspecies	25 (in any combination)	10 - No Limit

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)
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		

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

Gear/target species	Survey objective	Metrics	Sampling objective
Electrofishing			
Largemouth Bass	Evaluation of specific management strategy or environmental factor	CPUE- stock Size structure	RSE- Stock ≤ 25 10 fish/inch group
	Genetics	% FLMB	N = 30, any age
Bluegill [a]	Exploratory	Presence/Absence	Practical effort
Longear Sunfish [a]	Exploratory	Presence/Absence	Practical effort
Gizzard Shad [a]	Exploratory	Presence/Absence	Practical effort
Gill netting			
Channel Catfish	General monitoring and trend data	Size structure	N ≥ 50 stock
Blue Catfish	General monitoring and trend data	Size structure	N ≥ 50 stock
White Bass	General monitoring and trend data	Size structure	N ≥ 50 stock
Trap netting			
White Crappie	Exploratory	Presence/Absence	Practical effort
Creel Survey			
All sport fish species	Trend information on angler use	Angler CPUE, total harvest, effort, expenditures and size composition of harvest	

[a] No additional effort will be expended to achieve an RSE ≤ 25 for CPUE of prey species 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 structural habitat types, Pat Cleburne Reservoir, Texas, 2012. Survey was conducted using 2010 NAIP, 1-meter resolution satellite imagery. Shoreline habitat type units are in miles. Eleven (11) boat docks and piers were observed during the survey.

Habitat type	Estimate	% of total
Bulkhead	trace	< 1.0
Rock shoreline (rocks > 4")	1.5 miles	9.8
Natural shoreline	13.8 miles	90.2

Table 7. Survey of aquatic vegetation, Pat Cleburne Reservoir, Texas, 2011 and 2015. Percent of total reservoir surface area is listed for 2011, while percent of randomly-selected points where species occurred, is listed for 2015. Water level was 733.6 and 732.9 feet above MSL, respectively, at the time of the surveys.

Vegetation	2011	2015
American water-willow (Justicia *americana*)	37.4	64% (16 of 25)
Bulrush (*Scirpus spp.*)	trace	4% (1 of 25)
Common buttonbush (Cephalanthus occidentalis)		76% (19 of 25)
Cattail (*Typha spp.*)	1.8	
Smartweed (Polygonum hydropiperoides)		16% (4 of 25)
American lotus (*Nelumbo lutea*)		4% (1 of 25)
Sword plant (*Echinodorus spp.)*		4% (1 of 25)
Giant reed (*Arundo donax)*		4% (1 of 25)

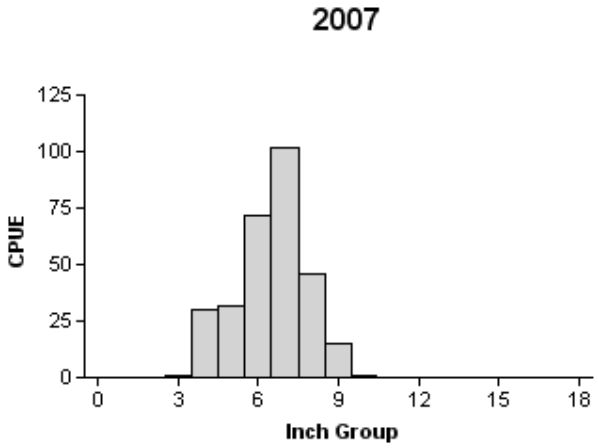
Table 8. Percent directed angler effort by species at Pat Cleburne Reservoir, Texas, Fall Quarter 2015. Survey period was from 1 September through 30 November.

Species	Fall Quarter 2015
Catfish Spp.	32.7
White Bass	5.1
Sunfish Spp.	0.6
Largemouth Bass	24.9
Crappie Spp.	7.7
Anything	29.0

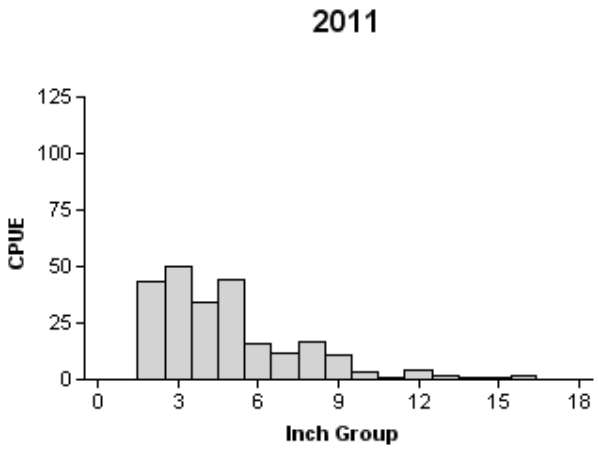
Table 9. Total fishing effort (h) for all species and total directed expenditures at Pat Cleburne Reservoir, Texas, Fall Quarter 2015. Survey period was from 1 September through 30 November. Relative standard error is in parentheses.

Creel survey statistic	Fall Quarter 2015
Total fishing effort	11,662 (20)
Total directed expenditures	$199,799 (219)

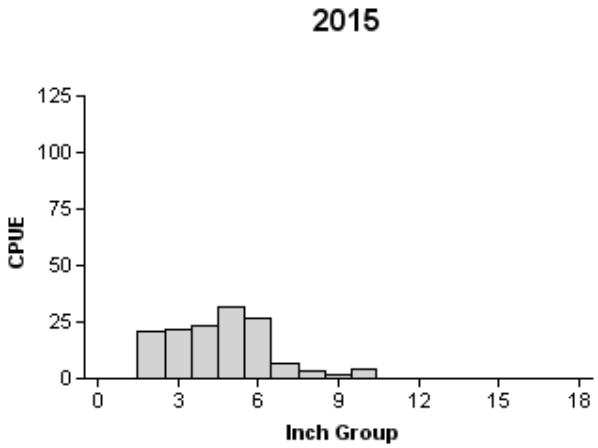
Gizzard Shad



Effort = 1.0
Total CPUE = 299.0 (24; 299)
Stock CPUE = 164.0 (25; 164)
IOV = 79 (4)



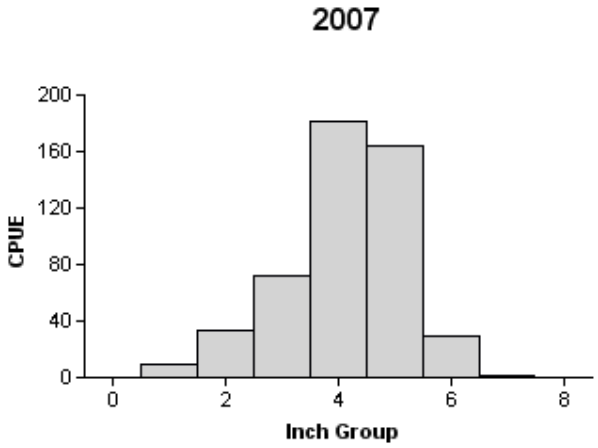
Effort = 1.0
Total CPUE = 241.0 (31; 241)
Stock CPUE = 54.0 (30; 54)
IOV = 83 (5)



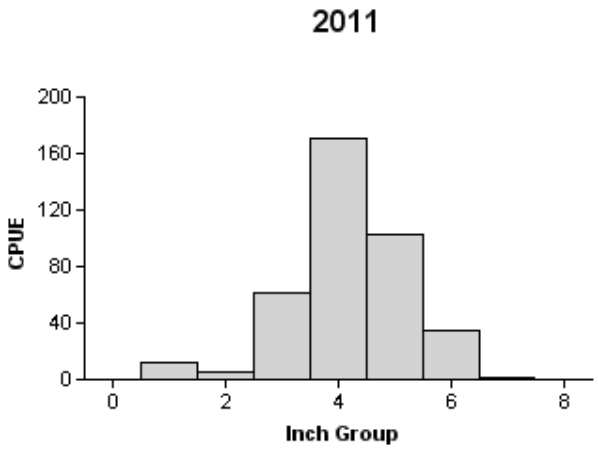
Effort = 1.0
Total CPUE = 141.0 (43; 141)
Stock CPUE = 16.0 (50; 16)
IOV = 94 (3)

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, 2007, 2011 and 2015.

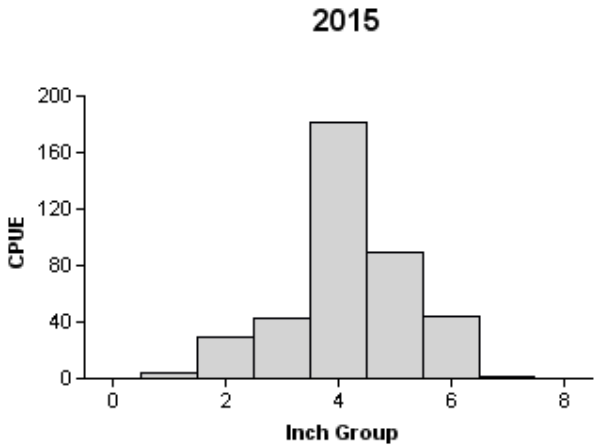
Bluegill



Effort = 1.0
Total CPUE = 492.0 (28; 492)
Stock CPUE = 449.0 (29; 449)
PSD = 7 (3)



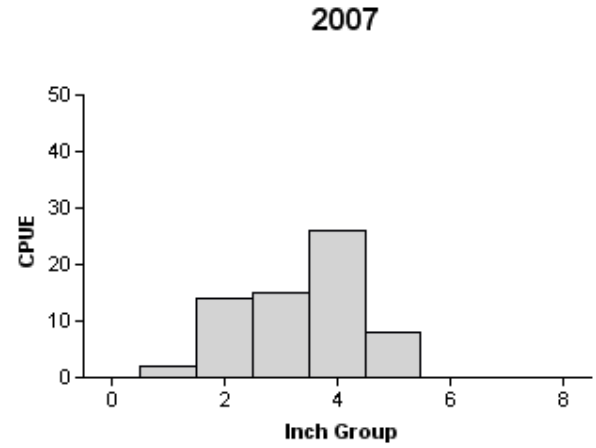
Effort = 1.0
Total CPUE = 391.0 (47; 391)
Stock CPUE = 373.0 (49; 373)
PSD = 10 (2)



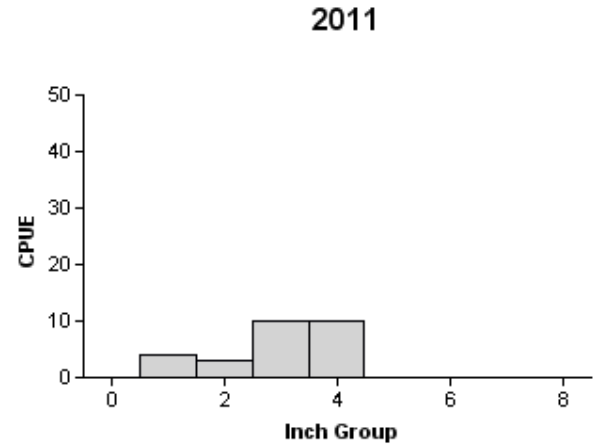
Effort = 1.0
Total CPUE = 393.0 (32; 393)
Stock CPUE = 360.0 (33; 360)
PSD = 13 (4)

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, 2007, 2011 and 2015.

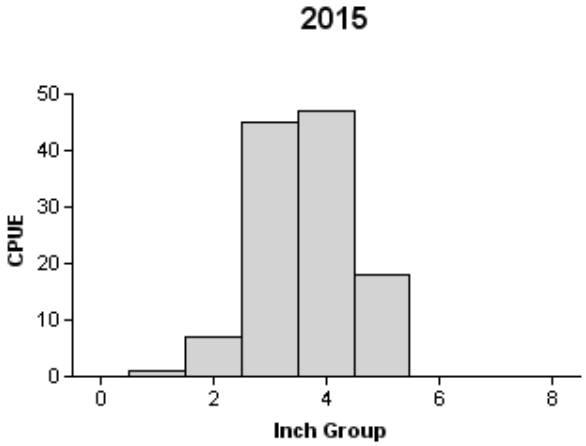
Longear Sunfish



Effort = 1.0
Total CPUE = 65.0 (45; 65)
Stock CPUE = 65.0 (45; 65)
PSD = 100 (0)



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



Effort = 1.0
Total CPUE = 118.0 (40; 118)
Stock CPUE = 118.0 (40; 118)
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, 2007, 2011 and 2015.

Blue Catfish

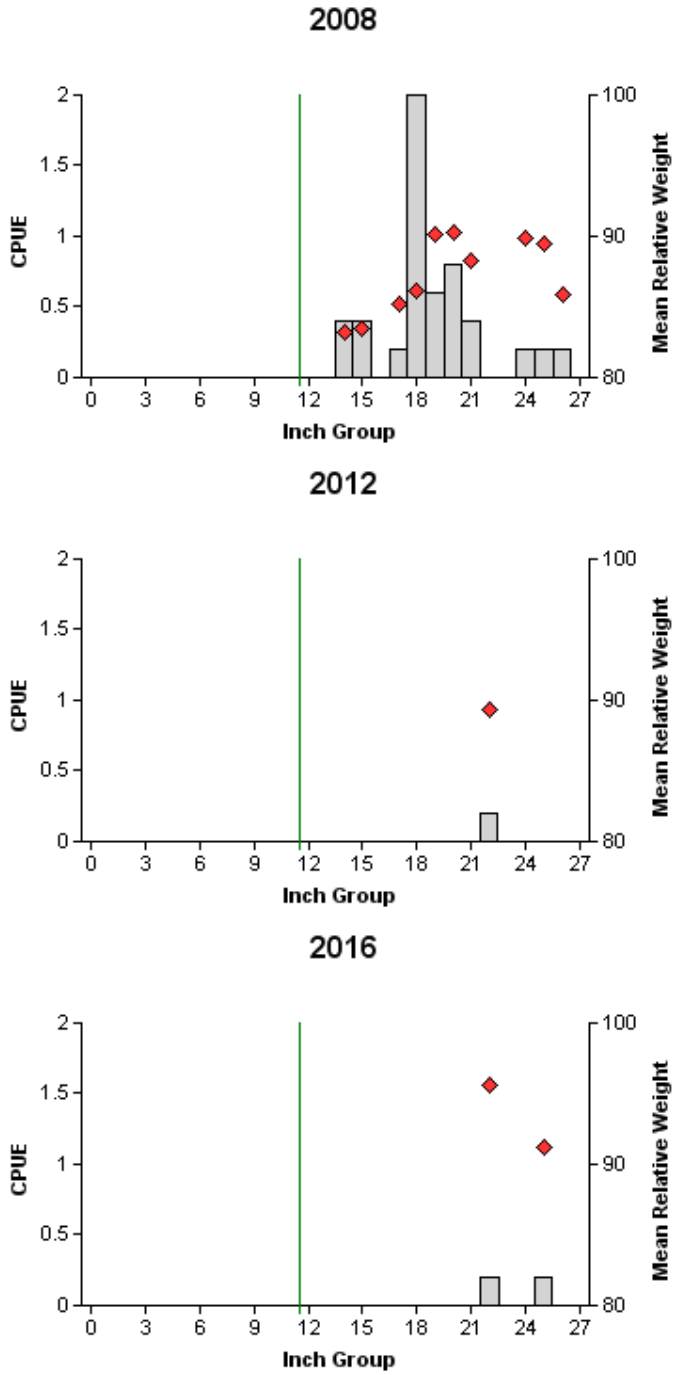


Figure 5. Number of Blue Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Pat Cleburne Reservoir, Texas, 2008, 2012 and 2016. The vertical line represents the minimum length limit.

Blue Catfish

Table 10. Creel survey statistics for catfishes at Pat Cleburne Reservoir, Texas, from September 2015 through November 2015. Directed effort, Directed effort/acre and total catch per hour are for anglers targeting Blue Catfish and Channel Catfish combined, while total harvest is the estimated number of Blue Catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Fall Quarter 2015
Surface area (acres)	1,568
Directed effort (h)	3,816.60 (27)
Directed effort/acre	2.43 (27)
Total catch/hour	0.13 (58)
Total harvest	839.10 (199)
Harvest/acre	0.54 (199)
Percent legal released	0.0

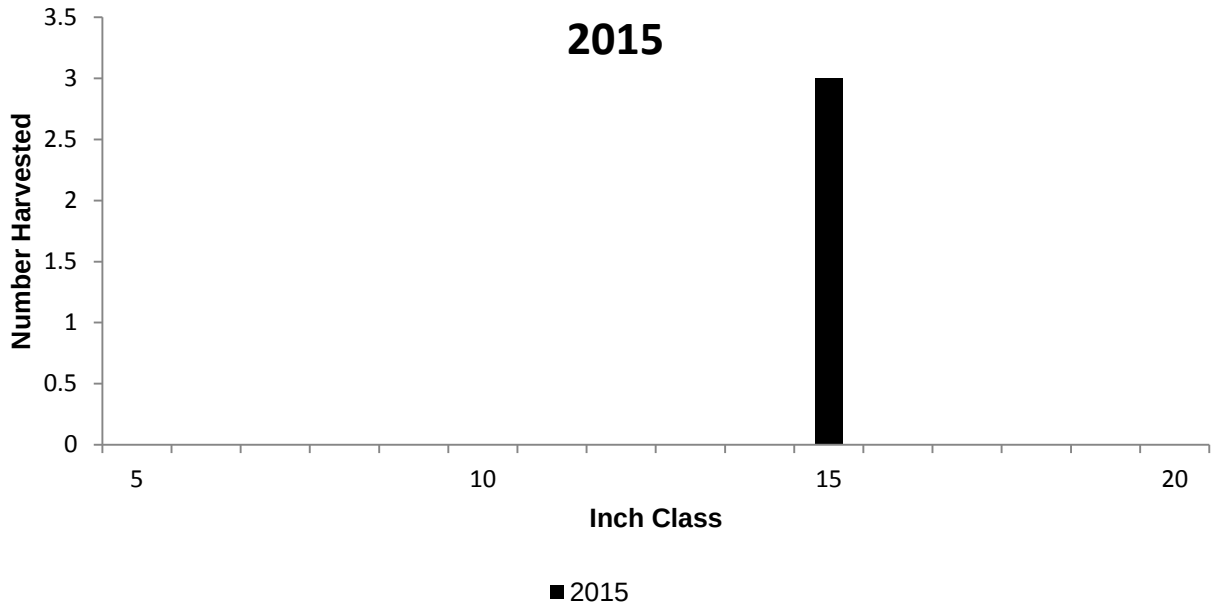
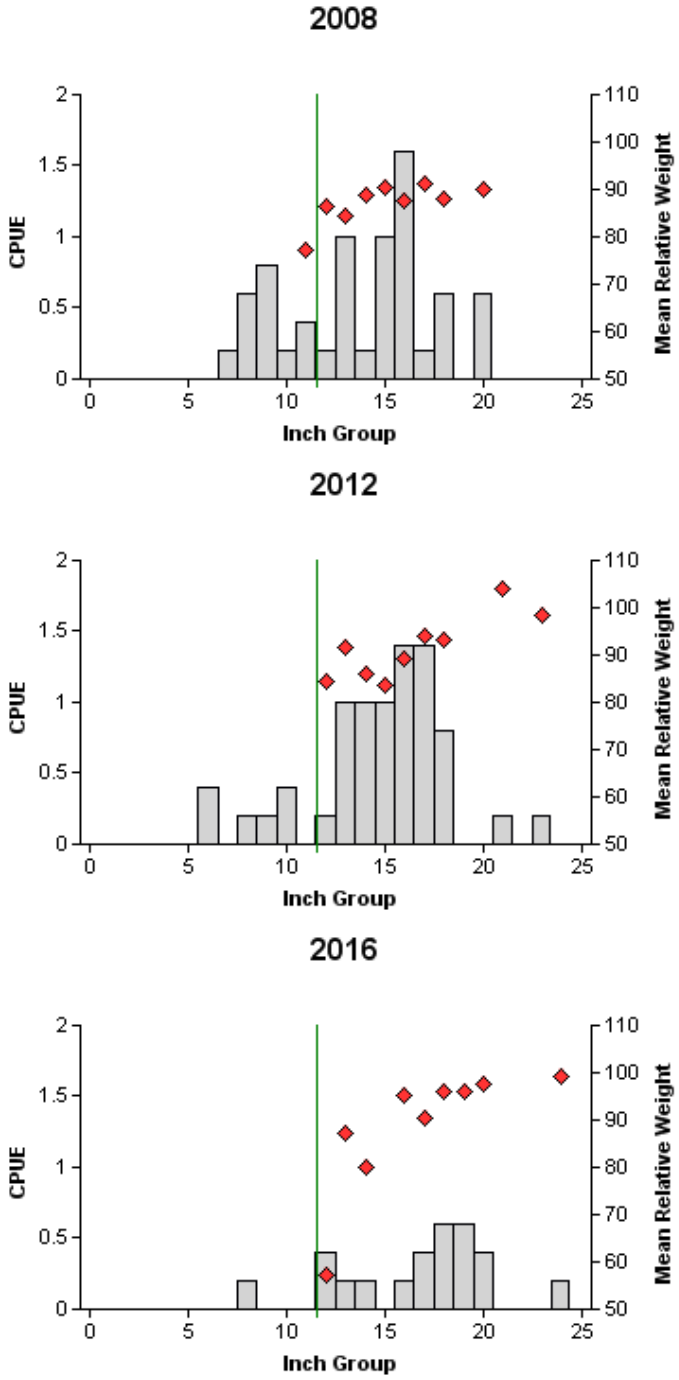


Figure 6. Length frequency of harvested Blue Catfish observed during creel surveys at Pat Cleburne Reservoir, Texas, September 2015 through November 2015, all anglers combined. The number of harvested Blue Catfish observed during creel surveys was 3 fish, and the total estimated harvest for the creel survey period was 839 fish.

Channel Catfish



Effort = 5.0
Total CPUE = 7.6 (15; 38)
Stock CPUE = 5.8 (17; 29)
PSD = 52 (12)
PSD-12 = 93 (5)

Effort = 5.0
Total CPUE = 8.4 (35; 42)
Stock CPUE = 7.2 (44; 36)
PSD = 56 (10)
PSD-12 = 100 (0)

Effort = 5.0
Total CPUE = 3.4 (43; 17)
Stock CPUE = 3.2 (40; 16)
PSD = 75 (22)
PSD-12 = 100 (0)

Figure 7. 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, 2008, 2012 and 2016. The vertical line represents the minimum length limit.

Channel Catfish

Table 11. Creel survey statistics for catfishes at Pat Cleburne Reservoir, Texas, from September 2015 through November 2015. Directed effort, Directed effort/acre and total catch per hour are for anglers targeting Channel Catfish and Blue Catfish combined, while total harvest is the estimated number of Channel Catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Fall Quarter 2015
Surface area (acres)	1,568
Directed effort (h)	3,816.60 (27)
Directed effort/acre	2.43 (27)
Total catch per hour	0.13 (58)
Total harvest	100.10 (97)
Harvest/acre	0.06 (97)
Percent legal released	0.0

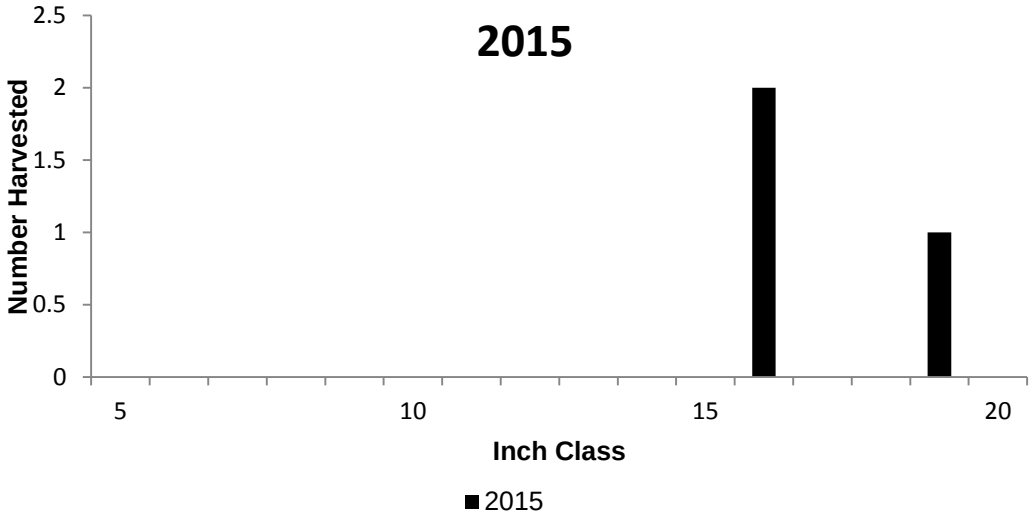
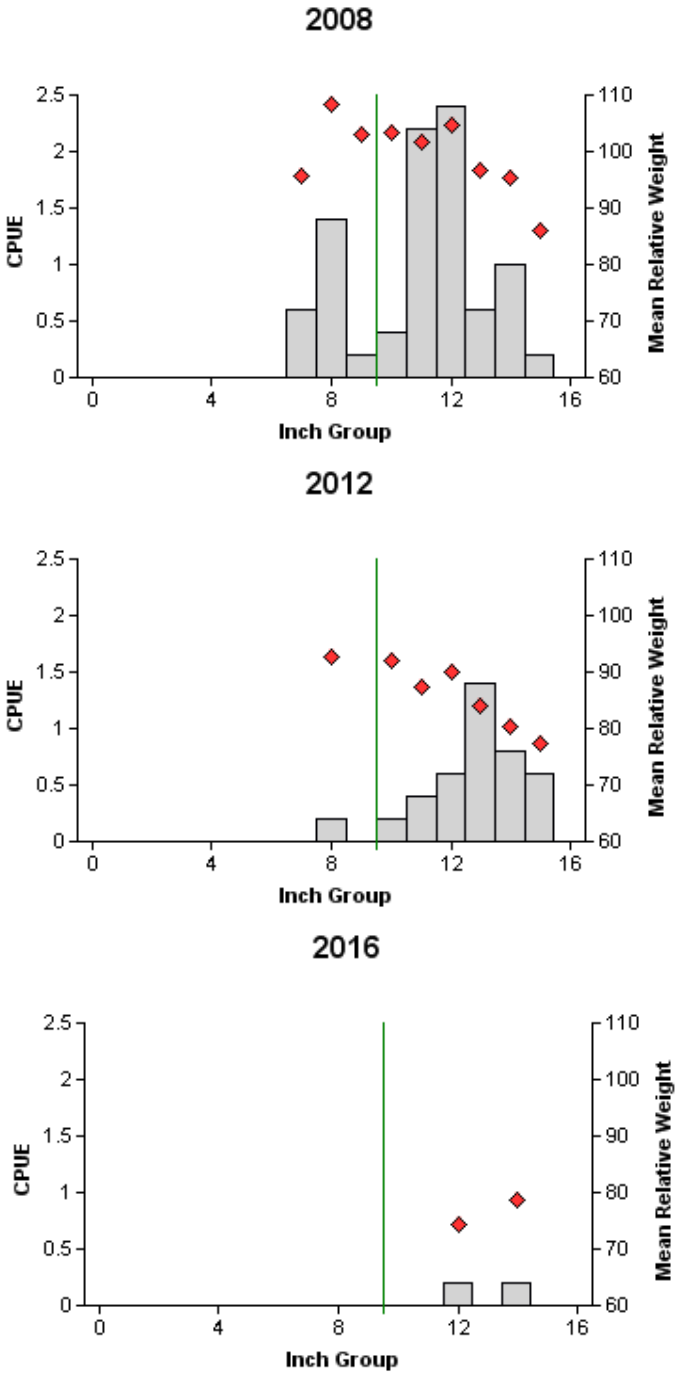


Figure 8. Length frequency of harvested Channel Catfish observed during creel surveys at Pat Cleburne Reservoir, Texas, September 2015 through November 2015, all anglers combined. The number of harvested Channel Catfish observed during creel surveys was 3 fish, and the total estimated harvest for the creel survey period was 100 fish.

White Bass



2008
Effort = 5.0
Total CPUE = 9.0 (54; 45)
Stock CPUE = 9.0 (54; 45)
PSD = 78 (12)
PSD-10 = 76 (14)

2012
Effort = 5.0
Total CPUE = 4.2 (62; 21)
Stock CPUE = 4.2 (62; 21)
PSD = 95 (2)
PSD-10 = 95 (2)

2016
Effort = 5.0
Total CPUE = 0.4 (61; 2)
Stock CPUE = 0.4 (61; 2)
PSD = 100 (0)
PSD-10 = 100 (0)

Figure 9. 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, 2008, 2012 and 2016. The vertical line represents the minimum length limit.

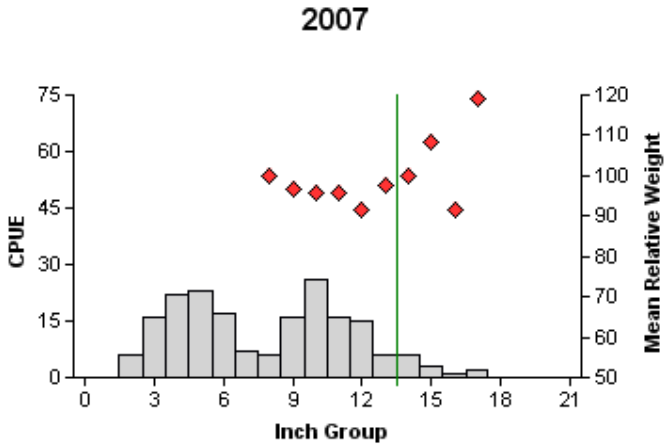
White Bass

Table 12. Creel survey statistics for White Bass at Pat Cleburne Reservoir, Texas, from September 2015 through November 2015. Total catch per hour is for anglers targeting White Bass and total harvest is the estimated number of White Bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

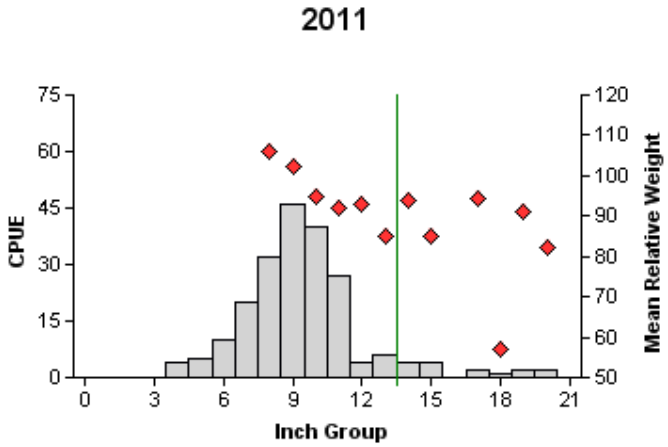
Creel survey statistic	Fall Quarter 2015
Surface area (acres)	1,568
Directed effort (h)	598.63 (55)
Directed effort/acre	0.38 (55)
Total catch per hour	0.83 (72)
Total harvest	5034.62 (93)
Harvest/acre	3.21 (93)
Percent legal released	1.5

Figure 10. Length frequency of harvested White Bass observed during creel surveys at Pat Cleburne Reservoir, Texas, September 2015 through November 2015, all anglers combined. The number of harvested White Bass observed during creel surveys was 18 fish, and the total estimated harvest for the creel survey period was 5,035 fish.

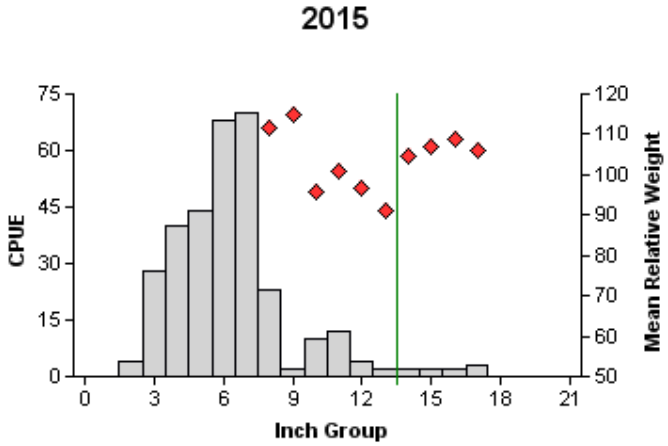
Largemouth Bass



Effort = 1.0
Total CPUE = 188.0 (25;188)
Stock CPUE = 97.0 (24; 97)
PSD = 34 (5)
PSD-14 = 12 (5)



Effort = 1.0
Total CPUE = 209.0 (54;209)
Stock CPUE = 170.0 (52; 170)
PSD = 15 (6)
PSD-14 = 9 (5)



Effort = 1.0
Total CPUE = 316.0 (19;316)
Stock CPUE = 62.0 (33; 62)
PSD = 24 (9)
PSD-14 = 15 (6)

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, 2007, 2011 and 2015. The vertical line represents the minimum length limit.

Largemouth Bass

Table 13. Creel survey statistics for Largemouth Bass at Pat Cleburne Reservoir, Texas, from September 2015 through November 2015. Total catch per hour is for anglers targeting Largemouth Bass and total harvest is the estimated number of Largemouth Bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Fall Quarter 2015
Surface area (acres)	1,568
Directed effort (h)	2,899.88 (31)
Directed effort/acre	1.85 (31)
Total catch per hour	1.11 (38)
Total harvest	839.10 (100)
Harvest/acre	0.54 (100)
Percent legal released	5.9

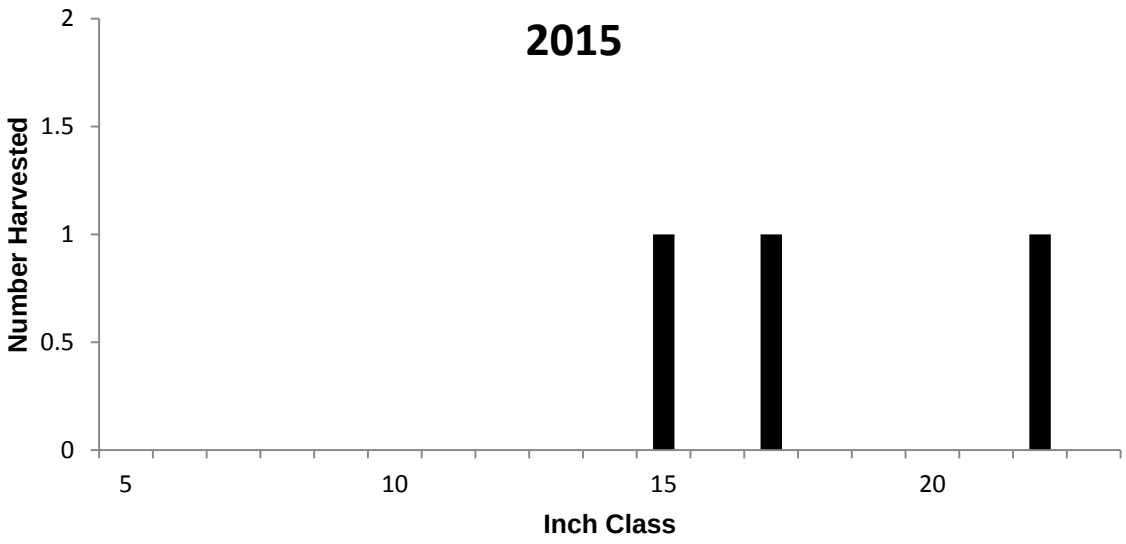
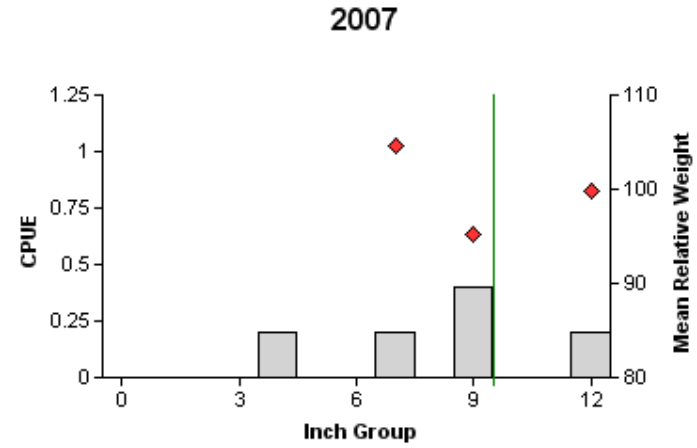


Figure 12. Length frequency of harvested Largemouth Bass observed during creel surveys at Pat Cleburne Reservoir, Texas, September 2015 through November 2015, all anglers combined. The number of harvested Largemouth Bass observed during creel surveys was 3 fish, and the total estimated harvest for the creel survey period was 839 fish.

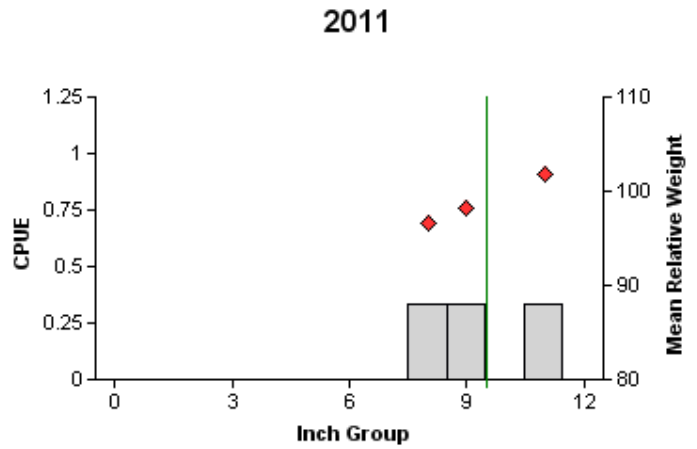
Table 14. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Pat Cleburne Reservoir, Texas, 2003, 2007 and 2015. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB. Genetic composition was determined by electrophoresis prior to 2005 and with micro-satellite DNA analysis since 2005.

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

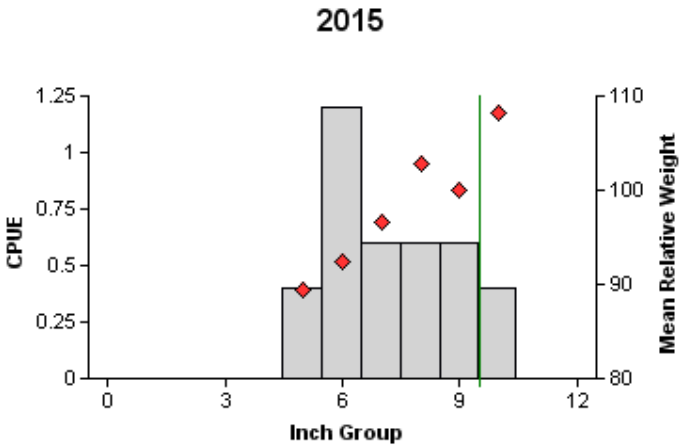
White Crappie



Effort = 5.0
Total CPUE = 1.0 (0; 5)
Stock CPUE = 0.8 (0; 4)
PSD = 75 (0)
PSD-10 = 25 (0)



Effort = 6.0
Total CPUE = 1.0 (63; 6)
Stock CPUE = 1.0 (63; 6)
PSD = 100 (0)
PSD-10 = 33 (0)



Effort = 5.0
Total CPUE = 3.8 (32; 19)
Stock CPUE = 3.8 (32; 19)
PSD = 42 (16)
PSD-10 = 11 (7)

Figure 13. 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, 2007, 2011 and 2015. The vertical line represents the minimum length limit.

White Crappie

Table 15. Creel survey statistics for all crappie species at Pat Cleburne Reservoir, Texas, from September 2015 through November 2015. Directed effort, Directed effort/acre and total catch per hour are for anglers targeting crappie (White Crappie and Black Crappie combined) while total harvest is the estimated number of White Crappie harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Fall Quarter 2015
Surface area (acres)	1,568
Directed effort (h)	895.51 (46)
Directed effort/acre	0.57 (46)
Total catch per hour	6.39 (51)
Total harvest	8,670.74 (92)
Harvest/acre	5.53 (92)
Percent legal released	1.5

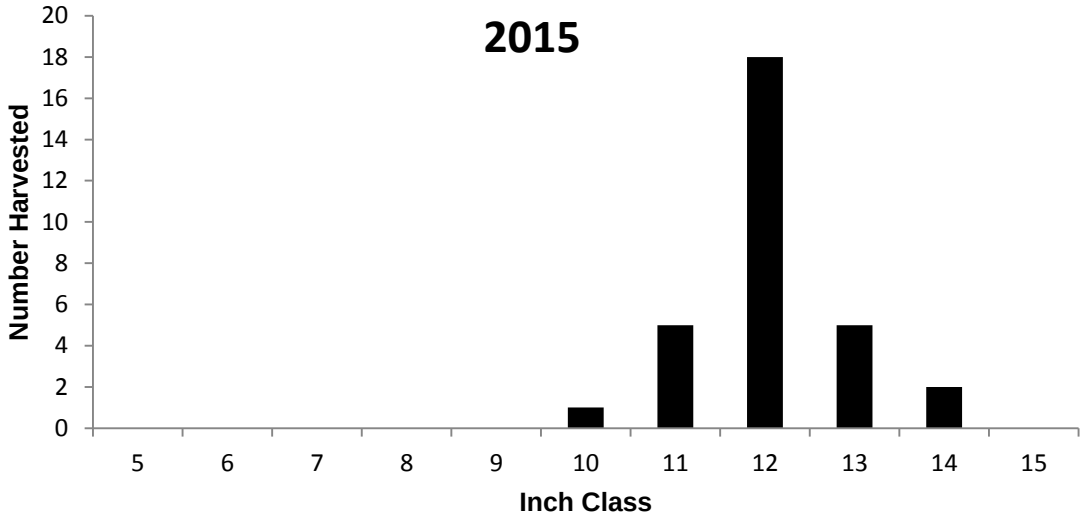


Figure 14. Length frequency of harvested White Crappie observed during creel surveys at Pat Cleburne Reservoir, Texas, September 2015 through November 2015, all anglers combined. The number of harvested White Crappie observed during creel surveys was 31 fish, and the total estimated harvest for the creel survey period was 8,671 fish.

Table 16. 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	Electrofish Fall	Trap net	Gill net	Habitat		Access	Creel survey	Report
				Structural	Vegetation			
2016-2017								
2017-2018								
2018-2019								
2019-2020	S	S	S		S	S		S

APPENDIX A

Number (N), relative standard error (RSE) and catch rate (CPUE) of all target species collected from all gear types from Pat Cleburne Reservoir, Texas, 2015-2016.

Species	Gill Netting		Trap Netting		Electrofishing	
	N/RSE	CPUE	N/RSE	CPUE	N/RSE	CPUE
Gizzard Shad					141/43	141.00
Threadfin Shad					91/67	91.00
Blue Catfish	2/100	0.40				
Channel Catfish	17/43	3.40				
White Bass	2/61	0.40				
Green Sunfish					3/100	3.00
Warmouth					5/46	5.00
Bluegill					393/32	393.00
Longear Sunfish					118/40	118.00
Redear Sunfish					25/29	25.00
Largemouth Bass					316/19	316.00
White Crappie	9/51	1.80	19/32	3.80		

APPENDIX B

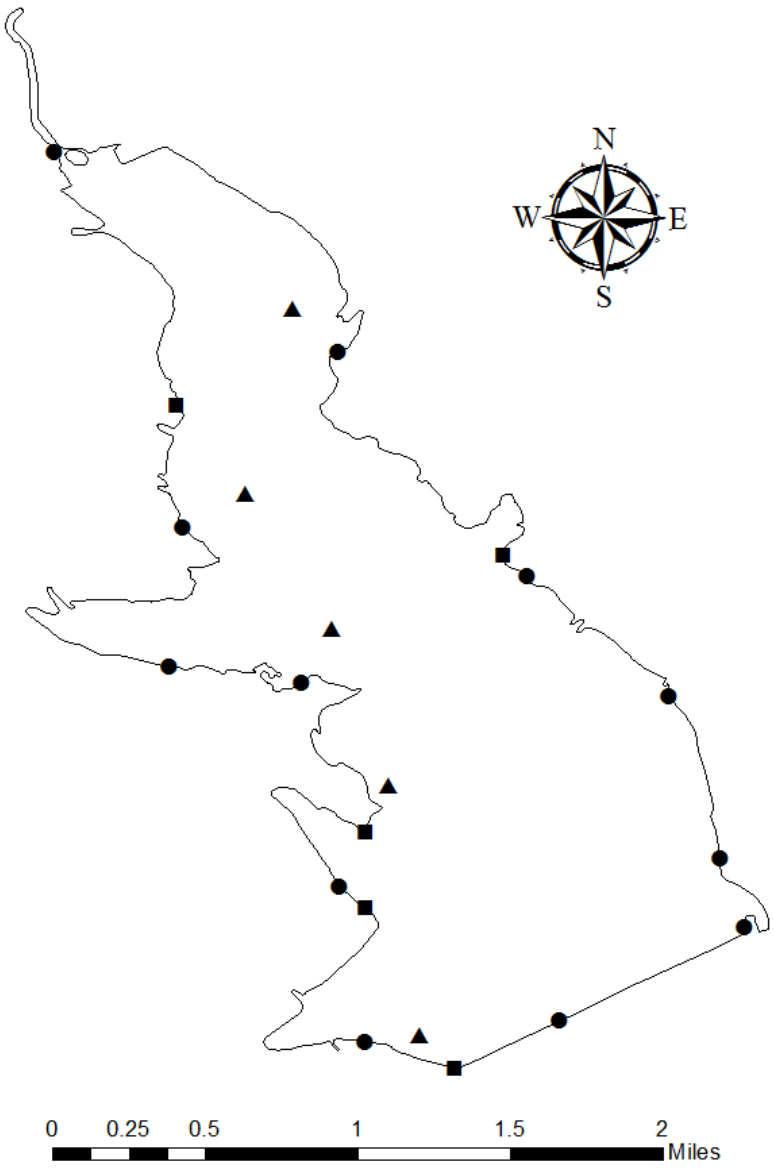
Catch rates (CPUE) of targeted species by gear type for standard surveys on Pat Cleburne Reservoir, Texas, 1991 to present. Surveys prior to 1996 utilized biologist-selected stations while those after 1996 utilized randomly-selected stations. Electrofishing stations were conducted with a 5.0 Smith-Root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

	Electrofishing							
	Bass	Shad		Sunfish				
Year	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
Avg.	**162.0**	**411.0**	**115.0**	**308.0**	**59.0**	**6.0**	**3.0**	**25.0**

APPENDIX B CONT.

	Gill nets				Trap nets	
	Catfish			Bass	Crappie	
Year	Blue	Channel	Flathead	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
Avg.	**5.1**	**6.2**	**0.5**	**7.2**	**19.7**	**0.2**

APPENDIX C



Location of sampling sites, Pat Cleburne Reservoir, Texas, 2015-2016. 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.