Big Creek Reservoir

2023 Fisheries Management Survey Report

PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-5

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

Prepared by:

Quintin Dean, Assistant District Management Supervisor

Inland Fisheries Division
Marshall District, Marshall, Texas

and

Jacob Norman, District Management Supervisor Inland Fisheries Division

Inland Fisheries Division
Tyler District, Tyler, Texas

David Yoskowitz, Ph.D.
Executive Director

Timothy Birdsong
Director, Inland Fisheries

July 31, 2024

Contents

Survey and Management Summary

Fish populations in Big Creek Reservoir were surveyed in 2023 using electrofishing, low-frequency electrofishing, and hoop netting. Historical data are presented with the 2023 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: Big Creek Reservoir is a 520-acre impoundment located on Big Creek in the Sulphur River Basin approximately 1 mile north of Cooper, Texas. Primary water uses include municipal water supply and recreation. Big Creek Reservoir has moderate productivity. Habitat features consisted of natural shoreline, standing timber and limited emergent aquatic vegetation.

Management History: Important sport fish include Largemouth Bass, Channel Catfish, and Blue Catfish. Florida Largemouth Bass were initially stocked in 1988 and last stocked in 2007. All sportfish are managed under the statewide harvest regulation. An angler access project was completed in 2017 to improve parking, boating access, and fishing from the pier.

Fish Community

- **Prey species:** Gizzard Shad were moderately abundant, and nearly all observed were available as prey to most sport fish. Sunfish relative abundance was very low, and all were less than 6-inches long.
- **Catfishes:** Channel Catfish were abundant; fish up to 21 inches were collected. The majority of Channel Catfish had poor condition suggesting prey limitation and potential overcrowding. Blue Catfish have been periodically stocked, most recently in 2017. Natural reproduction of Blue Catfish was confirmed in 2023 and warrants future monitoring.
- **Largemouth Bass:** Catch of Largemouth Bass was very low and few legal-size fish were available to anglers. The low catch of Largemouth Bass is most likely due to a combination of limited littoral habitat, sedimentation, and poor water clarity.

Management Strategies: Improve littoral habitat through re-establishing vegetation and consider projects to reverse negative effects of reservoir ageing. Evaluate the Blue Catfish population with a low-frequency electrofishing survey in 2027. Promote the Channel Catfish fishery. Continue managing all sport fish with statewide harvest regulations.

Introduction

This document is a summary of fisheries data collected from Big Creek Reservoir from 2020-2024. 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 2020-2024 data for comparison.

Reservoir Description

Big Creek Reservoir is a 520-acre impoundment constructed in 1987 on Big Creek in the Sulphur River Basin. It is located in Delta County approximately 1 mile north of Cooper, Texas, and is operated and controlled by the city of Cooper. Primary water uses include municipal water supply and recreation. Big Creek Reservoir was eutrophic with a mean TSI cl-a of 60.2 and has low water clarity with a mean Secchi depth of 0.42 meters (Texas Commission on Environment Quality 2022). The reservoir has been drastically impacted by siltation resulting in high turbidity, limited littoral habitat and poor spawning substrate for fish. Approximately 20% of the reservoir's upper end is difficult to access at full pool due to sedimentation. In 2017, a partnership between the City of Cooper and Texas Parks and Wildlife funded a large-scale project for access and habitat improvements to include extending the boat ramp, dredging the boat ramp channel, removing willow trees, adding two handicap parking spaces, repairing the fishing pier and improving access roads. Habitat at time of sampling consisted of natural shoreline and emergent vegetation. Other descriptive characteristics for Big Creek Reservoir are in Table 1

Angler Access

Big Creek Reservoir has one public boat ramp. Additional boat ramp characteristics are in Table 2. Shoreline access is available at the public park and fishing pier.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Norman 2020) included:

1. Promote quality Channel Catfish fishery.

   Action: While no press releases or social media advertising has occurred, the abundant Channel Catfish population is frequently recommended to anglers via email, phone call and individual inquiries.

2. Seek funding options for large-scale dredging operations.

   Action: Consideration for large-scale dredging operations is on-going.

3. Continue monitoring for invasive species.

   Action: Vegetation survey was conducted in 2023.

Harvest regulation history: Sport fish in Big Creek Reservoir are managed under statewide regulations (Table 3).

Stocking history: Florida Largemouth Bass were initially stocked into Big Creek Reservoir in 1989 and 1990, then again from 1998-2000, and most recently in 2007. Blue Catfish were introduced in 1988 and most recently stocked in 2017. Channel Catfish were introduced in 1989. The complete stocking history is in Table 4.

Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Big Creek Reservoir (Norman 2020). 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 2022).

Common names of fishes and their hybrids in this report are used following Page et al. (2023) with an exception for Largemouth Bass. While we recognize recent changes to black bass names, Texas reservoirs contain a mix of Florida Bass, Largemouth Bass, and their intergrade offspring. Therefore, Largemouth Bass is used in this report for simplicity as well as consistency with previous reports.

Electrofishing – Largemouth Bass, sunfishes, Gizzard Shad, and Threadfin Shad were collected by fall daytime electrofishing (1.0 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.

Low-frequency electrofishing – Blue Catfish were collected by low-frequency electrofishing at 4 stations. The minimum duration of electrofishing at each station was 3 minutes. Total sampling time was 18 minutes. CPUE for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing.

Tandem hoop nets – Channel Catfish were collected using 6 tandem hoop-net series at 6 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 Neumann et al. (2012). Index of Vulnerability (IOV) was calculated for Gizzard Shad (DiCenzo et al. 1996). Standard error (SE) was calculated for structural indices and IOV. Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE.

Habitat – A vegetation survey was conducted in 2023. Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2022).

Results and Discussion

Habitat: Historically, Big Creek contained abundant aquatic vegetation, consisting predominantly of American lotus and Eurasian watermilfoil. By 2015, aquatic vegetation occupied less than 3% of the reservoir's surface area. The 2023 vegetation survey measured 3.4 acres of native emergent vegetation and 9.2 acres of alligatorweed; total vegetation coverage was under 2.5% for the waterbody (Table 6). Loss of vegetated habitat can be contributed to the effects of reservoir aging, primarily sedimentation and water clarity (Texas Water Development Board 2022). A structural survey was conducted in 2007 and has not significantly changed since (Jubar and Storey 2008).

Prey species: Electrofishing catch rates of Gizzard Shad was lower in 2023 (148.0/h) compared to 2019 (389.0/h) however, Gizzard and Threadfin shad continue to be the primary forage species available. Index of Vulnerability (IOV) for Gizzard Shad continued to be excellent in 2023, indicating that 99% of Gizzard Shad were available to existing predators (Figure 1). Longear Sunfish were the only sunfish species observed in 2023, had low abundance (CPUE = 11/h) and were all under 5 inches in length (Appendix A).

Channel Catfish: The 2023 hoop net catch rate was notably higher (245.3/series) compared to 2019 (97.2/series) (Figure 2). Both hoop net surveys had a consistent catch rate (25/series) for fish greater than 15 inches in length, however, body condition was poor for most size classes (W_r range: 70-83). Poor

relative weights, a moderate prey base, and exceedingly high abundance suggests increased angler harvest would benefit the Channel Catfish in Big Creek reservoir.

Blue Catfish were not observed during the 2019 or 2023 hoop net surveys. An exploratory low-frequency survey was conducted in 2023 to determine if Blue Catfish could be captured and monitored with this gear on Big Creek Reservoir. A total of 42 Blue Catfish were captured and ranged from 5 to 27 inches in length with most individuals less than 10 inches (Figure 3). The abundance of fish observed < 7 inches suggests some level of Blue Catfish reproduction has occurred in the reservoir; Blue Catfish were last stocked in 2017.

Largemouth Bass: The electrofishing catch rate of Largemouth Bass was low over the last two daytime surveys (CPUE range: 18.0/h – 23.0/h; Figure 4). The number of fish above the legal minimum length (14 inches) was low for both 2019 and 2023. However, the small sample size in 2019 and 2023 limits the ability to assess population size structure precisely and extra sampling was not warranted with the amount of effort required to adequately assess these metrics. Age and growth analysis was not conducted as a result of inadequate sample sizes. The sharp decline in Largemouth Bass abundance is likely driven by declining water quality, high sedimentation, and limited quality littoral habitat.

Fisheries Management Plan for Big Creek Reservoir, Texas

Prepared – July 2013

ISSUE 1: Littoral habitat at Big Creek Reservoir has greatly diminished over the past two decades. Between 1997 and 2003, aquatic vegetation occupied 26.7 - 36.7% of the reservoir surface area (Storey and Myers 2000, Storey and Myers 2004). With adequate aquatic vegetation, Largemouth Bass and sunfish species were abundant. The effects of reservoir ageing, primarily siltation, has greatly diminished the littoral habitat in Big Creek Reservoir and efforts to improve the sport fish populations in this waterbody will be negligible without first re-establishing quality littoral habitat.

MANAGEMENT STRATEGIES

1. Consider low-investment, high-reward strategies for re-establishing native aquatic vegetation (i.e. water-willow cuttings, American Lotus seeds, coontail fragments, cutgrass plugs).
2. Contact controlling authority about the feasibility for temporary drawdowns to establish terrestrial vegetation withing the littoral zone.
3. Seek funding options for large-scale dredging operations

ISSUE 2: Channel Catfish abundance in Big Creek Reservoir is excellent, with over 240 fish captured per net series in 2023. As a consequence of high catfish abundance and low abundance of forage species, Channel Catfish body condition is low across all sizes.

MANAGEMENT STRATEGIES

1. Continue efforts to promote the harvest of Channel Catfish through public outreach.
2. Consult with the city of Cooper about purchasing a fish feeder on the pier to improve angle catch of Channel Catfish.
3. Consider removal efforts for Channel Catfish less than 12 inches using fall hoop nets in 2024-2027. Coordinate with hatchery staff on transportation to hatchery ponds or direct stocking into other waterbodies.

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. Giant salvinia and other invasive vegetation species can form dense mats, interfering with recreational activities like fishing, boating, skiing, and swimming. The financial costs of controlling and/or eradicating these types of invasive species are significant. Additionally, the potential for invasive species to spread to other river drainages and reservoirs via watercraft and other means is a serious threat to all public waters of the state.

MANAGEMENT STRATEGIES

1. Cooperate with the controlling authority to post appropriate signage at access points around the reservoir.
2. 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 (2024–2028)

Sport fish, forage fish and other important fishes

Sport fish in Big Creek Reservoir include Largemouth Bass, Blue and Channel Catfish, and crappie. Gizzard and Threadfin Shad, and sunfishes are all present in the reservoir.

Low-density/underutilized fisheries

Blue Catfish: Blue Catfish have periodically been stocked, but traditional survey methods suggest poor survival. An exploratory low-frequency electrofishing survey conducted in 2023 confirmed natural reproduction and affirmed the utility of this gear for monitoring Blue Catfish in Big Creek Reservoir. In 2027, an additional low-frequency electrofishing survey will be conducted. The results of the combined exploratory surveys will be used to direct future, targeted sampling efforts of Blue Catfish.

Crappie: Crappie have historically been present in the reservoir. Historical trap net data indicated a declining population and trap net surveys were discontinued in 2007. Trap net catch rates are likely further hindered by heavy siltation, resulting in flat, shallow water around most of the littoral zone where trap nets are traditionally set. Incidental catch of crappie has occurred during the last two hoop net surveys; however, catch rates and size structure from this gear indicate significant sampling bias, resulting in poor estimates. Anecdotal information has indicated the potential for a trophy crappie fishery on the reservoir, but reports suggest strong year class variation and inconsistent fishing success amongst years. Given the remote location and current low utilization of the reservoir, a traditional creel survey is not a justifiable method to gauge the crappie fishery.

Survey objectives, fisheries metrics and sampling objectives

Largemouth Bass/Forage: Recent electrofishing results have indicated low density populations of Largemouth Bass and sunfish. With very little anecdotal information on angler utilization of the reservoir there is not a substantial justification to conduct a creel survey. Electrofishing surveys will be limited to no more than 12 stations, during the day, every four years to detect any large-scale changes in the

Largemouth Bass population (relative abundance; no target survey precision). This sampling effort will also be sufficient to sample shad and sunfish abundances. No additional effort will be expended after 12 stations as body condition of predators such as Largemouth Bass and Channel Catfish can provide information on forage abundance relative to predator density.

Channel Catfish: The 2023 hoop net data suggests a high abundance of Channel Catfish in Big Creek Reservoir. In the summer of 2027, six baited hoop net series will be set at randomly selected sites to monitor Channel Catfish population trend data (CPUE, PSD, W_r) to detect large scale population fluctuations. Based on previous survey results, 6 net series will be sufficient effort to estimate relative abundance with acceptable precision (RSE<30) and size structure of at least 50 stock-size fish. No additional series will be set. Otoliths will be removed from 13 Channel Catfish between 11.0 and 12.9 inches to determine average age at 12 inches.

Literature Cited

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.

Jubar, A.K. and K.W. Storey 2008. Statewide freshwater fisheries monitoring and management program survey report for Big Creek Reservoir, 2007. Texas Parks and Wildlife Department, Federal Aid in Sport Fish Restoration, Performance Report, Project F-30-R-33, Job A, 20 pp.

Neumann, R. M., C. S. Guy, and D. W. Willis. 2012. Length, weight, and associated indices. Pages 637-676 in A. V. Zale, D. L. Parrish, and T. M. Sutton, editors. Fisheries techniques, 3rd edition. American Fisheries Society, Bethesda, Maryland.

Norman, J. 2020. Statewide freshwater fisheries monitoring and management program survey report for Big Creek Reservoir, 2019. Texas Parks and Wildlife Department, Federal Aid in Sport Fish Restoration, Performance Report, Project F-221-M-4, Austin.19 pp.

Page, L. M., K. E. Bemis, T. E. Dowling, H. S. Espinosa-Perez, L. T. Findley, C. R. Gilbert, K. E. Hartel, R. N. Lea, N. E. Mandrak, M. A. Neighbors, J. J. Schmitter-Soto, and H. J. Walker, Jr. 2023. Common and scientific names of fishes from the United States, Canada, and Mexico. American Fisheries Society, Special Publication 37, Bethesda, Maryland.

Storey, K.W. and R.A. Myers. 2000. Statewide freshwater fisheries monitoring and management program survey report for Big Creek Reservoir, 1999. Texas Parks and Wildlife Department, Federal Aid in Sport Fish Restoration, Performance Report, Project F-30-R-24, 25 pp.

Storey, K.W. and R.A. Myers. 2004. Statewide freshwater fisheries monitoring and management program survey report for Big Creek Reservoir, 2003. Texas Parks and Wildlife Department, Federal Aid in Sport Fish Restoration, Performance Report, Project F-30-R-29, 26 pp.

Texas Commission on Environmental Quality. 2022. Trophic classification of Texas reservoirs. 2022 Texas Water Quality Inventory and 303 (d) List, Austin. 17 pp.

Texas Water Development Board, 2022. Volumetric survey of Big Creek Lake. Contract No. 2348012713 with the City of Cooper, Texas

Tables and Figures

Table 1. Characteristics of Big Creek Reservoir, Texas.

Characteristic	Description
Year constructed	1987
Controlling authority	City of Cooper
Surface area	520 acres
County	Delta
Reservoir type	Tributary
Shoreline Development Index	3.52
Mean depth	12.0 feet
Secchi visibility (range)	1-2 feet
Conductivity	160 µS/cm

Table 2. Boat ramp characteristics for Big Creek Reservoir, Texas, August 2023.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Big Creek	33.39628 -95.69553	Y	12	UNK	Good, no access issues

Table 3. Harvest regulations for Big Creek Reservoir, Texas.

Species	Bag limit	Length limit
Catfish: Channel and Blue Catfish, their hybrids and subspecies	25 (only 10 > 20 inches)	None
Catfish, Flathead	5	18-inch minimum
Bass, Largemouth	5	14-inch minimum
Crappie: White and Black Crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum

Table 4. Stocking history of Big Creek Reservoir, Texas. FRY = fry, FGL = fingerling; AFGL = advanced fingerling; ADL = adults.

Species	Year	Number	Size
Gizzard Shad	1988	60	ADL
Threadfin Shad	1991	1,200	ADL
Blue Catfish	1988	26,000	FRY
	1990	5,269	FGL
	1991	26,135	FGL
	2017	48,391	FGL
	Total	105,795	
Channel Catfish	1989	13,000	AFGL
	1991	13,000	AFGL
	Total	26,000	
Coppernose Bluegill	1988	150,626	FRY
Florida Largemouth Bass	1988	54,057	FRY
	1988	625	AFGL
	1989	10,988	FGL
	1990	38,578	FRY
	1990	2,108	FGL
	1998	52,894	FGL
	1999	51,960	FGL
	2000	4,500	FGL
	2007	123,860	FGL
	Total	339,570	
White Crappie	1988	26,000	FGL

Table 5. Objective-based sampling plan components for Big Creek Reservoir, Texas 2023–2024.

Gear/target species	Survey objective	Metrics	Sampling objective
Electrofishing			
Largemouth Bass	Abundance	CPUE–Stock	
	Size structure	PSD, length frequency	
	Age-and-growth	Age at 14 inches	
	Condition	W_r	
Bluegill [a]	Abundance	CPUE–Total	
	Size structure	PSD, length frequency	
Gizzard Shad [a]	Abundance	CPUE–Total	
	Size structure	PSD, length frequency	
	Prey availability	IOV	
Low-frequency electrofishing			
Blue Catfish	Abundance	CPUE–stock	
	Size structure	Length frequency	
Tandem hoop netting			
Channel Catfish	Abundance	CPUE–stock	RSE-Stock ≤ 25
	Size structure		N ≥ 50 stock
	Age-and-Growth	Age at 12 inches	N = 13, 11.0 – 12.9 inches

Table 6. Survey of aquatic vegetation, Big Creek Reservoir, Texas, 2015, 2020, and 2023. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Vegetation	2015	2020	2023
Native submersed			
Native floating-leaved			
Native emergent	< 3 (<1.0)	<5 (<1.0)	3.3 (<1.0)
Non-native			
Alligator Weed (Tier III)*			9.2 (1.7)

*Tier III is Watch Status

Gizzard Shad

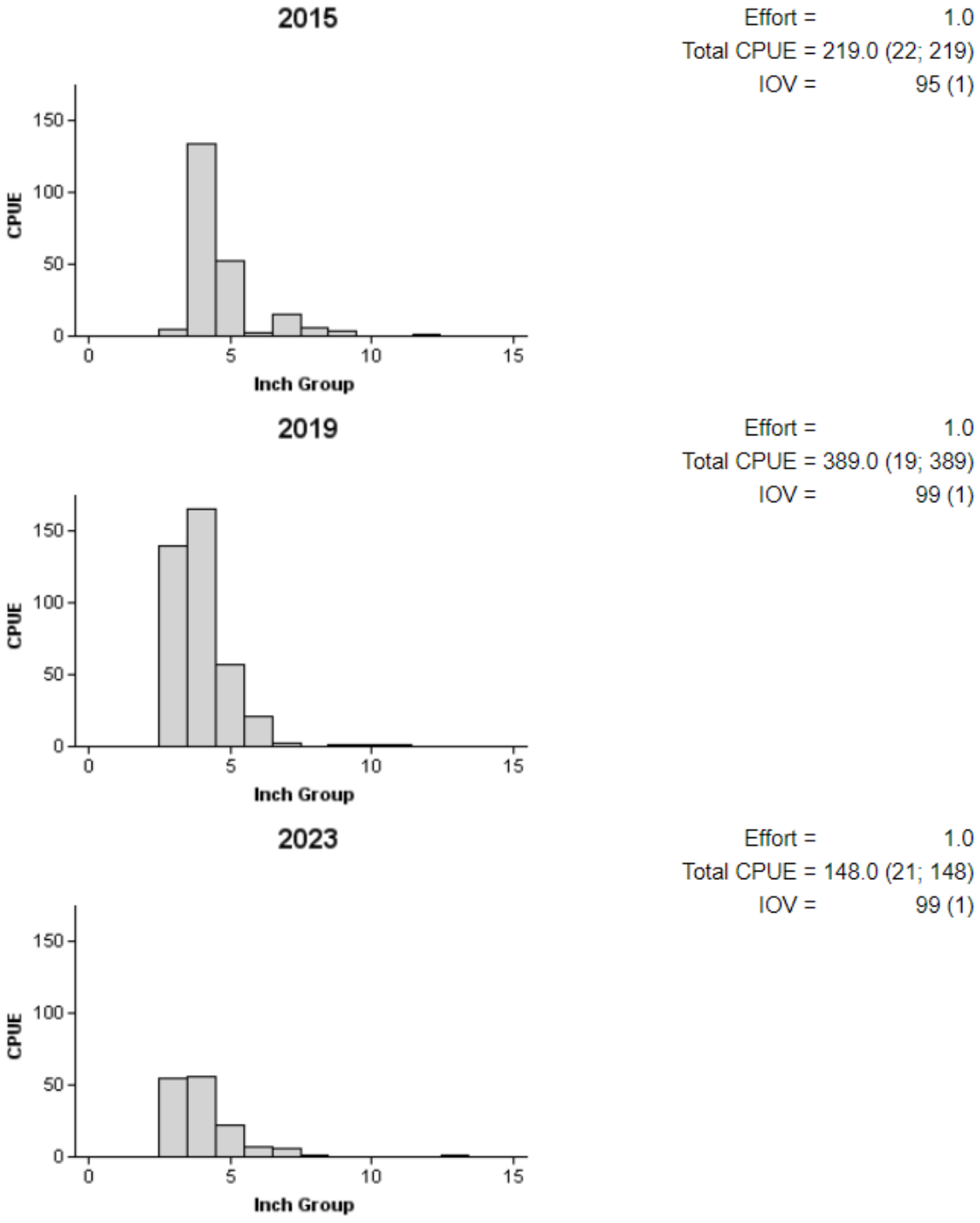


Figure 1. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall daytime electrofishing surveys, Big Creek Reservoir, Texas, 2015, 2019, and 2023.

Channel Catfish

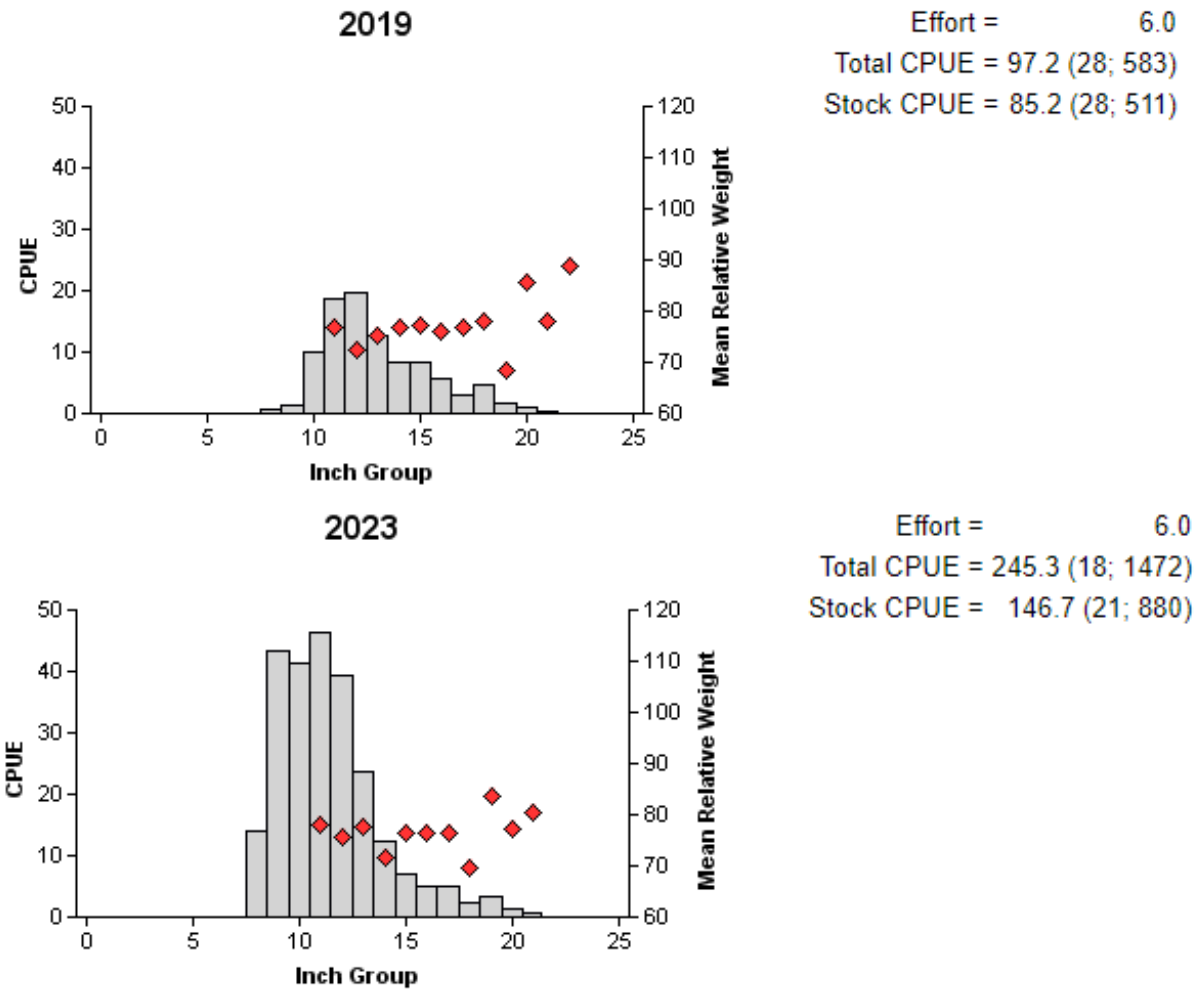


Figure 2. Number of Channel Catfish caught per series (CPUE), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall tandem-hoop net survey, Big Creek Reservoir, Texas, 2019 and 2023.

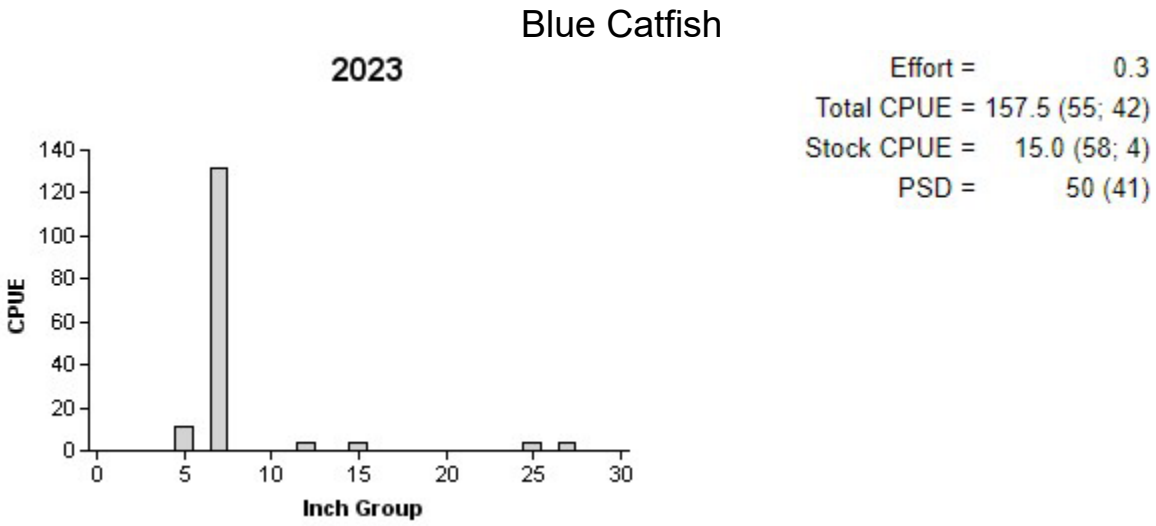


Figure 3. Number of Blue Catfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for low-frequency electrofishing survey, Big Creek Reservoir, Texas, 2023.

Largemouth Bass

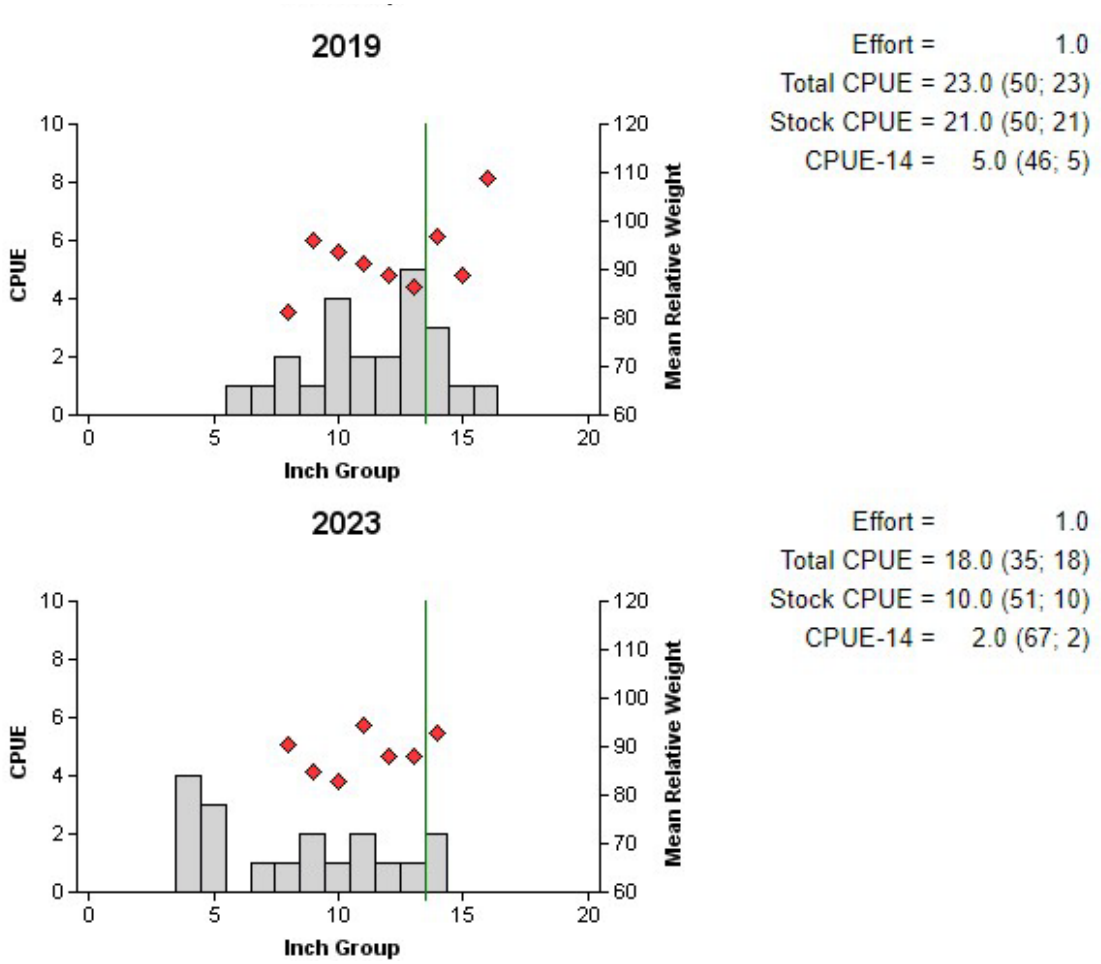


Figure 4. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall daytime electrofishing surveys, Big Creek Reservoir, Texas, 2019 and 2023. Vertical line indicates minimum length limit.

Proposed Sampling Schedule

Table 7. Proposed sampling schedule for Big Creek 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.

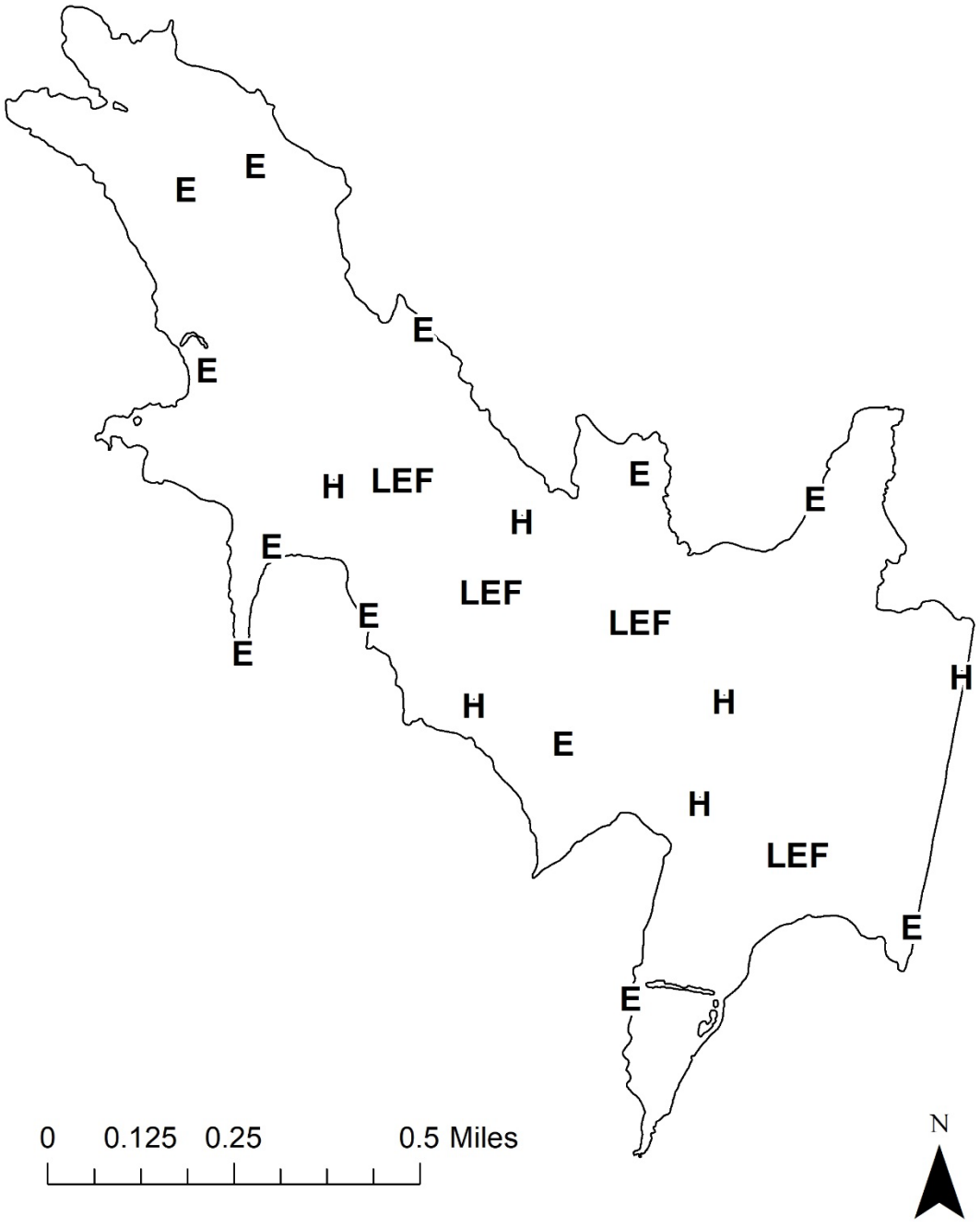
	Survey year			
	2024-2025	2025-2026	2026-2027	2027-2028
Angler Access				X
Vegetation				X
Electrofishing – Fall				X
Electrofishing – Low frequency				X
Baited tandem hoop netting				X
Report				X

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 Big Creek Reservoir, Texas, 2023-2024. Sampling effort was six net nights for hoop netting, one hour for electrofishing, and 0.27 hours for low-frequency electrofishing.

Species	Low-Frequency Electrofishing		Electrofishing		Hoop Netting	
	N	CPUE	N	CPUE	N	CPUE
Gizzard Shad			148	148 (21)		
Threadfin Shad			515	515 (19)		
Blue Catfish	42	157.5 (55)				
Channel Catfish					1,472	245.3 (18)
Longear Sunfish			11	11 (43)		
Largemouth Bass			18	18 (35)		

APPENDIX B – Map of sampling locations



Location of sampling sites, Big Creek Reservoir, Texas, 2023-2024. Hoop net, low-frequency electrofishing, and electrofishing stations are indicated by H, LEF, and E, respectively. Water level was near full pool at time of sampling.

Life's better outside.®

In accordance with Texas State Depository Law, this publication is available at the Texas State Publications Clearinghouse and/or Texas Depository Libraries.