

Greenbelt 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

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July 31, 2020



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Survey and Management Summary

Fish populations in Greenbelt Reservoir were surveyed in 2019 using electrofishing and trap netting. Gill nets were planned in 2020 but were cancelled due to the COVID-19 pandemic. Gill net data from 2019 is included in lieu of the missing 2020 data. Anglers were surveyed from April 2017 through June 2017 with a creel survey. Historical data are presented with the 2019 data for comparison. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

Reservoir Description: Greenbelt Reservoir is a 1,990-acre impoundment located on the Salt Fork of the Red River five miles north of Clarendon in Donley County, Texas. It is controlled by the Greenbelt Municipal and Industrial Water Authority, used for water supply and recreational purposes and has a history of significant water level fluctuations. The reservoir covered 666 acres in 2019. Angler access was good, but boat access is limited to one low-water ramp. At the time of sampling, the habitat was primarily natural and gravel shoreline with some standing timber. Eurasian watermilfoil is present in the waterbody but to date has not negatively affected boating or angler access.

Management History: Important sport fish included Largemouth Bass, Walleye, White Bass, White Crappie, and catfish. Harvest of most species has been managed with statewide limits. An experimental 18-inch minimum length limit, three-fish bag limit was implemented on Smallmouth Bass in 1994 with no documented success. The special regulation was rescinded in 2001.

Fish Community

- **Prey species:** Gizzard Shad and Bluegill were present in Greenbelt Reservoir. Electrofishing catch of Gizzard Shad had decreased but most fish were available as prey to sport fish. Electrofishing catch of Bluegill was high and continued to be dominated by small fish.
- **Catfishes:** Due to the COVID-19 pandemic, Channel Catfish were not sampled in 2020. Data from 2019 indicates that populations were increasing. Angler creel survey data suggested that anglers were actively targeting and harvesting fish. Flathead Catfish were present in the reservoir but catch rates and angler effort were low.
- **Temperate basses:** White Bass were not sampled in 2020 but were present in the reservoir. Gill net data from 2019 indicated that the population was increasing. Directed angler effort was low for White Bass but harvest rates were high.
- **Largemouth Bass:** Largemouth Bass were moderately abundant, and the size structure was increasing. Nearly 33% of anglers at Greenbelt Reservoir fished for Largemouth Bass and catch and release angling was popular. Genetic sampling indicated a strong prevalence of Florida Largemouth Bass influence.
- **White Crappie:** There was a modest population of White Crappie with few legal fish available. Approximately 24% of the angler effort was directed toward crappie.
- **Walleye:** Walleye abundance was low but there were harvestable fish available. There were no documented Walleye anglers in 2017.

Management Strategies: Continue stocking Smallmouth Bass and Walleye to reestablish those populations. Continue to monitor Eurasian watermilfoil and educate the public about the dangers of aquatic invasive species. Conduct additional electrofishing and gill netting surveys in 2021-2022, and general monitoring surveys with trap nets, gill nets, and electrofishing surveys in 2023-2024. Access, habitat, and vegetation surveys will be conducted in 2023.

Introduction

This document is a summary of fisheries data collected from Greenbelt Reservoir in 2019. All sampling activities planned for 2020 were cancelled in response to the COVID-19 pandemic. Data collected in 2019 is reported in lieu of the missing 2020 data. 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 2019 data for comparison.

Reservoir Description

Greenbelt Reservoir is a 1,990-acre impoundment on the Salt Fork of the Red River five miles north of Clarendon in Donley County, Texas. It is owned by the Greenbelt Municipal and Industrial Water Authority and is used for water supply and recreational purposes. The reservoir has a history of water level fluctuations (Figure 1). The reservoir surface area was approximately 666 acres in 2019. At the time of sampling, the habitat was primarily natural and gravel shoreline with some flooded timber. There were also 143 acres of Eurasian watermilfoil documented in 2019. Other descriptive characteristics for Greenbelt Reservoir are in Table 1.

Angler Access

Greenbelt Reservoir has six public boat ramps and no usable private boat ramps. At full pool, angler and boat access is good with six boat ramps and large shoreline access areas. At current water levels (April 2020, 2,627 feet above msl), shoreline access is fair, but boat access is limited to the one low-water ramp (Table 2) and extension of other ramps is not feasible. Additional boat ramp characteristics are in Table 2. There are no ADA compliant angling facilities at Greenbelt Reservoir.

Management History

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

1. Reestablish and monitor Smallmouth Bass and Walleye populations in Greenbelt Reservoir.

Action: Smallmouth Bass fingerlings were requested but were unavailable during this report cycle. Walleye fry were stocked in 2017, 2018, and 2019. Fish populations were monitored using fall electrofishing and spring gill netting.

2. Address parking improvements at the usable boat ramps.

Action: Parking improvements were not completed during the last report cycle.

3. Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically.

Action: Cooperated with the controlling authority and educated the public during contacts about the risks of invasive species. A vegetation survey was completed in 2019 to quantify the spread of Eurasian watermilfoil and Torpedograss.

Harvest regulation history: Sport fishes in Greenbelt Reservoir have been and are currently managed with statewide regulations with one exception. The exception was from 1994 to 2002 when Smallmouth Bass were managed under an 18-inch minimum length limit and 5-fish daily bag limit. Current regulations are found in Table 3.

Stocking history: The reservoir was experimentally stocked with Northern Pike (1967) and Yellow Perch (1983-1986) with limited success. Walleye were introduced in 1974, and Smallmouth Bass in 1980. Walleye were recently stocked in 2017, 2018, and 2019. A complete stocking history is available in Table 4.

Vegetation/habitat management history: Eurasian watermilfoil has not presented access problems under normal water levels. No vegetation or habitat management actions have been taken.

Water transfer: Greenbelt Municipal and Industrial Water Authority provides water from Greenbelt Reservoir, on the Salt Fork of the Red River, to approximately 25,000 people through a 121-mile aqueduct system. There are five cities that use water from this reservoir (Clarendon, Hedley, Childress, Quanah, and Crowell). Water is not transferred out of the Red River basin.

Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Greenbelt Reservoir (Munger and Clayton 2016). 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 2017).

Electrofishing – Largemouth Bass, sunfishes, and Gizzard Shad, were collected by electrofishing (1.1 hour at 13, 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.

Gill netting – The gill net survey was cancelled in 2020 due to concerns about the COVID-19 pandemic. Channel Catfish, White Bass, and Walleye were collected by gill netting in 2019 (5 net nights at 5 stations) and the data from the 2019 survey is reported below. 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 2017). Micro-satellite DNA analysis was used to determine genetic composition of individual fish from 2005 through 2019.

Statistics – Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD), terminology modified by Guy et al. 2007], and condition indices [relative weight (W_r)] were calculated for target fishes according to Anderson and Neumann (1996). Index of Vulnerability (IOV) was calculated for Gizzard Shad (DiCenzo et al. 1996). Standard error (SE) was calculated for structural indices and IOV. Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE and creel statistics.

Creel survey – A roving spring creel survey was conducted from 1 April 2017 through 30 June 2017. Angler interviews were conducted on 7 weekend days and 6 weekdays to assess angler use and fish catch/harvest statistics in accordance with the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2017). The average surface acres for the creel survey period was 830 acres (USGS 2020).

Habitat – A structural habitat survey was conducted in 2019. Vegetation surveys were conducted in 2019 to monitor expansion of Eurasian watermilfoil. Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2017).

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

Results and Discussion

Habitat: Littoral zone structural habitat consisted primarily of gravel and natural shoreline, in addition there were 37 acres of standing timber (Table 6). Eurasian watermilfoil covered 21.6 percent of the reservoir's total surface acres. The proliferation of Eurasian watermilfoil has been variable but appears to be increasing and is most likely linked to water level fluctuations. Coverage was 16.0 percent (112 acres) in 2011, 0.0 percent (0.0 acres) in 2015, and 21.6 percent (143.8 acres) in 2019. There were no native floating or emergent plants recorded during the 2019 vegetation survey (Table 7).

Creel: Directed fishing effort by anglers was highest for Largemouth Bass (32.3%), followed by anglers fishing for White Crappie (23.7%) and Channel Catfish (6.2%) (Table 8). Total fishing effort for all species and direct expenditures at Greenbelt Reservoir were similar across years (Table 9). The analysis of angler ZIP code data indicates that most of the angling pressure at Greenbelt Reservoir was from local anglers (Appendix D).

Prey species: Electrofishing catch rates of Gizzard Shad and Bluegill were 96.0/h and 208.6/h, respectively. Index of Vulnerability (IOV) for Gizzard Shad was good, indicating that 62% of Gizzard Shad were available to existing predators; this was higher than IOV estimates in 2017 but lower than IOV estimates in 2015 (Figure 2). Total CPUE of Gizzard Shad was lower in 2019 compared to the 2017 and 2015 survey data (Figure 2). Total CPUE of Bluegill in 2019 was higher than total CPUE from surveys in 2017 and 2015, and size structure (PSD = 9) continued to be dominated by small individuals (Figure 3).

Channel Catfish: Data collected in 2016, 2018, and 2019 is presented in Figure 4. The gill net catch rate of Channel Catfish was 18.8/nn in 2019. This was an increase from 2018 (CPUE = 6.58) and 2016 (CPUE = 5.4). Size structure was lower in 2019 (PSD = 24) because there was a high catch rate of substock fish which will be available to anglers in future. Directed fishing effort, catch per hour, and total harvest for Channel Catfish showed a moderate catfish fishery (Table 10). Channel Catfish were a harvest-oriented fish as all legal fish were harvested in 2017. Total harvest histogram indicated good angler compliance although the small sample size (N=4) should be noted (Figure 5.). Sampling objectives were not met because the 2020 gill net survey was cancelled.

White Bass: Data collected in 2016, 2018, and 2019 is presented in Figure 6. The gill net catch rate of White Bass was 7.4/nn in 2019 which was an increase from 4.2/nn in 2018 but a decrease compared to the 20.5/nn in 2016. Size structure metrics indicated an unbalanced population with few small fish and poor recruitment. Directed fishing effort of 243 angler hours indicated minimal demand for White Bass. However, catch per hour and total harvest suggest that anglers targeting White Bass were successful (Table 11). White Bass were a harvest-oriented fish as only 34.5% of the legal fish were released. Observed harvest from 2017, 2012, and 2006 showed good angler compliance, and harvested fish ranged in length from 10-14 inches (Figure 7). Sampling objectives were not met because the 2020 gill net survey was cancelled.

Largemouth Bass: The electrofishing catch rate of total and stock-length Largemouth Bass was 109.8/h and 45.2/h in 2019 and 63.2/h and 42.4/h in 2017 (Figure 8). Total catch rates had increased but the catch rate of stock-length fish was stable. Size structure has increased since 2015 and a PSD = 69 was calculated in 2019. The 2019 PSD value is at the upper threshold of what is considered a balanced Largemouth Bass population. Body condition in 2019 was poor (relative weight under 90) for nearly all size classes of fish and has declined since 2015 (Figure 8). Directed fishing effort, catch per hour, and total harvest for Largemouth Bass was 7,381.9 h, 1.11 fish/h, and 142 fish, respectively, from April 2017 through June 2017, and all values increased compared to historic creel survey data (Table 12). The percent legal release was 90.9% in 2017, relatively high for Largemouth Bass in this reservoir. Most of the harvested fish ranged in length from 14 to 16 inches and no sublegal fish was recorded in 2017 (Figure 9). Florida Largemouth Bass influence had increased in 2019 but it is important to note that Florida Largemouth Bass were stocked in 2019 and influenced the results of genetic analysis as some sub-stock length fish were analyzed. Florida alleles increased from 33% (2015) to 38% (2019) and Florida genotype increased from 0% (2015) to 20% (2019, Table 13).

White Crappie: The trap net catch rate of total and stock-length White Crappie was 17.2/nn and 16.8/nn in 2019, similar to 2017 (14.7/nn and 10.7/nn) and higher than 2013 (8.0/nn and 7.6/nn). The PSD was 65 but had been variable when compared to past surveys (Figure 10). Mean relative weight was approximately 90 for most size classes in 2019 and was comparable to values observed in 2017 and 2015 (Figure 10). The objective based sampling criteria prescribed by Munger and Clayton (2016) for relative abundance were not achieved. Directed effort for White Crappie was 5,407.6 hours in 2017, and estimated total harvest was 2,123 fish (Table 14). White Crappie total harvest has been highly variable (Table 14). Size of harvested White Crappie in 2019 ranged from 10 to 15 inches in total length and no sublegal fish were reported. (Figure 11).

Walleye: Data collected in 2016, 2018, and 2019 is presented in Figure 12. The total and stock-length Walleye catch rates were 4.2/nn in 2019. Values were similar to 2018 catch rates and more than 2016 (Figure 12). Size structure metrics (PSD=81 in 2019) indicated an unbalanced population with poor recruitment. Body condition was acceptable with calculated relative weight values greater or equal to 90

for most length categories. There were no harvested Walleye or anglers seeking Walleye recorded in the 2017 creel survey. The lack of Walleye anglers can be attributed to drought and poor lake levels. Sampling objectives were not met because the 2020 gill net survey was cancelled.

Fisheries Management Plan for Greenbelt Reservoir, Texas

Prepared – July 2020

ISSUE 1: Smallmouth Bass historically maintained a self-sustaining population at Greenbelt Reservoir. The population has not recovered following the 2011-12 drought even though lake levels have improved.

MANAGEMENT STRATEGIES

1. Conduct supplemental stocking of Smallmouth Bass to re-establish the population and natural reproduction.
2. Following successful stocking events, personnel will monitor future reproduction to determine if regular stocking is warranted to maintain the populations.

ISSUE 2: Walleye historically maintained a self-sustaining population at Greenbelt Reservoir. Walleye have been reintroduced and the population has reestablished. Due to the likelihood of low water elevations and reservoir aging, it may be necessary to develop a long-term stocking plan to maintain acceptable Walleye populations.

MANAGEMENT STRATEGY

1. Evaluate the feasibility of a biennial Walleye fry stocking schedule. Gill net data will be used to quantify year class strength of stocking and non-stocking years.

ISSUE 3: Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels (*Dreissena polymorpha*) can multiply rapidly and attach themselves to any available hard structure, restricting water flow in pipes, fouling swimming beaches, and plugging engine cooling systems. Giant salvinia (*Salvinia molesta*) and other invasive vegetation species can form dense mats, interfering with recreational activities like fishing, boating, skiing, and swimming. The financial costs of controlling and/or eradicating these types of invasive species are significant. Additionally, the potential for invasive species to spread to other river drainages and reservoirs via watercraft and other means is a serious threat to all public waters of the state.

MANAGEMENT STRATEGIES

1. Cooperate with the controlling authority to post appropriate signage at access points around the reservoir.
2. 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 (2020–2024)

Sport fish, forage fish, and other important fishes

Sport fishes in Greenbelt Reservoir include Channel Catfish, Flathead Catfish, White Bass, Smallmouth Bass, Largemouth Bass, White Crappie, and Walleye. The primary forage species is Gizzard Shad and Bluegill.

Low-density fisheries

Smallmouth Bass: Historically Greenbelt Reservoir maintained a population of Smallmouth Bass, but none have been recorded since 2011. Currently this is a minimal or nonexistent fishery. Staff are working to reestablish Smallmouth Bass, and if stocked the sampling effort will be as described for Largemouth Bass below.

Flathead Catfish: While Flathead Catfish are typically collected in gill nets at a rate of 1-2/nn, past angler surveys have indicated limited directed effort toward this species. Flathead Catfish that are sampled during planned surveys will be recorded.

Survey objectives, fisheries metrics, and sampling objectives

Channel Catfish: Creel survey data collected in 2017 indicates that Channel Catfish received 6.2% of the directed angler effort. General monitoring and trend data will be collected to document any large-scale changes in the fish population. Analysis of past sampling effort indicates that a minimum of 10 randomly selected gill net stations will be necessary to achieve population abundance objectives (CPUE-S; $RSE \leq 25$ with 80% confidence) and size structure indices (PSD: 50 stock-length fish minimum with 80% confidence). Sampling effort in spring 2022 and 2024 will be 5 random gill net stations (Table 15). If survey objectives are not met additional gill net stations will be conducted but total effort will not exceed 10 random stations.

White Bass: Creel survey data collected in 2017 indicates that White Bass received 1.1% of the directed effort. Due to low angler demand, general monitoring and trend data will be collected to document any large-scale changes in the fish population. Analysis of past sampling effort indicates that a minimum of 15 randomly selected gill net stations will be necessary to achieve population abundance objectives (CPUE-S; $RSE \leq 25$ with 80% confidence) and 25 stations will be necessary to estimate size structure indices (PSD: 50 stock-length fish minimum with 80% confidence). Due to excessive effort anticipated to meet minimum sampling criteria and lack of angler demand, sampling effort will be the same as described for Channel Catfish (Table 15).

Largemouth Bass: Creel survey data collected in 2017 estimate that Largemouth Bass received 32.3% of the directed angler effort. General monitoring and trend data for catch rate (abundance) and size structure will be collected to document any large-scale changes in the fish population. Analysis of past sampling efforts indicate that 10 randomly selected stations will be necessary to achieve population abundance objectives (CPUE-S; $RSE \leq 25$ with 80% confidence) and 18 stations will be needed to calculate size structure indices (PSD: 50 stock-length fish minimum with 80% confidence). Sampling effort will be a minimum of 12 randomly selected 5-min electrofishing stations in fall 2021 and 2023 (Table 15). If necessary, additional stations will be planned if sampling objectives are not met. In addition, a 30 fish sample of Largemouth Bass \geq stock length (8 in) will be collected in 2023 for genetic analysis.

White Crappie: Creel survey data collected in 2017 indicate that White Crappie received 23.7% of the directed effort. General monitoring and trend data will be collected to document any large-scale changes in the fish population. Analysis of past sampling effort estimates that a minimum of 18 randomly selected trap net stations will be necessary to achieve population abundance objectives (CPUE-S; $RSE \leq 25$ with 80% confidence) and 7 stations will be necessary to calculate size structure indices (PSD: 50 stock-length fish minimum with 80% confidence). Because trap net data is highly variable, sampling effort will

be 5 randomly selected trap net station in fall 2023 to document presence/absence and minimal population trend data (Table 15).

Walleye: Creel survey data collected in 2017 indicates that Walleye received 0.0% of the directed effort. General monitoring and trend data will be collected to document any large-scale changes in the fish population as staff work to reestablish the Walleye population. Analysis of past sampling effort indicates that a minimum of 25 randomly selected gill net stations will be necessary to achieve population abundance objectives (CPUE-S; $RSE \leq 25$ with 80% confidence) and 20 stations will be necessary to estimate size structure indices (PSD: 50 stock-length fish minimum with 80% confidence). Due to excessive effort anticipated to meet minimum sampling criteria, sampling effort will be the same as described for Channel Catfish (Table 15). In addition, any Walleye observed during other planned surveys will be processed to provide additional data.

Forage: Bluegill and Gizzard Shad are the primary forage species at Greenbelt Reservoir. Continuation of sampling will allow for monitoring of large-scale changes in relative abundance and size structure. Sampling, as per Largemouth Bass above, will allow for general monitoring of large-scale changes of relative abundance, size structure, and IOV data for forage species. No additional effort will be extended beyond what is used for black bass sampling.

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Tables and Figures

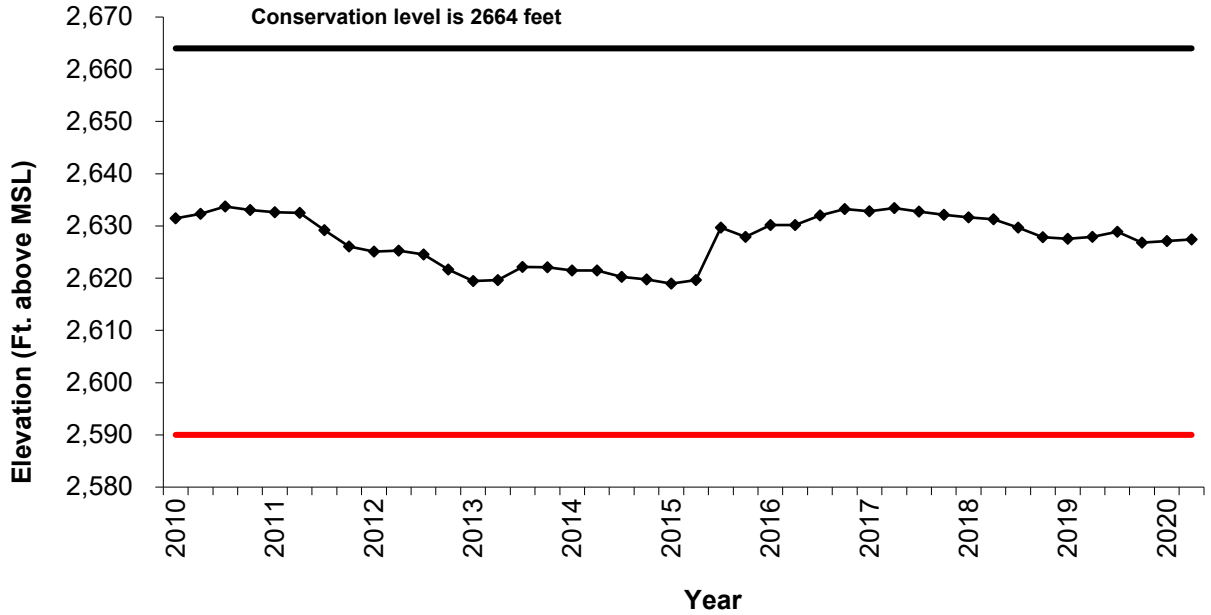


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Greenbelt Reservoir, Texas. Black horizontal line indicates conservation pool (2,664 ft above MSL) and red line indicates dead pool (2,590 ft above MSL).

Table 1. Characteristics of Greenbelt Reservoir, Texas.

Characteristic	Description
Year constructed	1967
Controlling authority	Greenbelt Municipal and Industrial Water Authority
County	Donley
Reservoir type	Mainstream
Shoreline Development Index	2.87
Conductivity	942 μ S/cm

Table 2. Boat ramp characteristics for Greenbelt Reservoir, Texas, August 2019. Reservoir elevation at time of survey was 2,628 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Lakeside Marina	34.99668 -100.89582	Y	20	2,647	Out of water. Extension is not feasible
Kinkaid Park	34.99331 -100.90499	Y	15	2,643	Out of water. Extension is not feasible
Kelly Creek North	34.99392 -100.91020	Y	15	2,645	Out of water. Extension is not feasible
North Ramp	35.01086 -100.89725	Y	30	2,646	Out of water. Extension is not feasible
Salt Fork	35.01721 -100.92597	Y	15	2,646	Out of water. Extension is not feasible
Low water	34.99886 -100.89896	Y	10	2,626	Adequate, rough launch and unpaved parking

Table 3. Harvest regulations for Greenbelt Reservoir, Texas.

Species	Bag limit	Length limit
Catfish: Channel and Blue Catfish, their hybrids and subspecies	25 (in any combination)	12-inch minimum
Catfish, Flathead	5	18-inch minimum
Bass, White	25	10-inch minimum
Bass, Smallmouth and Largemouth	5 (in any combination)	14-inch-minimum
Crappie: White and Black crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum
Walleye	5	No more than 2 under 16 inches

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

Species	Year	Number	Size
Blue Catfish	1967	9,600	UNK
	1971	8,000	UNK
	1982	20,000	UNK
	1987	6,240	FGL
	Total	43,840	
Channel Catfish	1967	30,000	AFGL
	1968	45,000	AFGL
	1969	51,000	AFGL
	1971	8,000	AFGL
	1995	131,455	FGL
	2000	50,000	AFGL
	Total	315,455	
Flathead Catfish	1977	39	UNK
Florida Largemouth Bass	1982	75,333	FGL
	1982	4,000	FRY
	2000	201,025	FGL
	2019	31,140	FGL
	Total	236,165	
Green Sunfish x Redear Sunfish	1967	201,000	UNK
Largemouth Bass	1967	240,000	UNK
	1980	14,523	UNK
	1981	20,000	UNK
	2018	20,426	FGL
	Total	294,949	
Northern Pike	1967	150,000	UNK
Rainbow Trout	1991	3,339	ADL
Smallmouth Bass	1980	5,000	UNK
	1981	72,400	UNK
	1982	100,500	UNK
	1987	30	ADL
	Total	177,930	

Table 4. Stocking history continued.

Species	Year	Number	Size
Walleye	1974	100,000	FRY
	1976	100,000	FRY
	1977	4,600	FRY
	2001	99,000	FGL
	2006	41,200	FGL
	2013	815,000	FRY
	2017	1,681,620	FRY
	2018	812,360	FRY
	2019	592,634	FRY
	Total	4,246,414	
White Crappie	1967	97	UNK
	1968	96	UNK
	Total	193	
Yellow Perch	1983	7,500	FGL
	1985	1,145	FGL
	1986	330	FGL
	Total	8,975	

Table 4. Objective-based sampling plan components for Greenbelt Reservoir, Texas 2019-2020.

Gear/target species	Survey objective	Metrics	Sampling objective
<i>Electrofishing</i>			
Largemouth Bass	Abundance	CPUE – stock	RSE-Stock \leq 25
	Size structure	PSD, length frequency	$N \geq$ 50 stock
	Genetics	% FLMB	$N =$ 30, any age
Gizzard Shad ^a	Abundance	CPUE – Total	RSE \leq 25
	Size structure	PSD, length frequency	$N \geq$ 50
	Prey availability	IOV	$N \geq$ 50
<i>Trap netting</i>			
White Crappie	Abundance	CPUE-stock	RSE-stock \leq 25
	Size structure	PSD, length frequency	$N =$ 50
<i>Gill netting</i>			
Channel Catfish	Abundance	CPUE– stock	RSE-Stock \leq 25
	Size structure	PSD, length frequency	$N \geq$ 50 stock
White Bass	Abundance	CPUE– stock	RSE-Stock \leq 25
	Size structure	PSD, length frequency	$N \geq$ 50 stock
Walleye	Abundance	CPUE– stock	RSE-Stock \leq 25
	Size structure	PSD, length frequency	$N \geq$ 50 stock

^a No additional effort will be expended to achieve an RSE \leq 25 for CPUE of Bluegill and Gizzard Shad if not reached from designated Largemouth Bass sampling effort. Instead, Largemouth Bass body condition can provide information on forage abundance, vulnerability, or both relative to predator density.

Table 5. Survey of structural habitat types, Greenbelt Reservoir, Texas, 2019. Shoreline habitat type units are in miles and open water and standing timber are acres. Total acreage at time of survey was 666 acres.

Habitat type	Estimate	% of total
Bulkhead	1.2 miles	10.2
Gravel	2.5 miles	21.2
Natural	6.4 miles	54.2
Natural with Piers or Boat Docks	1.3 miles	11.0
Rocky	0.4 miles	3.4
Open Water	522.2 acres	78.4
Standing Timber	37.3 acres	5.6

Table 6. Survey of aquatic vegetation, Greenbelt Reservoir, Texas, 2011–2019. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Vegetation	2011	2015	2019
Flooded terrestrial		32.75 (4.4)	
Native floating-leaved		0.10 (0.0)	
Native emergent		29.02 (3.9)	
Non-native			
Eurasian watermilfoil (Tier III)*	112.7 (16.0)	0.01 (0.0)	143.8 (21.6)
Torpedograss (Tier III)*		0.01 (0.0)	

*Tier I is immediate response, Tier III is watch status

Table 7. Percent directed angler effort by species for Greenbelt Reservoir, Texas, 2006, 2012, and 2017. Survey periods were from 1 April through 30 June.

Species	2006	2012	2017
Channel Catfish	7.3	5.9	6.2
White Bass	3.5	0.8	1.1
Bluegill	0.6	1.0	2.0
Largemouth Bass	0.6	23.2	32.3
White Crappie	23.5	31.6	23.7
Walleye	2.9	10.0	0.0
Anything	38.6	24.7	34.7

Table 8. Total fishing effort (h) for all species and total directed expenditures at Greenbelt Reservoir, Texas, 2006, 2012, and 2017. Survey periods were from 1 April through 31 June. Relative standard error is in parentheses.

Creel survey statistic	2006	2012	2017
Total fishing effort	24,751 (20)	19,014 (17)	22,844 (24)
Total directed expenditures	\$161,448 (55)	\$128,498 (47)	\$142,257 (43)

Gizzard Shad

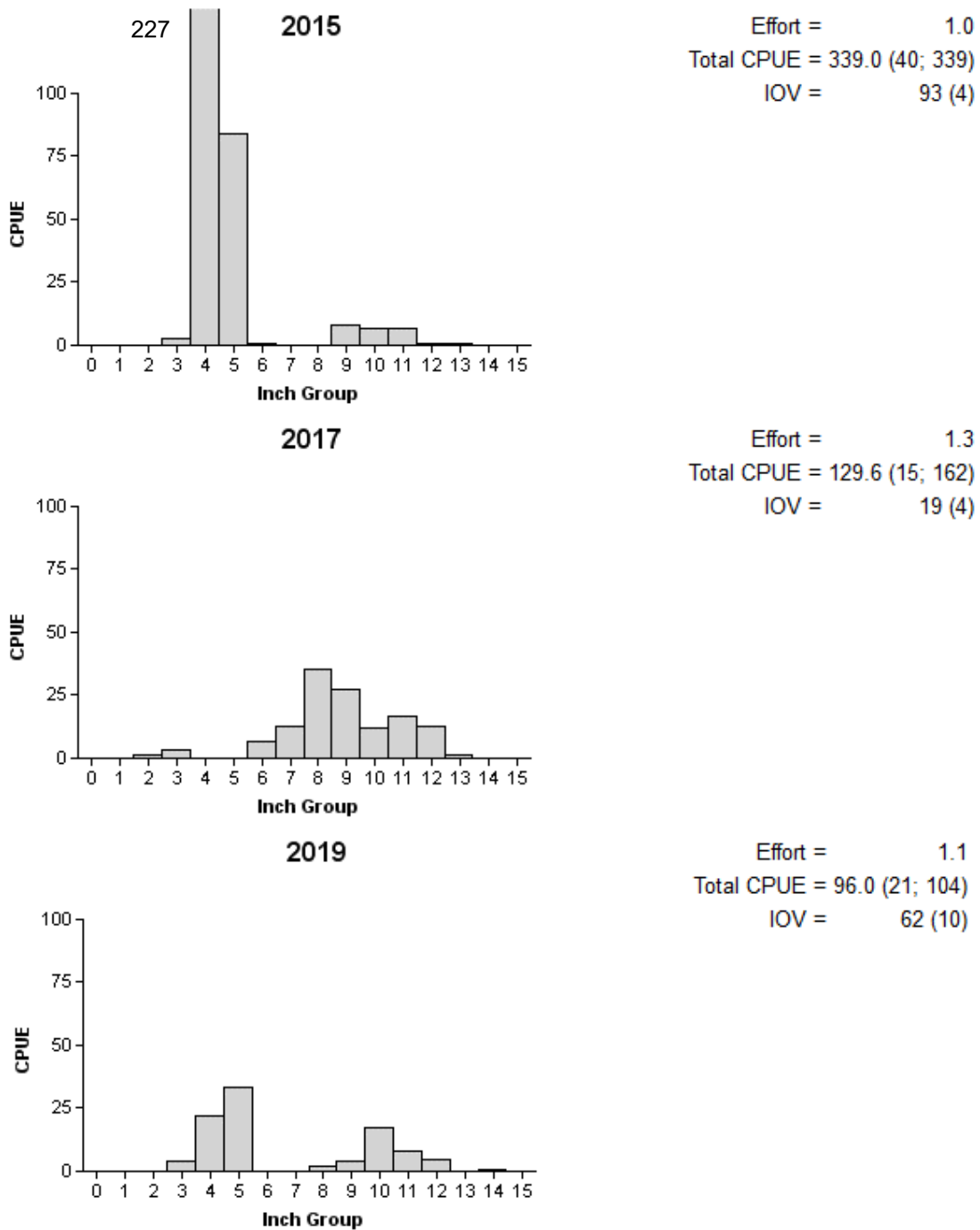


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Greenbelt Reservoir, Texas, 2015, 2017, and 2019.

Bluegill

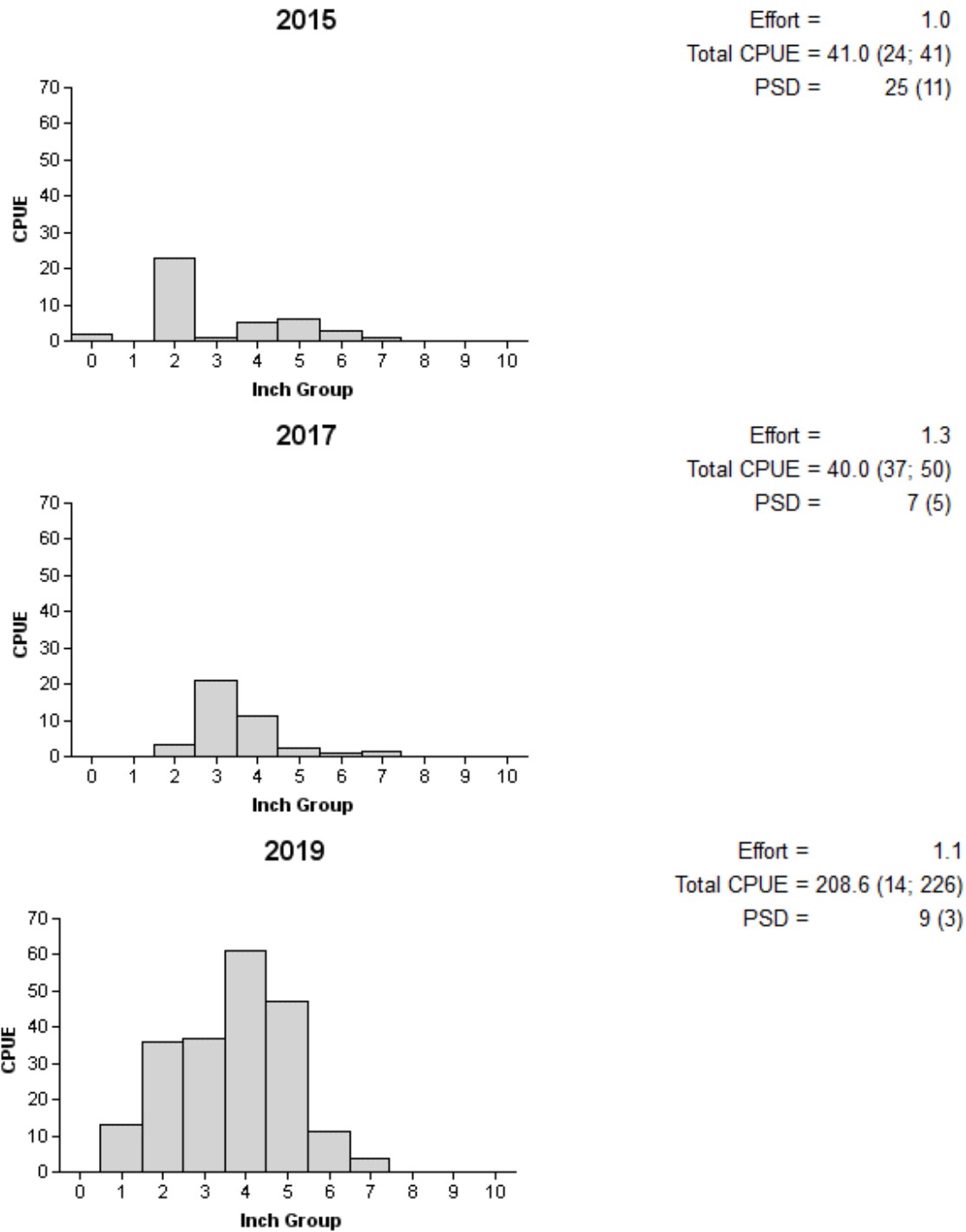


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Greenbelt Reservoir, Texas, 2015, 2017, and 2019.

Channel Catfish

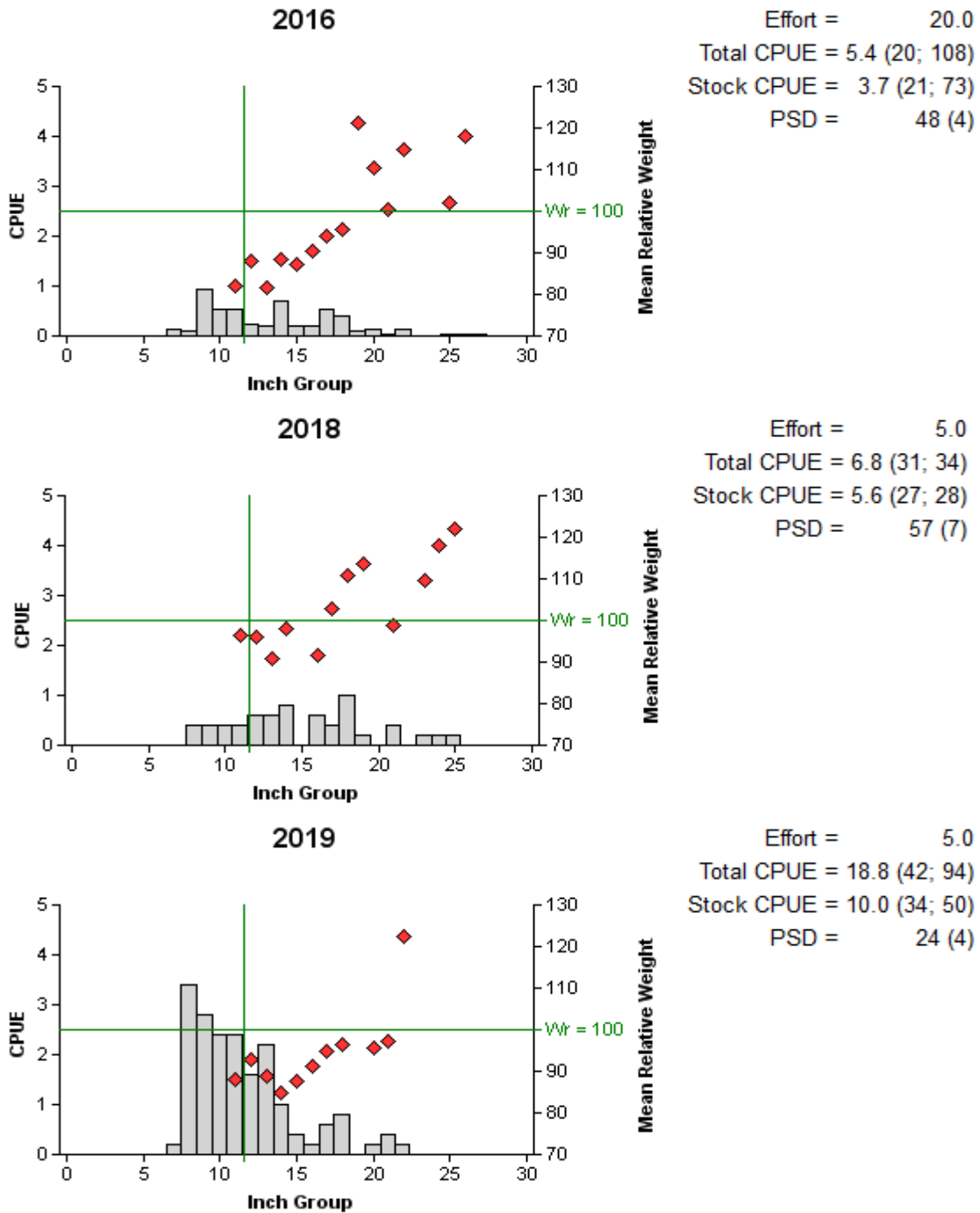


Figure 4. Number of Channel Catfish caught per net night (CPUE, bar) mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Greenbelt Reservoir, Texas, 2016, 2018 and 2019. Vertical line indicates minimum length limit and horizontal line indicates $W_r = 100$.

Table 9. Creel survey statistics for Channel Catfish at Greenbelt Reservoir, Texas, from April 2006 through June 2006, April 2012 through June 2012 and April 2017 through June 2017. Total catch per hour is for anglers targeting Channel Catfish and total harvest is the estimated number of Channel Catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2006	2012	2017
Surface area (acres)	1,085	700	830
Directed effort (h)	1,783.0 (47)	1,125.2 (51)	1,424.9 (45)
Directed effort/acre	1.5 (47)	1.6 (51)	1.7 (45)
Total catch per hour	0.1 (109)	0.1 (71)	0.0 (136)
Total harvest	190 (116)	265 (202)	91 (390)
Harvest/acre	0.2 (116)	0.4 (202)	0.1 (390)
Percent legal released	0.0	41.1	0.0

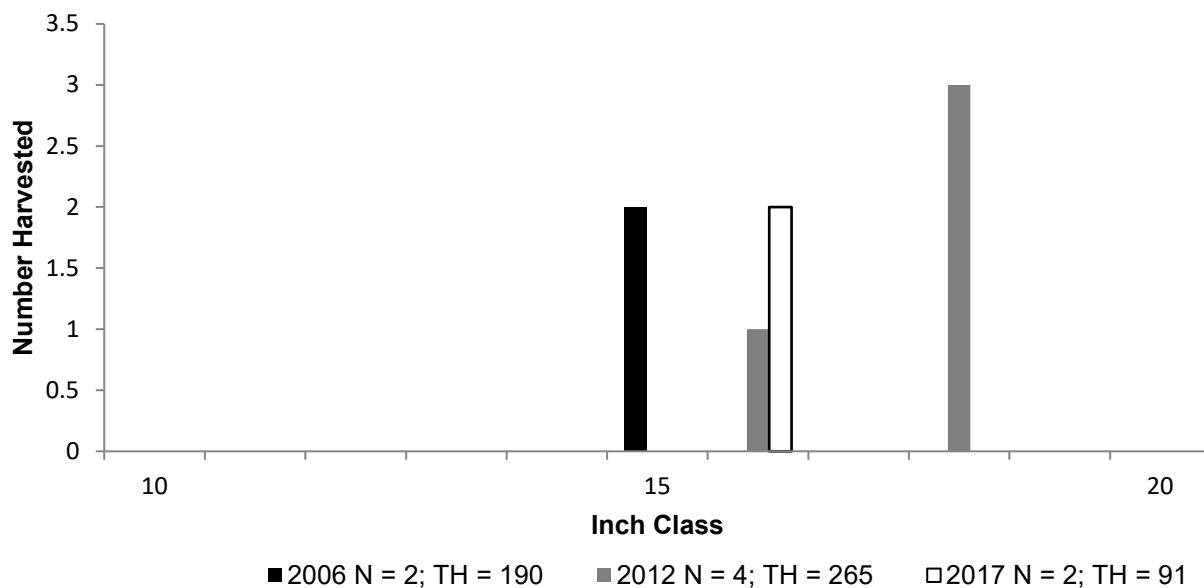


Figure 5. Length frequency of harvested Channel Catfish observed during creel surveys at Greenbelt Reservoir, Texas, April 2006 through June 2017, all anglers combined. N is the number of harvested Channel Catfish observed during creel surveys, and TH is the total estimated harvest for the creel survey period.

White Bass

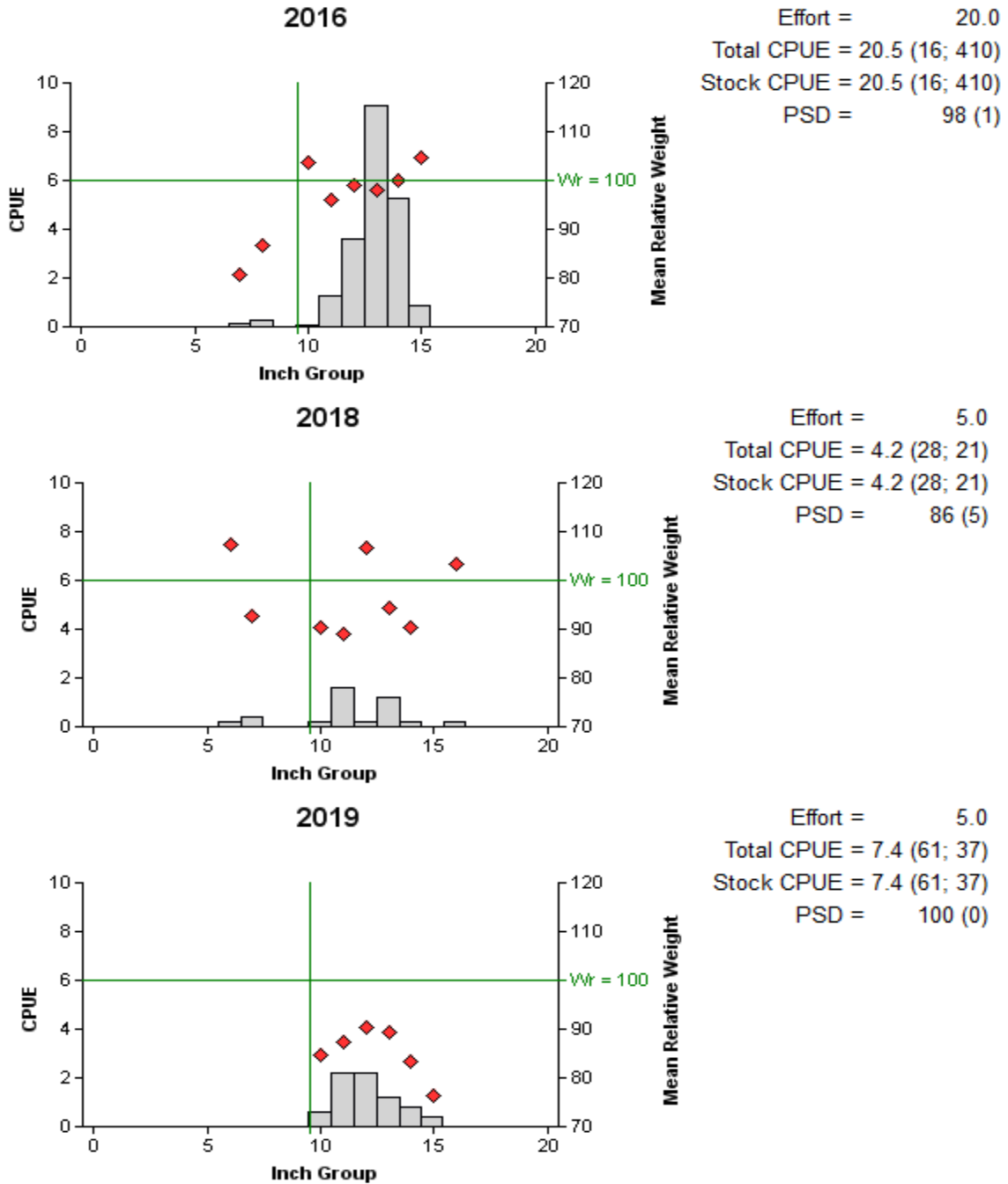


Figure 6. Number of White Bass caught per net night (CPUE, bars) mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Greenbelt Reservoir, Texas, 2018 and 2019. Vertical indicates minimum length limit and horizontal line indicates $Wr=100$.

Table 10. Creel survey statistics for White Bass at Greenbelt Reservoir, Texas, from April 2006 through June 2006, April 2012 through June 2012, and April 2017 through June 2017. 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	Year		
	2006	2012	2017
Surface area (acres)	1,085	700	830
Directed effort (h)	856.3 (64)	156.7 (106)	243.2 (103)
Directed effort/acre	0.8 (64)	0.2 (106)	0.3 (103)
Total catch per hour	0.8 (166)	0.0 (--)	0.7 (--)
Total harvest	95 (162)	1,007 (73)	1,016 (58)
Harvest/acre	0.1 (162)	1.4 (73)	1.2 (58)
Percent legal released	91.6	57.4	34.5

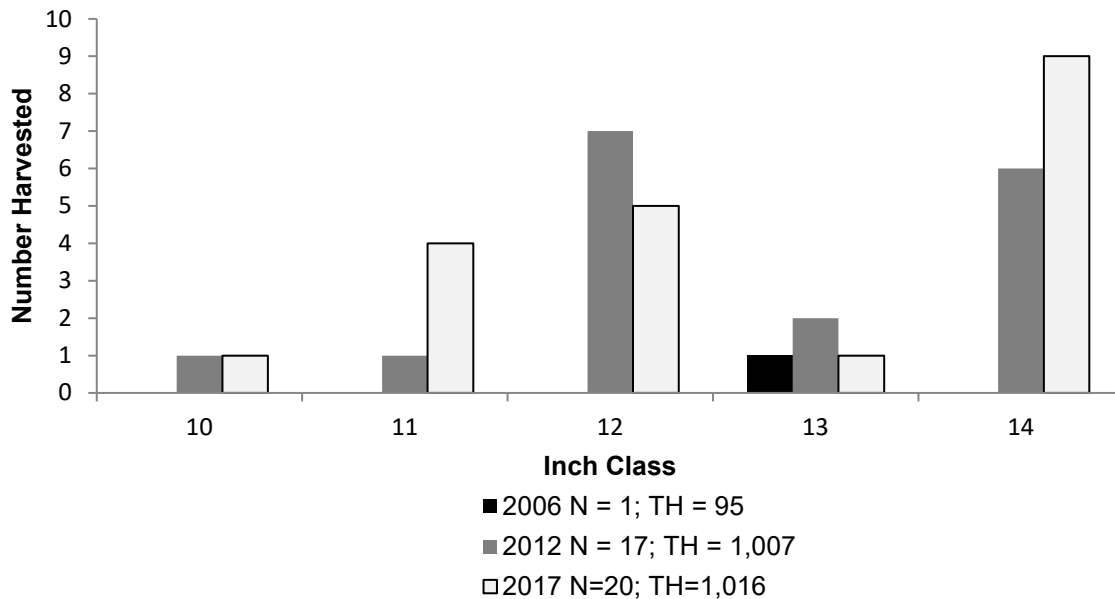


Figure 7. Length frequency of harvested White Bass observed during creel surveys at Greenbelt Reservoir, Texas, April 2006 through June 2017, all anglers combined. N is the number of harvested White Bass observed during creel surveys, and TH is the total estimated harvest for the creel survey period.

Largemouth Bass

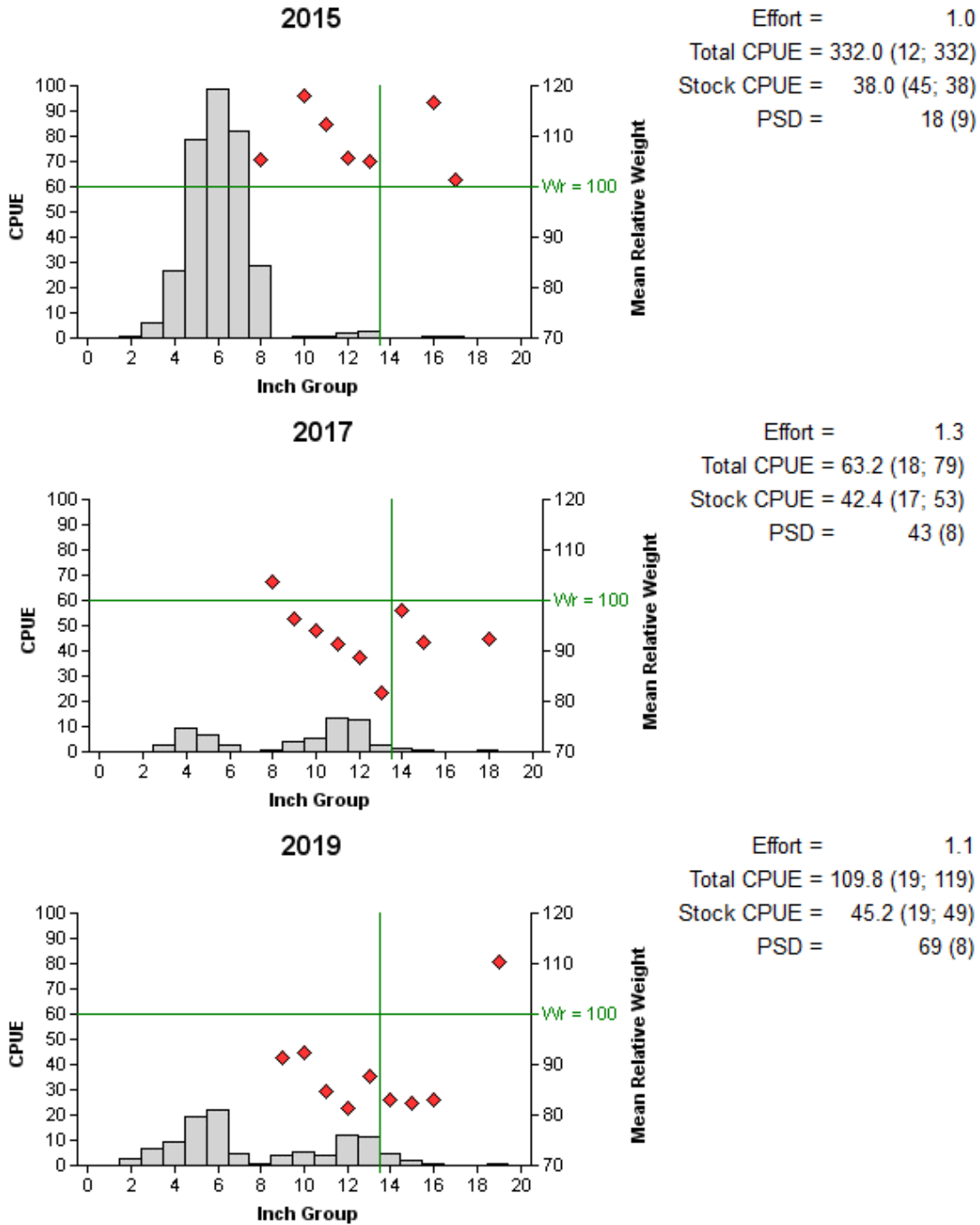


Figure 8. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Greenbelt Reservoir, Texas, 2015, 2017, and 2019. Vertical line indicates minimum length limit and horizontal line indicates $Wr=100$.

Table 12. Creel survey statistics for Largemouth Bass at Greenbelt Reservoir, Texas, from April 2006 through June 2006, April 2012 through June 2012, and April 2017 through June 2017. 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.

Statistic	Year		
	2006	2012	2017
Surface area (acres)	1,085	700	830
Directed effort (h)	5,843.8 (29)	4,401.9 (26)	7,381.9 (26)
Directed effort/acre	5.4 (29)	6.3 (26)	8.9 (26)
Total catch per hour	1.0 (23)	0.4 (41)	1.1 (40)
Total harvest	557 (43)	1,801 (46)	142 (90)
Harvest/acre	0.6 (43)	2.6 (46)	0.2 (90)
Percent legal released	74.2	42.4	90.9

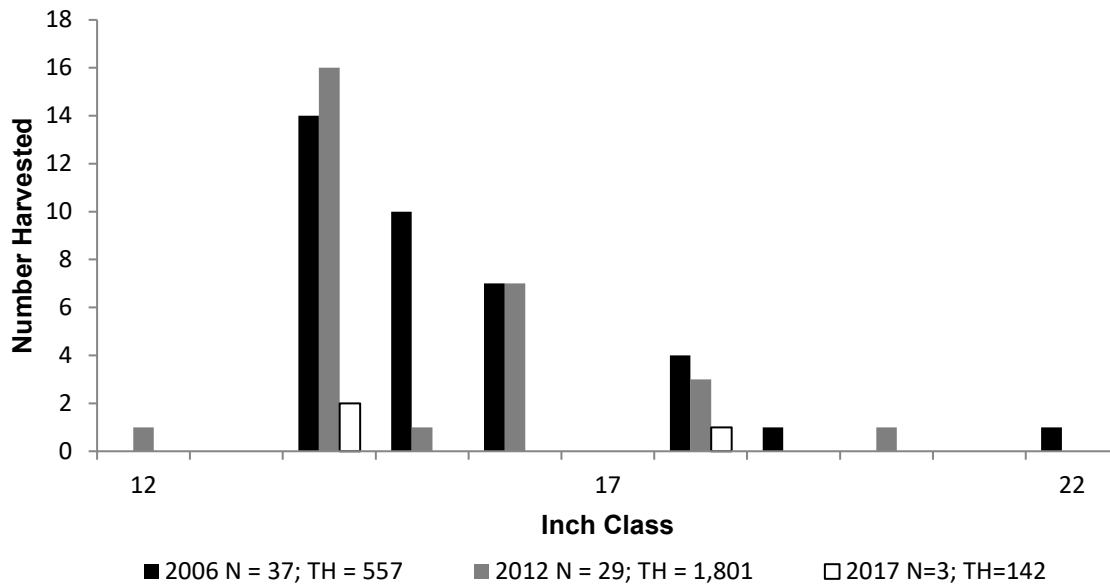


Figure 9. Length frequency of harvested Largemouth Bass observed during creel surveys at Greenbelt Reservoir, Texas, April 2006 through June 2017, all anglers combined. N is the number of harvested Largemouth Bass observed during creel surveys, and TH is the estimated harvest for the creel survey period.

Table 13. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Greenbelt Reservoir, Texas. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, F1 = first generation hybrid between a FLMB and a NLMB, Fx = second or higher generation hybrid between a FLMB and a NLMB. Genetic composition was determined with micro-satellite DNA analysis.

Year	Sample size	Number of fish				% FLMB alleles	% pure FLMB
		FLMB	F1	Fx	NLMB		
2005	31	0	0	16	15	15	0
2011	30	0	1	22	7	14	0
2015	30	0	0	11	13	33	0
2019	30	6	0	22	2	38	20

White Crappie

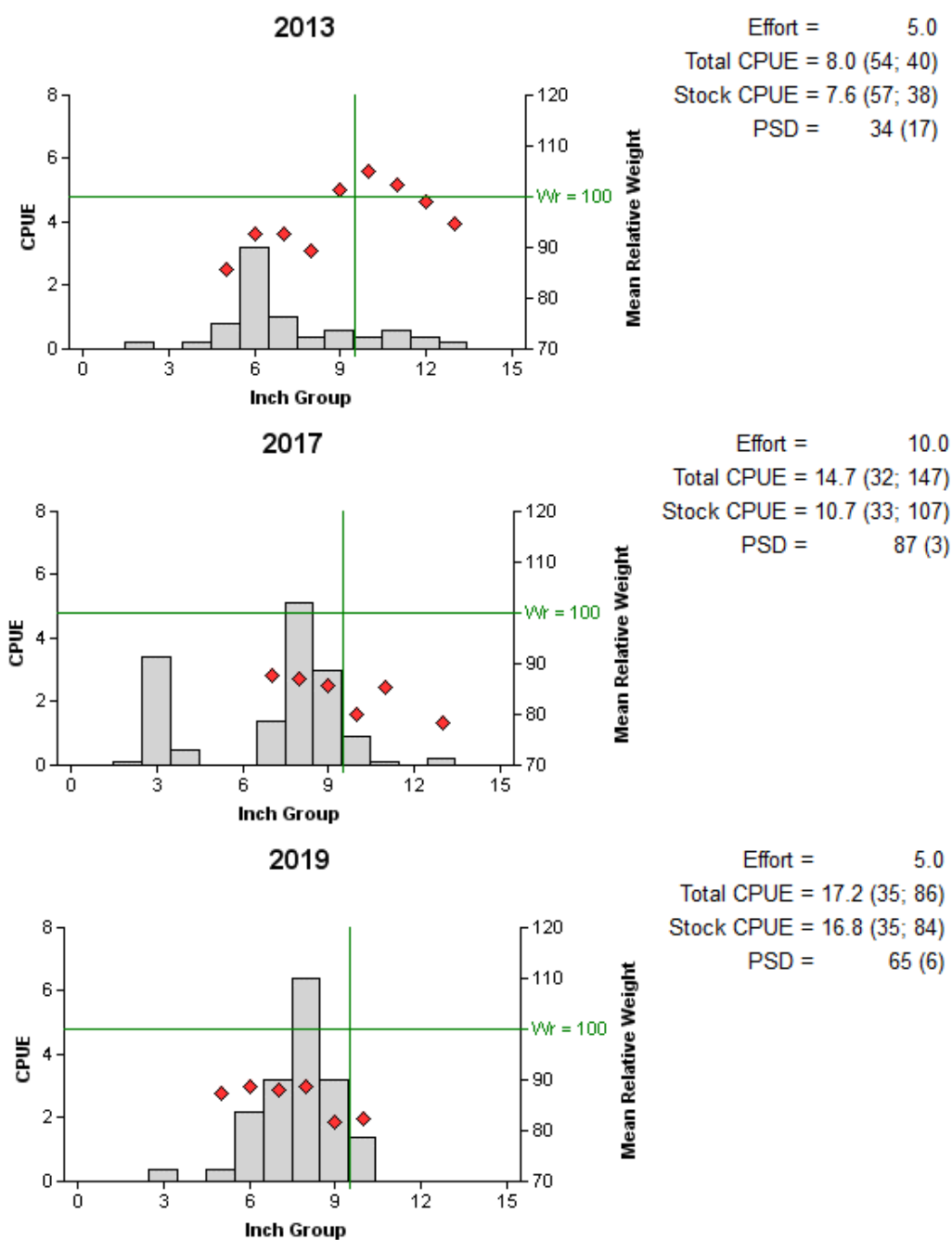


Figure 10. Number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Greenbelt Reservoir, Texas, 2013, 2017, and 2019. Vertical line indicates minimum length limit and horizontal line indicates $Wr=100$.

Table 14. Creel survey statistics for White Crappie at Greenbelt Reservoir, Texas, from April 2006 through June 2006, April 2012 through June 2012, and April 2017 through June 2017. Total catch per hour is for anglers targeting White Crappie and total harvest is the estimated number of White Crappie harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year		
	2006	2012	2017
Surface area (acres)	1,085	700	830
Directed effort (h)	203.4 (104)	6,013.5 (23)	5,407.6 (29)
Directed effort/acre	0.2 (104)	8.6 (23)	6.5 (29)
Total catch per hour	0.0 (--)	1.1 (27)	1.3 (43)
Total harvest	44 (113)	6,260 (40)	2,123 (49)
Harvest/acre	0.0 (113)	8.9 (40)	2.6 (49)
Percent legal released	80.9	4.6	32.3

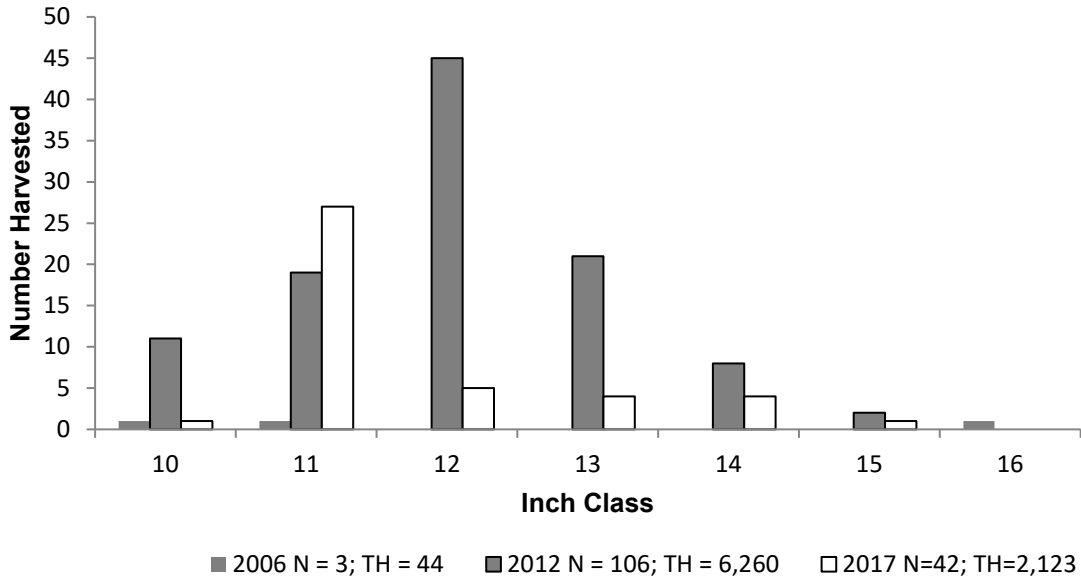


Figure 11. Length frequency of harvested White Crappie observed during creel surveys at Greenbelt Reservoir, Texas, June 2009 through May 2012, all anglers combined. N is the number of harvested White Crappie observed during creel surveys, and TH is the total estimated harvest for the creel survey period.

Walleye

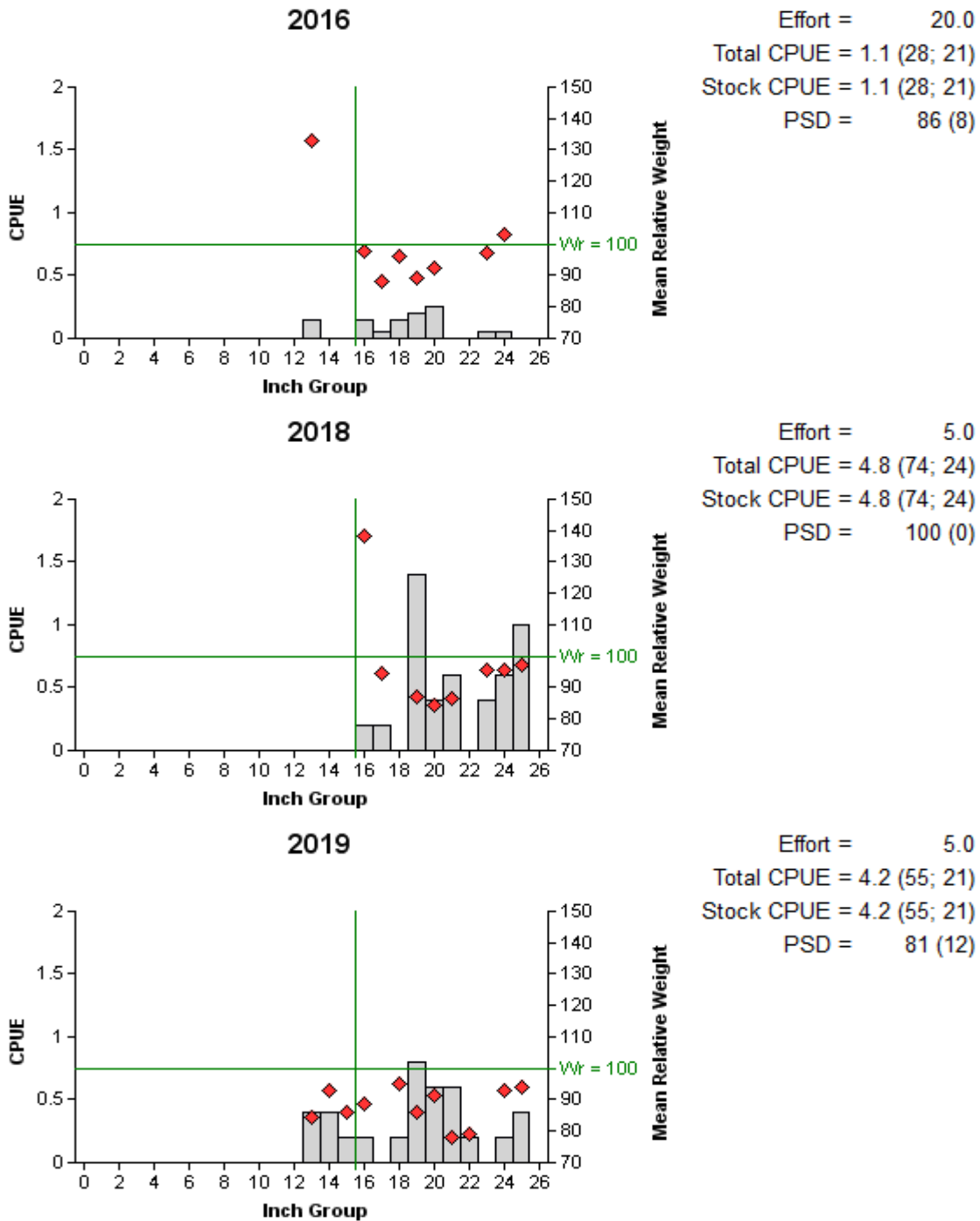


Figure 12. Number of Walleye caught per net night (CPUE, bars) mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Greenbelt Reservoir, Texas, 2016, 2018, and 2019. Vertical line indicates minimum length limit and horizontal line indicates $W_r = 100$.

Proposed Sampling Schedule

Table 15. Proposed sampling schedule for Greenbelt 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. Standard survey denoted by S and additional survey denoted by A.

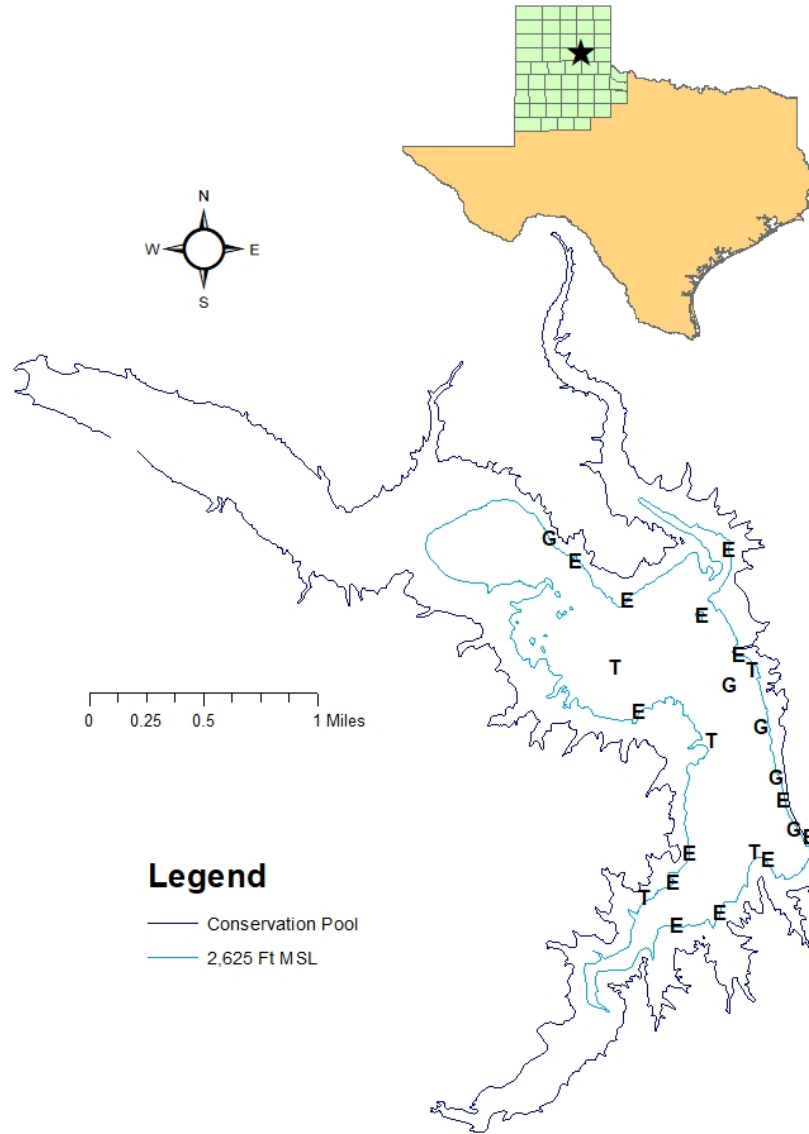
	Survey year			
	2020-2021	2021-2022	2022-2023	2023-2024
Angler Access				S
Structural Habitat				S
Vegetation				S
Electrofishing – Fall		A		S
Genetics				S
Trap netting				S
Gill netting		A		S
Report				S

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

Number (N) and catch rate (CPUE) (RSE in parentheses) of all species collected from all gear types from Greenbelt Reservoir, Texas, 2019-2020. Sampling effort was 5 net nights for trap netting, and 1.1 hour for electrofishing.

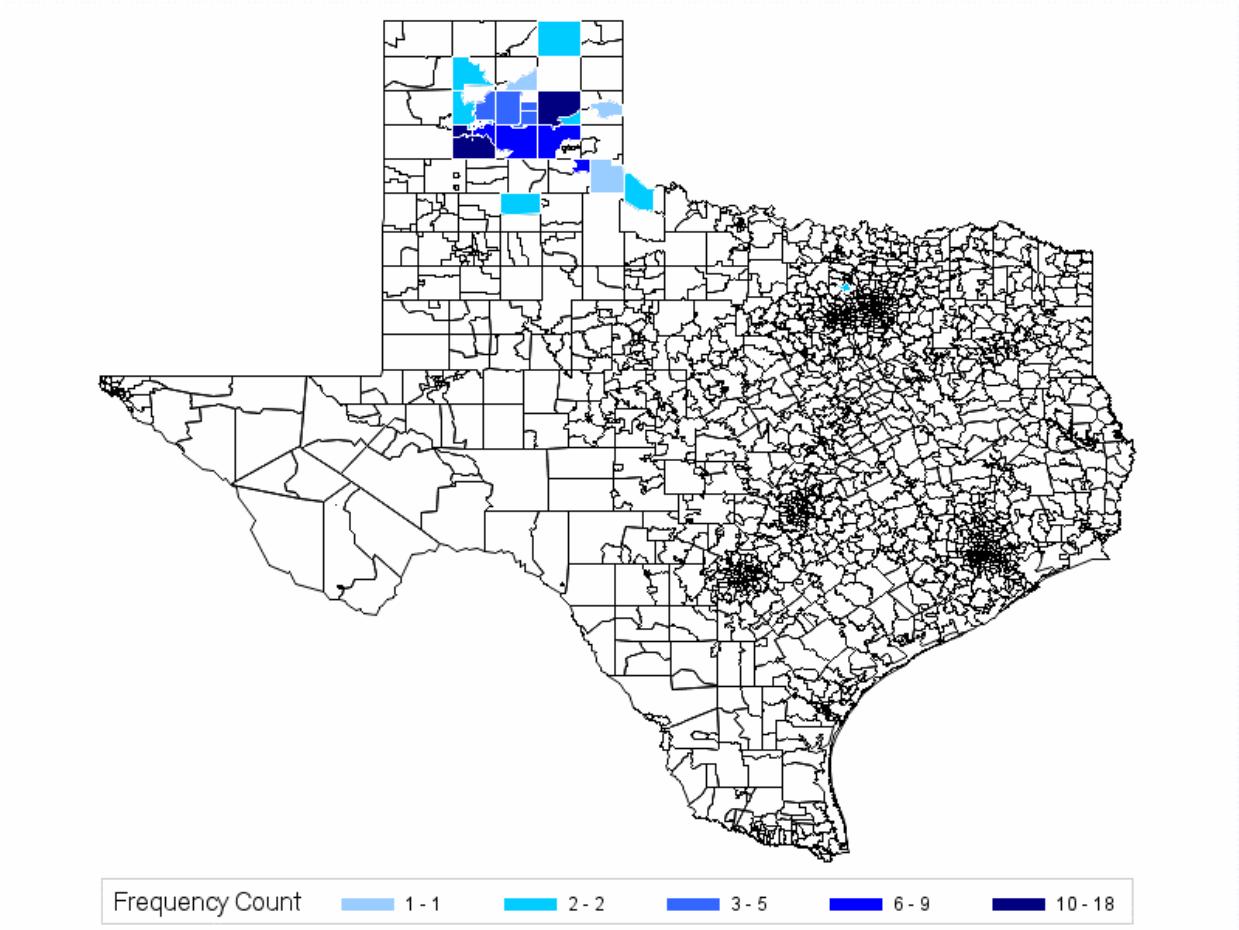
Species	Trap Netting		Electrofishing	
	N	CPUE	N	CPUE
Gizzard Shad			104	96.0 (21)
Goldfish			33	30.5 (31)
Common Carp			66	61.9 (41)
Channel Catfish			2	1.9 (68)
White Bass			12	11.1 (74)
Green Sunfish			3	2.8 (53)
Bluegill	36	7.2 (53)	226	208.6 (14)
Longear Sunfish			6	5.5 (47)
Largemouth Bass			119	109.9 (19)
White Crappie	86	17.2 (35)	62	57.2 (17)
Yellow Perch			1	0.9 (100)
Walleye			1	0.9 (100)

APPENDIX B – Map of sampling locations



Location of sampling sites, Greenbelt Reservoir, Texas, 2019-2020. Trap net, gill net, and electrofishing stations are indicated by T, G, and E, respectively. Water level was 2,625 feet above MSL at time of sampling.

APPENDIX D – reporting of creel ZIP code data



Location, by ZIP code, and frequency of anglers that were interviewed at Greenbelt Reservoir, Texas, during the April 2017 through June 2017 creel survey.



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