

Benbrook Reservoir

2021 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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Survey and Management Summary

Fish populations in Benbrook Reservoir were surveyed in 2021 using electrofishing and trap netting and in 2022 using gill netting. Historical data are presented with the 2021-2022 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: Benbrook Reservoir is a 3,635-acre impoundment located on the Clear Fork of the Trinity River approximately 10 miles southwest of Fort Worth. Water level fluctuates drastically in the reservoir from year to year. Benbrook Reservoir has consistently been eutrophic. Habitat consisted of rock, gravel, natural shoreline, and standing timber.

Management History: Important sport fishes include White Bass, Hybrid Striped Bass, Largemouth Bass, White Crappie, and catfishes. The management plan from the 2018 survey report included stocking Hybrid Striped Bass fingerlings, and increased gill net sampling to improve catch of Hybrid Striped Bass. Because Largemouth Bass are the most sought-after species by anglers, Florida Largemouth Bass have also been stocked. Historically, efforts were made to increase shoreline vegetation. Plantings have included, water willow, cattail, and pickerel weed. However, the vegetation was unable to establish due to frequent and significant water level fluctuations.

Fish Community

- **Prey species:** Threadfin Shad continued to be abundant, but electrofishing catch rate was below reservoir average. Electrofishing catch of Gizzard Shad was below reservoir average but 80% were available as prey. Electrofishing catch of Bluegill and Longear Sunfish was higher than the previous survey. The Bluegill catch was above the reservoir average while the Longear Sunfish catch was near the reservoir average.
- **Catfishes:** The catch rate of Blue Catfish was slightly lower than the catch rate over the previous two surveys but well above the reservoir average. Body condition of Blue Catfish was good. The Channel Catfish catch rate was lower than previous survey. Catfishes are the fourth most sought-after species by anglers.
- **Temperate basses:** White Bass and Hybrid Striped Bass were present in the reservoir. Abundance of both species appears to have been negatively affected by the introduction of Yellow Bass. White Bass catch rate was similar to previous surveys but below the reservoir average. Hybrid Striped Bass abundance continued to be low.
- **Largemouth Bass:** Total catch of Largemouth Bass increased and population size structure was good. Largemouth Bass are the most sought-after species by anglers.
- **Crappies:** Catch rates of White and Black Crappie catch rate was slightly lower than previous survey. Crappies were the second most sought-after species by anglers

Management Strategies: Stock fingerling Hybrid Striped Bass at 7-15 fish/acre and stock Lonestar Bass. Inform the public about the negative impacts of aquatic invasive species. Conduct additional gill netting surveys in 2024, and general monitoring surveys with trap nets, gill nets, and electrofishing surveys in 2025-2026. Conduct creel survey in 2025-2026 to determine how many anglers are seeking Hybrid Striped Bass to determine if stockings should continue.

Introduction

This document is a summary of fisheries data collected from Benbrook Reservoir in 2021-2022. The purpose of the document is to provide fisheries information and make management recommendations to protect and improve the sport fisheries. While information on other species of fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2021-2022 data for comparison.

Reservoir Description

Benbrook Reservoir is a 3,635-acre impoundment constructed in 1952 on the Clear Fork of the Trinity River. It is located in Tarrant County approximately 10 miles southwest of Fort Worth and is operated and controlled by the United States Army Corps of Engineers (USACE). Benbrook Reservoir has a drainage area of 429 square miles in Tarrant and Parker Counties. Primary water uses include municipal water supply (controlled by Tarrant Regional Water District [TRWD]) and recreation. Benbrook Reservoir was listed as eutrophic with a mean TSI chl-a reading of 61.76, which was slightly higher than the two previous samples (Texas Commission on Environmental Quality 2018). The primary habitat at time of sampling consisted of natural, gravel and rocky shorelines, and standing timber. Water level has been highly variable since 1995, and in subsequent years the water level has, at times, reached 10 or more feet below conservation pool (Figure 1). Tarrant Regional Water District began drawing more water from Benbrook Reservoir (Clear Fork) for municipal uses in 2005 to reduce the demand on the West Fork of the Trinity River Reservoirs (e.g., Bridgeport, Eagle Mountain, and Worth). Other descriptive characteristics for Benbrook Reservoir are in Table 1.

Angler Access

Benbrook Reservoir has 16 public boat ramps within six public parks, but when water levels drop to approximately 10 feet low, none are useable. Bank fishing access is available at many of the numerous parks around the Reservoir. Additional boat ramp characteristics are in Table 2.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Hungerford and Brock 2018) included:

1. Maintain a Hybrid Striped Bass fishery through annual stocking.
Action: Hybrid Striped Bass (Sunshine Bass cross) fry were stocked in 2020 and 2021. Gill net surveys were conducted in 2021 and 2022 to monitor population.
2. Communicate with the public regarding the spread of aquatic nuisance species. Contact marina operators and emphasize the importance of cleaning, draining, and drying vessels when leaving all reservoirs to reduce risk of spreading zebra mussels.
Action: We made a speaking point when talking to the public the importance of cleaning, draining, and drying vessels prior to launching at other reservoirs. Since Benbrook does receive water from a pipeline connected to two other reservoirs, TRWD was informed of the risk of zebra mussel movement as well.

Harvest regulation history: Sport fishes in Benbrook Reservoir are currently managed with statewide harvest regulations (Table 3). Statewide catfish regulations changed on September 1, 2021.

Stocking history: Benbrook Reservoir has been stocked periodically with Hybrid Striped Bass and Florida Largemouth Bass. Blue Catfish were stocked in 1984. The complete stocking history is in Table 4.

Vegetation/habitat management history: Negligible amounts of vegetation which included Cattail and American water willow have at times existed in the reservoir. Experimental plantings of native emergent vegetation have also been conducted however water level fluctuations have limited the amount of aquatic vegetation.

Water transfer: Benbrook Reservoir is primarily used for municipal water supply, recreation, and to a lesser extent, flood control. There is currently one permanent pumping station on the reservoir which connects to a raw water treatment plant for municipal use. There is also an outfall from a pipeline operated by TRWD that transfers water to Benbrook Reservoir from Richland Chambers and Cedar Creek Reservoirs in East Texas. According to TRWD staff, the water is mixed with approximately 66.7% Richland Chambers water and 33.3% from Cedar Creek. Because of the water transfers from these reservoirs, Yellow Bass were introduced into Benbrook Reservoir. This introduction appears to have had a negative impact on the White Bass and Hybrid Striped Bass populations.

Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Benbrook Reservoir (Hungerford and Brock. 2018). Primary components of the OBS plan are listed in Table 5. Survey sites for electrofishing, trap netting, and 5 gill netting stations were randomly selected. Five other gill netting stations were biologist determined and non-random. All surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2017).

Electrofishing – Largemouth Bass, sunfishes, Gizzard 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 – 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, White Bass, and Hybrid Striped Bass were collected by gill netting (10 net nights at 10 stations). Five of the stations were randomly selected while five other stations were biologist determined locations to try and maximize Hybrid Striped Bass catch rates. CPUE for gill netting was recorded as the number of fish caught per net night (fish/nn). Ages were determined using otoliths for all Hybrid Striped Bass collected.

Genetics – Genetic analysis of Largemouth Bass was last conducted in 2017 and was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2017). Genetic composition of individual Largemouth Bass was estimated using Micro-satellite DNA analysis beginning in 2005 and using electrophoresis prior to 2005.

Statistics – Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD), terminology modified by Guy et al. 2007], and condition indices [relative weight (W_r)] were calculated for target fishes according to Anderson and Neumann (1996). Palmetto Bass PSD was calculated according to Dumont and Neely (2011). Index of Vulnerability (IOV) was calculated for Gizzard Shad (DiCenzo et al. 1996). Standard error (SE) was calculated for structural indices and IOV. Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE statistics.

Habitat – A structural habitat survey was conducted in 2021. Habitat was assessed with the random point method (TPWD, Inland Fisheries Division, unpublished manual revised 2017).

Water level – Source for water level data was the United States Geological Survey (USGS 2022) and from Tarrant Regional Water District.

Results and Discussion

Habitat: A structural habitat survey was conducted in 2021 and littoral zone habitat consisted primarily of gravel, rock, and natural shoreline (Table 6). Major water level fluctuations have been detrimental to the littoral habitat in Benbrook Reservoir. Native emergent vegetation (cattail and American water-willow) has been present historically but none has been observed for several years.

Creel: The most recent creel was conducted in 2017-2018. Directed fishing effort by anglers was highest for Largemouth Bass (36%), followed by anglers fishing for crappies and anything (Table 7).

Prey species: Electrofishing catch rates of Threadfin and Gizzard Shad were 316.0/h and 157.0/h, respectively (Figure 2; Appendix D.). Both catch rates were below the reservoir average for the species (Appendix D). Index of Vulnerability (IOV) for Gizzard Shad was good, indicating that 80% of Gizzard Shad were available to existing predators (Figure 2). The total catch rate of Bluegill and Longear Sunfish was 245.0/h and 106.0/hr respectively (Figure 3; Appendix D). These rates were higher than the catch rates observed in the previous surveys. Sampling objectives for Gizzard Shad were met.

Catfishes: The gill net catch rate of Blue Catfish was 8.0/nn in 2022, which is lower than the previous two surveys but higher than the reservoir average (Figure 4; Appendix D). Mean relative weight was between 80 and 110. Size structure was similar to 2021 survey and included several large individuals (Figure 4). Catch and size structure sampling objectives were accomplished for Blue Catfish. The gill net catch rate of Channel Catfish was 3.3/nn in 2022 which is lower than previous sample and the reservoir average (Figure 5; Appendix D). The Channel Catfish population size structure was similar to previous sample (Figure 5).

White Bass: The White Bass catch rate was 2.9/nn in 2022 (Figure 6). This was higher than previous sample but lower than the reservoir average (Appendix D). Since Yellow Bass were introduced into the reservoir in 2004, White Bass catch rates have decreased (Appendix C and D).

Hybrid Striped Bass: Hybrid Striped Bass catch rates have been low since the stocking of fry began in 2013 (Table 4; Appendix D). In 2022 the total catch rate of Hybrid Striped Bass was 1.0/nn which is below reservoir average but higher than previous two samples (Figure 7). Only one fish of legal length was collected but the catch also revealed at least one fry stocking may have been successful (Figure 7). Fry have been stocked annually since 2013, and this stocking strategy has resulted in reduced abundance. Several factors may be responsible for the fry stockings failure, including high stocking mortality and predation by Yellow Bass. In 2018, we reached out to Benbrook anglers on our District Facebook page for reports and photos of any Hybrid Striped Bass caught. A few of the photos received revealed undersized hybrids in coolers. Thus, angler compliance could also be an issue. Sampling objectives for age and growth sample size was not met. Historically, Hybrid Striped Bass reach legal length by age 3 (Figure 8).

Largemouth Bass: The electrofishing catch rate of Largemouth Bass was 109.0.0/h in 2021, which is slightly higher than previous sample (Figure 9). Catch rate of fish ≥ 14 inches was also higher than previous sample. Body condition for all sizes classes in 2021 was good (mean relative weights between 85 and 110; Figure 9). Sampling objectives were met for Largemouth Bass. Historically Florida Largemouth Bass influence has remained relatively constant as Florida alleles have ranged from 55 to 63% (Table 8). Largemouth Bass are the most sought-after species by anglers on the reservoir (Hungerford and Brock 2018). Based on the Sharelunker program data, several fish over 8 pounds are caught annually.

Crappies: The trap net catch rate of White Crappie was 10.4/nn in 2021, which is lower than previous two samples (Figure 10). The catch rate of White Crappie over 10 inches (5.8/nn) remained unchanged from previous sample (Figure 10). Mean relative weight was over 90 for all size classes (Figure 10). The trap net catch rate of Black Crappie was 1.0/nn in 2021, which was lower than previous surveys (Figure 11).

Fisheries Management Plan for Benbrook Reservoir, Texas

Prepared – July 2022

ISSUE 1: Hybrid Striped Bass were a popular sport fish in Benbrook Reservoir and have been a part of the fishery at Benbrook Reservoir since the late 1970s. Historically the fishery supported several fishing guides and was maintained with annual stockings of Hybrid Striped Bass fingerlings. Hybrid Striped Bass fry were stocked annually beginning in 2013 to get more consistent stockings which was thought could improve the fishery. However, since the transition to fry stockings, the population has declined greatly. Several factors could have affected fry stockings including drastic water level fluctuations and the introduction of Yellow Bass due to water transfers from other reservoirs.

MANAGEMENT STRATEGIES

1. Stock Hybrid Striped Bass fingerlings annually at 7-15 fish/acre if prey availability remains adequate.
2. Monitor Hybrid Striped Bass stockings through gill netting every other year (2024 and 2026) with 10 net nights per survey.
3. If population improves, use social media and other marketing outlets to promote fishery.
4. Conduct creel survey in 2025-2026 if population improves to determine if future stockings are warranted.

ISSUE 2: Largemouth Bass are the most sought-after fish in Benbrook Reservoir. Several fish have been submitted to the ShareLunker program.

MANAGEMENT STRATEGIES

1. Request Lone Star Bass for stocking in 2024.
2. Monitor Largemouth Bass population by fall electrofishing in 2025.
3. Conduct genetic analysis to determine stocking success.
4. Conduct creel survey in 2025-2026 to determine if Largemouth Bass are still the most sought-after fish in the Reservoir.

ISSUE 3: Due to major water level fluctuations, fish habitat can be limited, and possible disconnection from the main tributary could be having a negative effect on sport fish populations. Habitat projects involving rocks and boulders and possible dredging could improve habitat.

MANAGEMENT STRATEGIES

1. Meet with USACE to determine feasibility of installing rock and boulder habitat.
2. If USACE approves the possible rock and boulder habitat projects, develop detailed plans for habitat (Appendix E).
3. If approved by USACE, Investigate funding for rock and boulder habitat.

4. Investigate connectivity issues with tributaries.

ISSUE 4: Despite significant water level issues Benbrook Reservoir has a good Largemouth Bass, White Crappie, and Blue Catfish populations.

MANAGEMENT STRATEGIES

1. Use social media to promote the existing fisheries.
2. Develop better communication with controlling authority and Tarrant Regional Water District to promote existing fisheries.

ISSUE 5: 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 USACE 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 (2022–2026)

Sport fish, forage fish, and other important fishes:

Important sport fishes in Benbrook Reservoir include Largemouth Bass, Channel and Blue Catfish, White Bass, Hybrid Striped Bass and crappie. Known important forage species include Bluegill, Longear Sunfish, Threadfin and Gizzard Shad.

Low density fisheries:

Flathead Catfish: Flathead Catfish are present in Benbrook Reservoir, however, they are rarely captured in gill nets. Data on CPUE and size structure data will be recorded from all Flathead Catfish collected by gill nets targeting catfishes, and temperate bass.

Survey objectives, fisheries metrics, and sampling objectives

Catfishes: The popularity of catfish fishing at this reservoir warrant sampling time and effort. A gillnet survey consisting of 10 gillnet net nights at 10 biologist selected stations will be conducted in spring of 2024 and 2026 to determine CPUE and size structure of Channel and Blue Catfish. No sampling objectives will be set for catch rates or population size structure. The 10 net survey should be adequate to obtain statistics on catch rate and size structure of the Blue and Channel Catfish populations to monitor long term population trends.

Temperate Bases: Data on White Bass will be collected when the gillnet survey is conducted in the spring of 2024 and 2026 using 10 gill net nights at 10 biologist selected stations throughout Benbrook Reservoir. Sampling objective will be limited to general monitoring trend data (without precision or sample size requirements). This should give an idea of the population status when compared to past surveys. Historically, Hybrid Striped Bass were a popular sport fish in Benbrook Reservoir. Since the transition to fry stockings, the population has declined greatly. Only fingerlings and or a very high rate of fry will be stocked in the next 4 years to rebuild population. If the population rebounds, the fishery will be promoted and then angler effort will be calculated to determine if continued stocking is warranted. As with White Bass, data on Hybrid Striped Bass will be collected when the gillnet survey is conducted in the spring of 2024 and 2026. Sampling objective for Hybrid Striped Bass will be limited to monitoring trend data (without precision or sample size requirements). This should give an idea of the population status when compared to past surveys.

Largemouth Bass: To continue monitoring of Largemouth Bass, fall nighttime electrofishing will be conducted at a minimum of 12 randomly selected 5-min electrofishing sites in 2025. Based on past catch rates, this should be adequate to obtain an RSE of $CPUE-S \leq 25$ (the anticipated effort to meet both sampling objectives is 12 stations with 80% confidence). If the RSE objective is not met, additional electrofishing sampling will only continue if 35 stocked length fish or larger are not captured in the 12 sample sites.

Crappie: Trend data on Crappie CPUE, size structure, and body condition will be collected using 5 shoreline-set single-cod trap nets at 5 randomly selected locations in fall of 2025. Sampling objective will be limited to general monitoring trend data (without precision or sample size requirements). This level of effort should be sufficient to collect 50 stock size fish for size structure estimation.

Bluegill, Longear Sunfish, and Threadfin and Gizzard Shad: Bluegill, Longear Sunfish, and Threadfin, and Gizzard Shad are the primary forage in Benbrook Reservoir. Like Largemouth Bass, trend data on CPUE and size structure have been collected with fall nighttime electrofishing. Sampling, as with Largemouth Bass above, will allow for monitoring of large-scale changes in Bluegill, Longear Sunfish, and Threadfin and Gizzard Shad relative abundance and size structure. Sampling effort based on achieving sampling objectives for Largemouth Bass will result in sufficient numbers of these species.

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Tables and Figures

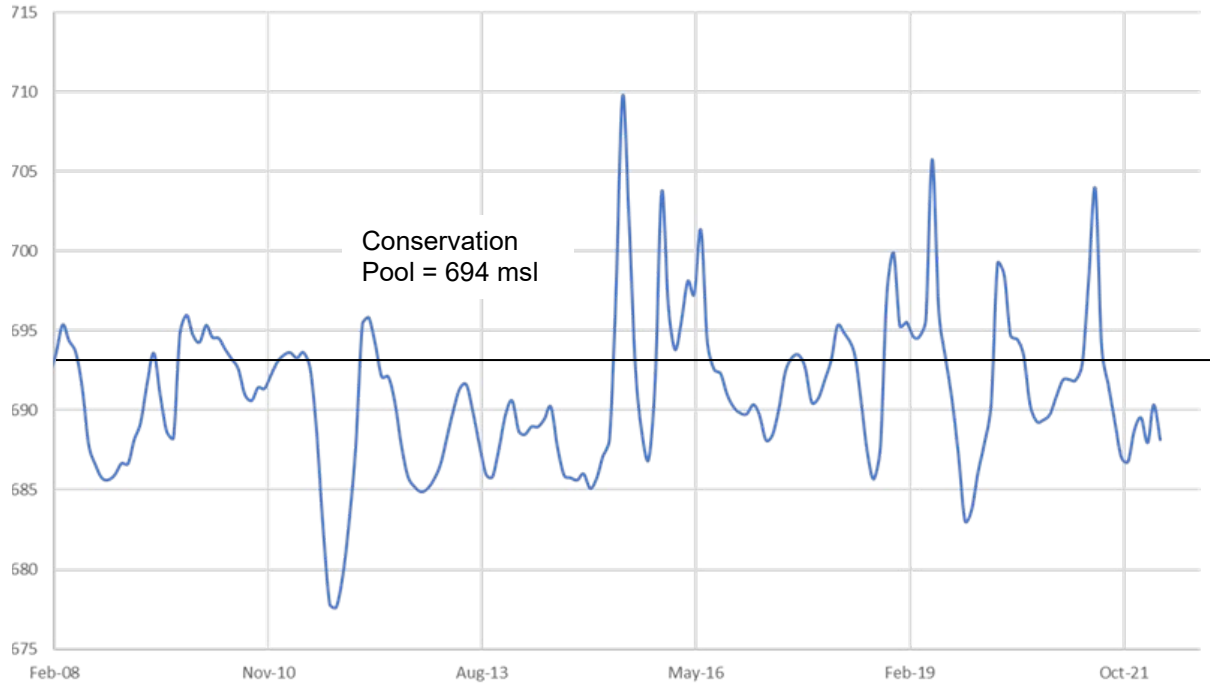


Figure 1. Monthly water level elevations in feet above mean sea level (MSL) recorded for Benbrook Reservoir, Texas. Conservation pool is 694 ft. MSL and is indicated by solid black line.

Table 1. Characteristics of Benbrook Reservoir, Texas.

Characteristic	Description
Year constructed	1952
Controlling authority	U.S. Army Corps of Engineers
County	Tarrant
Reservoir type	Mainstream
Shoreline Development Index	4.48
Conductivity	320 $\mu\text{S}/\text{cm}$

Table 2. Boat ramp characteristics for Benbrook Reservoir, Texas, Fall 2021. Reservoir elevation at time of survey was 689.1 feet above mean sea level.

Boat ramp	Latitude Longitude	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Benbrook Marina	32.65592 -97.47547	Y	75	688.0	Good.
North Holiday Park (Hobie Point)	32.65239 -97.47014	Y	25	685.0	Good.
North Holiday Park (Swimming Beach)	32.64272 -97.47086	Y	25	691.0	Poor slope.
North Holiday Park (Mercer Day Use)	32.63153 -97.47772	Y	25	685.0	Poor.
Holiday Park (Mercer Camping)	32.62928 -97.48100	Y	15	688.0	Poor slope. Only open to campers.
Holiday Park (Holiday Camping)	32.62364 -97.48497	Y	15	691.0	Good. Only open to campers.
Holiday Park (Double Ramp)	32.61644 -97.49547	Y	20	687.0	Good.
Bear Creek Campground (Bear Creek Ramp)	32.60347 -97.49881	Y	10	688.0	Poor slope. Only open to campers.
Bear Creek Campground (Double Ramp)	32.61167 -97.48847	Y	10	689.0	Good. Only open to campers.
Mustang Park (Mustang Creek)	32.60728 -97.47253	Y	10	690.0	Good for small craft.
Mustang Park (Mustang Point)	32.61039 -97.47056	Y	40	682.0	Good.
Longhorn Park	32.64711 -97.44630	Y	11	689.0	Good.
Rocky Creek Park (Double Ramp)	32.60233 -97.45958	Y	25	689.0	Good.
Rocky Creek Park (South Creek)	32.59458 -97.45347	Y	15	690.0	Poor slope.

Table 3. Harvest regulations for Benbrook Reservoir, Texas.

Species	Bag limit	Length limit
Catfish: Channel and Blue Catfish, their hybrids and subspecies	25 (in any combination; only 10 can be over 20 inches)	no minimum length limit
Catfish, Flathead	5	18-inch minimum
Bass, White	25	10-inch minimum
Bass, Palmetto	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 Benbrook Reservoir, Texas. Life stages are fry (FRY), fingerlings (FGL), advanced fingerlings (AFGL), and unknown (UNK). Life stages for each species are defined as having a mean length that falls within the given length range.

Year	Number	Size	Year	Number	Size
	<u>Threadfin Shad</u>			<u>Palmetto Bass</u>	
1984	1,000	AFGL	1978	19,980	UNK
			1979	38,190	UNK
	<u>Blue Catfish</u>		1982	30,000	UNK
1990	38,246	FGL	1991	59,600	FRY
1991	37,446	FGL	1992	30,126	FGL
Species Total	75,692		1994	57,133	FGL
			1995	97,887	FGL
	<u>Channel Catfish</u>		1996	59,212	FGL
1970	15,000	AFGL	1997	57,000	FGL
1972	9,374	AFGL	1998	57,423	FGL
Species Total	23,374		1999	32,244	FGL
			2002	18,954	FGL
	<u>Florida Largemouth Bass</u>		2003	33,760	FGL
1974	20,800	FGL	2004	38,050	FGL
1974	48,000	FRY	2005	54,628	FGL
1976	180,000	FRY	2006	36,336	FGL
1992	38,271	FGL	2008	26,209	FGL
1992	151,318	FRY	2009	27,847	FGL
1997	190,546	FGL	2011	44,990	FGL
2002	181,438	FGL	2013	363,501	FRY
2007	182,472	FGL	2014	181,760	FRY
2018	66,216	FGL	2015	326,594	FRY
2019	65,787	FGL	2016	181,902	FRY
Species Total	1,154,848		2017	718,240	FRY
			2018	380,000	FRY
			Species Total	2,971,566	
	<u>Largemouth Bass</u>			<u>Sunshine Bass</u>	
1968	115,000	UNK	2020	165,300	Fry
1969	98,000	UNK	2021	57,310	Fry
Species Total	213,000		2022	738,267	Fry
			Species Total	960,877	

Table 5. Objective-based sampling plan components for Benbrook Reservoir, Texas 2021–2022.

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
	Condition	W_r	none
Bluegill ^a	Abundance	CPUE – Total	none
Gizzard Shad ^a	Abundance	CPUE – Total	none
	Size structure	IOV, length frequency	$N \geq 50$
<i>Trap netting</i>			
Crappie	Abundance	CPUE – Total	none
	Size structure	PSD, length frequency	none
<i>Gill netting</i>			
Blue Catfish	Abundance	CPUE	$N \geq 50$
	Size structure	PSD, length frequency	$N \geq 50$ stock
Channel Catfish ^b	Abundance	CPUE– stock	None
White Bass	Abundance	CPUE-stock	none
	Size structure	PSD, length frequency	$N \geq 50$ stock
Hybrid Stripped Bass ^b	Abundance	CPUE-total	none
	Size structure	PSD, length frequency	$N \geq 25$
	Age-and-growth	Length at age	30

^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.

^b No additional effort will be expended to achieve an RSE \leq 25 for CPUE of Channel Catfish if not reached from designated Hybrid Stripped Bass and Blue Catfish sampling effort.

Table 6. Percent occurrence with lower and upper 95% confidence limits (CL) of shoreline structural habitat at 100 random sites in Benbrook Reservoir, Texas, August 2021. Water level was near conservation pool at time of sampling.

Structural habitat type	% Occurrence	Lower CL	Upper CL	Estimate
Gravel	5.0	2.0	11.0	1.9 miles
Natural	70.0	60.0	79.0	26.6 miles
Rock Bluff	2.0	0.0	7.0	0.8 miles
Rocky	23.0	15.0	32.0	8.7 miles

Table 7. Percent directed angler effort by species for Benbrook Reservoir, Texas, 2000/2001 and 2017/2018. Survey period was from 1 June through 31 May.

Species	2000/2001	2017/2018
Catfishes	13.4	10.3
White Bass	18.2	3.7
Palmetto Bass	11.9	2.1
Largemouth Bass	15.8	36.0
Crappies	9.3	23.0
Anything	25.8	12.8

Gizzard Shad

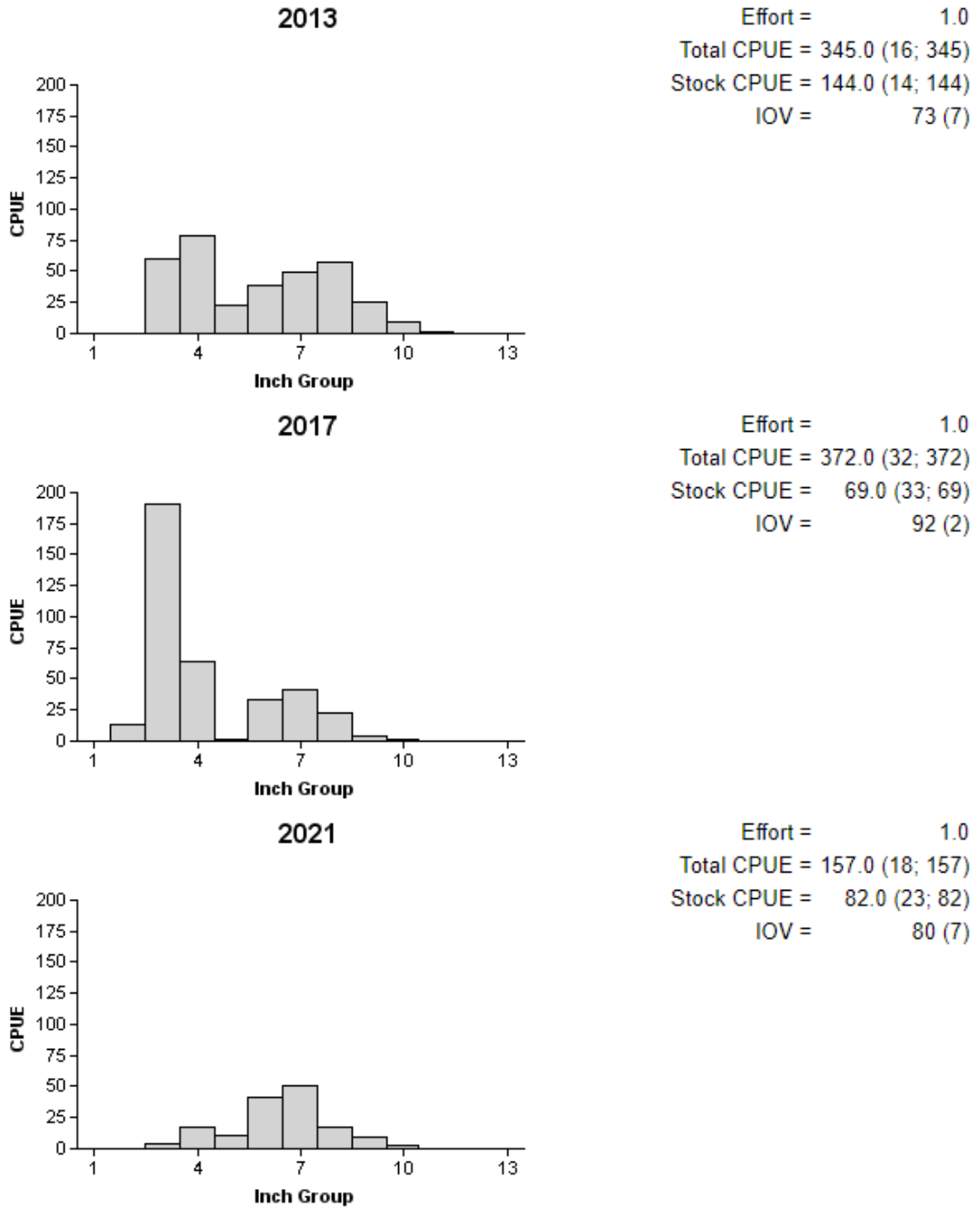


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Benbrook Reservoir, Texas, 2013, 2017, and 2021.

Bluegill

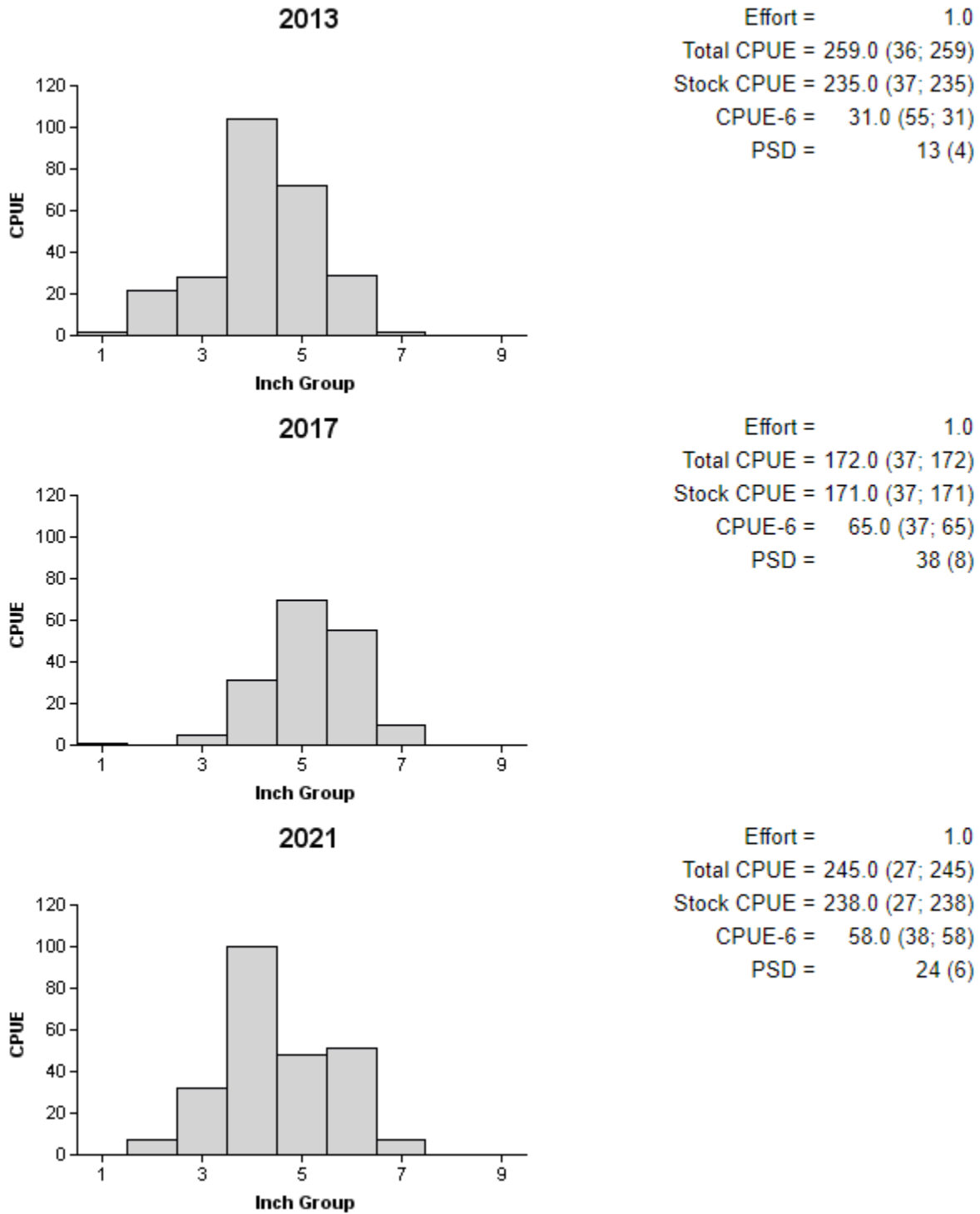


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Benbrook Reservoir, Texas, 2013, 2017, and 2021.

Blue Catfish

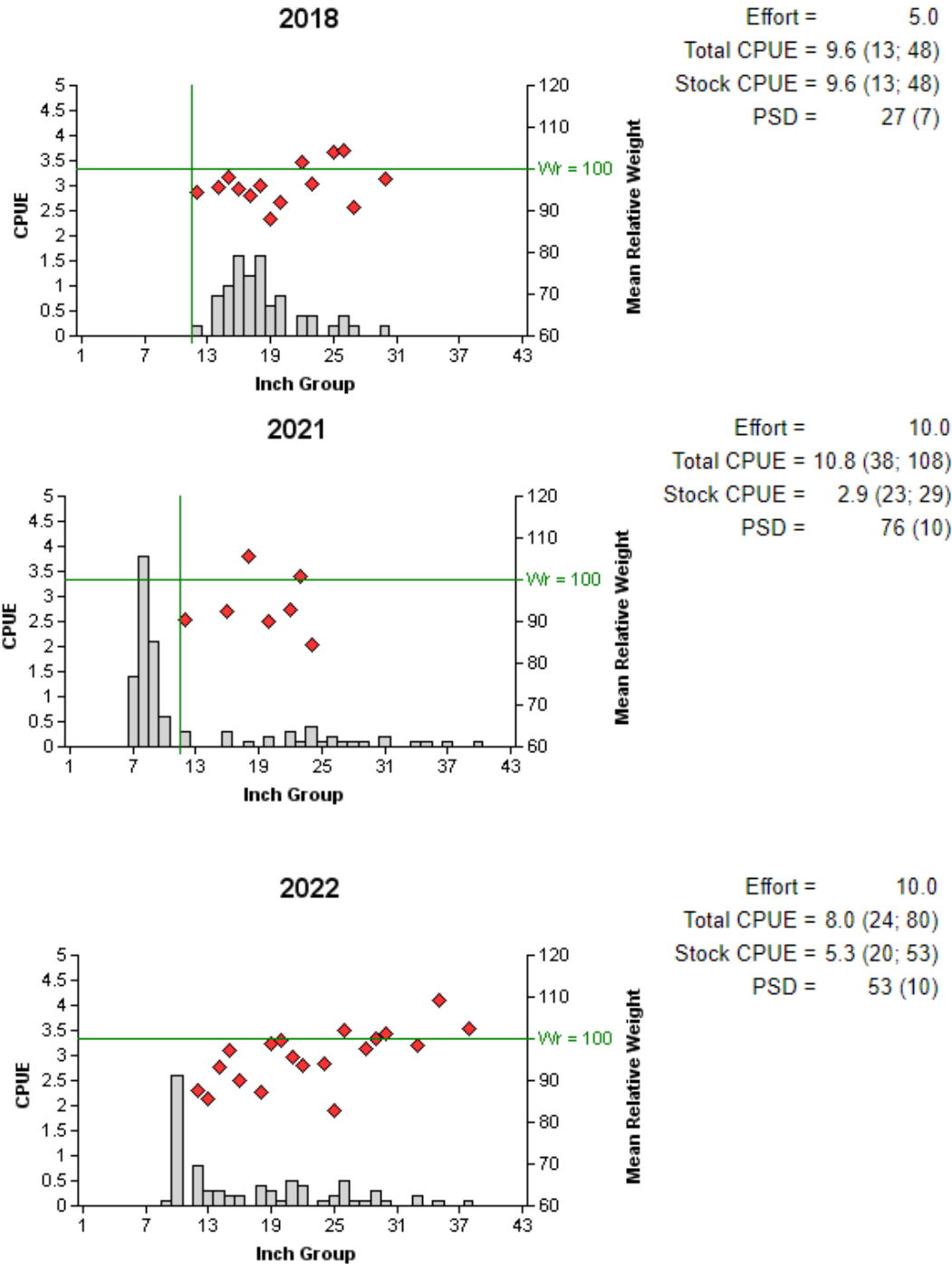


Figure 4. Number of Blue Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for standard and non-standard spring gill net surveys, Benbrook Reservoir, Texas, 2018, 2021, and 2022. Solid vertical lines indicate minimum length limit at time of sampling (2018 and 2021). Horizontal line represents optimal relative weight value of 100.

Channel Catfish

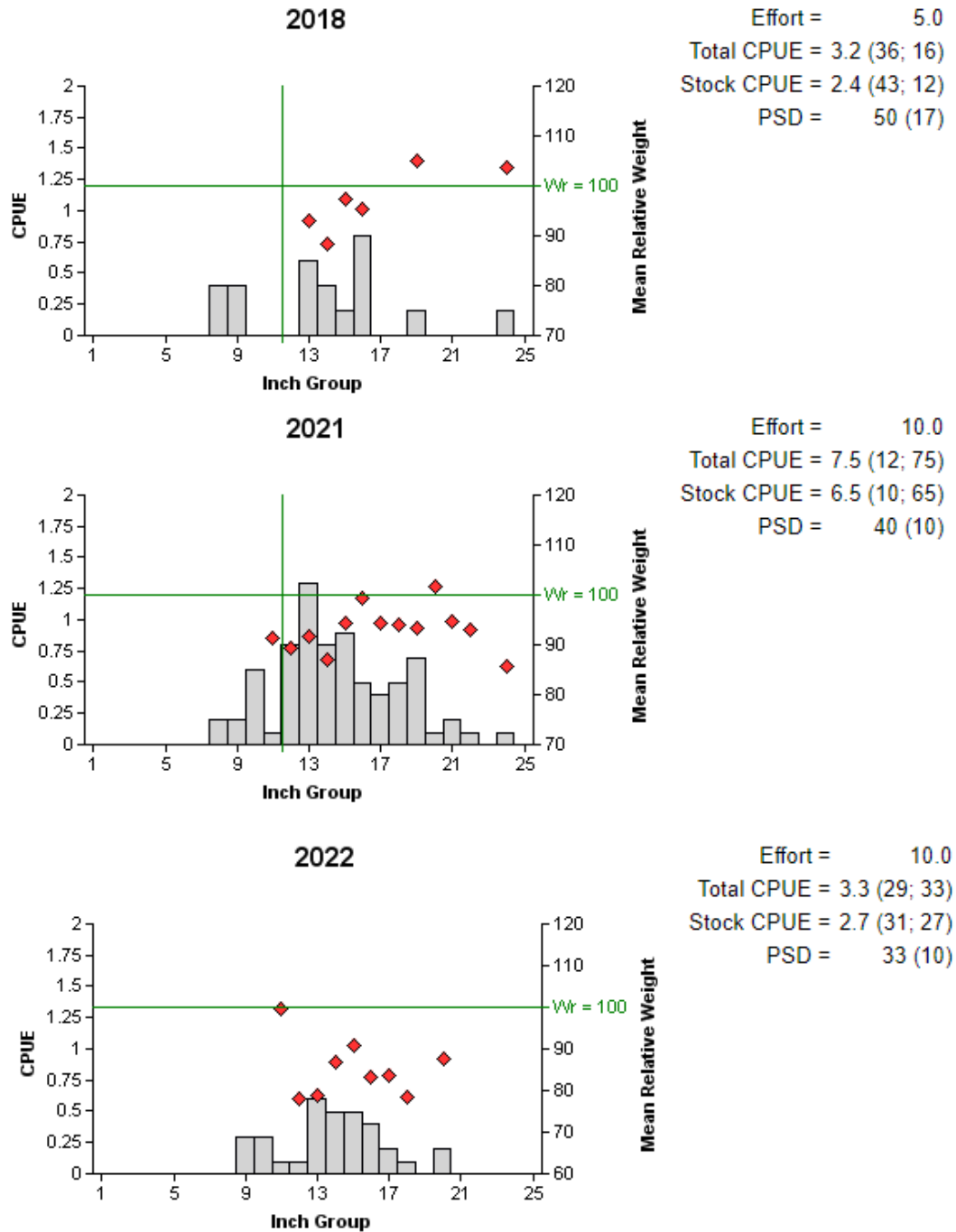


Figure 5. Number of Channel Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for standard and non-standard spring gill net surveys, Benbrook Reservoir, Texas, 2018, 2021 and 2022. Solid vertical lines indicate minimum length limit at time of sampling (2018 and 2021). Horizontal line represents optimal relative weight value of 100.

White Bass

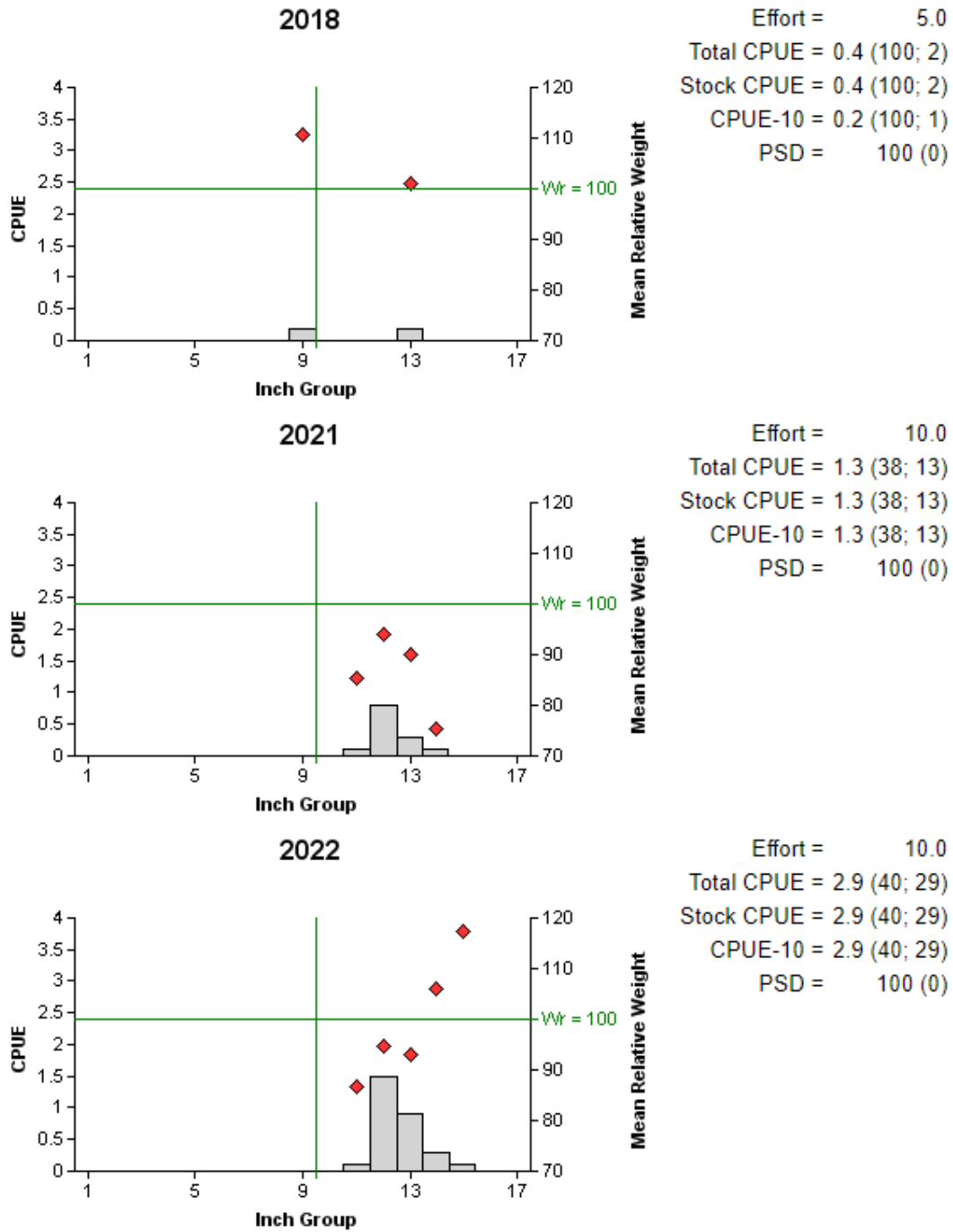


Figure 6. Number of White Bass caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for standard and non-standard spring gill net surveys, Benbrook Reservoir, Texas, 2018, 2021, and 2022. Solid vertical lines indicate minimum length limit at time of sampling. Horizontal line represents optimal relative weight value of 100.

Hybrid Striped Bass

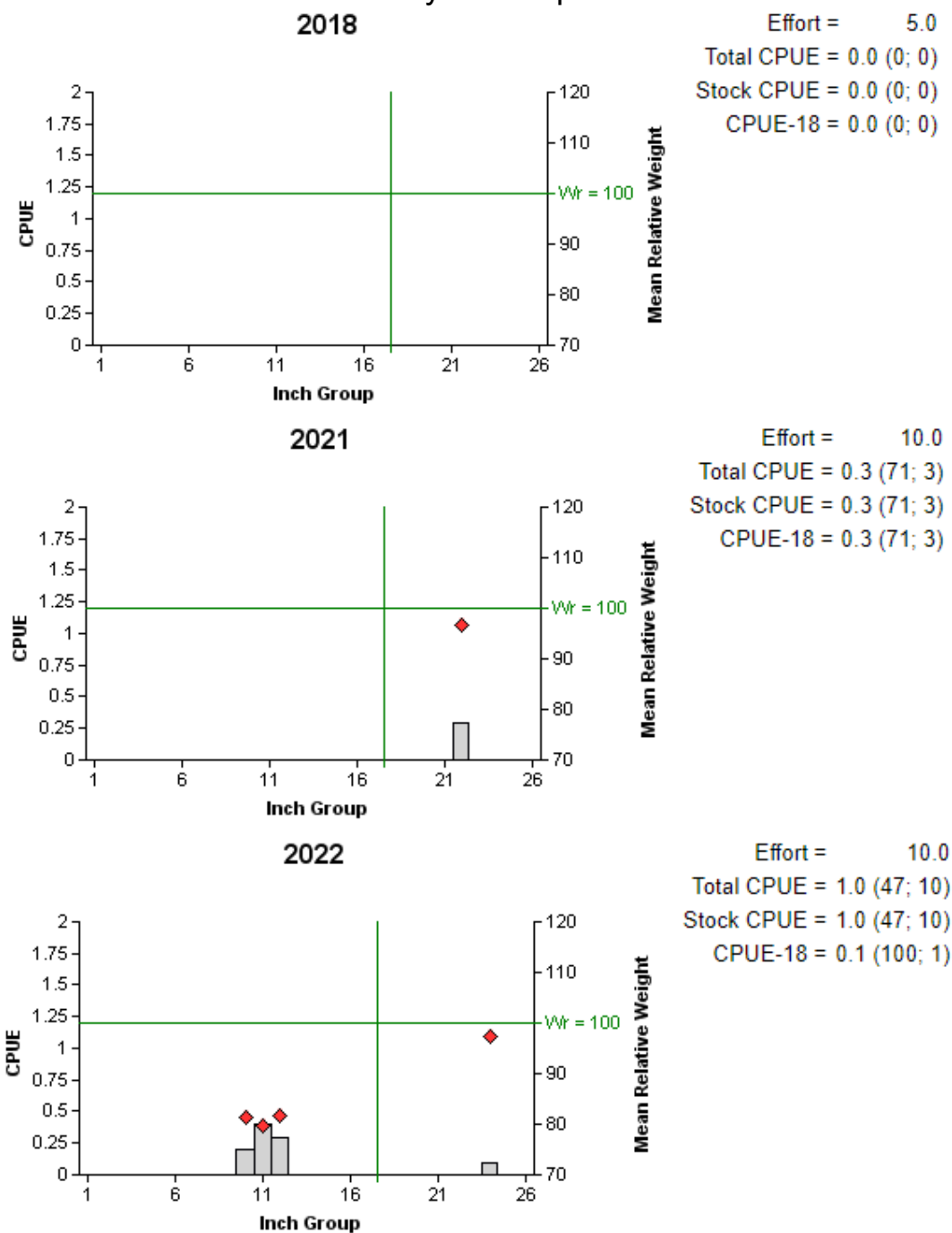


Figure 7. Number of Hybrid Striped Bass caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for standard and non-standard spring gill net surveys, Benbrook Reservoir, Texas, 2018, 2021, and 2022. Solid vertical lines indicate minimum length limit at time of sampling. Horizontal line represents optimal relative weight value of 100.

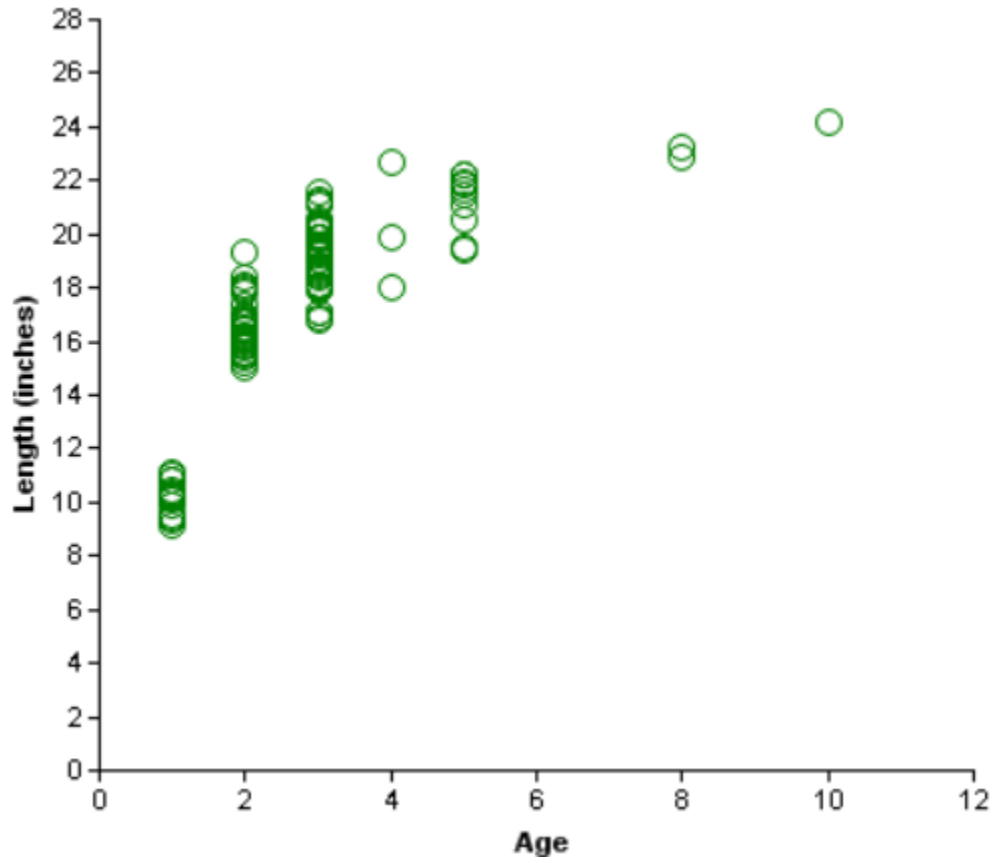


Figure 8. Historic Length at age for Hybrid Striped Bass (sexes combined) collected from gill nets at Benbrook Reservoir, Texas, 2000-2022 (N= 100).

Largemouth Bass

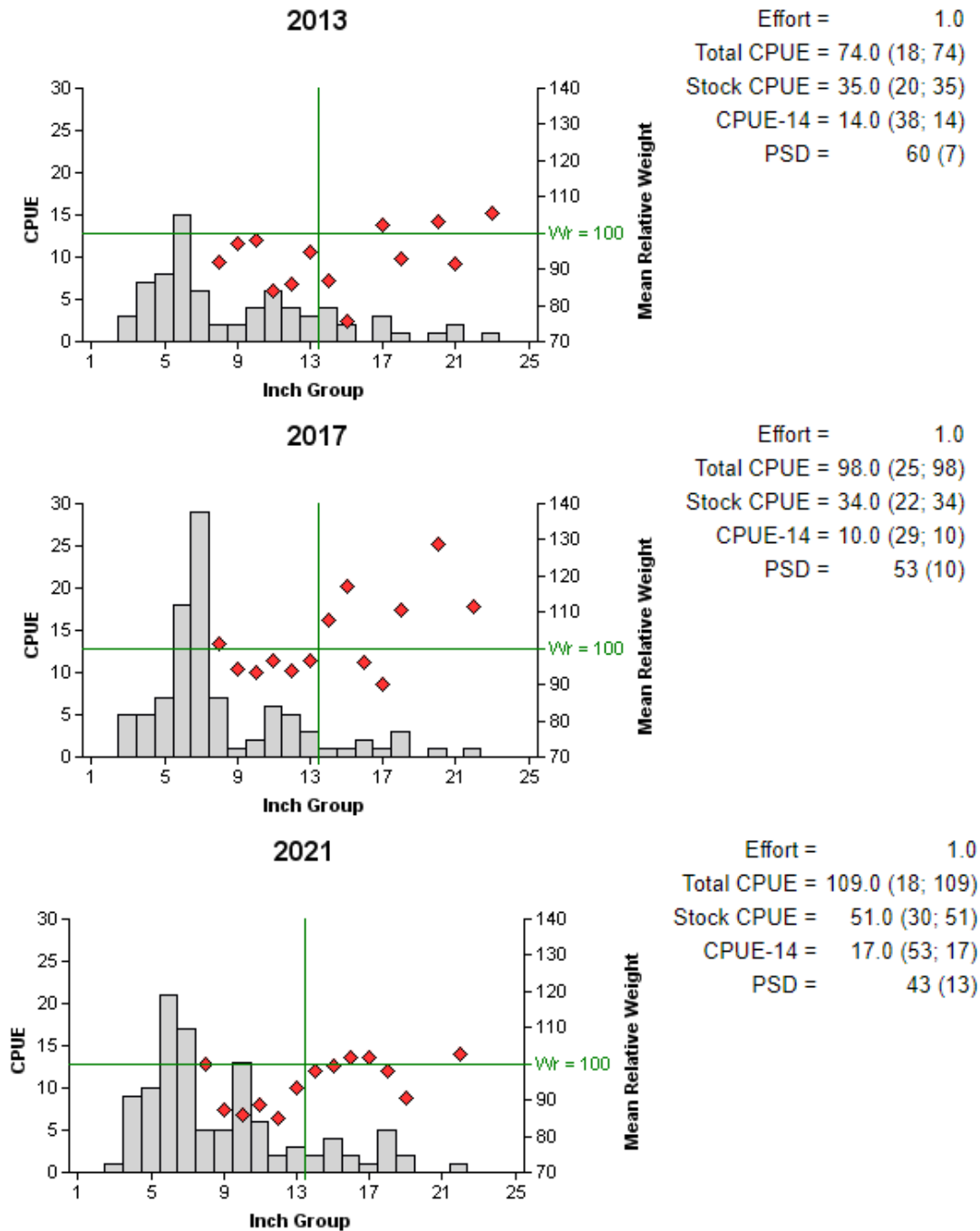


Figure 9. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Benbrook Reservoir, Texas, 2013, 2017, and 2021. Solid vertical lines indicate minimum length limit at time of sampling. Horizontal line represents optimal relative weight value of 100.

Table 8. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Benbrook Reservoir, Texas, 1996, 1999, 2001, 2009, 2013, and 2017. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB. Genetic composition was determined by electrophoresis prior to 2005 and with micro-satellite DNA analysis since 2005.

Year	Sample size	Number of Fish				
		FLMB	Intergrade	NLMB	% FLMB alleles	% FLMB
1996	26	5	16	5	50.1	19.2
1999	30	3	21	6	48.3	10.0
2001	29	5	20	4	52.6	17.2
2009	25	0	25	0	63.0	0.0
2013	30	0	30	0	60.0	0.0
2017	30	0	27	3	55.0	0.0

White Crappie

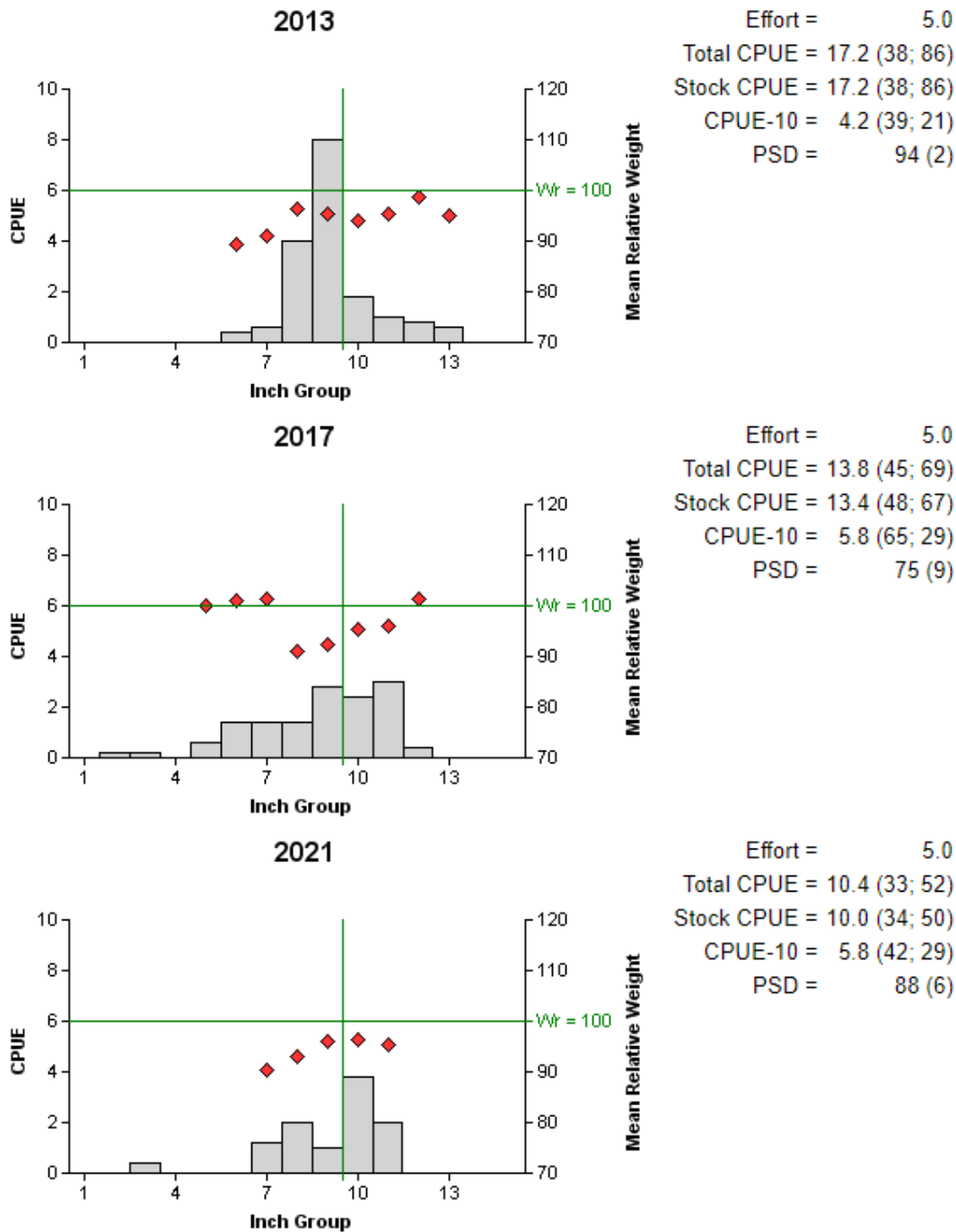


Figure 10. Number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Benbrook Reservoir, Texas, 2013, 2017, and 2021. Horizontal line represents optimal relative weight value of 100. Vertical line indicates minimum length limit.

Black Crappie

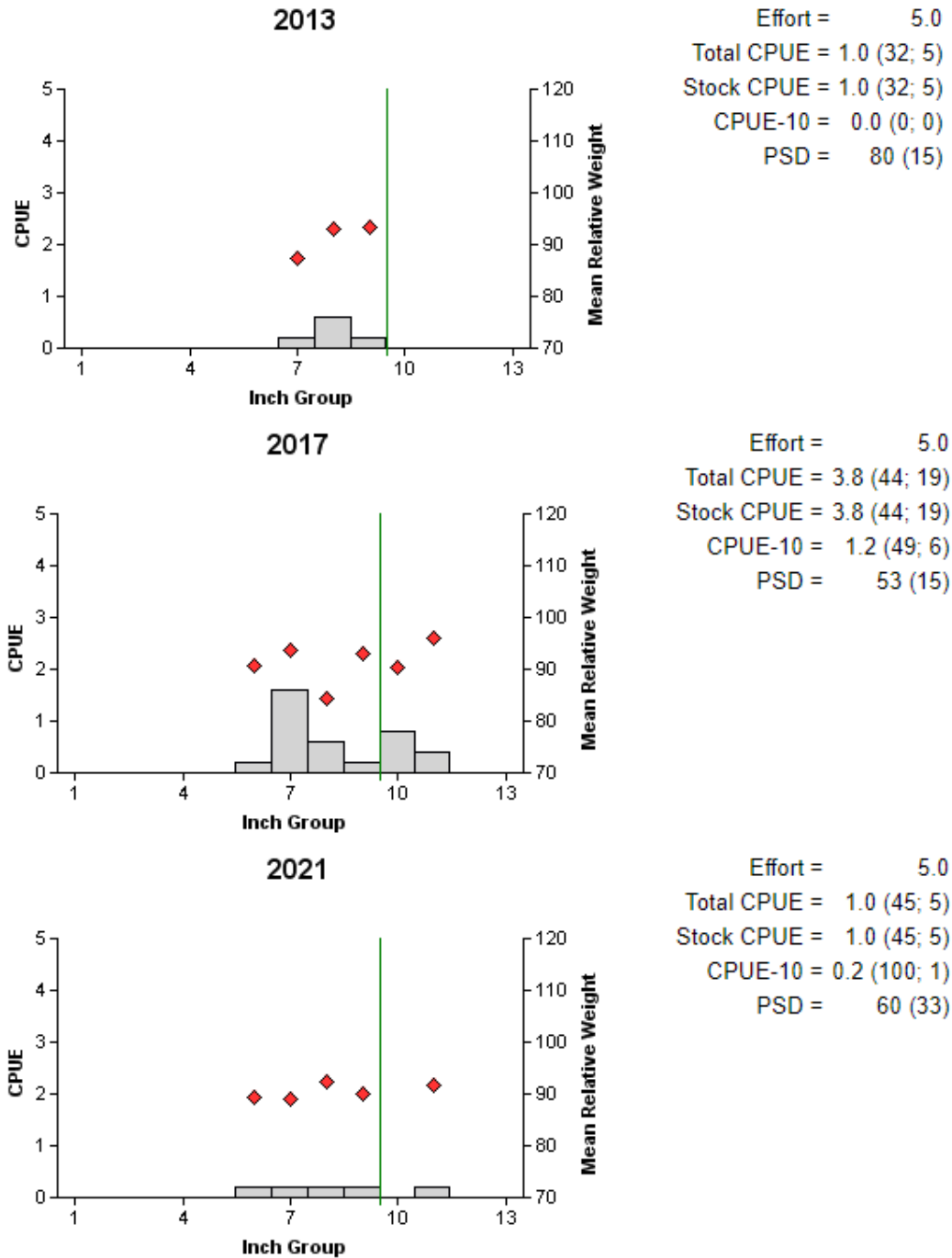


Figure 11. Number of Black Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Benbrook Reservoir, Texas, 2013, 2017, and 2021. Vertical line indicates minimum length limit. . Horizontal line represents optimal relative weight value of 100

Proposed Sampling Schedule

Table 9. Proposed sampling schedule for Benbrook 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.

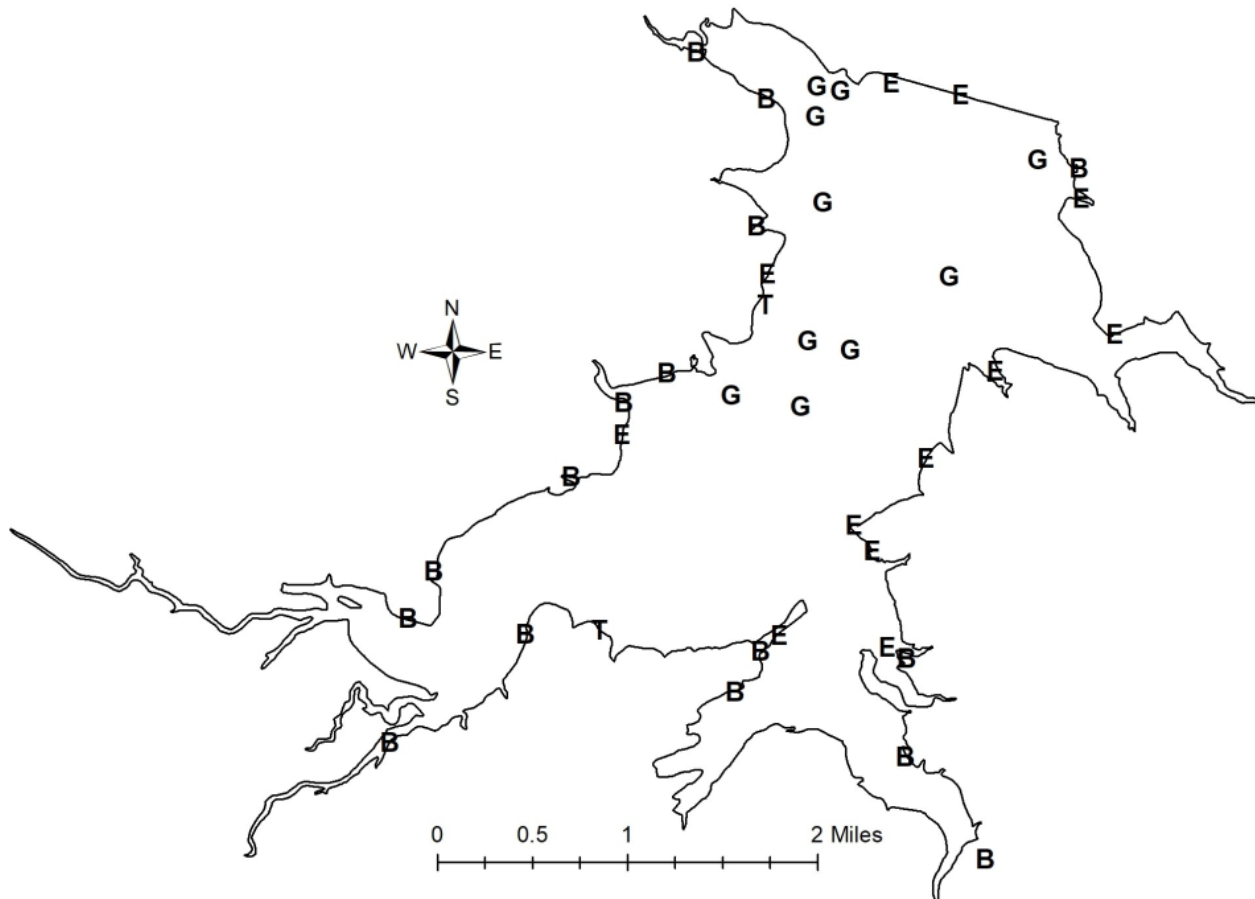
	Survey year			
	2022-2023	2023-2024	2024-2025	2025-2026
Angler Access				X
Structural Habitat				
Vegetation				
Electrofishing – Fall				X
Electrofishing – Low frequency				
Trap netting				X
Gill netting		X		X
Creel survey				X
Report				X

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 Benbrook Reservoir, Texas, 2021-2022. Sampling effort was 10 net nights for gill netting, 5 net nights for trap netting, and 1 hour for electrofishing.

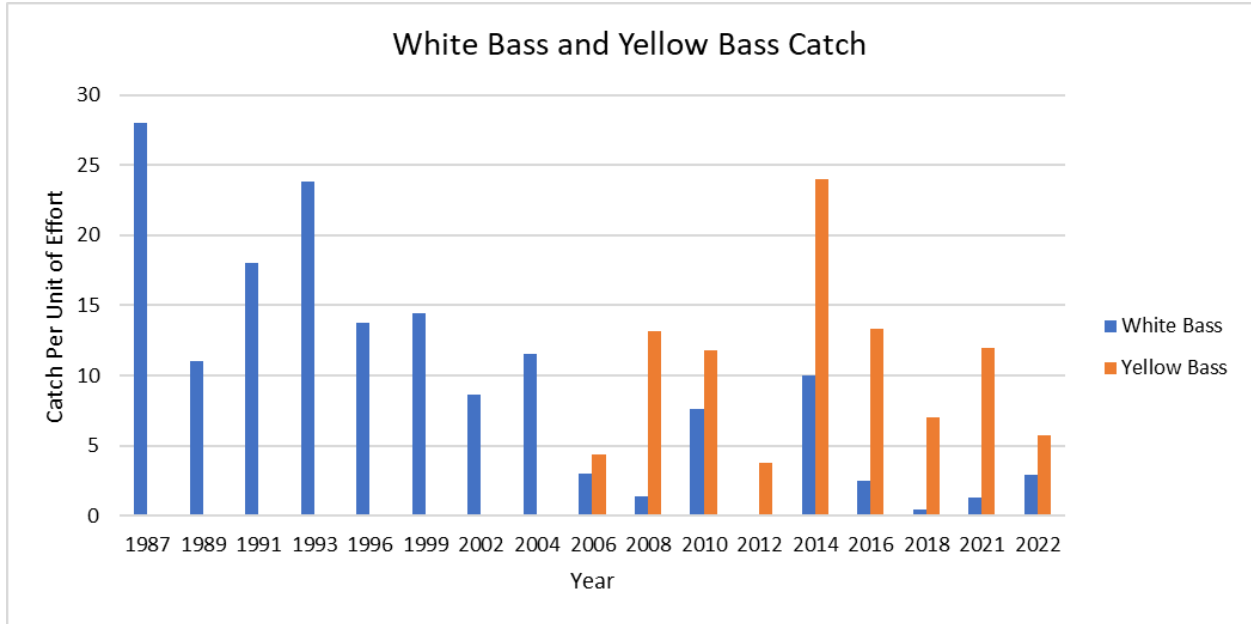
Species	Gill Netting		Trap Netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Gizzard Shad	216	21.6 (32)			157	157 (18)
Threadfin Shad					316	316 (39)
Channel Catfish	33	3.3 (29)				
Blue Catfish	80	8.0 (24)				
White Bass	2.9	29 (40)				
Yellow Bass	57	5.7 (29)				
Hybrid Stripped Bass	10	1.0 (47)				
Bluegill					245	245.0 (27)
Longear Sunfish					106	106.0 (37)
Redear Sunfish					12	12.0 (37)
Largemouth Bass	.20	20 (67)			109	109.0 (18)
White Crappie	34	3.4 (19)	33	10.4 (52)		
Black Crappie	16	1.6 (36)	5	1.0 (45)		

APPENDIX B – Map of sampling locations



Location of sampling sites, Benbrook Reservoir, Texas, 2021-2022. Trap net, gill net, and electrofishing stations are indicated by T, G, and E, respectively. Boat ramps are indicated with a B. Water level was near full pool at time of sampling.

Appendix C – Historical catch rates of White Bass and Yellow Bass



Gill netting catch rates of White Bass and Yellow Bass in Benbrook Reservoir. Prior to 2006, Yellow Bass were not collected in Benbrook. Their introduction is likely the result of a raw-water pipeline that moves water from Richland Chambers and Cedar Creek Reservoirs in East Texas.

APPENDIX D – Historical catch rates of targeted species by gear type for Benbrook Reservoir, Texas.

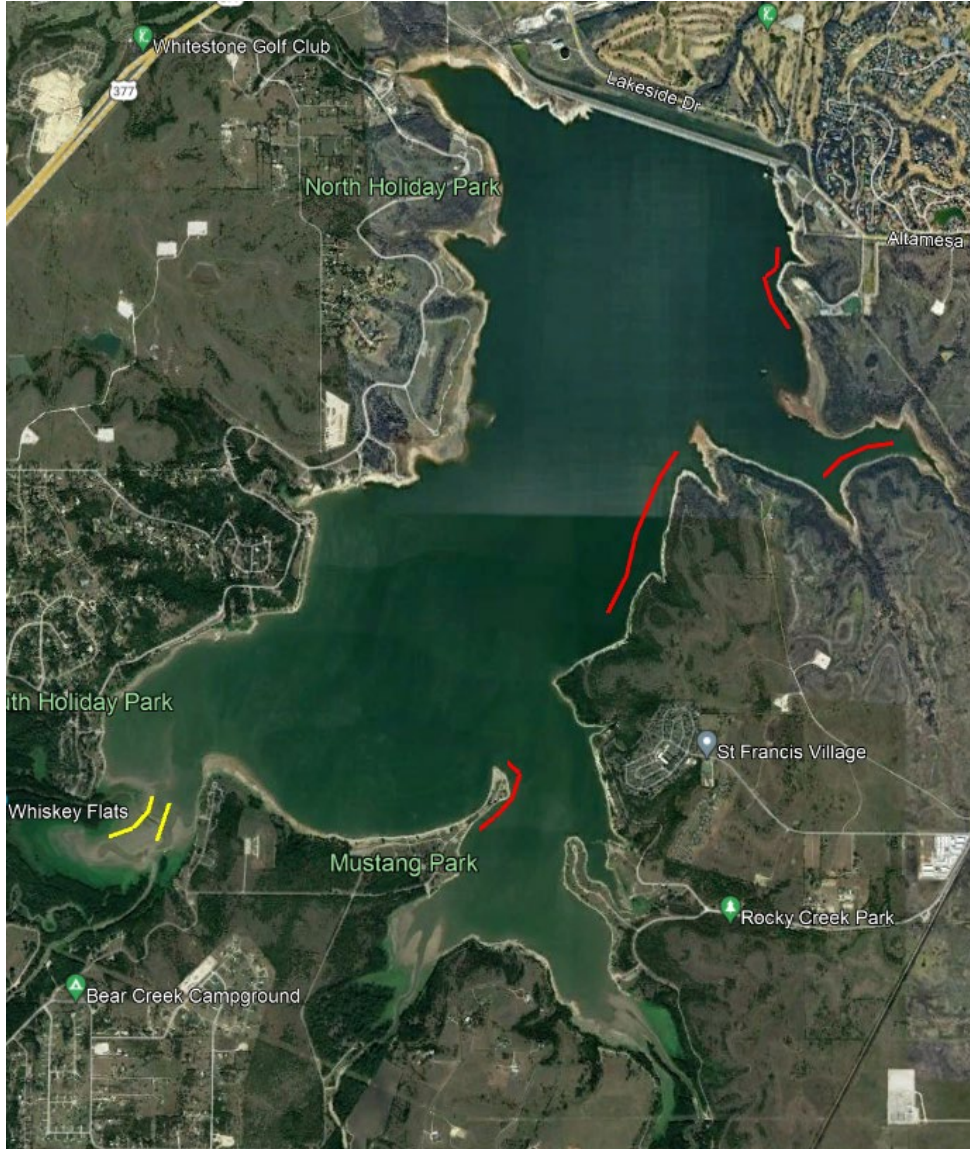
Gear	Species	Year											
		1987	1989	1991	1993	1996	1999	2001	2002	2003	2004	2005	2006
Gill Netting (fish/net night)	Blue Catfish	0.1	0.1	0.0	0.0	0.6	1.0		0.6		0.8		3.8
	Channel Catfish	7.0	12.0	4.0	3.8	3.5	3.0		1.6		6.8		3.4
	White Bass	28.0	11.0	18.0	23.8	13.8	14.4		8.6		11.5		3.0
	Yellow Bass	0.0	0.0	0.0	0.0	0.0	0.0		0.0		0.0		4.4
	Palmetto Bass	0.0	1.0	0.0	1.4	6.0	9.4		2.4		1.8		8.4
Electrofishing (fish/hour)	Gizzard Shad	311.0	139.0	177.0	394.0	131.0	272.0	256.0		192.0			288.0
	Threadfin Shad	518.0	243.3	523.0	298.0	29.0	224.0	232.0		464.0			1089.0
	Bluegill	277.0	346.0	165.0	104.0	27.0	41.0	194.0		253.0			276.0
	Longear Sunfish	191.0	207.3	277.0	0.0	19.0	28.0	97.0		151.0			145.0
	Redear Sunfish	30.0	80.0	15.0	5.3	2.0	0.0	0.0		3.0			0.0
	Largemouth Bass	145.0	314.0	159.0	127.3	72.0	125.0	72.0		66.0			120.0
Trap Netting (fish/net night)	White Crappie	3.0	3.0	2.8	5.0	2.6	2.6	8.6					2.0
	Black Crappie	0.0	0.0	1.0	0.4	0.6	0.2	0.2					0.0

APPENDIX D – Continued

Gear	Species	Year											Ave.	
		2008	2009	2010	2012	2012	2013	2014	2016	2017	2018	2021		2022
Gill Netting	Blue Catfish	3.0		1.4		5.4		2.6	5.0		9.6	10.8	8.0	3.0
(fish/net night)	Channel Catfish	3.0		7.2		2.2		4.6	1.3		3.2	7.5	3.3	4.8
	White Bass	1.4		7.6		0.0		10.0	2.5		0.4	1.3	2.9	9.7
	Yellow Bass	13.2		11.8		3.8		24.0	13.3		7.0	12.0	5.7	5.1
	Palmetto Bass	4.4		3.8		1.0		2.8	0.0		0.0	0.3	1.0	2.7
Electrofishing	Gizzard Shad		207.0	165.0			345.0			372.0		157.0		243.3
(fish/hour)	Threadfin Shad		787.0	586.0			495.0			1020.0		316.0		487.5
	Bluegill		21.0	365.0			259.0			172.0		245.0		196.1
	Longear Sunfish		12.0	193.0			90.0			85.0		106.0		114.4
	Redear Sunfish		0.0	3.0			0.0			3.0		12.0		11.0
	Largemouth Bass		32.0	94.0			74.0			98.0		109.0		114.8
Trap Netting	White Crappie		11.0				17.2			13.8		10.4		6.8
(fish/net night)	Black Crappie		0.8				1.0			3.8		1.0		0.8

APPENDIX E– Potential Habitat Projects and Locations for Benbrook Reservoir, Texas

Potential Habitat Activity	Map Location (Line Color)
Rock/Boulder	Red
Dredging	Yellow





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