

Marble Falls Reservoir

2017 Fisheries Management Survey Report

PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-3

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

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Contents

Contents	i
Survey and Management Summary	1
Introduction.....	2
Reservoir Description	2
Angler Access.....	2
Management History	2
Methods.....	4
Results and Discussion.....	4
Fisheries Management Plan for Marble Falls Reservoir, Texas.....	7
Objective-Based Sampling Plan and Schedule (2018–2022).....	8
Literature Cited.....	10
Tables and Figures	11
Harvest Regulations	12
Stocking History.....	12
Gizzard Shad.....	17
Redbreast Sunfish	18
Bluegill	19
Channel Catfish	20
Largemouth Bass	21
Proposed Sampling Schedule	23
APPENDIX A – Map of sampling locations.....	24
APPENDIX B – Habitat survey	25
APPENDIX C – Catch rates for target species	26

Survey and Management Summary

Fish populations in Marble Falls Reservoir were surveyed in 2017 using electrofishing and tandem hoop netting. Historical data are presented with the 2017 data for comparison. This report summarizes results of the survey and contains a fisheries management plan for the reservoir based on those findings.

Reservoir Description: Marble Falls Reservoir is a 573-acre (when full) mainstem stable-level impoundment of the Colorado River, located in the City of Marble Falls, Burnet County, TX. It was constructed in 1951 by the Lower Colorado River Authority (LCRA) for hydroelectric power, recreation and water supply. The reservoir is riverine in nature with a limited number of coves and creeks. The reservoir area represents a geological transition between granite outcroppings and limestone formations of the Edwards Plateau, and its shoreline length is 18.7 miles. Most of the shoreline is private; three public boat ramps are available.

Management History: Important sport fish include Largemouth Bass and Channel Catfish. Florida Largemouth Bass were stocked in Marble Falls Reservoir in 1999 to increase Florida Largemouth Bass genetic introgression. Channel Catfish were last stocked in 2016. The lake is managed under statewide regulations. Marble Falls Reservoir has historically had very low aquatic vegetation coverage. In 2013, non-native species were recorded (hydrilla and Eurasian watermilfoil). Since hydrilla can become an operational issue for the LCRA, an herbicide treatment plan was implemented in 2013 for the eradication/control of hydrilla.

Fish Community

- **Prey species:** Bluegill and Redbreast Sunfish were the predominant prey species in 2017, providing some good opportunities for panfish anglers. Gizzard Shad, Threadfin Shad, and Longear Sunfish were present in low numbers.
- **Channel Catfish:** Channel Catfish catch rate was 3.6 fish/series of tandem hoop nets. Most fish were of harvestable size, and the largest was 20 inches in length. Overall, body condition was poor for most size classes of fish.
- **Largemouth Bass:** Largemouth Bass abundance was moderate (86.0/h) and population size structure was good. Overall, body condition for most fish was close to optimal. Individuals reached harvestable-size length (14 inches) between ages two and three.

Management Strategies: Based on current information, the reservoir should continue to be managed with existing regulations. Conduct general monitoring surveys using tandem hoop nets and electrofishing in 2021. Standard access and vegetation surveys will also be conducted in 2021. Continue to inform the public about the negative impacts of aquatic invasive species.

Introduction

This document is a summary of fisheries data collected from Marble Falls Reservoir 2017. 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 2017 data for comparison.

Reservoir Description

Marble Falls Reservoir is a 573-acre (when full) mainstem stable-level impoundment of the Colorado River, located in the City of Marble Falls, Burnet County, TX. It was constructed in 1951 by LCRA for hydroelectric power, recreation and water supply. Marble Falls Reservoir is riverine in nature with a limited number of small coves and creeks. The upper third of the reservoir is extremely shallow (< 5 ft) and has many underwater hazards (granite boulders and outcroppings), making access to this part of the reservoir by motorized boats difficult. The reservoir area represents a geological transition between granite outcroppings and limestone formations of the Edwards Plateau. Marble Falls Reservoir has a shoreline length of 18.7 miles, and a shoreline development index of 3.1. Structural habitat consisted of natural shoreline, bulkhead with piers and docks, rock bluff, and rocky bluff with piers and docks. The reservoir maintains a stable water level, with little change in elevation (< 1.9 ft), so a water level figure was omitted from this report. Conservation level is 738 ft above mean sea level (MSL). Marble Falls Reservoir is eutrophic with a mean TSI chl-a of 57.06, and a 10-year change of +7.12 (Texas Commission on Environmental Quality 2018). Other descriptive characteristics for Marble Falls Reservoir are listed in Table 1.

Angler Access

Angler access at Marble Falls Reservoir was good for boat anglers, but poor for bank anglers. Boat access consisted of three public boat ramps. Public bank access was limited to park area at the Lakeside boat ramp. Additional boat ramp characteristics are in Table 2.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Farooqi and De Jesus 2014) included:

1. Continue to monitor the fishery and promote any positive aspects of the fishery when the opportunity arises.
Action: The fishery was monitored by electrofishing and hoop netting in 2017. Surveys were also conducted to assess vegetation coverage, structural habitat, and angler access. Bank angling for Smallmouth Buffalo was highlighted during interactions with local rough-fish angling groups.
2. Continue to engage partners and the public about the negative impacts of aquatic invasive species, using print media, social media, and public engagements.
Action: Outreach efforts regarding invasive species included social media, print media, public presentations, and other interactions with constituents.

Harvest regulation history: Sport fish in Marble Falls Reservoir are managed with statewide regulations (Table 3). The Guadalupe Bass 12-inch minimum length limit was changed to a statewide no minimum length limit in 2001. The White Bass minimum length limit was reduced to 10 inches in September 2004 as analyses indicated that population densities were determined by environmental factors rather than angler harvest (Cummings and Magnelia 2010).

Stocking history: Marble Falls Reservoir was last stocked with Channel Catfish in 2016 to enhance the population, and Florida Largemouth Bass in 1999 to increase Florida Largemouth Bass genetic influence. The complete stocking history is in Table 4.

Vegetation/habitat management history: Marble Falls Reservoir has historically had very low aquatic vegetation coverage. Two native species of aquatic emergent vegetation (cattail and American waterwillow) accounted for only 5.5 acres (< 1% coverage) in 2005 (Cummings and Magnelia 2010). Since then, no aquatic vegetation or habitat survey had been conducted until 2013. The estimated total coverage of all submerged aquatic plant species in 2013 was less than 11% (< 58 acres). However, non-native species were recorded. At least 8% (48 acres) of the total acreage in 2013 was Eurasian watermilfoil (*Myriophyllum spicatum*), and hydrilla (*Hydrilla verticillata*) was documented at less than 1%. In 2014, Eurasian watermilfoil had increased to 193.1 acres (33.6% coverage) and Hydrilla increased to 8.1 acres (1.4%). Hydrilla can become an operational issue for the LCRA, therefore in 2013, the LCRA implemented a plan to use herbicide treatments for the eradication/control of hydrilla. Most of the shoreline habitat was comprised of natural shoreline features, bulkhead and rock with piers and docks.

Water transfer: Marble Falls Reservoir is primarily used for hydroelectric power, municipal water supply, and recreation. The reservoir forms part of the chain of “highland lakes” on the Colorado River, receiving water directly from Lyndon B. Johnson Reservoir and discharging directly into Travis Reservoir. No inter-basin water transfers are known to exist at Marble Falls Reservoir.

Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Marble Falls Reservoir (TPWD unpublished). Primary components of the OBS plan are listed in Table 5. All survey sites (Appendix A) were randomly selected and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Electrofishing – Largemouth Bass, Sunfishes, and Gizzard Shad were collected by electrofishing (1.0 h 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. Ages for Largemouth Bass were determined by a Category 2 evaluation using otoliths from 13 randomly-selected fish (range 13.0 to 14.9 inches; TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Tandem hoop nets – Channel Catfish were collected using a total of 18 tandem hoop net series (nine tandem hoop net series set on two occasions) at a total of 18 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_t)] were calculated for target fishes according to Anderson and Neumann (1996). Index of Vulnerability (IOV) was calculated for Gizzard Shad (DiCenzo et al. 1996). Standard error (SE) was calculated for structural indices and IOV. Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE statistics.

Habitat – An aquatic vegetation survey was conducted during peak growing season around the entire reservoir. Aquatic vegetation coverage was estimated using a Trimble® GPS unit in conjunction with sonar depth finder. Species identification was confirmed on samples collected with a modified aquatic rake. Structural habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Results and Discussion

Habitat: In 2017, littoral zone structural habitat consisted primarily of natural shoreline (55.5 %), followed by bulkhead with piers and docks (14.3%), rocky bluff (10.8%), and rocky bluff with piers and docks (9.4%; Table 6; Appendix B).

In Marble Falls Reservoir, habitat for cover-seeking species has been mostly below optimal (30-40% of total coverage) for fish production (Durocher et al. 1984, Dibble et al. 1996). The exception being in 2014 when total coverage estimate of all plant species was 37.1% (213.1 acres), largely due to an expansion of Eurasian watermilfoil (193.1 acres, 33.6% coverage; Table 7). Drought conditions that prevailed from 2011 to 2014 most likely created an environment in which Eurasian watermilfoil could flourish since reservoir flow-through rate was significantly reduced. As the drought ended, Eurasian watermilfoil coverage was predicted to decline as water flow-through rate increased. In 2014, hydrilla was recorded (8.1 acres, 1.4% coverage), which prompted the LCRA to implement a plan to use herbicide treatments for the eradication/control of hydrilla and conduct vegetation surveys to monitor effectiveness. Hydrilla can become an operational issue for the LCRA by clogging up water intake structures during floods. By 2017, hydrilla and Eurasian watermilfoil were not observed in our survey.

Prey species: Bluegill and Redbreast Sunfish were the predominant prey species in the 2017 electrofishing survey. Gizzard Shad, Threadfin Shad, and Longear Sunfish were the most abundant of the remaining forage species available (Appendix C).

In 2017, total CPUE of Gizzard Shad was low (21.0/h). Total CPUE has been low in previous surveys conducted in 2013 (19.0/h) and 2009 (30.0/h; Figure 1). Index of Vulnerability for Gizzard Shad was 14; indicating 14% of Gizzard Shad were of vulnerable size (< 8 inches) and were available to existing predators in 2017. The IOV was higher than in the 2013 survey (IOV=0) and similar to that obtained in 2009 (IOV=17) surveys. This reservoir has had low IOV values since 2005 (IOV=15).

Threadfin Shad were present in low numbers in 2017 (CPUE=13.0/h) Threadfin Shad were not captured during the 2013 and 2005 surveys but were present in 2009 (360.0/h).

Total CPUE of Redbreast Sunfish in 2017 (113.0/h) was lower than in 2013 (160.0/h) and 2009 (170.0/h). However, larger fish (7- to 8-inches in length) were still present though less abundant (CPUE-7=10.0), providing some good opportunities for panfish anglers (Figure 2).

Total CPUE of Bluegill in 2017 (223.0/h) was higher than that obtained in 2013 (176.0/h) and in 2009 (118.0/h; Figure 3). Bluegill in the 6- to 8-inch size range provided good angling opportunities for those seeking larger sunfish.

Catch rates of Longear Sunfish (13.0/h) and Redear Sunfish (8.0/h) were lower in 2017 compared to catch rates in 2014 of 23.0/h and 40.0/h respectively.

Channel Catfish: The most recent enhancement stocking of Channel Catfish in Marble Falls Reservoir was in 2016. Tandem hoop nets were used to sample Channel Catfish in 2017, whereas gill nets were used in previous surveys. Hoop netting allows for targeted sampling of Channel Catfish with limited bycatch. In 2017, the total hoop net catch rate of Channel Catfish was 3.6 fish/series. Fifty-two percent of fish were of harvestable-size (≥ 12 inches) and the largest was 20 inches in length. The CPUE-12 was 1.8 fish/series. Overall, body condition was poor for most size classes of fish ($W_r < 85$; Figure 4). The total number of fish caught by hoop netting was 64 (RSE = 23) compared to totals of 9 (RSE = 21), 18 (RSE = 24), and 15 (RSE = 45) caught by gill netting in 2006, 2010, and 2014 respectively. Pending the results of future surveys, it appears that hoop netting may be better for obtaining larger sample sizes of Channel Catfish compared to gill netting.

Largemouth Bass: In 2017, the reservoir contained a moderate density Largemouth Bass population. The total CPUE of Largemouth Bass was 86.0/h in 2017 which is lower than that recorded in 2013 (155.0/h), but similar to the catch rate obtained in 2009 (85.0/h; Figure 5). Stock CPUE has remained relatively consistent. Stock CPUE was 68.0/h in 2017, 67.0/h in 2013, and 50.0 in 2009. In 2017, the catch rate of harvestable bass (CPUE-14) was higher than in the previous two surveys. The CPUE-14 was 28.0/h compared to 12.0/h and 9.0/h in 2013 and 2009 respectively, thus making available a greater number of harvestable-size bass to anglers than in the previous two surveys.

Population size structure in the last three surveys was good. Except for 2017, where PSD (72) marginally exceeded the preferred range of between PSD 40 to 70, while the PSD-P was within the preferred range of 10-40 for a balanced population (Figure 5; Gabelhouse 1984).

Body condition of Largemouth Bass in 2017 was good for most size classes of fish. Overall, body condition was close to optimal ($W_r = 100$), with fish in most length groups having relative weights of between 90 and 110.

Age and growth analysis from 2017 indicated individuals reached harvestable-size length (14 inches) between ages two and three (N = 13; range = 2 – 4 years; Figure 6), which is about average compared to values for the Edwards Plateau ecological area (Prentice 1987).

Other species: White Crappie, White Bass, Blue Catfish, and Flathead Catfish are present in low abundance at Marble Falls Reservoir (Farooqi and De Jesus 2013). Sampling for these species was not a priority for this survey period due to historically low catch rates. However, field observations were taken

when these species were encountered while sampling for other species at the reservoir. In 2017, one Blue Catfish was collected by hoop netting and White Crappie, White Bass, and Flathead Catfish were not collected during sampling. A new waterbody record (1.8 lbs, rod and reel) for White Crappie was set in 2016.

Fisheries Management Plan for Marble Falls Reservoir, Texas

Prepared – July 2018

ISSUE 1: Marble Falls Reservoir has poor reservoir morphology and low water residence time resulting in limited productivity (Baker et al. 1993). Quality aquatic habitat has also been limited historically. Under these circumstances many sport fish species in Marble Falls Reservoir have not thrived in the past. Additional fisheries management through supplemental stocking or, more restrictive length limit harvest regulations would likely be ineffective or minimally effective. The structural composition of its shoreline and riverine nature makes it difficult to implement sustainable habitat enhancement projects. However, since 2013, submerged aquatic habitat has increased and this has coincided with an improvement in the population structure and condition of the Largemouth Bass population.

MANAGEMENT STRATEGY

1. Continue standard sampling surveys to monitor the fishery.

ISSUE 2: Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels (*Dreissena polymorpha*) can multiply rapidly and attach themselves to any available hard structure, restricting water flow in pipes, fouling swimming beaches, and plugging engine cooling systems. Giant salvinia (*Salvinia molesta*) and other invasive vegetation species can form dense mats, interfering with recreational activities like fishing, boating, skiing, and swimming. The financial costs of controlling and/or eradicating these types of invasive species are significant. Additionally, the potential for invasive species to spread to other river drainages and reservoirs via watercraft and other means is a serious threat to all public waters of the state.

MANAGEMENT STRATEGIES

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

Objective-Based Sampling Plan and Schedule (2018–2022)

Sport fish, forage fish, and other important fishes

Important sport fish in Marble Falls Reservoir include Largemouth Bass and Channel Catfish. Known important forage species include Bluegill, Redbreast Sunfish, Gizzard Shad, and Threadfin Shad. Redear Sunfish and Longear Sunfish are also present.

Low-density fisheries

White Crappie: White Crappie are present in low densities at Marble Falls Reservoir. This is based on poor catch rates rendered by trap netting. Historically, trap netting surveys have failed to capture enough fish for precise estimates of relative abundance. Gill netting and electrofishing have confirmed their presence but are also unsuitable methods for precise estimates. Since few anglers have been observed targeting White Crappie, and few catch reports have been submitted for this species, directed effort is expected to be low. Sampling for White Crappie is not a priority for 2018-2022 due to historically low catch rates. However, field observations will be taken of any White Crappie encountered while sampling for other species at the reservoir.

White Bass: White Bass are present in low abundance at Marble Falls Reservoir. The last gill netting survey conducted in 2014 captured only three individuals (0.6/n). The small size of the reservoir and inaccessibility to the upper reaches of the reservoir likely deter anglers from targeting them during the spring spawn. Since few anglers have been observed targeting White Bass, and few catch reports have been submitted for this species, directed effort is expected to be low. Sampling this population is not a priority for 2018-2022. However, field observations will be taken of any White Bass encountered while sampling for other species at the reservoir.

Blue Catfish: Blue Catfish are present in low density at Marble Falls Reservoir. Blue Catfish have not been captured in gill netting surveys since 2010, when only four stock-size length individuals were netted. The gill netting catch rate of Blue Catfish ranged between 0.4/n to 0.8/n across three surveys between 1990 and 2010. Sampling this population is not a priority for 2018-2022. However, field observations will be taken of any Blue Catfish encountered while sampling for other species at the reservoir.

Flathead Catfish: Flathead Catfish are present in low abundance based on historic gill netting surveys. The gill netting catch rate of Flathead Catfish ranged between 0.2/n to 1.8/n between 2002 and 2014. Since few anglers have been observed targeting Flathead Catfish, and few catch reports have been submitted for this species, directed effort is expected to be low. Sampling this population is not a priority for 2018-2022. However, field observations will be taken of any Flathead Catfish encountered while sampling for other species at the reservoir.

Survey objectives, fisheries metrics, and sampling objectives

Largemouth Bass: Anecdotal information indicates that Largemouth Bass is one of the most sought-after species by anglers at Marble Falls Reservoir. The reservoir attracts local bass anglers, and historic electrofishing surveys reveal the availability of memorable-size individuals (20.0- to 24.9 inches; Gablehouse 1984)). Trend data on CPUE, size structure, and body condition have been collected every four years since 1993 with fall nighttime electrofishing. The last survey in 2017 revealed higher stock CPUE and CPUE-14 than in previous surveys. This was probably related to a quick expansion of vegetated habitat during drought conditions from 2011 - 2014 when minimal flow through rates created a conducive environment for growth. This vegetative expansion augmented catch rates and attracted bass anglers to the reservoir, based on anecdotal reports.

After reviewing historical data, electrofishing catch rates of stock-size length Largemouth Bass since 1993 were sufficient to meet minimal objectives in 12 stations, which should result in a RSE \leq 25. A minimum of

12 randomly selected 5-min electrofishing sites will be sampled in 2021, but sampling will continue at random sites, if necessary, until 50 stock-size fish are collected and the RSE of CPUE-S is ≤ 25 . Six additional random stations will be pre-determined in the event extra sampling is necessary. If failure to achieve either objective has occurred after one night of sampling and objectives can be attained with up to six additional random stations, another night of sampling will be conducted. An age and growth sample of 13 fish between 13.0 and 14.9 inches in length will be collected to assess the time required for Largemouth Bass to grow to the minimum length limit (Category 2 evaluation, TPWD, Inland Fisheries Division, unpublished manual revised 2015). The next sampling session for Largemouth Bass is scheduled for 2021-2022 period (Table 8).

Channel Catfish: Channel Catfish angling effort has been observed and reported by anglers at Marble Falls Reservoir on a frequent basis. However, Channel Catfish seem to be present in low abundance based on historic gill netting surveys. The gill netting catch rate of stock-size Channel Catfish ranged between 0.4/n to 5.0/n between 1987 and 2014. The precision and catch rates never met suggested values to generate a confident assessment. We propose to continue sampling using tandem hoop nets with two nights of effort. We anticipate that setting a minimum of nine tandem hoop nets, with a soak time of two nights, will achieve our sampling objective (50 Channel Catfish ≥ 11 inches; RSE of CPUE-S ≤ 30). A minimum of nine randomly-selected tandem hoop netting sites will be sampled in summer 2021, but sampling will continue at random sites until 50 stock-size fish are collected and the RSE of CPUE-S is ≤ 30 (the anticipated effort to meet both sampling objectives is nine stations with 70% confidence). Exclusive of the original nine random stations, nine additional random stations will be pre-determined in the event some extra sampling is necessary. If failure to achieve either objective has occurred after one soak session, and objectives can be attained with up to nine additional random stations, another soak session of effort will be expended. If tandem hoop netting surveys do not improve precision for this species, Channel Catfish will likely be monitored as a low-density species in following years without the need for increased sampling precision.

Bluegill, Redbreast Sunfish, and Gizzard Shad: Bluegill, Redbreast Sunfish, and Gizzard Shad are the predominant prey species available in Marble Falls Reservoir. Sampling effort based on achieving sampling objectives for Largemouth Bass will result in sufficient numbers of Bluegill, Redbreast Sunfish and Gizzard Shad for size structure estimation in 2017 (PSD and IOV; 50 stock-size fish minimum at 12 stations with 80% confidence), but not for relative abundance estimates (RSE ≤ 25 of CPUE-Total (CPUE-T); anticipated effort is 25-30 stations). At the sampling effort needed to achieve sampling objectives for Largemouth Bass, the expected RSE for CPUE-T is 30 for Bluegill and Redbreast Sunfish, and 35 for Gizzard Shad. No additional effort will be expended to achieve an RSE=25 for CPUE of Bluegill, Redbreast Sunfish, and Gizzard Shad. Instead, Largemouth Bass body condition can provide information on forage abundance, vulnerability, or both relative to predator density. Relative weight of Largemouth Bass ≥ 8 inches total length will be determined from their length/weight data (maximum of 10 fish weighed and measured per inch class). The next sampling session for prey species is scheduled for 2021-2022 period (Table 8).

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Tables and Figures

Table 1. Characteristics of Marble Falls Reservoir, Texas.

Characteristic	Description
Year constructed	1951
Controlling authority	Lower Colorado River Authority
County	Burnet
Reservoir type	Mainstream: Colorado River
Shoreline Development Index	3.1
Conductivity	341 $\mu\text{S}/\text{cm}$

Table 2. Boat ramp characteristics for Marble Falls Reservoir, Texas, September 2017. Reservoir elevation at time of survey was 736 feet above mean sea level. This is a stable-level reservoir (conservation level is 738 feet).

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft.)	Condition
Lakeside Park	30.567403 -98.278761	Y	8	NA	Good
Johnson Park	30.567508 -98.281231	Y	6	NA	Good
Out Ramp	30.562392 -98.283278	Y	4	NA	Good

Table 3. Harvest regulations for Marble Falls Reservoir, Texas.

Species	Bag limit	Length limit (inches)
Channel and Blue Catfish	25 (in any combination)	12 (minimum)
Flathead Catfish	5	18 (minimum)
White Bass	25	10 (minimum)
Largemouth Bass	5 ^a	14 (minimum)
Guadalupe Bass	5 ^a	None
White and Black Crappie	25 (in any combination)	10 (minimum)

^a Daily bag for Largemouth Bass and Guadalupe Bass = five fish in any combination.

Table 4. Stocking history for Marble Falls 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. For each year and life stage the species mean total length (Mean TL; in) is given. For years where there were multiple stocking events for a particular species and life stage the mean TL is an average for all stocking events combined.

Species	Year	Number	Life Stage	Mean TL (in)
Blue Catfish	1971	38,200	UNK	UNK
	1979	<u>21,868</u>	UNK	UNK
	Total	60,068		
Channel Catfish	1966	20,700	AFGL	7.9
	1969	18,500	AFGL	7.9
	1971	10,500	AFGL	7.9
	1972	15,000	AFGL	7.9
	1984	7,523	AFGL	11.0
	2012	211,835	FRY	0.7
	2016	<u>8,199</u>	FGL	1.4
Total	292,257			
Florida Largemouth Bass	1999	<u>78,525</u>	FGL	1.4
	Total	78,525		
Green Sunfish x Redear Sunfish	1966	<u>200</u>		UNK
	Total	200		
Largemouth Bass	1966	<u>1,200</u>	UNK	UNK
	Total	1,200		
Palmetto Bass (Striped X White Bass hybrid)	1976	1,922	UNK	UNK
	1980	9,100	UNK	UNK
	1983	<u>7,873</u>	UNK	UNK
	Total	18,895		
Smallmouth Bass	1978	48,000	UNK	UNK
	1979	36,350	UNK	UNK
	1980	10,000	UNK	UNK
	1988	38,954	FRY	0.5

Table 4. Stocking history for Marble Falls 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. For each year and life stage the species mean total length (Mean TL; in) is given. For years where there were multiple stocking events for a particular species and life stage the mean TL is an average for all stocking events combined.

Species	Year	Number	Life Stage	Mean TL (in)
	Total	133,304		
White Crappie	1971	<u>1,000</u>	UNK	UNK
	Total	<u>1,000</u>		

Table 5. Objective-based sampling plan components for Marble Falls Reservoir, Texas 2017 – 2018.

Gear/target species	Survey objective	Metrics	Sampling objective
<i>Electrofishing</i>			
Largemouth Bass	Abundance	CPUE – stock	RSE-stock ≤ 25
	Size structure	PSD, length frequency	$N \geq 50$ stock
	Age-and-growth	Age at 14 inches	$N = 13, 13.0 - 14.9$ inches
	Condition	W_r	10 fish/inch group (max)
Redbreast Sunfish ^a	Abundance	CPUE – total	RSE ≤ 25
	Size structure	PSD, length frequency	$N \geq 50$ stock
Bluegill ^a	Abundance	CPUE – total	RSE ≤ 25
	Size structure	PSD, length frequency	$N \geq 50$
Gizzard Shad ^a	Abundance	CPUE – total	RSE ≤ 25
	Size structure	Length frequency	$N \geq 50$
	Prey availability	IOV	$N \geq 50$
<i>Tandem Hoop netting</i>			
Channel Catfish	Abundance	CPUE – stock	RSE-stock ≤ 25
	Size structure	Length frequency	$N \geq 50$ stock
	Condition	W_r	10 fish/inch group (max)

^a No additional effort will be expended to achieve an RSE ≤ 25 for CPUE and $N \geq 50$ for Redbreast Sunfish, 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 6. Survey of structural habitat types, Marble Falls Reservoir, Texas, 2017.

Habitat type	Shoreline coverage (miles)	% of total
Natural shoreline	10.4	55.5
Bulkhead with docks and piers	2.7	14.3
Rocky bluff	2.0	10.8
Rocky bluff with piers and docks	1.8	9.4
Bulkhead	0.8	4.4
Natural shoreline with piers and docks	0.7	3.5
Rocky shoreline with piers and docks	0.3	1.4
Rocky shoreline	0.1	0.7

Table 7. Survey of aquatic vegetation, Marble Falls Reservoir, Texas, 2014–2017. Surface area (acres) is listed with percent of total reservoir surface area in parentheses; NS = not sampled.

Vegetation	2014	2015	2016	2017
Native submersed	11.9 (2.1)	NS	NS	0.0
Native emergent	0.0	NS	NS	11.4 (1.9)
Non-native		NS	NS	0.0
Hydrilla (Tier I)*	8.1 (1.4)			
Eurasian watermilfoil (Tier III)*	193.1 (33)			

*Tier I is immediate Response, Tier III is Watch Status

Gizzard Shad

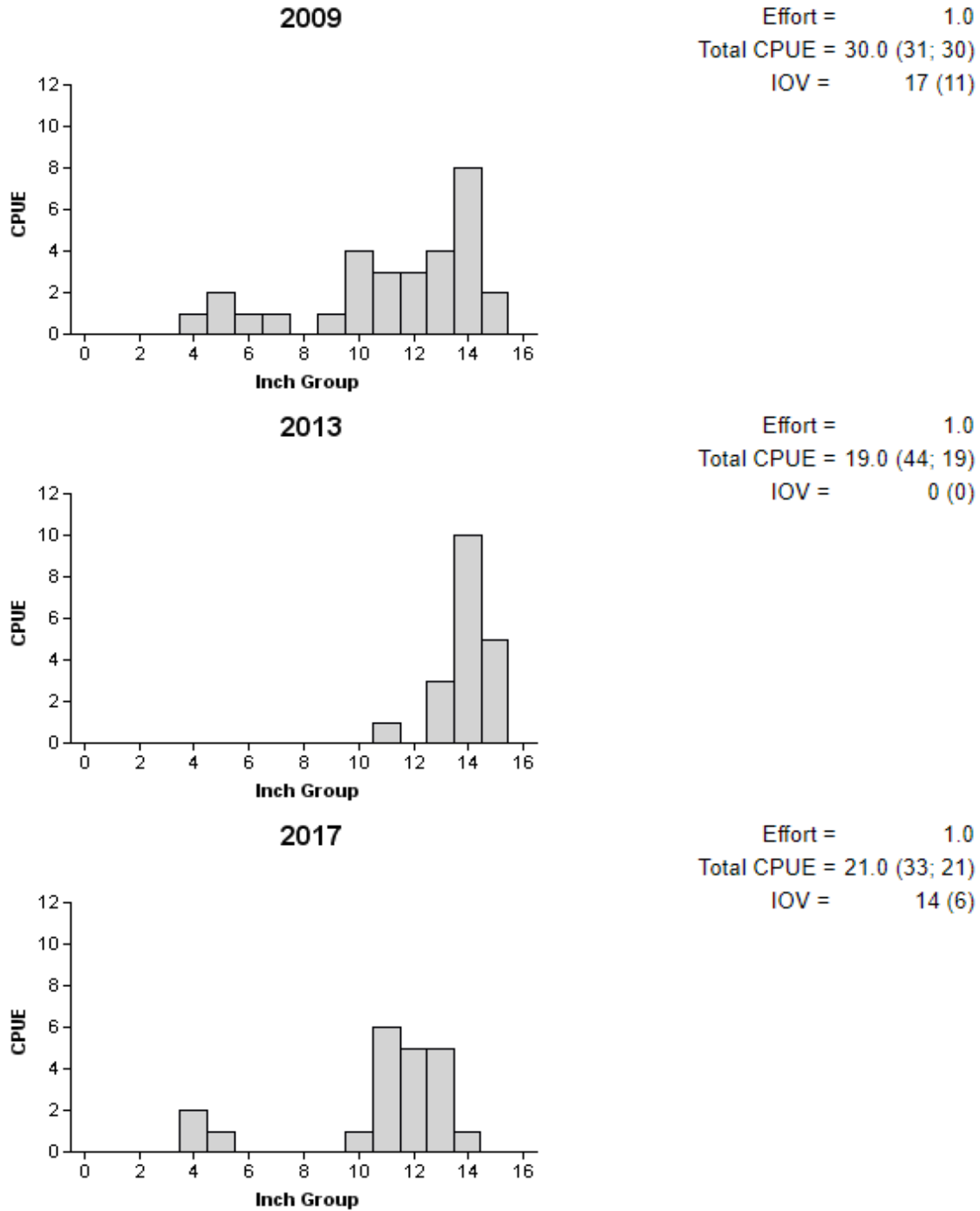


Figure 1. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Marble Falls Reservoir, Texas, 2009, 2013, and 2017.

Redbreast Sunfish

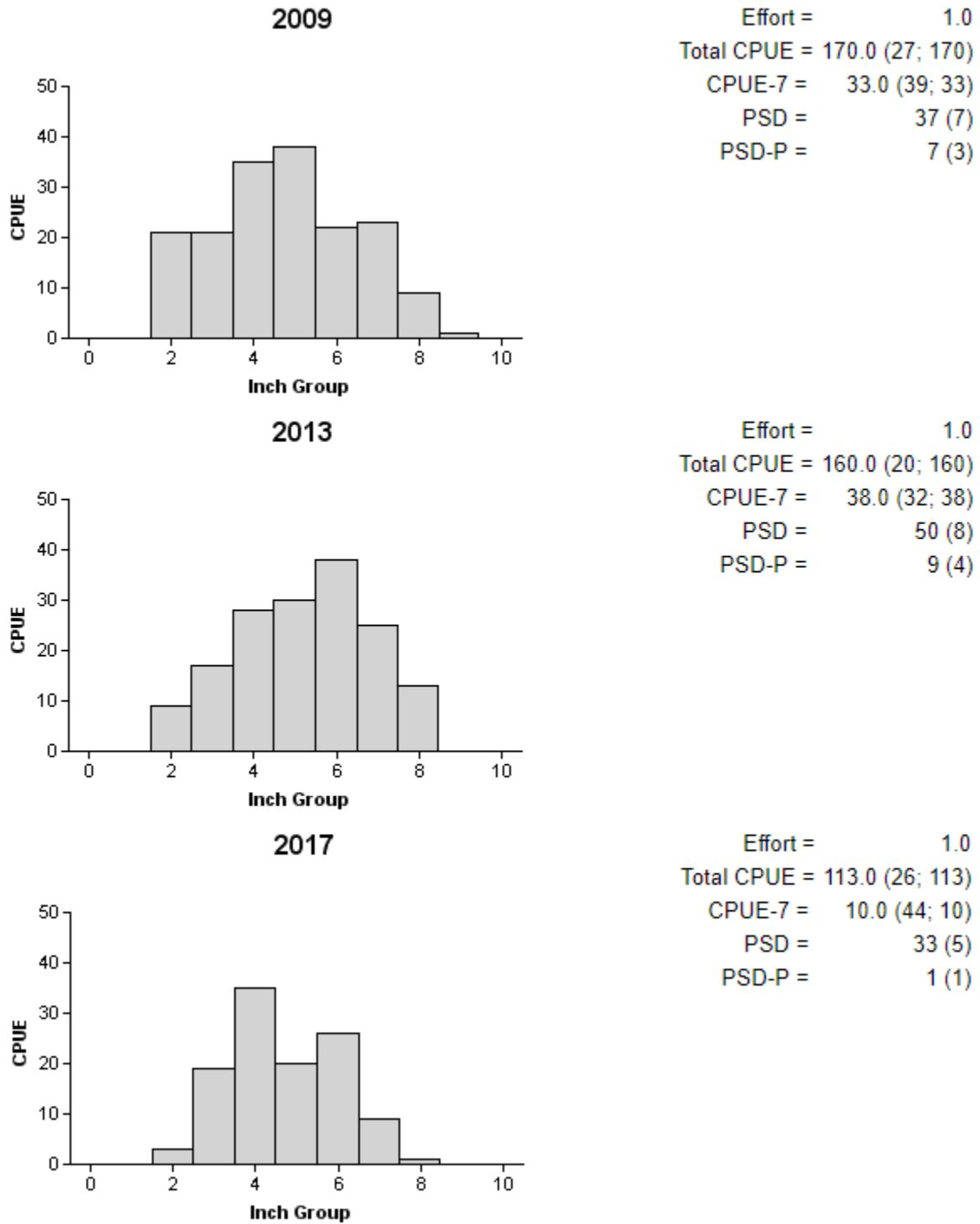


Figure 2. Number of Redbreast Sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Marble Falls Reservoir, Texas, 2009, 2013, and 2017.

Bluegill

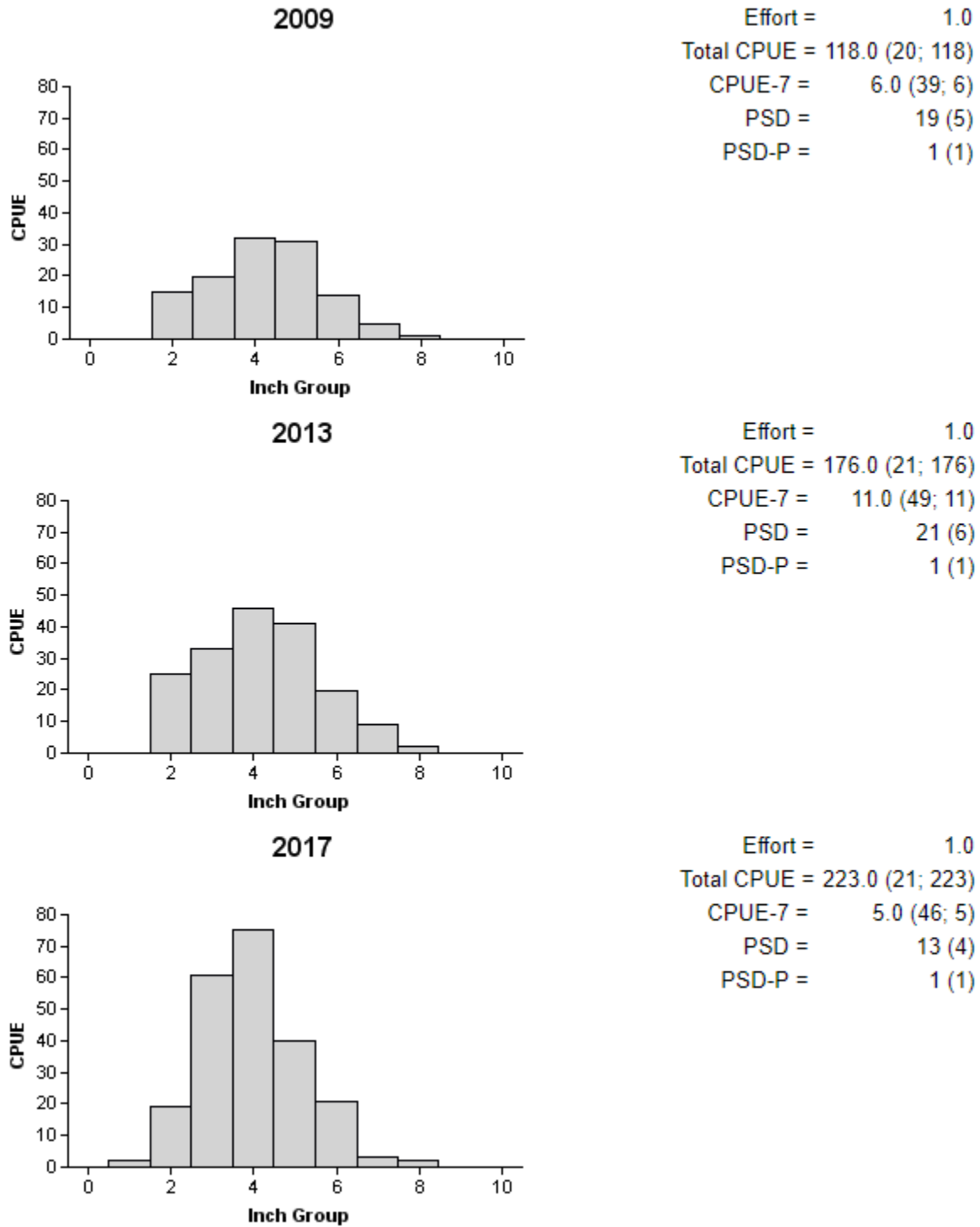


Figure 3. Number of Bluegill caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Marble Falls Reservoir, Texas, 2009, 2013, and 2017.

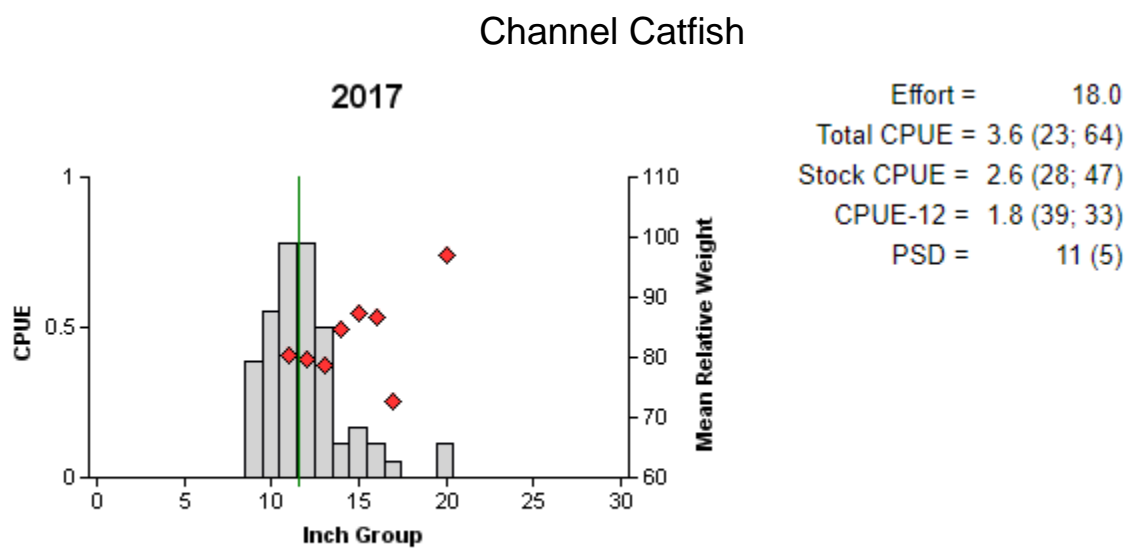


Figure 4. Number of Channel Catfish caught per tandem hoop net series (fish/series; CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for June hoop net surveys, Marble Falls Reservoir, Texas, 2017. Vertical line represents minimum length limit at the time of sampling.

Largemouth Bass

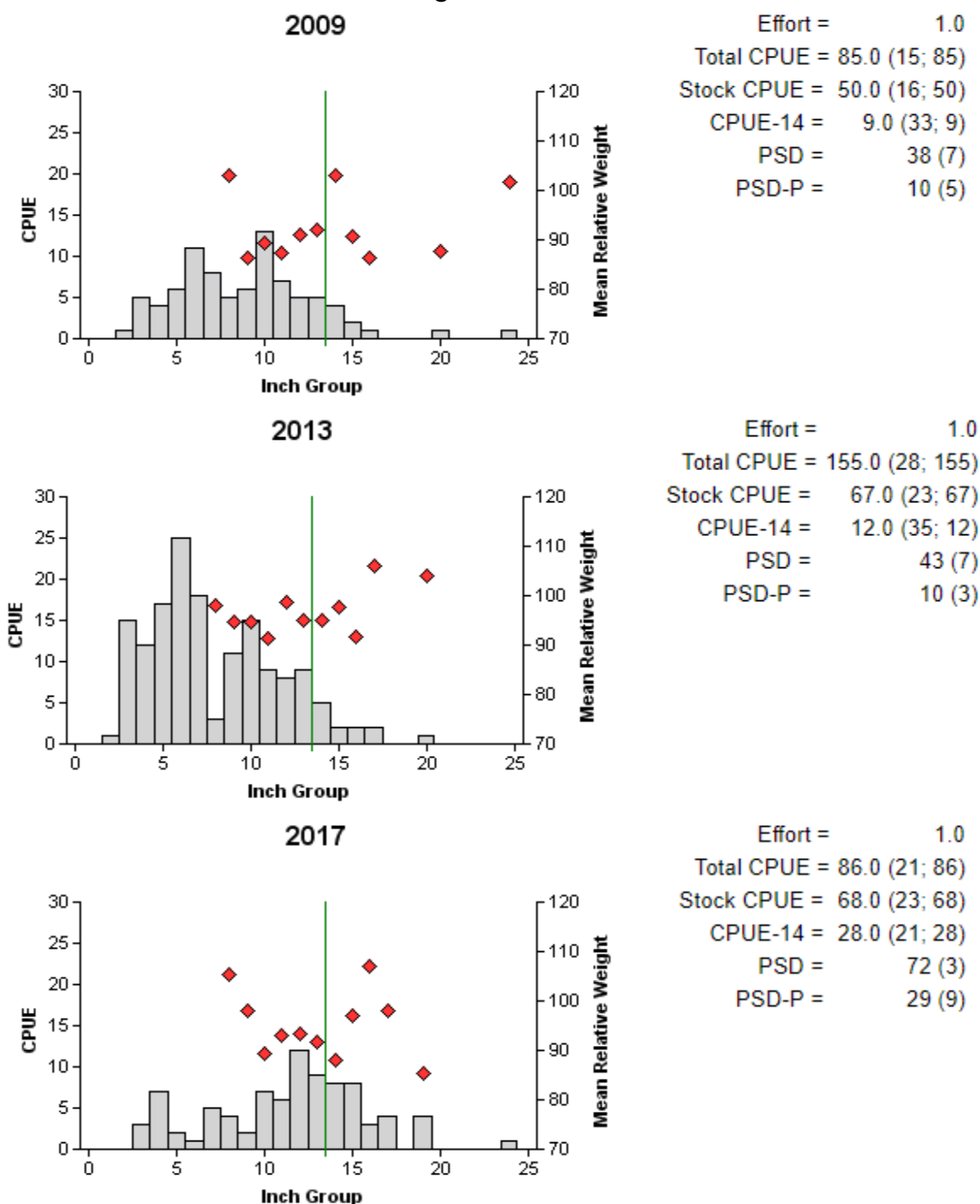


Figure 5. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Marble Falls Reservoir, Texas, 2009, 2013, and 2017. Vertical line represents the minimum length limit at the time of sampling.

Largemouth Bass

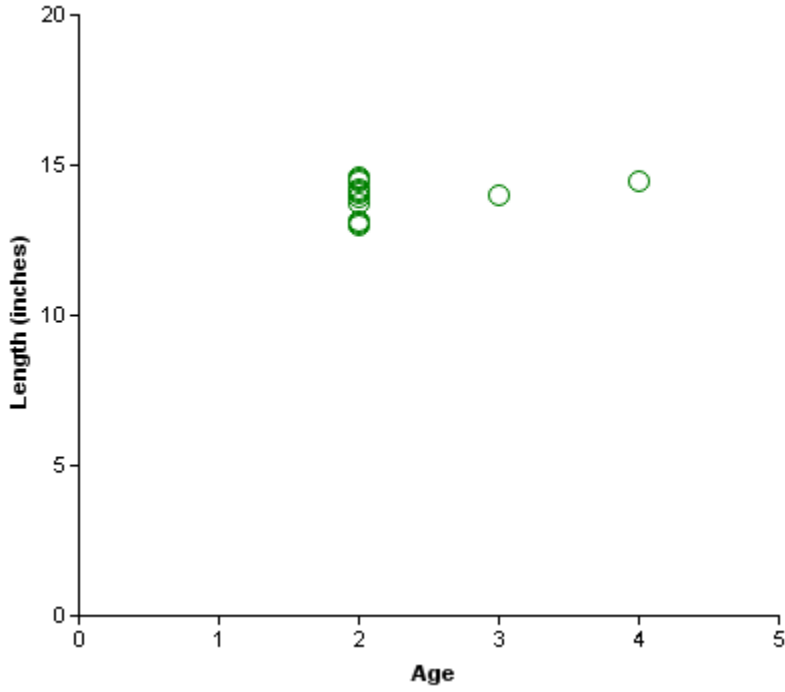


Figure 6. Length at age for Largemouth Bass (n=13) collected by electrofishing at Marble Falls Reservoir, Texas, November 2017.

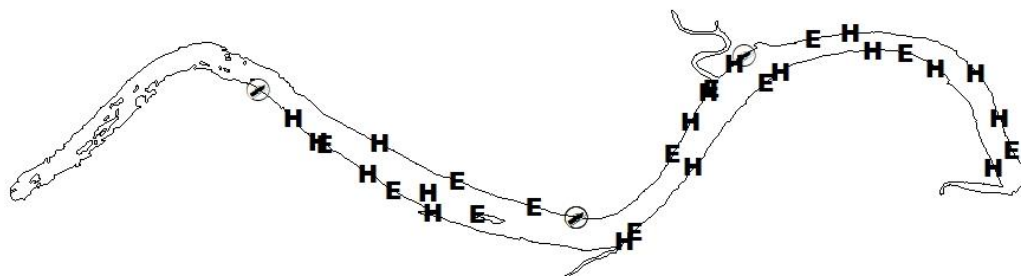
Proposed Sampling Schedule

Table 8. Proposed sampling schedule for Marble Falls Reservoir, Texas. Survey period is June through May. Hoop netting surveys are conducted in the summer, while electrofishing is conducted in the fall. Standard survey denoted by S.

	Survey year			
	2018-2019	2019-2020	2020-2021	2021-2022
Angler access				S
Structural habitat				S
Vegetation				S
Electrofishing – fall				S
Electrofishing – spring				
Electrofishing – Low frequency				
Trap netting				
Gill netting				
Baited tandem hoop netting				S
Creel survey				
Report				S

APPENDIX A – Map of sampling locations

Marble Falls Sampling 2018



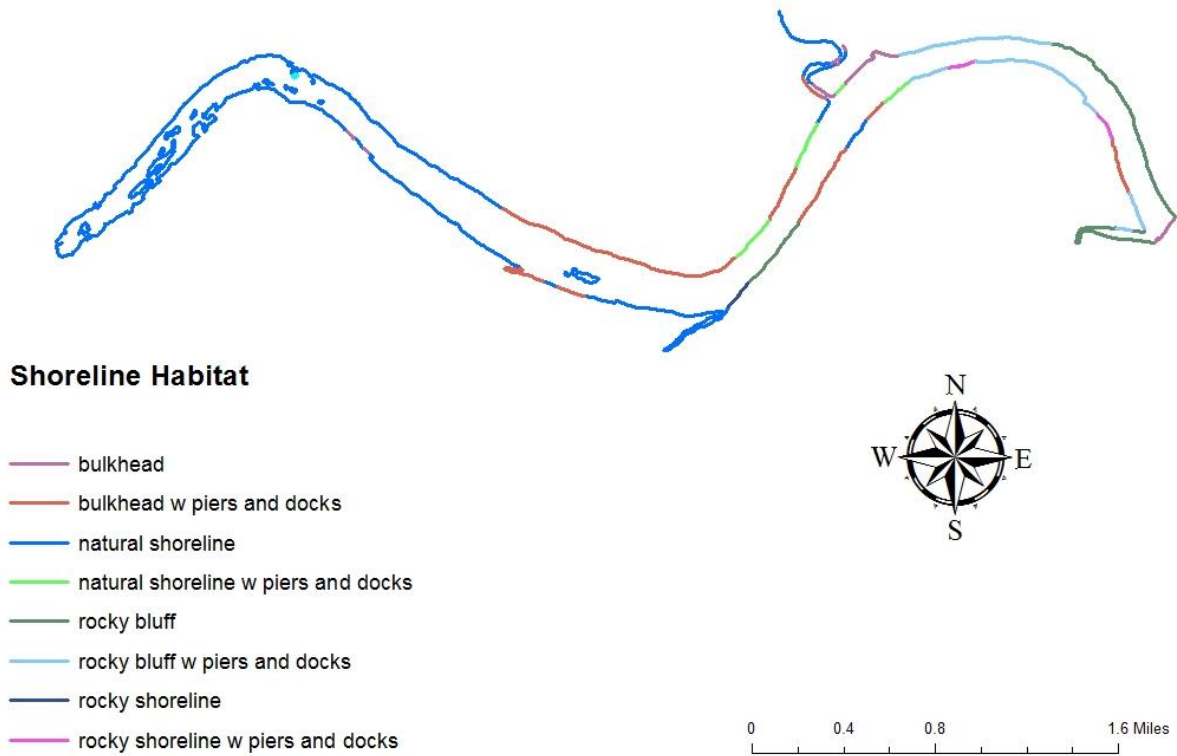
-  Boat Ramps
- E** Electrofishing Stations
- H** Hoop Net Stations



Location of sampling sites, Marble Falls Reservoir, Texas, 2017-2018. Hoop net and electrofishing stations are indicated by H and E respectively. This is a stable-level reservoir (conservation pool is 738 ft. above mean sea level).

APPENDIX B – Habitat survey

2017 Lake Marble Falls Habitat Survey



Structural habitat survey map for Marble Falls Reservoir, Texas, September 2017,

APPENDIX C – Catch rates for target species

Number (N) and catch rate (CPUE; RSE in parentheses) of all target species collected from all gear types from Marble Falls Reservoir, Texas, 2017. Sampling effort was 18 tandem hoop-net series deployed for 2-night soak durations, and 1.0 h for electrofishing.

Species	Tandem Hoop Netting		Electrofishing	
	N/RSE	CPUE	N/RSE	CPUE
Gizzard Shad			21/33	21.0
Threadfin Shad			13/76	13.0
Blue Catfish	1/100	0.1		
Channel Catfish	64/23	3.6		
Redbreast Sunfish			113/26	113.0
Green Sunfish			3/100	3.0
Warmouth			4/56	4.0
Bluegill			223/21	223.0
Longear Sunfish			13/27	13.0
Redear Sunfish			8/53	8.0
Largemouth Bass			86/21	86.0
Guadalupe Bass			1/100	1.0
Rio Grande Cichlid			4/56	4.0



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