

# Georgetown 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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July 31, 2018



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## Survey and Management Summary

Fish populations in Georgetown Reservoir were surveyed in 2017 using electrofishing and in 2018 using gill netting. Historical data are presented with the 2017-2018 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:** Georgetown Reservoir is a 1,297-acre impoundment (when full) of the North San Gabriel River located in Williamson County, Texas. The dam was constructed in 1980 by the U.S. Army Corp of Engineers (USACE) for flood control, municipal water supply and recreation. Georgetown Reservoir is mesotrophic with a mean TSI chl-a of 57.06, and a 10-year change of +7.11 (Texas Commission on Environmental Quality 2018). Water level varies widely and is replenished via an intra-basin transfer from Stillhouse Hollow Reservoir.

**Management History:** Important sport fish included White Bass, Largemouth Bass, and Hybrid Striped Bass (Palmetto Bass and Sunshine Bass). Since 2003, Palmetto Bass were stocked annually, except in 2010, 2012, and 2014. Sunshine Bass were stocked instead of Palmetto Bass in 2014. Smallmouth Bass were first stocked in 1978 and more recently from 2006 to 2008, and from 2010 to 2011. However, stocking ceased in 2012 to reduce potential impact to the genetically pure Guadalupe Bass population in the San Gabriel River. Stockings of Blue Catfish were conducted in 2000 and 2001 in an attempt to establish a fishery for this species. Florida Largemouth Bass were stocked in 1986 to improve trophy fish potential. Largemouth Bass have been managed since 1993 with a 14- to 18-inch slot-length limit. An evaluation of that length limit suggested it had been successful in increasing density and angler catch rate of Largemouth Bass greater than 14 inches in length. Angler harvest of sub-slot bass was not sufficient to improve growth under the slot length limit. Georgetown Reservoir has never been reported to support aquatic vegetation. Since 2007, 30 fish habitat sites were installed and are maintained in partnership with SCHFC to provide cover for fish and allow anglers the opportunity to increase their catch rate by targeting these known sites. In 2017, all 30 existing fish attractor sites were supplemented with Mossback fish habitat structures in partnership with the Sun City Hunting and Fishing Club (SCHFC) and funded by the Brazos River Authority (BRA). Structural shoreline habitat consisted primarily of rocky shoreline and gravel shoreline.

In collaboration with BRA, fish habitat availability, river/reservoir connectivity, and access were assessed at various lake levels at Georgetown Reservoir as a component of the controlling authority's operating plan for the Brazos River Basin. Threshold recommendations were provided to decrease potential impacts to the fishery during future basin-wide water level manipulations. The Georgetown Reservoir management threshold recommendation was 787 ft above mean sea level (MSL). Overall, littoral areas and woody habitat are significantly compromised below 787 ft above MSL. Two of three public ramps on the reservoir remain functional below 772 ft MSL. All boat ramp functionality is lost below 769 ft MSL, which is 22 ft below conservation pool.

In 2017, Georgetown Reservoir was classified as infested with zebra mussels by Texas Parks and Wildlife Department (TPWD) biologists after discovering larvae in routine water samples and young zebra mussels were found attached to rocks along the shoreline by BRA and TPWD.

### Fish Community

- **Prey species:** Redbreast Sunfish, Gizzard Shad, Bluegill, and Threadfin Shad were the predominant prey species in 2017. Green Sunfish were also available as forage. Catch rates for Redbreast Sunfish and Threadfin Shad had increased since the 2013 survey.
- **Catfishes:** Blue Catfish, Channel Catfish, and Flathead Catfish were present in low abundance.
- **Temperate basses:** White Bass and Hybrid Striped Bass were present in the reservoir. White

Bass were present in low abundance, fish up to 13 inches in length were present. The catch rate of Hybrid Striped Bass was also low. Individuals collected in 2018 ranged from 7- to 22-inches in length and reached harvestable-size (18 inches) between ages three and four. Body condition of harvestable-size Hybrid Striped Bass was poor.

- **Black basses:** Largemouth Bass abundance was moderate and population size structure had improved since the 2009 and 2013 surveys. Body condition was low for fish over 14 inches in length. Growth was below average. The largest fish caught was 19 inches in length. Smallmouth Bass and Guadalupe Bass were present in low abundance.

**Management Strategies:** Most sport fish should continue to be managed with existing regulations. However, as a result of a review of existing harvest regulations for Largemouth Bass statewide, the 14- to 18-inch slot length limit will be replaced by the statewide 14-inch minimum length limit, effective September 1, 2018. Largemouth Bass daily bag will remain at five fish. Hybrid Striped Bass stocking will be terminated in 2018 due to the failure of the establishment of a viable fishery despite consistent stocking since 2003. Standard electrofishing will be conducted in 2021-2022. Fish structural habitat sites should continue to be replenished with brush and artificial habitat structures as needed.

## Introduction

This document is a summary of fisheries data collected from Georgetown Reservoir 2017-2018. 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 2017-2018 data for comparison.

## Reservoir Description

Georgetown Reservoir is a 1,297-acre impoundment (when full) of the North San Gabriel River, a tributary of the Brazos River, located in Williamson County, Texas. The dam was constructed in 1980 by the USACE for flood control, municipal water supply, and recreation. Georgetown Reservoir has a drainage area of approximately 246 square miles, a shoreline length of 21.6 miles, and a shoreline development index of 4.9. The basin is steep-sided with relatively few shallow coves and shoal areas. The reservoir is located within the Edwards Plateau ecological area. Georgetown Reservoir is mesotrophic with a mean TSI chl-*a* of 57.06, and a 10-year change of +7.11 (Texas Commission on Environmental Quality 2018). Water level varies widely (Figure 1) and is replenished via transfer from Stillhouse Hollow Reservoir. Shoreline structural habitat consisted primarily of rocky shoreline and gravel shoreline. Georgetown Reservoir has never been reported to support aquatic vegetation. Other descriptive characteristics for Georgetown Reservoir are in Table 1.

## Angler Access

Boat access consisted of three public boat ramps, which were in good condition. Bank fishing access was good as the entire shoreline is USACE property and there are two public fishing piers. The upper end of the reservoir has a hiking trail (The Good Water Trail) and primitive camping area (Camp Tejas) which has historically allowed anglers access to the upper end of the reservoir during the White Bass spawning migration. Bank access was excellent along the USACE parks. 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. New fish attractor sites should be added as needed and existing fish attractors should be refurbished at least once every three years in partnership with SCHFC.

**Action:** In 2007, all 30 existing fish attractor sites were supplemented with Mossback fish habitat structures in partnership with the SCHFC and funded by the BRA. These durable structures will ensure that the fish attractor sites continue to provide cover for fish even as the Ashe juniper brushpiles installed in 2013 and 2015 degrade between refurbishment intervals.

2. Request annual Palmetto Bass stockings at 15 per acre and conduct an additional gill net survey in spring 2016 to monitor the status of the Hybrid Striped Bass population and determine whether future stocking efforts should continue.

**Action:** Palmetto Bass were stocked in 2015, 2016, 2017, and 2018. Due to logistical issues, gill netting was not carried out in 2016, but was conducted in 2018.

3. Discontinue the stocking of Smallmouth Bass, since a genetically pure Guadalupe Bass population is known to exist in the South San Gabriel River, and hybridization between Guadalupe Bass and Smallmouth Bass has been shown to be detrimental to the integrity and sustainability of pure Guadalupe Bass populations.

**Action:** Stocking of Smallmouth Bass in Georgetown Reservoir has been terminated.

4. Continue to engage partners and the public about the negative impacts of aquatic invasive species using print media, social media, and public engagements.

**Action:** Following the confirmed infestation of zebra mussels in Georgetown Reservoir on 10/27/17, outreach efforts have included social media, print media, public presentations, and one-on-one interactions with constituents to help ensure “clean, drain, and dry” procedures are followed at Georgetown Reservoir.

**Harvest regulation history:** From 1986 to 1993, Largemouth Bass were managed with a 14-inch minimum length limit. A 14- to 18-inch slot length limit was implemented on September 1, 1993 to: increase abundance of bass greater than 14 inches in length; increase angler catches of bass greater than 14 inches in length; and, re-direct harvest at individuals less than 14 inches in length. White Bass were managed under an experimental 12-inch minimum length limit beginning September 1, 1995 to increase density, help stabilize year-to-year fluctuations in year class strength and increase angler yield. An analysis suggested reservoir inflows during spawning periods were more influential in determining White Bass density than angler harvest (Magnelia and De Jesus 2010). This regulation was rescinded September 1, 2004 in favor of the statewide 10-inch minimum length limit. Current regulations are found in Table 3.

**Stocking history:** Florida Largemouth Bass, Blue Catfish, Palmetto Bass, and Smallmouth Bass have been important species stocked in the reservoir. Georgetown Reservoir has been stocked with Palmetto Bass nearly every year since 2003 with the exceptions of 2010, 2012, and 2014 when the request could not be met due to production issues. However, Sunshine Bass were available and stocked in place of Palmetto Bass in 2014 to maintain the Hybrid Striped Bass fishery. Smallmouth Bass were stocked every year from 2006 to 2011 (except for 2009). In 2012, it was decided that Smallmouth Bass would no longer be stocked in Georgetown Reservoir due to potential negative effects on the genetically pure Guadalupe Bass Population in the South San Gabriel River. Florida Largemouth Bass were stocked in 1986 to increase trophy potential of the existing Largemouth Bass population. The complete stocking history is in Table 4.

**Vegetation/habitat management history:** Georgetown Reservoir has never been reported to support aquatic vegetation; probably due to the widely fluctuating water level and rocky substrate. Structural shoreline habitat consisted primarily of rocky shoreline and gravel shoreline. Some standing timber was available in main lake coves and the upper reaches of the reservoir. Artificial fish habitat structures have been installed and maintained throughout the reservoir to provide concentrated habitat for cover-seeking species and to help improve angler success.

In 2012, the BRA, in discussions with TPWD, asked for a fishery assessment to be provided for all eleven BRA jurisdictional reservoirs (Farooqi and De Jesus 2014). These assessments have been taken into consideration for a multi-year system operating plan for the Brazos River Basin. Assessments for Georgetown Reservoir included habitat availability, river/reservoir connectivity, and access at various lake levels. Based on these multiple assessments, threshold recommendations were provided to decrease potential impacts to the fishery during future basin-wide water level manipulations. Thus, the Georgetown Reservoir management threshold recommendation was designated as 787 ft above MSL, i.e., 4 ft below conservation pool. Overall, littoral areas and woody habitat are significantly compromised below 787 ft above MSL. Of three public ramps on Georgetown Reservoir, two remain functional below 772 ft MSL, and access is completely lost below 769 ft MSL, which is 22 feet below conservation pool. Future water level models under predicted BRA management potential scenarios show that duration of low-water periods reaching the critical threshold will be minimal and not significantly greater than what it has been recently.

**Water transfer:** Georgetown Reservoir is primarily used for flood control, municipal water supply, and recreation. An intra-basin pipeline from Stillhouse to Georgetown Reservoir is used to replenish water supply for the growing cities of Georgetown and Round Rock.

## Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Georgetown 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).

**Gill netting** – Hybrid Striped Bass and White Bass were collected by gill netting (15 net nights at 15 stations). Catch per unit effort (CPUE) was recorded as the number of fish per net night (fish/nn).

Age and growth for Hybrid Striped Bass were determined using otoliths for all stock-size fish ( $\geq 10$  inches) collected in 2018 (Category 1, variable sample size; TPWD, Inland Fisheries Division, unpublished manual revised 2015).

**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). 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 =  $100 \times \text{SE of the estimate/estimate}$ ) was calculated for all CPUE statistics.

**Habitat** – A structural habitat and vegetation survey was conducted in 2017. Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

**Water level** – Source for water level data was the United States Geological Survey (USGS 2018).

## Results and Discussion

**Habitat:** In 2017, littoral habitat consisted primarily of rocky shoreline (55.4%), natural shoreline (27.6%), and rock bluff (16.5%; Table 6, Appendix B). Stands of aquatic vegetation have never been documented at Georgetown Reservoir. In 2017, all 30 existing fish habitat sites were supplemented with Mossback fish habitat structures in partnership with the SCHFC and funded by BRA (Appendix C and D). These durable structures will ensure that the fish attractor sites continue to provide cover for fish even as the Ashe juniper brushpiles installed in 2013 and 2015 degrade between refurbishment intervals.

**Prey species:** Redbreast Sunfish, Gizzard Shad, Bluegill, and Threadfin Shad were the predominant prey species in 2017. Green Sunfish were also available as forage (Appendix E).

Total CPUE of Gizzard Shad (49.0/h) was lower than in 2013 (99.0/h) and 2009 (67.3/h; Figure 2). Index of Vulnerability for Gizzard Shad was 27; indicating 27% of Gizzard Shad were of vulnerable size ( $< 8$  inches) and were available to existing predators. The IOV was similar to that recorded in the 2013 survey (29), but lower than in 2009 (50). Historically, this reservoir has had relatively low IOV values. The IOV in 2005, 2001, and 2000 were 17, 17, and 47 respectively.

Threadfin Shad were collected at the rate of 22.0/h in 2017, which is higher than in 2013 (8.0/h), but much lower than in 2009 (126.7/h).

Total CPUE of Redbreast Sunfish in 2017 (177.0/h) was higher than in 2013 (112.0/h) and considerably more than in 2009 (12.0/h). Population size structure has improved since 2009. A greater abundance of larger fish (6 to 8 inches in length) provide for better fishing opportunities for panfish anglers (Figure 3).

Bluegill total electrofishing CPUE was 40.0/h in 2017 which was similar to that recorded in 2013 (57.0/h), but higher than in 2009 (10.7/h). Nevertheless, Bluegill CPUE is typically relatively low for this reservoir (96.7/h in 2005, 63.0/h in 2001, and 35.0/h in 2000). In 2017, the majority of Bluegill were in the 2- to 3-inch size class (Figure 4).

**White Bass:** White Bass relative abundance remained low, based on gill netting. Nevertheless, angling pressure has historically accounted for a large fraction of the total fishing effort (40%; Magnelia and De Jesus (2006)).

The total gill net catch rate of White Bass was 3.7/nn in 2018. This was lower than that recorded in 2014 (7.1/nn) but was higher than in 2010 (1.6/nn) (Figure 5). The gillnet CPUE of harvestable size White Bass ( $\geq 10$  inches) mirrored that of total CPUE for the last two surveys; nearly all the fish caught were  $\geq 10$  inches. CPUE-10 was 3.6/nn in 2018 compared to 7.1/nn in 2014, and 1.6/nn in 2010. In 2018, the largest fish caught was 13 inches in length. Body condition ( $W_r$ ) for most fish was adequate. A new waterbody record weighing 2.2 lbs (16.88 in) was recorded in 2017.

Age of White Bass at harvestable size (requiring 13 fish between 9.0 and 10.9 inches in length) could not be determined because the sample size was too small to provide meaningful data (n=2).

**Hybrid Striped Bass:** This reservoir has been stocked with Palmetto Bass (female Striped Bass X male White Bass hybrid) nearly annually since 2003. However, in 2014 Palmetto Bass were unavailable so Sunshine Bass (male Striped Bass X female White Bass hybrid) were stocked instead of Palmetto Bass to maintain the Hybrid Striped Bass fishery. The gill net catch rate of Hybrid Striped Bass in 2018 was low (0.9/nn), similar to that obtained in 2014 (1.1/nn), and marginally higher than in 2010 (0.3/nn; Figure 6). In 2018, CPUE of harvestable-size fish was 0.3/nn. However, in both 2010 and 2014 no harvestable-size fish were captured despite gill net effort being tripled in 2010 and 2014 to better determine if stockings had been successful and document further expansion of the population. Individuals collected in 2018 ranged from 7- to 22-inches in length. Age and growth analysis from 2018 indicated individuals reached harvestable-size (18 inches) between ages three and four (N = 13; Figure 7). Body condition of Hybrid Striped Bass  $\geq 18$  inches in length (harvestable size) was poor ( $W_r < 85$ ).

**Largemouth Bass:** The lack of aquatic vegetation habitat and the frequency of fluctuating water levels on this reservoir most likely have a negative effect on Largemouth Bass spawning success and recruitment. Angler catch rates for Largemouth Bass on this reservoir have historically been low (Farooqi and De Jesus 2014).

In 2017, the reservoir contained a moderate-density Largemouth Bass population. The total CPUE of Largemouth Bass was 121.0/h in 2017 which is higher than that recorded in 2013 (53.0/h) and in 2009 (41.3/h; Figure 8). Stock CPUE has steadily increased since 2009. Stock CPUE was 30.0/h in 2009, 41.0/h in 2013, and 116.0 in 2017. In 2017, CPUE-14 was higher than in the previous two surveys. The CPUE-14 was 17.0/h compared to 5.0/h and 1.3/h in 2013 and 2009 respectively, while CPUE-18 was 2.0/h compared to 1.0/h and 0.0/h in 2013 and 2009 showing an improvement in numbers of bass within the slot limit.

In 2017, population size structure was good and had improved since the previous two surveys; population indices (Figure 8) were within the expected range (PSD 40 to 70, PSD-P 10 to 40, PSD-M 0 to 10) for a balanced population (Gabelhouse 1984).

Body condition of Largemouth Bass less than 14 inches in length was adequate in 2017 (Figure 6). However, most fish over 14 inches had poor body condition ( $W_r < 85$ ), which was not evident in the

previous two surveys.

Age and growth analysis from 2017 indicated individuals reached 14 inches between ages two and three (N = 13; range = 2 – 4 years; Figure 9), which is below average compared to values for the Edwards Plateau ecological area (Prentice 1987).

**Other species:** Blue Catfish, Channel Catfish, Flathead Catfish, Smallmouth Bass, and Guadalupe Bass are present in low abundance at Georgetown Reservoir (Farooqi and De Jesus 2014). 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. Sampling during the 2017-2018 season indicated the aforementioned species were present in very low numbers (Appendix E).

# Fisheries Management Plan for Georgetown Reservoir, Texas

Prepared – July 2018

**ISSUE 1:** Angler catch rates for Largemouth Bass on this reservoir have historically been low, as determined by previous fisheries management reports, due in part to a lack of suitable habitat.

## MANAGEMENT STRATEGY

1. The artificial fish habitat program on this reservoir has been popular judging by interactions with anglers and reports by members of SCHFC. New fish habitat sites should be added as needed and existing sites should be refurbished with Ashe juniper brushpiles at least once every four years in partnership with SCHFC. Any new fish attractor sites should be supplemented with Mossback fish habitat structures.

**ISSUE 2:** Hybrid Striped Bass have been stocked in this reservoir almost annually since 2003. Despite this, low catch rates, slow growth, and poor body condition of Hybrid Striped Bass, along with low catch rates of Gizzard Shad have been observed.

## MANAGEMENT STRATEGY

1. Effective 2018, terminate Hybrid Striped Bass stocking in Georgetown Reservoir.

**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. In 2017, Georgetown Reservoir was classified as infested by TPWD biologists.

## MANAGEMENT STRATEGIES

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

## Objective-Based Sampling Plan and Schedule (2019–2022)

### Sport fish, forage fish, and other important fishes

Largemouth Bass is the most important sport fish species in Georgetown Reservoir. Known important forage species include Gizzard Shad, Redbreast Sunfish, and Bluegill.

### Low-density fisheries

**Channel Catfish:** Historically, gill net catch rates have been low. Directed effort for Channel Catfish was 2.9% in a March 2003 to February 2004 creel survey (Magnelia and De Jesus, 2006). Due to low abundance, sampling for Channel Catfish is not a priority for the 2019-2022 sampling period.

**Blue Catfish:** Historically, gill net catch rates have been low. Sampling this population is not a priority for 2019-2022.

**Flathead Catfish:** Historically, gill net catch rates have been low. Sampling this population is not a priority for 2019-2022.

**White Bass:** Historically, White Bass relative abundance has been low. Total CPUE in 2018, 2014, and 2010 were 3.7/nn, 7.1/nn, and 1.6/nn, respectively. Sampling this population is not a priority for 2019-2022.

**Hybrid Striped Bass:** Georgetown Reservoir has been stocked with Palmetto Bass nearly every year since 2003 except for 2010, 2012, and 2014 when the request could not be met due to production issues. However, Sunshine Bass were available and stocked instead of Palmetto Bass in 2014 to maintain the Hybrid Striped Bass fishery. Total CPUE in 2018, 2014, and 2010 were 0.9/nn, 1.1/nn, and 0.3/nn respectively. In view of the historically low abundance of Hybrid Striped Bass, stocking of this species has been terminated and future sampling is not required.

**Smallmouth Bass:** Smallmouth Bass were present in low numbers. A creel survey conducted from March 2003 to February 2004 indicated there was no directed effort for this species, although angler catches were documented (Magnelia and De Jesus 2006). Stocking requests for Smallmouth Bass were cancelled in 2012 following the confirmation of a pure Guadalupe Bass population in the South San Gabriel River. Hybridization between these two species has been shown to be detrimental to the integrity and sustainability of pure Guadalupe Bass populations. Sampling this population is not a priority for 2018-2020. However, we will conduct general monitoring without established sampling objectives while conducting electrofishing surveys for Largemouth Bass.

### Survey objectives, fisheries metrics, and sampling objectives

**Largemouth Bass:** Largemouth Bass is the most sought-after sport fish in Georgetown Reservoir. Directed angler effort was 35.4% during a creel survey conducted from March 2003 to February 2004 (Magnelia and De Jesus 2006). Total CPUE in 2018, 2013, and 2009 was 121.0/nn, 53.0/nn, and 41.3/nn respectively. A minimum of 12 randomly selected 5-min electrofishing sites will be sampled in 2021, but sampling will continue at random sites, if needed, until 50 stock-size fish are collected and the RSE of CPUE-S is  $\leq 25$  (the anticipated effort to meet both sampling objectives is 12 stations with 80% confidence). Exclusive of the original 12 random stations, three 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 6-12 additional random stations, another night of effort will be expended. 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 lower limit of the slot regulation (Category 2 evaluation, TPWD, Inland Fisheries Division, unpublished manual revised 2015).

**Bluegill, Redbreast Sunfish, and Gizzard Shad:** Bluegill, Redbreast Sunfish, and Gizzard Shad are the predominant prey species available in Georgetown Reservoir. Sampling effort determined by Largemouth Bass sampling objectives will result in sufficient numbers of Bluegill, Redbreast Sunfish, and Gizzard Shad for size structure estimation (PSD and IOV; 50 fish minimum at 5-12 stations with 80% confidence), but not for relative abundance estimates ( $RSE \leq 25$  of CPUE-Total; 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 sunfish species combined. 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  $\geq 8$  inches will be determined from their length/weight data (maximum of 10 fish weighed and measured per inch class).

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## Tables and Figures

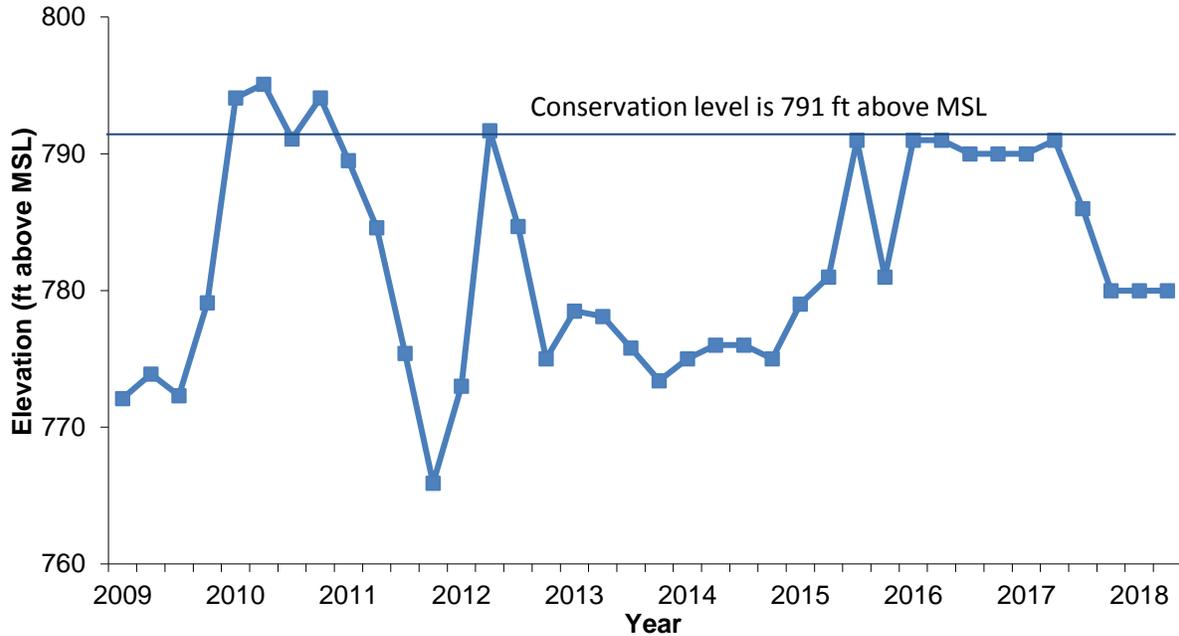


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Georgetown Reservoir, Texas 2009-2018.

Table 1. Characteristics of Georgetown Reservoir, Texas.

Characteristic	Description
Year constructed	1980
Controlling authority	United States Army Corps of Engineers
County	Williamson
Reservoir type	Mainstem: North San Gabriel River
Shoreline Development Index	4.9
Conductivity	351.0 $\mu\text{S/cm}$

Table 2. Boat ramp characteristics for Georgetown Reservoir, Texas, September, 2017. Reservoir elevation at time of survey was 781 feet above mean sea level (conservation level is 791 feet).

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Cedar Breaks Park	30.672826 -97.734870	Y	40	NA	Good
Jim Hogg	30.681000 -97.742890	Y	40	NA	Good
Russell Park	30.675530 -97.754193	Y	40	NA	Good

Table 3. Harvest regulations for Georgetown Reservoir, Texas.

Species	Bag limit	Length limit (inches)
Channel and Blue Catfish, their hybrids and subspecies	25 (in any combination)	12 (minimum)
Flathead Catfish	5	18 (minimum)
White Bass	25	10 (minimum)
Hybrid Striped Bass	5	18 (minimum)
Smallmouth Bass	5 <sup>a</sup>	14 (minimum)
Largemouth Bass	5 <sup>a</sup>	14 to 18 slot
Spotted and Guadalupe Bass	5 <sup>a</sup>	None
White and Black Crappie, their hybrids and subspecies	25 (in any combination)	10 (minimum)

<sup>a</sup> Daily bag for Smallmouth Bass, Largemouth Bass, Spotted Bass, and Guadalupe Bass = 5 fish in any combination.

Table 4. Stocking history for Georgetown 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.

<b>Species</b>	<b>Year</b>	<b>Number</b>	<b>Life Stage</b>	<b>Mean TL (in)</b>
Blue Catfish	1989	13,240	FGL	2.4
	2000	167,173	FGL	2.2
	2001	4,030	AFGL	10.6
	2001	131,019	FGL	2.1
	Total	315,462		
Channel Catfish	1978	14,900	AFGL	7.9
	1978	98	UNK	UNK
	1979	40,000	AFGL	7.9
	Total	54,998		
Florida Largemouth Bass	1986	3,000	FGL	2.0
	Total	3,000		
Largemouth Bass	1981	10,020	UNK	UNK
	Total	10,020		
Palmetto Bass	1980	13,000	UNK	UNK
	1982	13,179	UNK	UNK
	2003	6,485	FGL	1.5
	2004	6,494	FGL	1.6
	2005	6,475	FGL	1.5
	2006	6,487	FGL	1.8
	2007	5,495	FGL	1.7
	2008	6,734	FGL	1.5
	2009	7,595	FGL	1.5
	2011	6,764	FGL	1.5
	2013	19,745	FGL	1.8
	2015	6,698	FGL	2.0
	2016	6,632	FGL	1.7
2017	6,493	FGL	1.9	
2018	7,044	FGL	2.0	
	Total	125,320		
Smallmouth Bass	1978	30,000	UNK	UNK
	1979	100,000	UNK	UNK
	1980	100,552	UNK	UNK
	1981	107,264	UNK	UNK
	1992	32,774	FGL	1.3
	1995	32,721	FRY	0.9

Table 4. Stocking history for Georgetown 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.

<b>Species</b>	<b>Year</b>	<b>Number</b>	<b>Life Stage</b>	<b>Mean TL (in)</b>
	2006	11,764	FGL	2.0
	2007	29,795	FGL	2.0
	2008	32,457	FGL	1.4
	2010	35,438	FGL	1.4
	2011	10,535	FGL	1.7
	Total	523,300		
Sunshine Bass	2014	6,611		1.5
	Total	6,611		
Walleye	1981	2,000,000	FRY	0.2
	1983	2,514,729	FRY	0.2
	Total	4,514,729		

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

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
	Age and growth	Age at 14 inches	$N = 13, 12.9 - 14.9$ inches
	Condition	$W_r$	10 fish/inch group (max)
Redbreast Sunfish <sup>a</sup>	Abundance	CPUE – total	RSE $\leq 25$
	Size structure	PSD, length frequency	$N \geq 50$ stock
Bluegill <sup>a</sup>	Abundance	CPUE – total	RSE $\leq 25$
	Size structure	PSD, length frequency	$N \geq 50$
Gizzard Shad <sup>a</sup>	Abundance	CPUE – total	RSE $\leq 25$
	Size structure	Length frequency	$N \geq 50$
	Prey availability	IOV	$N \geq 50$
<i>Gill netting</i>			
White Bass	Abundance	CPUE – total	General Monitoring
	Size structure	Length frequency	General Monitoring
	Age and growth	Age at 10 inches	$N = 13, 9.0 - 10.9$ inches
Hybrid Striped Bass	Abundance	CPUE – stock	RSE-stock $\leq 30$
	Size structure	Length frequency	$N \geq 50$ stock
	Age and growth	Rough estimate of growth	10 fish/inch group (max)
	Condition	$W_r$	10 fish/inch group (max)

<sup>a</sup> No additional effort will be expended to achieve an RSE  $\leq 25$  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, Georgetown Reservoir, Texas, 2017.

Habitat type	Shoreline coverage (miles)	% of total
Rocky Shoreline	12.0	55.4
Natural Shoreline	5.9	27.6
Rocky Bluff	3.6	16.5
Gravel Shoreline	0.1	0.4

## Gizzard Shad

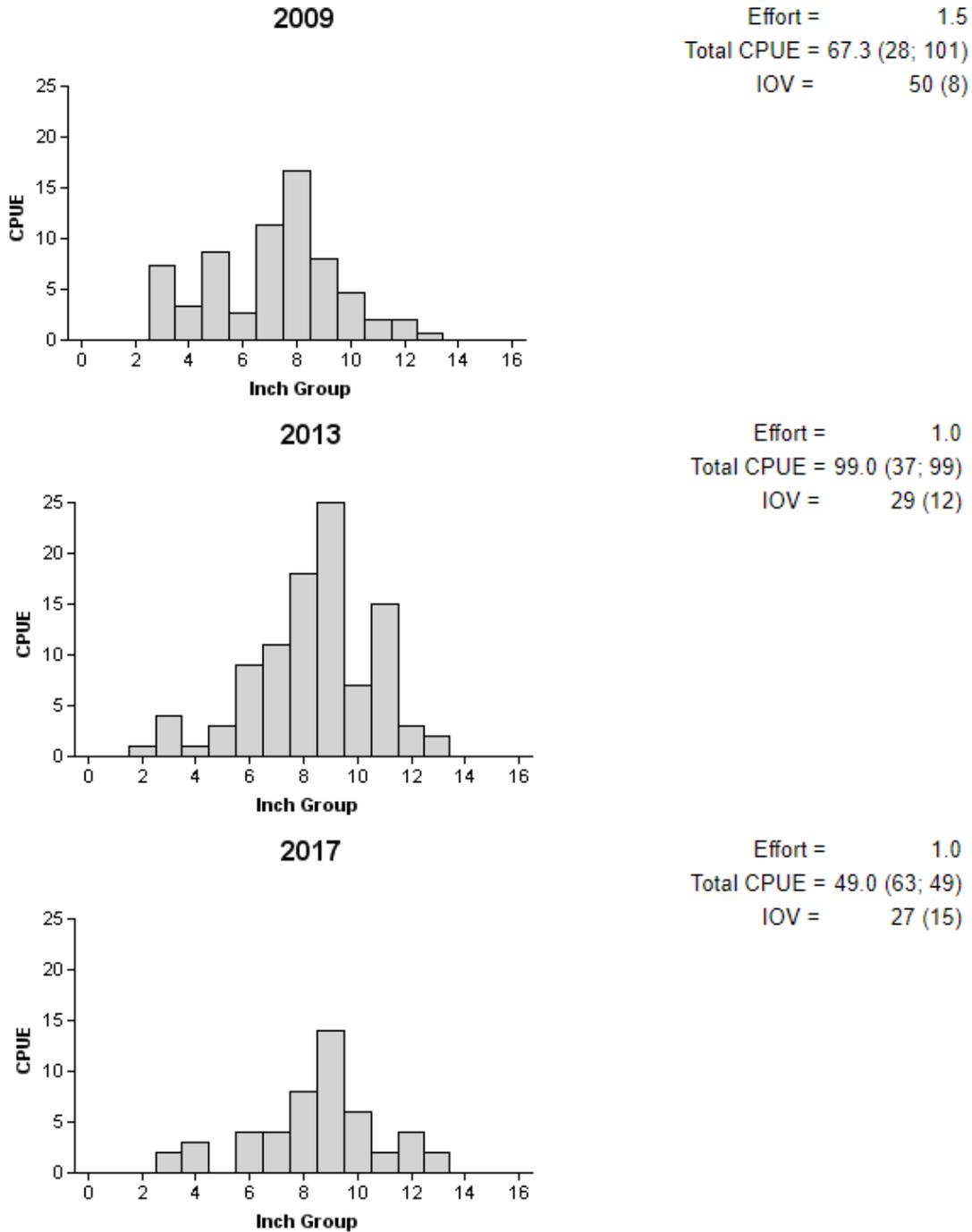


Figure 1. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Georgetown Reservoir, Texas, 2009, 2013, and 2017.

## Redbreast Sunfish

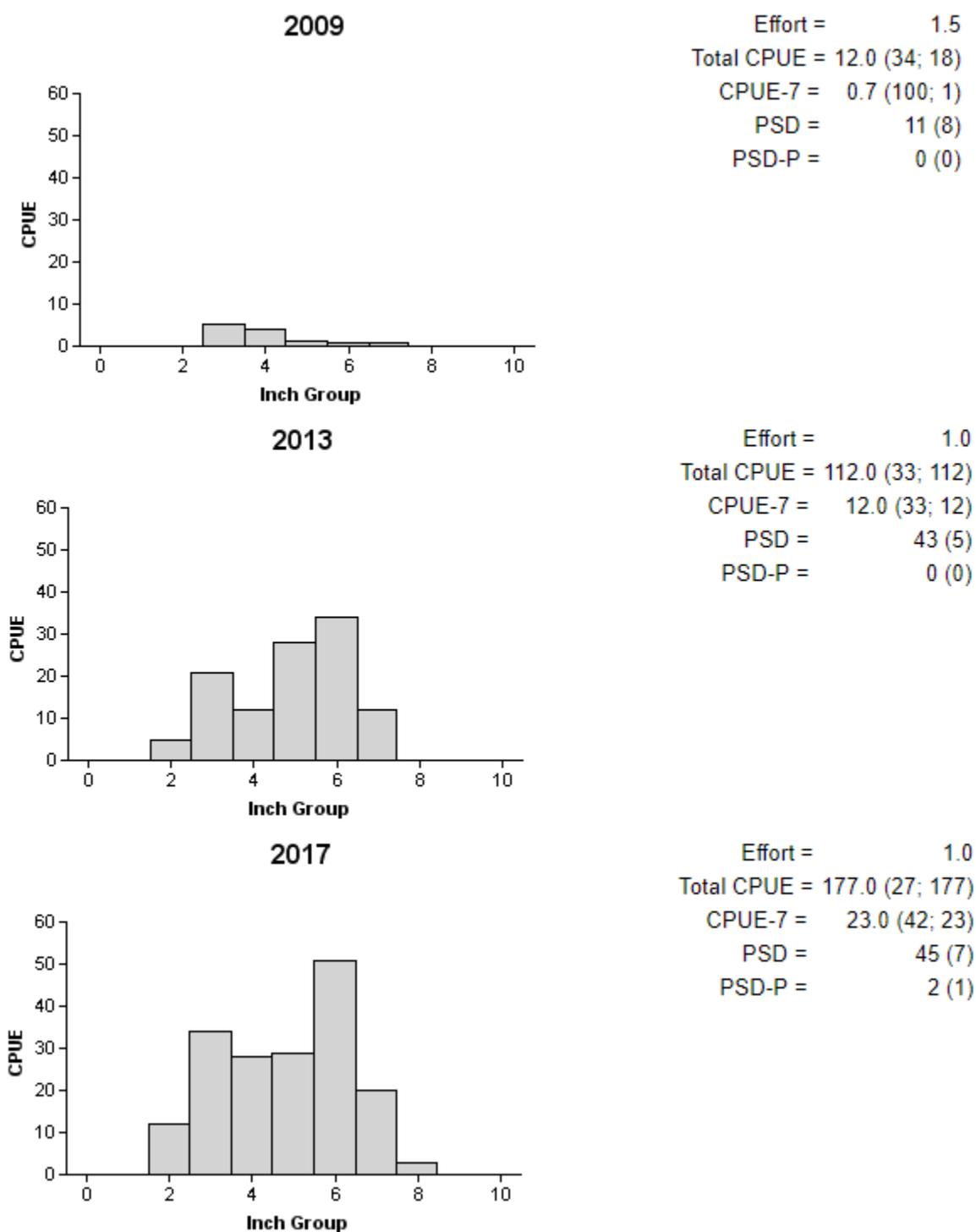


Figure 3. Number of Redbreast Sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Georgetown Reservoir, Texas, 2009, 2013, and 2017.

## Bluegill

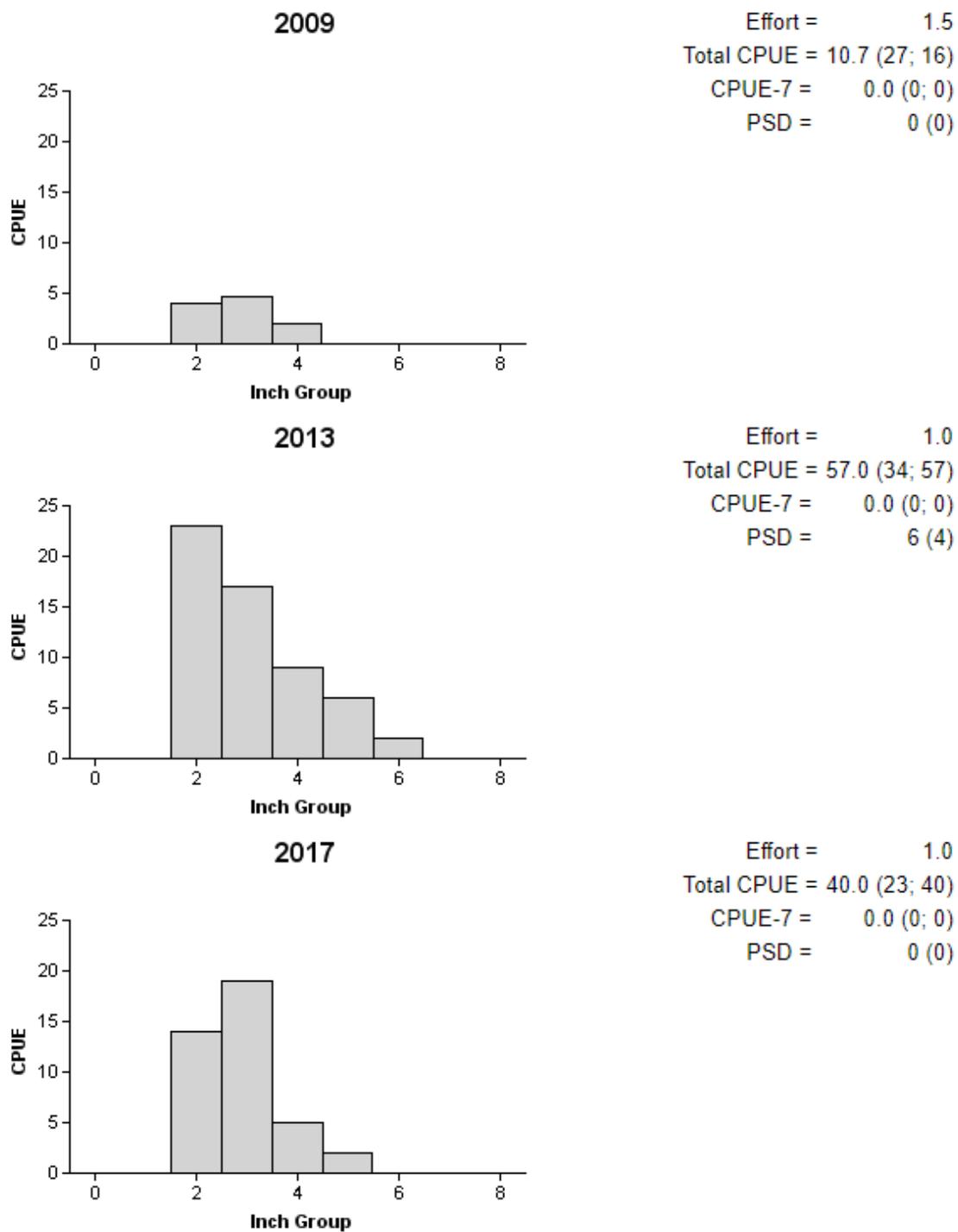


Figure 4. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Georgetown Reservoir, Texas, 2009, 2013, and 2017.

## White Bass

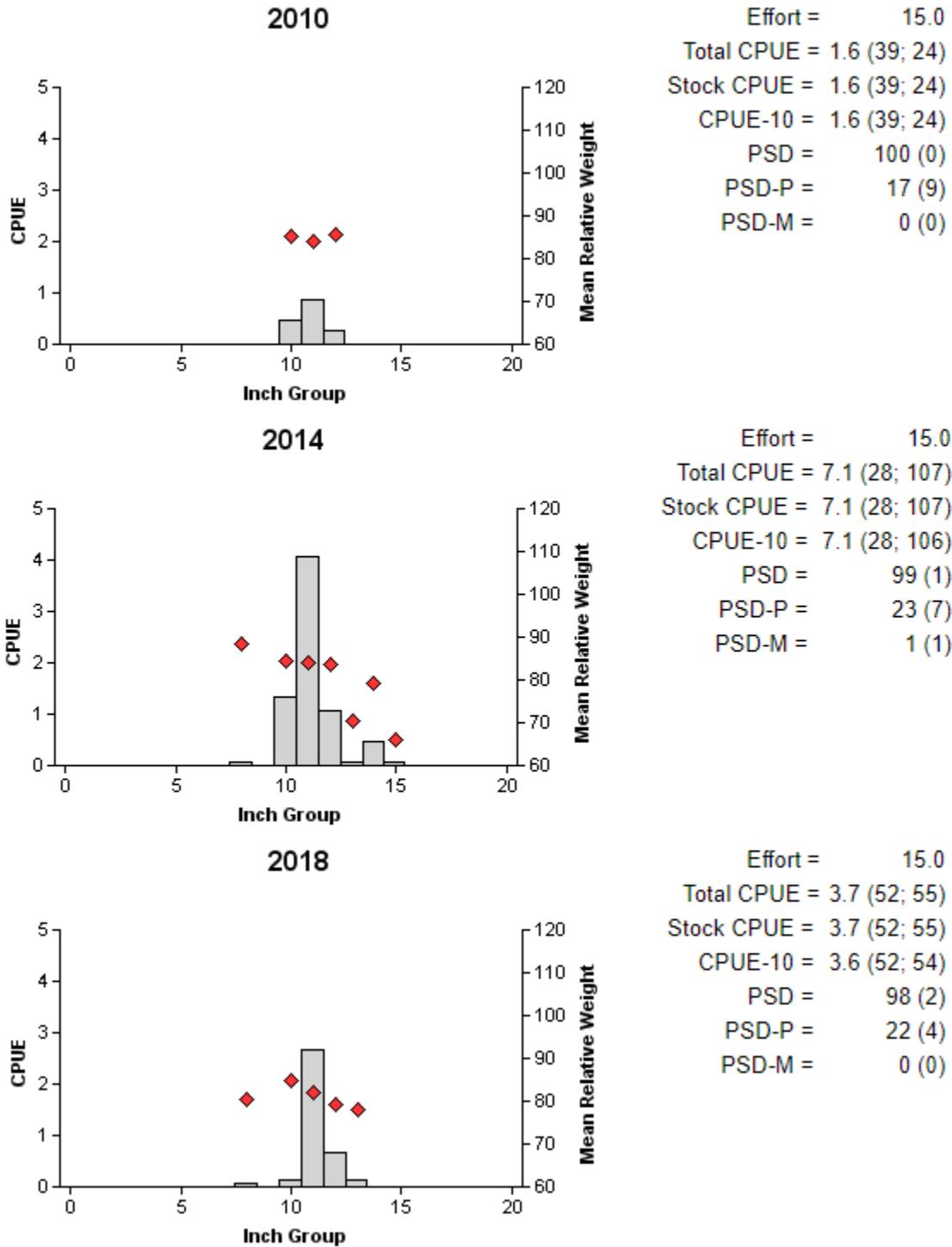


Figure 5. Number of White Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Georgetown Reservoir, Texas, 2010, 2014, and 2018.

### Hybrid Striped Bass

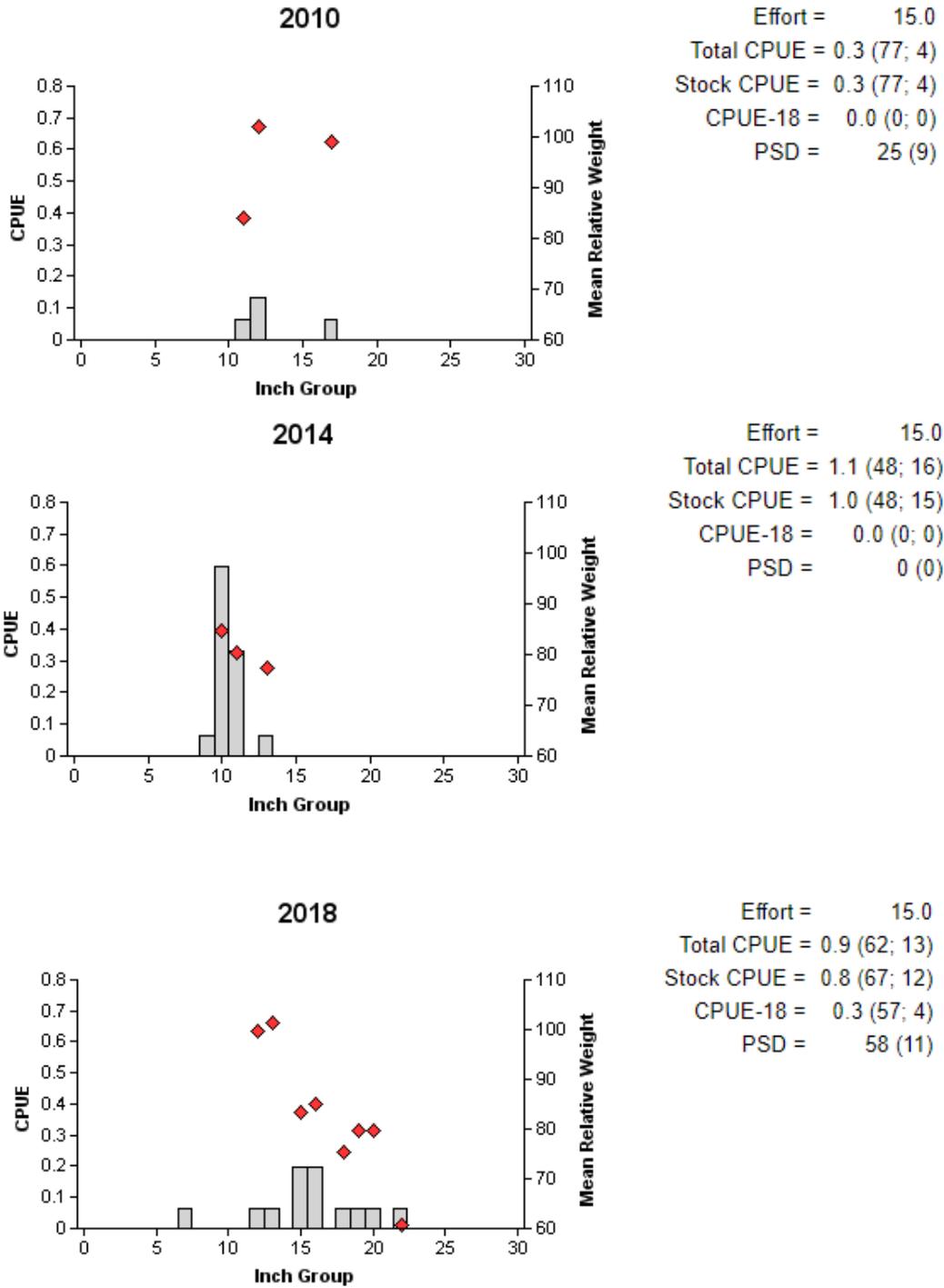


Figure 6. Number of Hybrid Striped Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Georgetown Reservoir, Texas, 2010, 2014, and 2018.

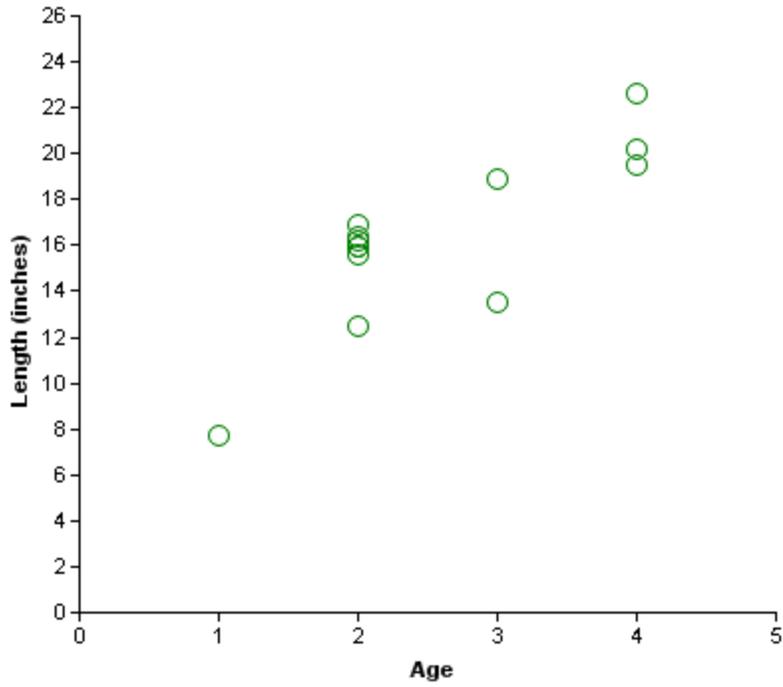


Figure 7. Length at age for Hybrid Striped Bass (n=13) collected from gill nets at Georgetown Reservoir, Texas, April 2018.

## Largemouth Bass

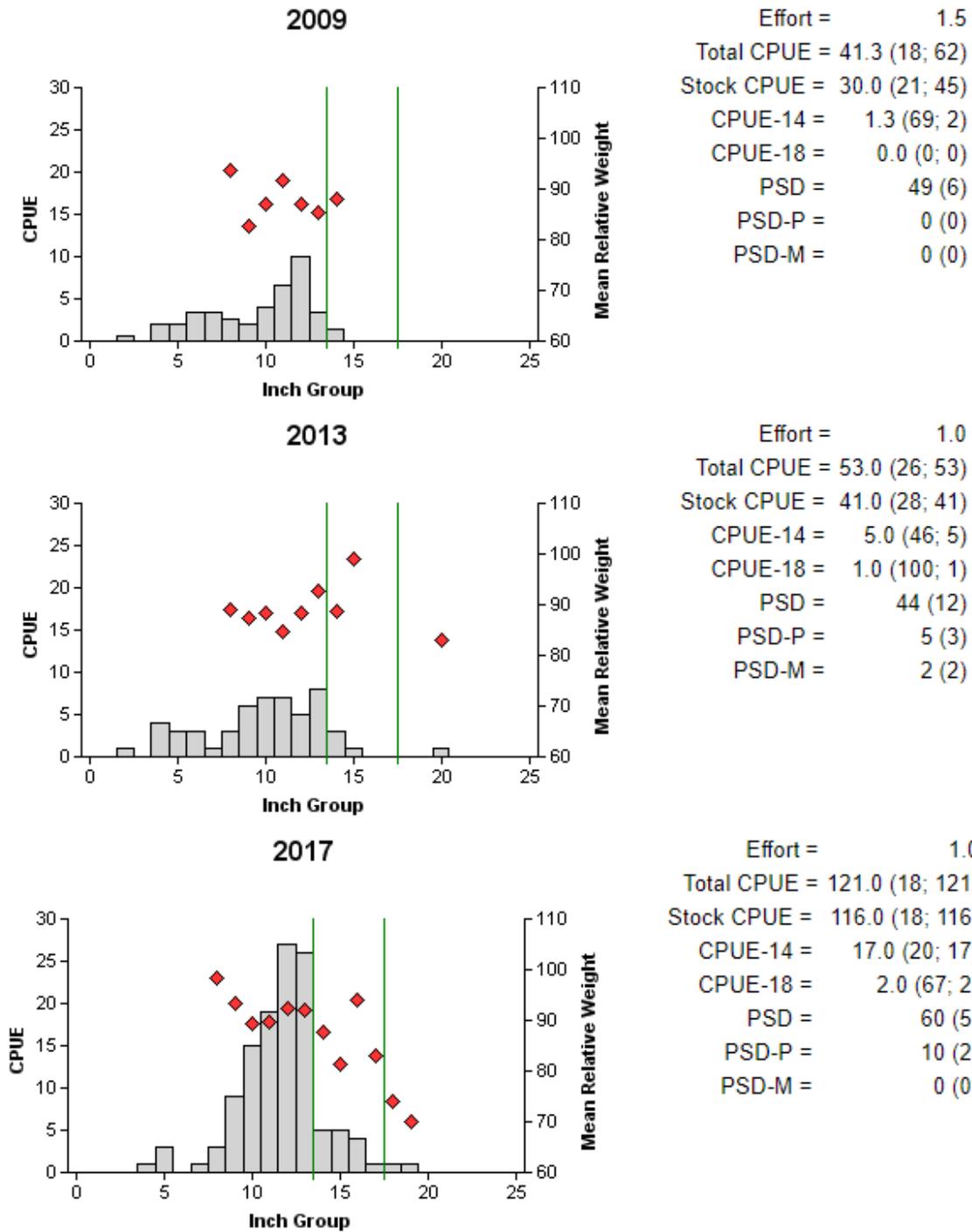


Figure 8. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Georgetown Reservoir, Texas, 2009, 2013, and 2017. Vertical lines represent the slot length limit at the time of sampling.

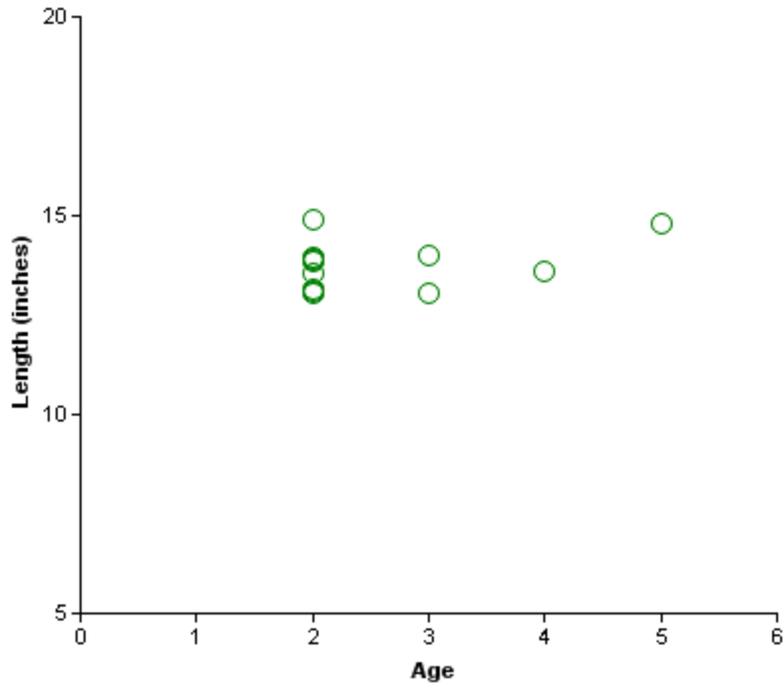


Figure 9. Length at age for Largemouth Bass (n=13) collected by electrofishing at Georgetown Reservoir, Texas, October 2017.

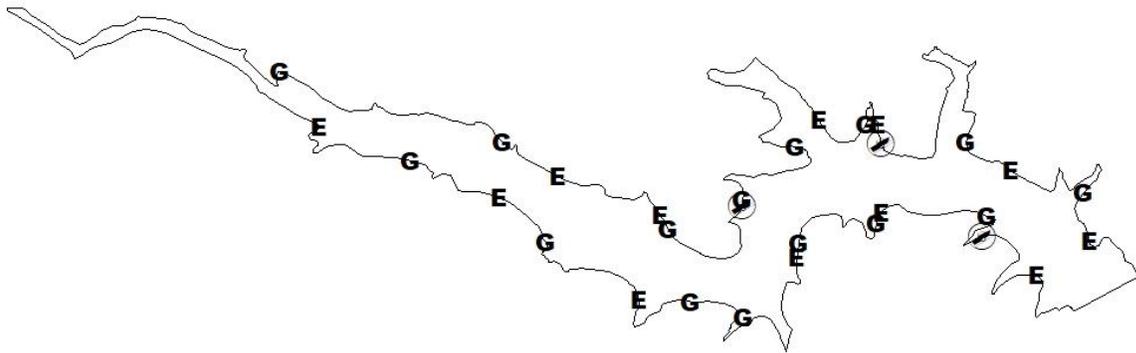
## Proposed Sampling Schedule

Table 7. Proposed sampling schedule for Georgetown Reservoir, Texas. Survey period is June through May. Electrofishing surveys are conducted in the fall. Standard survey denoted by S.

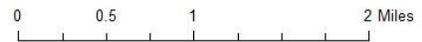
	Survey year			
	2018-2019	2019-2020	2020-2021	2021-2022
Angler Access				S
Structural Habitat				S
Vegetation				S
Electrofishing – Fall				S
Report				S

# APPENDIX A – Map of sampling locations

## Lake Georgetown Sampling 2017 - 2018



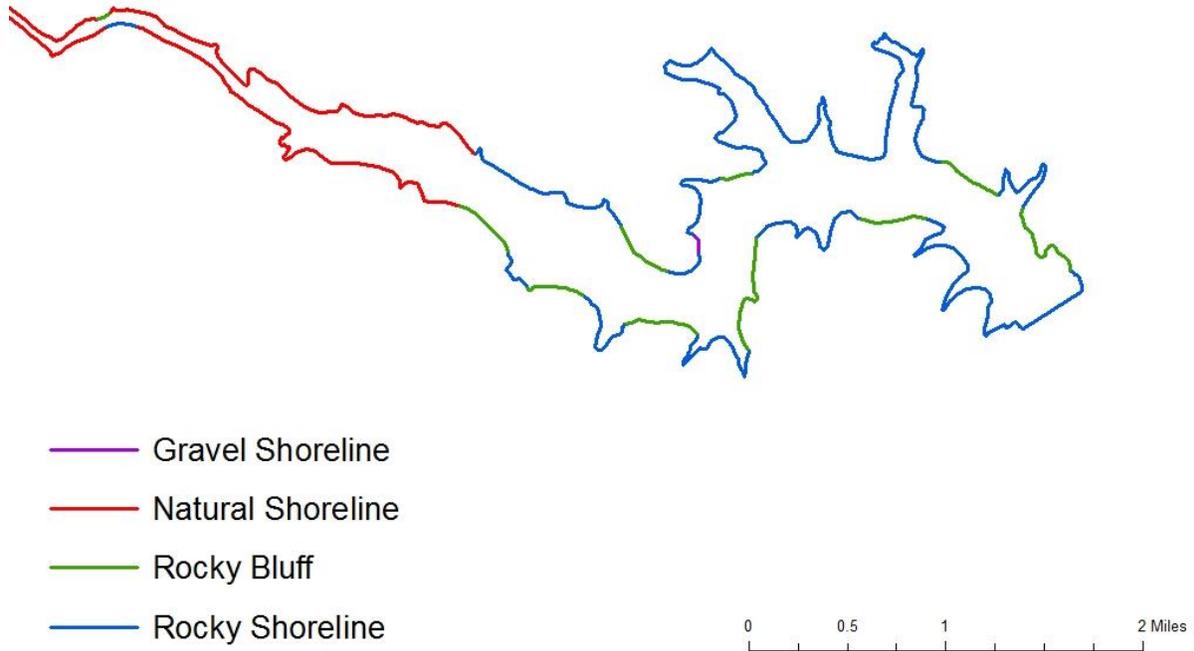
-  Boat Ramp
- E** Electrofishing Station
- G** Gill Netting Station



Location of gill net and electrofishing sampling sites, Georgetown Reservoir, Texas, 2017-2018. Water level was 12 ft below conservation level at the time of sampling.

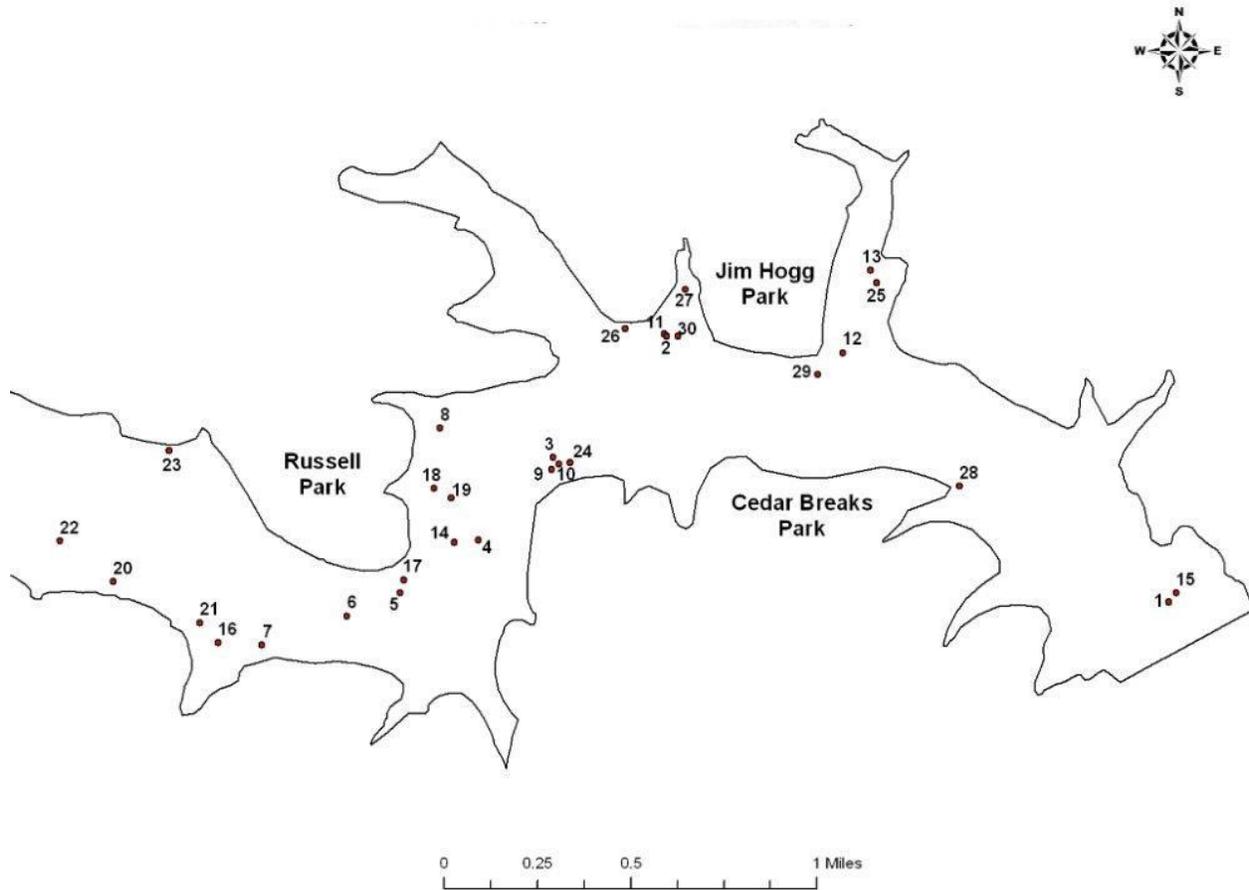
## APPENDIX B – Structural habitat

### 2017 Lake Georgetown Habitat Survey



Structural habitat survey map for Georgetown Reservoir, Texas, September 2017

## APPENDIX C – Artificial fish habitat enhancement sites



Map of Georgetown Reservoir with fish habitat structure locations. Habitat structures (N = 30) have been installed and refurbished since 2007. Ashe juniper brush piles were used at the sites, except in 2017 when Mossback fish habitat structures were installed.

## APPENDIX D – Coordinates for artificial fish habitat sites

GPS coordinates for Georgetown Reservoir fish attractor locations. Coordinates are in degree decimal minutes. Attractors were installed or refurbished from 2007 to 2015. Ashe juniper brush piles were used at the sites during that period. In 2017, Mossback fish habitat structures were installed at all 30 sites.

Site #		Lat/Long	Attractor Description	Year Installed	Refurbished
1	N	30 40.196 °	Point in northwest corner of dam	2007	2013
	W	-97 43.503 °			
2	N	30 40.815 °	Ridge next to extremely deep water; across from Jim Hogg boat ramp	2007	2013
	W	-97 44.673 °			
3	N	30 40.532 °	Main lake point next to ledge	2007	2013
	W	-97 44.937 °			
4	N	30 40.339 °	Point at Russell Park	2007	2015
	W	-97 45.111 °			
5	N	30 40.217 °	Flat on south side of Russell Park	2007	2015
	W	-97 45.292 °			
6	N	30 40.162 °	Mid-river high spot next to river channel south of Russell Park	2007	2013
	W	-97 45.417 °			
7	N	30 40.096 °	High spot next to river channel edge	2007	2015
	W	-97 45.614 °			
8	N	30 40.601 °	Drop off at point north of Russell Park Ramp that enters small cove	2008	2013
	W	-97 45.201 °			
9	N	30 40.504 °	Drop off on main river channel ledge	2008	2013
	W	-97 44.941 °			
10	N	30 40.517 °	Main lake point inshore of #9 brushpile	2008	2013
	W	-97 44.923 °			
11	N	30 40.821 °	Ridge close to #2 brushpile	2008	2011
	W	-97 44.678 °			
12	N	30 40.777 °	Ledge on backside of main lake point	2008	2015
	W	-97 44.262 °			
13	N	30 40.969 °	Secondary point near confluence of creek channels	2008	2011
	W	-97 44.198 °			
14	N	30 40.333 °	Flat near beach	2008	2011
	W	-97 45.167 °			
15	N	30 40.216 °	Rocky ledge near dam	2008	2011
	W	-97 43.486 °			
16	N	30 40.101 °	River point near cove mouth	2008	2015
	W	-97 45.717 °			
17	N	30 40.247 °	Rock flat	2008	2015
	W	-97 45.284 °			
18	N	30 40.460 °	Drain in sand flat	2008	2011
	W	-97 45.213 °			
19	N	30 40.438 °	Drain in sand flat	2009	2011
	W	-97 45.174 °			
20	N	30 40.242 °	Channel swing near steep bank	2009	2015
	W	-97 45.961 °			

## APPENDIX D - (cont.)

GPS coordinates for Georgetown Reservoir fish attractor locations. Coordinates are in degree decimal minutes. Attractors were installed or refurbished from 2007 to 2015. Ashe juniper brush piles were used at the sites. In 2017, Mossback fish habitat structures were installed at all 30 sites.

Site #		Lat/Long		Attractor Description	Year	Refurbished
21	N	30 40.147	°	Edge of point at river channel drop	2009	2015
	W	-97 45.760	°			
22	N	30 40.338	°	Creek/River channel intersection	2009	2013
	W	-97 46.085	°			
23	N	30 40.519	°	Mainlake point flat	2009	2013
	W	-97 44.896	°			
24	N	30 40.939	°	Main lake point	2009	2013
	W	-97 44.183	°			
25	N	30 40.548	°	Secondary point ledge	2009	2011
	W	-97 45.830	°			
26	N	30 40.832	°	Ledge west of Jim Hogg boat ramp	2010	
	W	-97 44.769	°			
27	N	30 40.923	°	Jim Hogg boat ramp cove on secondary point	2010	2011
	W	-97 44.628	°			
28	N	30 40.465	°	Off main lake point on south side of lake	2011	
	W	-97 43.990	°			
29	N	30 40.726	°	Main lake point ledge at mouth of Jim Hogg Cove	2011	2015
	W	-97 44.321	°			
30	N	30 40.814	°	Main lake ridge across from Jim Hogg Boat ramp	2011	2015
	W	-97 44.646	°			

## APPENDIX E– Catch rates for target species

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Georgetown Reservoir, Texas, 2017-2018. Sampling effort was 15 net nights for gill netting and 1 h for electrofishing.

Species	Gill Netting		Electrofishing	
	N/RSE	CPUE	N/RSE	CPUE
Gizzard Shad			49/63	49.0
Threadfin Shad			22/66	22.0
Inland Silverside			1/100	1.0
Blue Catfish	6/48	0.4		
Channel Catfish	18/27	1.2		
Flathead Catfish	1/100	0.1		
White Bass	55/52	3.7		
Redbreast Sunfish			177/27	177.0
Green Sunfish			24/37	24.0
Warmouth			1/100	1.0
Bluegill			40/23	40.0
Longear Sunfish			1/100	1.0
Smallmouth Bass			11/56	11.0
Largemouth Bass			121/18	121.0
Guadalupe Bass			4/56	4.0
Rio Grande Cichlid			3/52	3.0
Hybrid Striped Bass	13/62	0.9		



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