Austin Reservoir

2020 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 Austin Reservoir were surveyed in 2020 by using electrofishing. This report summarizes the results of the survey and contains a fisheries management plan for the reservoir based on those findings. Historical data are presented with the 2017-2020 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: Austin Reservoir is a stable-level 1,589-acre riverine-type impoundment of the Colorado River located in the heart of the City of Austin (COA). It was constructed in 1893 for hydro-electric power, municipal water supply, water conservation and recreation. The reservoir is used to pass water downstream from Travis Reservoir. The reservoir is operated by COA and the Lower Colorado River Authority (LCRA). The reservoir lies within the Edwards Plateau and has a catchment area of approximately 38,240 square miles. Land surrounding the reservoir is highly developed with commercial and residential property bordering most of the shoreline. Natural habitat features consisted of boulders and emergent aquatic plants.

Management History: Important sport fish include Largemouth Bass. The 2016 management plan included stocking Florida Largemouth Bass to maintain high genetic influence and managing invasive levels of hydrilla. Largemouth Bass have been managed under statewide regulations. Other species of interest are Common Carp and Smallmouth Buffalo; the reservoir has been promoted as a prime destination for bank anglers pursuing these species. The triploid Grass Carp permit was lifted in 2016 to allow harvest and help restore aquatic vegetation in the reservoir.

Fish Community

- **Prey species:** Gizzard Shad, Threadfin Shad, Redbreast Sunfish, and Bluegill were the predominant sources of forage.
- **Catfishes:** Blue Catfish, Channel Catfish, and Flathead Catfish have historically been present in low densities.
- **Temperate basses:** White Bass have historically been present in low densities. Striped Bass have been present in very low densities due to emigration from Travis Reservoir during flood events.
- **Largemouth Bass:** Largemouth Bass were moderately abundant. Previous creel surveys showed almost all angling effort is directed towards Largemouth Bass. Austin Reservoir was considered one of Texas' best trophy Largemouth Bass fisheries. Since 1994, anglers have submitted 21 Largemouth Bass weighing 13 pounds or greater to the Texas Parks and Wildlife Department (TPWD) ShareLunker Program. The most recent entry was in January 2021; almost 6 years after the previous entry in 2014. Since 2014, the depletion of aquatic vegetation habitat has impacted catch of trophy-size bass.
- **Guadalupe Bass:** Guadalupe Bass have been present in low densities. Seven Guadalupe Bass ranging from 3-12 inches were collected in 2020.
- **Crappie:** Black Crappie and White Crappie have been historically present in low densities.
- **Rough fishes:** Common Carp, Smallmouth Buffalo, and Freshwater Drum are present in moderate densities and provide recreational angling opportunities for bank anglers. Austin Reservoir is known to consistently produce trophy-size specimens of these species, which attracts bank anglers who direct their efforts towards a catch-and-release experience.

Management Strategies: The reservoir should continue to be managed with existing harvest regulations. Efforts to restore quality bass fishing by restoring aquatic habitat should be pursued. Encourage the removal of triploid Grass Carp. Continue to conduct annual electrofishing surveys to measure Largemouth Bass abundance as it relates to aquatic vegetation coverage. When habitat is restored, continue Florida Largemouth Bass stockings to maintain optimal genetic influence and trophy

potential for this population. Educate angler groups about lake vegetation management and encourage them to support a “balanced” management approach. Continue efforts to create awareness and educate people about invasive species.

Introduction

This document is a summary of fisheries data collected from Austin Reservoir in 2017-2020. 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 species of fishes was collected (Appendix A), this report deals primarily with major sport species and important prey species. Fisheries management strategies are included to address existing problems or opportunities. Historical data are presented with the 2017-2020 data for comparison.

Reservoir Description

Austin Reservoir is a stable-level 1,589-acre riverine-type impoundment of the Colorado River located in the City of Austin (COA). It was constructed in 1893 for purposes of hydro-electric power, municipal water supply, water conservation, and recreation. The reservoir is used to pass water downstream from Travis Reservoir. The reservoir is operated by COA and the Lower Colorado River Authority (LCRA). The reservoir lies within the Edwards Plateau and has a catchment area above the dam of 38,240 square miles. The flow into Lake Austin is basically controlled/regulated by reservoirs upstream. Austin Reservoir was classified mesotrophic, with a mean TSI chl-*a* value of 49.76 (Texas Commission on Environmental Quality 2020). Land surrounding the reservoir is highly developed with commercial and residential property bordering most of the shoreline. Shoreline habitat at time of sampling consisted of bulkhead, natural shoreline, rocky bluffs, boulders, and caged native submerged/emergent vegetation. The most common shoreline habitat feature was bulkhead (50%). Exotic hydrilla (*Hydrilla verticillata*) and Eurasian watermilfoil (*Myriophyllum spicatum*), non-natives, previously accounted for the vast majority of the aquatic vegetation in the reservoir. High numbers of stocked triploid Grass Carp in 2013 led to decimation of the aquatic vegetation habitat. Other descriptive characteristics for Austin Reservoir are listed in Table 1.

Angler Access

Austin Reservoir has four public boat ramps. All ramps remained open under stable water level conditions maintained at this reservoir. Additional boat ramp characteristics are in Table 2. Public shoreline access was available in seven public parks.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (De Jesús and Farooqi 2017) included:

1. Encourage and participate in triploid Grass Carp removal efforts. Continue to approve native aquatic vegetation plantings by the COA. Partner with local fishing outfits to install natural and artificial fish habitat structures. Continue annual aquatic vegetation and fall electrofishing surveys to document vegetation coverage and Largemouth Bass population trends. Develop new methodology to help monitor the effects of Grass Carp on aquatic vegetation density to refine traditional aerial surveys currently used. Educate angler groups about aquatic vegetation management at Austin Reservoir and encourage them to advocate for a balanced approach.

   Action: The Grass Carp permit was lifted in 2016 which allowed legal harvest of Grass Carp from Lake Austin. Native aquatic vegetation plantings by the COA in 2017 were approved by TPWD. Artificial structures (Mossback) and a series of concrete pillars were installed in Lake Austin in 2018 and 2019. Annual aquatic vegetation surveys and fall electrofishing surveys were completed. Sonar technology using Biobase software that measures plant volume in the water column was obtained to compliment future vegetation monitoring. Continued outreach via social media, angler group presentations,

and print media outlets were completed to further educate the public on a balanced management approach for aquatic vegetation.

2. Continue requesting annual Florida Largemouth Bass fingerling stockings at 100/acre when vegetation habitat recovers.

   Action: No Florida Largemouth Bass stockings occurred due to a lack of suitable submerged aquatic vegetated habitat.

3. Promote the availability of the Smallmouth Buffalo fishery in Austin Reservoir to recruit more anglers. Investigate opportunities to increase bank access for these angler types.

   Action: The trophy Smallmouth Buffalo fishing opportunities at Austin Reservoir were promoted via social media and at organized carp angler events. Additional bank access locations via the available public parks were and continue to be investigated.

4. Cooperate with management authorities and educate the public on the prevention of the spread of aquatic invasive species

   Action: Invasive species awareness signs and boat ramp stencils were installed at all the public boat ramps. Zebra mussel presentations were provided to several Texas Master Naturalist Groups.

Harvest regulation history: Sport fish in Austin Reservoir have been managed with statewide regulations. Current regulations are found in Table 3.

Stocking history: Since 1996 Austin Reservoir has been stocked regularly with Florida Largemouth Bass, however stockings have not occurred since 2014 due to lack of suitable habitat. ShareLunker offspring were stocked six times from 2008-2014. Triploid Grass Carp were stocked from 2003-2013 to control expanding hydrilla. One-hundred and twenty-six retired broodstock Florida Largemouth Bass, weighing about four to eight pounds, from TPWD's A.E. Wood Fish Hatchery were stocked into Lake Austin in May 2021. The complete stocking history is in Table 4.

Vegetation/habitat management history: Aquatic vegetation management has been a part of the Austin Reservoir overall management scheme for over 50 years. A history of aquatic vegetation management efforts through 2000 was published in Tennant and Magnelia (2001). Since 2003, 56,767 triploid Grass Carp have been stocked by the COA, TPWD, LCRA and Friends of Lake Austin (FOLA) to control the aquatic plant hydrilla. A history of those efforts and effects on the Largemouth Bass population through 2006 is found in Chilton and Magnelia (2009). In addition to triploid Grass Carp stockings the reservoir has been periodically drawn down 12 feet during the winter months in an attempt to manage aquatic vegetation. Waterfront homeowners have also used bottom barriers and harvesters to control aquatic vegetation along their shoreline. Angler attitudes and opinions concerning aquatic vegetation management practices on the reservoir are found in Smith et al. (2002).

Water transfer: There are no inter-basin water diversion structures at Austin Reservoir.

Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Austin Reservoir (De Jesus and Farooqi 2017). Primary components of the OBS plan are listed in Table 5. All survey sites were randomly selected and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2017).

Electrofishing – Largemouth Bass, sunfishes, Gizzard Shad, and Threadfin Shad were collected by electrofishing (1.5 hours at 18, 5-min stations; Appendix B). 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 ranging 13.0 to 14.9 inches; TPWD, Inland Fisheries Division, unpublished manual revised 2017).

Genetics – Genetic analysis of Largemouth Bass was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2017). Micro-satellite DNA analysis was used to determine genetic composition of individual fish.

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

Habitat – A structural habitat survey was conducted in 2020. Vegetation surveys were conducted annually from 2017 to 2020. Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2017).

Results and Discussion

Habitat: Littoral zone structural habitat consisted primarily of bulkhead and natural shoreline (Table 6). Aquatic vegetation coverage peaked at over 600 acres (39.5% of the reservoir's surface area) in 2012 (De Jesus and Farooqi 2013). At that time, hydrilla accounted for 554 acres and Eurasian watermilfoil for 78 acres. By fall 2013, hydrilla was, for practical purposes, eradicated, allowing Eurasian watermilfoil to expand to 202 acres, 13% of the reservoir's surface area (Table 7). A prolonged, cold winter in 2013/14 along with excessive grazing by wintering coots and Grass Carp decimated the remaining milfoil by the following spring. The reservoir continues to be void of free-growing submersed aquatic vegetation ever since (Table 7). A complete history of aquatic vegetation management on Austin Reservoir is provided in the 2016 Austin Reservoir survey management report (De Jesus and Farooqi 2017).
This was the first time since triploid Grass Carp have been stocked in Austin Reservoir that complete eradication of aquatic vegetation was the outcome. A healthy aquatic plant community is essential to restore the excellent trophy Largemouth Bass fishery in Lake Austin.

Some actions taken were to reduce the grazing pressure in the lake to help accelerate the reestablishment of aquatic vegetation and aid angling success: 1) Hundreds of native aquatic plant species propagules were planted by COA along littoral areas (protected by cages); 2) The triploid Grass Carp permit was lifted by TPWD in 2016, allowing for angler harvest of the triploid Grass Carp; 3) A network of 13 fish brush habitat attractors were installed by TPWD and the Texas Tournament Zone Friends of Reservoirs chapter along the lake to maintain angler success. This was followed by the installation of artificial structure (Mossbacks) at these brush pile locations as well as a concrete pillar installation near the dam (Appendix C and D); 4) A triploid Grass Carp removal effort by TPWD, the Austin Carp Anglers, and COA led to the removal of 167 fish, totaling almost 2,700 pounds.

Prey species: Electrofishing catch rates of Gizzard Shad decreased to 21.3/h in 2020 from 102.7/h, in 2016. Index of vulnerability for Gizzard Shad was very poor, indicating that 0% of Gizzard Shad were available to existing predators which was a decline from the previous survey (Figure 1). Total CPUE of Redbreast Sunfish, Bluegill, and Redear Sunfish in 2020 were 206.7/h, 66.0/h, and 18.7/h, respectively. Redbreast Sunfish relative abundance noticeably increased since 2016 (Figure 2). Bluegill relative abundance remained similar to previous surveys, with a slight decrease since 2016 (85.3/h; Figure 3). Size structure continued to be dominated by small individuals for all sunfish species; however large Bluegill, Redbreast Sunfish and Redear Sunfish individuals were present and provided quality sunfish fishing opportunities (Figures 2 - 4). Other available prey species captured included Bullhead Minnows and Inland Silversides (Appendix A). Inland Silversides have been observed in previous surveys, however, they are typically difficult to capture with our dip nets.

Largemouth Bass: The electrofishing catch rate of stock-length Largemouth Bass in 2020 was 43.3/h, similar to the 50.0/h in 2017 (Figure 5), and below the average (59.4/h) since 2000. Size structure was adequate as PSD varied from 40 to 59 since 2017; with memorable-size individuals present (Figure 5). Growth of Largemouth Bass in Austin Reservoir was below average for the Edwards Plateau eco-region (Prentice 1987); as, fish reached legal harvest size of 14 inches by age 3.5 (N = 13; range = 2 – 8 years; Figure 6). Body condition in 2020 was sub-optimal (relative weight ≤ 100) for nearly all size classes of fish, with more size groups below 85 than in previous surveys (Figure 5). Florida Largemouth Bass influence has remained relatively constant as Florida alleles have ranged from 76 to 84% and Florida genotype has ranged from 13 to 30% (Table 8).

Austin Reservoir hosts a moderate-density Largemouth Bass population. Historic creel surveys revealed almost all angling effort (91%) on the reservoir was directed towards Largemouth Bass (Smith et al. 2002). Many large bass have been caught in this reservoir since the early 1990's, including 21 bass over 13 pounds, entered into the TPWD ShareLunker Program. Based on those catches, it was regarded as one of the state's best trophy Largemouth Bass fisheries. Anecdotal fishing reports seem to coincide with electrofishing catch rates; they are at their best when vegetation coverage is not excessive, allowing open patches and defined edges for Largemouth Bass to thrive. The best electrofishing catch rates were obtained when vegetation coverage hovered between 300 and 400 acres or 19 to 25% of lake surface area (Appendix E). The triploid Grass Carp stocking strategy was adequate to maintain these desirable conditions from 2003 through 2011, when extreme drought conditions began to alter the ecosystem and impact the successful strategy. Hydrilla began to expand aggressively in 2011, which likely led to strong year classes (combined with stockings) and poor foraging conditions that resulted in poor growth. The reactive increased triploid Grass Carp stocking rates in 2011-2012 led to an immediate elimination of aquatic vegetation, also linked to poor foraging and growth.

Fisheries Management Plan for Austin Reservoir, Texas

Prepared – July 2021

ISSUE 1: A balanced healthy aquatic plant community has been the driving force of the quality bass fishing history on Austin Reservoir. A less-conservative and reactive stocking scheme of triploid Grass Carp, attributed to the aggressively expanding hydrilla during drought conditions led to the eradication of most of the aquatic vegetation in the lake. Much to the dismay of anglers and TPWD, the quality Largemouth Bass fishing component at Austin Reservoir has been lost. Restoration of habitat to improve fishing quality is necessary.

MANAGEMENT STRATEGIES

1. Continue to approve native aquatic vegetation plantings by the COA.
2. Continue to partner with local fishing outfits to install natural and artificial fish habitat structures.
3. Continue annual aquatic vegetation and fall electrofishing surveys to document vegetation coverage and Largemouth Bass population trends.
4. Once submerged vegetation begins to become established, implement the use of BioBase help monitor the effects of Grass Carp on aquatic vegetation density to refine traditional aerial surveys, currently used.
5. Continue to share management activities on Lake Austin on social media. Continue to educate angler groups about aquatic vegetation management at Austin Reservoir and encourage them to advocate for a balanced approach.

ISSUE 2: Twenty-one Largemouth Bass over 13 pounds (i.e., ShareLunker trophy bass) have been documented caught from this reservoir since the early 1990's. Many 8- to 12-pound fish were regularly reported caught in tournaments and by recreational anglers as well. Based on these catches the reservoir has proven its potential for producing trophy Largemouth Bass. Maintaining genetic influence from the Florida Largemouth Bass will increase the potential for future trophy bass catches.

MANAGEMENT STRATEGY

1. Continue requesting annual Florida Largemouth Bass fingerling stockings at 100/acre when vegetation habitat recovers.

ISSUE 3: In recent years there has been increasing interest in trophy Smallmouth Buffalo fishing in Texas, especially Austin-area reservoirs. The species is attracting anglers from other states and overseas, where Smallmouth Buffalo rarely reach large sizes or are not available. The rod and reel record for Austin Reservoir is 70.5 pounds. The anglers employ European-style bank fishing techniques and are limited to those reservoirs offering good bank access. Historically, the species has not been recognized as a sport fish.

MANAGEMENT STRATEGIES

1 Continue to promote the availability of the Smallmouth Buffalo fishery in Austin Reservoir to recruit more anglers.
2 Continue to investigate opportunities to increase bank access for these angler types.

ISSUE 4: Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels (*Dreissena polymorpha*) can multiply rapidly and attach themselves to any available hard structure, restricting water flow in pipes, fouling swimming beaches, and plugging engine cooling systems. Giant salvinia (*Salvinia molesta*) and other invasive vegetation species can form dense mats, interfering with recreational activities like fishing, boating, skiing, and swimming. The financial costs of controlling and/or eradicating these types of invasive species are significant. Additionally, the potential for invasive species to spread to other river drainages and reservoirs via watercraft and other means is a serious threat to all public waters of the state.

MANAGEMENT STRATEGIES

1. Cooperate with the controlling authorities 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.
6. Make boaters aware of zebra mussel infestation in Travis and that Lake Austin will likely have them soon.

Objective-Based Sampling Plan and Schedule (2021-2025)

Sport fish, forage fish, and other important fishes

The main sport fish in Austin Reservoir is Largemouth Bass. Known important forage species include Bluegill, Redear Sunfish, Redbreast Sunfish, Gizzard Shad, and Threadfin Shad. Other sport fishes occur in the reservoir; however provide insignificant fishing opportunities.

Low-density fisheries

Blue Catfish: Blue Catfish are present in the Colorado River Basin but have never been stocked into Austin Reservoir. Occasional bycatch is reported by anglers, not targeting this species. This species is present in very low density and does not provide a viable fishery. Blue Catfish will not be sampled in the 2021-2025 sampling period.

Channel Catfish: The 2001 creel survey indicated Channel Catfish angling comprised 5.0% of total angling effort (third to Largemouth Bass and anglers fishing for anything). Directed total effort for this species was 2,455 hours at 1.5 hours/acre. Gill netting total CPUE ranged from 0.2/nn to 2.8/nn (1.4/nn average) from 1997 to 2013. The only stocking of Channel Catfish at Austin Reservoir was a supplemental stocking of 204 adult fish averaging 14 inches in length in 2007. This species is present in very low abundance and does not provide a viable fishery. Channel Catfish will not be sampled in the 2021-2025 sampling period.

Flathead Catfish: Flathead Catfish are present in low abundance, based on gill netting surveys conducted between 2005 and 2013. During this time, CPUE total averaged 0.7 fish/nn, and ranged between 0 and 1.6 fish/nn. A creel survey in 2001 did not capture directed effort for this species, revealing little interest by anglers to pursue this species at Austin Reservoir. Flathead Catfish will not be sampled in the 2021-2025 sampling period.

White Bass: White Bass are present in low abundance, based on gill netting surveys conducted between 2005 and 2013. During this time, CPUE total averaged 0.6/nn, and ranged between 0.4/nn and 0.8/nn. A creel survey in 2001 did not capture directed effort for this species, revealing little interest by anglers to pursue this species at Austin Reservoir. White Bass will not be sampled in the 2021-2025 sampling period.

Crappie: Crappie are present in low abundance. Optional trap netting was deemed unnecessary over a decade ago due to poor catches. A creel survey in 2001 did not capture directed effort for this species, revealing little interest by anglers to pursue this species at Austin Reservoir. Crappie will not be sampled in the 2021-2025 sampling period.

Survey objectives, fisheries metrics, and sampling objectives

Largemouth Bass: Largemouth Bass have been the most popular sport fish in Austin Reservoir. The popularity and reputation for quality/trophy Largemouth Bass fishing at this reservoir warrant sampling time and effort. Results from a 2001 creel survey showed directed angling effort for Largemouth Bass to be 24.5 hours/acre and accounted for 91% of the total directed effort. Largemouth Bass are managed with a 14-inch minimum statewide regulation. This lake is known for quality fish and good catch rates, tied in historically with a healthy aquatic vegetation community. Trend data on CPUE, size structure, and body condition have been collected annually since 2000 with fall nighttime electrofishing. Continuation of annual trend data in this reservoir with fall night electrofishing in 2021-2024 (bass-only in 2021 – 2023)

will allow for determination of any large-scale changes in the Largemouth Bass population in relation to changes in the aquatic habitat (Table 9). A minimum of 18 randomly selected 5-min electrofishing sites will be sampled in 2020 but sampling will continue at random sites until 50 stock-size fish are collected and the RSE of CPUE-S is ≤ 25 (the anticipated effort to meet both sampling objectives is 18 stations with 75% confidence). Exclusive of the original 18 random stations, six 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 night of sampling and objectives can be attained with up to 6 additional random stations, another night of effort will be expended.

Sunfish and Shad: Bluegill, Redear Sunfish, Redbreast Sunfish, Gizzard Shad, and Threadfin Shad are the primary forage at Austin Reservoir. Trend data on CPUE and size structure of these sunfish have been collected every four years since 2000. Abundance of Threadfin Shad was also measured as a function of CPUE during those surveys and will remain the main sampling objective to measure Threadfin Shad abundance. Continuation of sampling every four years (next survey in 2024) will allow for monitoring of large-scale changes in sunfish relative abundance and size structure. Sampling effort based on achieving sampling objectives for Largemouth Bass will result in sufficient numbers of sunfish for size structure estimation (PSD and IOV; 50 fish minimum at 5-12 stations with 80% confidence) but not for relative abundance estimates (RSE ≤ 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 sunfish. Instead, Largemouth Bass body condition can provide information on forage abundance, vulnerability, or both relative to predator density. Relative weight of Largemouth Bass ≥ 8” TL will be determined from their length/weight data (maximum of 10 fish weighed and measured per inch class).

Literature Cited

Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Chilton, E. W., and S. J. Magnelia. 2009. Use of an incremental triploid Grass Carp stocking strategy for maintaining vegetation coverage in a riverine Texas reservoir. Pages 543-555 In: M.S. Allen, S. Sammons and M.J. Maceina, editors. Balancing Fisheries Management and Water Uses for Impounded River Systems. American Fisheries Society, Bethesda, Maryland.

De Jesus, M. J., and M. Farooqi. 2013. Statewide freshwater fisheries monitoring and management program survey report for Austin Reservoir, 2012. Texas Parks and Wildlife Department, Federal Aid Report F-221-M-3, Austin, TX. 27 pp.

De Jesus, M. J., and M. Farooqi. 2017. Statewide freshwater fisheries monitoring and management program survey report for Austin Reservoir, 2016. Texas Parks and Wildlife Department, Federal Aid Report F-222-M-2, Austin, TX. 27 pp.

DiCenzo, V. J., M. J. Maceina, and M. R. Stimpert. 1996. Relations between reservoir trophic state and Gizzard Shad population characteristics in Alabama reservoirs. North American Journal of Fisheries Management. 16:888-895.

Guy, C. S., R. M. Neumann, D. W. Willis, and R. O. Anderson. 2007. Proportional Size Distribution (PSD): A further refinement of population size structure index terminology. Fisheries 32(7):348.

Magnelia, S. J., and M. J. De Jesus. 2009. Statewide freshwater fisheries monitoring and management program survey report for Austin Reservoir, 2008. Texas Parks and Wildlife Department, Federal Aid Report F-30-R-33, Austin, TX. 25 pp.

Prentice, J.A. 1987. Length-weight relationships and average growth rates of fishes in Texas. Texas Parks and Wildlife Department, Inland Fisheries Management Data Series Number 6. Austin, TX.

Smith, T. O., S. J. Magnelia and F. Janssen. 2002. Lake Austin angler attitude and opinion and economic impact study: Final Report. Texas Parks and Wildlife Department, Austin, Texas. 15 pp.

Tennant, M. A. and S. J. Magnelia. 2001. Statewide freshwater fisheries monitoring and management program survey report for Austin Reservoir, 2000. Texas Parks and Wildlife Department, Federal Aid Report F-30-R, Austin. 31 pp.

Texas Commission on Environmental Quality. 2020. Trophic classification of Texas reservoirs. 2020 Texas Water Quality Inventory and 303 (d) List, Austin, Texas. 15 pp.

Tables and Figures

Table 1. Characteristics of Austin Reservoir, Texas.

Characteristic	Description
Year constructed	1893
Controlling authority	City of Austin and LCRA
County	Travis
Reservoir type	Mainstem river system: Colorado
Shoreline Development Index	8.5
Conductivity	378 µS/cm

Table 2. Boat ramp characteristics for Austin Reservoir, Texas, August 2020. Reservoir elevation at time of survey was 492 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft.)	Condition
Walsh	30.29721 -97.78380	Y	13	480	Good/
Loop 360 Bridge	30.34975 -97.79940	Y	20	482	Good.
Emma Long Park	30.32930 -97.84285	Y	20	482	Fair
Mary Quinlan Park	30.32624 -97.92852	Y	10	485	Good

Table 3. Harvest regulations for Austin Reservoir, Texas.

Species	Bag limit	Length limit (inches)
Catfish: Channel and Blue Catfish	25 (in any combination)	12-minimum
Flathead Catfish	5	18-minimum
White Bass	25	10-minimum
Bass: Largemouth	5 [a]	14-minimum
Bass: Guadalupe	5 [a]	No minimum limit
White and Black Crappie	25 (in any combination)	10-minimum

[a] Daily bag for Largemouth Bass and Guadalupe Bass = 5 fish in any combination.

Table 4. Stocking history for Austin Reservoir, Texas. Life stages are fry (FRY), fingerlings (FGL), advanced fingerlings (AFGL), adults (ADL) 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)
Channel catfish	2007	204	ADL	14.6
	Total	204		
Florida largemouth bass	1996	1,103,215	FRY	0.6
	1997	196,074	FRY	0.7
	1998	184,554	FGL	1.4
	1998	685,311	FRY	0.7
	1999	4,980	AFGL	5.4
	1999	184,016	FGL	1.7
	2003	262,750	FGL	1.7
	2003	881,925	FRY	0.6
	2004	318	ADL	10.2
	2004	162,149	FGL	1.6
	2004	431,007	FRY	0.4
	2005	12,000	FGL	1.9
	2007	171,291	FGL	2.1
	2007	89,897	FRY	0.3
	2009	174,246	FRY	0.3
	2010	182,277	FGL	1.7
	2011	436,843	FRY	0.3
	2013	164,679	FGL	1.5
	2014	160,109	FGL	1.6
	2021	151		0.0
	Total	5,487,792		
Grass carp	2003	13		24.1
	Total	13		
Northern pike	1980	88,500		0.0
	1981	34,514		0.0
	Total	123,014		
Palmetto Bass (striped X white bass hybrid)	1975	20,000	UNK	0.0
	1977	20,035	UNK	0.0
	1981	5,000	UNK	0.0
	1983	10,089	UNK	0.0
	Total	55,124		
Rainbow trout	2001	3,008	ADL	9.3

Species	Year	Number	Life Stage	Mean TL (in)
	Total	3,008		
ShareLunker largemouth bass	2008	12,612	AFGL	6.2
	2010	2,220	FGL	2.5
	2011	3,913	FGL	2.4
	2012	11,025	FGL	2.0
	2013	6,380	FGL	2.0
	2014	11,230	FGL	2.0
	2021	10,723	FGL	1.5
	Total	58,103		
Triploid grass carp	2003	3,825		0.0
	2004	4,300		0.0
	2006	1,600		0.0
	2007	3,075		0.0
	2009	4,400		12.0
	2011	13,200		10.0
	2012	17,369		9.0
	2013	8,998		12.0
	Total	56,767		
Walleye	1976	20,200	FRY	0.2
	Total	20,200		

Table 5. Objective-based sampling plan components for Austin Reservoir, Texas 2020.

Gear/target species	Survey objective	Metrics	Sampling objective
Electrofishing			
Largemouth Bass	Abundance	CPUE – stock	RSE-stock ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock
	Age-and-growth	Age at 14 inches	N = 13, 13.0 – 14.9 inches
	Condition	W_r	10 fish/inch group (max)
	Genetics	% FLMB	N = 30, any age
Bluegill [a]	Abundance	CPUE – total	RSE ≤ 25
	Size structure	PSD, length frequency	N ≥ 50
Gizzard Shad [a]	Abundance	CPUE – total	RSE ≤ 25
	Size structure	Length frequency	N ≥ 50
	Prey availability	IOV	N ≥ 50

[a] No additional effort will be expended to achieve an RSE ≤ 25 for CPUE and N ≥ 50 for 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.

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Table 6. Survey of structural habitat types, Austin Reservoir, Texas, 2020. Shoreline habitat type units are in miles and standing timber is acres.

Habitat type	Distance	% of total
Natural shoreline	19.8	34.0
Bulkhead w/ piers	23.0	40.0
Rocky bluff	1.4	2.0
Bulkhead	5.7	10.0
Natural shoreline w/ piers	7.4	13.0
Rocky shoreline w/ piers	0.2	< 1.0
Rocky bluff w/ piers	0.1	< 1.0

Table 7. Survey of aquatic vegetation, Austin Reservoir, Texas, 2013 – 2020. Surface area (acres) is listed with percent of total reservoir surface area in parentheses. Surveys were conducted in the fall.

Vegetation	2013	2014	2015	2016	2017	2018	2019	2020
Native submersed	1.0 (<1.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Native floating-leaved	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Native emergent*	-	-	<1.0 (<1.0)	<1.0 (<1.0)	<1.0 (<1.0)	<1.0 (<1.0)	<1.0 (<1.0)	<1.0 (<1.0)
Non-native								
Hydrilla (Tier I)**	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Eurasian watermilfoil (Tier III)**	202 (13.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)

*Coverage not calculated in historical surveys.

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

Gizzard Shad

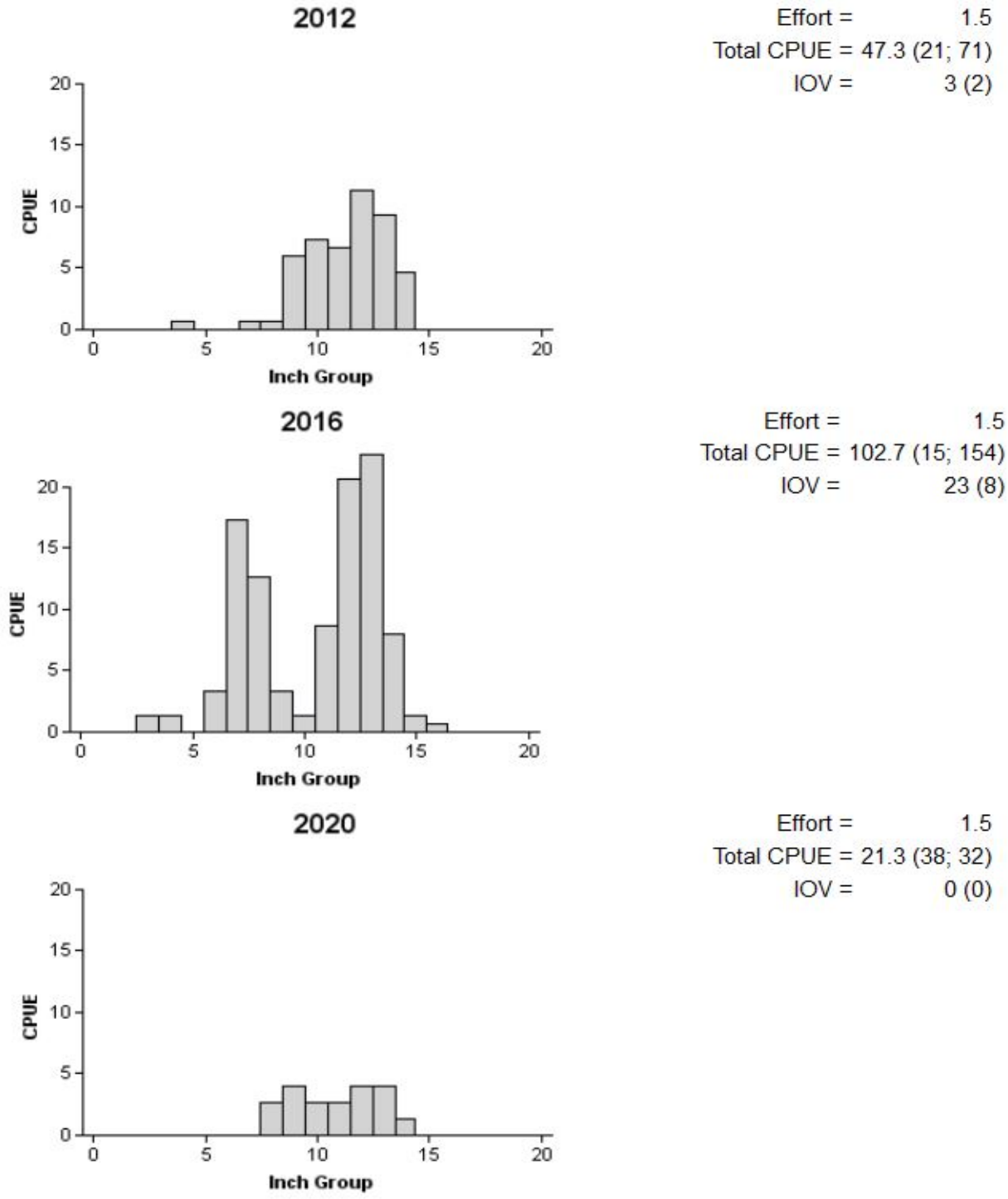


Figure 1. Number of Gizzard Shad caught per hour (CPUE) population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Austin Reservoir, Texas, 2012, 2016, and 2020.

Redbreast Sunfish

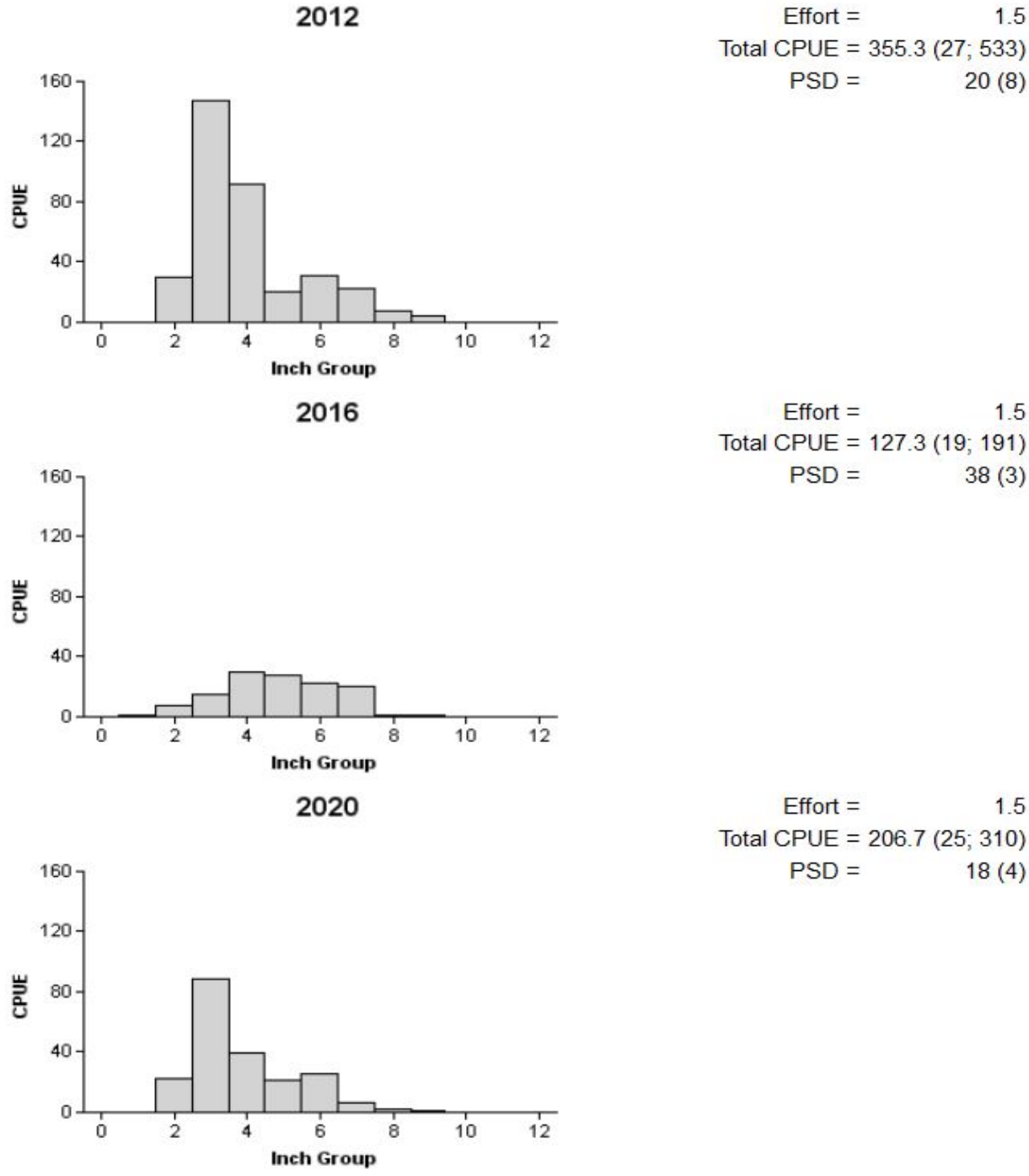


Figure 2. Number of Redbreast Sunfish caught per hour (CPUE) population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Austin Reservoir, Texas, 2012, 2016 and, 2020.

Bluegill

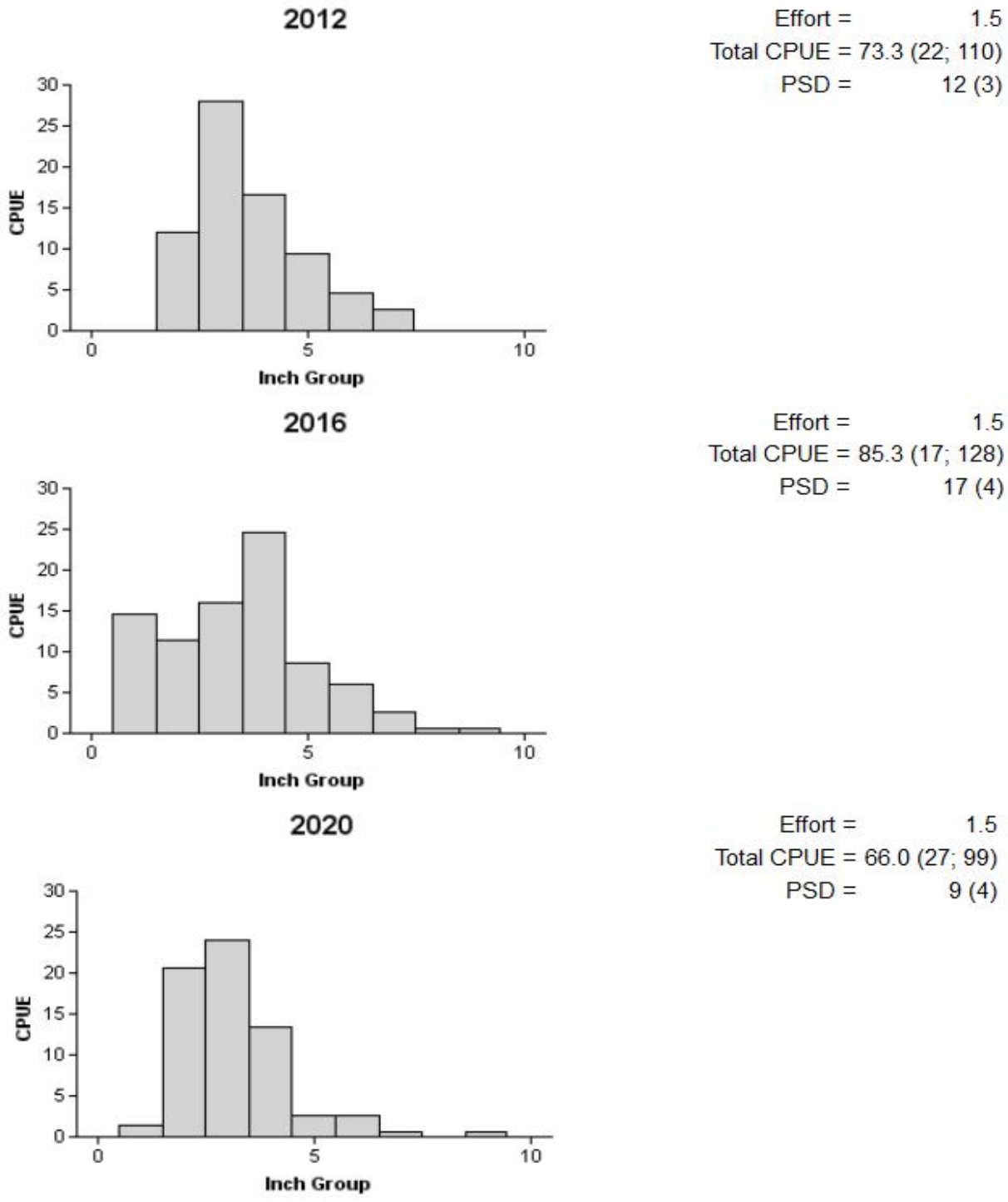


Figure 3. Number of Bluegill Sunfish caught per hour (CPUE) population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Austin Reservoir, Texas, 2012, 2016 and, 2020.

Redear Sunfish

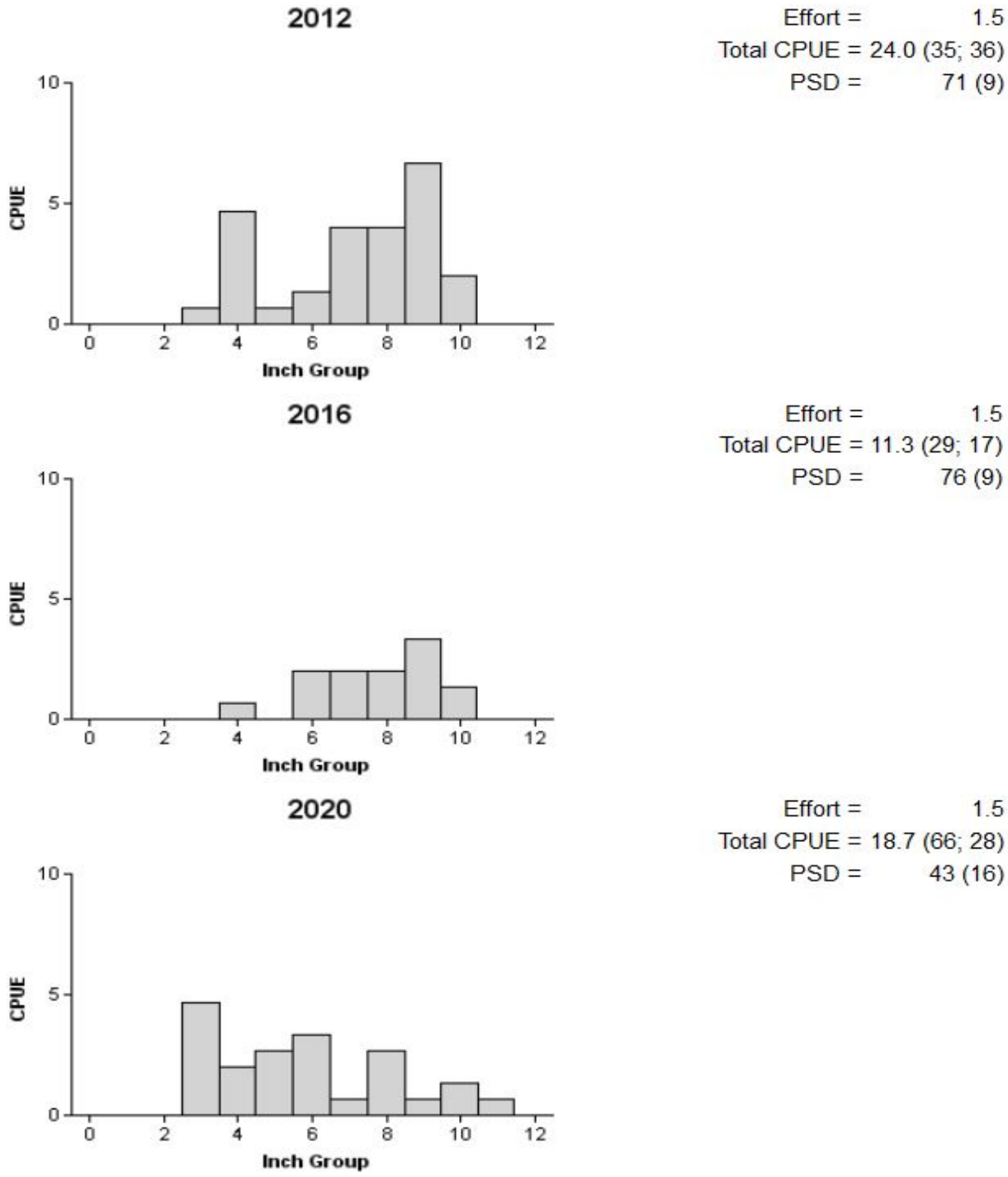
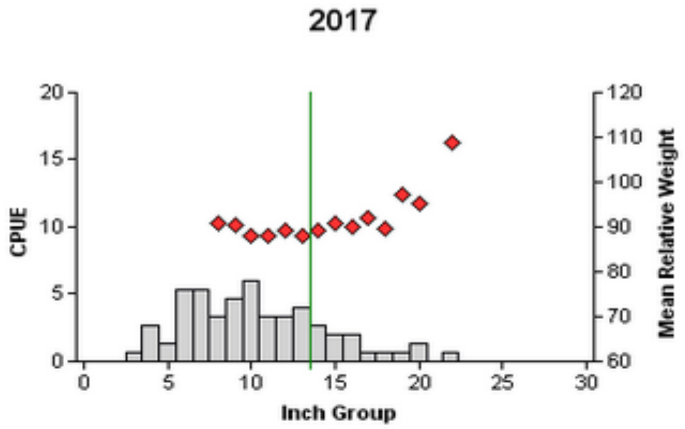
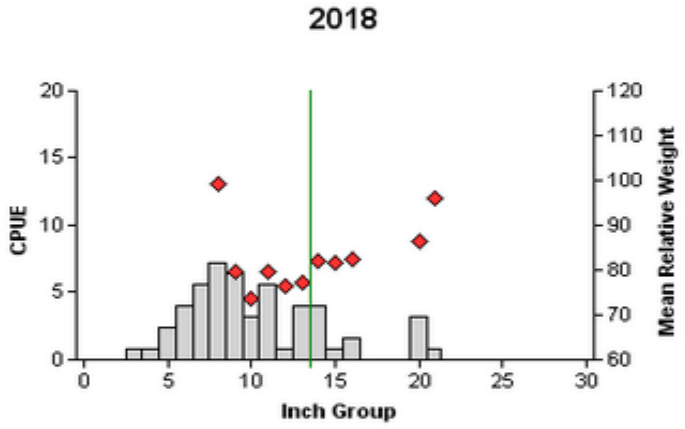


Figure 4. Number of Redear Sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Austin Reservoir, Texas, 2012, 2016, and 2020.

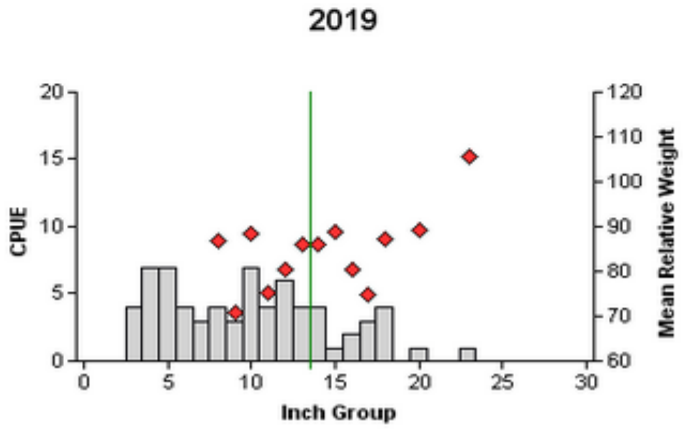
Largemouth Bass



Effort = 1.5
Total CPUE = 50.7 (15; 76)
Stock CPUE = 35.3 (17; 53)
CPUE-14 = 10.7 (24; 16)
CPUE-18 = 3.3 (49; 5)
CPUE-21 = 0.7 (100; 1)
PSD = 51 (7)



Effort = 1.3
Total CPUE = 51.2 (21; 64)
Stock CPUE = 37.6 (20; 47)
CPUE-14 = 10.4 (35; 13)
CPUE-18 = 4.0 (48; 5)
CPUE-21 = 0.8 (100; 1)
PSD = 40 (9)



Effort = 1.0
Total CPUE = 69.0 (20; 69)
Stock CPUE = 44.0 (17; 44)
CPUE-14 = 16.0 (25; 16)
CPUE-18 = 6.0 (39; 6)
CPUE-21 = 1.0 (100; 1)
PSD = 59 (7)

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 bass-only electrofishing surveys (2017-2019) and standard fall electrofishing survey (2020), Austin Reservoir, Texas, 2017 through 2020. Minimum length limit indicated by vertical line.

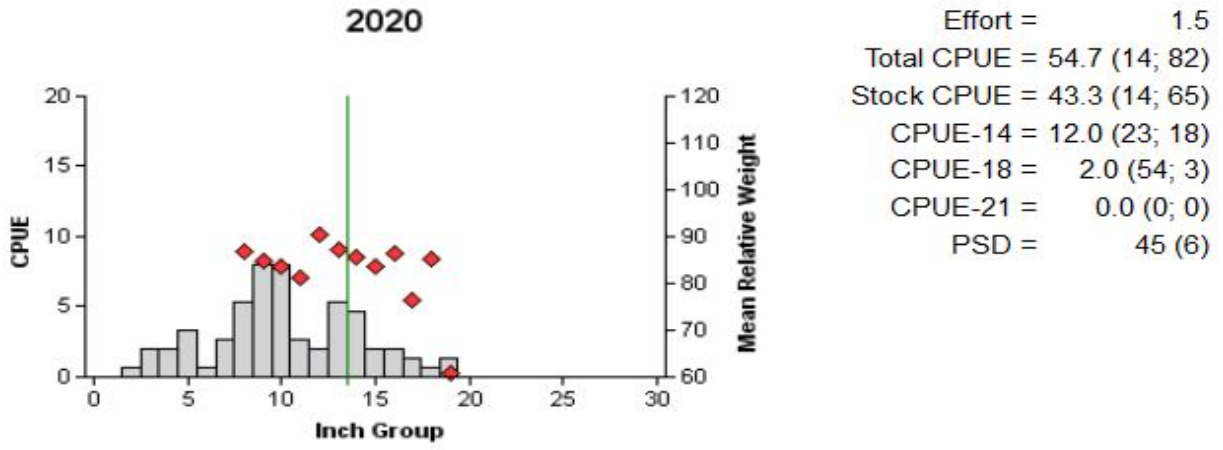


Figure 5 (cont.). Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall bass-only electrofishing surveys (2017-2019) and standard fall electrofishing survey (2020), Austin Reservoir, Texas, 2017 through 2020. Minimum length limit indicated by vertical line.

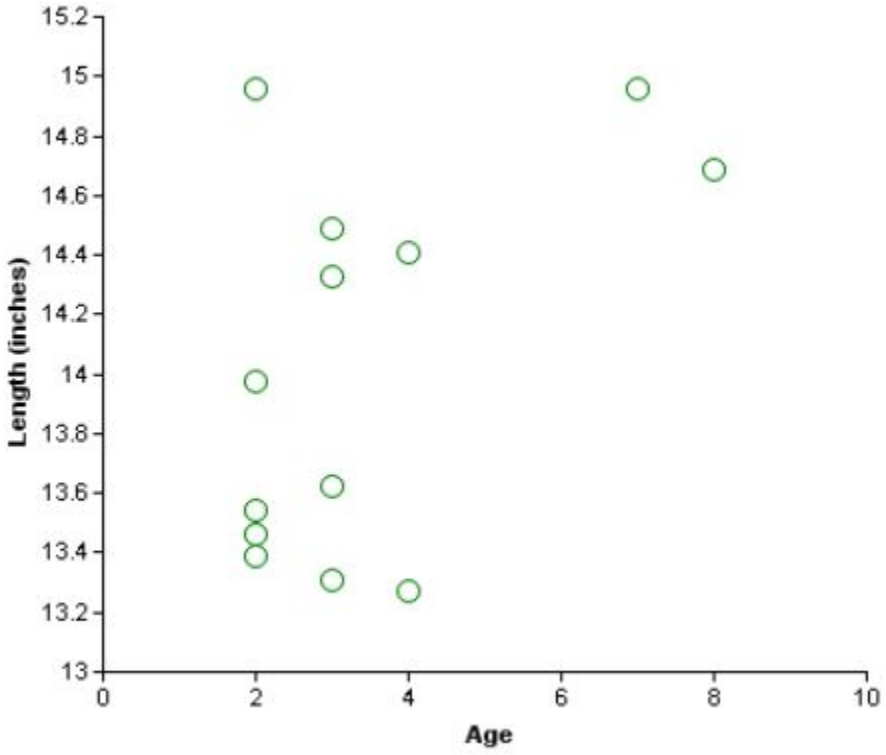


Figure 6. Length at age for Largemouth Bass collected during electrofishing at Austin Reservoir, Texas, fall 2020 (N = 13). Mean length at age by survey year displayed in the table below graph.

Table 8. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Austin Reservoir, Texas, 2008, 2012, 2016, and 2020. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB. Genetic composition was determined by micro-satellite DNA analysis.

Year	Sample size	Number of fish			% FLMB alleles	% FLMB
		FLMB	Intergrade	NLMB		
2008	30	4	26	0	76	13
2012	30	5	25	0	80	17
2016	30	6	24	0	84	20
2020	30	9	21	0	81	30

Proposed Sampling Schedule

Table 9. Proposed sampling schedule for Austin Reservoir, Texas. Survey period is June through May.

Survey year	Electrofish Fall(Spring)	Trap net	Gill net	Habitat		Access	Creel survey	Report
				Structural	Vegetation			
2021-2022	X*				X			
2022-2023	X*				X			
2023-2024	X*				X			
2024-2025	X				X	X		X

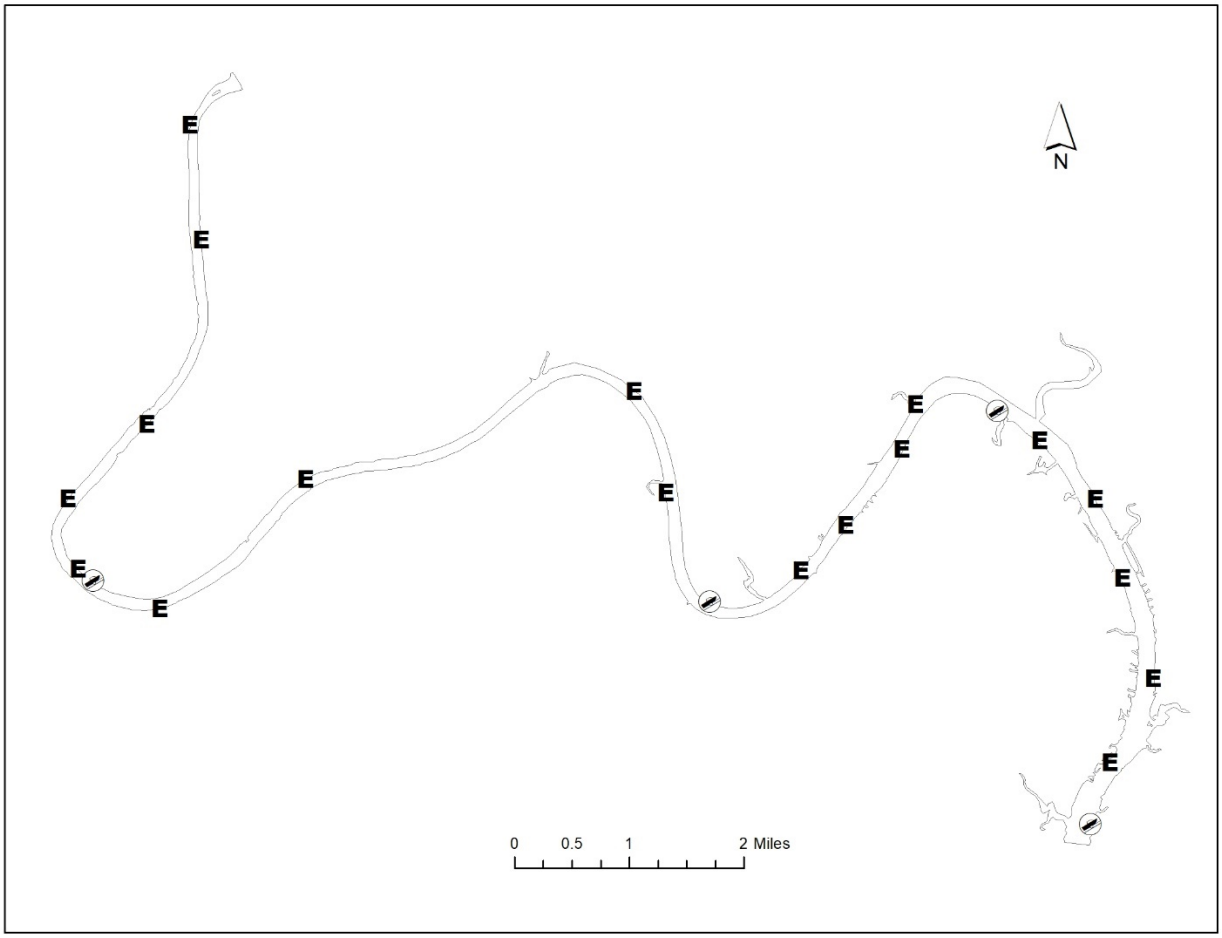
*Bass-only electrofishing

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 by electrofishing in October 2020 from Austin Reservoir, Texas. Sampling effort was 1.5 hours for electrofishing.

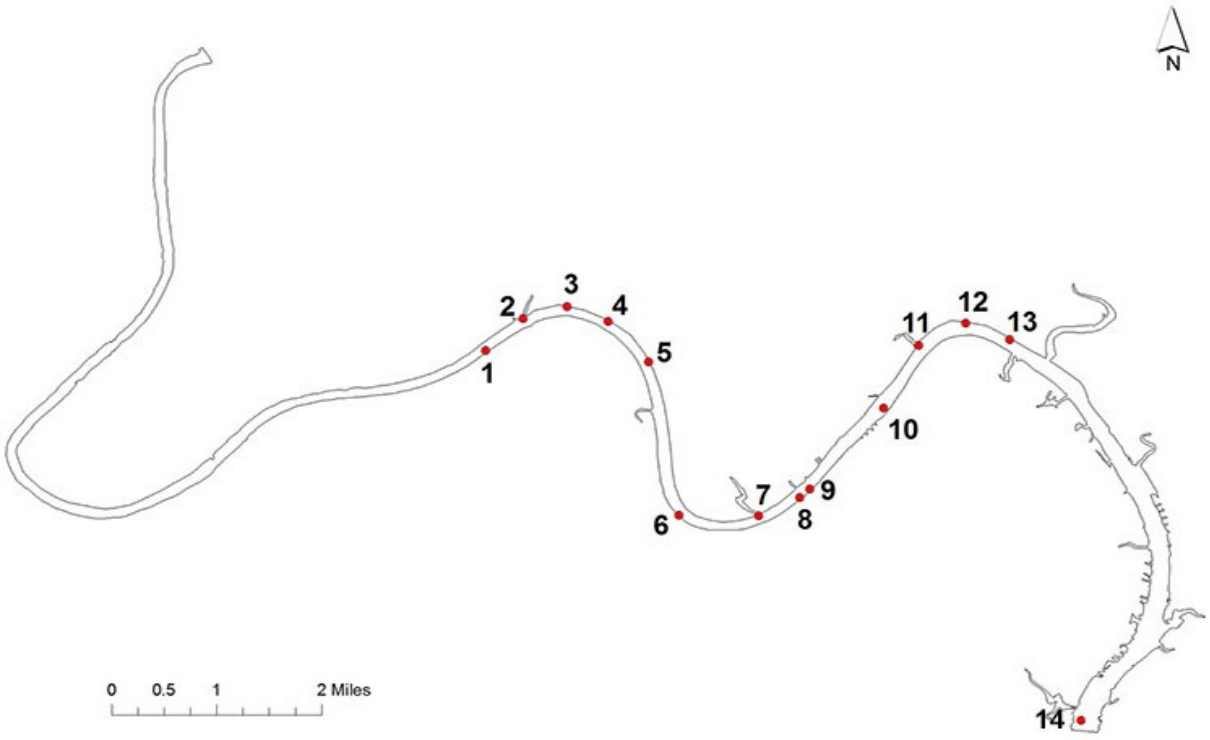
Species	Electrofishing	
	N	CPUE
Gizzard Shad	32	21.3 (38)
Bullhead minnow	1	0.7 (100)
Inland Silverside	24	16.0 (92)
Blacktail Shiner	1	0.7 (100)
Redbreast Sunfish	310	206.7 (25)
Bluegill	99	66.0 (27)
Longear Sunfish	2	1.3 (69)
Redear Sunfish	28	18.7 (66)
Largemouth Bass	82	54.7 (14)
Guadalupe Bass	7	4.7 (52)
Logperch	2	1.3 (69)

APPENDIX B – Map of sampling locations



Location of sampling sites, Austin Reservoir, Texas, 2020. Electrofishing stations indicated by E. Boat ramps marked by encircled boat symbols.

APPENDIX C – Map of Fish Attractors at Austin Reservoir



Map showing fish attractor locations. Locations 1-13 are Mossback and location 14 is a concrete pillar reef.

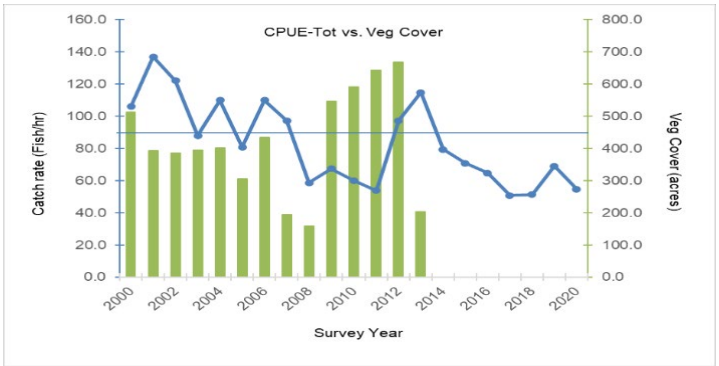
APPENDIX D – GPS Coordinates for Fish Attractors at Austin Reservoir

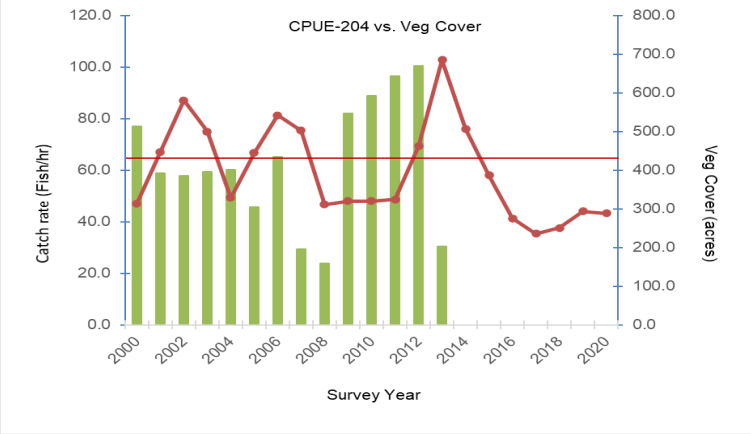
GPS coordinates for Austin Reservoir, Texas fish attractor locations. GPS coordinates are in degree decimal minutes. Attractors, in the form of Ash juniper (*Juniperus ashei*) were originally installed in 2015. Artificial Trophy Tree structures (Mossback) were installed in 2018 and 2019. Concrete pillars, indicated as "14" on the table were installed in 2018.

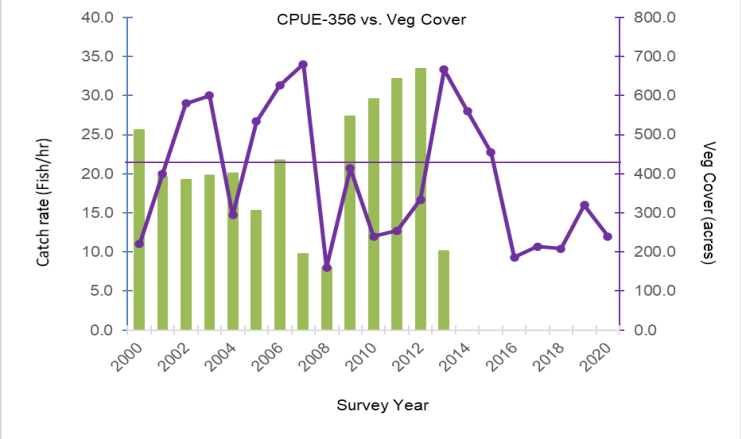
#	Latitude	Longitude	Description
1	30° 20.943'	97° 52.159'	Boulder ledge
2	30° 21.216'	97° 51.851'	Creek mouth point
3	30° 21.321'	97° 51.487'	Boulder ledge
4	30° 21.193'	97° 51.148'	Boulder ledge
5	30° 20.842'	97° 50.812'	Boulder ledge
6	30° 19.519'	97° 50.560'	Creek mouth point
7	30° 19.510'	97° 49.898'	Creek mouth point
8	30° 19.670'	97° 49.556'	Boulder ledge
9	30° 19.744'	97° 49.475'	Creek mouth gravel bar
10	30° 20.445'	97° 48.861'	Hump
11	30° 20.984'	97° 48.570'	Creek mouth point
12	30° 21.181'	97° 48.180'	Boulder ledge
13	30° 21.035'	97° 47.816'	Ledge under 360 bridge
14	30° 17.796'	-97° 47.222'	Concrete pillar reef near dam

APPENDIX E: Historic Largemouth Bass Electrofishing Catch Rates versus Vegetation Cover

Historic Largemouth Bass fall electrofishing catch rates (CPUE; dots) in relation to total aquatic vegetation coverage (bars) from Austin Reservoir, Texas, from 2000 to 2020. Catch rates represent total fish (all sizes), 8-inches (204 mm) stock-size fish, and 14-inches (356 mm) harvest-size fish caught per hour of electrofishing. Mean catch rate during the time frame is represented by the horizontal line.

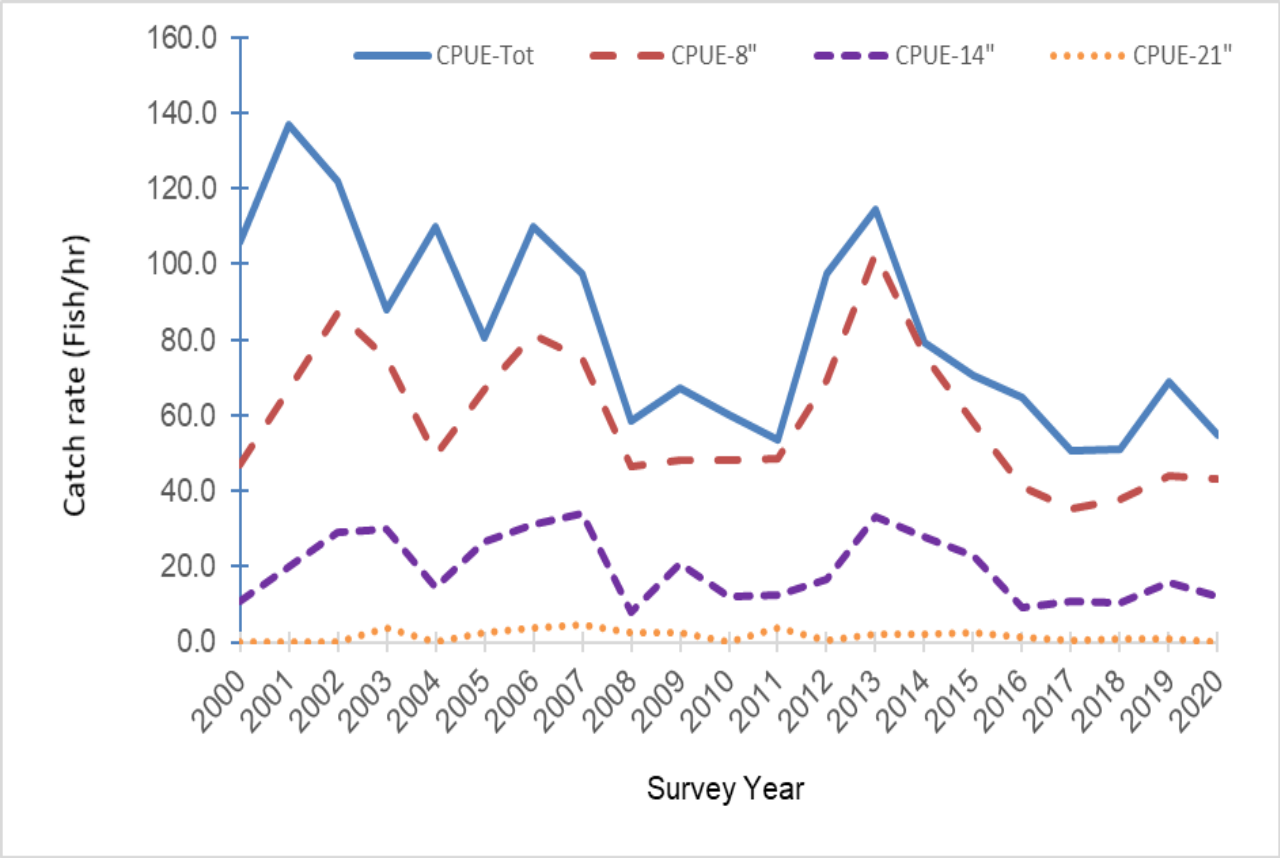






APPENDIX F: Scaled Historic Largemouth Bass Electrofishing Catch Rates

Scaled historic Largemouth Bass fall electrofishing catch rates (CPUE) from Austin Reservoir, Texas, from 2000 to 2020. Catch rates represent total fish (all sizes), 8-inches (204 mm) stock-size fish, 14-inches (356 mm) harvest-size fish, and 18-inches (534 mm) memorable-size fish caught per hour of electrofishing.



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