

# Lyndon B. Johnson Reservoir

## 2020 Fisheries Management Survey Report

PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

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INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

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## Survey and Management Summary

Fish populations in Lyndon B. Johnson (LBJ) Reservoir were surveyed in 2020 using electrofishing, and in 2021 using gill netting. Historical data are presented with the 2017-2021 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:** Lyndon B. Johnson Reservoir is a stable-level 6,502-acre impoundment of the Colorado and Llano Rivers in Burnet and Llano counties, Texas. It was constructed in 1951 by the Lower Colorado River Authority (LCRA) for purposes of hydro-electric and steam-electric power, flood control, and water conservation. The reservoir has a drainage area of approximately 36,290 square miles and a shoreline length of about 270 miles. Residential and commercial properties border most of the shoreline area.

**Management History:** Important sport fish include Largemouth Bass, Channel Catfish, and White Bass. Management activities included Florida Largemouth Bass stockings from 2011 to 2016 to improve the potential for trophy Largemouth Bass, and conducting annual aquatic vegetation surveys to monitor exotic invasive species. The reservoir is managed under statewide regulations. Lyndon B. Johnson Reservoir had little vegetative coverage prior to 2012.

### Fish Community

- **Prey species:** Bluegill, Gizzard Shad, and Redbreast Sunfish were the predominant prey species in 2020. Threadfin Shad and Redear Sunfish were also available as forage. The forage base was sufficient to support sportfish.
- **Catfishes:** Blue Catfish relative abundance was low, as was the case in previous surveys. Channel Catfish was the predominant catfish species in the reservoir; catch rate had increased since the previous two surveys. Flathead Catfish were present in low numbers.
- **White Bass:** This reservoir continued to support a low-abundance White Bass population. Most individuals sampled were of harvestable size.
- **Largemouth Bass:** Largemouth Bass abundance was moderate; population size structure was good, and overall body condition for most fish was close to optimal.

**Management Strategies:** Based on current information, the reservoir should continue to be managed with existing regulations. Aquatic vegetation surveys should continue to be conducted annually to monitor coverage of non-native water hyacinth, Eurasian watermilfoil, and hydrilla. Standard gill netting and electrofishing surveys will be conducted in 2024 – 2025, and an additional electrofishing survey in 2022.

## Introduction

This document is a summary of fisheries data collected from Lyndon B. Johnson (LBJ) Reservoir from 2017-2021. 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 2017-2021 data for comparison.

## Reservoir Description

Lyndon B. Johnson Reservoir is a 6,502-acre impoundment of the Colorado and Llano rivers in Burnet and Llano counties, Texas. It was constructed in 1951 by the Lower Colorado River Authority (LCRA) for purposes of hydro-electric and steam-electric power production, flood control, and water conservation. The reservoir is eutrophic with a mean TSI chl-*a* of 56.40, and a 10-year change of +3.72 (Texas Commission on Environmental Quality 2020). Lyndon B. Johnson Reservoir has a drainage area of approximately 36,290 square miles and a shoreline length of 270 miles. This is a stable-level reservoir (825 ft. above mean sea level), and lies within the Edwards Plateau ecological area and Colorado River Basin. Land use in the watershed is predominantly ranching. Residential and commercial properties border most of the shoreline. Shoreline habitat at the time of sampling consisted mostly of bulkhead with docks, and vegetated natural shoreline. Aquatic vegetation is present, but has been below optimal levels for fish production (Durocher 1984; Dibble et al. 1996). Other descriptive characteristics for LBJ Reservoir are in Table 1.

## Angler Access

Angler access at LBJ Reservoir was good for boat anglers, but poor for bank anglers. Nineteen concrete boat ramps were available for anglers. Of the 19 ramps, two are considered the primary public ramps on the reservoir, Cottonwood Shores (lower reservoir) and the Kingsland Lions Club (upper reservoir). Cottonwood Shores requires a fee. The remaining ramps are controlled by various home-owner associations, but provide access to lake area residents. 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 2017) included:

1. Continue annual aquatic vegetation surveys and conduct an additional electrofishing survey in 2018 to monitor the Largemouth Bass population in response to vegetation dynamics.

**Action:** With the exception of 2018, annual vegetation surveys have been conducted since 2017. A major flood occurred at the reservoir in October 2018, which resulted in structural damage, and prevented the 2018 vegetation and electrofishing surveys.

2. Continue online monitoring of the results of Largemouth Bass tournaments to capture large fish data.

**Action:** Largemouth Bass tournament data was collated from 2012 to 2021.

3. Continue to engage partners and the general public about the negative impacts of aquatic invasive species through the use of print media, social media, and public engagements.

**Action:** Outreach efforts regarding invasive species included social media, print media, public presentations, and one-on-one interactions with constituents.

**Harvest regulation history:** Sport fish in LBJ Reservoir have been, and are currently managed with statewide regulations (Table 3).

**Stocking history:** Florida Largemouth Bass were first stocked in LBJ Reservoir in 1976. They were last stocked between 2011 to 2016 to improve the growth potential for Largemouth Bass. In 2010, a 13.7-pound bass from LBJ Reservoir was submitted to the ShareLunker selective breeding program and a

portion of the offspring (2,220 ShareLunker Largemouth Bass fingerlings) were stocked in LBJ Reservoir. The most recent Channel Catfish stockings were in 2012, 2013, and 2016. The complete stocking history is in Table 4.

**Vegetation/habitat management history:** The reservoir had sub-optimal aquatic vegetation coverage for fish production (Durocher 1984; Dibble et al. 1996). In efforts to increase native aquatic vegetation coverage, nine sites were planted with aquatic vegetation beginning in 2000 and these have been evaluated since 2005. Little expansion was documented at most sites (Bonds and Magnelia 2005); however, one site had thrived (DeJesus and Magnelia 2009).

While aquatic vegetative coverage has been low from a fishery perspective, reservoir-based businesses and waterfront homeowners have been impacted by localized nuisance vegetation issues. With the cooperation and participation of LCRA, municipal authorities that surround the reservoir, and Texas Parks & Wildlife Department (TPWD), a nuisance aquatic vegetation management plan was developed by TPWD in 2015 to help coordinate treatment proposals on behalf of applicants for localized nuisance aquatic vegetation control. The plan is no longer in effect.

Water hyacinth was first documented in 2003 in one cove of the reservoir and has spread. This species is still only present in small quantities. Herbicide treatments have successfully been used by the LCRA to control large scale infestations of this species. Eurasian watermilfoil has been the dominant non-native species since 2011.

Most of the shoreline habitat was comprised of bulkhead, and natural vegetated shoreline.

**Water transfer:** No inter-basin water transfers are known to exist at LBJ Reservoir.

## Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for LBJ Reservoir (Farooqi and De Jesus 2017). 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 2017).

**Electrofishing** – Largemouth Bass, sunfishes, Gizzard Shad, and Threadfin Shad were collected by electrofishing (1.5 hours at 18, 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. Category 2 age and growth analysis was performed for Largemouth Bass according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2017).

**Gill netting** – Catfish and White Bass were collected by gill netting (10 net nights at 10 stations). Catch per unit effort for gill netting was recorded as the number of fish caught per net night (fish/nn). Category 2 age and growth analysis was performed for White Bass according to the Fishery Assessment Procedures (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.

**Habitat** – A structural habitat survey was last conducted in 2016. Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2017).

## Results and Discussion

**Habitat:** A structural habitat survey was not conducted in 2020 since large-scale changes in structural habitat were not suspected. The last structural survey was conducted in 2016 (Farooqi and De Jesus 2017) when habitat consisted primarily of bulkheads and natural shoreline (Table 6). In 2020, native vegetation and non-native vegetation covered < 1% of the reservoir's surface area (Table 7; Appendix B). Total coverage estimate of all plant species from 2017 to 2020 (ranging from 0.7 % to 2.5% of the reservoir's surface area) was considerably lower than that considered optimum for productive fisheries (Dibble et al. 1996, Durocher et al. 1984). Prior to 2016, the dynamics of vegetative coverage in the reservoir had been driven largely by Eurasian watermilfoil (Farooqi and De Jesus 2017). Drought conditions that prevailed from 2011 to 2014 most likely created an environment in which Eurasian watermilfoil could flourish. As the drought ended, Eurasian watermilfoil coverage was reduced to 0.0% by 2016, likely aided by heavy grazing from coots, and has not recovered since then.

Hydrilla became established by 2014 (22.3 acres) and reached 112.9 acres (1.8% of reservoir surface area) by 2016 (Farooqi and De Jesus 2017). In 2017, hydrilla covered 18.9 acres, but has not been detected since then. Water hyacinth coverage has remained < 1 acre since 2017.

**Prey species:** Bluegill, Gizzard Shad, and Redbreast Sunfish were the predominant prey species in 2020. Threadfin Shad and Redear Sunfish were also available as forage (Appendix C).

In 2020, Threadfin Shad CPUE was 50.7/h which was less than that obtained in 2016 (305.3/h); nevertheless, Threadfin Shad CPUE was higher than in 2012 (8.0/h) and 2010 (34.0/h). Total CPUE of

Gizzard Shad (165.3/h) was higher than in previous surveys conducted in 2016 (88.7/h), 2012 (106.7/h; Figure 1), and 2010 (121.3/h). Index of vulnerability for Gizzard Shad was relatively low (24); indicating 24% of Gizzard Shad were of vulnerable size (< 8 inches) to existing predators. The IOV was lower than in 2016 (47), but was still an improvement compared to the 2012 (4) and 2010 (8) surveys. Historically, this reservoir has had low IOV values (De Jesus and Magnelia 2009).

Total CPUE of Redbreast Sunfish in 2020 (117.3/h) was higher than in 2016 (75.3/h), but was lower than in 2012 (186.0/h). Larger fish (up to 7 inches in length) were present, providing some good opportunities for sunfish anglers and population size structure was adequate as indicated by a PSD of 25 (Figure 2). A new water body record (rod and reel) for Redbreast Sunfish (0.8 pounds, 10.0 inches) was established in 2017.

Bluegill was the most abundant prey species. In 2020, total CPUE of Bluegill (227.3/h) had improved compared to 2016 (94.7/h), but was less than in 2012 (307.3/h). Although less abundant than in previous years, fish in the 6 to 8-inch size range were still present (PSD-P = 1) and overall population size structure was good (Figure 3). Relatively lower catch rates of Redear Sunfish (42.7/h) and Longear Sunfish (12.0/h) were obtained in 2020. A new water body record (rod and reel) for Longear Sunfish (0.88 pounds, 10.75 inches) was established in 2017.

**Catfishes:** Blue Catfish relative abundance was low (1.1/nn in 2021), as was the case in previous surveys (0.5/nn in 2017 and 0.3/nn in 2013); the few individuals that were sampled were large fish – up to 33 inches in length (PSD=65; PSD-P=12). Juvenile fish production was not detected (Figure 4). Blue Catfish have never been stocked in the reservoir by TPWD so their presence could be due to emigration from upstream reservoirs or unauthorized introductions. Relative weight was good (> 90) for the majority of stock size fish. The current water body record (rod and reel) for Blue Catfish was established in 2016 (71.4 pounds, 51.8 inches).

Channel Catfish was the predominant catfish species in the reservoir. Objective based sampling metrics (Table 5) were met. In 2021, the total gill net catch rate of Channel Catfish had increased to 8.6/nn compared to 2.7/nn in 2017 and 1.8/nn in 2013 (Figure 5). In 2021, CPUE-12 (4.4/nn) indicated a good proportion of the fish sampled were above harvestable-size ( $\geq 12$  inches), and the largest fish was 27 inches in length (PSD=56; PSD-P=3). Body condition of harvestable-size Channel Catfish was good with most fish having relative weights  $\geq 90$ , and some fish were at or above optimum ( $\geq 100$ ).

Flathead Catfish relative abundance is typically low in this reservoir. Total CPUE of Flathead Catfish was 1.5/nn in 2021 compared to 0.5/nn in 2017 and 1.2/nn in 2013 (Figure 6). Nearly all the fish collected were over harvestable-size ( $\geq 18$  inches) and the largest fish measured 29" in length (PSD=91; PSD-P=17). Relative weight of stock-size fish was quite variable, nevertheless nearly all the fish had a  $W_r$  of  $\geq 85$ , and some fish were at or above optimum ( $\geq 100$ ).

**White Bass:** This reservoir continued to support a low-abundance White Bass population. The total CPUE of White Bass was 2.5/nn in 2021 compared to 1.6/nn in 2017 and 1.5/nn in 2013 (Figure 7). The total catch rate in 2021 (2.5/nn) was a little higher than the average (1.8/nn) calculated from the previous eight surveys going back to 1997. Furthermore, most individuals sampled were of harvestable size ( $\geq 10$  inches) with the largest fish measuring 15 inches long (PSD=89, PSD-P=11). Body condition was sub-optimum ( $W_r < 100$ ) ranging from 80 to 92. Based on a Category 2 age and growth analysis, all 11 fish were 2 years old (Figure 8). In the absence of age-1 fish, we can infer that White Bass reached harvestable size (10 inches) between age 1 and 2, as was the case in previous years (Farooqi and De Jesus 2017). A new water body record (rod and reel) for White Bass (3.6 pounds, 19.0 inches) was established in 2017.

**Largemouth Bass:** In 2020, the reservoir contained a moderate density Largemouth Bass population relative to bass populations in other central Texas reservoirs. Objective based sampling metrics (Table 5) were met. The total CPUE of Largemouth Bass was 82.7/h in 2020 which was consistent with catch rates of 60.7/h in 2016 and 70.0/h in 2014 (Figure 9) and was equal to the 22-year average total CPUE of

82.7/h. The CPUE of larger size classes of Largemouth Bass were also more consistent with the previous two surveys. The electrofishing catch rate of stock-length Largemouth Bass was 49.3/h in 2020 compared to 54.0/h in both 2016 and in 2014. However, there was a decline in the catch rate of harvestable bass (CPUE-14) in 2020 (12.0/h), compared to 2016 (21.3/h) and 2014 (16.7/h). Nevertheless, in all three surveys, CPUE-14 was above the historical average of 10.4/h for LBJ Reservoir. Population size structure in the last three surveys was good; population indices (Figure 9) 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). Overall, body condition was close to optimal ( $W_r = 100$ ) in 2020, with fish in most length groups having relative weights of between 90 and 102. Category 2 age and growth analysis was not completed due to an inadequate sample size ( $n=5$ ).

In 2016, Florida Largemouth Bass influence was 58.0%; nearly all the fish were intergrades. Florida Largemouth Bass influence has remained relatively constant during the last four evaluations since 2006, ranging from 58.0% to 66.0% of Florida Largemouth Bass alleles (Table 8), even though the reservoir was stocked with Florida Largemouth Bass annually from 2011 to 2016. Due to the historic genetic stability of the Largemouth Bass population and the level of Florida Largemouth Bass alleles, no genetic analysis was performed in 2020.

The characteristics of the Largemouth Bass population in LBJ Reservoir have made it a popular venue for tournaments. One of the biggest local organizations is the Texas Tournament Zone which has held annual tournaments on the reservoir from 2012 to 2021 (although no data was available from 2013 and 2019). Appendix D shows that annual mean bag weight (ranging from 13.2 lbs to 20.7 lbs) and mean fish weight per year (2.7 lbs to 4.1 lbs) has been very similar since 2012. Total annual bag weight has varied from 328.9 lbs to 517.4 lbs. The size of the largest fish caught during tournaments has varied from 7.5-10.6 lbs. The total number of fish caught by the top 25 ranking teams has varied from 112 to 125 since 2012. These statistics, derived from strong tournament activity, are indicative of a well performing Largemouth Bass fishery.



# Fisheries Management Plan for LBJ Reservoir, Texas

Prepared – July 2021

**ISSUE 1:** Since 2015, there have been significant changes to the plant community driven by natural fluctuations that may influence Largemouth Bass population dynamics in the reservoir.

## MANAGEMENT STRATEGIES

1. Continue annual aquatic vegetation surveys.
2. Conduct an additional electrofishing survey in 2022 to monitor the Largemouth Bass population in response to vegetation dynamics.

**ISSUE 2:** Largemouth Bass tournament activity has become a feature of this fishery and is indicative of its performance. Large individuals are reported caught by tournament anglers from an active tournament scene at LBJ Reservoir.

## MANAGEMENT STRATEGY

1. Continue to monitor the Largemouth Bass tournament activity to capture fish data, particularly from the larger fish which are typically underrepresented by electrofishing.

**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 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 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. Continue to cooperate with LCRA to ensure adequate appropriate signage at access points around the reservoir.
2. Continue to partner with marina owners regarding invasive species by providing them with posters, literature, etc. so that they can in turn educate their customers.
3. Continue to inform the public about invasive species through the use of media and the internet.
4. Make a speaking point about invasive species when presenting to constituent and user groups.
5. Keep track of (i.e., map) existing and future inter-basin water transfers to facilitate potential invasive species responses.

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

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

Important sport fish in Lyndon B. Johnson (LBJ) Reservoir include Largemouth Bass, White Bass, and Channel Catfish species. Known important forage species include Bluegill, Redbreast Sunfish, Gizzard Shad, and Threadfin Shad.

### Low density fisheries

**White Crappie:** White Crappie total CPUE in 2012, 2008, 2004, and 2000 were 0.2, 3.5, 0.8, 4.5/nn respectively. The historical average total CPUE is 2.3/nn (range 0.8/nn – 4.5/nn). The CPUE-10 was 0.1/nn, 0.3/nn and 0.2/nn in 2012, 2008, and 2004, respectively. Sampling this population is not a priority for 2021-2025. However, any crappie caught while gill netting for Channel Catfish and White Bass will be enumerated.

**Blue Catfish:** Blue Catfish have not been stocked in LBJ Reservoir. Some Blue Catfish have been recorded in surveys and their presence is most likely a result of upstream emigration from stocked reservoirs. Blue Catfish total CPUE in 2021, 2017, 2013, 2009, 2005, and 2001 were 1.1, 0.5, 0.3, 0.2, 0.1, 0.1/nn, respectively. Sampling this population is not a priority for 2021-2025. However, we will monitor presence/absence of Blue Catfish while conducting gill netting surveys for Channel Catfish.

**Flathead Catfish:** Flathead Catfish are present in low abundance based on gill netting surveys. Flathead Catfish total CPUE in 2021, 2017, 2013, 2009, 2005, and 2001 were 1.5, 0.5, 1.2, 1.5, 1.6, 0.4/nn respectively. Sampling this population is not a priority for 2021-2025. However, we will monitor presence/absence while conducting gill netting surveys for Channel Catfish.

### Forage Species

**Bluegill, Redbreast Sunfish and Gizzard Shad:** Bluegill, Redbreast Sunfish, Gizzard Shad, Threadfin Shad, and Redear Sunfish are the predominant prey species available in LBJ 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 (PSD for sunfish and IOV for Gizzard Shad; 50 stock-size fish minimum at 18 stations with 80% confidence), but not for relative abundance estimates ( $RSE \leq 25$  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  $RSE \leq 25$  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.

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

**Largemouth Bass:** Largemouth Bass are the most popular sport fish in LBJ Reservoir. Recent improvements in abundance and size structure of the population is reflected by an increase in Largemouth Bass fishing tournament activity since 2012. These statistics, derived from a strong presence of tournament activity, are indicative of a well performing Largemouth Bass fishery. A ShareLunker weighing 13.7 lbs. was caught from LBJ Reservoir in 2010. The popularity and growing reputation for quality Largemouth Bass fishing at this reservoir warrants sampling time and effort.

Trend data on CPUE, size structure, and body condition have been collected biennially since 2000 with fall nighttime electrofishing. Continuation of biennial trend data with night-electrofishing in the fall will allow for determination of any large-scale changes in the Largemouth Bass population. A minimum of 18 randomly selected 5-min electrofishing sites will be sampled in 2022 and 2024, but sampling will continue at random sites 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 18 stations with 80% confidence). Exclusive of the original 18 random stations, three 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 6-12 additional random stations, another night of effort will be expended.

Relative weight of Largemouth Bass  $\geq 8$ " will be determined from their length/weight data (maximum of 10 fish weighed and measured per inch class). Ages for Largemouth Bass will be determined by a Category 2 evaluation using otoliths from 13 randomly selected fish (range 12.9 to 14.9 inches) to determine at what age fish reach harvestable size. Fin tissue samples will be taken from 30 randomly selected Largemouth Bass for genetic analysis.

**Channel Catfish:** Channel Catfish were last stocked in LBJ Reservoir in 2016. Target sample sizes to evaluate size structure and CPUE will be 50 stock-length fish, and an RSE of CPUE-S  $\leq 30$ . Based on the number of gill nets set in previous surveys, a minimum of 15 randomly selected gill net stations will be sampled, but sampling will continue at random stations until a minimum of 50 stock size Channel Catfish have been collected. In addition to the original 15 random stations, five additional random stations will be pre-determined in the event extra sampling is necessary.

**White Bass:** White Bass will be collected when sampling for Channel Catfish with gill nets. Sampling will be limited to general monitoring trend data (without precision or sample size requirements). An age and growth sample with a minimum of 13 fish between 9.0 and 10.9 inches in length will be collected from gill netting to assess the time required for White Bass to grow to the minimum length limit for harvest (Category 2 evaluation).

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## Tables and Figures

Table 1. Characteristics of LBJ Reservoir, Texas.

| Characteristic              | Description                    |
|-----------------------------|--------------------------------|
| Year constructed            | 1951                           |
| Controlling authority       | Lower Colorado River Authority |
| Counties                    | Burnet and Llano               |
| Reservoir type              | Mainstream: Colorado River     |
| Shoreline Development Index | 13.3                           |
| Conductivity                | 338 $\mu\text{S}/\text{cm}$    |

Table 2. Boat ramp characteristics for LBJ Reservoir, Texas, last assessed in September 2016. Reservoir elevation at time of survey was 824 ft. above MSL (conservation level is 825 ft. above MSL).

| Boat ramp                | Latitude<br>Longitude<br>(dd) | Public | Parking<br>capacity<br>(N) | Elevation at<br>end of boat<br>ramp (ft.) | Condition         |
|--------------------------|-------------------------------|--------|----------------------------|---|-------------------|
| Cottonwood Shores        | 30.550603<br>-98.337208       | Y      | 50                         | NA  | Good              |
| Sherwood Forest<br>Park  | 30.584761<br>-98.370508       | Y      | 10                         | NA  | Good              |
| Clear Cove City<br>Park  | 30.579892<br>-98.369933       | Y      | 10                         | NA  | Good              |
| Timberhill Park          | 30.580825<br>-98.376675       | Y      | 10                         | NA  | Good              |
| Belaire Park             | 30.576706<br>-98.385850       | Y      | 10                         | NA  | Good              |
| Bluebriar City Park      | 30.593392<br>-98.395156       | Y      | 10                         | NA  | Good              |
| Castleshoals Park        | 30.594089<br>-98.389842       | Y      | 10                         | NA  | Needs improvement |
| Dove Point Park          | 30.603619<br>-98.392897       | Y      | 10                         | NA  | Good              |
| Boat Ramp #9             | 30.603883<br>-98.394597       | N      | 10                         | NA  | Needs improvement |
| Granite Shoals<br>Park   | 30.604406<br>-98.406822       | Y      | 10                         | NA  | Needs improvement |
| Boat ramp #11            | 30.628600<br>-98.415583       | N      | 10                         | NA  | Good              |
| Riverside View           | 30.647325<br>-98.418103       | N      | 10                         | NA  | Good              |
| Boat Ramp #13            | 30.649772<br>-98.419142       | N      | 10                         | NA  | Good              |
| Gas Station Boat<br>Ramp | 30.657461<br>-98.427850       | N      | 15                         | NA  | Good              |
| Clearwater Marina        | 30.672928<br>-98.420567       | Y      | 10                         | NA  | Good              |
| Boat Ramp #16            | 30.704183<br>-98.412719       | N      | 10                         | NA  | Good              |
| RV and Boat<br>Storage   | 30.491119<br>-98.429969       | N      | 10                         | NA  | Good              |
| Kingsland Lions<br>Club  | 30.653214<br>-98.436011       | Y      | 15                         | NA  | Needs improvement |
| Sidney Rowe Mem.<br>Park | 30.643678<br>-98.450256       | Y      | 10                         | NA  | Good              |

Table 3. Harvest regulations for LBJ Reservoir, Texas.

| Species   | Bag limit                  | Length limit    |
|---|----------------------------|-----------------|
| Catfish: Channel and Blue Catfish,<br>their hybrids, and subspecies | 25<br>(in any combination) | 12-inch minimum |
| Catfish, Flathead   | 5                          | 18-inch minimum |
| Bass, White   | 25                         | 10-inch minimum |
| Bass, Largemouth  | 5 <sup>a</sup>             | 14-inch minimum |
| Bass, Guadalupe   | 5 <sup>a</sup>             | None            |
| Crappie: White and Black Crappie,<br>their hybrids, and subspecies  | 25<br>(in any combination) | 10-inch minimum |

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

Table 4. Stocking history for LBJ 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.

| <b>Species</b>                 | <b>Year</b> | <b>Number</b> | <b>Life Stage</b> | <b>Mean TL (in)</b> |
|--------------------------------|-------------|---------------|-------------------|---------------------|
| Channel Catfish                | 1969        | 112,457       | AFGL              | 7.9                 |
|                                | 1971        | 263,925       | AFGL              | 7.9                 |
|                                | 1972        | 32,400        | AFGL              | 7.9                 |
|                                | 1984        | 7,682         | AFGL              | 11.0                |
|                                | 1989        | 5,346         | ADL               | 12.0                |
|                                | 1991        | 10,900        | AFGL              | 5.9                 |
|                                | 1994        | 580           | AFGL              | 7.4                 |
|                                | 2009        | 400           | ADL               | 14.5                |
|                                | 2012        | 22,923        | AFGL              | 4.3                 |
|                                | 2012        | 40,179        | FGL               | 1.1                 |
|                                | 2012        | 62,371        | FRY               | 0.9                 |
|                                | 2013        | 17,995        | AFGL              | 4.3                 |
|                                | 2016        | 64,903        | FGL               | 1.6                 |
|                                | Total       | 642,061       |                   |                     |
| Flathead Catfish               | 1971        | 52            |                   | 0.0                 |
|                                | Total       | 52            |                   |                     |
| Florida Largemouth Bass        | 1976        | 64,600        | FRY               | 1.0                 |
|                                | 2001        | 228,300       | FGL               | 1.4                 |
|                                | 2002        | 420,790       | FGL               | 1.6                 |
|                                | 2011        | 338,740       | FGL               | 1.5                 |
|                                | 2012        | 335,752       | FGL               | 1.5                 |
|                                | 2013        | 472,365       | FRY               | 0.3                 |
|                                | 2014        | 330,103       | FGL               | 1.6                 |
|                                | 2015        | 240,671       | FGL               | 1.7                 |
|                                | 2016        | 156,140       | FGL               | 1.8                 |
|                                | Total       | 2,587,461     |                   |                     |
| Green Sunfish x Redear Sunfish | 1972        | 15,000        |                   | 0.0                 |
|                                | Total       | 15,000        |                   |                     |
| Largemouth Bass                | 1971        | 308,126       | FRY               | 0.7                 |
|                                | Total       | 308,126       |                   |                     |



Table 4. Stocking history for LBJ 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.

| <b>Species</b>                                 | <b>Year</b> | <b>Number</b>    | <b>Life Stage</b> | <b>Mean TL (in)</b> |
|--|-------------|------------------|-------------------|---------------------|
| Palmetto Bass<br>(Striped X White Bass hybrid) | 1977        | 71,000           | UNK               | 0.0                 |
|  | 1980        | <u>64,000</u>    | UNK               | 0.0                 |
|  | Total       | 135,000          |                   |                     |
| ShareLunker Largemouth Bass                    | 2010        | <u>2,220</u>     | FGL               | 2.5                 |
|  | Total       | 2,220            |                   |                     |
| Smallmouth Bass                                | 1976        | 25,000           | UNK               | 0.0                 |
|  | 1984        | 59,400           | FGL               | 2.0                 |
|  | 1985        | 59,500           | FGL               | 2.0                 |
|  | 1986        | <u>747</u>       | AFGL              | 4.0                 |
|  | Total       | 144,647          |                   |                     |
| Striped Bass                                   | 1983        | <u>59,881</u>    | UNK               | 0.0                 |
|  | Total       | 59,881           |                   |                     |
| Walleye  | 1973        | 5,600,000        | FRY               | 0.2                 |
|  | 1974        | <u>1,600,000</u> | FRY               | 0.2                 |
|  | Total       | 7,200,000        |                   |                     |

Table 5. Objective-based sampling plan components for LBJ Reservoir, Texas 2020–2021.

| 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      | $N = 13$ , 13.0 – 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          | Presence/absence              |
|                                | Size structure    | Length frequency      | Presence/absence              |
|                                | Age-and-growth    | Age at 10 inches      | $N = 13$ , 9.0 – 10.9 inches  |
| Channel Catfish                | Abundance         | CPUE – stock          | RSE-stock $\leq 30$           |
|                                | Size structure    | Length frequency      | $N \geq 50$ stock             |
|                                | 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, LBJ Reservoir, Texas, last conducted in 2016.

| Habitat type                  | Shoreline coverage (miles) | % of total |
|-------------------------------|----------------------------|------------|
| Bulkhead with Piers and Docks | 138.3                      | 51.2       |
| Natural Shoreline             | 103.9                      | 38.5       |
| Natural Shoreline/Piers/Docks | 21.0                       | 7.8        |
| Rocky Shoreline               | 4.4                        | 1.6        |
| Rocky Bluff                   | 2.4                        | 0.9        |

Table 7. Survey of aquatic vegetation, LBJ Reservoir, Texas, 2017 – 2020. Surface area (acres) is listed with percent of total reservoir surface area in parentheses. Surveys were conducted in the fall.

| Vegetation                         | 2017        | 2018 | 2019       | 2020       |
|------------------------------------|-------------|------|------------|------------|
| Native submersed                   | 6.8 (0.1)   | n/a  | 0.0        | 0.0        |
| Native floating-leaved             | 7.1 (0.1)   | n/a  | 11.3 (0.2) | 10.4 (0.2) |
| Native emergent                    | 103.7 (1.6) | n/a  | 28.1 (0.5) | 26.7 (0.4) |
| <i>Non-native</i>                  |             |      |            |            |
| Hydrilla (Tier I)*                 | 18.9 (0.3)  | n/a  | 0.0        | 0.0 (0.0)  |
| Eurasian watermilfoil (Tier III)** | <1.0 (n/a)  | n/a  | 0.0        | 0.0 (0.0)  |
| Water Hyacinth (Tier I) *          | <1.0 (n/a)  | n/a  | <1.0 (n/a) | <1.0 (n/a) |
| Elephant ear (Tier III)**          | 0.0         | n/a  | 0.0        | 4.5 (0.1)  |

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

## Gizzard Shad

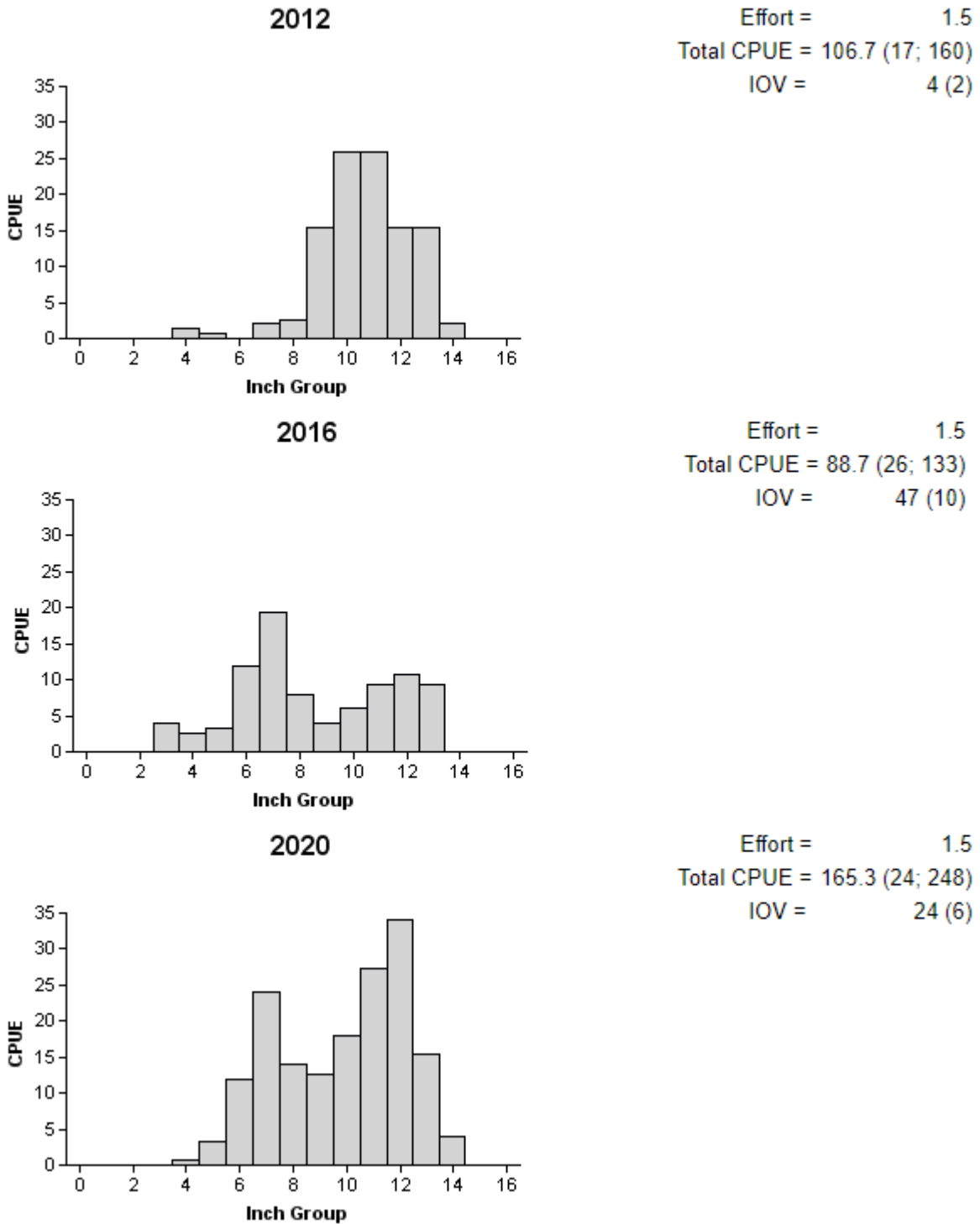


Figure 1. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, LBJ Reservoir, Texas, 2012, 2016, and 2020.

## Redbreast Sunfish

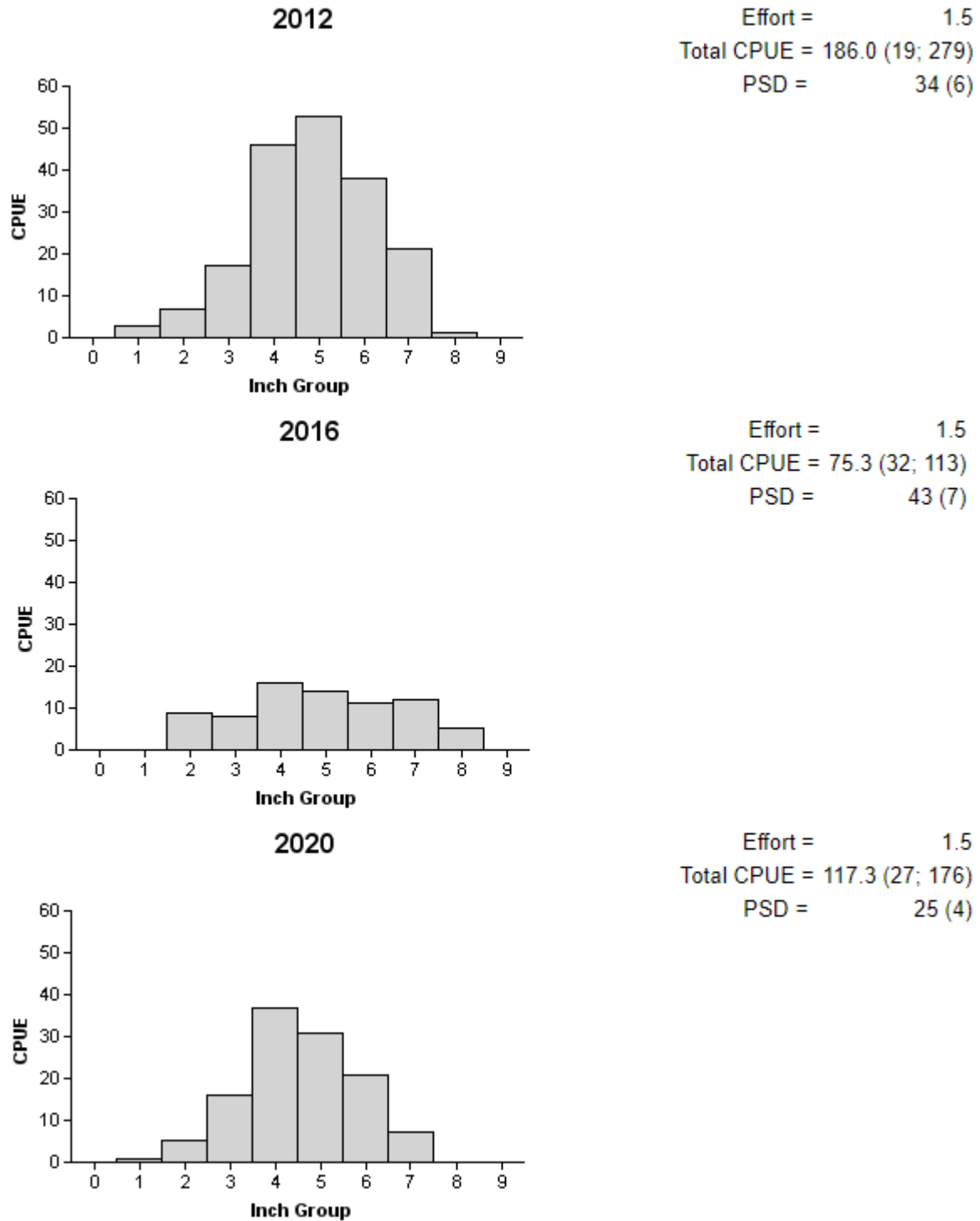


Figure 2. Number of Redbreast Sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, LBJ Reservoir, Texas, 2012, 2016, and 2020.

Bluegill

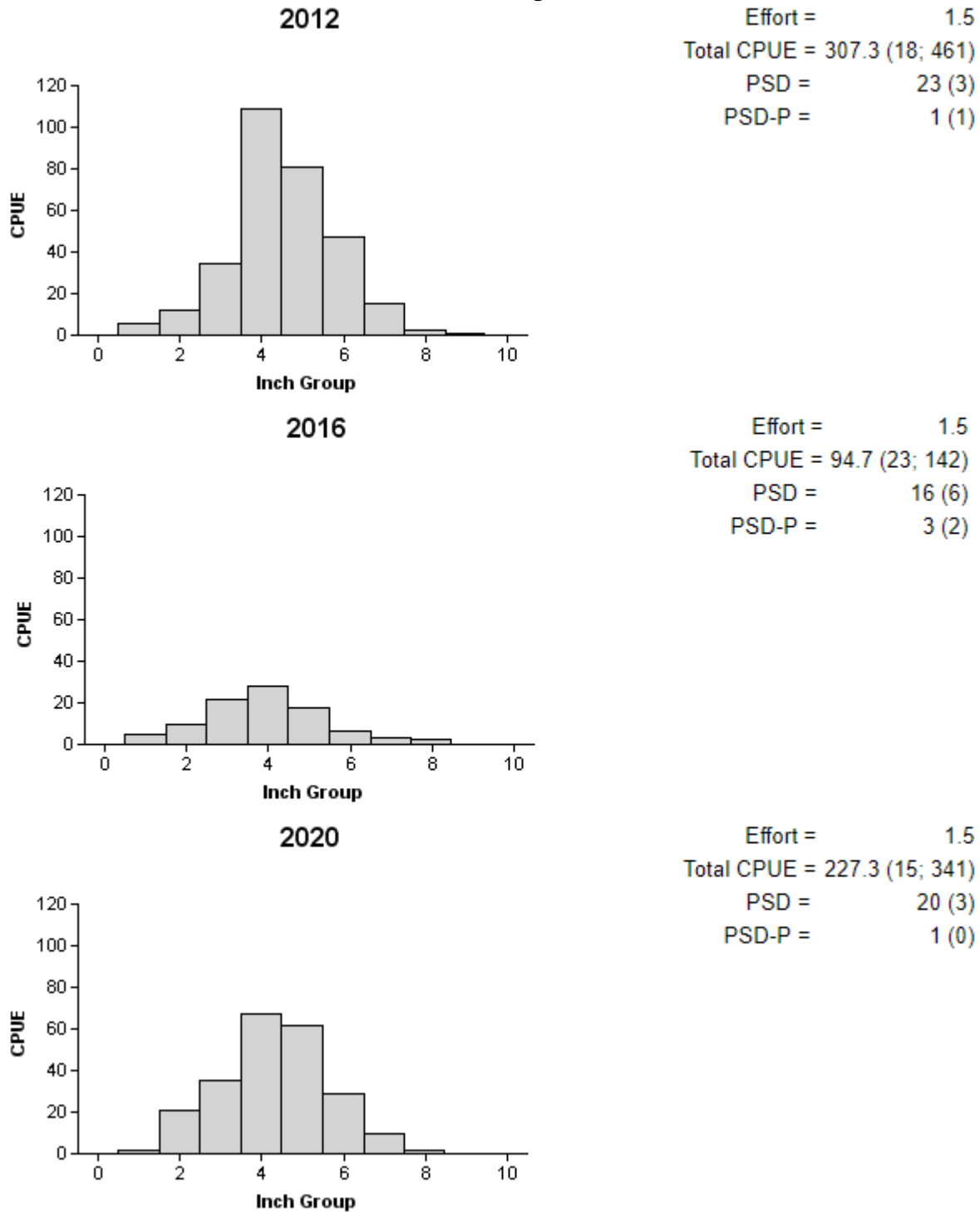


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, LBJ Reservoir, Texas, 2012, 2016, and 2020.

### Blue Catfish

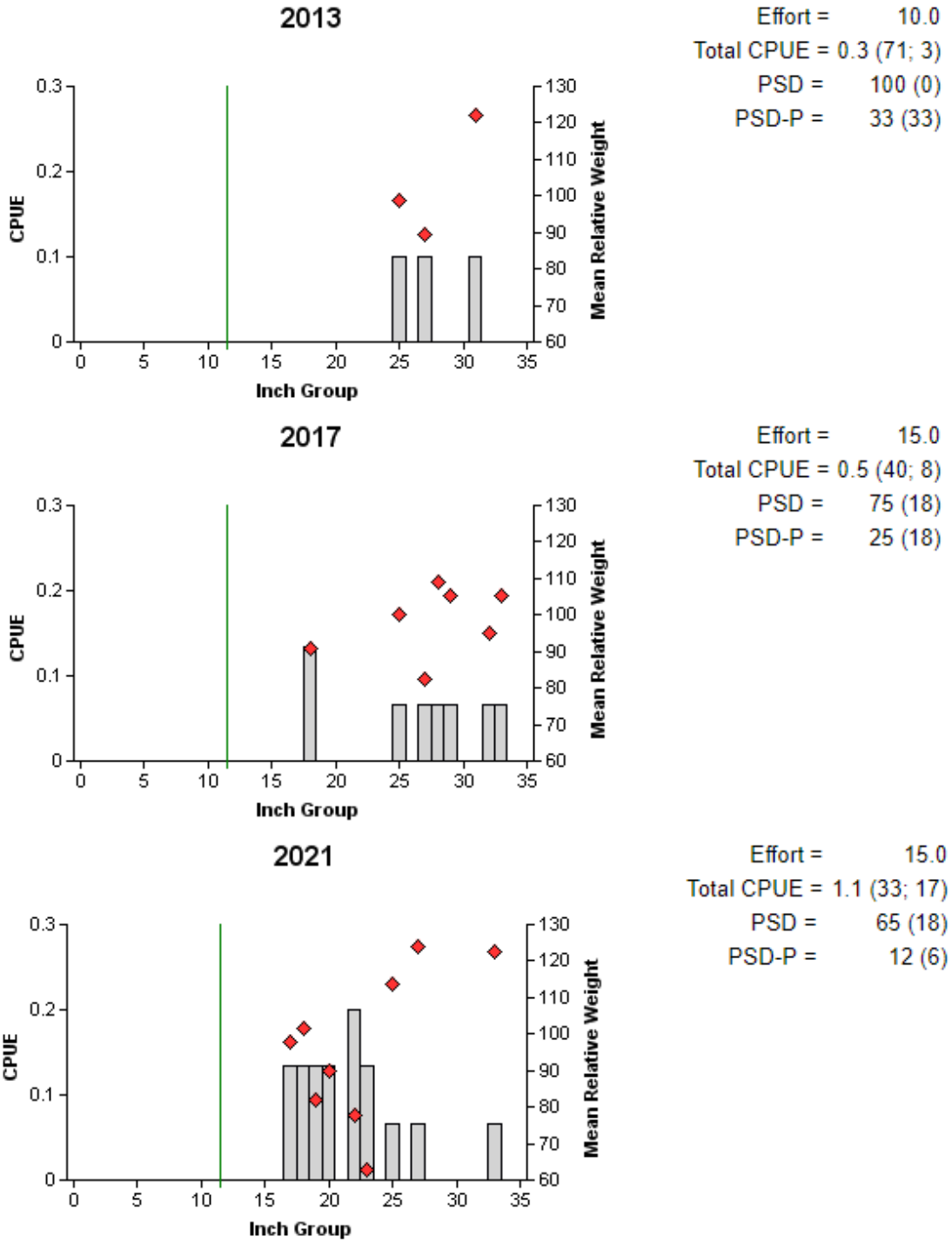


Figure 4. Number of Blue Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE are in parentheses) for spring gill net surveys, LBJ Reservoir, Texas, 2013, 2017, and 2021. Vertical line represents minimum length limit at the time of sampling.

## Channel Catfish

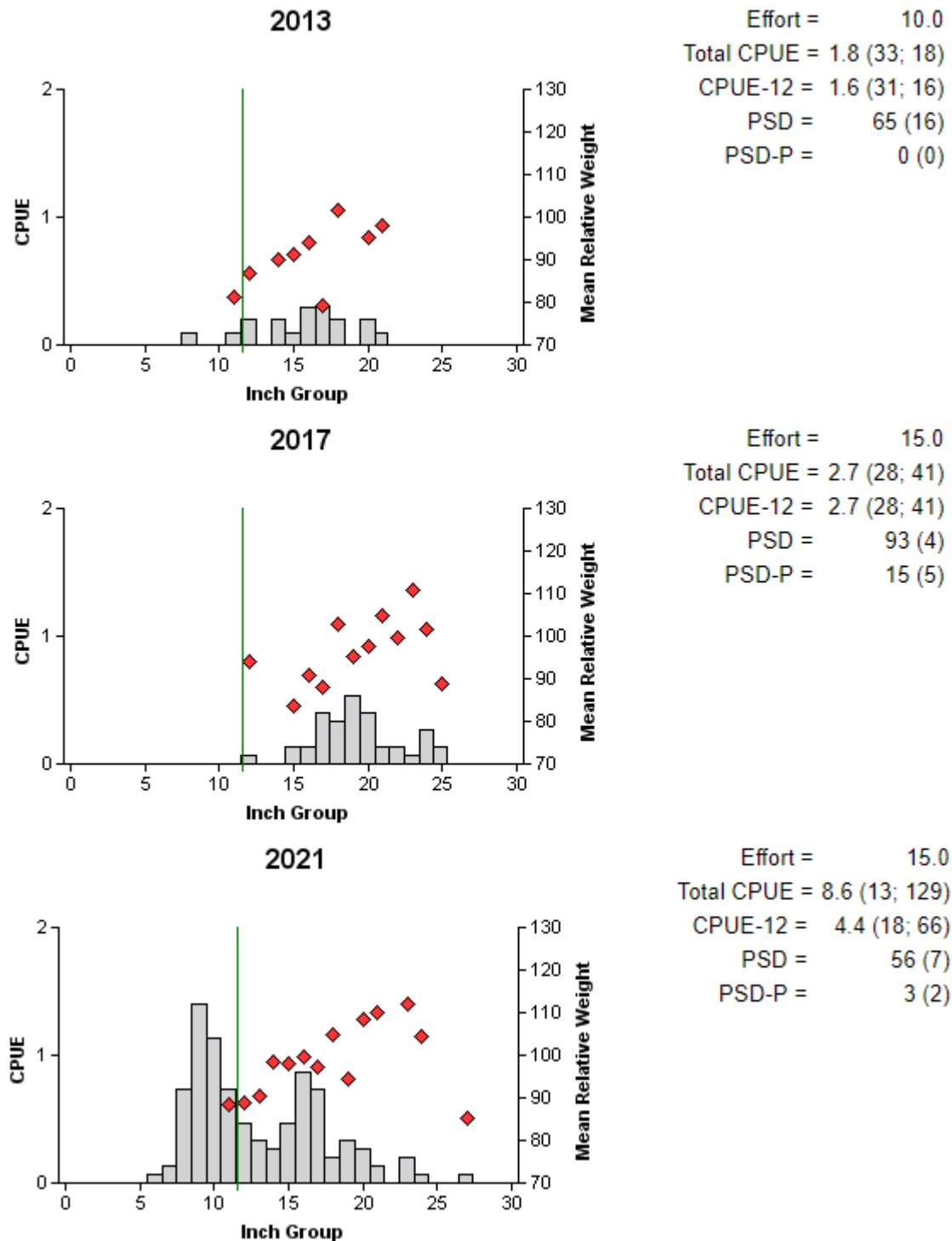


Figure 5. Number of Channel Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, LBJ Reservoir, Texas, 2013, 2017, and 2021. Vertical line represents minimum length limit at the time of sampling.



## Flathead Catfish

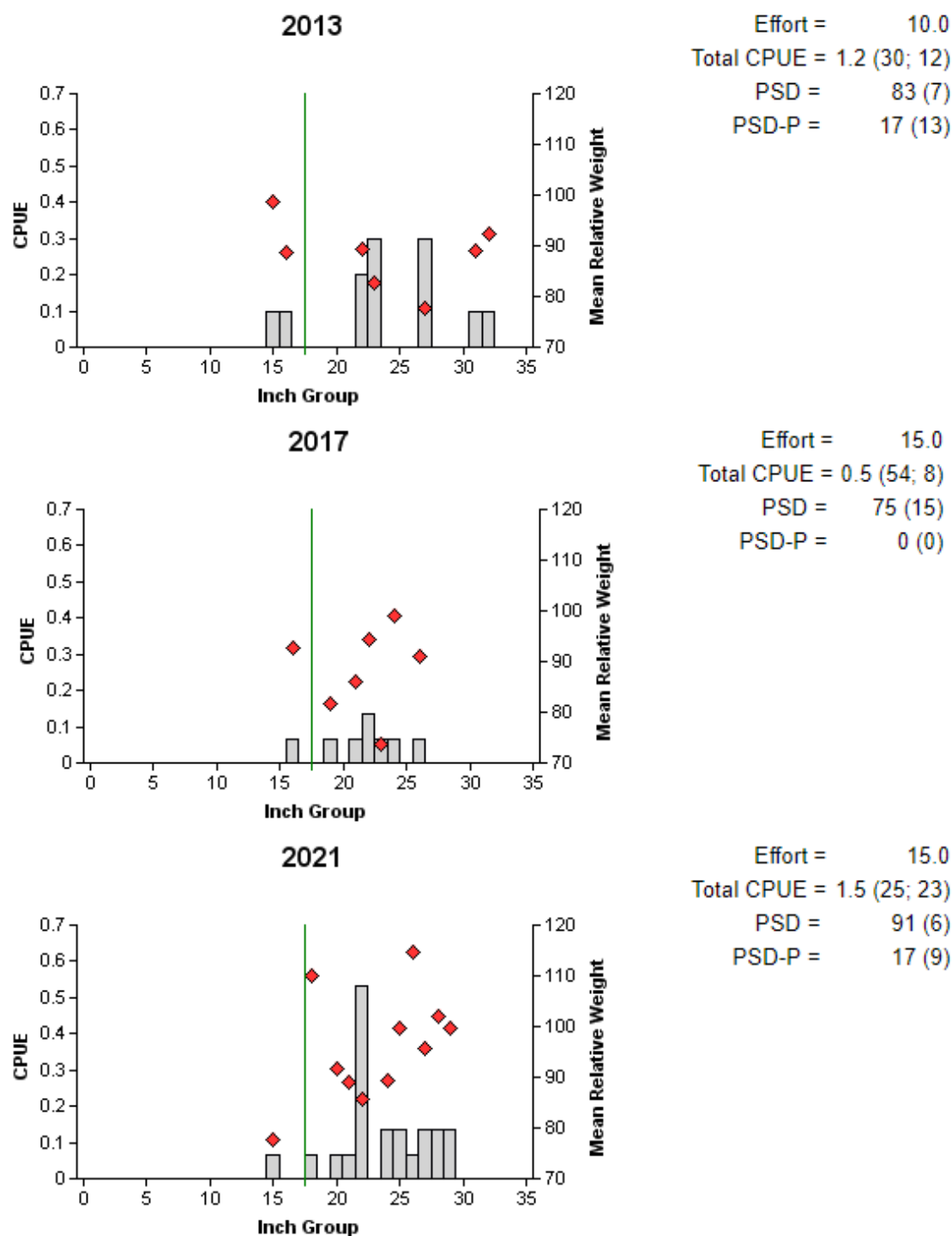


Figure 6. Number of Flathead Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE are in parentheses) for spring gill net surveys, LBJ Reservoir, Texas, 2013, 2017, and 2021. Vertical line represents minimum length limit at the time of sampling.

## White Bass

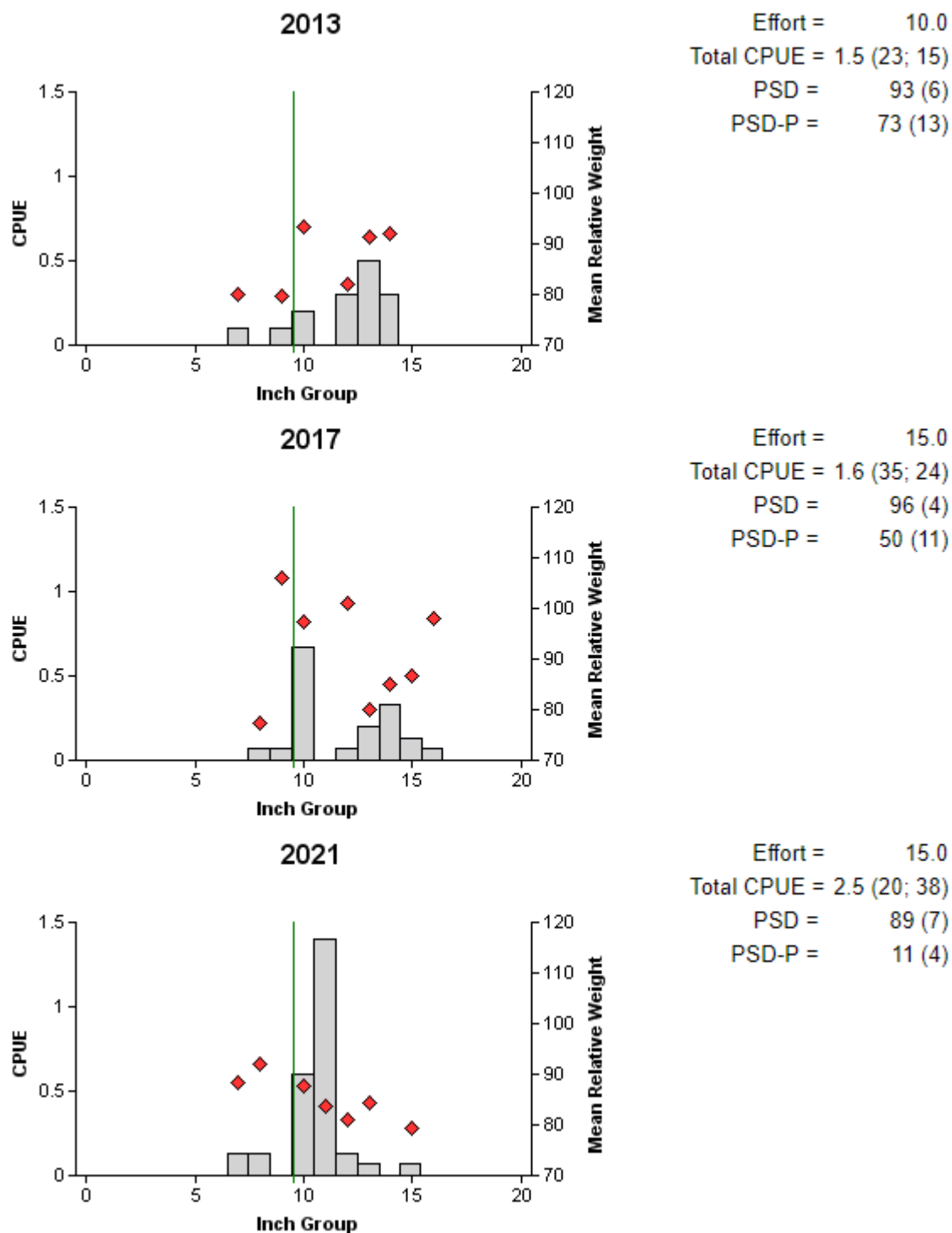


Figure 7. Number of White Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE are in parentheses) for spring gill net surveys, LBJ Reservoir, Texas, 2013, 2017, and 2021. Vertical line represent minimum length limit at the time of sampling.

## White Bass

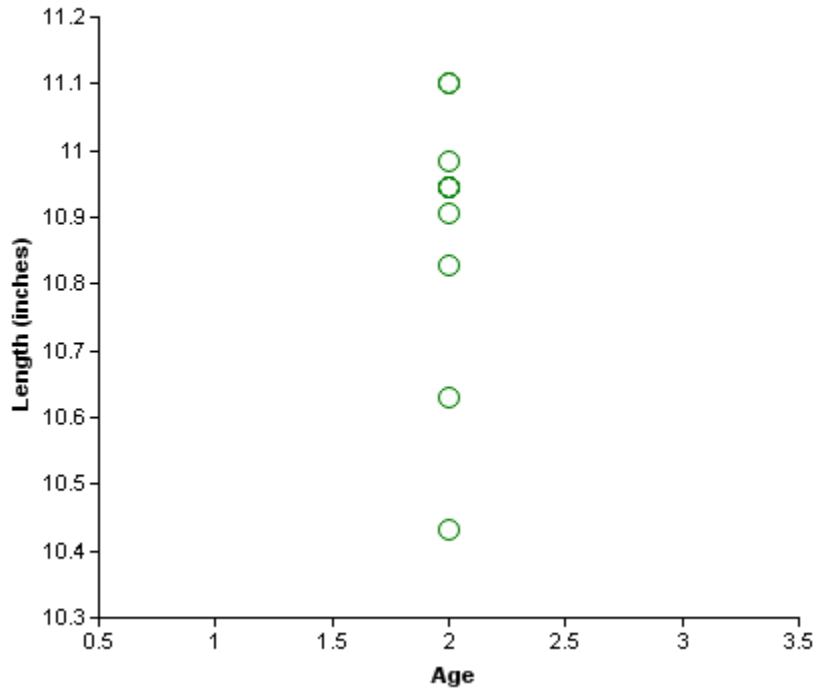


Figure 8. Length at age for White Bass (n=11) collected by gill netting at LBJ Reservoir, Texas, March 2021.

## Largemouth Bass

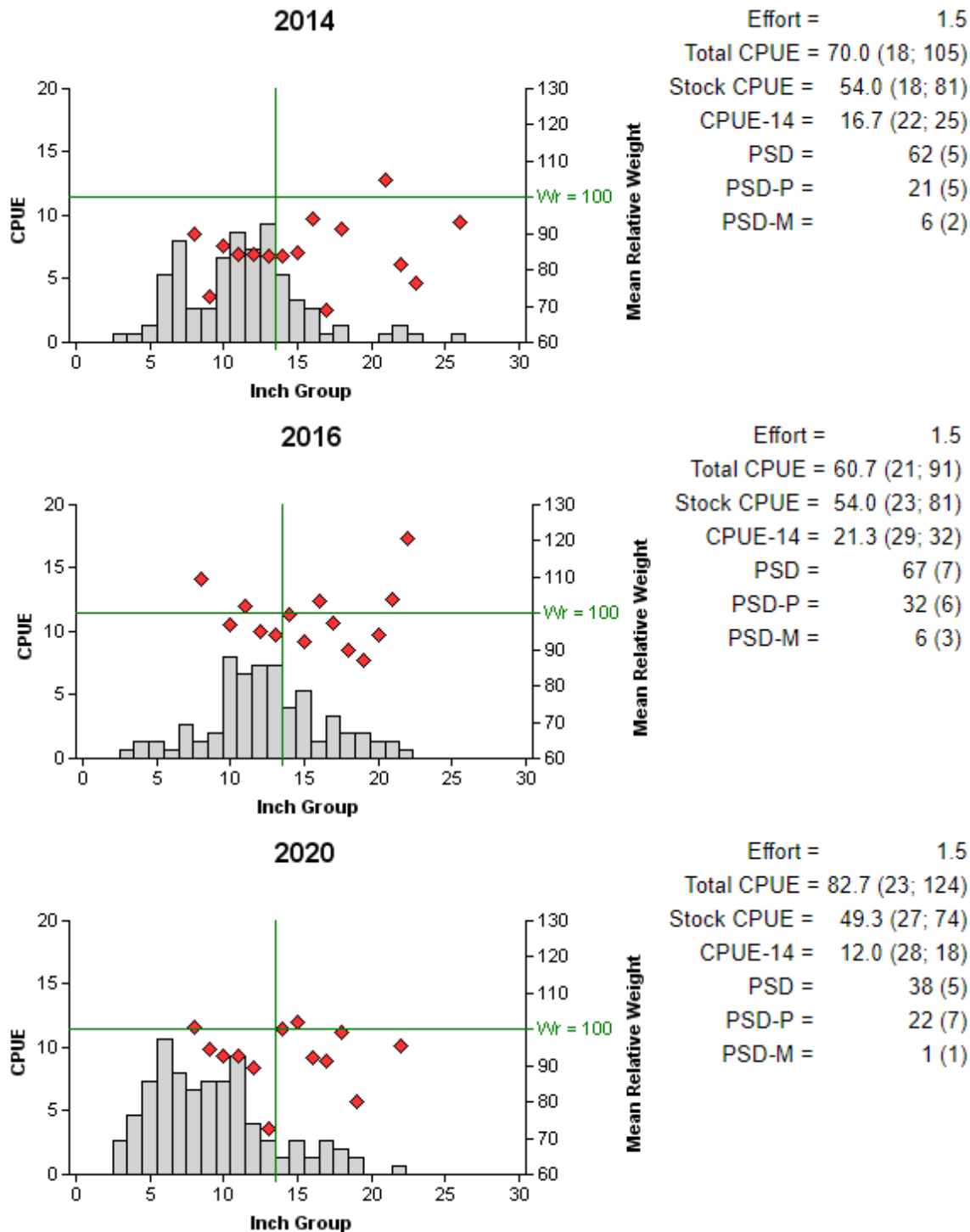


Figure 9. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, LBJ Reservoir, Texas, 2014, 2016, and 2020. Vertical line represents the minimum length limit at the time of sampling.

Table 8. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, LBJ Reservoir, Texas, 2006, 2008, 2012, and 2016. 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.

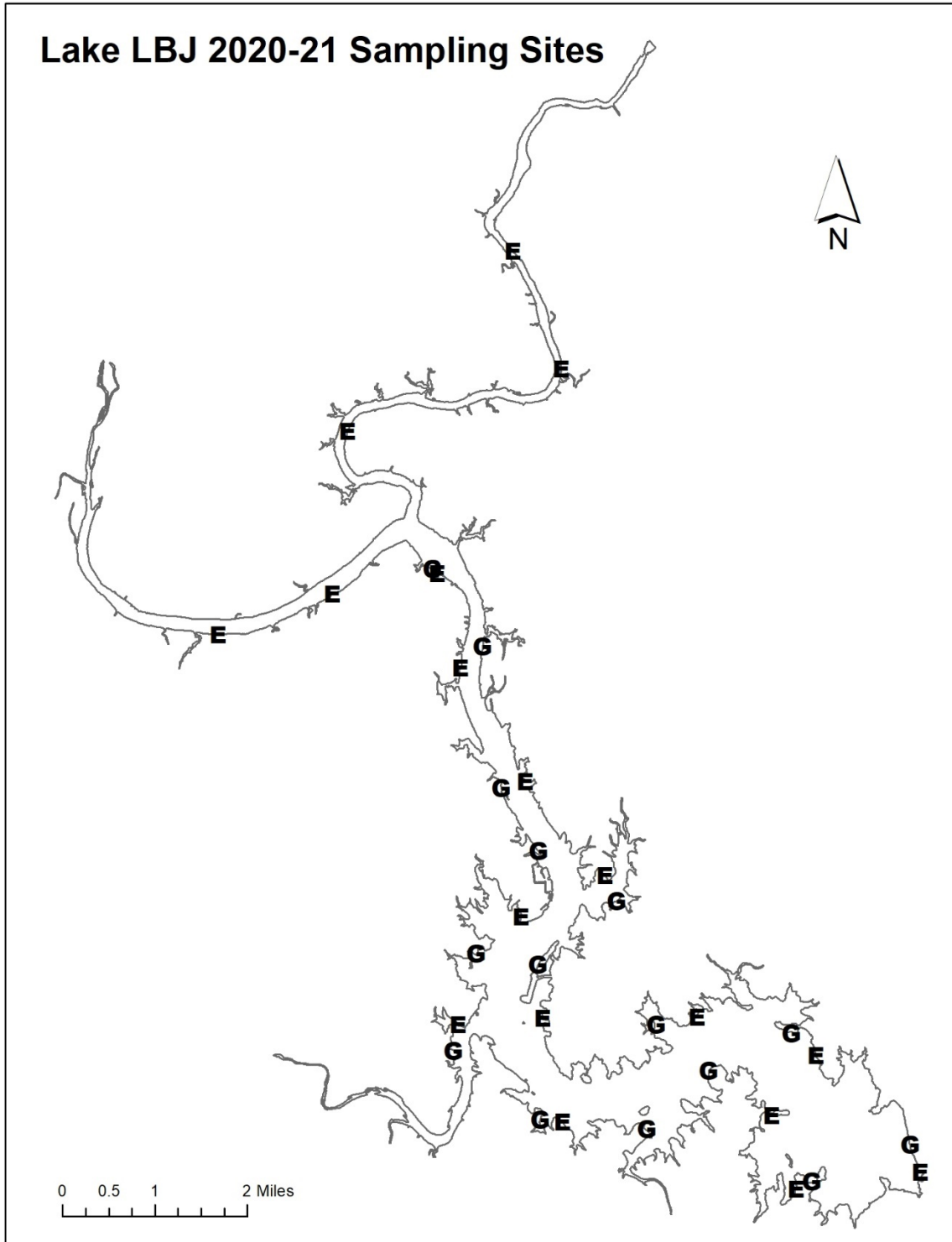
| Year | Sample size | Number of fish |            |      | % FLMB alleles | % FLMB |
|------|-------------|----------------|------------|------|----------------|--------|
|      |             | FLMB           | Intergrade | NLMB |                |        |
| 2006 | 30          | 1              | 29         | 0    | 61.0           | 3.3    |
| 2008 | 30          | 0              | 30         | 0    | 58.0           | 0.0    |
| 2012 | 29          | 1              | 28         | 0    | 66.0           | 3.4    |
| 2016 | 30          | 1              | 29         | 0    | 58.0           | 3.3    |

## Proposed Sampling Schedule

Table 9. Proposed sampling schedule for LBJ Reservoir, Texas. Survey period is June through May. Gill netting surveys are conducted in the spring, while electrofishing and trap netting surveys are conducted in the fall.

|                                | Survey year |           |           |           |
|--------------------------------|-------------|-----------|-----------|-----------|
|                                | 2021-2022   | 2022-2023 | 2023-2024 | 2024-2025 |
| Angler Access                  |             |           |           | X         |
| Structural Habitat             |             |           |           | X         |
| Vegetation                     | X           | X         | X         | X         |
| Electrofishing – Fall          |             | X         |           | X         |
| Electrofishing – Spring        |             |           |           |           |
| Electrofishing – Low frequency |             |           |           |           |
| Trap netting                   |             |           |           |           |
| Gill netting                   |             |           |           | X         |
| Baited tandem hoop netting     |             |           |           |           |
| Creel survey                   |             |           |           |           |
| Report                         |             |           |           | X         |

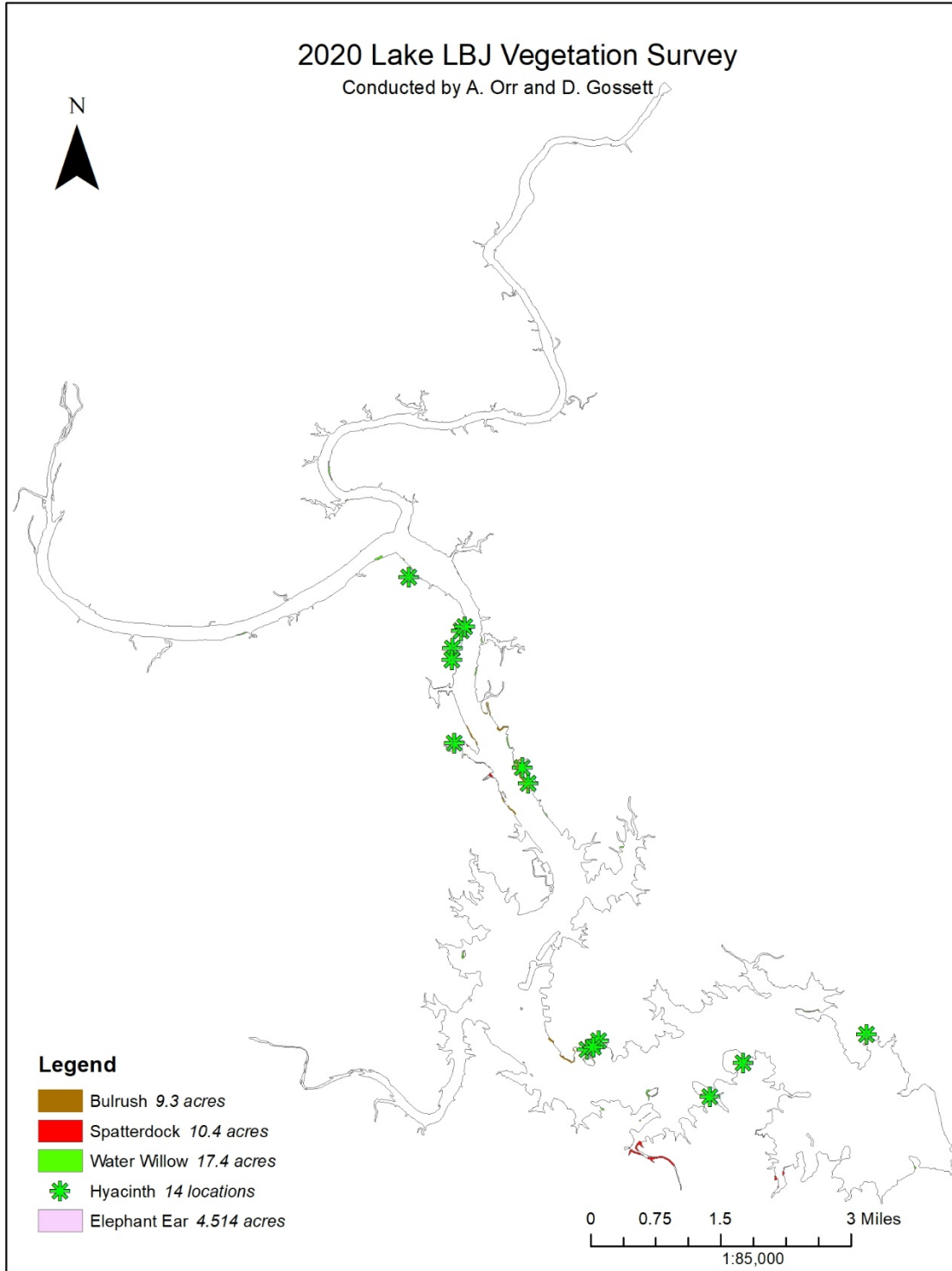
## APPENDIX A – Map of sampling locations



Location of sampling sites, LBJ Reservoir, Texas, 2020-2021. Gill net and electrofishing stations are indicated by G and E, respectively.

## APPENDIX B – Aquatic vegetation map

Aquatic vegetation survey coverage map for LBJ Reservoir, Texas, August 2020.





## APPENDIX C – Catch rates for all species from all gear types

Number (N) and catch rate (CPUE) (RSE in parentheses) of all target species collected from all gear types from LBJ Reservoir, Texas, 2020-2021. Sampling effort was 15 net nights for gill netting and 1.5 hours for electrofishing.

| Species            | Gill Netting |            | Electrofishing |            |
|--------------------|--------------|------------|----------------|------------|
|                    | N            | CPUE       | N              | CPUE       |
| Gizzard Shad       |              |            | 248            | 165.3 (24) |
| Threadfin Shad     |              |            | 76             | 50.7 (38)  |
| Inland Silverside  |              |            | 16             | 10.7 (62)  |
| Blacktail Shiner   |              |            | 4              | 2.7 (100)  |
| Smallmouth Buffalo | 2            | 0.1 (68)   |                |            |
| Blue Catfish       | 17           | 1.1 (33)   |                |            |
| Channel Catfish    | 129          | 8.6 (13)   |                |            |
| Flathead Catfish   | 23           | 1.5 (25)   |                |            |
| White Bass         | 38           | 2.5 (20)   |                |            |
| Redbreast Sunfish  |              |            | 176            | 117.3 (27) |
| Green Sunfish      |              |            | 1              | 0.7 (100)  |
| Bluegill           |              |            | 341            | 227.3 (15) |
| Longear Sunfish    |              |            | 18             | 12.0 (27)  |
| Redear Sunfish     |              |            | 64             | 42.7 (18)  |
| Largemouth Bass    |              |            | 124            | 82.7 (23)  |
| Guadalupe Bass     |              |            | 12             | 8.0 (38)   |
| White Crappie      | 20           | 1.3 (31)   |                |            |
| Black Crappie      | 1            | <0.1 (100) |                |            |
| Log Perch          |              |            | 1              | 0.7 (100)  |
| Tilapia            |              |            | 6              | 4.0 (73)   |

## APPENDIX D – Catch statistics for Texas Tournament Zone

| Year | Mean bag weight (lbs) | Mean fish weight (lbs) | Total bag weight (lbs) | Biggest fish (lbs) | Number Fish caught by top 25 teams |
|------|-----------------------|------------------------|------------------------|--------------------|------------------------------------|
| 2021 | 13.7                  | 3.1                    | 343.4                  | 9.4                | 112                                |
| 2020 | 13.2                  | 2.7                    | 328.9                  | 8.2                | 120                                |
| 2019 | N/A                   | N/A                    | N/A                    | N/A                | N/A                                |
| 2018 | 17.7                  | 3.7                    | 443.1                  | 9.1                | 121                                |
| 2017 | 20.7                  | 4.1                    | 517.4                  | 10.6               | 125                                |
| 2016 | 14.4                  | 3.0                    | 360.4                  | 7.5                | 122                                |
| 2015 | 16.7                  | 3.5                    | 418.7                  | 10.1               | 121                                |
| 2014 | 14.7                  | 3.2                    | 366.6                  | 8.6                | 113                                |
| 2013 | N/A                   | N/A                    | N/A                    | N/A                | N/A                                |
| 2012 | 13.4                  | 2.7                    | 335.1                  | 9.9                | 122                                |



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