

# Lake Raven

## 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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July 31, 2021



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## Survey and Management Summary

Fish populations in Lake Raven were surveyed in 2018 and 2020 using electrofishing and in 2020 and 2021 using tandem hoop netting. Anglers were surveyed from March through May in both 2018 and 2021 with a roving creel survey. Historical data are presented with the 2018-2021 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:** Lake Raven is a 203-acre reservoir located in Huntsville State Park. The reservoir was repaired and re-impounded in 1956 by the Texas Parks & Wildlife Department for recreational use.

**Management History:** Lake Raven has a history of producing trophy Largemouth Bass. The population was managed with a catch-and-release regulation from September 1996 until September 2018 when the regulation changed to a 16-inch maximum with a 5 fish bag limit. The regulation allows the angler to retain Largemouth Bass measuring > 24 inches for weighing in the Huntsville State Park and subsequent release or, if weighing 13 pounds or more, donation into the Toyota ShareLunker Program. Lake Raven was included in Operation World Record (OWR) from 2006-2016, a research project designed to compare growth of selectively bred ShareLunker Largemouth Bass fingerlings to resident bass fingerlings and received preferential stocking under the program for several years.

Alligator weed, hydrilla, giant salvinia, and water hyacinth have all impeded access and degraded habitat to varying degrees at different times and have been managed with an integrated pest management plan including use of herbicides, biological control (Grass Carp, hydrilla flies, and alligator weed flea beetles), and manual removal.

### Fish Community

- **Prey species:** Threadfin Shad were present in the reservoir. Electrofishing catch of Gizzard Shad was very low, and none were available as prey to sport fish. Electrofishing catch was high for Bluegill and moderate for Redear Sunfish. Most sunfish were under 6 inches in length and available as prey to most sport fish.
- **Catfishes:** The Channel Catfish population has increased due to stocking efforts in recent years, but angler effort and harvest were both low compared to the 2018 creel survey.
- **Largemouth Bass:** Largemouth Bass were abundant with the majority available to anglers for harvest. Largemouth Bass had adequate growth (average age at 16 inches was 4.14 years) and good body condition (mean relative weight of 85 or more). They were the most targeted species, as 40% of all anglers at Lake Raven fished for Largemouth Bass.
- **Crappie:** Black Crappie and White Crappie were present in the reservoir with legal-size fish available and harvested by anglers.

**Management Strategies:** Largemouth Bass will continue to be managed for big fish potential with a 16-inch maximum length limit and annual stockings of Florida Largemouth Bass. Assessment of efforts to establish an adult Channel Catfish population will continue. Continue to implement strategies to improve the aquatic vegetation community including native vegetation plantings and control efforts of invasive exotic species to improve bank access.

## Introduction

This document is a summary of fisheries data collected from Lake Raven from 2018 through 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 2018 through 2021 data for comparison.

## Reservoir Description

Lake Raven is a 203-acre reservoir located within Huntsville State Park. The drainage area for Lake Raven is approximately 1,556 square miles with rainfall in the watershed averaging 46.2 inches per year. The reservoir has a maximum depth of 28 feet, a mean depth of 6 feet, and has little bathymetric variation (Figure 1). Lake Raven has a shoreline length of 6.3 miles and a shoreline development ratio of 2.3. Lake Raven lies within the Piney Woods Land Resource Area. Land use around the reservoir is recreational. Other descriptive characteristics from Lake Raven are found in Table 1.

## Angler Access

Lake Raven is located entirely within Huntsville State Park and has one public boat ramp. Boat and bank access are excellent. Additional boat ramp characteristics are presented in Table 2. Shoreline access is outstanding except for times when overabundant nuisance aquatic vegetation limits casting from some areas of the shore. Two fishing piers located within campground areas are open to day use and are in good condition.

## Management History

**Previous management strategies and actions:** Management strategies and actions from the previous survey report (Best and Webb 2017) included:

1. Support the Largemouth Bass fishery through annual stockings of Florida Largemouth Bass, maintaining and evaluating the catch-and-release-only regulation for Largemouth Bass, and promoting the fishery through available media resources.
 

**Action:** Florida Largemouth Bass fingerlings were stocked in 2019 and 2020. Retired Florida Largemouth Bass broodstock were stocked in 2021. In September 2018, the Largemouth Bass regulation changed from catch-and-release-only to a 16-inch maximum length limit to simplify state-wide fishing regulations. Participation in the revamped ShareLunker program was promoted by signs and fliers displayed at the ramp and in the park office. The new program was also promoted via the district's social media accounts.
2. Use an integrated pest management plan to control invasive plant species that impede fishing and recreational access at Lake Raven.
 

**Action:** Booms were installed in two arms to corral water hyacinth and giant salvinia to mitigate spread and to facilitate herbicide treatments. ProcellaCor was used to treat hydrilla. ProcellaCor treatments were focused on day-use and camping areas of shoreline to increase bank angler access. Additionally, vegetation was also managed in the arms of the lake to provide boat lanes for paddlecraft and powerboats. Vegetation volume in Lake Raven and bathymetry were mapped using BioBase software in 2018 and 2021.
3. Continue to establish native emergent, submersed, and floating leaved plants to improve fish habitat.
 

**Action:** The use of ProcellaCor to control non-natives limits the effects on native vegetation. With less need for broad spectrum herbicides, native vegetation has

expanded. Expanded species include spatterdock, white water lily, vallisneria, American pondweed, bull rush, bull tongue, arrowhead, and pickerel weed.

4. Stock 9-inch Channel Catfish to establish an initial spawning population in the reservoir. Place catfish spawning structures into Lake Raven to determine if increased spawning habitat and reproduction will help establish a self-sustaining catfish fishery in the presence of Largemouth Bass predation. Determine reproduction and recruitment success as described in OBS plan.

**Action:** Adult Channel Catfish were stocked into Lake Raven in 2017, 2018, and 2019. Nine-inch Channel Catfish were stocked in 2017 and 2018. In March of 2018, 78 spawning barrels were placed along the dam at Lake Raven in 3-5 feet of water. Barrel occupancy, egg masses, and fry were documented in 2018, 2019, and 2020; however, hoop net surveys have yet to indicate recruitment.

5. Consult with State Park staff about adding green light fish attractors and artificial structures around fishing piers. Place educational signage such as “how to fish” signs on piers and along shorelines to better educate anglers on appropriate angling methods.

**Action:** In June 2017, Mossback artificial fish habitat structures were placed around fishing piers and near shorelines around camping and day use areas to improve angling opportunities for bank anglers.

**Harvest regulation history:** Since September 2018, Largemouth Bass at Lake Raven have been managed under a 16-inch maximum length limit and a 5 fish bag limit with the caveat that anglers may retain a bass 24 inches or greater for immediate weighing and release or donation to the ShareLunker Program (if qualifying). Between 1996 and 2018, Largemouth Bass were managed under a catch-and-release regulation with the same 24-inch and greater caveat. Prior to that, the fishery was under a 14-21-inch slot length limit. Other species have been managed under statewide regulations, except Blue and Channel Catfish which are managed under the Community Fishing Lake regulation. As a state park lake, no fishing license is required. Current regulations are found in Table 3.

**Stocking history:** Fish stockings began at Lake Raven in 1966 with the introduction of Channel Catfish. Periodic stockings of Channel Catfish continued over the next 40 years, but a self-sustaining population has never been created. Florida Largemouth Bass were first introduced in 1979 and have been stocked nine times for a total of over 108,000 fingerlings. In 2005, 2007, 2010, and 2013 ShareLunker advanced fingerling Largemouth Bass were stocked as part of Operation World Record, a research project designed to compare growth of selectively bred ShareLunker fingerlings to that of resident bass fingerlings. Both hybrid and triploid Grass Carp have been stocked for the control of aquatic vegetation. A complete stocking history is provided in Table 4.

**Vegetation/habitat management history:** The primary habitat in Lake Raven is aquatic vegetation, both native and exotic. Hydrilla has caused access problems in past years and has been controlled by stocking 400 Triploid Grass Carp in 2009 and by herbicide treatments annually since 2017. Water hyacinth, giant salvinia, and alligator weed also persist as problem exotic aquatic species. These species were also chemically treated annually since 2014. In addition, 6,000 alligator weed flea beetles were stocked in 2014 as part of an integrated pest management approach.

**Water transfer:** Lake Raven is a recreational reservoir contained completely within Huntsville State Park. No interbasin water transfers exist.

## Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Lake Raven (Best and Webb 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 (55 minutes at 11, 5-min stations). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing. Ages for Largemouth Bass were determined using otoliths from 13 randomly selected fish (range 15.0 to 16.9 inches).

**Tandem hoop nets** – Channel Catfish were collected using 10 tandem hoop-net series at 10 stations. Nets were baited with soap and deployed for 2-night soak durations. CPUE for tandem hoop netting was recorded as the number of fish caught per tandem hoop net series (fish/series).

**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 since 2005. Electrophoresis analysis was used prior to 2005.

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

**Creel survey** – A roving creel survey of boat and bank anglers was conducted in 2018 and 2021. The creel period was March 1 through May 31 for both years. Angling pressure was estimated from progressive angler counts during each creel time block. Angler interviews were conducted on 5 weekend days and 4 weekdays to assess angler use and fish catch/harvest statistics in accordance with the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2017).

**Habitat** – Structural habitat has not significantly changed since the last comprehensive survey was completed in 2016. Vegetation surveys were conducted in 2017–2020 to monitor expansion of hydrilla. Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2017). Vegetation volume and bathymetry were also mapped using BioBase software in 2018 and 2021.

## Results and Discussion

**Habitat:** Shoreline habitat consisted primarily of natural shoreline with minimal bulkhead (Table 6). Both native and invasive plant species have made a comeback since herbicide treatments in 2014 stripped the reservoir of most plant life. In July 2018 and April 2021, vegetation volume and bathymetry were mapped with BioBase software, showing total coverage of both native and invasive species (Appendix B). The 2018 map shows an incomplete survey due to dense mats of topped out hydrilla that made navigation into those areas impossible. During the 2020 survey, native floating-leaved species covered the most area at 22.9 acres (11% coverage), with native submersed and emergent plants covering 9.4 (5%) and 8.7 acres (4%), respectively. Species present included: bull tongue, pickerelweed, *Panicum* sp., water pennywort, American pondweed, giant bulrush, white waterlily, American lotus, spatterdock, water primrose, smartweed, bushy pondweed, cattail, and giant cutgrass. Invasive species have been kept in check through annual herbicide treatments, with alligator weed and water hyacinth both covering less than one surface acre. However, hydrilla and giant salvinia have persisted in the reservoir, having 76.3 (38%) and 55.4 acres (27%) of coverage, respectively, during the 2020 survey (Table 7).

**Creel:** Lake Raven is utilized by both bank and boat anglers: bank anglers expended 11,804 hours and boat anglers expended 13,956 hours of effort during the 2021 creel (Table 8). Total directed fishing effort by both angler types was highest for Largemouth Bass at 44% (Table 9). Boat anglers primarily targeted Largemouth Bass (72% of boat angling effort) and bank anglers primarily fished for anything (63% of bank angling effort). Total fishing effort and expenditures increased from the 2018 creel (19,157 hours and \$88,288, respectively) to 2021 (25,760 hours and \$178,630, Table 10). The 2021 effort and expenditures were on par with 2017 creel statistics (27,631 hours and \$172,188).

**Prey species:** Electrofishing catch rates of Gizzard and Threadfin shad were low (7.6/h and 46.9/h, respectively, Appendix A). The IOV of Gizzard Shad was 0 indicating little to no individuals were available as forage (Figure 2). Catch rate for Bluegill in 2020 (963.3/h) was much higher than in 2016 (197.0/h) or 2013 (352.0/h, Figure 3). Most individuals were five inches or shorter in length. Redear catch rates for 2020 (472.4/h, Figure 4) were comparable to 2016 (449.0/h), but individuals were smaller with most being under 5 inches in length.

**Catfish:** In 2020, 41 Channel Catfish were collected via hoop net, but only seven Channel Catfish were collected during the 2021 hoop net survey (Figure 5). This is likely due to the timing of sampling efforts. In 2020, surveys were conducted in May when water temperatures were ideal, but hydrilla impeded sampling at ideal depths and Channel Catfish were in the process of forming annuli, making it difficult to accurately age fish. To avoid sampling efficiency complications caused by hydrilla and to collect potential young of year Channel Catfish prior to annulus formation, 2021 hoop net surveys were conducted in March. However, water temperatures in March of 2021 were lower than desired and likely hindered catch rates.

The catfish fishery at Lake Raven increased in popularity from the 2017 creel (3.6% of total angling effort) to the 2018 creel (42.0% of total angling effort), and then decreased to the 2021 creel (3.8% of the total angling effort, Table 9). Increased popularity in 2018 is likely due to stocking over 28,000 fish in the fall of 2017 and the district's promotion of the fishery. Total catch rate for catfish was low all three years (< 0.1 fish/h, Table 11).

Thus far, catfish populations in Lake Raven are dependent on stockings and historically exhibited increased gill net catch rates after stocking years, followed by decreasing population abundances (Webb and Best 2014). Efforts to increase Channel Catfish reproduction via the addition of spawning barrels to the reservoir have been successful, as district staff have witnessed spawning pairs, egg masses, and fry occupying barrels, but recruitment has yet to be documented.

**Largemouth Bass:** Electrofishing catch rates have steadily increased over the last 3 surveys with 95.0/h in 2016, 122.0/h in 2018, and 156.0/h in 2020 (Figure 7). The OBS plan for 2017-2021 called for 1 hour of electrofishing at 12, 5-minute stations; however, in 2020, only 11, 5-minute stations (55 minutes total) were completed due to equipment malfunction. The proportion of the population that is at or above the maximum length limit has also increased across the three survey years (PSD-16) and two Lunker Class ShareLunkers have been submitted since the last report. The February 2018 entry was 24.25 inches long and weighed 9.90 pounds and the July 2021 entry was 25.00 inches and 9.59 pounds. Body condition was good in 2020 ( $W_r \geq 85$ ) and growth was good with fish reaching 16 inches in 4.1 years ( $N=22$ ; range 3-7 years). Florida Largemouth Bass influence has remained high with 81-85% Florida-strain alleles (Table 13).

Directed fishing effort for Largemouth Bass was highest in 2017 with 60% of angler effort. Effort decreased to 31% in 2018 but increased slightly in 2021 to (44%, Table 9). In 2021, boat angling effort was heavily skewed towards Largemouth Bass with 81% of directed effort, while 46% of bank angler effort was directed at Largemouth Bass (Table 8). Under the new 16-inch maximum length limit, 86% of legal fish (under 16 inches in length) were released (Table 12).

**Crappie:** Trap netting was discontinued after 2013 due to historically low catch rates. Since then, Black Crappie and White Crappie have been monitored on a presence/absence basis via electrofishing. Persistence of Black Crappie and White Crappie was documented in the 2020 electrofishing survey

(Appendix A). Crappie were the third most popular target at Lake Raven during the 2021 creel with 9.9% of directed effort (Table 9), and though more Black Crappie were collected during electrofishing surveys (Appendix A), more White Crappie were caught and harvested (Table 14, Figure 9, Figure 10).

# Fisheries Management Plan for Lake Raven, Texas

Prepared – July 2021

**ISSUE 1:** Largemouth Bass continue to be a popular sport fish at Lake Raven providing an outstanding fishery. Efforts to manage the fishery for big fish potential should continue.

## MANAGEMENT STRATEGY

1. Beginning in 2021, all Florida Largemouth Bass will be from ShareLunker brood stock. Request annual stockings of 1.5-inch fingerling ShareLunker Largemouth Bass at the same stocking rate as past Florida Largemouth Bass (100 fish/acre) to maximize trophy potential.
2. Continue to promote the Largemouth Bass fishery through available media resources and promote participation in the ShareLunker Program.

**ISSUE 2:** Lake Raven is subject to an overabundance of hydrilla, giant salvinia, water hyacinth, and alligator weed that has historically impeded bank fishing access and swimming areas, while competing with native aquatic plant species that have thrived in the past. Chronic coverage can impede bass performance and interferes with our Channel Catfish recruitment evaluations. The goal is to maintain ideal coverage between 20% and 30%.

## MANAGEMENT STRATEGIES

1. Use appropriate herbicide to control hydrilla for improved boat lanes, areas of open deep water, and shoreline access along the day use and camping shorelines. ProcellaCor, which is not effective on many native species, will be used when appropriate to reduce impacts on native species.
2. Maintain vegetation booms in the upper coves to concentrate giant salvinia, water hyacinth, and alligator weed which will be treated with appropriate herbicide to reduce abundance and improve shoreline access as needed.
3. Continue to promote native emergent, submersed, and floating leaved plants to improve fish habitat. Existing native vegetation will be protected by limited use of herbicides that impact existing native species and by additional planting, if needed.
4. Use biocontrols and mechanical removal of exotic nuisance species as needed as part of the integrated pest management approach.

**ISSUE 3:** Recent creel surveys revealed that anglers target Channel Catfish at Lake Raven. Channel Catfish populations in Lake Raven are limited by natural recruitment and are currently maintained as a low-density population by stocking. Efforts to improve reproduction and recruitment have yet to reveal results.

## MANAGEMENT STRATEGY

1. Continue evaluation of artificial spawning structure effect on Channel Catfish reproduction and recruitment in Lake Raven. Reproduction in barrels was observed in 2018, 2019, and 2020. Hoop netting and age determination will be conducted in summer 2021 and 2022 to investigate recruitment success.

**ISSUE 4:** Lake Raven is heavily utilized by both bank and boat anglers, but fishing success is much lower for anglers fishing from shoreline or pier than for those fishing from boats.

## MANAGEMENT STRATEGY

1. Control vegetation along the shorelines of the day use and camping areas to maintain open shorelines.
2. Add fish attracting structures near shorelines around camping and day use areas to improve angling opportunities for bank anglers.
3. Place "how to fish" signs on piers and along shorelines to better educate occasional anglers on appropriate angling methods.

**ISSUE 5:** Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically and multiple invasive species, including giant salvinia, alligator weed, and water hyacinth are present on Lake Raven. 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. Cooperate with the Huntsville State Park to post appropriate signage at access points around the reservoir and monitor traffic into and out of the park for obvious transport of invasive species.
2. Educate the public about invasive species through the use of media and the internet.
3. Make a speaking point about invasive species when presenting to constituent and user groups.
4. Keep track of (i.e., map) existing and future inter-basin water transfers to facilitate potential invasive species responses.

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

Largemouth Bass are the primary sport fish in Lake Raven. Blue Catfish, Channel Catfish, Black Crappie, and White Crappie are also present, but are less common and receive less targeted pressure. Forage species include Gizzard Shad, Threadfin Shad, Redear Sunfish, and Bluegill. Many anglers report fishing for sunfishes as well.

### Low density fisheries

**Blue Catfish:** Blue Catfish populations in Lake Raven are dependent on stockings and were last stocked in Lake Raven in 2015. No Blue Catfish were observed during the electrofishing, hoop net, or creel surveys in 2020-2021. The presence/absence of Blue Catfish will be monitored through creel surveys every four years.

**Crappie:** White Crappie and Black Crappie are present in the reservoir but are historically negligible. During the 2021 creel survey, anglers reported an increase in undersized crappie catches. Few adult crappie were harvested by anglers. Crappie populations will be monitored for presence/absence through fall electrofishing surveys and crappie fishing pressure and catches will be monitored during a spring quarter creel in 2025.

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

**Channel Catfish:** Channel Catfish in Lake Raven are historically dependent on stockings. Efforts to establish a self-sustaining Channel Catfish population through the addition of artificial spawning structures were started in 2017. The Channel Catfish population will be surveyed in 2021-2023 to determine whether fish have recruited to the fishery with the survey goal of collecting 75 fish for age analysis annually. The primary method of collection will be hoop netting with a maximum effort of 9 baited tandem hoop net sets. Should hoop nets fail to capture sufficient numbers of fish, alternative methods will be tried, including hook-and-line sampling and creel-catch donation until 75 Channel Catfish are collected.

Beyond the recruitment study, long-term trend data for the Channel Catfish population will be collected through regular survey monitoring every 4 years. Data for size structure (PSD and length frequency), relative abundance (CPUE-total and CPUE-stock), condition ( $W_r$ ), and fisheries-dependent metrics (angler preference, angling pressure, and angler catch) will be collected every four years through summer hoop netting and a spring quarter creel survey starting in 2025. A minimum of four tandem hoop nets and maximum of eight tandem hoop nets will be used.

**Largemouth Bass:** Largemouth Bass are the most popular sport fish in Lake Raven with about half of all fishing effort dedicated to the fishery by both boat and bank anglers (a combined 10,343 angling hours). The popularity and reputation for quality Largemouth Bass fishing and alternative management regulation for Largemouth Bass at Lake Raven warrant sampling time and effort. One hour of fall electrofishing over 12 randomly selected, 5-minute stations has historically provided sufficient data (CPUE RSEs < 25) and will be used to survey the Largemouth Bass population in 2022 and 2024. The 2022 survey will collect Largemouth Bass only, and the 2024 survey will collect Largemouth Bass and prey species. Sampling objectives will include size structure (PSD and length frequency), growth (13 fish sample between 15.0 and 16.9 inches to determine mean age at 16 inches), relative abundance (CPUE-total and CPUE-stock), and condition ( $W_r$ ). Angler effort, catch rate, and harvest will be estimated through a spring quarter creel in 2025.

**Prey Species:** Threadfin Shad, Bluegill, and Redear Sunfish are the primary forage species at Lake Raven. Gizzard Shad are present but provide limited forage. Sampling Threadfin Shad, Bluegill, and

Redear Sunfish at the same intensity as is proposed for Largemouth Bass every four years will provide trend information to detect large-scale changes in general population characteristics (size structure, relative abundance) of sunfish and shad species. Relative weight estimates for Largemouth Bass will be used for supplemental qualitative assessment of prey suitability. No additional effort will be expended beyond the effort required to collect for Largemouth Bass.

**Creel Survey:** A roving angler creel survey will be conducted March 1, 2025 – May 31, 2025 to estimate directed angling effort, catch, harvest, and expenditures for all game fish species. This is a general monitoring creel survey that intends to capture information about all species sought by anglers, economic expenditures, travel distances for anglers and angling pressure on Lake Raven fisheries. Creel data will also be used to evaluate angler satisfaction with regulation changes and Channel Catfish recruitment into the fishery as a result of increased spawning success because of added spawning structures.

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## Tables and Figures

Table 1. Characteristics of Lake Raven, Texas.

Characteristic	Description
Year constructed	1956
Controlling authority	Texas Parks and Wildlife Department
County	Walker (location of dam)
Reservoir type	Tributary: State Park
Shoreline Development Index	2.3
Conductivity	160 $\mu\text{S}/\text{cm}$



Figure 1. Bathymetric map of Lake Raven, Texas 2021. Data was collected using side scan and rendered using BioBase software.

Table 2. Boat ramp characteristics for Lake Raven, Texas, August 2020. Reservoir elevation at time of survey was 284 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Huntsville State Park	30.614394 -95.535277	Y	15	282	Excellent, no access issues

Table 3. Harvest regulations for Lake Raven, Texas.

Species	Bag limit	Length limit
Catfish: Channel and Blue Catfish, their hybrids and subspecies	5 (in any combination)	No limit
Catfish, Flathead	5	18
Bass, Largemouth	5	16-inch maximum*
Crappie: White and Black crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum

\*16-inch maximum for Largemouth Bass except that any bass 24 inches or greater caught may be weighed on personal scales and then immediately released or donated to the ShareLunker Program.

Table 4. Stocking history of Lake Raven, Texas. FGL = fingerling; AFGL = advanced fingerling; ADL = adults; UNK = unknown.

Species	Year	Number	Size
Black Crappie	1968	30	UNK
	1970	4,120	UNK
	Total	4,150	
Blue Catfish	2000	1,591	AFGL
	2003	5,157	AFGL
	2015	25,020	FGL
	Total	31,768	
Channel Catfish	1966	9,900	AFGL
	1971	52,000	AFGL
	1972	57,400	AFGL
	1980	80	UNK
	1982	2,016	AFGL
	1987	21,087	AFGL
	1992	5,252	AFGL
	1996	5,250	AFGL
	1998	5,256	AFGL
	1999	5,251	AFGL
	2000	3,672	AFGL
	2001	5,253	AFGL
	2002	5,237	AFGL
	2004	2,034	AFGL
	2005	12,084	AFGL
	2006	2,930	AFGL
	2010	5,196	AFGL
	2010	20,280	FGL
	2012	1,860	AFGL
	2015	859	AFGL
2017	3,500	ADL	
2017	25,325	AFGL	
2018	426	ADL	
2018	5,332	AFGL	
2019	40	UNK	
Total	257,520		
Florida Largemouth Bass	1979	10,800	FGL
	1980	338	ADL
	1987	16,850	FGL
	1991	22,487	FGL
	1996	142	ADL
	1998	952	AFGL
	2013	12,451	FGL
	2019	20,613	FGL
	2020	23,590	FGL
	2021	22	ADL
Total	108,223		

Table 4. Stocking history continued.

Species	Year	Number	Size
Grass Carp x Bighead Carp	1989	3,038	UNK
	1990	400	UNK
	Total	3,438	
Green Sunfish x Redear Sunfish	1968	13	UNK
	1972	300	UNK
	Total	313	
Northern Pike	1974	1,160	UNK
	Total	1,160	
Northern Pike x Muskellunge	1976	2,100	UNK
	Total	2,100	
ShareLunker Largemouth Bass	2005	5,901	AFGL
	2007	5,088	AFGL
	2010	2,375	AFGL
	2013	12,375	FGL
	Total	25,739	

Table 5. Objective-based sampling plan components for Lake Raven, 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 16 inches	$N = 13, 15.0 - 16.9$ inches
	Condition	$W_r$	10 fish/inch group (max)
	Genetics	% FLMB	$N = 30$ , any age
Bluegill <sup>a</sup>	Abundance	CPUE–Total	RSE $\leq 25$
	Size structure	PSD, length frequency	$N \geq 50$
Redear Sunfish <sup>a</sup>	Abundance	CPUE–Total	RSE $\leq 25$
	Size structure	PSD, length frequency	$N \geq 50$
Crappies	Presence / Absence		
Gizzard Shad <sup>a</sup>	Abundance	CPUE–Total	RSE $\leq 25$
	Size structure	PSD, length frequency	$N \geq 50$
	Prey availability	IOV	$N \geq 50$
<i>Tandem hoop netting</i>			
Channel Catfish	Abundance	CPUE–stock	RSE–Stock $\leq 25$
	Size structure		$N \geq 50$ stock
<i>Creel survey</i>			
Blue Catfish	Presence / Absence		

<sup>a</sup> No additional effort will be expended to achieve an RSE  $\leq 25$  for CPUE of Bluegill, Redear Sunfish, 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, Lake Raven, Texas, 2020. Shoreline habitat type units are in miles and standing timber is acres.

Habitat type	Estimate	% of total
Bulkhead	0.4 miles	6.6
Natural	5.9 miles	93.4

Table 7. Survey of aquatic vegetation, Lake Raven, Texas, 2017–2020. Surface area (acres) is listed with percent of total reservoir surface area in parentheses. Vegetation surveys in 2017-2019 exotics only, and the 2020 survey documented all plant species.

Vegetation	2017	2018	2019	2020
Native submersed				9.4 (5.0)
Native floating-leaved				22.9 (11.3)
Native emergent				8.69 (4.3)
Non-native				
Alligator Weed (Tier II)*	3.0 (1.5)	22.6 (11.1)	11.3 (5.6)	0.8 (< 0.1)
Giant salvinia (Tier II)*	49.9 (24.6)	21.8 (10.7)	23.2 (11.4)	55.4 (27.3)
Hydrilla (Tier II)*	65.7 (32.4)	98.5 (48.5)	78.7 (38.8)	76.3 (37.6)
Water hyacinth (Tier II)*	7.2 (3.5)	38.5 (19.0)	< 0.1 (< 0.1)	< 0.1 (< 0.1)

\* Tier II is maintenance control status

Table 8. Total fishing effort (h) for all species, total direct expenditures, and percent direct effort, catch per hour of directed effort, and harvest by species for anglers fishing from boat and bank for Lake Raven, Texas 2021. Bank anglers included those on natural shoreline, bulkhead, or fishing pier. Relative standard error is in parentheses where applicable. Survey periods were from March 1 to May 31.

Creel statistic	Bank anglers	Boat anglers
Total fishing effort	11,804 (35)	13,956 (40)
Percent fishing effort	46%	54%
Total directed expenditures	\$112,605 (100)	\$66,025 (93)
Percent directed expenditures	63%	37%
Percent directed effort		
Catfish	6.8	1.2
Sunfishes	11.0	0
Largemouth Bass	10.9	72.3
Crappie	7.8	11.7
Anything	63.5	14.8
Catch per hour		
Catfish	0 (0)	0.57 (-)*
Sunfishes	0 (-)*	N/A
Largemouth Bass	0.75 (100)	0.36 (25)
Crappie	3.80 (100)	0.74 (86)
Anything	0.11 (64)	N/A
Total harvest		
Catfish	0 (0)	0 (0)
Sunfishes	476 (105)	76 (206)
Largemouth Bass	0 (0)	153 (80 )
Crappie	952 (97)	459 (87)

Table 9. Percent directed angler effort by species for Lake Raven, Texas, 2017–2021. Survey periods were from 1 March through 31 May.

Species	2017	2018	2021
Catfish	3.6	42.0	3.8
Sunfishes	3.8	3.5	5.0
Largemouth Bass	60.0	30.7	44.2
Crappie	5.8	1.0	9.9
Anything	26.9	22.8	37.1

Table 10. Total fishing effort (h) for all species and total directed expenditures at Lake Raven, Texas, 2017-2021. Survey periods were from 1 March through 31 May. Relative standard error is in parentheses.

Creel statistic	2017	2018	2021
Total fishing effort	27,632 (13)	19,157 (26)	25,760 (36)
Total directed expenditures	\$172,188 (72)	\$88,288 (285)	\$178,630 (72)

## Gizzard Shad

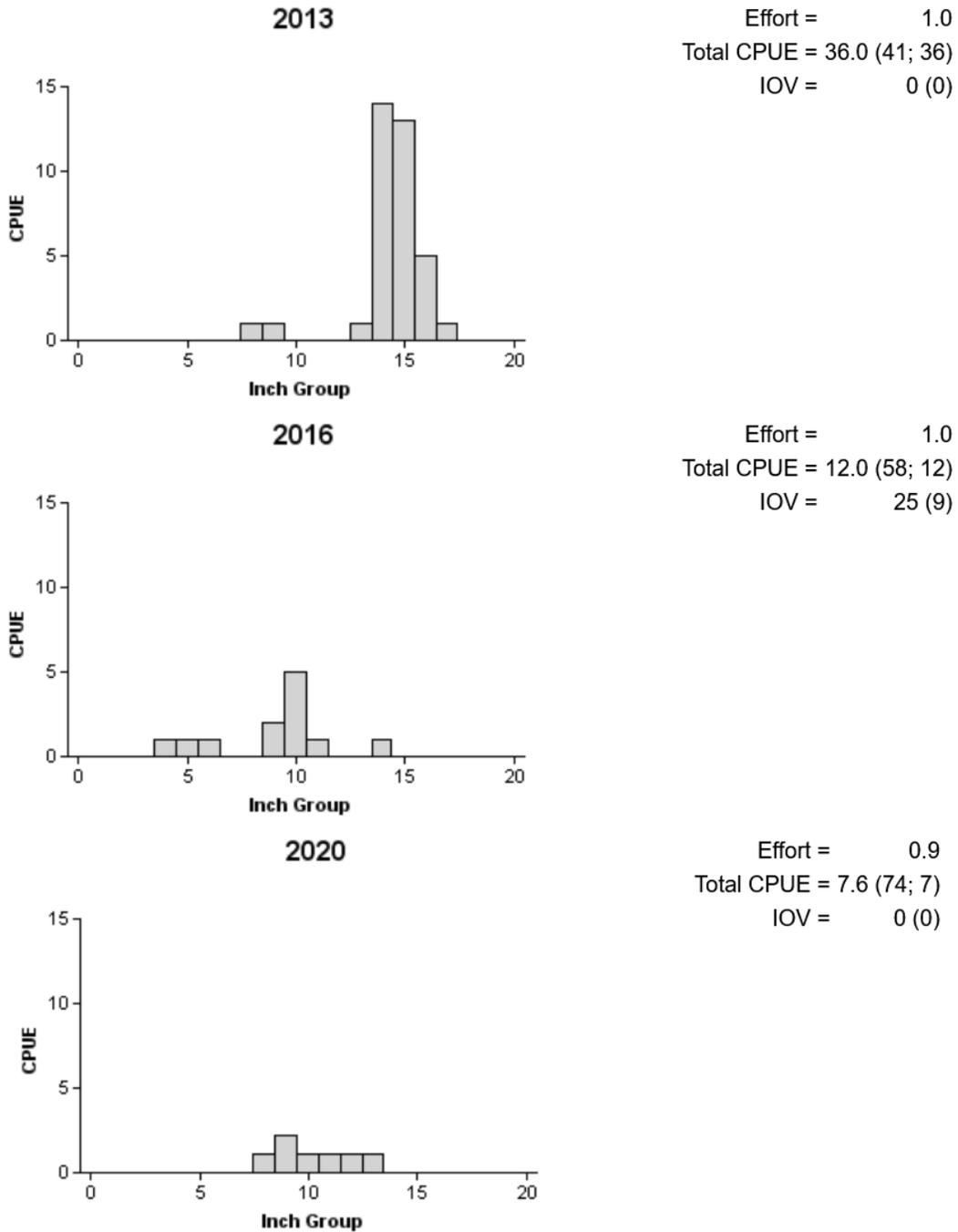


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Lake Raven, Texas, 2013, 2016, and 2020.

# Bluegill

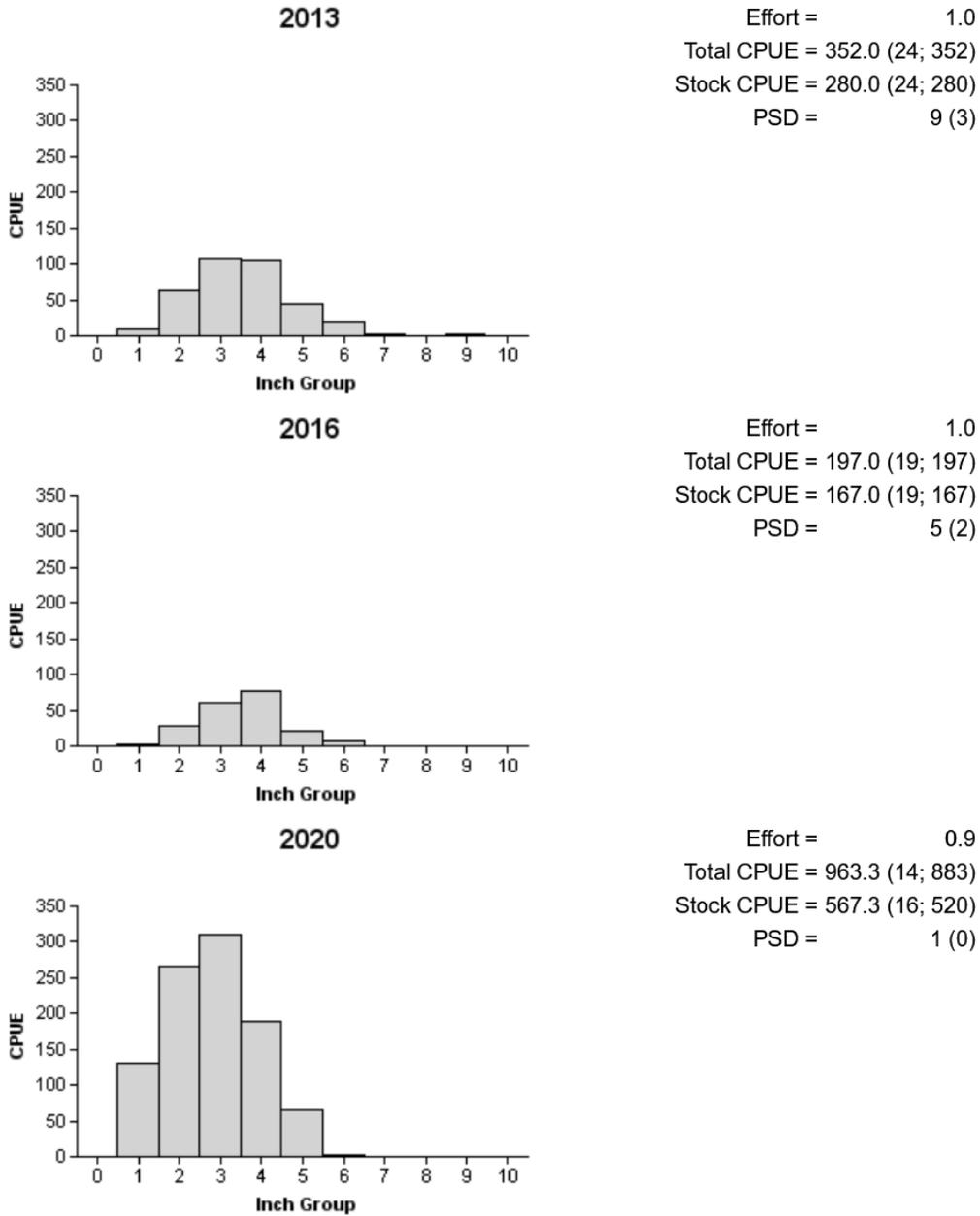
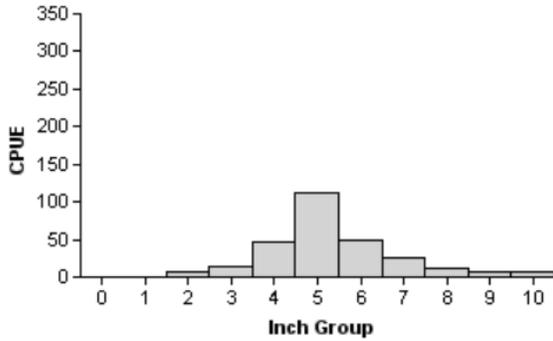


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Raven, Texas, 2013, 2016, and 2020.

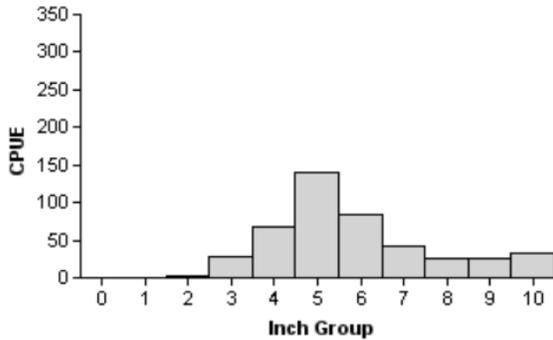
## Redear Sunfish

**2013**



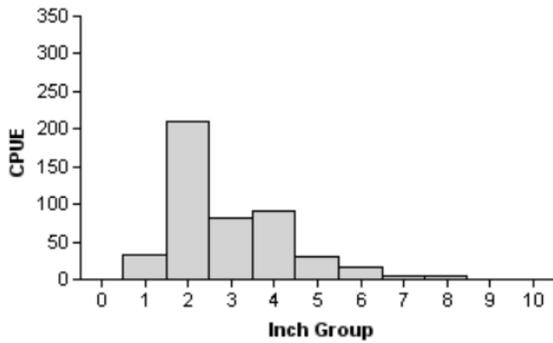
Effort = 1.0  
 Total CPUE = 279.0 (18; 279)  
 Stock CPUE = 258.0 (19; 258)  
 PSD = 20 (4)

**2016**



Effort = 1.0  
 Total CPUE = 449.0 (10; 449)  
 Stock CPUE = 419.0 (11; 419)  
 PSD = 30 (4)

**2020**



Effort = 0.9  
 Total CPUE = 472.4 (37; 433)  
 Stock CPUE = 147.3 (22; 135)  
 PSD = 7 (3)

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, Lake Raven, Texas, 2013, 2016, and 2020.

### Channel Catfish

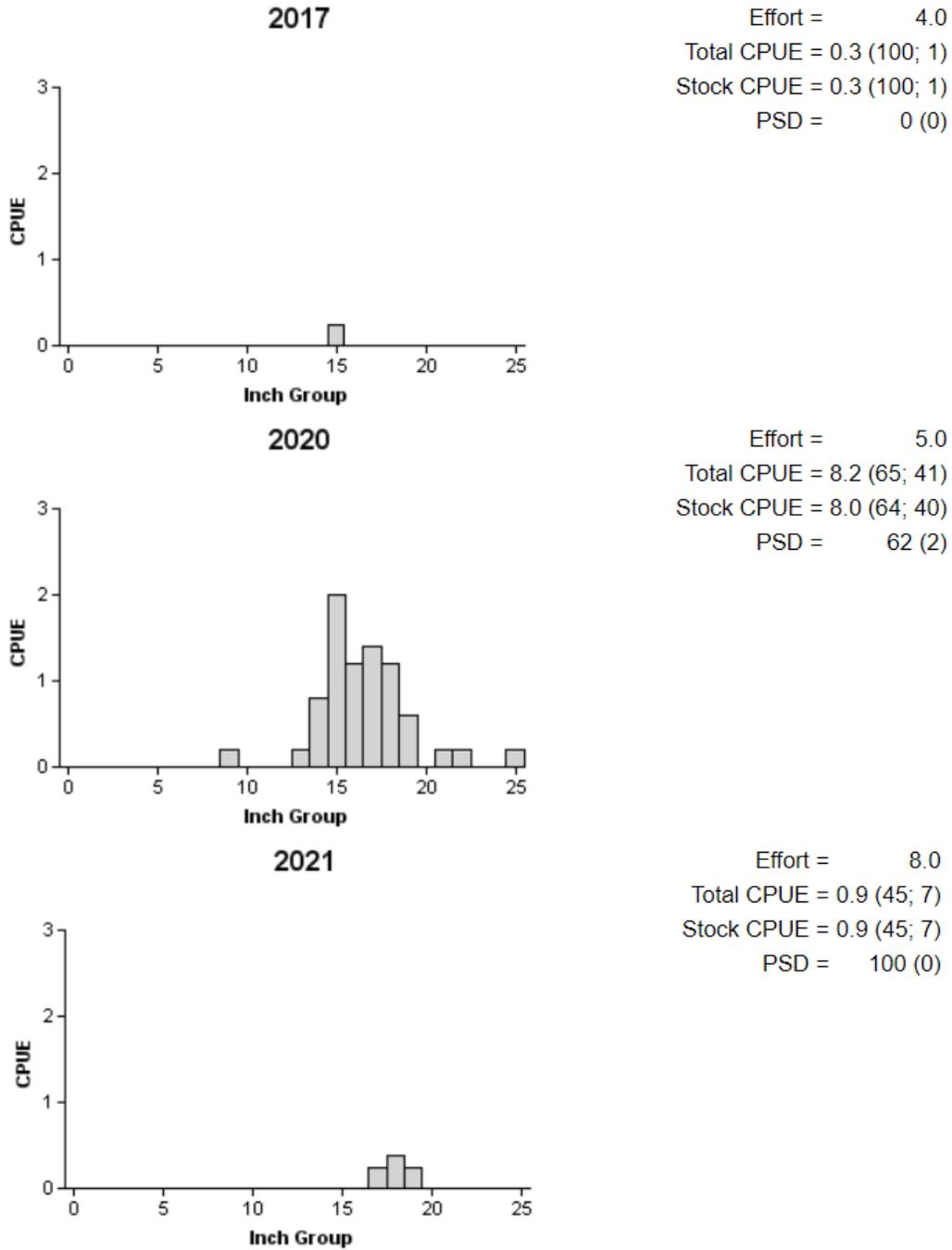


Figure 5. Number of Channel Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring hoop net surveys, Lake Raven, Texas, 2017, 2020, and 2021.

Table 11. Creel survey statistics for Channel Catfish at Lake Raven, Texas, from March 2017 through May 2017, March 2018 through May 2018, and March 2021 through May 2021. Total catch per hour is for anglers targeting Channel Catfish and total harvest is the estimated number of Channel Catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2017	2018	2021
Surface area (acres)	203	203	203
Directed effort (h)	982.96 (70)	8,054.71 (33)	971.17 (70)
Directed effort/acre	4.84 (70)	39.68 (33)	4.78 (70)
Total catch per hour	0 (-)*	0.02 (-)*	0.10 (-)*
Total harvest	0 (0)	44.23 (130)	0 (0)
Harvest/acre	0 (0)	0.22 (130)	0 (0)
Percent legal released	0	0	100

\* Sample size too small to calculate RSE.

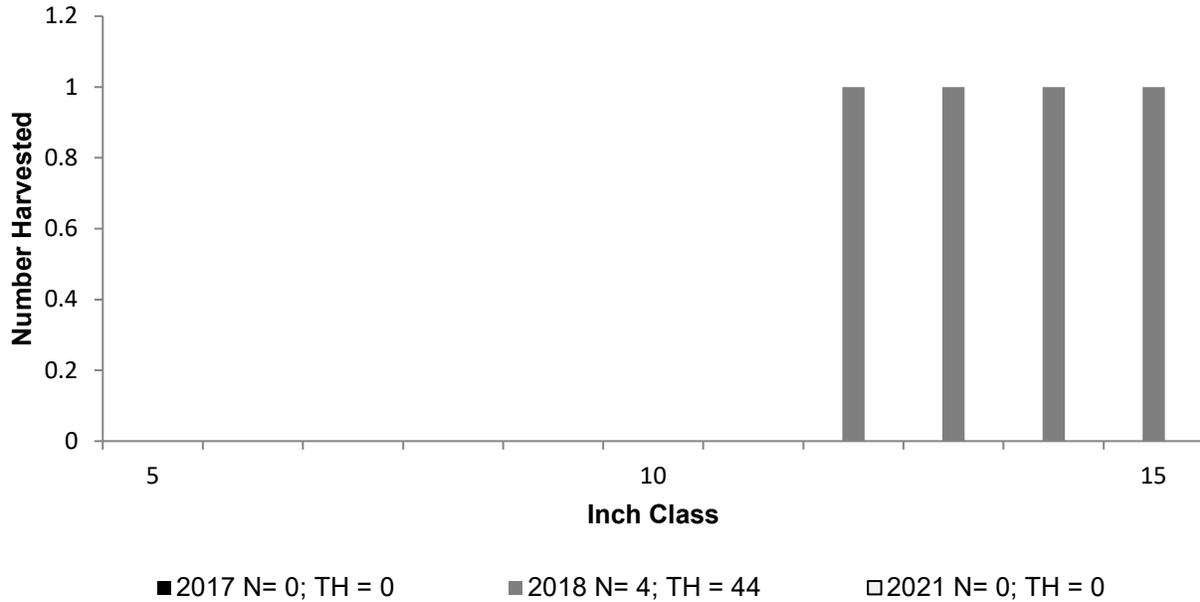


Figure 6. Length frequency of harvested Channel Catfish observed during creel surveys at Lake Raven, Texas, March 2017 through May 2017, March 2018 through May 2018, and March 2021 through May 2021, all anglers combined. N is the number of harvested Channel Catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

## Largemouth Bass

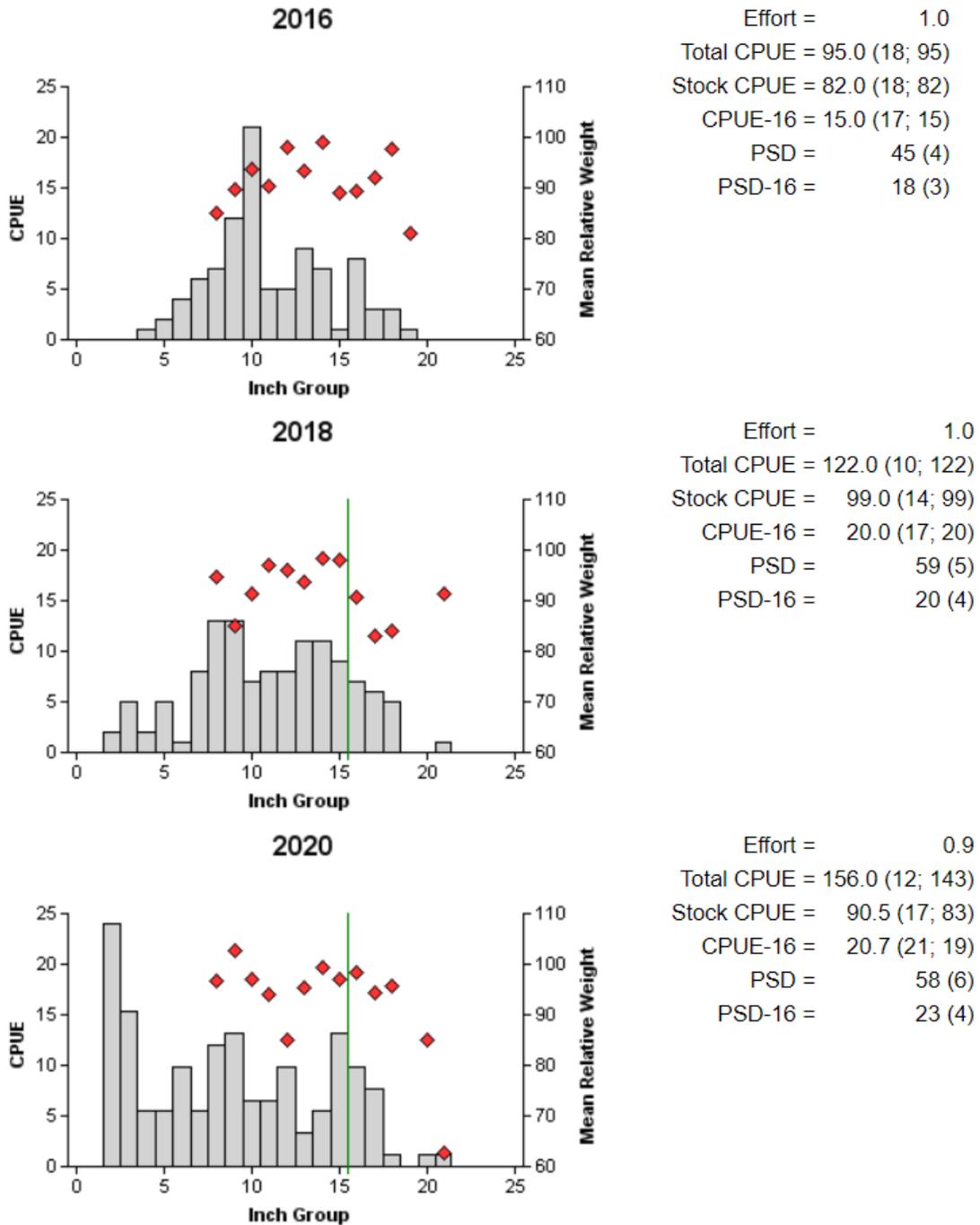


Figure 7. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Raven, Texas, 2016, 2018, and 2020. Vertical line indicates maximum length limit.

Table 12. Creel survey statistics for Largemouth Bass at Lake Raven, Texas, from March 2017 through May 2017, March 2018 through May 2018, and March 2021 through May 2021. Catch rate is for all anglers targeting Largemouth Bass. Harvest is partitioned by the estimated number of fish harvested by non-tournament anglers and the number of fish retained by tournament anglers for weigh-in and release. The estimated number of fish released by weight category is for anglers targeting Largemouth Bass. Relative standard errors (RSE) are in parentheses.

Statistic	2017	2018	2021
Surface area (acres)	203	203	203
Directed angling effort (h)			
Tournament	N/A	N/A	10,343 (37)
Non-tournament	16,581 (15)	5,877 (33)	1,030 (65)
All black bass anglers combined	16,581 (15)	5,877 (33)	11,373 (37)
Angling effort/acre	81.7 (15)	29.0 (44)	56.0 (40)
Catch rate (number/h)	0.2 (70)	0.4 (49)	0.4 (32)
Harvest			
Non-tournament harvest	0 (0)	0 (0)	153 (81)
Harvest/acre	0 (0)	0 (0)	0.8 (81)
Tournament weigh-in and release	N/A	N/A	0
Release by weight			
<4.0 lbs	N/A	N/A	4,445 (50)
4.0-6.9 lbs	N/A	N/A	567 (58)
7.0-9.9 lbs	N/A	N/A	0 (0)
≥10.0 lbs	N/A	N/A	0 (0)
Percent legal released (non-tournament)*	N/A	N/A	86

\* Largemouth Bass were managed under a catch and release only regulation during 2017 and 2018 and thus do not have a percent released. During 2021, percent legal release was calculated using Largemouth Bass released under 16 inches.

\*\* Sample size too small to calculate RSE.

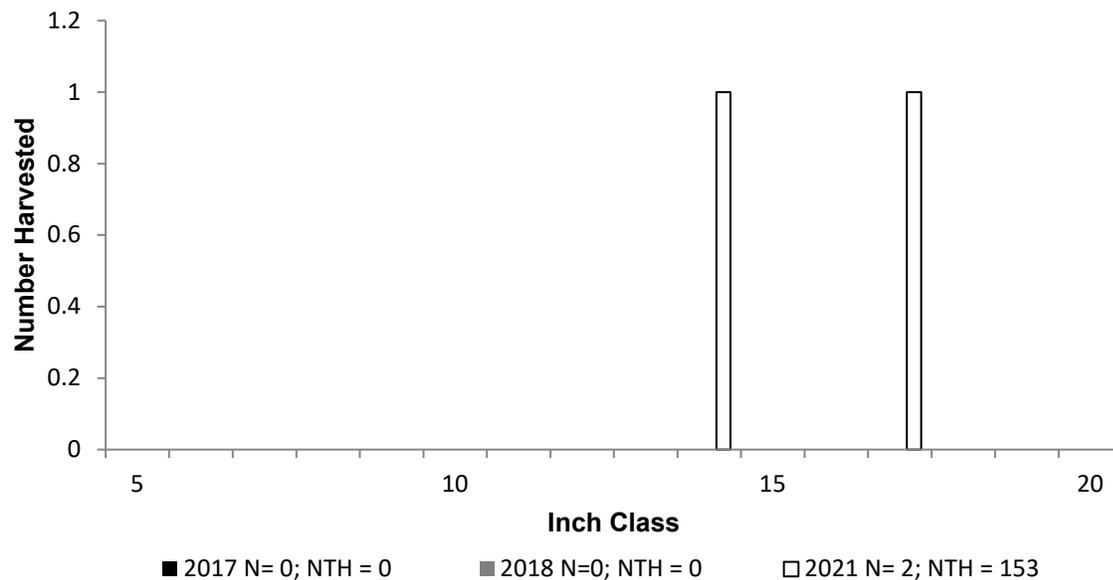


Figure 8. Length frequency of non-tournament harvested Largemouth Bass observed during creel surveys at Lake Raven, Texas, March 2017 through May 2017, March 2018 through May 2018, and March 2021 through May 2021, all anglers combined. N is the number of harvested Largemouth Bass observed during creel surveys, and NTH is the estimated non-tournament harvest for the creel period

Table 13. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Lake Raven, Texas. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, F1 = first generation hybrid between a FLMB and a NLMB, Fx = second or higher generation hybrid between a FLMB and a NLMB. Genetic composition was determined with micro-satellite DNA analysis.

Year	Sample size	Number of fish				% FLMB alleles	% pure FLMB
		FLMB	F1	Fx	NLMB		
2015	30	5.1	0	25.2	0	85	17
2020	30	2.1	0	27.9	0	81	7

## Crappie

Table 14. Creel survey statistics for crappie at Lake Raven, Texas, from March 2017 through May 2017, March 2018 through May 2018, and March 2021 through May 2021. Total catch per hour is for anglers targeting crappie and total harvest is the estimated number of White Crappie and Black Crappie harvested by all anglers. Percent legal released is the percentage of all legal-sized fish that were released. Undersized catch released is the percentage of the catch that was released because it did not meet minimum length limit. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year		
	2017	2018	2021
Surface area (acres)	203	203	203
Directed effort (h)	1,591 (56)	194 (223)	2,559 (45)
Directed effort/acre	7.84 (56)	0.96 (223)	12.61 (45)
Total catch per hour			
All Crappie	0.25 (100)	0.67 (-)**	1.84 (106)
Total harvest			
White Crappie	0 (0)	199 (80)	1,029 (91)
Black Crappie	0 (0)	133 (97)	382 (78)
Harvest/acre			
White Crappie	0 (0)	0.98 (80)	5.07 (91)
Black Crappie	0 (0)	0.66 (97)	1.88 (78)
Percent legal released			
White Crappie	0	40.7	0
Black Crappie	0	0	0

\*\* Sample size too small to calculate RSE.

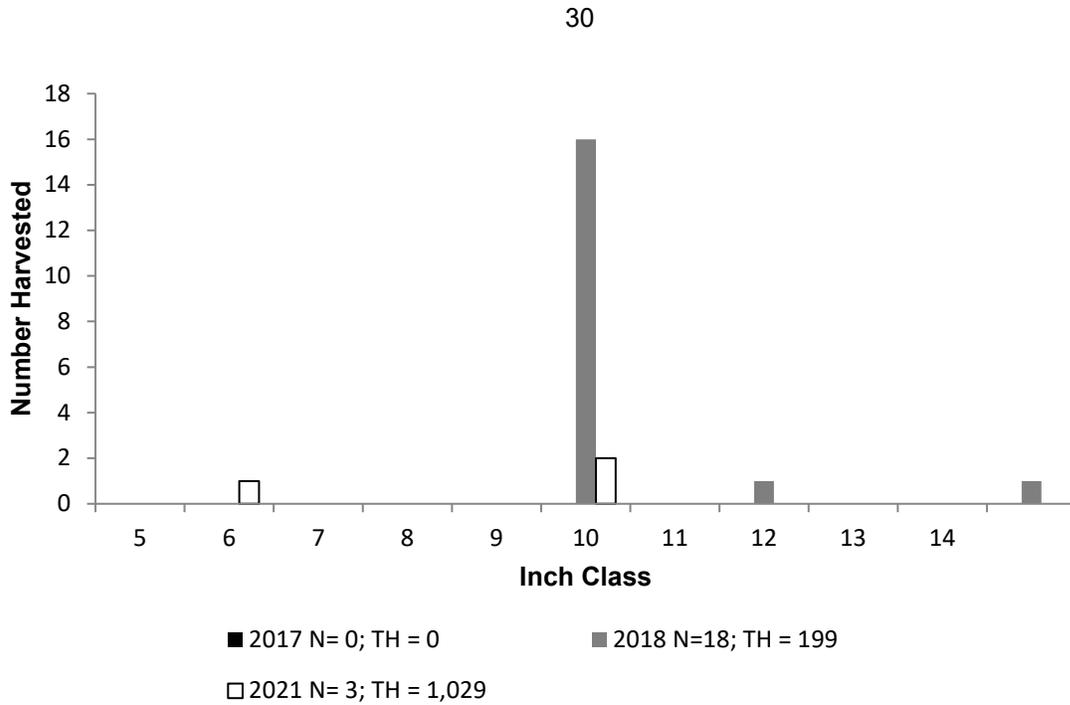


Figure 9. Length frequency of harvested White Crappie observed during creel surveys at Lake Raven, Texas, March 2017 through May 2017, March 2018 through May 2018, and March 2021 through May 2021, all anglers combined. N is the number of harvested White Crappie observed during creel surveys, and TH is the total estimated harvest for the creel period.

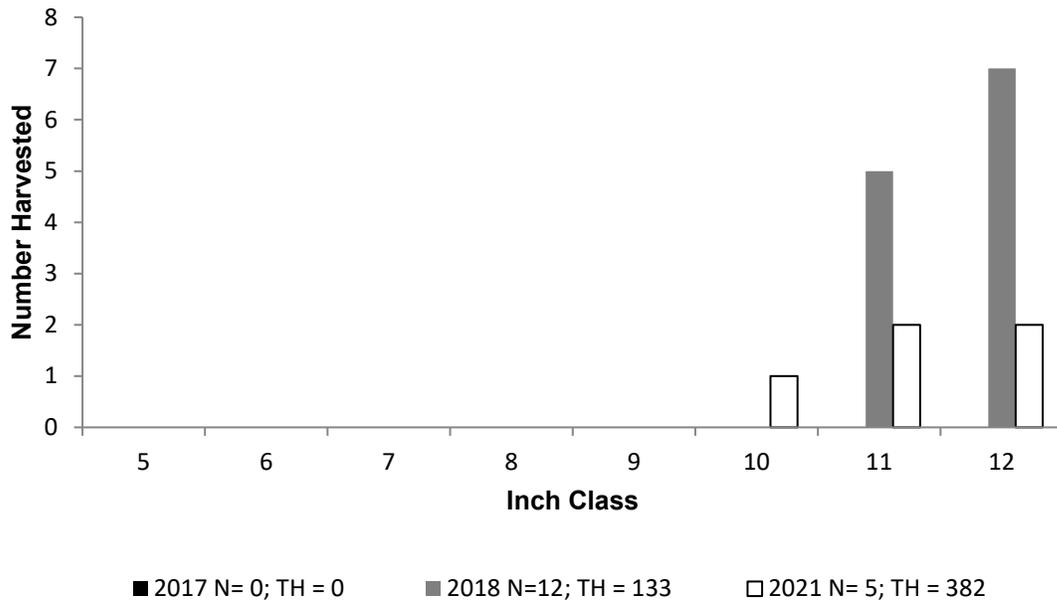


Figure 10. Length frequency of harvested Black Crappie observed during creel surveys at Lake Raven, Texas, March 2017 through May 2017, March 2018 through May 2018, and March 2021 through May

2021, all anglers combined. N is the number of harvested Black Crappie observed during creel surveys, and TH is the total estimated harvest for the creel period.

## Proposed Sampling Schedule

Table 15. Proposed sampling schedule for Lake Raven, Texas. Survey period is June through May. Hoop netting surveys are conducted in the summer, while electrofishing 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
Baited Tandem Hoop Netting	X	X		X
Spring Quarter Creel Survey				X
Report				X

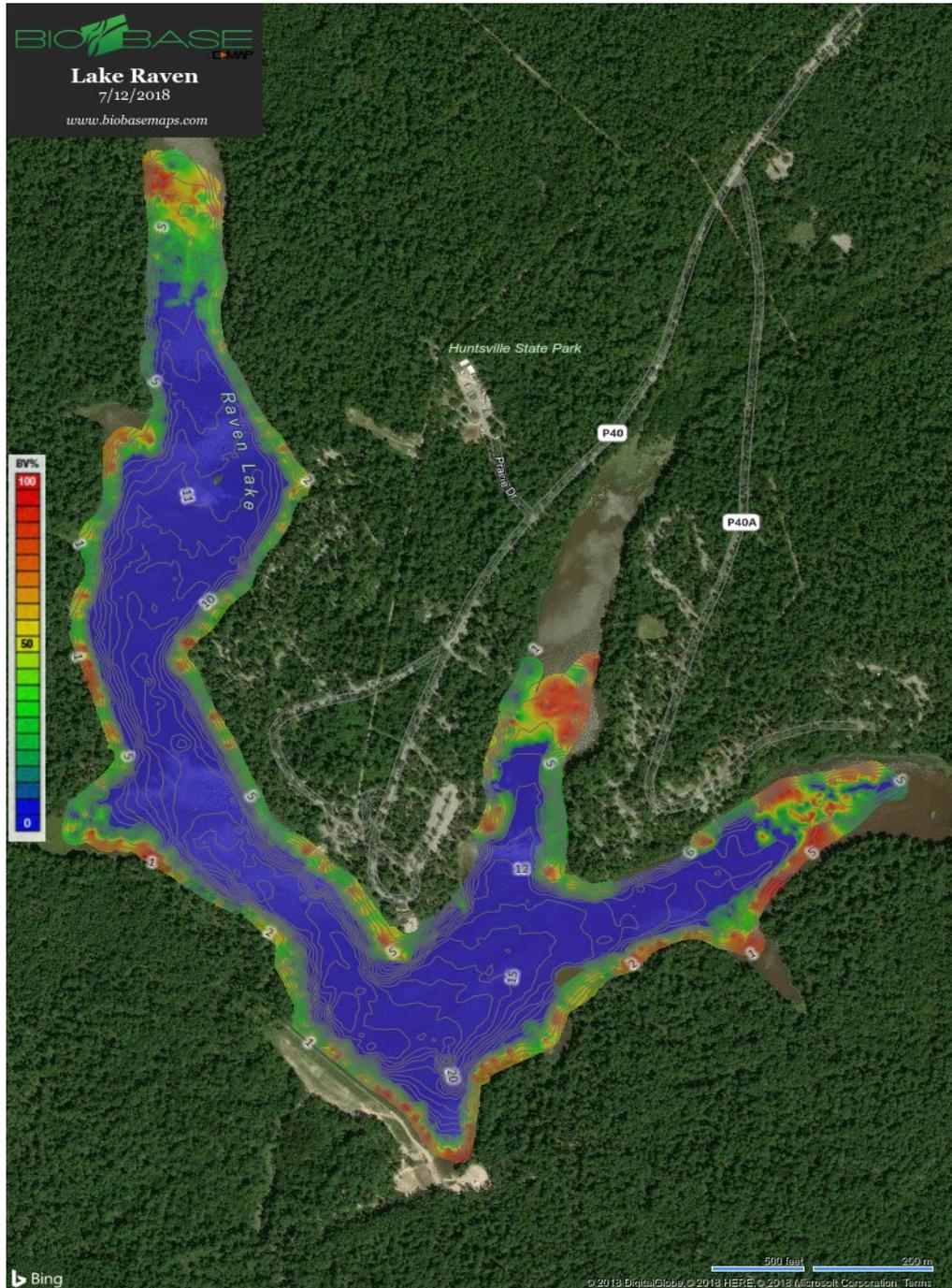
## APPENDIX A – Catch rates for all species from all gear types

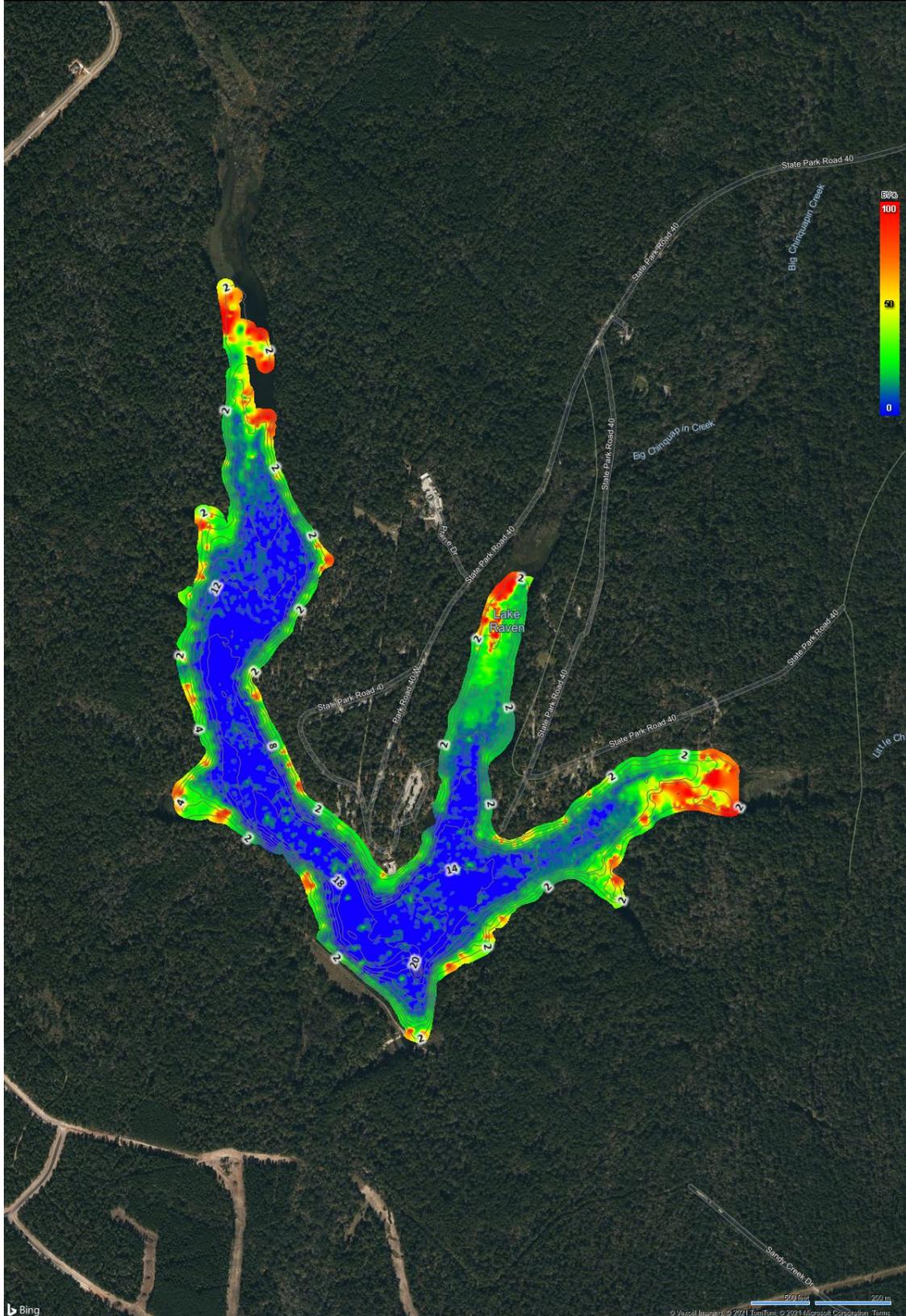
Number (N) and catch rate (CPUE) (RSE in parentheses) of all target species collected from all gear types from Lake Raven, Texas, 2020-2021. Sampling effort was 8 net nights for hoop netting and 0.92 hour for electrofishing.

Species	Hoop Netting		Electrofishing	
	N	CPUE	N	CPUE
Gizzard Shad	-	-	7	7.64 (74)
Threadfin Shad	-	-	43	46.91 (35)
Redfin Pickerel	-	-	21	22.91 (34)
Golden Shiner	-	-	14	15.27 (30)
Brook Silverside	-	-	13	14.18 (36)
Lake Chubsucker	-	-	24	26.18 (34)
Black Bullhead	-	-	1	1.09 (100)
Yellow Bullhead	1	0.13 (100)	2	2.18 (67)
Channel Catfish	7	0.88 (45)	-	-
Pirate Perch	-	-	8	8.73 (53)
Blackstripe Topminnow	-	-	1	1.09 (100)
Redbreast Sunfish	-	-	1	1.09 (100)
Warmouth	-	-	27	19.45 (40)
Bluegill	1	0.13 (100)	883	963.27 (14)
Longear Sunfish	-	-	3	3.27 (52)
Redear Sunfish	2	0.25 (100)	433	472.36 (37)
Redspotted Sunfish	-	-	186	202.91 (16)
Largemouth Bass	-	-	143	156.00 (12)
White Crappie	6	0.75 (65)	3	3.27 (71)
Black Crappie	3	0.38 (49)	12	13.09 (29)
Hybrid Sunfish	-	-	2	2.18 (67)

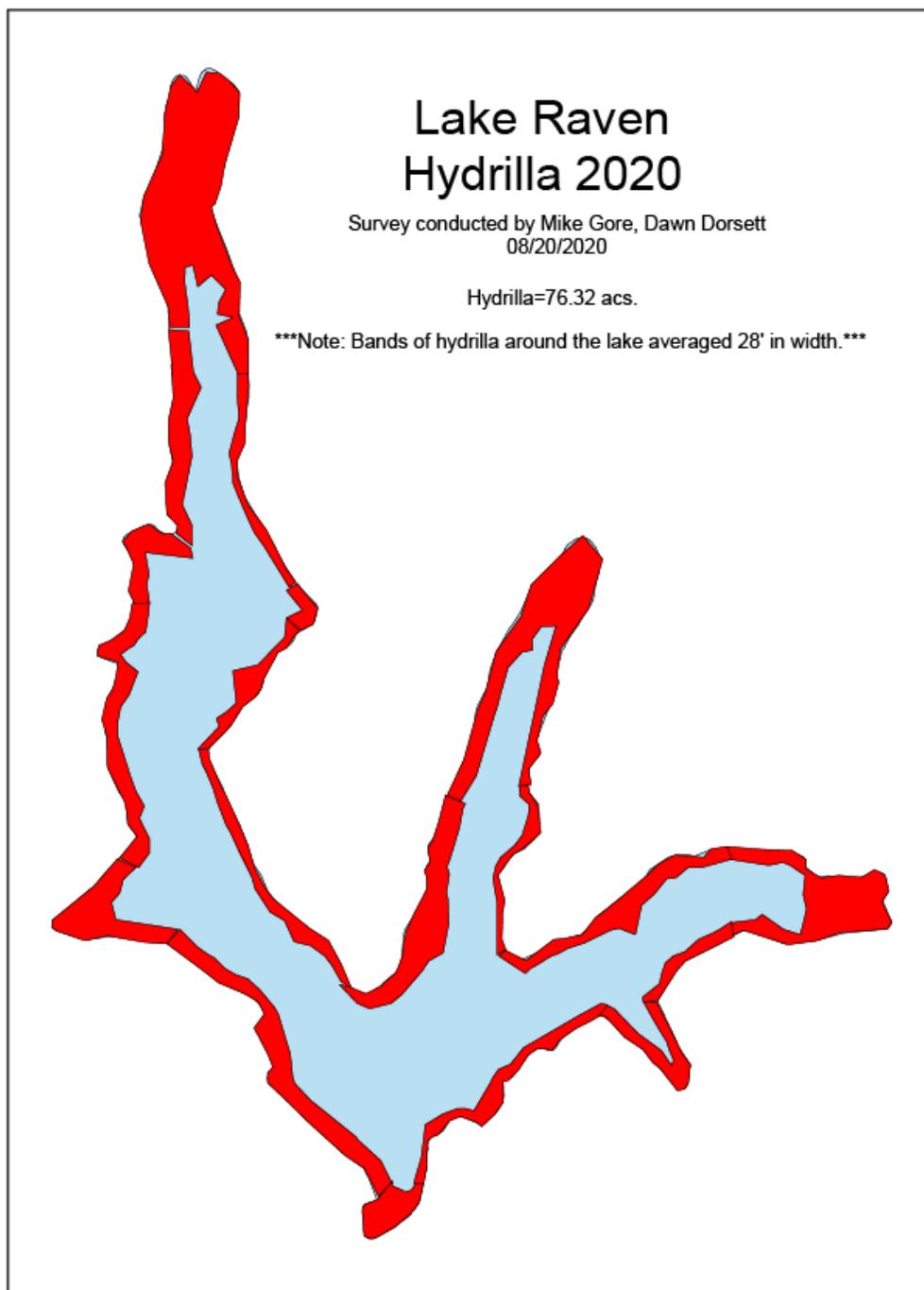
## APPENDIX B – Vegetation Density Maps

Vegetation density was surveyed in July 2018 and April 2021 using side scan sonar and imaged using BioBas software. Warm colors indicate increasing vegetation density, composed mostly of hydrilla. Red areas indicate the highest areas of density.

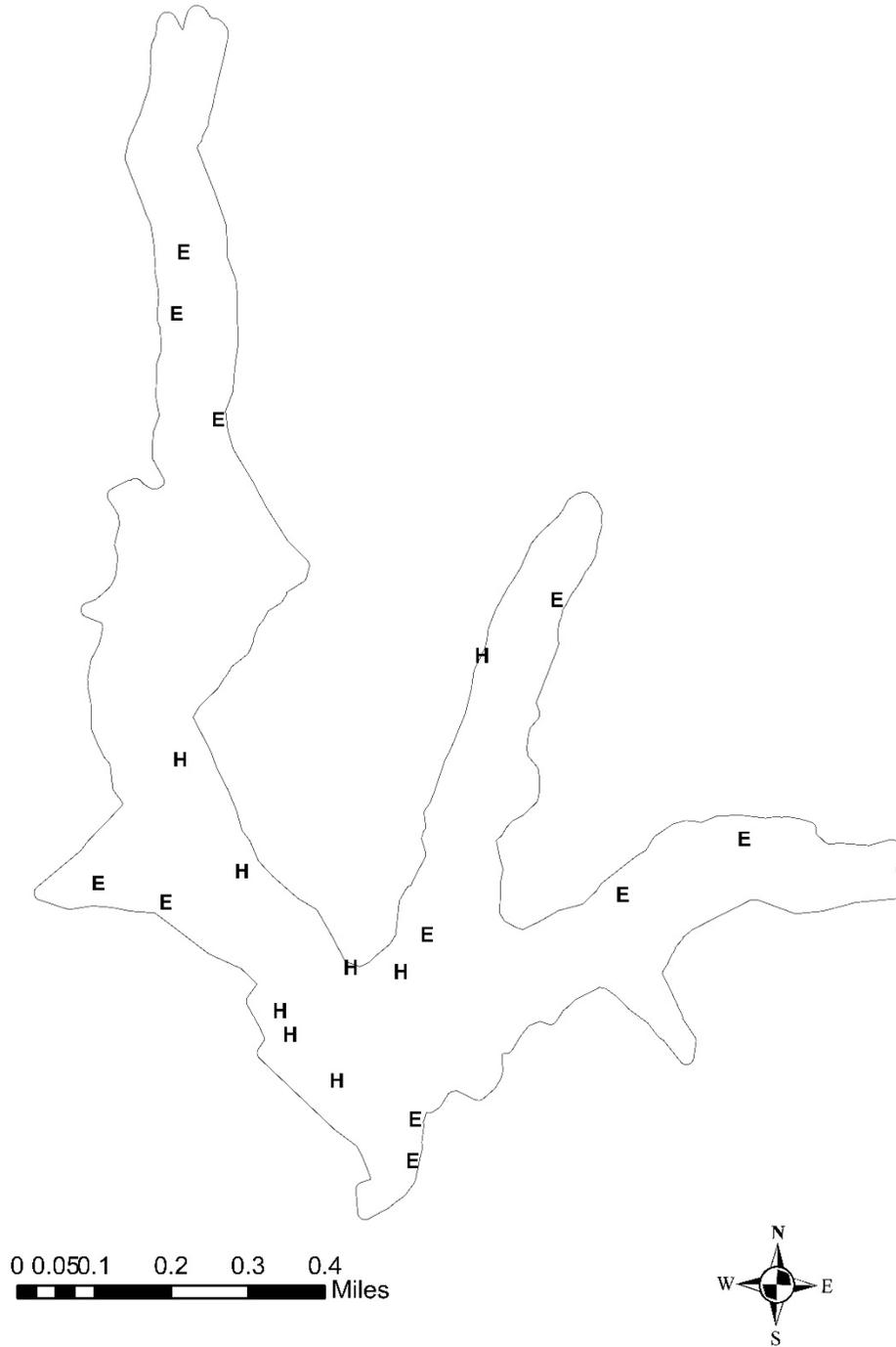




## APPENDIX C – Map of 2020 Hydrilla Coverage



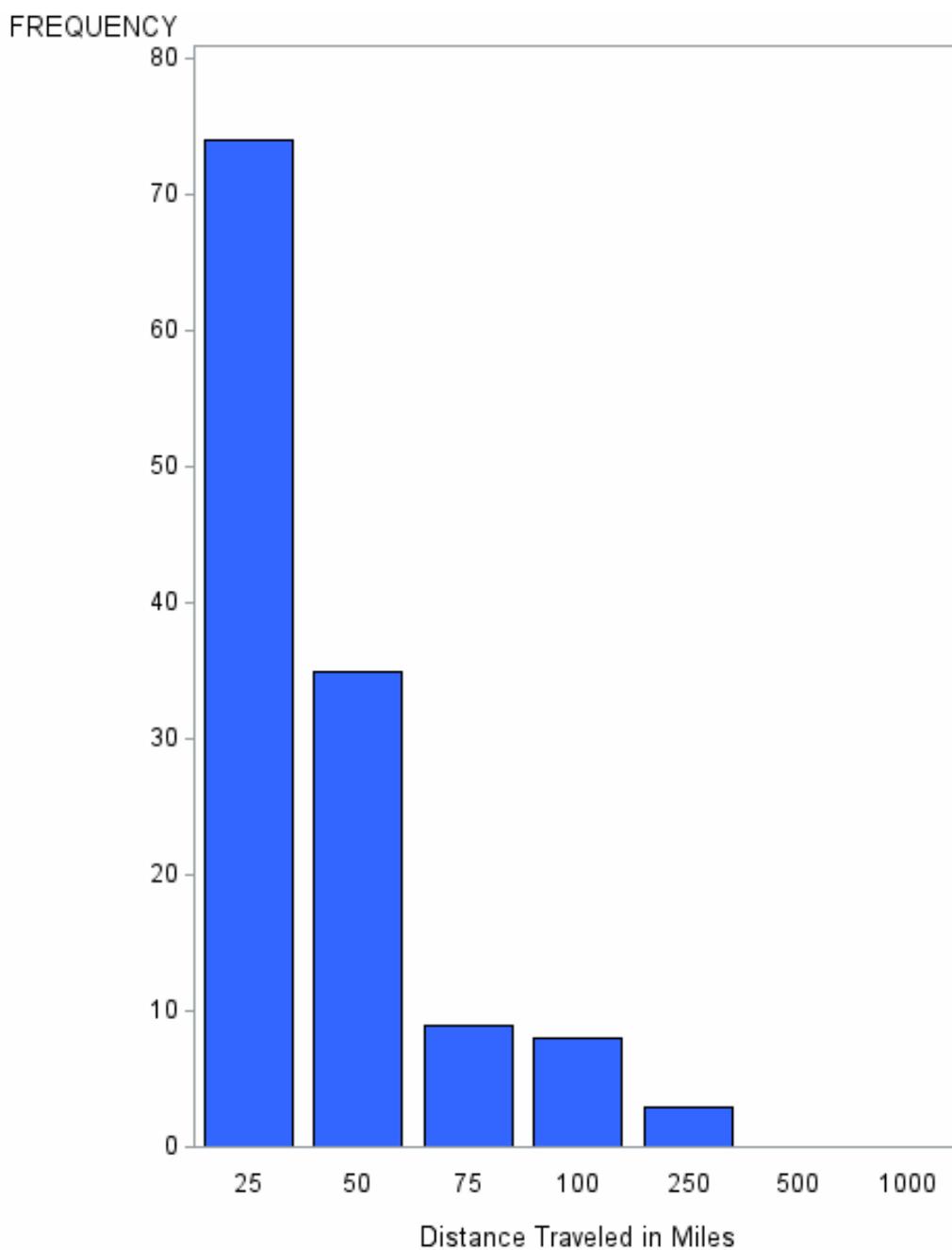
## APPENDIX D – Map of Sampling Locations



Location of sampling sites, Lake Raven, Texas, 2020-2021. Hoop net and electrofishing stations are indicated by H and E, respectively. Water level was near full pool at time of sampling.

## APPENDIX E – Reporting of Creel ZIP Code Data

Distance traveled to reservoir by anglers that were interviewed at Lake Raven, Texas, during the March 2021 through May 2021 creel survey.





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