

Lake Conroe

2022 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 Lake Conroe were surveyed in 2021 using electrofishing and in 2022 using gill netting. Anglers were surveyed from June 2021 through May 2022 with a creel survey. Historical data are presented with the 2021-2022 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 Conroe is a 20,118-acre reservoir on the West Fork of the San Jacinto River, Texas, built to provide water for municipal and industrial purposes. The reservoir was constructed in 1973 by the San Jacinto River Authority (SJRA), the Texas Water Development Board (TWDB), and the City of Houston. The Sam Houston National Forest borders most of the upper third of Lake Conroe, and considerable private and commercial real estate development surrounds the lower two-thirds.

Management History: Important sport fishes include Largemouth Bass, White Bass, Hybrid Striped Bass, Blue Catfish, Channel Catfish, Black Crappie, and White Crappie. Florida Largemouth Bass and Hybrid Striped Bass have been stocked when available. Previous habitat management actions included control of hydrilla using triploid Grass Carp beginning in 2006, regular monitoring of plant communities (including the exotic species hydrilla, giant salvinia, and water hyacinth) from 2006-2022, maintenance of the native aquatic vegetation nursery below Lake Conroe with SJRA, deployment of large fish attractor structures at 14 sites, and planting a five-mile stretch of shoreline in the Caney Creek arm with native vegetation.

Fish Community

- **Prey species:** The predominant prey fish species at Lake Conroe were Bluegill, Gizzard Shad, Longear Sunfish, and Threadfin Shad. Collectively, these species provided ample forage for sportfish.
- **Catfishes:** Catfishes were the second most sought-after group of fishes by anglers in recent years. Channel Catfish were the most abundant catfish species in Lake Conroe, but Blue Catfish also provided a substantial fishery.
- **Temperate basses:** White Bass and Hybrid Striped Bass were present in Lake Conroe. Angling effort for temperate basses during the 2021-2022 creel survey was similar to the 2016-2017 creel survey.
- **Largemouth Bass:** Largemouth Bass were the most sought-after species in Lake Conroe, and the population has provided high quality angling opportunities. The current lake record Largemouth Bass, caught in January 2009, weighed 15.93 pounds and measured 27 inches in length. The record Largemouth Bass was one of four fish entered into the Toyota ShareLunker Program in the 2008-2009 season. Three individuals weighing 13 pounds or more have been submitted since that season: one in 2015, 2019, and 2021.
- **Crappies:** Both Black Crappie and White Crappie have provided angling opportunities at Lake Conroe. Angling effort for crappie increased in the 2021-2022 creel survey compared to that of the previous survey in 2016-2017.

Management Strategies: Hybrid Striped Bass and Florida Largemouth Bass stockings will be requested annually. Continue to work with SJRA, the Lake Conroe Association (LCA), the Seven Coves Bass Club (SCBC), and other interested groups to address the ongoing problem of exotic vegetation control and native vegetation restoration at Lake Conroe.

Introduction

This document is a summary of fisheries data collected from Lake Conroe from June 2021 through May 2022. The purpose of this document is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other species of fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2021-2022 data for comparison.

Reservoir Description

Lake Conroe is a 20,118-acre reservoir located on the West Fork of the San Jacinto River in Montgomery and Walker Counties, Texas, lying within the Piney Woods Vegetation Area. Soil types are generally a deep and moderately well drained combination of sand, loam, and clay (Conroe, Wicksburg-Susquehanna, and Ferris-Houston Black-Kipling soil associations). The SJRA, the TWDB, and the City of Houston constructed Lake Conroe in 1973 to supply water for municipal and industrial purposes (Table 1). The Sam Houston National Forest borders most of the upper third of Lake Conroe, and considerable private and commercial real estate development surrounds the lower two-thirds. Water level has been generally stable with a typical 1- to 2-foot drop in water level during the summer. The exceptions have been in 2001 when drought conditions caused summer water level to fall 3 feet below conservation pool elevation, in 2005–2006 when damage to the dam caused by Hurricane Rita required the water level to be held at 4 feet below pool for about 6 months, in the drought of 2010-2013 when the reservoir ranged from 3- to 8-feet low, and in late summer of 2017 when Hurricane Harvey created flood conditions exceeding pool elevation (Figure 1). Littoral habitat at Lake Conroe is provided by standing timber in the upper third of the reservoir, riprap along the dam and FM 1097 and FM 1375 bridges, and various vegetation types including submersed, emergent, and floating-leaved native species.

Angler Access

Boat access is adequate with one free public ramp, two U.S. Forest Service ramps, and five marinas with ramps accessible for a fee. However, public bank access is limited to the U.S. Forest Service parks in the upper reservoir and one public park owned and maintained by the SJRA and Montgomery County near the dam. When the reservoir was 8 feet low in 2011, only one marina and one Forest Service ramp provided public boat access to Lake Conroe. A renovation project for the FM 830 Boat Ramp is currently proposed by SJRA, Montgomery County, Texas Parks and Wildlife Department (TPWD), and Texas Department of Transportation. The renovation would include increased security, low water access, and bank angling access. Public access sites are listed in Table 2.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Best et al. 2018) included:

1. Manage vegetation coverage of native and exotic plant species to support fish communities while preventing water access impairments for all stakeholders through the development of management plans with the Lake Conroe Habitat Partnership (LCHP), which includes SJRA, the Lake Conroe Advisory Board (LCAB), Seven Coves Bass Club (SCBC), and other stakeholders. Specific strategies mentioned in Best et al. 2018 were regular meetings with the LCAB, annual vegetation surveys, introduction of native aquatic plant species, maintenance of a native aquatic plant nursery, treatment of exotic species with an Integrated Pest Management (IPM) plan, and development of stocking recommendations for triploid Grass Carp focused on the lowest effective stocking rate possible should hydrilla reemerge.

Actions: TPWD surveyed the native and exotic vegetation community annually and presented survey results at the LCHP meeting, where members also discussed exotic vegetation control needs and native vegetation establishment efforts. During the 2019 meeting, members discussed a response plan for when hydrilla reemerged.

SJRA has maintained the native aquatic plant nursery below the Lake Conroe Dam and planted native aquatic vegetation in Lake Conroe with assistance from TPWD, SCBC, and other community volunteers. Native vegetation coverage has expanded from 204 acres to 1,302 acres since the last report period.

SJRA continues to lead in controlling water hyacinth and giant salvinia abundance through contract-managed herbicide applications.

In 2020 hydrilla was found growing outside of native plant establishment enclosures. The LCHP agreed to spot treat hydrilla colonies with herbicide and stock limited, incremental numbers of grass carp.

2. Continue to meet with the LCHP annually to discuss habitat management and inform the public about fisheries issues, including exotic species control efforts, vegetation restoration efforts, and fish stocking in Lake Conroe.

Action: Meet with the LCHP annually to discuss the state of hydrilla at Lake Conroe and management options. Local magazine articles, press releases, and social media posts were distributed multiple times a year highlighting fisheries and habitat management at Lake Conroe.

3. Maximize trophy potential of the Largemouth Bass fishery through regular stockings of Florida strain Largemouth Bass (FLMB), optimizing regulations, and continuing to increase native vegetation.

Actions: FLMB have been stocked in Lake Conroe annually during this report period for a total of 380,893 fish since 2018. Additionally, 23,917 ShareLunker offspring were stocked in 2019-2021 and 109,680 Lone Star Bass were stocked in 2022.

In 2018, changing the length limit for Largemouth Bass from a 16-inch minimum to a 14-inch minimum length limit was proposed to simplify statewide regulations. The proposed change was not popular among Largemouth Bass anglers on lake Conroe, who preferred to protect larger fish. The regulation was not changed, and the 16-inch minimum length limit remains in place.

SJRA has maintained the native aquatic plant nursery below the Lake Conroe Dam and planted native aquatic vegetation in Lake Conroe with assistance from TPWD, SCBC, and other community volunteers. Native vegetation coverage has expanded from 204 acres to 1,302 acres since the last report period.

4. Maintain Hybrid Striped Bass fishery through regular stockings, increase interest in the fishery, and assess angler opinions through regular communication with guides and anglers.

Action: Hybrid Striped Bass (Palmetto and Sunshine Bass) were stocked annually from 2019-2022. Regular communication with Hybrid Striped Bass guides and anglers was established. Responded to angler requests for stocking updates that were shared on fishing forums.

5. Educate marinas and the public about the threat of aquatic invasive species introductions at Lake Conroe.

Action: TPWD staff worked with marina owners to post signs and notify the public of the threat of invasive species. Several marina owners intercepted zebra mussel-infected vessels before they could be launched and referred owners to TPWD and SJRA for decontamination.

Harvest regulation history: Sport fishes are currently managed under statewide fishing regulations except for Blue Catfish, Channel Catfish, and Largemouth Bass (Table 3). Largemouth Bass were under the statewide 14-inch minimum length limit until September 1, 1993, when the Lake Conroe minimum length limit was increased to 16 inches. White Bass regulations have fluctuated from a 10-inch minimum length limit (September 1, 1988) to a 12-inch minimum limit (September 1, 1992) and back to 10 inches (September 1, 2003); all maintained a 25 fish bag limit. Channel Catfish were regulated under an experimental 14-inch minimum length limit beginning in 1992, but the regulation was changed in 1995 to the statewide 12-inch minimum length limit. From 1995-2021, Blue Catfish and Channel Catfish were both managed under a statewide 12-inch minimum length limit. Since September 2021 Blue and Channel Catfish have been managed under a trophy-oriented regulation, allowing for a 25-fish bag of which no more than 5 fish 20 inches or greater in length may be retained, and no more than 1 of those can be 30 inches or longer. Current regulations are found in Table 3.

Stocking history: Hybrid Striped Bass were first introduced in 1978 and have been stocked regularly since 1995. Florida Largemouth Bass were first introduced in 1979. Subsequent regular stockings have resulted in a Largemouth Bass population heavily influence by Florida-strain genetics and growth potential. Lake Conroe has also been stocked with fish from the ShareLunker Program, including direct offspring (aka "ShareLunker Largemouth Bass") and 2nd generation offspring of pure Florida strain ShareLunker Largemouth Bass that have proven to be able to grow to ≥ 13 pounds (aka "Lone Star Bass").

Diploid Grass Carp were stocked in 1981 and 1982 and infertile triploid Grass Carp were stocked from 2006-2008 as a part of an IPM plan for the control of hydrilla: natural mortality reduced this population to an estimated 1,103 fish by 2019. In 2020 and 2022, a small number of triploid Grass Carp were stocked as part of an updated IPM plan for the management of hydrilla that also allows for native vegetation species to persist in the reservoir.

The complete stocking history is presented in Table 4.

Vegetation/habitat management history: Lake Conroe has standing timber in the upper third of the reservoir and riprap along the dam, the FM 1097 bridge, and the FM 1375 bridge. Additional submerged structural habitat from roads and equipment prior to impoundment are also distributed through the reservoir.

Lake Conroe has a complicated and contentious history with vegetation management. Hydrilla was first encountered shortly after impoundment in 1973. By 1979, roughly half of Lake Conroe's surface area (approx. 10,000 acres) was covered by topped-out hydrilla, drastically limiting access and recreational use. In response to public concerns, the Texas Legislature directed Texas A&M University in conjunction with the Lake Conroe Association to stock 270,000 diploid Grass Carp into the reservoir in 1981 and 1982. By 1983, Klussman et al. (1988) reported that macrophytes had been almost completely removed from the reservoir.

Lake Conroe remained largely devoid of aquatic vegetation until 1995 when TPWD in conjunction with United States Army Corp of Engineer's Lewisville Aquatic Ecosystem Research Facility (USACE-LAERF), SJRA, LCRA, and SCBC—a chapter of Texas Black Bass Unlimited (TBBU)—began establishing native aquatic vegetation founder colonies of several species of native submersed, emergent, and floating-leaved vegetation into the reservoir. Hydrilla re-emerged at Lake Conroe in 1996 and TPWD and SJRA successfully treated hydrilla with herbicides while allowing the native vegetation to expand for the next nine years.

However, in 2005 hydrilla coverage increased to over 868 acres which was beyond SJRA and TPWD's ability to control through herbicide application alone. Combined with increasing concerns about reduced access and recreational opportunities, this created the need for a long-term, comprehensive hydrilla management plan that accounted for the needs of all Lake Conroe's stakeholders. The Lake Conroe Habitat Partnership was formed to develop an IPM plan, which included biological control of hydrilla via incremental stockings of triploid Grass Carp, chemical control through herbicide applications, and

ecological control through support of native plant species that would compete with hydrilla. Triploid Grass Carp were stocked in from 2006-2008. These stockings successfully reduced hydrilla to levels consistent with management goals, but they also greatly reduced native vegetation coverage and shifted the plant community composition from submersed species to Grass Carp-resistant emergent species. TPWD, SJRA, SCBC, B.A.S.S., TBBU, U. S. Fish and Wildlife Service (USFWS), and USACE-LAERF continued to support native vegetation populations in Lake Conroe by planting founder colonies in wire mesh enclosures to protect plants from herbivory, following best management practices as described in Webb et al. 2012. Planting efforts focused on a five-mile stretch of the Caney Creek shoreline where over 20,000 plants have been planted since 2012. Planted species included American water willow, spatterdock, wild celery, American pondweed, Illinois pondweed, bulrushes, spike rushes, American white water lily, and bull tongue. These species have expanded outside of the Caney Creek arm and are now found across the upper third of the reservoir.

Water hyacinth was found in Lake Conroe shortly after the reservoir was impounded and continues to exist there. Giant salvinia was first discovered in the spring of 2000 but was confined to one cove and was successfully treated by TPWD and SJRA; however, it reappeared in 2002. Both species have been controlled with bio-control insects and herbicide. Common salvinia was found intermixed with giant salvinia in 2021.

Water transfer: No inter-basin transfers exist.

Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Lake Conroe (Best et al. 2018). 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 (2 hours at 24, 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 16 randomly selected fish (range 15.0 to 16.9 inches). In 2021, electrofishing was conducted with a Smith Root Apex system powered by a fuel injected Honda EU7000iS generator.

Gill netting – Blue Catfish, Channel Catfish, White Bass, and Hybrid Striped Bass were collected by gill netting (15 net nights at 15 stations). CPUE for gill netting was recorded as the number of fish caught per net night (fish/nn). Ages for Hybrid Striped Bass were determined using otoliths from 12 randomly selected fish (range 17.0 to 18.9 inches).

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). Palmetto Bass PSD was calculated according to Dumont and Neely (2011). Index of Vulnerability (IOV) was calculated for Gizzard Shad (DiCenzo et al. 1996). Standard error (SE) was calculated for structural indices and IOV. Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE and creel statistics.

Creel survey – A roving creel survey was conducted from June 2021 through May 2022. Angler interviews were conducted on 5 weekend days and 4 weekdays per quarter to assess angler use and fish catch/harvest statistics in accordance with the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2017). Effort per acre and black bass catch rates were analyzed using generalized additive models (Smith et al. 2021; Wood 2006) to depict changes over time.

Habitat – A structural habitat survey was conducted in 2013 and has not changed significantly since. Vegetation surveys were conducted annually in 2018-2021 to monitor expansion of hydrilla, native vegetation establishment success, and spread of other exotic nuisance vegetation including water hyacinth and giant salvinia. Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2017).

Water level – Source for water level data was the United States Geological Survey (USGS 2022).

Results and Discussion

Habitat: Structural shoreline habitat in Lake Conroe consists of rip rap along the dam and the FM 1097 and FM 1375 bridges, standing timber in the upper third of the lake, bulkhead and boat docks in the lower half of the lake, natural shoreline, and both native and exotic aquatic vegetation. The structural habitat survey in 2013 indicated that the predominant shoreline habitat was bulkhead and boat docks that encompassed over 50% of the total shoreline (Table 6). The upper third of the reservoir lies within the Sam Houston National Forest and is protected from commercial and residential development; most of the ecologically functional shoreline habitat occurs in this section of the reservoir.

Native emergent, floating-leaved, and submersed aquatic vegetation has continued to expand and there were 1,232 acres in 2020 and 1,302 acres of native vegetation in 2021 (Table 7, Appendix C). Expansion of American water willow, wild celery, and pondweeds have been the most notable increases in native plant abundance. SJRA continues to maintain the Lake Conroe Dam native vegetation nursery and SJRA and TPWD continue to introduce nursery-grown plants into Lake Conroe annually.

Water hyacinth and giant salvinia are present in Lake Conroe. Amounts of each fluctuate with water levels and treatment efforts, which results in populations that can vary greatly in coverage within years and between years (Table 7. Survey of aquatic vegetation, Lake Conroe, Texas, 2018-2021. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.). Common salvinia was positively identified as well during the 2021 vegetation survey. SJRA continues control efforts through herbicide applications throughout the summer growing season.

In July 2020, hydrilla was found free growing, without out protection from herbivory in the Caney Creek arm of Lake Conroe (Appendix C). The hydrilla was found in small, single colonies but marked the first time it had reemerged from dormant tubers in the reservoir sediment since 2008. The Lake Conroe Habitat Partnership agreed to implement a hydrilla management plan that included regular surveys and herbicide spot treatment of hydrilla colonies by TPWD and limited stockings of triploid Grass Carp. Agreed upon Grass Carp stocking rates were based on the goal of replacing the number of Grass Carp lost in the previous year. A 30% annual mortality rate was used based on Kirk et al. 2000. Thus, in 2019 there were an estimated 1,103 Grass Carp present in Lake Conroe and the estimated population fell to 750 in 2020. Five hundred and one triploid Grass Carp were stocked to replace the lost fish and to account for initial mortality of stocked fish, resulting in a final rate of 0.06 fish/surface acre. No triploid Grass Carp were stocked in 2021 due to COVID-19 pandemic complications, and hydrilla continued to reemerge from dormant tubers in other areas of the reservoir (Appendix C). In 2022, 1,044 triploid Grass Carp were stocked to again replace natural mortality from 2020 and 2021 and individual colonies of hydrilla were treated with herbicide.

Creel: Total angling effort on Lake Conroe remained consistent at 471,261 hours in 2021-2022 compared to 454,627 hours in 2016-2017 (Table 9). Total angling expenditures decreased by half to \$2,932,603 between 2016-2017 and 2021-2022; however, the relative standard error (RSE) for the projected expenditures was much lower (28) compared to the 2016-2017 creel survey results (168). Largemouth Bass was the most popular target species (38% of angler effort), closely followed in popularity by catfish (27%, Table 8). Percentages of directed effort for crappies, temperate basses, and sunfish were 14%, 3%, and <1%, respectively. The majority of angling effort came from boat anglers (81% boat anglers, 19% bank anglers).

Generalized additive models using historical creel surveys from 2004-2021 showed total fishing effort has increased significantly over time (GAM, $p < 0.004$, Smith et al. 2021, Wood 2006).

Prey species: Threadfin Shad was the dominant prey species in the 2021 electrofishing survey with a catch rate of 1,040/h (Appendix A). Bluegill was the second most abundant species (267/h, Figure 4), followed by Gizzard Shad (162/h, Figure 3) and Longear Sunfish (117/h, Appendix A). Prey species abundance in 2021 was reduced compared to 2017 for Bluegill but showed an increase in Threadfin Shad, Gizzard Shad, and Longear Sunfish. Catch rates for 2017 were 328/h for Bluegill, 60/h for Longear Sunfish, 76/h for Gizzard Shad, and 300/h for Threadfin Shad. The Index of Vulnerability (IOV) for Gizzard Shad was 74 in 2021 and 86 in 2019, indicating the proportion of Gizzard Shad that were a suitable size for predator fish consumption had almost doubled when compared to the IOV of 39 observed in 2017.

The 2021-2022 creel survey indicated a decrease in fishing effort and harvest for sunfish species. Fishing effort for sunfish was 1,851 hours during the 2021-2022 creel survey, a significant decrease from the 17,911 hours estimated for the 2016-2017 survey.

Catfishes: Both Blue Catfish and Channel Catfish occur at Lake Conroe, but Channel Catfish are the more abundant species (Appendix A).

Gill net catches of Blue Catfish have improved since 2008 when catches reached a low of 1.6/nn (Webb et al. 2014). The catch rate in spring 2022 was 9.3/nn, similar to the 2018 catch rate of 9.5/nn (Figure 5). Blue Catfish ≥ 30 inches total length were observed in all samples. The length distribution of the 2018, 2020, and 2022 samples indicated good reproduction and recruitment, and body condition of fish was good for most inch groups across all samples ($W_r > 90$). Anglers harvested an estimated 31,004 Blue Catfish during the 2021-2022 creel period, an increase from the 20,307 fish harvested during the 2016-2017 creel period (Table 10). Blue catfish observed in the creel ranged in length from 10 to 27 inches (Figure 7).

The gill net catch rate of Channel Catfish in spring 2022 was 19.8/nn, higher than the 2020 catch rate of 16.1/nn, but similar to the 19.7/nn observed in 2018 (Figure 6). Body condition of fish was good ($W_r > 90$) for most inch groups across all samples. During the 2021-2022 creel period, anglers harvested an estimated 111,732 Channel Catfish, a slight decrease from the estimated 139,076 fish harvested in 2016-2017 (Table 10). Channel catfish harvested ranged from 10 to 24 inches in length in 2021-2022 (Figure 8).

Temperate Basses: White Bass are present in Lake Conroe and exhibited an increase in catch rate and harvest from previous years, but Hybrid Striped Bass are more abundant and consistently support the temperate bass fishery.

Gill net catch rates of White Bass have been low and variable since 2006 (< 2.0 /nn) (Appendix A, Best et al. 2018, Webb et al. 2014). During the most recent creel period an estimated 12,629 White Bass were caught and 11,781 were harvested, a large increase from the 1,244 caught and 178 harvested during the 2016-2017 creel period (Table 11). Twenty-nine White Bass ranging from 12-19 inches in length were observed during the creel survey (Figure 11). Increased seasonal (spring) inflows into Lake Conroe during 2021 and the associated availability of spawning habitat are likely responsible for the recent increase in angler success.

Gill net catch rate of Hybrid Striped Bass was 2.5/nn in 2022, which is consistent with previous years: 1.5/nn in 2020 and 4.3/nn in 2018 (Figure 9). Most Hybrid Striped Bass collected ranged from 16 to 24 inches in total length and body condition was good ($W_r > 80$) for most inch groups across all samples. During the 2021-2022 creel survey, anglers harvested an estimated 7,561 Hybrid Striped Bass and released a similar percentage of legal-sized fish (8%) compared to the 2016-2017 creel period (11%) (Table 11). Hybrid striped Bass ranging from 14 to 24 inches were observed in the creel survey (Figure 10). Average age at legal harvest size (18 inches) Hybrid Striped Bass was approximately 2.08 years ($N = 12$, range = 2-3 years).

The 2021-2022 creel survey indicated that directed effort for temperate basses (12,658 h) had not changed significantly since the 2016-2017 creel survey (12,895 h). Angling success for temperate bass anglers increased from 0.40 fish/h in 2016-2017 to 0.72 fish/h in 2021-2022 but remained significantly lower than the 3.41 fish/h estimated during the 2012-2013 creel period (Table 11).

Black basses: Both Largemouth Bass and Spotted Bass occur at Lake Conroe, but Spotted Bass are few and do not contribute significantly to the black bass fishery. The total electrofishing catch rate of Largemouth Bass was 67.5/h in 2021, 98.0/h in 2019, 80.0/h in 2017, 66.5/h in 2015 and 67.5/h in 2010 (Figure 12). Catch rate for stock-sized Largemouth Bass was 38.5/h in 2021, 54.5/h in 2019, 62.0/h in 2017, 51.0/h in 2015, 25.0/h in 2013, and 44.5/h in 2010. Random site selection placed 80% of electrofishing sites in the lower, highly developed portion of the reservoir where complex structure and vegetation is rare. This could account for the lower catch rates in 2021. The population size distribution is good with PSD ranging from 48-74 since 2010. Although the majority of Largemouth Bass caught in electrofishing were less than the 16-inch minimum length limit, there were quality fish available with a PSD-16 of 16 in the 2022 survey and fish up to 19 inches in length were collected. Average age of 16-inch (15.76-16.16 inches) Largemouth Bass was 3.56 years ($N = 16$, range = 3-5 years).

Trophy Largemouth Bass are present in Lake Conroe, and though large fish are rarely seen in fall electrofishing surveys, they are represented in submissions to the TPWD ShareLunker Program.

Between July 2018 and July 2022, 82 ShareLunkers over 8 pounds, 16 Elite Lunkers over 10 pounds, and 2 Legacy Lunkers over 13 pounds were entered into the ShareLunker Program.

Florida Largemouth Bass have been stocked in Lake Conroe regularly since 1979 and have increasingly contributed to the Largemouth Bass population. Since 1993, FLMB contribution to Lake Conroe bass genetics has increased from 46% to 76%. FLMB allele frequency has remained stable around 71% to 76% for several years (Table 13).

The Largemouth Bass fishery is the most popular at Lake Conroe. Directed effort for black basses has continued to increase with an estimated 168,095 hours of effort in 2021-2022, 164,486 hours in 2016-2017, and 92,177 hours in 2012-2013 (Table 12). Though effort has increased significantly (GAM, $p < 0.004$, Figure 13), angler catch rates have not significantly changed since 2004 (Table 12, Figure 14). Bass ranging from 14-18 inches were harvested by non-tournament anglers during the survey (Figure 15), while tournament anglers retained bass ranging from 16-22 inches (Figure 16). Historic harvest rates of legal-sized Largemouth Bass are variable on Lake Conroe. Non-tournament anglers harvested 44% of legal-sized fish in 2004-2005, 19% in 2006-2007, 20% in 2008-2009, 8% in 2012-2013, 34% in 2016-2017, and 18% in 2021-2022. Tournament fishing effort was composed of live-release tournaments and accounted for 11% of Largemouth Bass fishing effort. Additionally, angler non-compliance was observed with two sub-legal fish observed in the creel (Figure 15).

Crappies: Black Crappie and White Crappie are present in Lake Conroe. Due to historically low catch rates, trap net sampling was discontinued in 2017. Angler creel surveys reflect an abundant population and productive fishery. Angling effort and success greatly increased during the 2016-2017 creel survey and again during the 2021-2022 survey. Angling effort for crappies was 14,101 hours during the 2012-2013, 38,111 hours during 2016-2017, and 60,651 hours in 2021-2022 (Table 14). An estimated 37,490 crappie were harvested during the 2021-2022 creel period with observed harvested fish ranging in length from 8 to 18 inches (Figure 17).

Fisheries Management Plan for Lake Conroe, Texas

Prepared – July 2022

ISSUE 1: Lake Conroe is a high-profile reservoir with diverse constituent groups who have great interest in all aspects of the reservoir’s management and habitat management and invasive species control continues to be a major focus at Lake Conroe. Hydrilla, giant salvinia, and water hyacinth have all been brought under control using IPM methods outlined in the Lake Conroe Habitat Management Plan and native vegetation has begun to expand throughout the upper third of the reservoir.

MANAGEMENT STRATEGIES

1. Continue to meet with the Lake Conroe Advisory Board annually, or more frequently as new information regarding habitat management or other issues becomes available.
2. Update the Lake Conroe Habitat Management Plan as needed in conjunction with SJRA and with input from the LCAB and other stakeholders.
3. Update the Lake Conroe Habitat Management Plan as needed in conjunction with SJRA and with input from the LCAB and other stakeholders.
4. Continue comprehensive vegetation surveys at end of each growing season and provide Lake Conroe Habitat Management Plan partners with updated information.
5. Continue to cooperate with SJRA, the SCBC, the USACE-LAERF, and others to maintain the native aquatic plant nursery below Lake Conroe Dam and plant Grass Carp-tolerant native aquatic vegetation in Lake Conroe to promote nursery habitat for juvenile Largemouth Bass and other important species.
6. Continue to cooperate with SJRA in treating exotic vegetation when necessary, using IPM methods outlined in the Lake Conroe Habitat Management Plan.
7. Cooperate with all partners to determine timing of minimal triploid Grass Carp stockings to maintain balance between native plant expansion and hydrilla control.
8. Continue to publish magazine articles and press releases whenever possible highlighting fisheries and habitat management issues at Lake Conroe.

ISSUE 3: Largemouth Bass at Lake Conroe provide a high-quality and popular fishery within easy driving of the Houston Metropolitan Statistical Area. Fishing effort in 2021-2022 was 18,991 tournament and 149,105 non-tournament angler hours. Lake Conroe has shown high trophy potential: the current lake record Largemouth Bass is 15.93 pounds; an estimated 998 fish between 7 and 9.9 pounds were caught during the 2021-2022 creel; and Lake Conroe has contributed 19 fish over 13 pounds to the ShareLunker program since 1994. Since July of 2018, 2 Legacy Lunkers (13+ pounds), 16 Elite Lunkers (10-12.9 pounds), and 82 Lunkers (8-9.9 pounds) were submitted to the ShareLunker program. It’s important we maintain this quality legacy for our anglers.

MANAGEMENT STRATEGIES

1. Request stocking of FLMB at a rate of 1,000/km of shoreline annually to maintain/maximize trophy production.

2. Continue public education efforts on the importance of native aquatic vegetation for Largemouth Bass production and work to protect native aquatic vegetation on Lake Conroe with the Lake Conroe Habitat Partnership and other partner organizations.
3. Continue to promote the ShareLunker program through social media, news releases, popular articles, and other means as available.

ISSUE 4: Hybrid Striped Bass support an important fishery at Lake Conroe that had an estimated 12,658 hours of directed fishing effort in the 2021-2022 creel survey. Regular communication with guides indicates Hybrid Striped Bass remain a popular target species at Lake Conroe. The quality of this fishery can only be supported through regular stockings, as the population cannot be sustained naturally.

MANAGEMENT STRATEGIES

1. Request stocking of Hybrid Striped Bass at a rate of 10/acre annually.
2. Continue regular communication with Hybrid Striped Bass guides and anglers to assess angler opinions and increase interest in the Hybrid Striped Bass fishery.

ISSUE 5: 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. Cooperate with the controlling authority to post appropriate signage at access points around the reservoir.
2. Contact and educate marina owners about invasive species, and provide them with posters, literature, etc... so that they can in turn educate their customers.
3. Educate the public about invasive species through the use of media and the internet.
4. Make a speaking point about invasive species when presenting to constituent and user groups.
5. Keep track of (i.e., map) existing and future inter-basin water transfers to facilitate potential invasive species responses.

Objective-Based Sampling Plan and Schedule (2022–2026)

Sport fishes in Lake Conroe include Blue Catfish, Channel Catfish, White Bass, Largemouth Bass, Black Crappie and White Crappie. Important forage species include Bluegill, Longear Sunfish, Gizzard Shad, and Threadfin Shad.

All sport fish species at Conroe contribute to the overall fishery and justify sampling effort.

Largemouth Bass

Largemouth Bass are the most popular sport fish in Lake Conroe and warrant significant sampling time and effort. Angler effort for black basses was 168,095 angler hours and 38% of the total directed angling effort during the June 2021-May 2022 creel survey.

Traditionally, Largemouth Bass were sampled on Lake Conroe every 2 years for trend data on relative abundance, size structure, growth, and condition. Continuation of biennial trend data with fall night electrofishing will be sufficient to accomplish the survey objective of determining any large-scale changes in the Largemouth Bass population that may spur further investigation.

Sampling objectives for Largemouth Bass will include relative abundance (CPUE), size structure (PSD and length frequency), growth (length at age of 13 fish within an inch of the minimum size-limit), and condition (mean W_r of all fish). Bootstrap analysis of fall 2021 electrofishing data suggests these sampling objectives can be met with 24 randomly selected 5-minute electrofishing stations with CPUE RSE values of less than 25. If necessary, additional biologist-selected sites will be sampled for Largemouth Bass only to collect 13 specimens 15.0-16.9 inches in length to estimate mean age at legal length.

Catfishes

Blue Catfish and Channel Catfish combined accounted for 27% of directed angler effort during the most recent creel survey (June 2021–May 2022). Blue Catfish and Channel catfish relative abundance, size structure, and condition trend data have been collected every 2 years. Due to the new trophy-oriented catfish regulations that went into effect on September 1, 2021, the 2-year survey interval will be continued to allow for the detection of any large-scale population fluctuations.

Sampling objectives for Blue Catfish and Channel Catfish will include relative abundance (CPUE) size structure (PSD and length frequency), and body condition (W_r). Boot strap analysis of 2022 spring gill netting data indicates that 15 gill nets will obtain data with acceptable precision. Fifteen randomly selected gill net sites will be sampled to achieve a CPUE RSE < 25 for each species and to collect at least 50 stock-sized individuals of each species.

Crappies

Directed effort for crappies was 60,651 hours and represented 14% of the total directed angler effort during the June 2021 through May 2022 creel survey, an increase in effort since the 2016-2017 creel survey. However, between the 2016-2017 and 2021-2022 creel surveys, catch rates decreased from 2.74/h to 0.66/h, and harvest decreased from 76,424 to 37,490 fish.

Crappie are an important sport fish at lake Conroe. Historical crappie surveys, conducted with 15 single-cod, shoreline set trap nets in late fall, had low catch rates (0-2.5 /nn from 2003-2013) with high

variability. Bootstrap analysis of historical data estimates greater than 15 trap nets would be needed obtain acceptable numbers of fish ($N > 50$) or precision ($RSE < 25$) to estimate relative abundance or size structure. Therefore, survey and sample objectives for crappies will be measured as presence/absence with electrofishing and gill netting efforts. Creel surveys will also indicate long-term changes in the fishery that may warrant further investigation or management action.

Temperate Basses

The temperate bass fishery in Lake Conroe is supported by White Bass and Hybrid Striped Bass and directed angling effort for White Bass and Hybrid Striped Bass was 12,658 angler hours (2.8% of total effort) during the 2021-2022 creel survey. Additionally, guide services and individuals frequently provide anecdotal effort reports which were not captured in the creel survey. Hybrid Striped Bass have been stocked annually since 2002 with the exceptions of 2010, 2012, 2016, and 2017. White Bass are present in the reservoir and there has been a recent increase in angler success, likely due to increased seasonal (spring) inflows into Lake Conroe during 2021; however, gill net catch rates remain low.

Bootstrap analysis of data from the 2021 gill net survey suggests over 25 gill net nights would be required to obtain reliable data for relative abundance (CPUE with an RSE of less than 25), size structure, age and growth, or body condition analysis. Temperate bass also have relatively low percentage of angler effort. Therefore, the sampling objective for temperate bass will be the same as for catfish sampling efforts to assess stocking success, availability to anglers, and to determine large-scale changes in the population that may warrant further investigation or management action. Regular communication will also continue with Hybrid Striped Bass guides and anglers to assess the Hybrid Striped Bass stocking success and angling effort and success.

Forage Species

Bluegill, Longear Sunfish, Gizzard Shad, and Threadfin Shad are the primary forage at Lake Conroe and trend data on relative abundance and size structure have been traditionally collected every 2 years along with Largemouth Bass surveys. Continuing biennial sampling, as per Largemouth Bass sampling above, will accomplish the survey objective of monitoring for large-scale changes in sunfish and shad relative abundance and size structure. No additional effort will be expended beyond effort necessary to achieve Largemouth Bass objectives. Largemouth Bass body condition (W_r) will be used for supplemental qualitative assessment of prey availability if needed.

Creel

Lake Conroe hosts multiple popular fisheries that supported an estimated 471,261 angler hours of fishing and contributed an estimated \$2,932,603 to the local economy during the 2021-2022 creel survey. A creel survey will be conducted in June 2025-May 2026 to monitor trends in angling effort, angling expenditures, catch, and harvest. The creel will supplement information on population trends for species with historically low sampling success.

Habitat

Aquatic vegetation coverage on Lake Conroe has fluctuated widely and has been among the most controversial aspect of the reservoir since it was constructed. Physical conditions on Lake Conroe are highly favorable for the growth of multiple aquatic species; overgrowth of some species, primarily hydrilla, has prevented access to resources in the past for some constituent groups. Aquatic vegetation

management on Lake Conroe is managed with multiple constituent groups in mind. Therefore, comprehensive aquatic vegetation surveys will be conducted annually at the beginning of the growing season to assess the plant community composition and distribution, distribution of invasive nuisance aquatic species, assess success of native vegetation planting efforts. In addition, a hydrilla-only survey will be conducted in March before annual reduced water levels occur in April, and again in July or August following any herbicide treatments, before annual reduced water levels occur in September, to more closely monitor hydrilla re-emergence and expansion.

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Tables and Figures

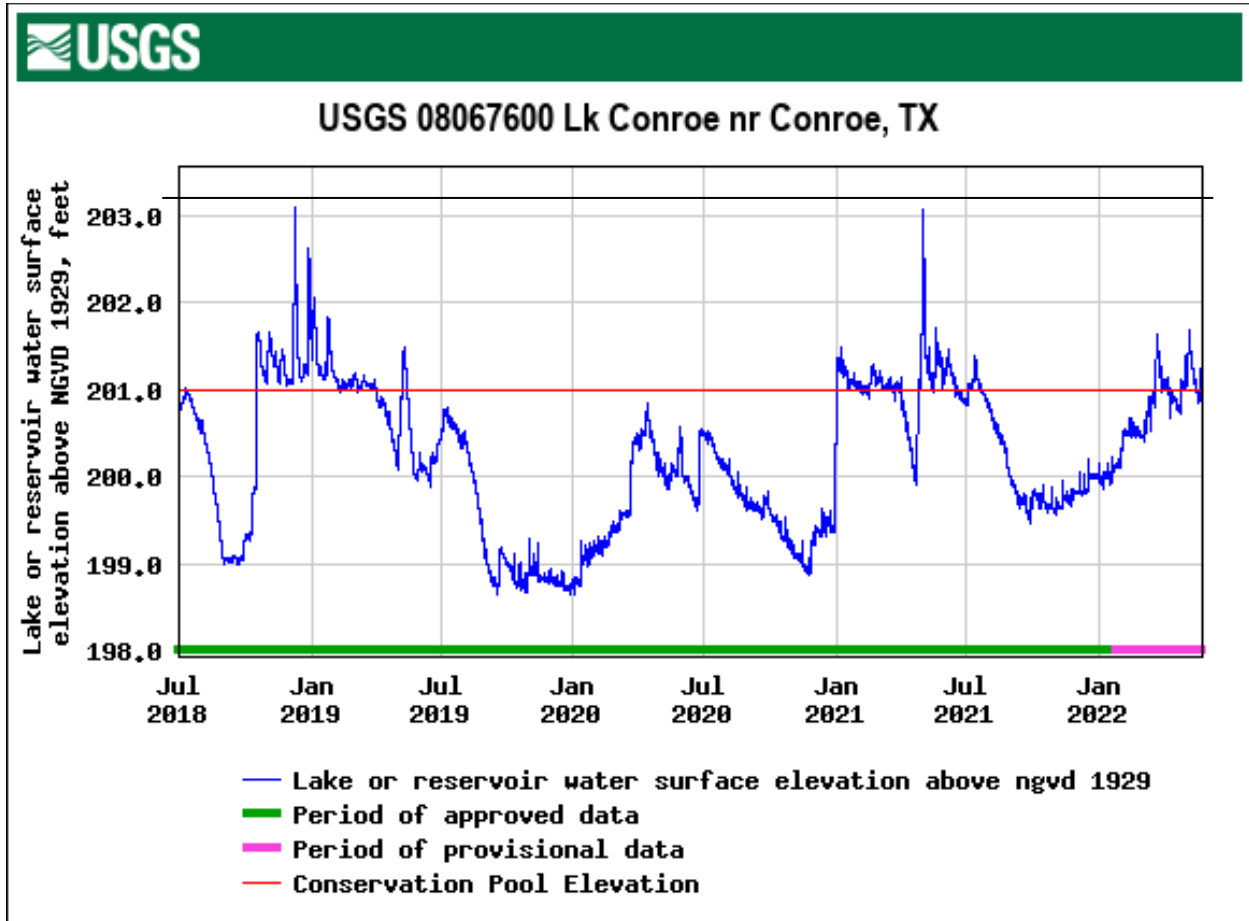


Figure 1. Daily water level elevations in feet above mean sea level (MSL) recorded for Lake Conroe, Texas.

Table 1. Characteristics of Lake Conroe, Texas.

Characteristic	Description
Year constructed	1973
Controlling authority	San Jacinto River Authority
Counties	Montgomery and Walker
Reservoir type	Mainstem
Shoreline Development Index	7.4
Conductivity	140-260 $\mu\text{S/cm}$

Table 2. Boat ramp characteristics for Lake Conroe, Texas, August 2021. Reservoir elevation at time of survey was 201 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Stubblefield Lake	30.563786 -95.635954	Y	5	199	Good
Cagle Recreation Area	30.518659 -95.591728	Y	45	192	Good
Stow-a-way Marina	30.473740 -95.567825	N	36	195	Good
Scott's Ridge	30.453716 -95.629961	Y	32	195	Good
FM 830 Ramp	30.413250 -95.571670	Y	20	194	Needs improvement
April Plaza Marina	30.373256 -95.633740	N	46	195	Good
Pier 105 Marina	30.363538 -95.596496	N	40	192	Good
Lakeview Marina	30.356824 -95.581341	N	56	195	Good

Table 3. Harvest regulations for Lake Conroe, Texas.

Species	Bag limit	Length limit
Catfish: Channel and Blue Catfish, their hybrids and subspecies	25 ^a (in any combination)	no minimum
Catfish, Flathead	5	18-inch minimum
Bass, White	25	10-inch minimum
Bass, Hybrid Striped	5	18-inch minimum
Bass, Largemouth	5 ^b	16-inch minimum
Bass, Spotted	5 ^b	None
Crappie: White and Black Crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum

^a Of which, only 5 \geq 20 inches and only 1 \geq 30 inches

^b Daily bag for Largemouth Bass and Spotted Bass = 5 fish in any combination.

Table 4. Stocking history of Lake Conroe, Texas. FRY = < 1 inch; FGL = fingerling, 1-3 inches; AFGL = advanced fingerling, ≥ 8 inches; ADL = adults.

Year	Number	Size	Year	Number	Size
<u>Walleye</u>			<u>Largemouth Bass</u>		
1973	5,900,000	FGL	1970	75,000	FGL
1974	4,500,000	FGL			
Species Total	10,400,000		<u>Florida Largemouth Bass</u>		
<u>Striped Bass</u>			1979	549,104	FGL
1994	210,000	FGL	1988	55,278	FGL
<u>Hybrid Striped Bass (Palmetto Bass)</u>			1989	52,148	FGL
1978	119,313	FGL	1990	51,256	FGL
1979	210,950	FGL	1991	151,453	FGL
1980	126,000	FGL	1992	209,310	FGL
1995	212,900	FGL	1993	101,217	FGL
1996	102,228	FGL	1994	103,416	FGL
1997	123,097	FGL	1995	526,806	FGL
1998	217,800	FGL	1996	543,871	FGL
1999	106,338	FGL	1997*	40,000	FGL
2002	105,170	FGL	1999	29,607	FGL
2003	151,195	FGL	2000	296,696	FGL
2004	201,554	FGL	2000*	31,050	FGL
2005	201,367	FGL	2001	448,267	FGL
2006	132,429	FGL	2002*	40,000	FGL
2007	169,027	FGL	2004	5,180	FGL
2008	217,000	FGL	2007	504,192	FGL
2009	104,045	FGL	2008	501,191	FGL
2011	117,360	FGL	2010	267,517	FGL
2013	95,642	FGL	2011	503,719	FGL
2014	100,694	FGL	2013	517,886	FGL
2015	201,920	FGL	2014	184,959	FGL
2016	105,812	FGL	2015	115,690	FGL
2019	142,124	FGL	2016	114,290	FGL
Species Total	3,263,965		2017	111,375	FGL
<u>Hybrid Striped Bass (Sunshine Bass)</u>			2018	111,061	FGL
2014	101,198	FGL	2019	106,669	FGL
2020	185,124	FGL	2020	56,199	FGL
2020	133,142	FRY	2021	44	ADL
2021	198,999	FGL	2021	106,920	FGL
2022	201,530	FGL	Species Total	6,540,452	
Species Total	819,993				

Table 4 Continued. Stocking history of Lake Conroe, Texas. FRY = < 1 inch; FGL = fingerling, 1-3 inches; AFGL = advanced fingerling, ≥ 8 inches.

Year	Number	Size	Year	Number	Size
<u>ShareLunker Largemouth Bass</u>			<u>Black Crappie</u>		
2006	4,592	FGL	1989*	99,850	FGL
2008	2,779	FGL	1992*	6,371	AFGL
2009	3,014	FGL	1994*	41,970	AFGL
2019	13,340	FGL	1996*	22,000	AFGL
2021	10,577	FGL	1998*	41,466	AFGL
Species Total	34,302		1999*	13,300	AFGL
			2000*	36,500	AFGL
<u>Lone Star Bass</u>			Species Total	261,457	
2022	109,680	FGL	<u>diploid Grass Carp</u>		
<u>Blue Catfish</u>			1981**	166,835	AFGL
1971	27,440	FGL	1982**	103,165	AFGL
<u>Channel Catfish</u>			Species Total	270,000	
1970	2,000	FGL	<u>triploid Grass Carp</u>		
1971	193,852	FGL	2006	27,441	AFGL
1973	68,570	FGL	2007	58,750	AFGL
Species Total	264,422		2008	37,839	AFGL
<u>White Crappie</u>			2020	501	AFGL
1990*	10,000	FGL	2022	1,044	AFGL
1992*	5,371	FGL	Species Total	125,575	
1995*	18,200		<u>Grass Carp (unknown ploidy)</u>		
1996*	26,444	FGL	2006	130	AFGL
Species Total	60,015	FGL			

* Stocking conducted by the Lake Conroe Restocking Association (LCRA).

** Stocking authorized by Texas Legislature in cooperation with Texas A&M University for research study on the effectiveness of Grass Carp at removal of the exotic plant hydrilla.

Table 5. Objective-based sampling plan components used to survey Lake Conroe, Texas, in 2021-2022.

Gear/target species	Survey objective	Metrics	Sampling objective
<i>Electrofishing</i>			
Largemouth Bass	Abundance	CPUE–Stock	RSE-Stock ≤ 25
	Size structure	PSD, length frequency	$N \geq 50$ stock
	Age-and-growth	Age at 16-inches	$N = 13, 15.0 - 16.9$ inches
	Condition	W_r	2 fish/inch group
	Genetics	% FLMB	$N = 30$, any age
Sunfishes, Bluegill and Redear ^a	Abundance	CPUE–Total	
	Size structure	PSD, length frequency	$N \geq 50$
Gizzard Shad ^a	Abundance	CPUE–Total	
	Size structure	Length frequency	$N \geq 50$
	Prey availability	IOV	$N \geq 50$
Crappie	Presence-absence		
<i>Gillnetting</i>			
Catfishes, Blue and Channel	Abundance	CPUE–stock	RSE-Stock ≤ 25
	Size structure	PSD, Length frequency	$N \geq 50$ stock
	Condition	W_r	5 fish/inch group
Temperate Basses, Hybrid Striped and White ^b	Abundance	CPUE–stock	
	Size structure	Length frequency	$N \geq 50$ stock
	Condition	W_r	5 fish/inch group
Crappie	Presence-absence		
<i>Roving Creel</i>			
Crappies, White Bass	Presence-absence		
All game species	General fishing pressure and harvest rates	Angling effort, Angling expenditures, Catch, and Harvest	

^a No additional effort was expended to achieve an RSE ≤ 25 for CPUE of 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.

^b No additional effort was expended to achieve an RSE ≤ 25 for CPUE of Hybrid Striped Bass and White Bass if not reached from designated catfish sampling effort.

Table 6. Survey of structural habitat types, Lake Conroe, Texas, 2013. Shoreline habitat type units are in miles and standing timber is acres.

Habitat type	Estimate	% of total
Bulkhead	13.2 miles	4.2
Natural shoreline	8.4 miles	8.5
Natural shoreline/Flooded terrestrial	9.8 miles	7.4
Natural shoreline/Native emerged	0.3 miles	0.2
Rock	6.5 miles	5
Under development	1.4 miles	1.1
Bulkhead/ Boat dock	70.2 miles	54.2
Bulkhead/ Standing timber	1.1 miles	0.9
Natural shoreline/ Standing timber	12.4 miles	9.4
Natural shoreline/Flooded terrestrial/ Standing timber	2.4 miles	1.8
Natural shoreline/Flooded terrestrial/ Native emergent	9.4 miles	7.2
Natural shoreline/Flooded terrestrial/ Native submersed	0.1 miles	0.1
Natural shoreline/ Native emergent	0.3 miles	0.2
Natural shoreline/Flooded terrestrial/ Standing timber/Native emergent	0.2 miles	0.1
Natural shoreline/Flooded terrestrial/ Native emergent/Native submersed	0.4 miles	0.3

Table 7. Survey of aquatic vegetation, Lake Conroe, Texas, 2018-2021. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Vegetation	2018	2019	2020	2021
Native submersed				137 (<1%)
Native floating-leaved				462 (2%)
Native emergent				704 (3%)
Native total	135 (1%)	332 (2%)	1,232 (6%)	1,302 (6%)
Non-native				
Alligator Weed (Tier III)	28 (<1%)	<1 (<1%)	0	3 (<1%)
Elephant ear (Tier III)	<1 (<1%)	<1 (<1%)	0	<1 (<1%)
Giant salvinia/common salvinia (Tier II)*	13 (<1%)	37 (<1%)	666 (3%)	154 (1%)
Hydrilla (Tier I)*	<1 (<1%)	0	<1 (<1%)	<1 (<1%)
Water hyacinth (Tier II)*	3 (<1%)	6 (<1%)	294 (1%)	48 (<1%)

*Tier I is immediate response, Tier II is maintenance, Tier III is watch status

Table 8. Percent directed angler effort by species for Lake Conroe, Texas, 2012-2013, 2016-2017, and 2021-2022. Survey periods were from June 1st through May 31st.

Species	2012/2013	2016/2017	2021/2022
Catfishes	29.9	31.8	26.7
Temperate Basses	4.1	2.8	2.8
Sunfishes	0.9	3.9	0.4
Largemouth Bass	51.1	36.2	37.8
Crappies	7.8	8.4	13.7
Anything	6.0	16.8	18.5

Table 9. Total fishing effort (h) for all species and total directed expenditures at Lake Conroe, Texas, 2012-2013, 2016-2017, and 2021-2022. Survey periods were from June 1st through May 31st. Relative standard error is in parentheses.

Creel statistic	2012/2013	2016/2017	2021/2022
Total fishing effort	184,408 (19)	454,627 (9)	471,261 (11)
Total directed expenditures	\$1,244,774 (27)	\$6,358,107 (168)	\$2,932,603 (28)

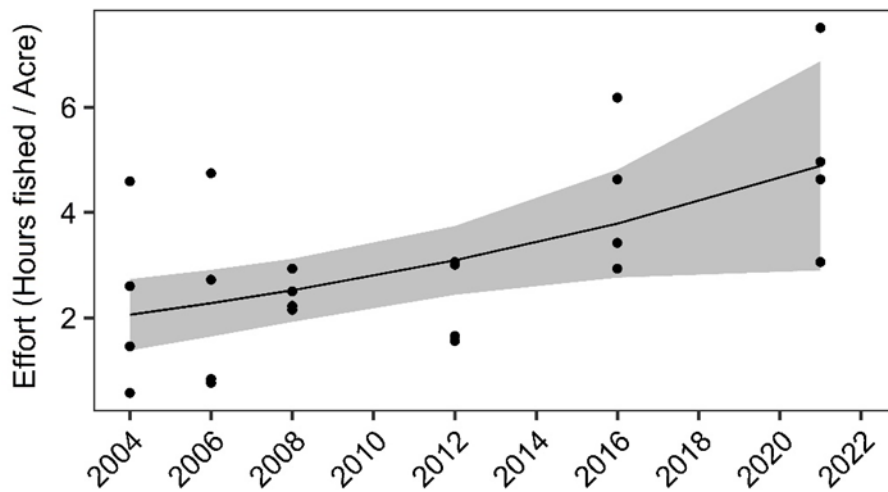
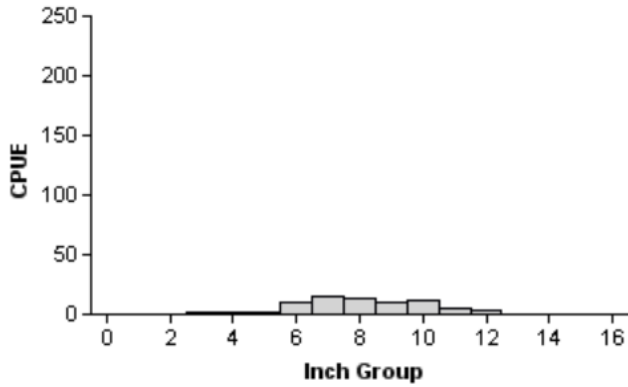


Figure 2. Total fishing effort (angler hours per acre) for Lake Conroe, Texas from 2004-2021 using generalized additive models (Smith et al. 2021; Wood 2006). Solid black line indicates the annual mean for total fishing pressure on Lake Conroe, black dots indicate total fishing effort for each quarter, and shaded area indicates the 95% confidence interval of the mean estimate.

Gizzard Shad

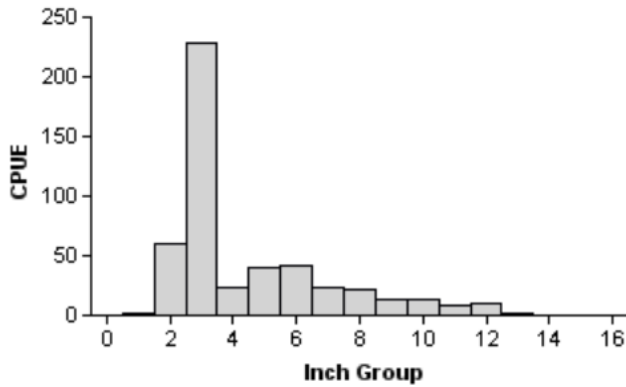
2017

Effort = 2.0
 Total CPUE = 76.0 (12; 152)
 IOV = 39 (7)



2019

Effort = 2.0
 Total CPUE = 489.5 (23; 979)
 IOV = 86 (5)



2021

Effort = 2.0
 Total CPUE = 162.0 (12; 324)
 IOV = 74 (4)

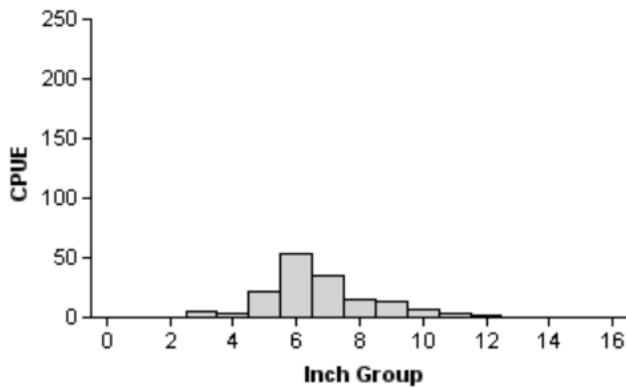


Figure 3. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Lake Conroe, Texas, 2017, 2019, and 2021.

Bluegill

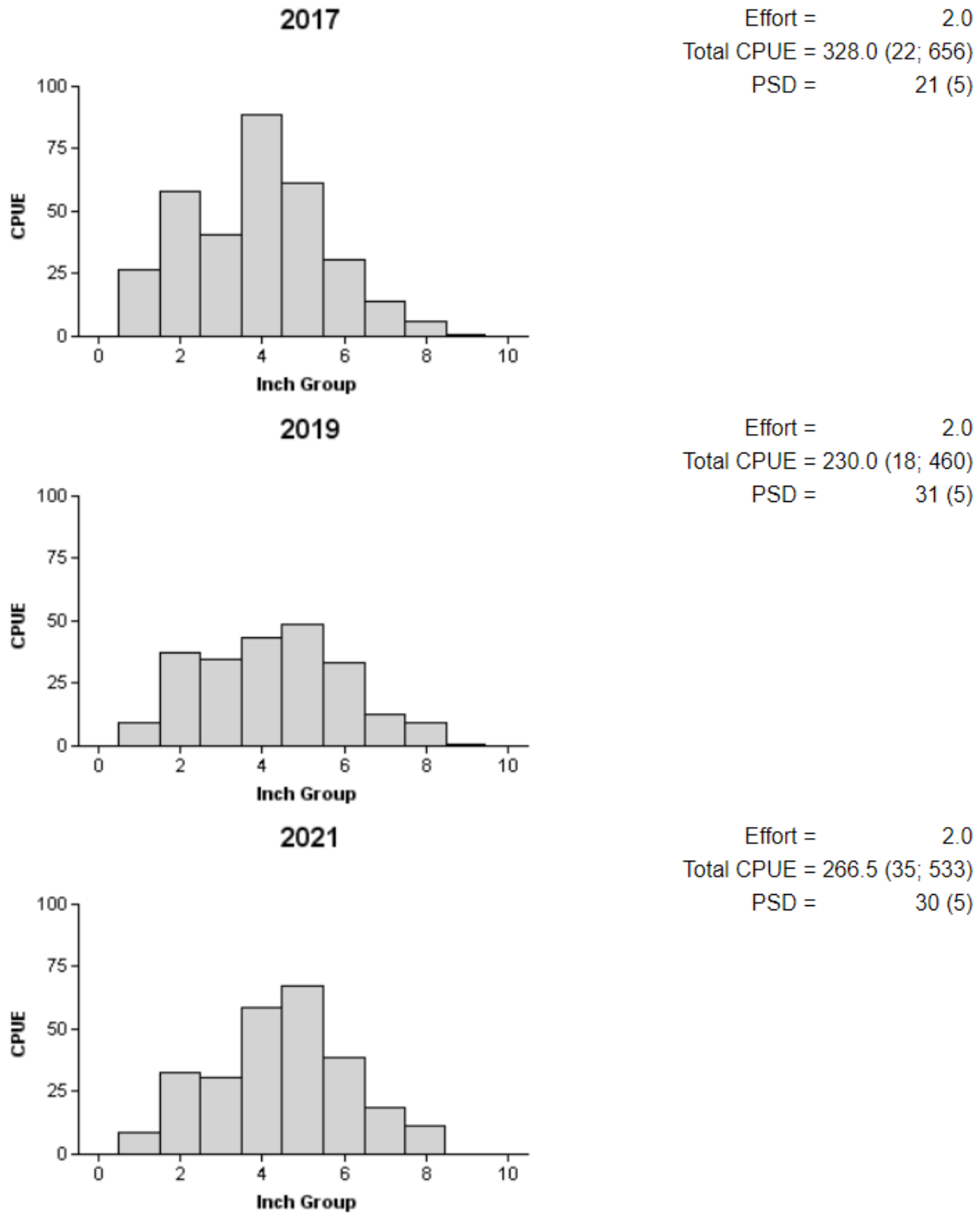


Figure 4. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Conroe, Texas, 2017, 2019, and 2021.

Blue Catfish

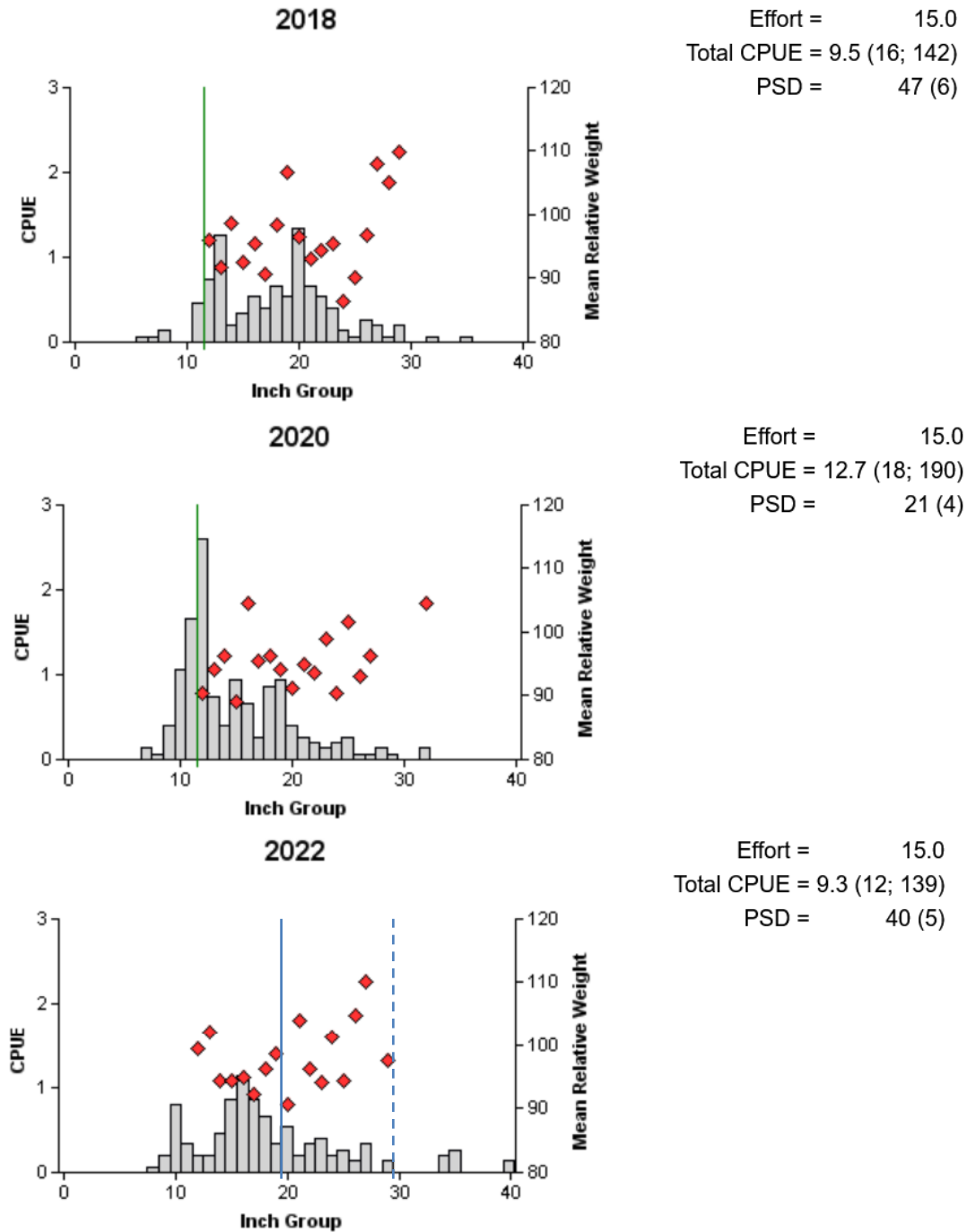


Figure 5. Number of Blue Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Conroe, Texas, 2018, 2020, and 2022. Vertical lines represent length limits for respective survey year.

Channel Catfish

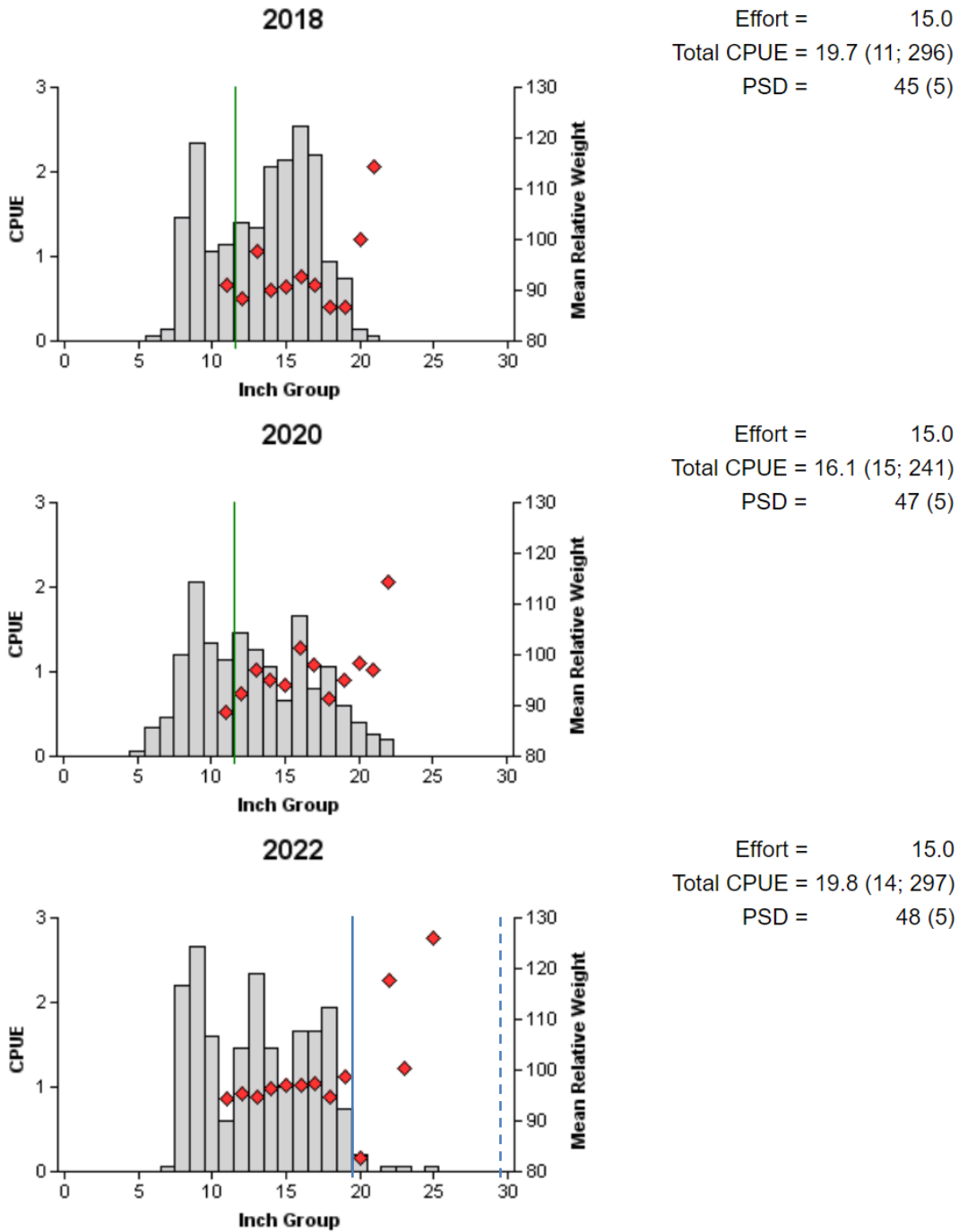


Figure 6. Number of Channel Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Conroe, Texas, 2018, 2020, and 2022. Vertical lines represent length limits for respective survey year.

Table 10. Creel survey statistics for Blue Catfish and Channel Catfish at Lake Conroe, Texas, June 2012 through May 2013, June 2016 through May 2017, and June 2021 through May 2022. Total catch per hour is for anglers targeting Blue Catfish or Channel Catfish, and total harvest is the estimated number of Channel Catfish or Blue Catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2012/2013	2016/2017	2021/2022
Surface area (acres)	20,118	20,118	20,118
Directed effort (h)	53,854.16 (19)	144,445.63 (12)	118,676.36 (14)
Directed effort/acre	2.68 (19)	7.18 (12)	5.90 (14)
Total catch per hour	1.13 (34)	1.14 (28)	1.53 (52)
Total harvest			
Blue Catfish	9,072 (70)	20,307 (55)	31,004 (51)
Channel Catfish	69,759 (30)	139,076 (37)	111,732 (40)
Harvest/acre			
Blue Catfish	0.45 (70)	0.01 (55)	1.54 (51)
Channel Catfish	3.47 (30)	6.91 (37)	5.55 (40)
Percent legal released	3	4	2

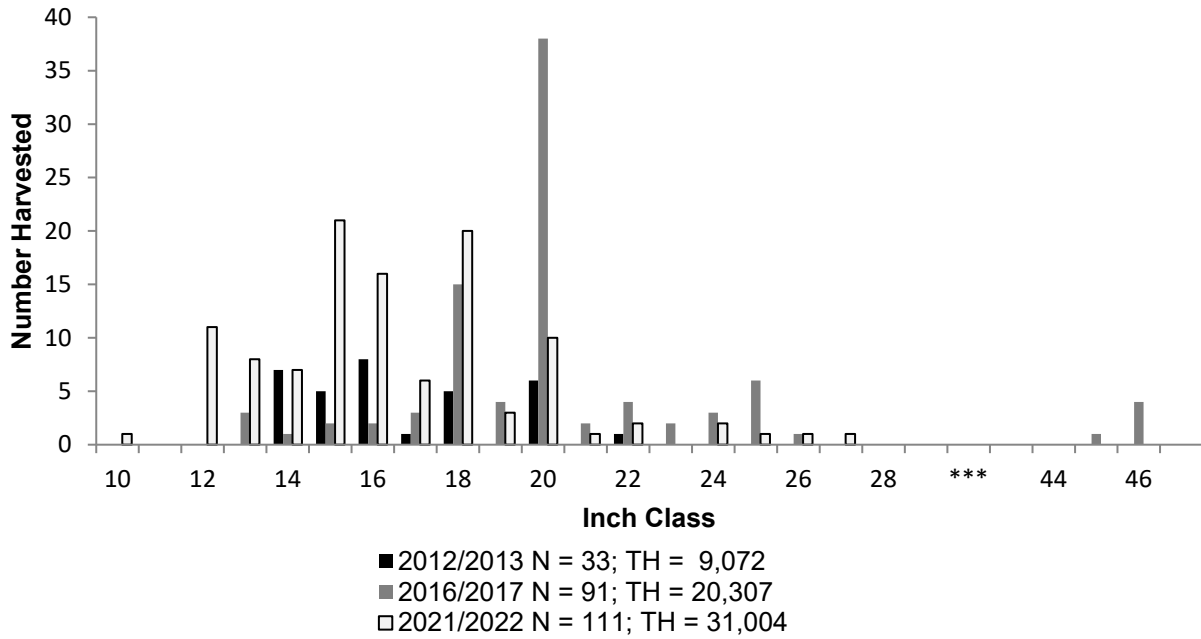


Figure 7. Length frequency of harvested Blue Catfish observed during creel surveys at Lake Conroe, Texas, June 2012 through May 2022, all anglers combined. N is the number of harvested Blue Catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

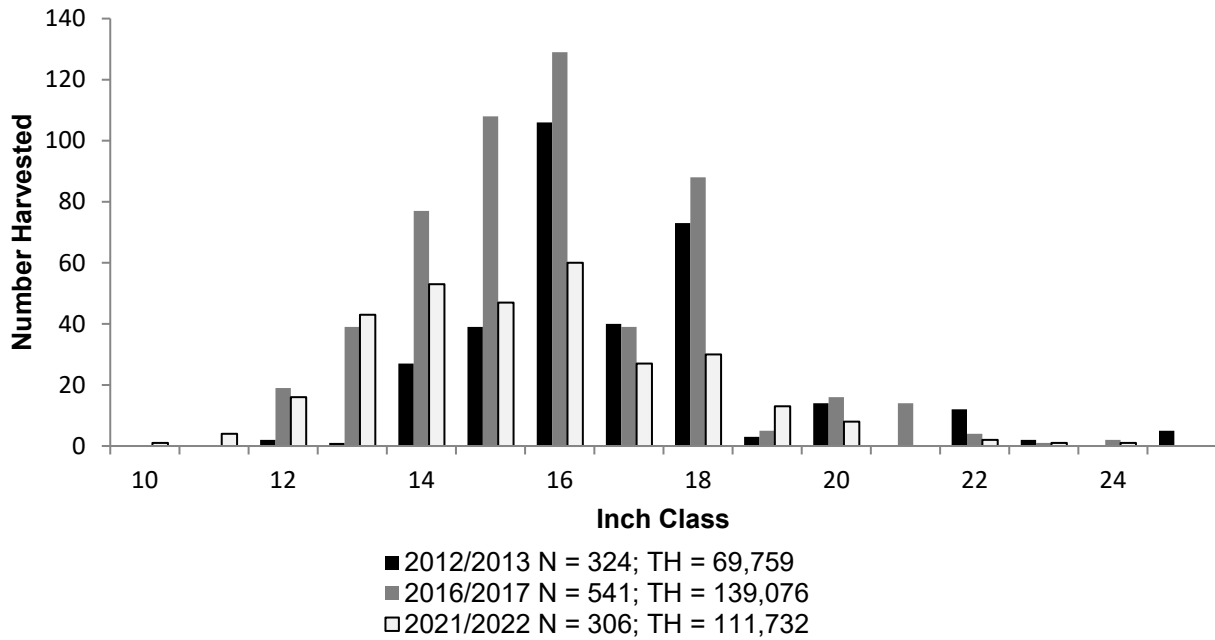


Figure 8. Length frequency of harvested Channel Catfish observed during creel surveys at Lake Conroe, Texas, June 2012 through May 2022, all anglers combined. N is the number of harvested Channel Catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

Hybrid Striped Bass

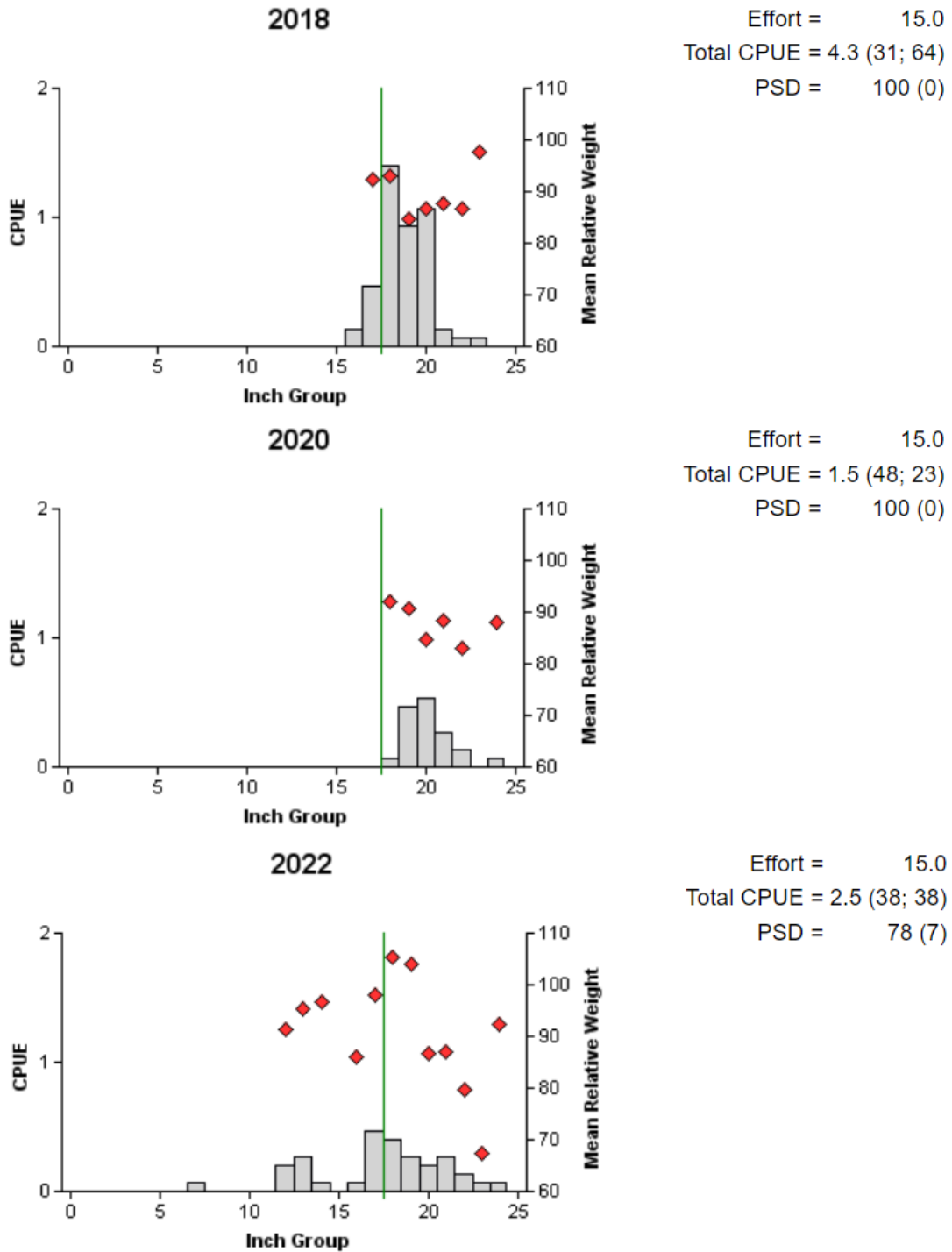


Figure 9. Number of Hybrid Striped Bass caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys Lake Conroe, Texas, 2018, 2020, and 2022. Vertical line indicates minimum length limit.

Table 11. Creel survey statistics for temperate basses at Lake Conroe, Texas, from June 2012 through May 2013, June 2016 through May 2017, and June 2021 through May 2022. Directed effort is for anglers targeting all temperate basses, total catch per hour is for anglers targeting all temperate basses, and total harvest is the estimated number of Hybrid Striped Bass and White Bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2012/2013	2016/2017	2021/2022
Surface area (acres)	20,118	20,118	20,118
Directed effort (h)	8,589.69 (43)	12,895.38 (27)	12,658.32 (29)
Directed effort/acre	0.43 (43)	0.89 (27)	0.63 (29)
Total catch per hour	3.41 (47)	0.40 (89)	0.72 (88)
Total harvest			
Hybrid Striped Bass	15,585 (69)	4,995 (128)	7,561 (278)
White Bass	0	178 (1765)	11,781 (131)
Harvest/acre			
Hybrid Striped Bass	0.77 (69)	0.25 (128)	0.38 (278)
White Bass	0	<0.01 (1765)	0.59 (131)
Percent legal released			
Hybrid Striped Bass	25	11	8
White Bass	0	45	3

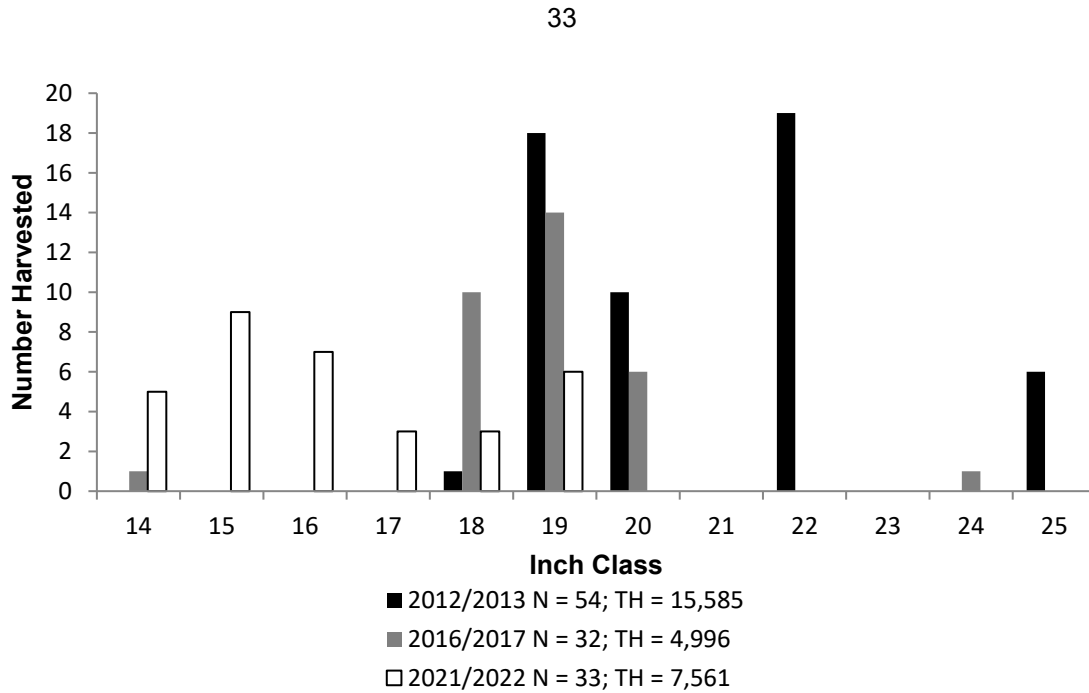


Figure 10. Length frequency of harvested Hybrid Striped Bass observed during creel surveys at Lake Conroe, Texas, June 2012 through May 2022, all anglers combined. N is the number of harvested Hybrid Striped Bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

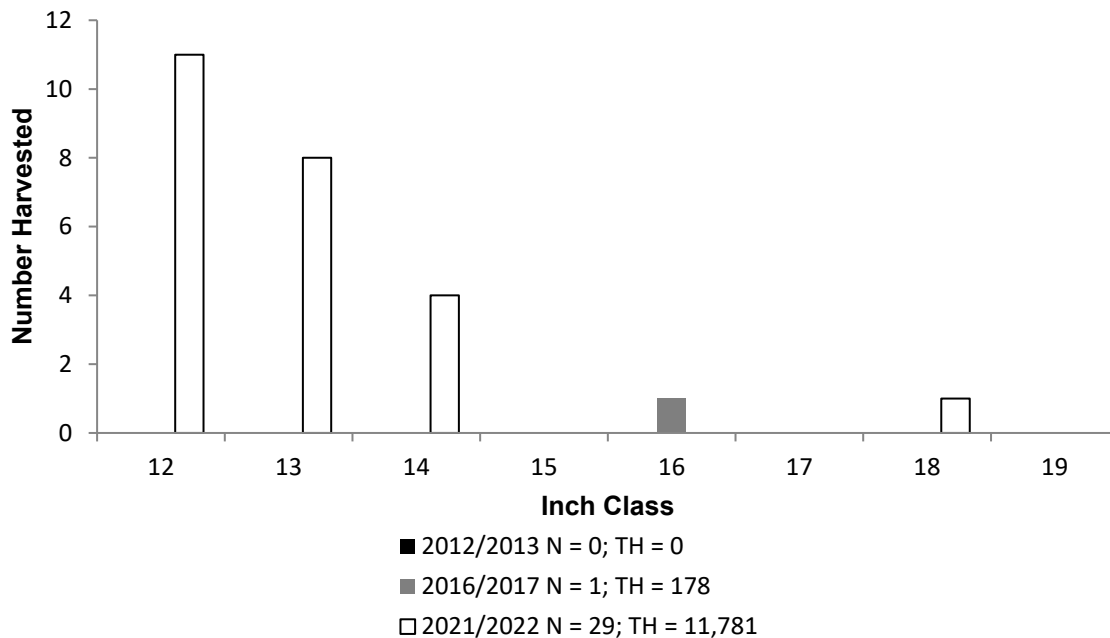


Figure 11. Length frequency of harvested White Bass observed during creel surveys at Lake Conroe, Texas, June 2012 through May 2022, all anglers combined. N is the number of harvested White Bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Largemouth Bass

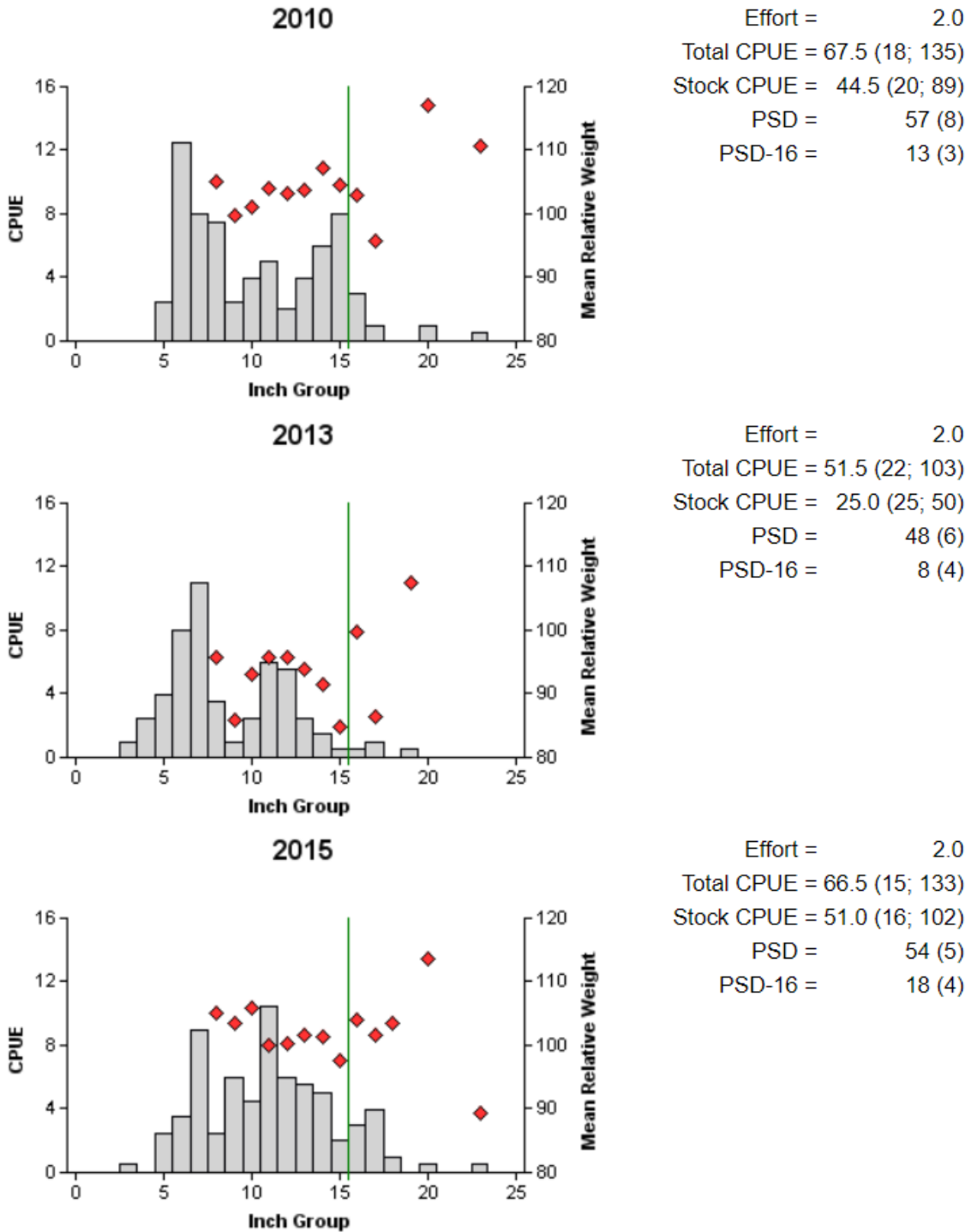
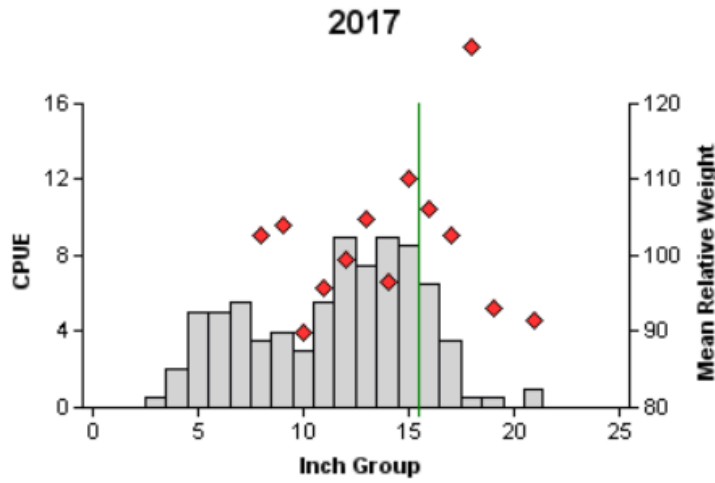
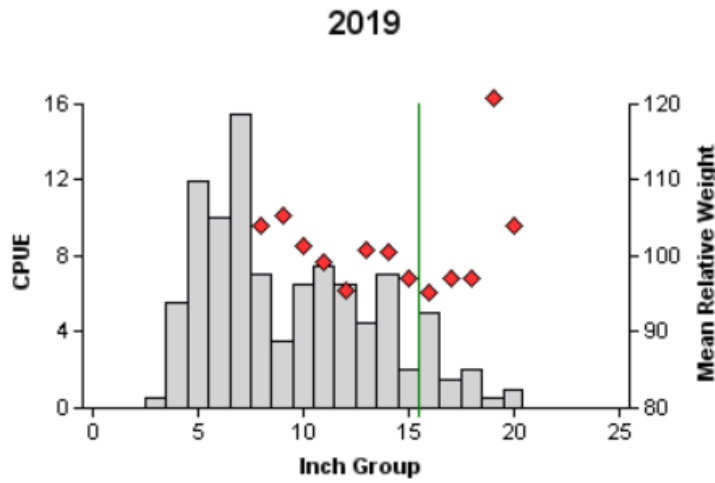


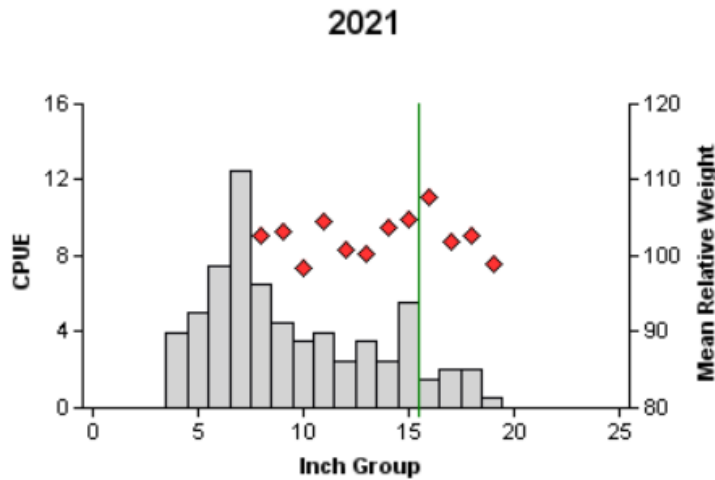
Figure 12. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Conroe, Texas, 2010, 2013, and 2015. Vertical line indicates minimum length limit.



Effort = 2.0
 Total CPUE = 80.0 (19; 160)
 Stock CPUE = 62.0 (21; 124)
 PSD = 74 (5)
 PSD-16 = 21 (3)



Effort = 2.0
 Total CPUE = 98.0 (16; 196)
 Stock CPUE = 54.5 (19; 109)
 PSD = 55 (8)
 PSD-16 = 18 (4)



Effort = 2.0
 Total CPUE = 67.5 (15; 135)
 Stock CPUE = 38.5 (19; 77)
 PSD = 52 (9)
 PSD-16 = 16 (5)

Figure 17 Continued. 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 Conroe, Texas, 2017, 2019, and 2021. Vertical line indicates minimum length limit.

Table 12. Creel survey statistics for Largemouth Bass at Lake Conroe, Texas, from June 2012 through May 2013, June 2016 through May 2017, and June 2021 through May 2022. 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	2012/2013	2016/2017	2021/2022
Surface area (acres)	20,118	20,118	20,118
Directed angling effort (h)			
Tournament	3,092.27 (47)	28,327.95 (18)	18,990.63 (25)
Non-tournament	89,084.64 (53)	136,158.30 (12)	149,104.67 (14)
All black bass anglers combined	92,176.91 (100)	164,486.24 (11)	168,095.30 (13)
Angling effort/acre	4.58 (100)	8.18 (11)	8.36 (13)
Catch rate (number/h)	0.63 (62)	0.61 (25)	0.69 (28)
Harvest			
Non-tournament harvest	6,896 (49)	9,967 (60)	7,153 (95)
Harvest/acre	0.34 (49)	0.50 (60)	0.36 (95)
Tournament weigh-in and release	1,171 (153)	13,376 (81)	7,701 (129)
Release by weight			
<4.0 lbs	16,058 (42)	71,910 (48)	109,360 (47)
4.0-6.9 lbs	963 (59)	4,287 (60)	7,495 (62)
7.0-9.9 lbs	0	519 (74)	998 (76)
≥10.0 lbs	0	0	0 (0)
Percent legal released (non-tournament)	57	56	82

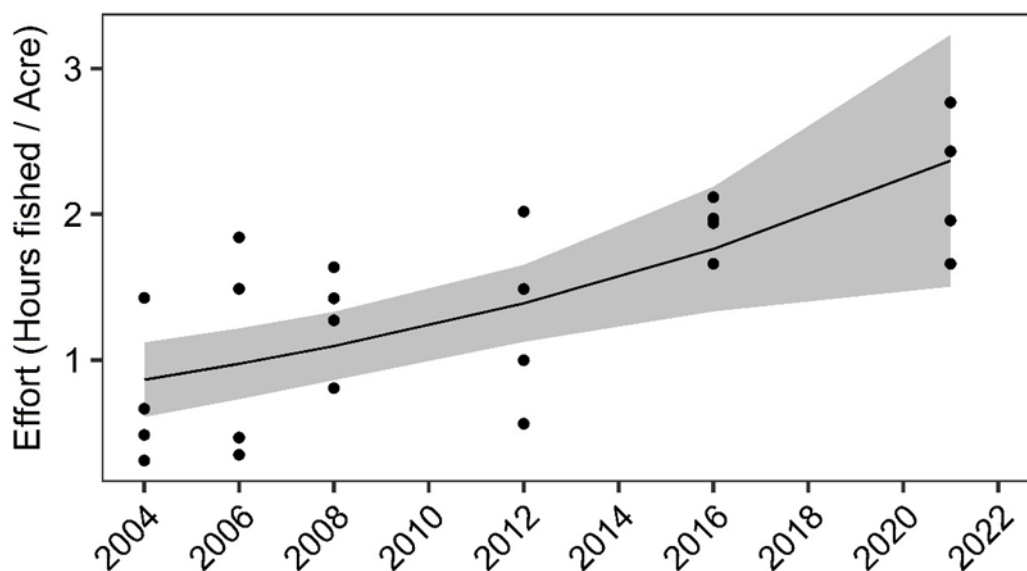


Figure 13. Directed effort for black basses on Lake Conroe from 2004-2021 using generalized additive models (Smith et al. 2021; Wood 2006). Solid black line indicates the annual mean for total fishing pressure directed towards black basses on Lake Conroe, black dots indicate mean black bass fishing effort for each quarter, and shaded area indicates the 95% confidence interval of the mean estimate.

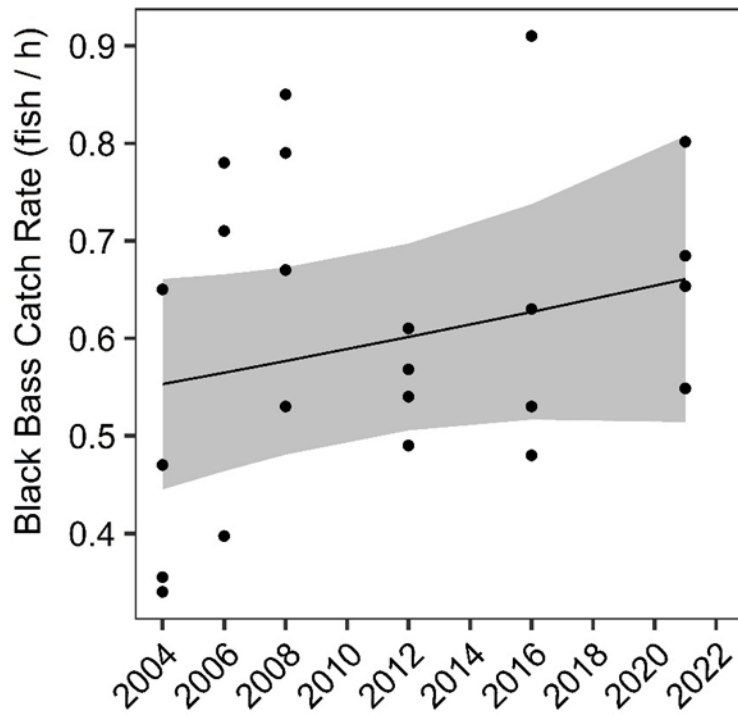


Figure 14. Estimated black bass catch rate for Lake Conroe, Texas 2004-2021 using generalized additive models (Smith et al. 2021; Wood 2006). Solid black line indicates the annual mean for black bass catch rate on Lake Conroe, black dots indicate mean catch rate for each quarter, and shaded area indicates the 95% confidence interval of the mean estimate.

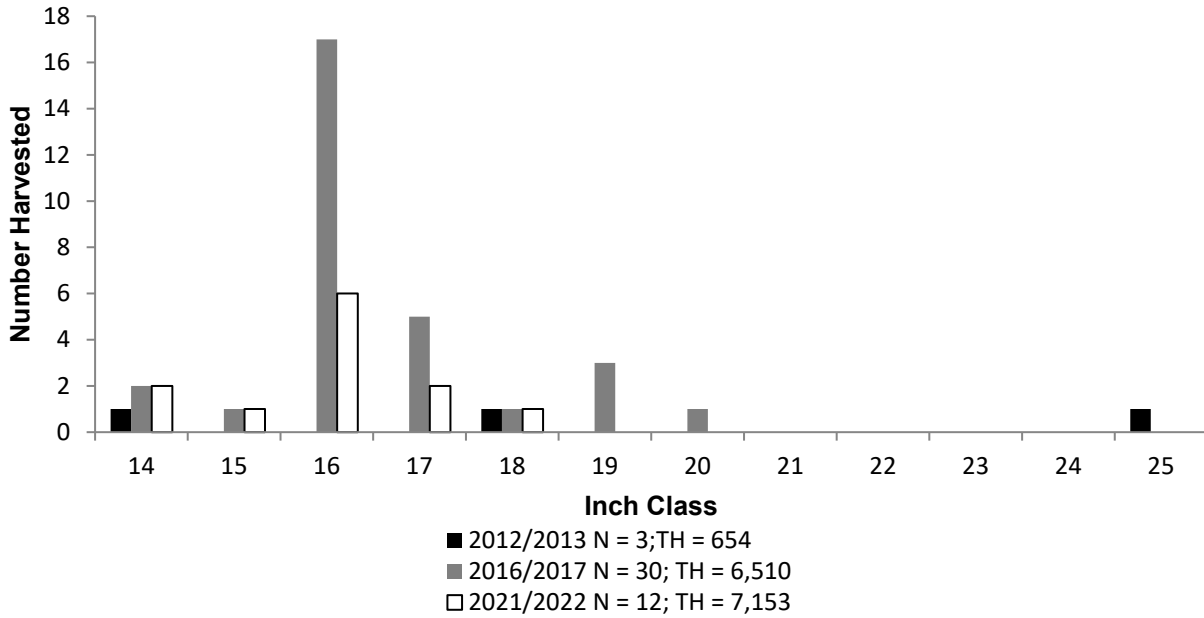


Figure 15. Length frequency of non-tournament harvested Largemouth Bass observed during creel surveys at Lake Conroe, Texas, June 2012 through May 2022, all anglers combined. N is the number of non-tournament harvested Largemouth Bass observed during creel surveys, and TH is the total estimated non-tournament harvest for the creel period.

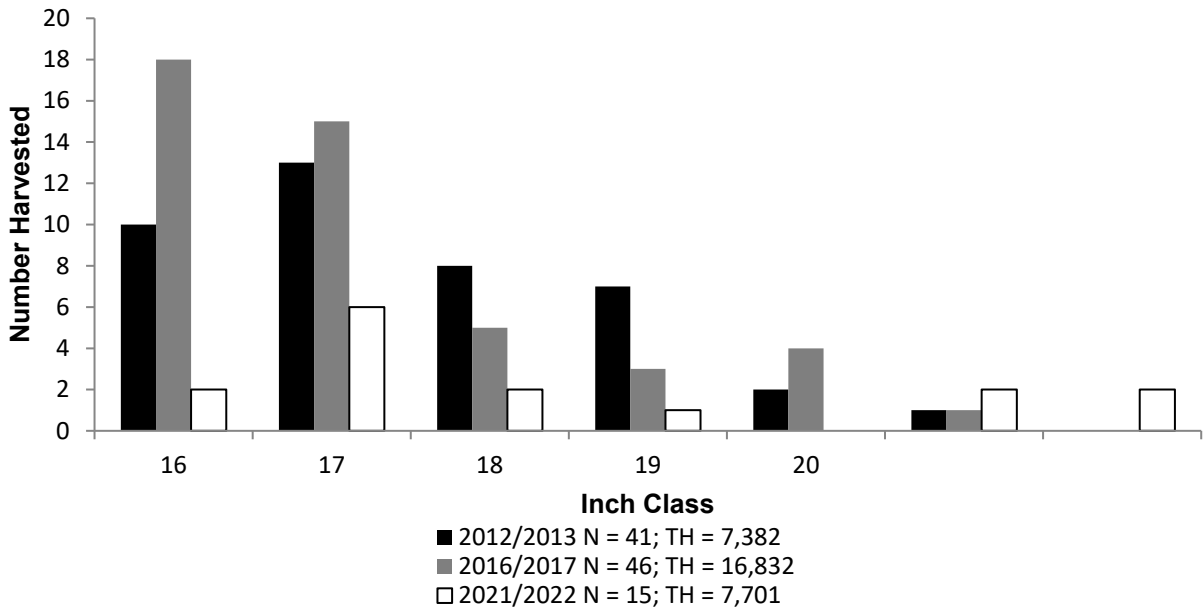


Figure 16. Length frequency of tournament harvested Largemouth Bass observed during creel surveys at Lake Conroe, Texas, June 2012 through May 2022, all anglers combined. N is the number of tournament harvested Largemouth Bass observed during creel surveys, and TH is the total estimated tournament harvest for the creel period.

Table 13. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Lake Conroe, Texas, 1993-1999, 2001, 2005, 2010, 2015, 2017, and 2019. FLMB = pure Florida Largemouth Bass, NLMB = pure 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		
2001	30	6	8	15	1	64	20
2005	60	7	2	51	0	71	12
2010	30	2	0	28	0	76	7
2015	29	7	0	22	0	72	24
2017	30	1	0	29	0	76	3
2019	30	2	0	28	0	76	7

Crappies

Table 14. Creel survey statistics for Black Crappie and White Crappie at Lake Conroe, Texas, from June 2012 through May 2013, June 2016 through May 2017, and June 2021 through May 2022. Total catch per hour is for anglers targeting Black Crappie and White Crappie combined and total harvest is the estimated number of Black Crappie and White Crappie harvested combined by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year		
	2012/2013	2016/2017	2021/2022
Surface area (acres)	20,118	20,118	20,118
Directed effort (h)	14,101.81 (28)	38,111.41 (21)	60,650.68 (18)
Directed effort/acre	0.70 (28)	1.89 (21)	3.01 (18)
Total catch per hour	0.64 (55)	2.74 (81)	0.66 (34)
Total harvest	7,543 (163)	76,424 (60)	37,490 (71)
Harvest/acre	0.37 (163)	3.80 (60)	1.86 (71)
Percent legal released	5	7	15

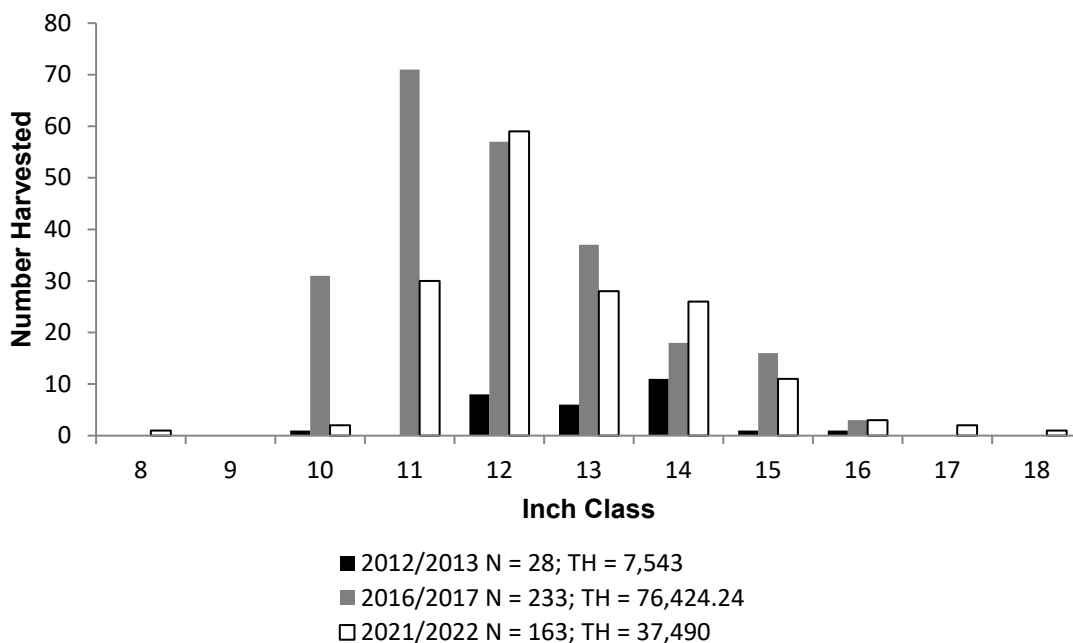


Figure 17. Length frequency of harvested Black Crappie and White Crappie (combined) observed during creel surveys at Lake Conroe, Texas, June 2012 through May 2022, all anglers combined. N is the number of harvested Black Crappie and White Crappie observed during creel surveys, and TH is the total estimated harvest for the creel period.

Proposed Sampling Schedule

Table 15. Proposed sampling schedule for Lake Conroe, Texas. Survey period is June through May. Gill netting surveys are conducted in the spring, while electrofishing surveys are conducted in the fall.

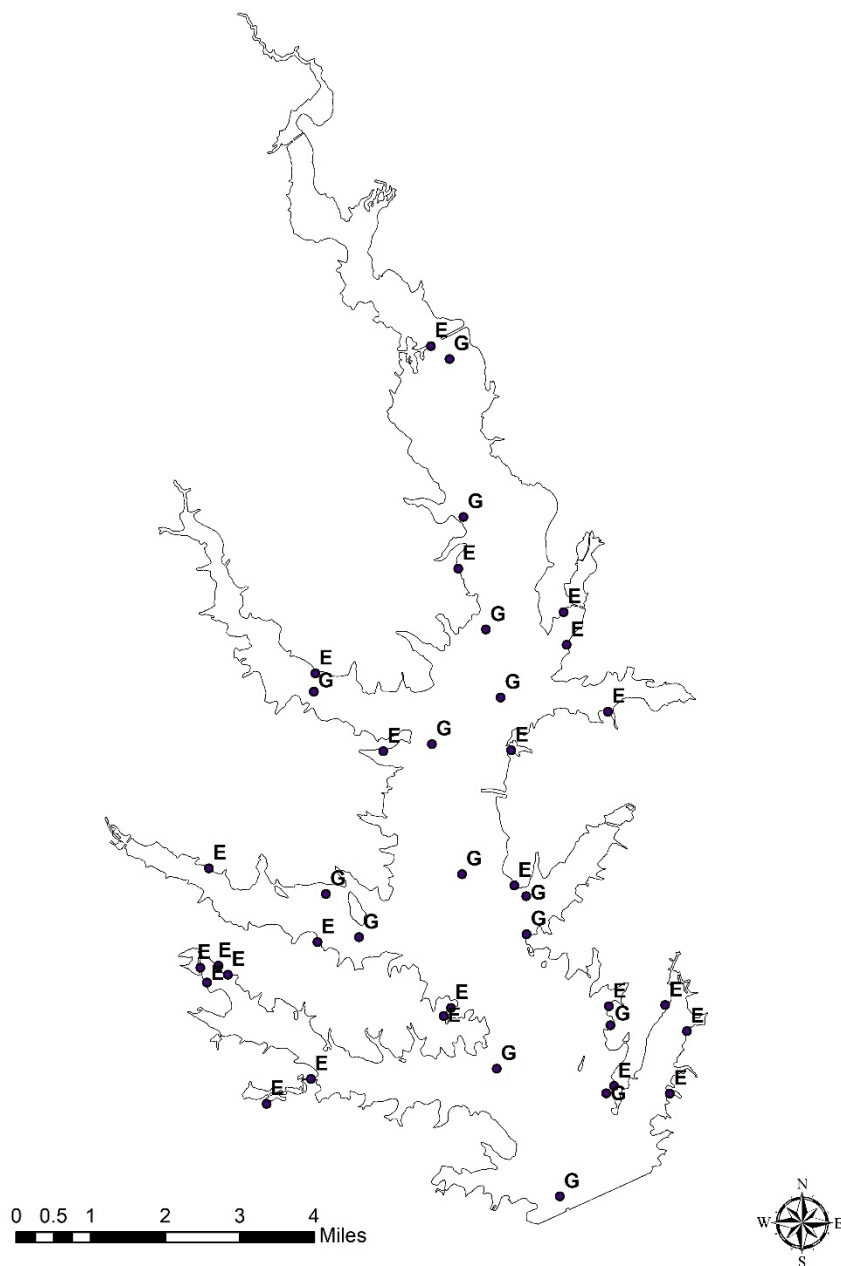
	Survey year			
	2021-2022	2022-2023	2023-2024	2024-2025
Angler Access				X
Structural Habitat				X
Vegetation	X	X	X	X
Electrofishing – Fall		X		X
Gill netting		X		X
Creel survey				X
Report				X

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 Conroe, Texas, 2021-2022. Sampling effort was 15 net nights for gill netting and 2 hours for electrofishing.

Species	Gill Netting		Electrofishing	
	N	CPUE	N	CPUE
Spotted Gar	2	0.13 (68)	2	1.00 (69)
Gizzard Shad	217	14.47 (17)	324	162.00 (12)
Threadfin Shad			2079	1039.50 (41)
Weed Shiner			2	1.00 (69)
Common Carp	2	0.13 (68)	5	2.50 (41)
Golden Shiner			3	1.50 (73)
Bullhead Minnow			111	55.50 (31)
Inland Silverside			86	43.00 (87)
Brook Silverside			29	14.50 (36)
Blacktail Shiner			12	6.00 (47)
Spotted Sucker			1	0.50 (100)
Blue Catfish	139	9.27 (12)	1	0.50 (100)
Channel Catfish	297	19.80 (14)	22	11.00 (27)
Flathead Catfish			2	1.00 (69)
White Bass	10	0.67 (32)	3	1.50 (73)
Yellow Bass	184	12.27 (18)	7	3.50 (44)
Green Sunfish			17	8.50 (100)
Warmouth			2	1.00 (100)
Bluegill	6	0.40 (59)	533	266.50 (35)
Longear Sunfish			234	117.00 (39)
Redear Sunfish	2	0.13 (68)	46	23.00 (39)
Spotted Bass			5	2.50 (41)
Largemouth Bass	16	1.07 (43)	135	67.50 (15)
White Crappie	4	0.27 (57)	2	1.00 (69)
Black Crappie			7	3.50 (73)
Bigscale Logperch			1	0.50 (100)
Logperch			1	0.50 (100)
Freshwater Drum	16	1.07 (39)	3	1.50 (55)
Hybrid Sunfish			1	0.50 (100)
Hybrid Striped Bass	38	2.53 (38)		

APPENDIX B – Map of sampling locations



Location of sampling sites, Lake Conroe, Texas, 2021-2022. Gill net and electrofishing stations are indicated by G and E, respectively. Water level was near full pool at time of sampling.

APPENDIX C – Vegetation Survey Images



Stands of American waterwillow and wild celery, Caney Creek Arm, Lake Conroe, 2021. Neither species were planted at the site and establishment is assumed to have been natural.



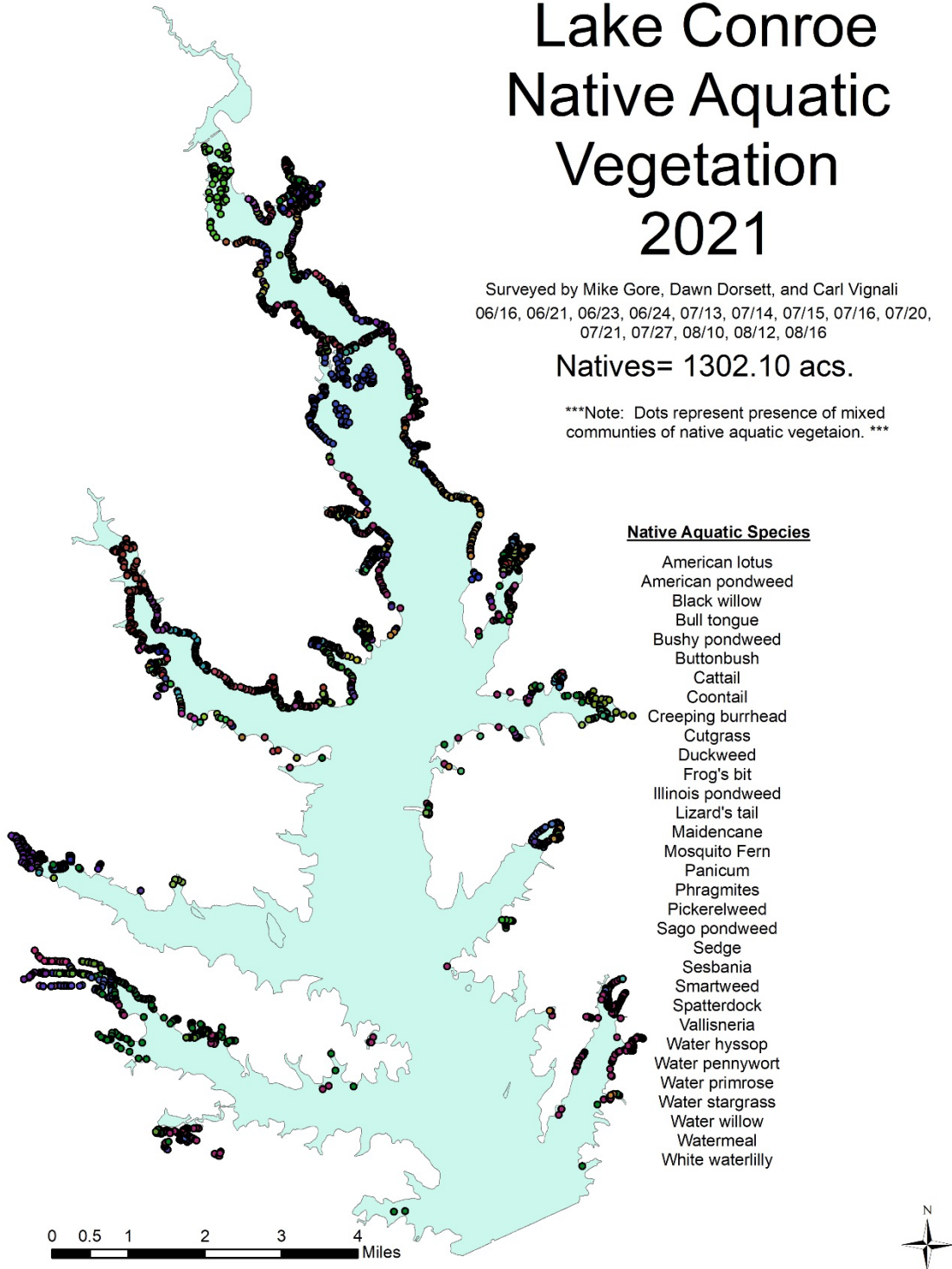
Stands of fragrant waterlily and Illinois pondweed, Caney Creek Arm, Lake Conroe, 2021. Species were originally planted at the site in an enclosure of wire-mesh fencing to protect against herbivory. Plants have since continue to spread outside of the fencing at this site and across the reservoir.

Lake Conroe Native Aquatic Vegetation 2021

Surveyed by Mike Gore, Dawn Dorsett, and Carl Vignali
06/16, 06/21, 06/23, 06/24, 07/13, 07/14, 07/15, 07/16, 07/20,
07/21, 07/27, 08/10, 08/12, 08/16

Natives= 1302.10 acs.

***Note: Dots represent presence of mixed communities of native aquatic vegetaion. ***



Distribution of all native vegetation in Lake Conroe, Texas, summer 2021. Dots indicate presence of vegetation, not abundance of vegetation. Most sites contained a mix of the species listed.

Lake Conroe Hydrilla 2021

Surveyed by Mike Gore, Dawn Dorsett, and Carl Vignali

06/16, 06/21, 06/23, 06/24, 07/13, 07/14, 07/15, 07/16, 07/20,
07/21, 07/27, 08/10, 08/12, 08/16

Hydrilla= 0.75 acs.

***Note: Dots represent areas present,
not mat size. ***

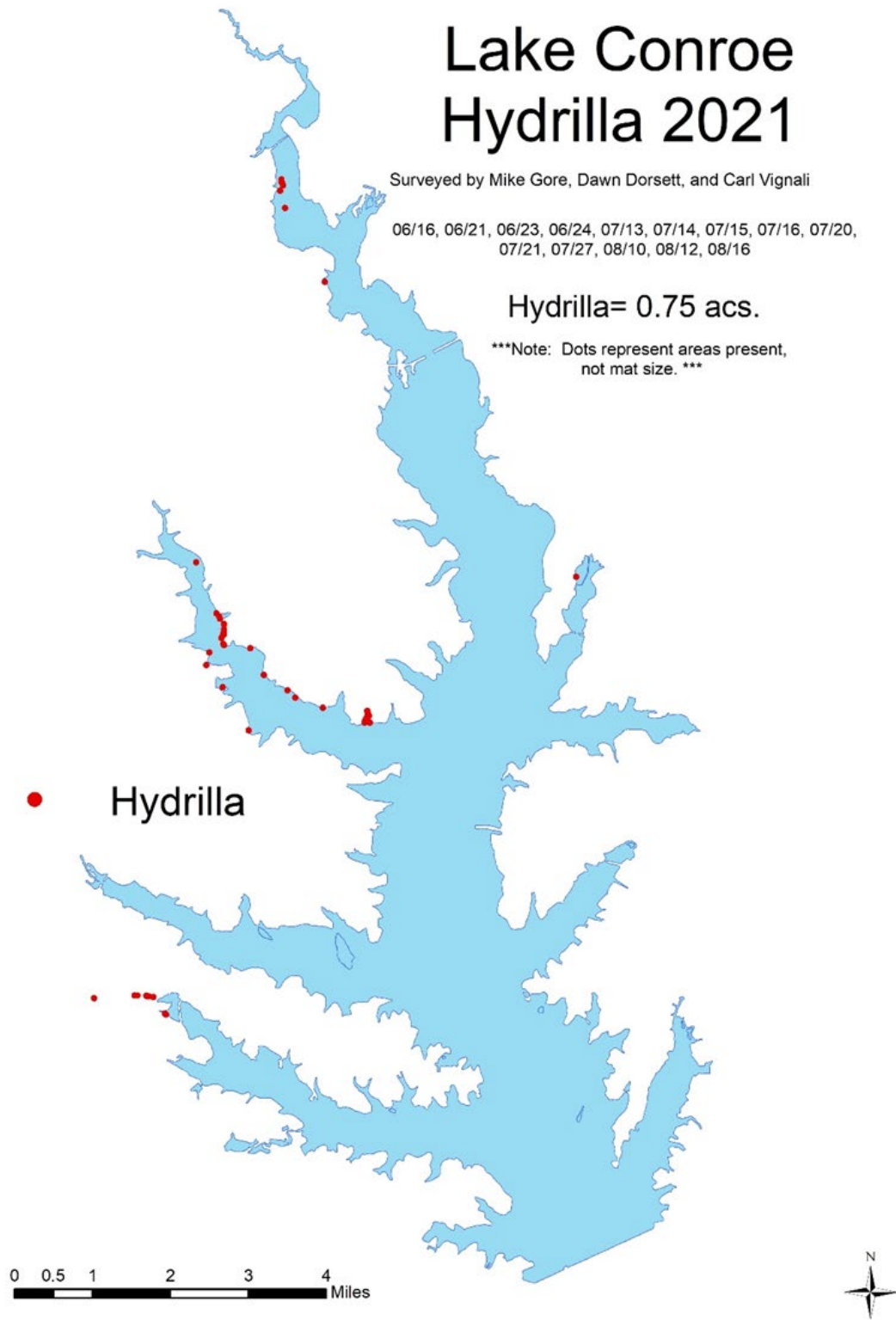
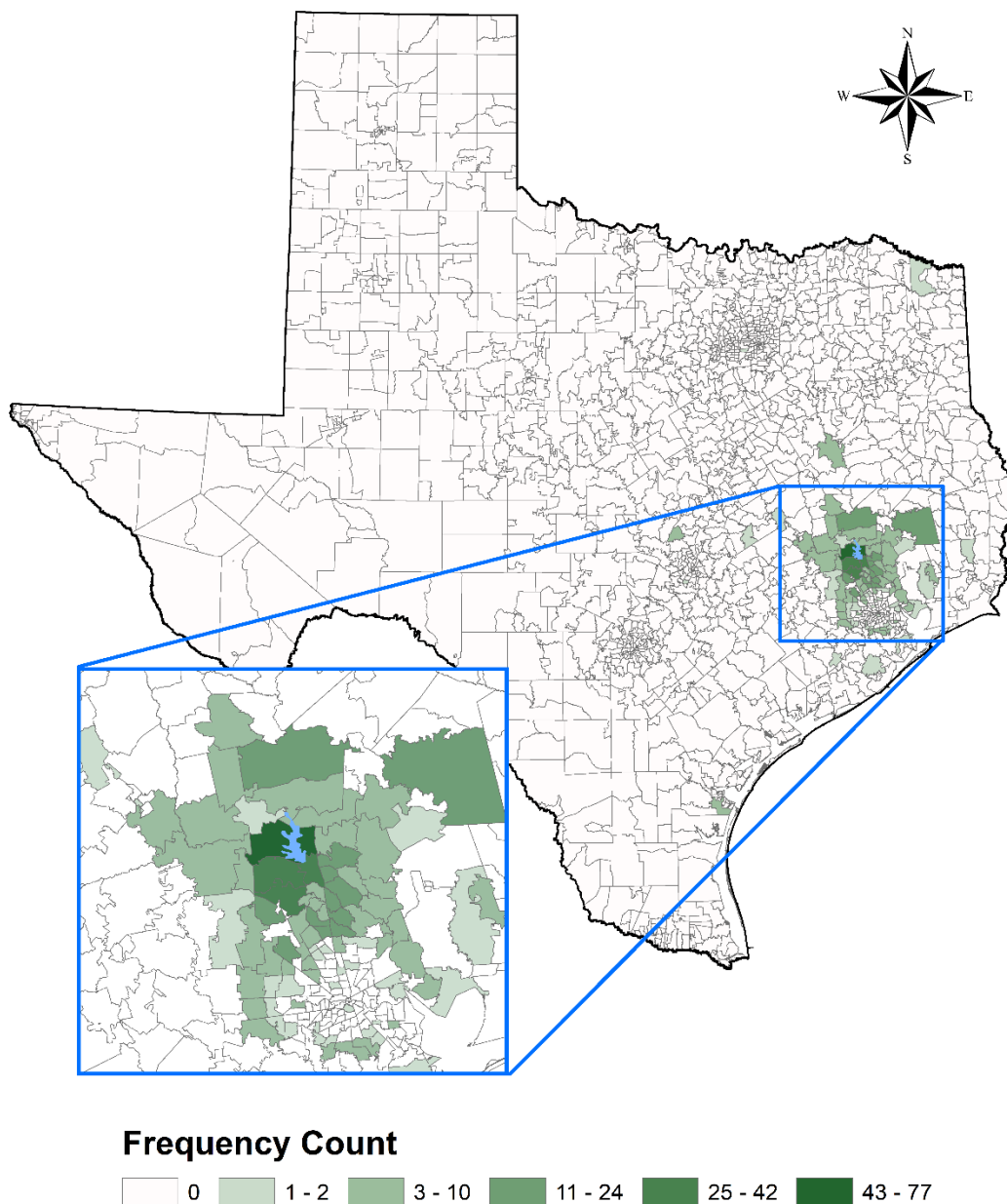


Figure 18. Distribution of hydrilla colonies, Texas, 2021. Dots indicate presence of vegetation, not abundance of vegetation.

APPENDIX D – Creel ZIP Code Data



Location, by ZIP code, and frequency of anglers that were interviewed at Lake Conroe, Texas, during the June 2021 through May 2022 creel survey.



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