

Lake Conroe

2018 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 2017 using electrofishing and trap netting and in 2018 using gill netting. Anglers were surveyed from June 2016 through May 2017 with a creel survey. Historical data are presented with the 2016–2018 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, White Crappie, and Black Crappie. Florida Largemouth Bass and Hybrid Striped Bass have been stocked when available. Recent habitat management actions included control of hydrilla using triploid Grass Carp beginning in 2006, biannual monitoring of plant communities (including the exotic species hydrilla, giant salvinia, and water hyacinth), 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.
- **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 increased in 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.
- **Crappies:** Both White Crappie and Black Crappie have provided angling opportunities at Lake Conroe. Angling effort for crappie increased in the 2016–2017 creel survey compared to that of the previous survey in 2012 – 2013.

Management Strategies: We are proposing a change from the 16-inch minimum length limit for Largemouth Bass to the statewide 14-inch minimum length limit. Lake Conroe is currently the only reservoir under a 16-inch minimum length limit and this change is proposed to help simplify regulations where possible. Hybrid Striped Bass and Florida Largemouth Bass stockings will be requested annually. We will 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 2016 through May 2018. 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 is presented with the 2016-2018 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; rock 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 good with one free public ramp, two U.S. Forest Service ramps, and six marinas with fee ramps. However, public bank angling 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 (Webb *et al.* 2014) included:

1. Update the Lake Conroe Habitat Management Plan annually in conjunction with SJRA and with input from the Lake Conroe Advisory Board (LCAB) and other constituent groups.

Action: The Lake Conroe Habitat Management plan has not been updated annually. However, the LCAB along with SJRA and TPWD have met at least annually to discuss survey results and habitat management strategies.
2. Continue comprehensive vegetation surveys at the beginning and end of each growing season.

Action: Comprehensive vegetation surveys were conducted at the beginning and end of each growing season.
3. Continue to cooperate with SJRA, the Seven Coves Bass Club (SCBC), the U.S. Army Corps of Engineers Lewisville Aquatic Ecosystem Research Facility (USACE-LAERF), and others to maintain the native aquatic plant nursery below Lake Conroe Dam.

Action: The Lake Conroe Aquatic Plant Nursery has been maintained as a cooperative effort between the partners.

4. Continue to cooperate with SJRA, the SCBC, the USACE, and others to plant Grass Carp tolerant native aquatic vegetation in Lake Conroe.

Action: A five-mile stretch of shoreline was planted with Grass Carp-resistant native plants during the summers of 2012 and 2013 with additional plantings in 2014, 2015, and 2016.

5. Continue to cooperate with SJRA in treating exotic vegetation when necessary using Integrative Pest Management methods outlined in the Lake Conroe Habitat Management Plan.

Action: SJRA and its contractors have treated giant salvinia, water hyacinth, and salt cedar as necessary.

6. Cooperate with all partners to determine timing of minimal triploid Grass Carp stockings to maintain balance between native plant expansion and hydrilla control.

Action: Partners are updated at least annually on the results of vegetation surveys and the calculated number of Grass Carp remaining in the reservoir.

7. Continue to meet with the LCAB at least annually or more frequently as new information regarding habitat management or other issues is available.

Action: LCAB with SJRA and TPWD meet at least once annually.

8. Continue to publish magazine articles and press releases whenever possible highlighting fisheries and habitat management issues at Lake Conroe.

Action: On average, one or more magazine articles, social media posts, or news releases on Lake Conroe fisheries and habitat issues are submitted and published monthly.

9. Monitor Largemouth Bass size distribution, body condition, growth, and genetics (allele frequencies and proportion of pure Florida Largemouth Bass in the stock) in the fall of 2015.

Action: The Largemouth Bass population was monitored biennially in 2015 and 2017.

10. Request stocking of Florida Largemouth Bass (FLMB) at a rate of 25/acre annually.

Action: Florida Largemouth Bass stockings were requested annually. Florida LMB were stocked in at 25/acre in 2014 and at 1,000/km of shoreline in 2015, 2016, and 2017 per updated stocking procedures.

11. Request stocking of Palmetto Bass at a rate of 10/acre annually.

Action: Hybrid Striped Bass stockings were requested annually at a rate of 10 fish/acre in 2014, 2015, 2016, and 2017.

12. Continue to work with Palmetto Bass guides and anglers to assess Palmetto Bass fishery.

Action: Hybrid Striped Bass guides and anglers regularly share catch and harvest information with TPWD district team.

13. Work with SJRA, Montgomery County, and TXDOT to enhance the FM 830 Boat Ramp and Park for better boating and bank angling access, including dredging to allow access during low water events.

Action: Plans for the improvement of the 830 Boat Ramp are ongoing.

Harvest regulation history: Sport fishes are currently managed under statewide fishing regulations except for 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. Current regulations are found in Table 3.

Stocking history: Fish stockings at Lake Conroe began in 1970 with pre-impoundment stockings of northern Largemouth Bass, Blue Catfish, and Channel Catfish (Table 4). Walleye were introduced in 1973, but a sustainable population never established. Hybrid Striped Bass were first introduced in 1978 and stocked for three consecutive years. Stocking was suspended after 1980 for fifteen years and then resumed in 1995. Striped Bass were stocked one time in 1994 and remained part of the fishery until 1999. Florida Largemouth Bass were first introduced in 1979 and have been stocked regularly over the past 39 years. Diploid Grass Carp were stocked in the early 1980s, and incremental stockings of Triploid Grass Carp began in 2006 as a part of an Integrated Pest Management (IPM) plan for the control of hydrilla. A total of 124,030 Triploid Grass Carp were stocked from 2006–2008, and their population has continued to decrease through natural mortality.

Various stakeholder groups have periodically stocked additional fish to supplement state efforts. The Lake Conroe Restocking Association stocked advanced-sized FLMB, Black Crappie, and White Crappie into Lake Conroe. From 1988 to the mid 1990's, Stowaway Marina stocked approximately 10,000 advanced Black Crappie per year in 2012 – 2017 to supplement the crappie fishery.

The complete stocking history is presented in Table 4.

Vegetation/habitat management history: Shortly after construction finished in 1973, hydrilla became established. By 1979, Lake Conroe was infested with approximately 10,000 acres of hydrilla, roughly half of the reservoir's surface area. The infestation drastically limited access and recreational use. To control overabundant exotic vegetation, 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 from 1980 through 1982. By 1983, Klussman *et al.* (1988) reported that macrophytes had been almost completely removed from the reservoir, resulting in an increase in primary productivity. By 1986 most nutrients had returned to pre-treatment levels.

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 Texas Black Bass Unlimited (TBBU) began establishing native aquatic vegetation founder colonies at Lake Conroe. These efforts introduced several species of native submersed, emergent, and floating-leaved vegetation into the reservoir. In 1996, hydrilla re-emerged at Lake Conroe. For the next nine years, TPWD and SJRA successfully treated hydrilla with herbicides while allowing the native vegetation to expand.

However, by 2005 over 868 acres of hydrilla were present, creating the need for a long-term, comprehensive hydrilla management plan including incremental stockings of Triploid Grass Carp as part of an Integrated Pest Management Approach. In March 2006, 4,200 Triploid Grass Carp were introduced into areas infested with hydrilla. Additional stockings continued through 2007 and 2008 as mandated by the Lake Conroe Hydrilla Management Plan. These stockings have been successful at reducing the hydrilla infestation to levels consistent with management goals, but they also greatly reduced native vegetation coverage from 1,078 acres in July 2007 to 152 acres in May 2008, with a shift in species composition from submersed species to more Grass Carp-resistant emergent species. To help re-establish the native vegetation population, TPWD, SJRA, SCBC, B.A.S.S., TBBU, U. S. Fish and Wildlife Service (USFWS), and USACE have continued to plant Grass Carp-resistant native vegetation into Lake Conroe. TPWD planted a five-mile stretch of the Caney Creek arm shoreline in the summers of 2012 and 2013, and 10,000 American Water Willow plants were planted in 2016. SJRA continues to plant native emergent and floating leaved species annually in the upper third of the lake as well.

Giant salvinia and water hyacinth were also present in Lake Conroe and have been controlled using herbicide and bio-control insects.

Littoral habitat is also provided at Lake Conroe by standing timber in the upper third of the reservoir and riprap along the dam, the FM 1097 bridge, and the FM 1375 bridge.

Water transfer: Historically, the only water discharge from Lake Conroe was via the dam outflow gates. However, in 2015 a water supply station and water treatment plant went into operation to supply areas of Montgomery County. All water use has been and will remain in the San Jacinto River Basin.

Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Lake Conroe (TPWD unpublished). 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 2015).

Electrofishing – Largemouth Bass, sunfishes, Gizzard Shad, and Threadfin Shad were collected by electrofishing (2 hours total at 24 5- minute stations). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing. All Largemouth Bass collected in 2017 were aged using sagittal otoliths. Resulting data was used for population dynamics and effects of minimum length limits modeling.

Trap netting – Crappie were collected using trap nets (15 net nights at 15 stations). CPUE for trap netting was recorded as the number of fish caught per net night (fish/nn).

Gill netting – Channel Catfish, Blue 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).

Genetics – Genetic analysis of Largemouth Bass was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015). Microsatellite DNA analysis was used to determine genetic composition of individual fish.

Statistics – Sampling statistics (CPUE for various length categories), structural indices (Proportional Size Distribution [PSD], terminology modified by Guy *et al.* 2007), and condition indices (relative weight [W_r]) were calculated for target fishes according to Anderson and Neumann (1996). Hybrid Striped 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. Fish Analyses and Modeling Simulator v1.64 (FAMS) was used to model Largemouth Bass population dynamics, including growth and recruitment, and to model the effects of minimum length limits in the Lake Conroe Largemouth Bass population (Slipke and Maceina 2014). The sample size was 107 fish ranging from 153mm to 551mm in length and 1 to 5 years of age. The population was modeled with a starting population of 100 fish and exploitation rates from 0% to 25%. Total annual mortality was determined with a catch curve from fish fully recruited to the gear (age 1 or older) and estimated to be 34.9%. Maximum age was estimated at 9.7 years, and the Length Infinity was estimated to be 482.23mm.

Creel survey – A roving creel survey was conducted from June 1, 2016 through May 31, 2017. 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 2015). From March 2017 to May 2017, anglers who reported fishing for Largemouth Bass during the creel survey and visitors to the 2017 Geico Bassmaster Classic were asked for their opinion about reducing the current Largemouth Bass 16-inch minimum length limit to 14 inches.

Habitat – A structural habitat survey was conducted in 2013 and has not changed significantly since. Vegetation surveys were conducted twice yearly at the beginning of summer and mid-fall in 2014-2017 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 2015).

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

Results and Discussion

Habitat: 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, bulkheads and boat docks in the lower half of the lake, natural shoreline, and both native and exotic aquatic vegetation. Structural shoreline habitat has changed little since 2013, and the predominant structural shoreline habitat was bulkhead and boat docks that encompassed over 50% of the total shoreline. 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. Establishment of native emergent, floating-leaved, and submersed aquatic vegetation is ongoing, and as of 2017 there were 204 acres of native vegetation. To supply native vegetation for these efforts, project partners established a native aquatic vegetation nursery below Lake Conroe Dam. TPWD continued to cooperate with SJRA to monitor and treat hydrilla, giant salvinia, and water hyacinth according to the Lake Conroe Habitat Management Plan. Survey details of structural habitat and vegetation on Lake Conroe can be found in Tables 6 and 7.

Creel: Angling effort and expenditures dramatically increased during the 2016–2017 creel survey. Total angling effort on Lake Conroe doubled to 454,627 hours, and total angling expenditure increased by five-fold to \$6,358,107 between 2012–2013 and 2016–2017 (Table 8). Largemouth Bass was the most popular target species (36% of angler effort), closely followed in popularity by catfish (32%). Percentages of directed effort for crappies, sunfish, and temperate basses were 8%, 4 %, and 3%, respectively (Table 9). The majority of angling effort came from boat anglers (74% boat anglers, 26% bank anglers). Boat anglers targeted Largemouth Bass and catfishes with 45% and 35% of their effort, respectively, and had higher catch rates for all groups of fish relative to bank angling success. An increase in bank angling was observed in 2016–2017 compared to bank angling rates in 2008–2009 (14%) and 2012 – 2013 (12%) and may have influenced higher harvest rates, especially of Bluegill. Bank anglers reported fishing for anything (45%), catfishes (22%), crappies (13%), and Largemouth Bass (12%). Detailed creel information between boat and bank anglers can be found in Table 10.

Prey species: Bluegill was the dominant prey species in the 2017 electrofishing survey with a catch rate of 328/h (Figure 3). Threadfin Shad was the second most abundant species (300/h), followed by Gizzard Shad (76/h) and Longear Sunfish (60/h) (Figure 2, Appendix A). Prey species abundance in 2017 was similar to that of 2013 for Bluegill but showed an increase in Threadfin Shad and a decrease in Gizzard Shad and Longear Sunfish. Catch rates for 2013 were 373/h for Bluegill, 141/h for Longear Sunfish, 73/h for Gizzard Shad, and 64/h for Threadfin Shad. The Index of Vulnerability (IOV) for Gizzard Shad was 39 in both 2017 and 2013, indicating less than half of Gizzard Shad were suitable size for predator fish consumption.

The creel survey indicated an increase in fishing effort for, and harvest of, sunfish species. Fishing effort for sunfish was 17,911 hours in 2016 – 2017. Prior creel surveys estimated angling effort for sunfish at 4,287 h in 2008 – 2009 and 1,573 h in 2012 – 2013. Release of caught fish also decreased from 74% and 71% in historical surveys to 11% 2016 – 2017, resulting in increased harvest (Table 11, Figure 4).

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

Gill net catches of Blue Catfish have continued to improve since 2008 when catches reached a low of 1.6/nm (Webb *et al.* 2014). The catch rate in spring 2018 was 9.5/nm compared to 5.9/nm in 2016 and 4.6/nm in 2014. Blue Catfish up to 30 inches total length and greater were observed in all samples. The length distribution of the 2014, 2016, and 2018 samples indicated good reproduction and recruitment, and body condition of fish was good ($W_r > 90$, Figure 5). Anglers harvested an estimated 20,307 Blue Catfish

during the 2016 through 2017 creel period. The estimated number harvested is a large increase from the 2012–2013 creel period when an estimated 9,072 Blue Catfish were harvested but is similar to the 2008 – 2009 harvest estimate of 19,585 fish (Table 12). Blue catfish observed in the creel ranged in length from 12 to 46 inches (Figure 7).

The gill net catch rate of Channel Catfish in spring 2018 was 19.7/nn, also showing an increase from previous years: 17.2/nn in 2016 16.6/nn in 2014. Body condition of fish was good ($Wr > 90$). The size distribution of the population indicates a high proportion of the population available for harvest (Figure 6). During the 2016–2017 creel period, anglers harvested an estimated 139,076 Channel Catfish, increasing from an estimated harvest of 69,759 Channel Catfish in 2012–2013 (Table 12). Channel catfish harvested ranged from 12 to 24 inches in length in 2016–2017 (Figure 8).

Temperate Basses: White Bass are present in Lake Conroe, but Hybrid Striped Bass are more abundant and support the temperate bass fishery. The 2016–2017 creel survey indicated that directed effort for temperate basses increased from 3,333 h in 2008–2009 and 8,589 h in 2012–2013 to 12,895 h in the 2016–2017 creel period. Angling success for temperate bass anglers was substantially reduced in 2016–2017 (0.40 fish/h) relative to 2012–2013 (3.41 fish/h) and most caught fish were Hybrid Striped Bass (Table 13)

Catch rates of White Bass have been low since 2006. Spring gill net survey catch rates were 0.2/nn in 2018, 0.0/nn in 2016 and 2014, 1.9/nn in 2006, 1.4/nn in 2008, and 0.5/nn in 2010 (Appendix A, Webb *et al.* 2014). During the most recent creel period an estimated 326 White Bass were caught, and 178 harvested. Only one 16-inch White Bass was observed during the creel survey. Low seasonal (spring) inflows into Lake Conroe and associated lack of spawning habitat are likely responsible for the steady decline in the White Bass population.

Gill net catch rate of Hybrid Striped Bass in 2018 was 4.3/nn, which is consistent with previous years: 3.1/nn in 2016 and 3.4/nn in 2014. Most Hybrid Striped Bass collected ranged from 18 to 25 inches in total length and body condition was average ($Wr > 80$, Figure 9). Anglers harvested an estimated 4,995 Hybrid Striped Bass and reported releasing fewer legal-sized fish (11%) than they did in 2012 – 2013 (25%); however, the 2016 – 2017 release rate was similar to the 10% release rate observed in 2008 – 2009 (Table 13). Hybrid striped Bass ranging from 14 to 24 inches were observed in the creel survey (Figure 10). Feedback requests made to Hybrid Striped Bass anglers through media outlets resulted in numerous emails indicating a relatively small but avid Hybrid Striped Bass angling community at Lake Conroe.

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 electrofishing catch rate of Largemouth Bass in 2017 was 80.0/h. This catch rate was an increase from that of 2015 (66.5/h) and 2010 (51.5/h). The population size distribution is good with PSD nearly constant around 50 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 21 in the 2017 survey and fish up to 21 inches in length were collected (Figure 11).

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%-76% for several years (Table 14).

The Largemouth Bass fishery is the most popular at Lake Conroe. Directed effort was 164,486 h (8.18 h/acre) in 2016 – 2017. Angler catch rate was 0.61/h during the 2016 – 2017 creel survey, nearly identical to the catch rates in 2012 – 2013 (0.63/h) and 2008 – 2009 (0.62/h). Angler harvest of fish was estimated to be 9,967 in the 2016 – 2017 creel. Bass ranging from 14 to 25 inches were observed during the survey. Historic and contemporary release rates of legal-sized Largemouth Bass are low on Lake Conroe. Non-tournament anglers released 51% of legally-sized fish in 2004 – 2005, 40% in 2006 – 2007, 70% in 2008 – 2009, 57% in 2012 – 2013, and 56% in 2016 – 2017. Tournament fishing effort was composed of live-release tournaments and accounted for 14% of Largemouth Bass fishing effort (Table

15). Additionally, angler compliance may be poor with three sub-legal fish observed in the creel (Figure 12).

Analysis of Largemouth Bass growth and modeling of population dynamics showed growth, recruitment, and mortality indicated a strong population; however, the fishery sustains high fishing and harvest pressure, so minimum length limits can strongly influence population structure. Largemouth Bass reached 14 inches in 2.4 years and 16 inches in 3.3 years (Figure 13). However, only 56% of legal-sized non-tournament fish were released, indicating that 44% of legally-sized non-tournament fish were retained. Reducing the minimum length limit from 16 inches to 14 inches has been proposed as an option to increase potential catch of individual fish. Modeling the effects of the 14-inch minimum length limit and a 16-inch minimum length limit showed more fish would be harvested from the population with a 14-inch minimum length limit resulting in a small decline in numbers of fish greater than 16 inches (2% to 5%) and a reduction in the mean size of caught fish (approximately 1") (Figures 14, 15 and 16).

Crappies: Black Crappie and White Crappie are present in Lake Conroe; however, trap net surveys from fall of 2017 indicated overall abundance was low with catch rates of 0.4/nn for White Crappie and 0.3/nn for Black Crappie (Figures 16 and 17). Despite the lower abundance in trap net surveys, angling effort and success greatly increased during the 2016–2017 creel survey. Angling effort for crappies was 22,088 hours (1.10 h/acre). Angling success, indicated by an angler catch rate catch rate of 2.7/h, was high during the 2016 – 2017. An estimated 31,186 White Crappie and 43,814 Black Crappie, ranging in length from 10 to 17 inches, were harvested by anglers during 2016 – 2017 (Table 16, Figure 18).

Fisheries Management Plan for Lake Conroe, Texas

Prepared – July 2018

ISSUE 1: 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; however, native vegetation has also decreased sharply due to the stocking of 124,030 triploid Grass Carp for hydrilla control.

MANAGEMENT STRATEGIES

1. Update the Lake Conroe Habitat Management Plan as needed in conjunction with SJRA and with input from the LCAB and other stakeholders.
2. Continue comprehensive vegetation survey at end of each growing season and provide Lake Conroe Habitat Management Plan partners with update information.
3. 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.
4. Continue to cooperate with SJRA in treating exotic vegetation when necessary using IPM methods outlined in the Lake Conroe Habitat Management Plan.
5. Cooperate with all partners to determine timing of minimal triploid Grass Carp stockings to maintain balance between native plant expansion and hydrilla control.

ISSUE 2: Lake Conroe is a high-profile reservoir with diverse constituent groups who have great interest in all aspects of the reservoir's management.

MANAGEMENT STRATEGIES

1. Continue to meet with the Lake Conroe Advisory Board at least annually or more frequently as new information regarding habitat management or other issues becomes available.
2. 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 2016-2017 was 28,378 tournament and 136,158 non-tournament angler hours. Lake Conroe has shown high trophy potential. The current lake record Largemouth Bass is 15.93 lbs, an estimated 519 fish between 7 and 9.9 lbs were caught during the 2016-2017 creel, and Lake Conroe contributed 17 fish over 13 lbs to the Sharelunker program. In 2017, 11 Elite Lunkers (10-12.9 lbs) and 23 Lunkers (8-9.9lbs) were submitted to the re-designed program. The Largemouth Bass population has been under the 16-inch minimum length limit since 1993. Efforts to evaluate and simplify Largemouth Bass regulations has been a recent priority. An evaluation at Lake Conroe showed going to the statewide 14-inch minimum length limit would have minor impacts on the Largemouth Bass population and fishery and simplify the statewide package of regulation options for Largemouth Bass.

MANAGEMENT STRATEGIES

1. Request stocking of FLMB at a rate of 1,000/km of shoreline annually to maintain/maximize trophy production.
2. Recommend that the 16-inch minimum length limit for Largemouth Bass be changed to a 14-inch minimum length limit to simplify statewide regulations. Lake Conroe is the only reservoir in the state under the 16-inch minimum length limit. The change to the 14-inch minimum length limit would likely result in slightly higher harvest rates of Largemouth Bass; however, there will be a small decline in the number of fish over 16 inches.
3. Continue efforts on Lake Conroe to increase native vegetation by TPWD and partners and continue public education efforts on the importance of native aquatic vegetation for Largemouth Bass production.

ISSUE 4: Hybrid Striped Bass support a Temperate Bass fishery at Lake Conroe that had an estimated 12,895 hours of directed fishing effort in the 2016-2017 creel survey.

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

MANAGEMENT STRATEGIES

1. Cooperate with the controlling 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 using 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 (2018–2022)

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 the popularity and reputation for quality Largemouth Bass fishing at Lake Conroe warrant sampling time and effort. Angler effort for black basses was 164,486 angler hours and 36% of the total directed angling effort during the June 2016–May 2017 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 size structure (PSD and length frequency), growth (mean W_r of all fish). Bootstrap analysis of fall 2017 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 13.0-14.9 inches in length to estimate mean age at legal length.

Catfish

Blue Catfish and Channel Catfish combined accounted for 31.8% of directed angler effort during the most recent creel survey (June 2016–May 2017). Blue Catfish and Channel catfish relative abundance, size structure, and condition trend data have been collected every four years. Continuing the 4-year survey interval will allow for the detection of 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 historical data indicates that 15 gill nets will obtain data with an 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.

Crappie

Directed effort for Crappies was 22,088 hours and represented 8.4% of the total directed angler effort during the June 2016 through May 2017 creel survey. Additionally, between the 2012–2013 and 2016–2017 creel surveys catch rates increased from 0.64/h to 2.74/h, and harvest increased from 7,546 fish to 74,999 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 12,895 angler hours (2.8% of total effort) during the 2016 – 2017 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 but have experienced a steady decline, likely due to low seasonal (spring) inflows into Lake Conroe and associated lack of spawning habitat.

Bootstrap analysis of data from the 2016 gill net survey suggests over 24 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 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 (Wr) will be used for supplemental qualitative assessment of prey availability if needed.

Creel

Lake Conroe hosts multiple popular fisheries that supported an estimated 454,627 angler hours of fishing and contributed an estimated \$6,358,107 to the local economy during the 2016–2017 creel survey. A creel survey will be conducted in June 2021–May 2022 to monitor trends in angling effort, angling expenditures, catch, and harvest. The creel will also provide additional information on population trends for species with historically low sampling success such as catfishes, White Bass, and crappies.

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 and 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, and monitor for the re-emergence of hydrilla.

Literature Cited

- Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.
- DiCenzo, V. J., M. J. Maceina, and M. R. Stimpert. 1996. Relations between reservoir trophic state and Gizzard Shad population characteristics in Alabama reservoirs. North American Journal of Fisheries Management 16:888-895.
- Dumont, S. C., and B. C. Neely. 2011. A proposed change to Hybrid Striped Bass proportional size distribution length categories. North American Journal of Fisheries Management 31: 722-725.
- Guy, C. S., R. M. Neumann, D. W. Willis, and R. O. Anderson. 2007. Proportional size distribution (PSD): a further refinement of population size structure index terminology. Fisheries 32(7): 348.
- Klussman, W.G., R.L. Noble, R.D. Martyn, W.J. Clark, R.K. Betsill, P.W. Bettoli, M.F. Cichra, and J.M. Campbell. 1988. Control of aquatic macrophytes by grass carp in Lake Conroe, Texas and the effects on the reservoir ecosystem. Texas Agricultural Experiment Station Bulletin MP-1664, College Station, TX.
- Webb, M, A. Best, and M. Gore 2014. Lake Conroe, 2013 fisheries management survey report. Texas Parks and Wildlife Department, Federal Aid Report F-221-M-4, Austin.
- Slipke, J. W. and M. J. Maceina. 2014. Fishery analysis and modeling simulator (FAMS version 1.64). American Fisheries Society, Bethesda, Maryland.
- Texas Commission on Environmental Quality. 2011. Trophic classification of Texas reservoirs. 2010 Texas Water Quality Inventory and 303 (d) List, Austin. 18 pp.
- United States Geological Society (USGS). 2018. National water information system: Web interface. Available: <http://waterdata.usgs.gov/tx/nwis> (May 2018).

Tables and Figures

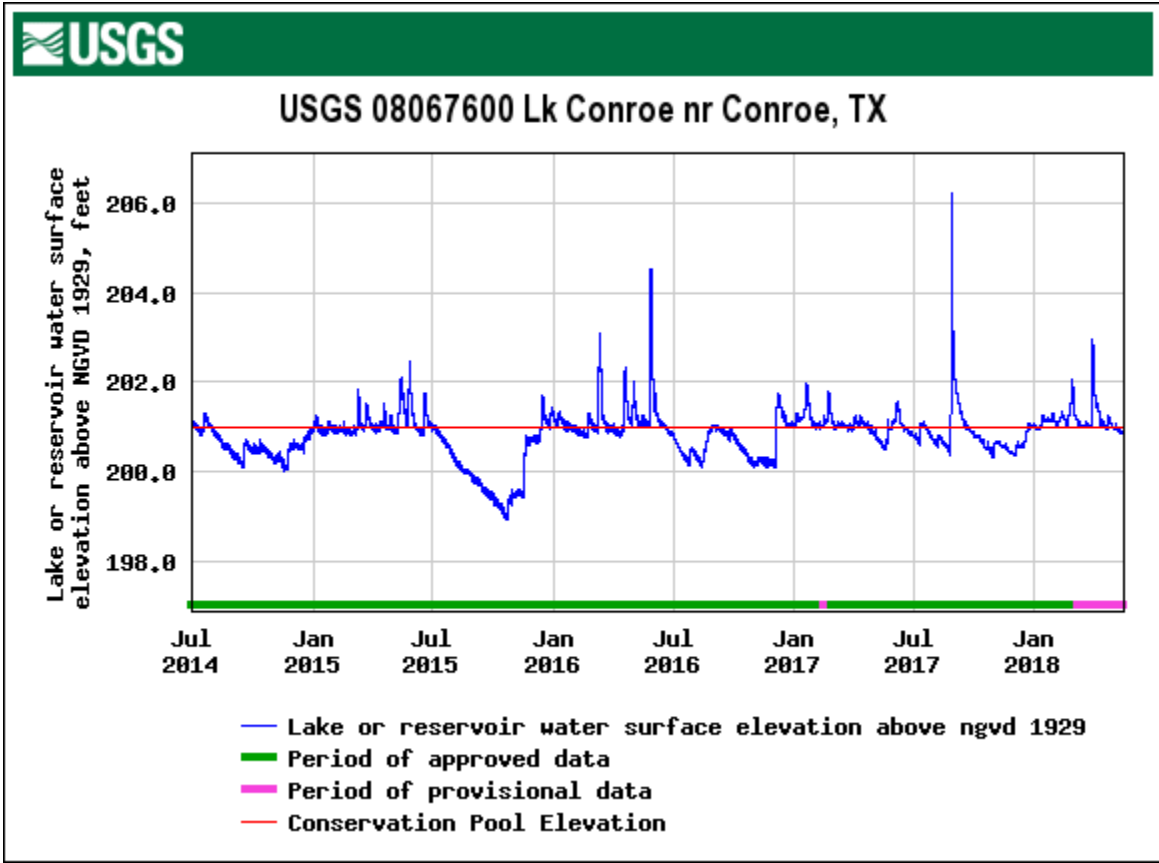


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Lake Conroe Reservoir, Texas.

Table 1. Characteristics of Lake Conroe, Texas.

Characteristic	Description
Year constructed	1973
Controlling authority	San Jacinto River Authority
County	Montgomery and Walker
Reservoir type	Mainstream
Shoreline Development Index	7.4 ^a
Conductivity	140-260 μ mhos/cm

^a TCEQ 2011 Trophic classification of Texas reservoirs.

Table 2. Boat ramp characteristics for Lake Conroe, Texas, August 2017. Reservoir elevation at time of survey was 200 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
Inland 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 (in any combination)	12-inch minimum
Catfish, Flathead	5	18-inch minimum
Bass, White	25	10-inch minimum
Bass, Hybrid	5	18-inch minimum
Bass, Largemouth	5 ^a	16-inch minimum
Bass, Spotted	5 ^a	No minimum length
Crappie: White and Black crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum

^aLargemouth Bass and Spotted Bass 5 fish bag in aggregate.

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

Year	Number	Size	Year	Number	Size
<u>Blue Catfish</u>			<u>Largemouth Bass</u>		
1971	27,440	FGL	1970	75,000	FGL
<u>Channel Catfish</u>			<u>ShareLunker Largemouth Bass</u>		
1970	2,000	FGL	2006	4,592	FGL
1971	193,852	FGL	2008	2,779	FGL
1973	<u>68,570</u>	FGL	2009	<u>3,014</u>	FGL
Species Total	264,422		Species Total	15,565	
<u>Striped Bass</u>			<u>Florida Largemouth Bass</u>		
1994	210,000	FGL	1979	549,104	FGL
<u>Hybrid Striped Bass</u>			1988	55,278	FGL
1978	119,313	FGL	1989	52,148	FGL
1979	210,950	FGL	1990	51,256	FGL
1980	126,000	FGL	1991	151,453	FGL
1995	212,900	FGL	1992	209,310	FGL
1996	102,228	FGL	1993	101,217	FGL
1997	123,097	FGL	1994	103,416	FGL
1998	217,800	FGL	1995	526,806	FGL
1999	106,338	FGL	1996	543,871	FGL
2002	105,170	FGL	1997*	40,000	FGL
2003	151,195	FGL	1999	29,607	FGL
2004	201,554	FGL	2000	296,696	FGL
2005	201,367	FGL	2000*	31,050	FGL
2006	132,429	FGL	2001	448,267	FGL
2007	169,027	FGL	2002*	40,000	FGL
2008	217,000	FGL	2004	5,180	FGL
2009	104,045	FGL	2007	504,192	FGL
2011	117,360	FGL	2008	501,191	FGL
2013	95,642	FGL	2010	267,517	FGL
2014	100,694	FGL	2011	503,719	FGL
2015	201,175	FGL	2013	517,886	FGL
2016	<u>103,312</u>	FGL	2014	184,959	FGL
Species Total	3,106,330		2015	115,690	FGL
<u>Sunshine Bass</u>			2016	114,290	FGL
2014	101,198	FGL	2017	<u>111,375</u>	FGL
			Species Total	6,159,559	

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>White Crappie</u>			<u>Walleye</u>		
1990*	10,000	FGL	1973	5,900,000	FGL
1992*	5,371	FGL	1974	<u>4,500,000</u>	FGL
1995*	18,200	FGL	Species Total	10,400,000	
1996*	<u>26,444</u>	FGL			
Species Total	60,015		<u>White Amur (diploid Grass Carp)</u>		
<u>Black Crappie</u>			1981**	166,835	AFGL
1989*	99,850	FGL	1982**	<u>103,165</u>	AFGL
1992*	6,371	AFGL	Species Total	270,000	
1994*	41,970	AFGL	<u>White Amur (triploid Grass Carp)</u>		
1996*	22,000	AFGL	2006	27,441	AFGL
1998*	41,466	AFGL	2007	58,750	AFGL
1999*	13,300	AFGL	2008	<u>37,839</u>	AFGL
2000*	<u>36,500</u>	AFGL	Species Total	124,030	
Species Total	261,457				

* 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 2017–2018.

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 ≥ 50 stock
	Age-and-growth	Comprehensive growth curve	N > 2 for all inch classes
	Condition	W_r	10 fish/inch group (max)
	Genetics	% FLMB	N = 30, any age
Sunfishes, Bluegill and Redear ^a	Abundance	CPUE–Total	RSE ≤ 25
	Size structure	PSD, length frequency	N ≥ 50
Gizzard Shad ^a	Abundance	CPUE–Total	RSE ≤ 25
	Size structure	PSD, length frequency	N ≥ 50
	Prey availability	IOV	N ≥ 50
<i>Gillnetting</i>			
Catfishes, Blue and Channel	Abundance	CPUE–stock	RSE-Stock ≤ 25
	Size structure	Length frequency	N ≥ 50 stock
Temperate Basses	Abundance	CPUE–stock	RSE-Stock ≤ 25
	Size structure	Length frequency	N ≥ 50 stock
<i>Trap netting</i>			
Crappie	Size structure	PSD, length frequency	N = 50

^a No additional effort will be 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.

Table 6. Survey of structural habitat types, Lake Conroe, Texas, 2018. 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 emergent	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, 2014-2017. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Vegetation	2014	2015	2016	2017
Native submersed	0	0	0	< 1
Native floating-leaved	405 (2%)	367 (2%)	68 (<1%)	32 (<1%)
Native emergent	803 (4%)	848 (4%)	265 (1%)	172 (<1%)
Non-native				
Alligator Weed (Tier III)	25 (<1%)	196 (1%)	5 (<1%)	3 (<1%)
Elephant ear (Tier III)	< 1 (<1%)	< 1 (<1%)	1 (<1%)	< 1 (<1%)
Giant salvinia (Tier II)*	78 (<1%)	350 (2%)	58 (<1%)	154 (<1%)
Hydrilla (Tier I)*	< 1 (<1%)	< 1 (<1%)	< 1 (<1%)	< 1 (<1%)
Water hyacinth (Tier II)*	162 (<1%)	314 (2%)	89 (<1%)	48 (<1%)

*Tier I is immediate Response, Tier II is maintenance, Tier III is Watch Status

Table 8. Total fishing effort (h) for all species and total directed expenditures at Lake Conroe, Texas, 2008-2009, 2012-2013, and 2016-2017. Survey periods were from June 1st through May 31st. Relative standard error is in parentheses.

Creel statistic	2008/2009	2012/2013	2016/2017
Total fishing effort	216,063 (15)	184,408 (19)	454,627 (9)
Total directed expenditures	\$970,236 (27)	\$1,244,774 (27)	\$6,358,107 (168)

Table 9. Percent directed angler effort by species for Lake Conroe, Texas, 2008-2009, 2012-2013, and 2016-2017. Survey periods were from June 1st through May 31st.

Species	2008/2009	2012/2013	2016/2017
Catfishes	18.4	29.9	31.8
Temperate Basses	0.6	4.1	2.8
Sunfishes	1.8	0.9	3.9
Largemouth Bass	40.0	51.1	36.2
Crappies	11.7	7.8	8.4
Anything	13.6	6.0	16.8

Table 10. Total fishing effort (h) for all species, total direct expenditures, directed effort by species, total catch, and angler catch rate among boat and bank anglers, Lake Conroe, Texas, 2016-2017. Bank anglers included those on natural shoreline, bulkhead, or fishing pier. Relative standard error is in parentheses where applicable.

Creel statistic	Bank anglers	Boat anglers
Total fishing effort (h)	119,130 (12)	335,497 (10)
Percent fishing effort	26%	74%
Total directed expenditures	\$431,447 (73)	\$5,926,660 (179)
Percent directed expenditures	15%	85%
Percent directed effort		
Catfish	22 (31)	35 (12)
Sunfishes	8 (47)	2 (33)
Largemouth Bass	12 (41)	45 (11)
Crappie	13 (38)	7 (22)
Temperate Basses	0	4 (27)
Anything	45 (20)	7 (22)
Total Catch (No. of fish)		
Catfish	2,363 (<1)	246,325 (<1)
Sunfishes	23,229 (58)	49,426 (<1)
Largemouth Bass	3,654 (291)	96,405 (23)
Crappie	81,666	65,236 (<1)
Temperate Basses	0	13,884 (<1)
Catch rate (fish/h)		
Catfish	0.2 (77)	1.4 (24)
Sunfishes	2.3	6.4 (81)
Largemouth Bass	0.4 (0)	0.6 (24)
Crappie	2.5 (20)	2.9 (92)
Temperate Basses	0	0.4 (89)

Gizzard Shad

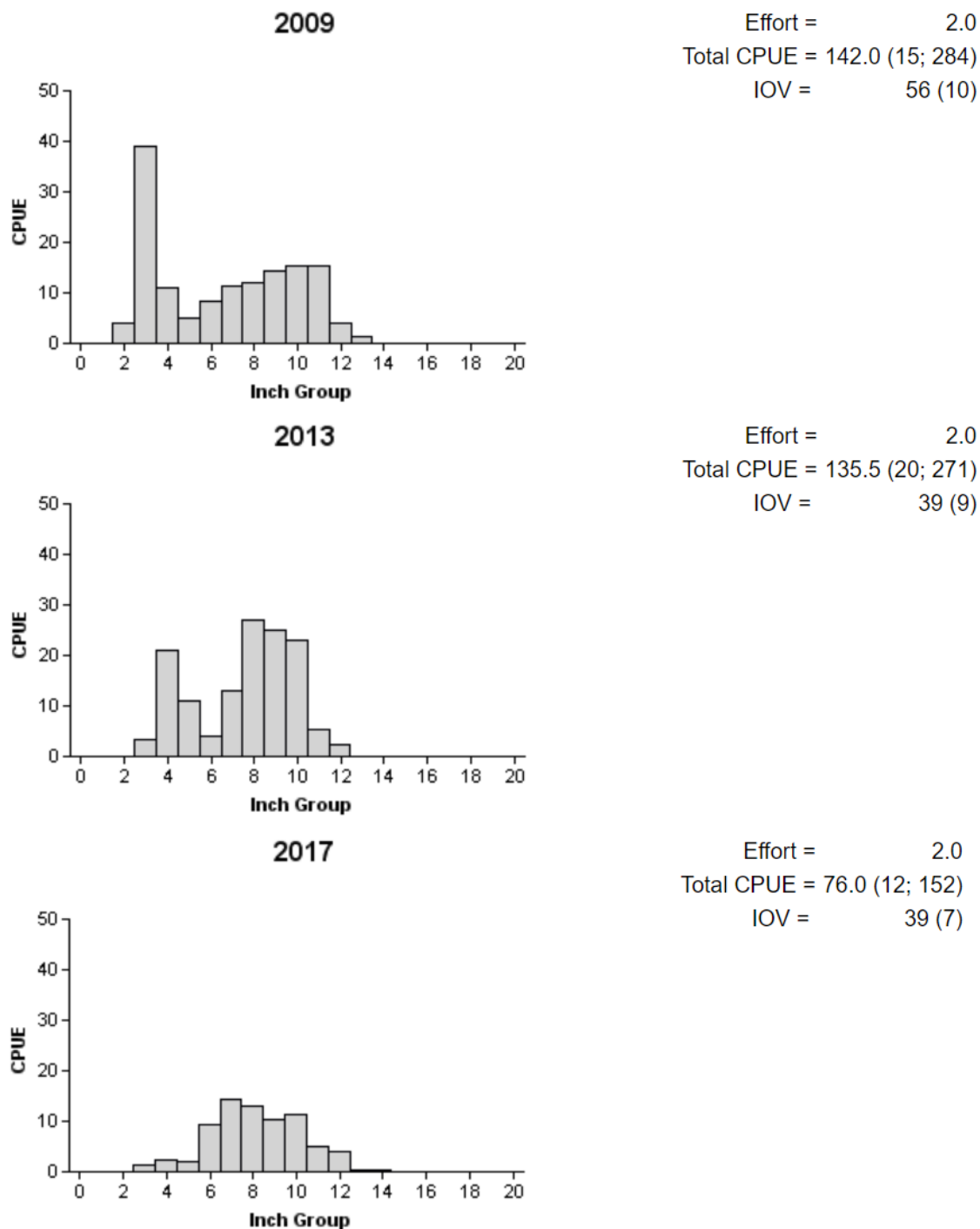


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Lake Conroe, Texas, 2009, 2013, and 2017.

Bluegill

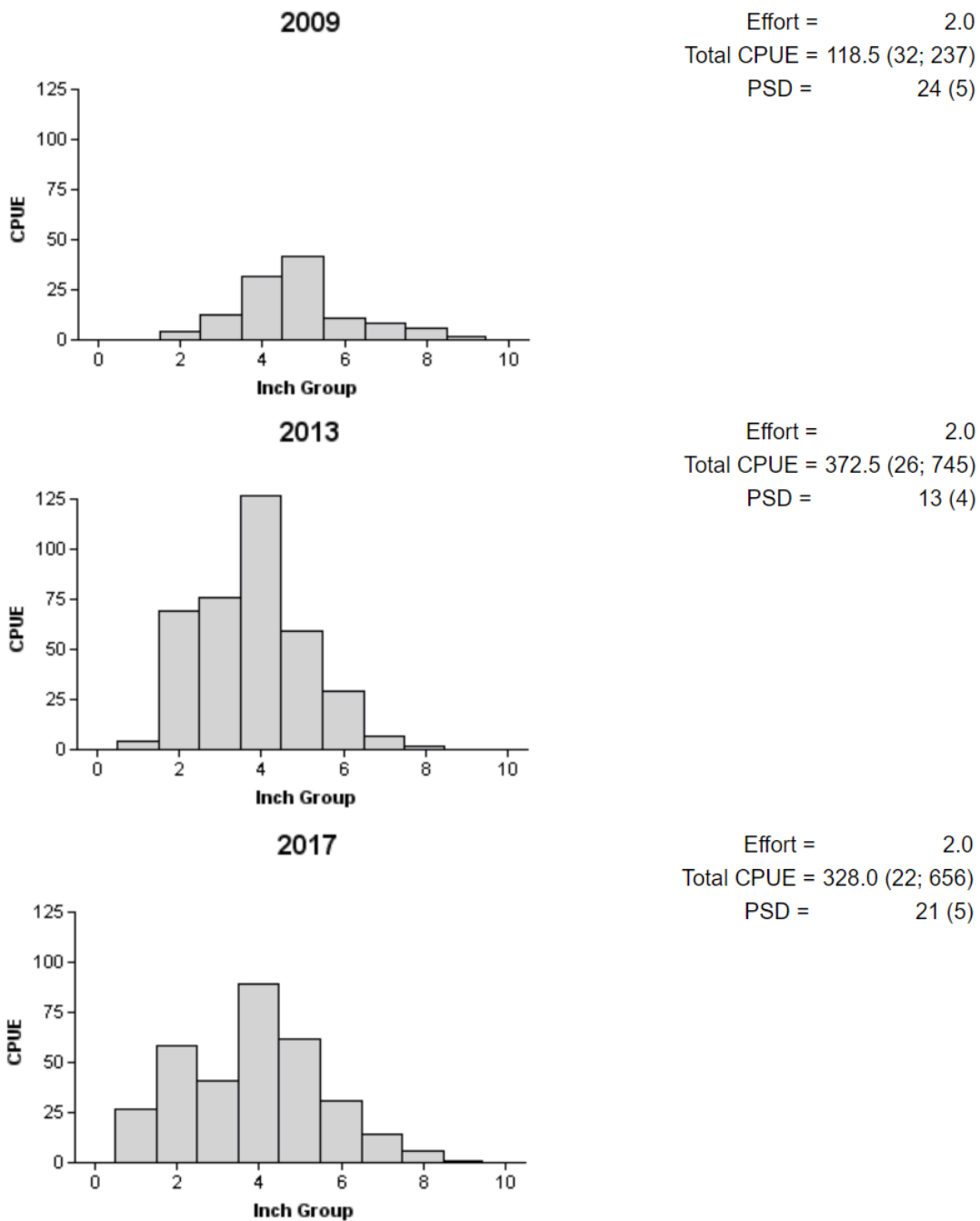


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Conroe, Texas, 2009, 2013, and 2017.

Table 11. Creel survey statistics for sunfish at Lake Conroe, Texas, from June 2008 through May 2009, June 2012 through May 2013, and June 2016 through May 2017. Total catch per hour is for anglers targeting sunfish, and total harvest is the estimated number of Bluegill harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2008/2009	2012/2013	2016/2017
Surface area (acres)	20,118	20,118	20,118
Directed effort (h)	4,287.66 (53)	1,573.90 (67)	17,911.67 (30)
Directed effort/acre	0.21 (53)	0.08 (67)	0.89 (30)
Total catch per hour	4.40 (61)	3.31 (121)	4.18 (125)
Total harvest	4,800 (84)	1,524 (198)	57,910 (45)
Harvest/acre	0.24	0.08	2.88 (45)
Percent legal released	74 %	71 %	11 %

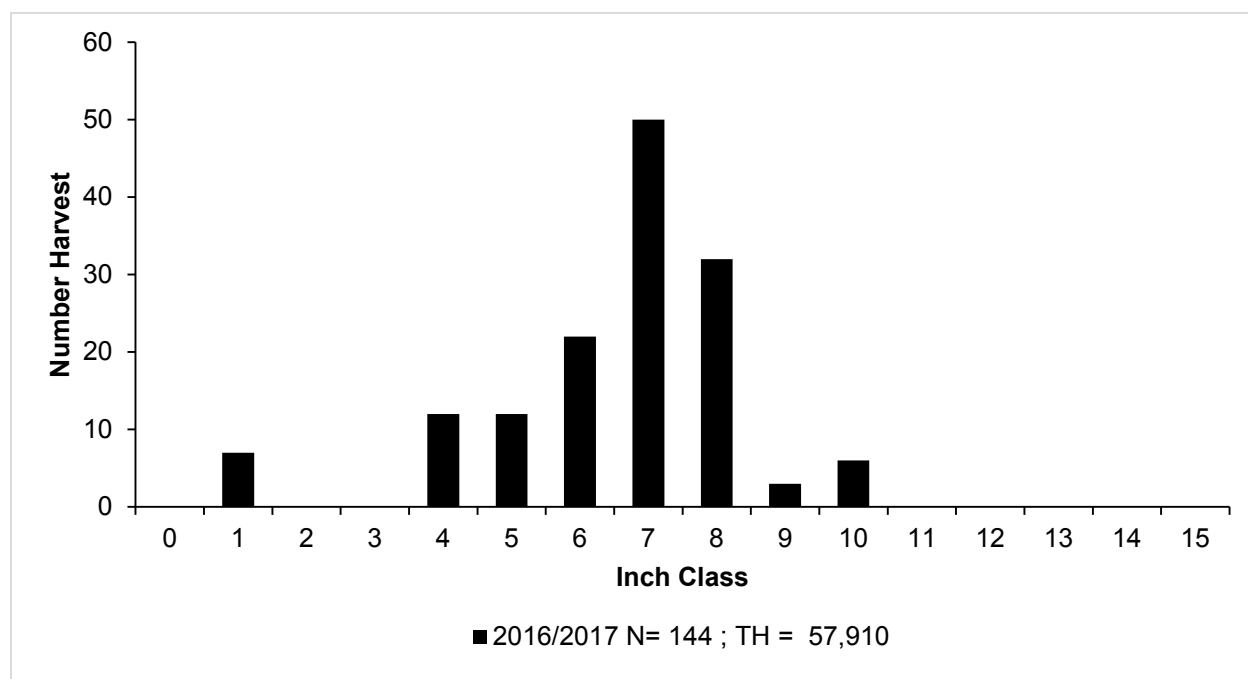


Figure 4. Length frequency of harvested Bluegill observed during creel surveys at Lake Conroe, Texas, June 2016 through May 2017, all anglers combined. N is the number of harvested Bluegill observed during creel surveys, and TH is the total estimated harvest for the creel period

Blue Catfish

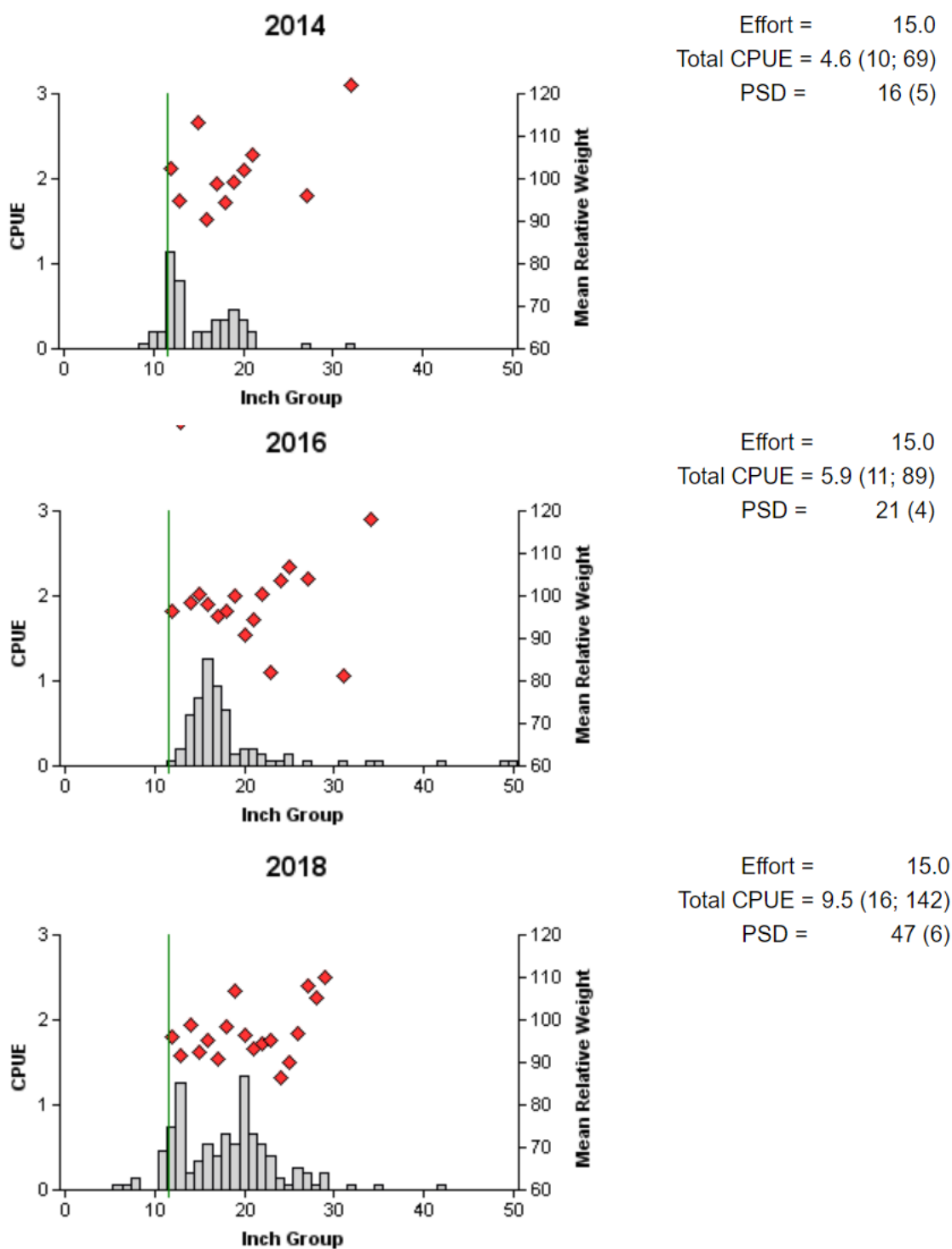


Figure 5. Number of Blue Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Conroe, 2014, 2016, and 2018. Vertical line indicates minimum length limit.

Channel Catfish

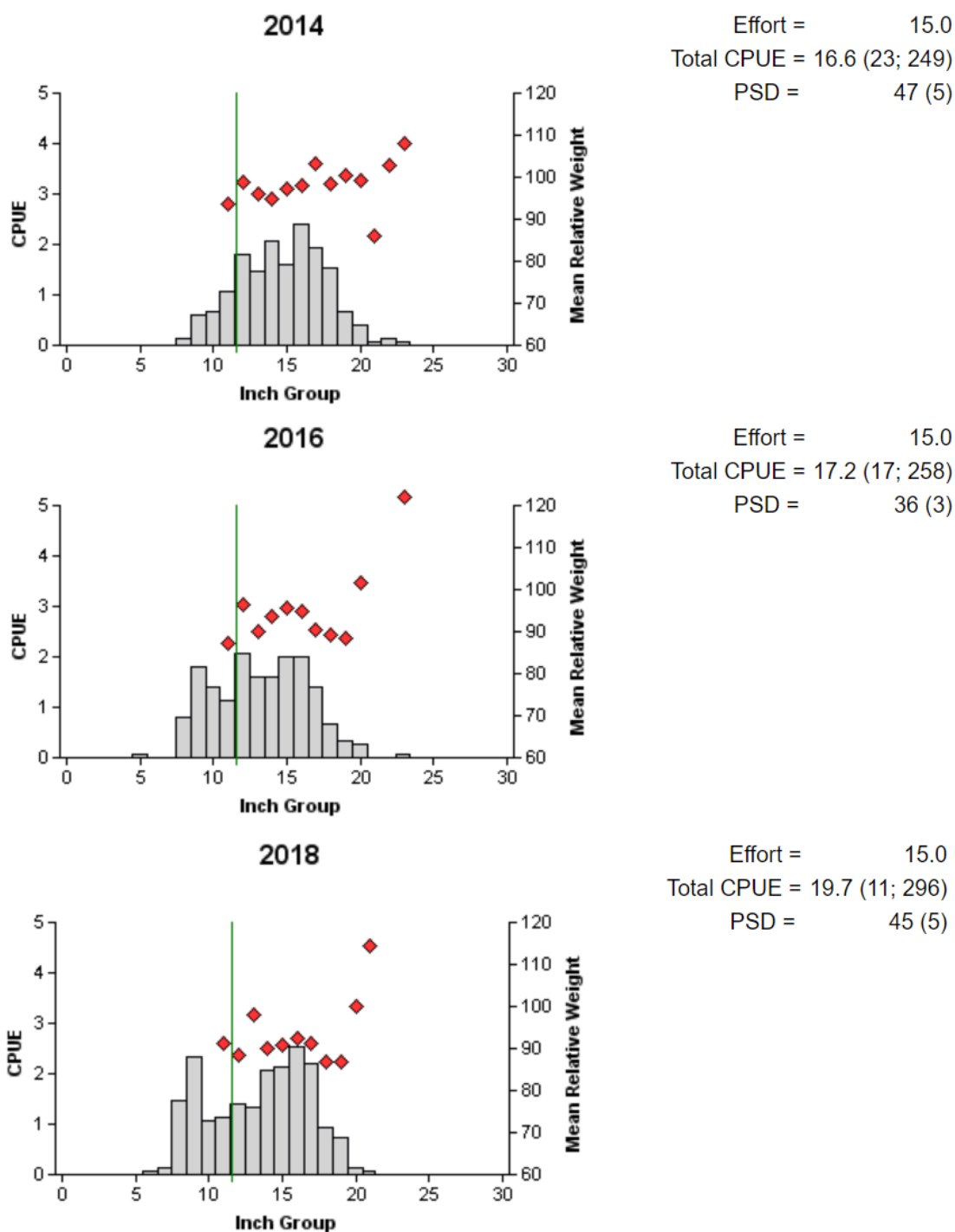


Figure 6. Number of Channel Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Conroe, 2014, 2016, and 2018. Vertical line indicates minimum length limit.

Table 12. Creel survey statistics for Blue Catfish and Channel Catfish at Lake Conroe, Texas, June 2008 through May 2009, June 2012 through May 2013, and June 2016 through May 2017. 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		
	2008/2009	2012/2013	2016/2017
Surface area (acres)	20,118	20,118	20,118
Directed effort (h)	39,001.34 (25)	53,854.16 (19)	144,445.63 (12)
Directed effort/acre	1.94 (25)	2.68 (19)	7.18 (12)
Total catch per hour	1.89	2.01	1.74
Total harvest			
Blue Catfish	19,586 (33)	9,072 (70)	20,307 (55)
Channel Catfish	33,919 (31)	69,759 (30)	139,076 (37)
Harvest/acre			
Blue Catfish	0.97 (33)	0.45 (70)	0.01 (55)
Channel Catfish	1.69 (31)	3.47 (30)	6.91 (37)
Total percent legal released	8 %	7 %	4 %

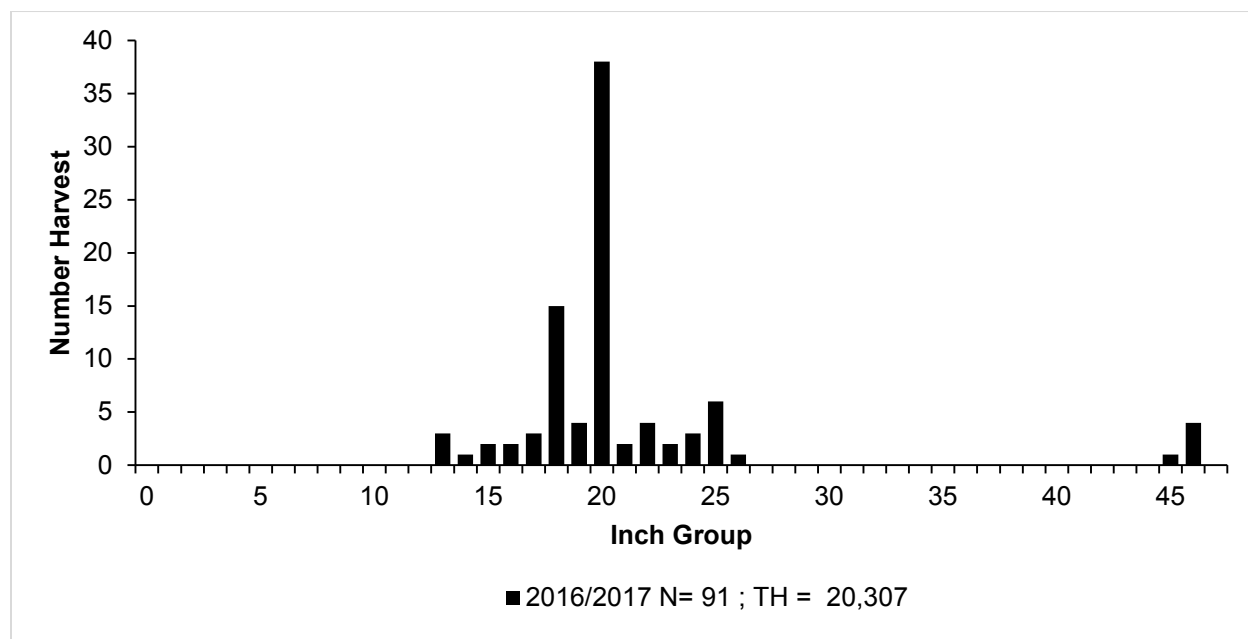


Figure 7. Length frequency of harvested Blue Catfish observed during creel surveys at Lake Conroe, Texas, June 2016 through May 2017, all anglers combined. N is the number of harvested Blue Catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

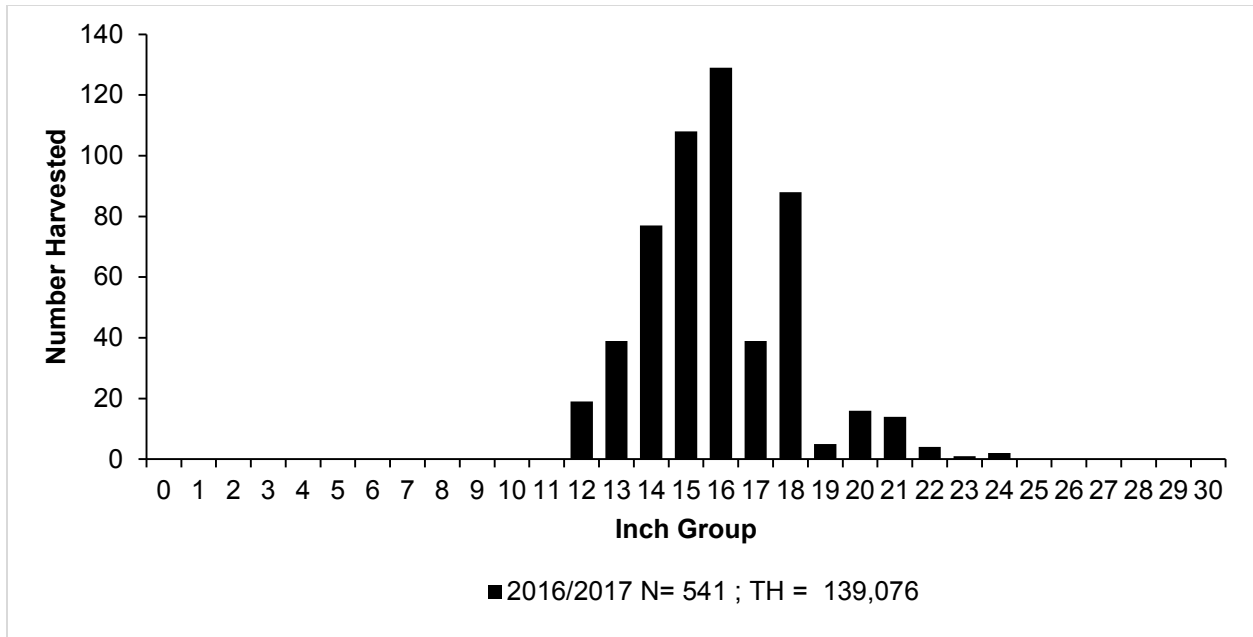


Figure 8. Length frequency of harvested Channel Catfish observed during creel surveys at Lake Conroe, Texas, June 2016 through May 2017, all anglers combined. N is the number of harvested Channel Catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

Hybrid Striped Bass

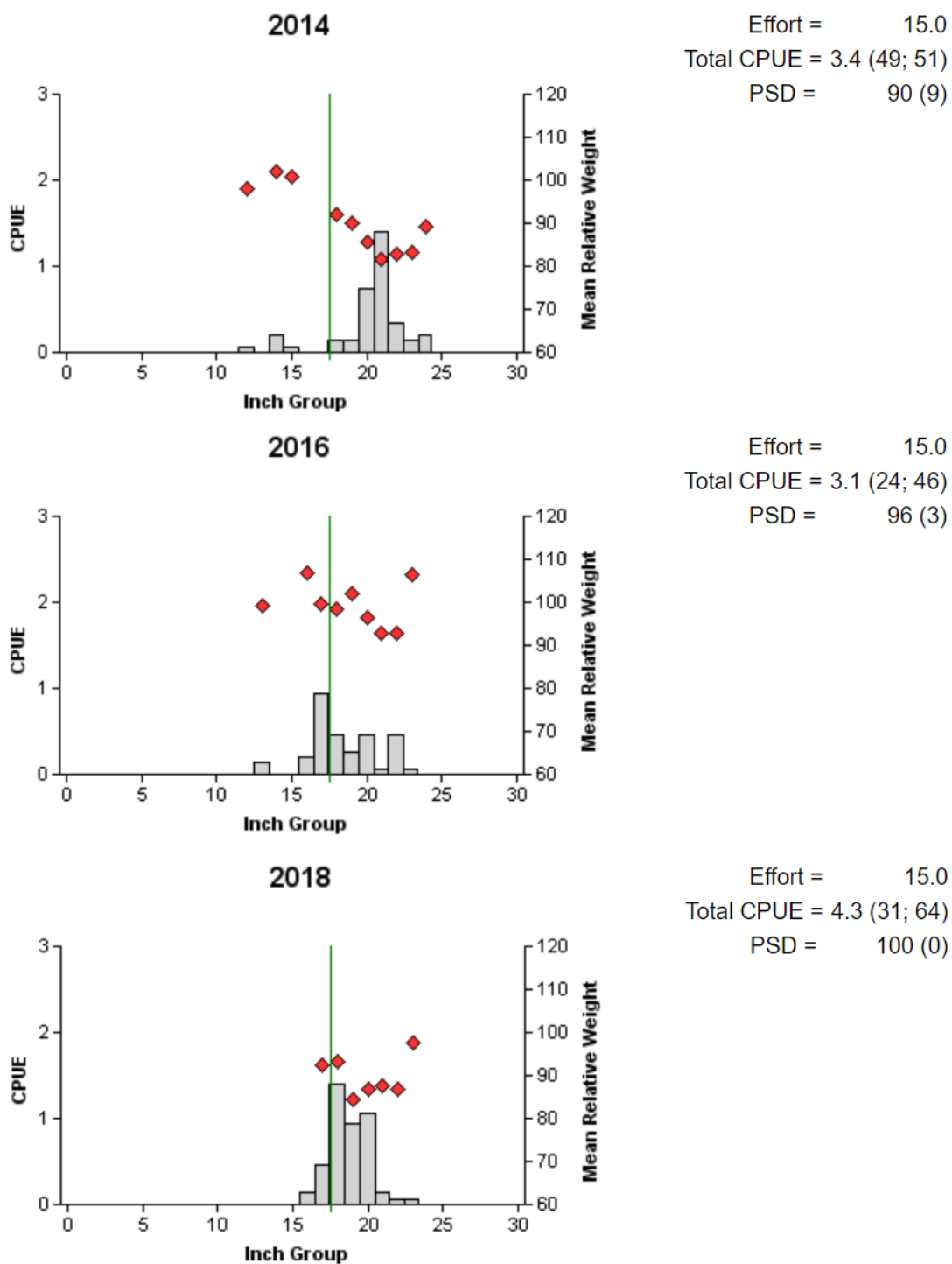


Figure 9. Number of Hybrid Striped Bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Conroe, 2014, 2016, and 2018. Vertical line indicates minimum length limit.

Table 13. Creel survey statistics for temperate basses at Lake Conroe, Texas, from June 2008 through May 2009, June 2012 through May 2013, and June 2016 through May 2017. Directed effort is for anglers targeting all temperate basses, total catch per hour is for anglers targeting Hybrid Striped Bass and White Bass, 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		
	2008/2009	2012/2013	2016/2017
Surface area (acres)	20,118	20,118	20,118
Directed effort (h)	3,333.61 (100)	8,589.69 (43)	12,895.38 (27)
Directed effort/acre	0.17	0.43	0.89
Total catch per hour	4.51 (175)	3.41 (47)	0.40 (89)
Total harvest			
White Bass	275 (435)	0	178 (1765)
Hybrid Striped Bass	1,450 (141)	15,585 (69)	4,995 (128)
Harvest/acre			
White Bass	0.01 (424)	0.00	<0.01 (1765)
Hybrid Striped Bass	0.07 (352)	0.77 (69)	0.25 128
Percent legal released			
White Bass	50.25 (365)	0.00	45.23 (725)
Hybrid Striped Bass	10 %	25 %	11 %

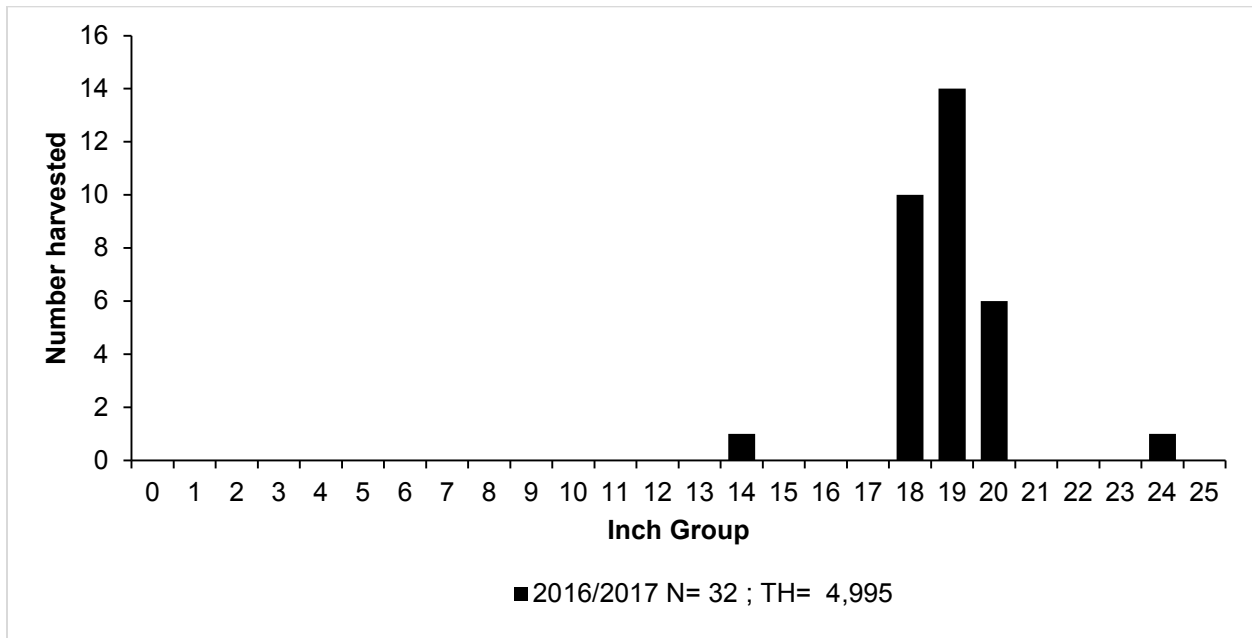


Figure 10. Length frequency of harvested Hybrid Striped Bass observed during creel surveys at Lake Conroe, Texas, June 2016 through May 2017, all anglers combined. N is the number of harvested Hybrid Striped Bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Largemouth Bass

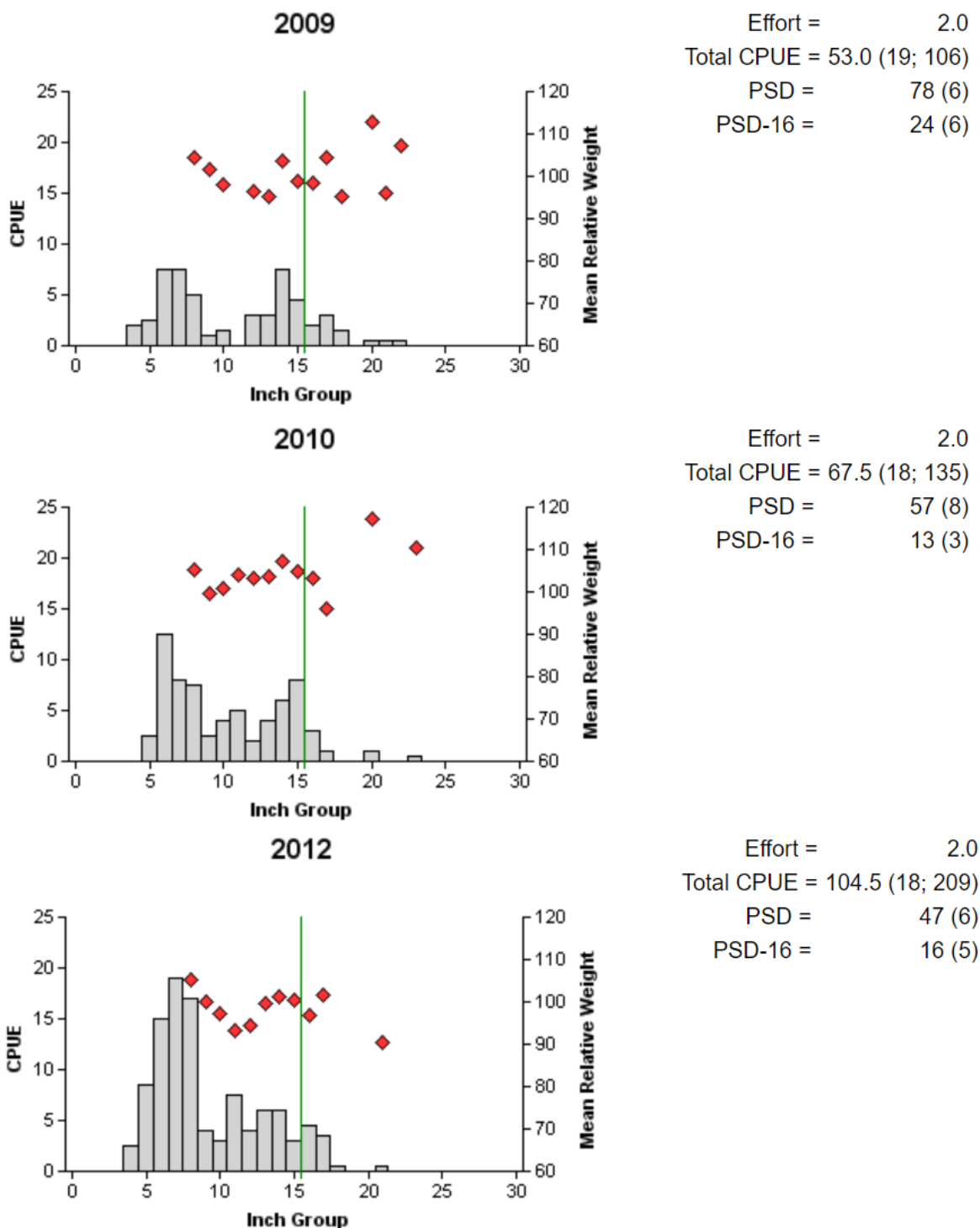


Figure 11. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Conroe, Texas, 2009, 2010, and 2012. Vertical line indicates minimum length limit.

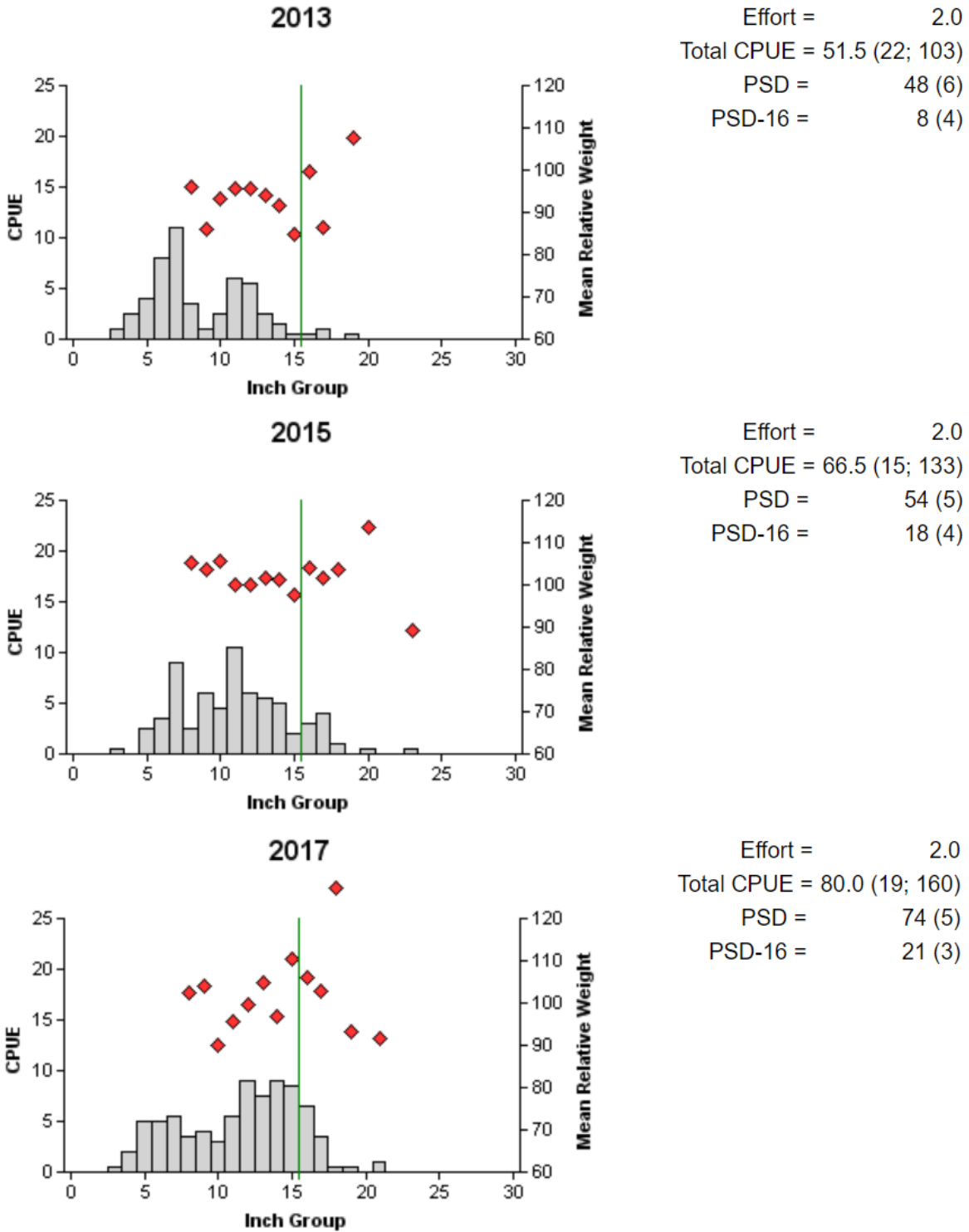


Figure 11 (Continued). Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Conroe, Texas, 2013, 2015, and 2017. Vertical line indicates minimum length limit.

Table 14. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Lake Conroe, Texas, 2017. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB. Genetic composition was determined by micro-satellite DNA analysis.

Year	Sample size	Number of Fish				% FLMB alleles	% pure FLMB
		FLMB	F1	Fx	NLMB		
1993	31	2	5	19	5	46	6.5
1994	50	9	9	30	2	57	18
1995	35	9	9	13	4	61	26
1996	27	4	12	7	4	55	15
1997	30	10	5	12	3	62	33
1998	26	5	8	13	0	61	19
1999	25	4	5	16	0	67	16
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

Table 15. Creel survey statistics for Largemouth Bass at Lake Conroe, Texas, from from June 2008 through May 2009, June 2012 through May 2013, and June 2016 through May 2017. 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	2008/2009	2012/2013	2016/2017
Surface area (acres)	20,118	20,118	20,118
Directed angling effort (h)			
Tournament	930.42 (75)	3,092.27 (47)	28,327.95 (18)
Non-tournament	99,270.51 (49)	89,084.64 (53)	136,158.30 (12)
All black bass anglers combined	100,200.93 (124)	92,176.91 (100)	164,486.24 (11)
Angling effort/acre	4.98 (124)	4.58 (100)	8.18 (11)
Catch rate (number/h)	0.62 (77)	0.63 (62)	0.61 (25)
Harvest			
Non-tournament harvest	5,404 (44)	6,896 (49)	9,967 (60)
Harvest/acre	0.27 (44)	0.34 (49)	0.50 (55)
Tournament weigh-in and release	136 (592)	1,171 (153)	13,376 (81)
Release by weight			
<4.0 lbs	NA	16,058.00 (42)	71,910 (48)
4.0-6.9 lbs	NA	963.00 (59)	4,287 (60)
7.0-9.9 lbs	NA	0.00	519 (74)
≥10.0 lbs	NA	0.00	0.00
Percent legal released (non-tournament)	75%	57%	56%

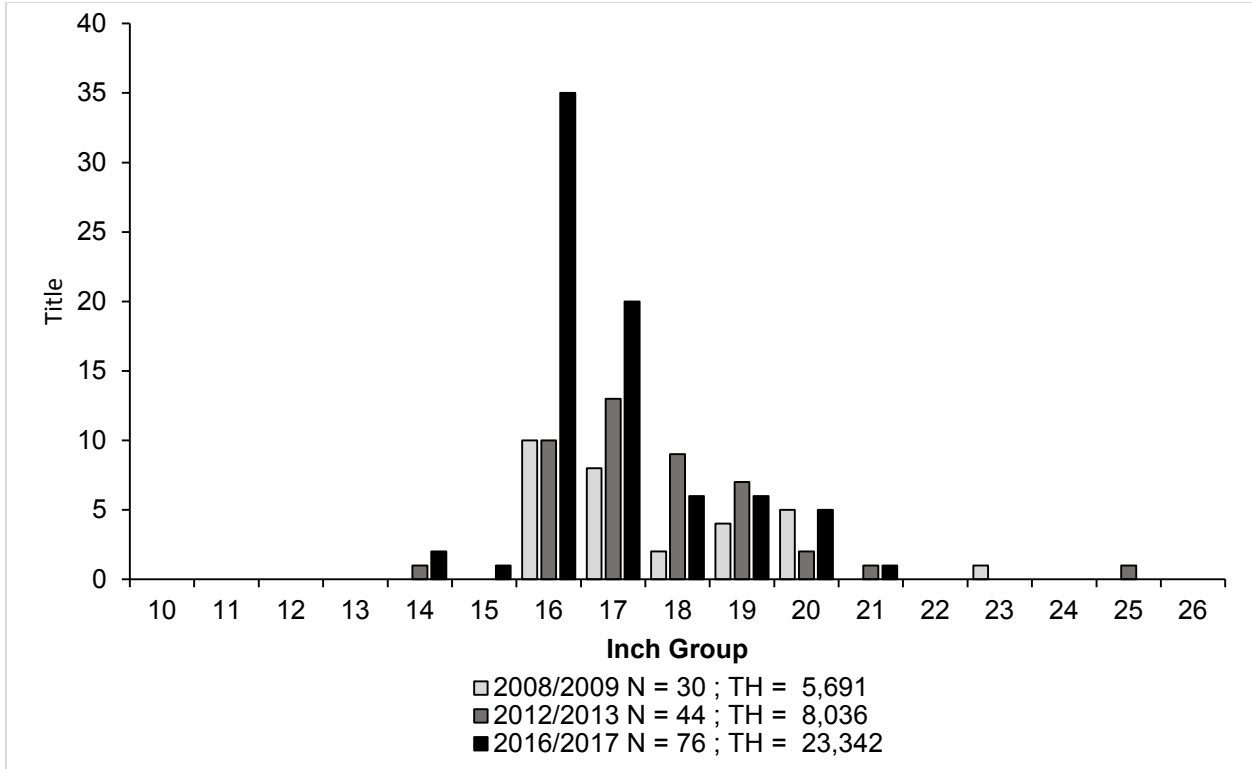


Figure 12. Length frequency of non-tournament harvested Largemouth Bass observed during creel surveys at Lake Conroe, Texas, June 2016 through May 2017, all anglers combined. N is the number of harvested Largemouth Bass observed during creel surveys, and TH is the estimated non-tournament harvest for the creel period.

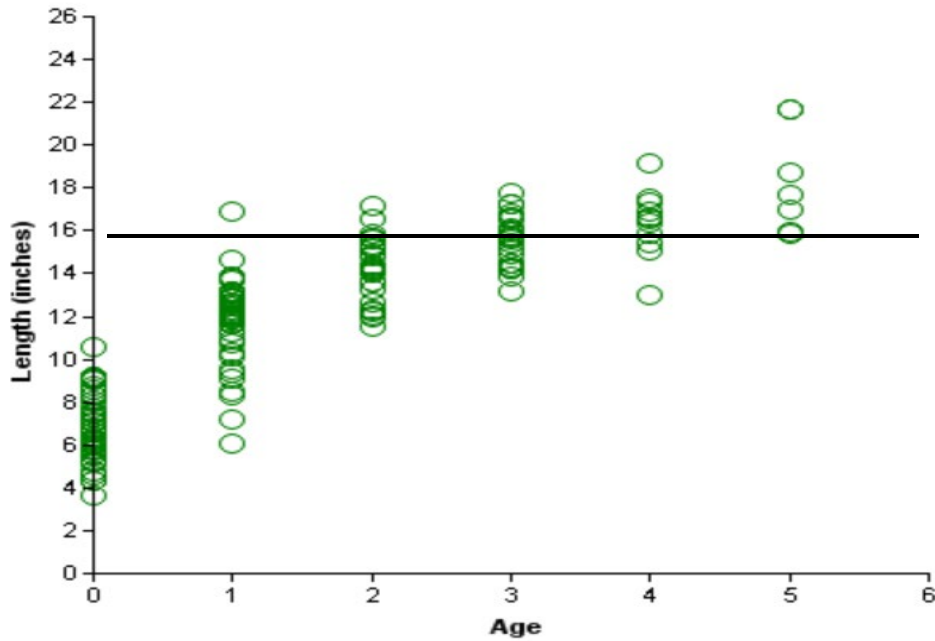


Figure 13. Length at age for Largemouth Bass collected from electrofishing surveys at Lake Conroe, Texas, 2017. Horizontal line represents minimum length limit.

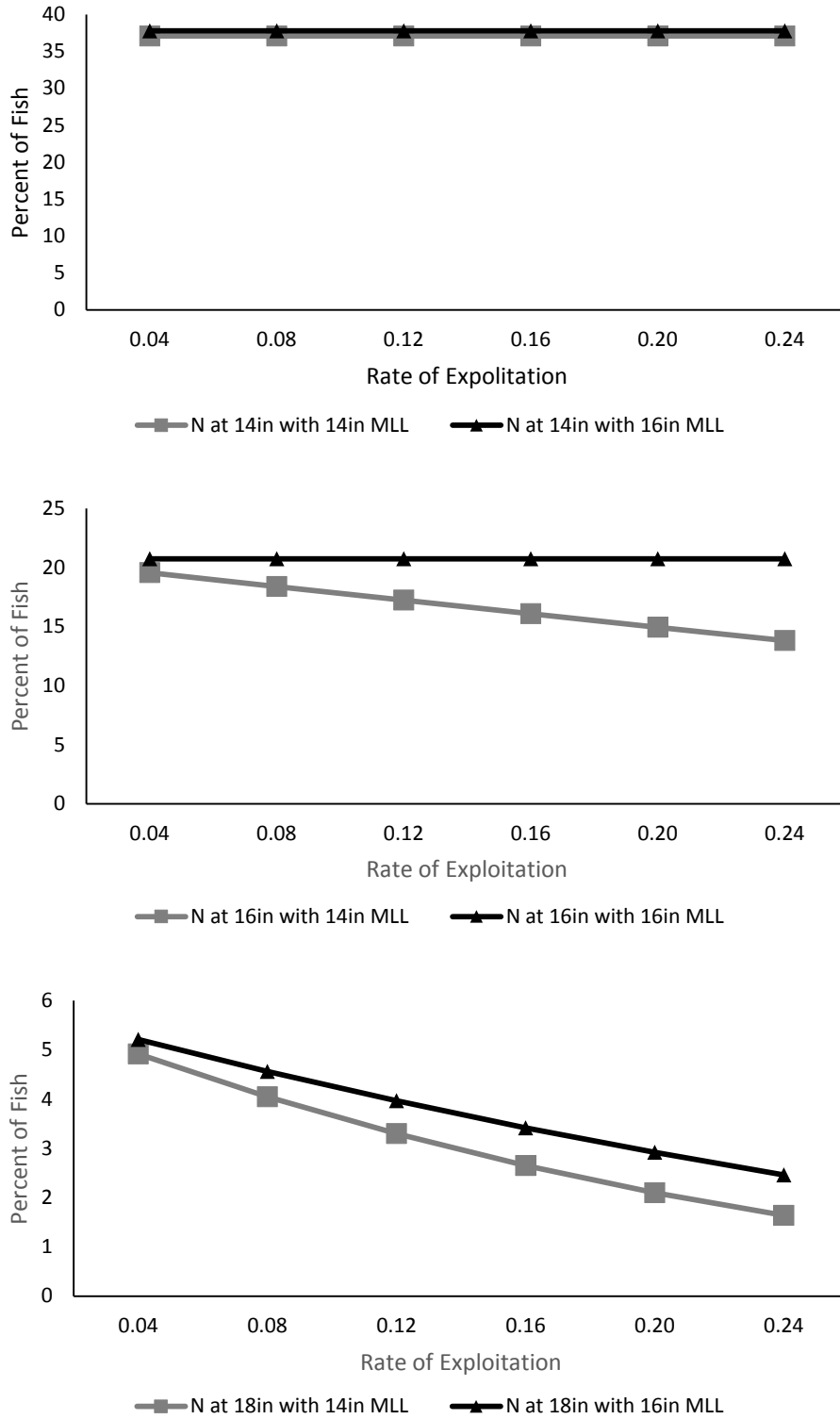


Figure 14. The percent of Largemouth Bass in Lake Conroe that would be 14-inches, 16-inches, and 18-inches under a 14-inch (355 mm) and 16-inch (406 mm) minimum length limits at varying rates of exploitation. Exploitation on Lake Conroe was estimated to be between 5% and 15% in the 2017 creel survey.

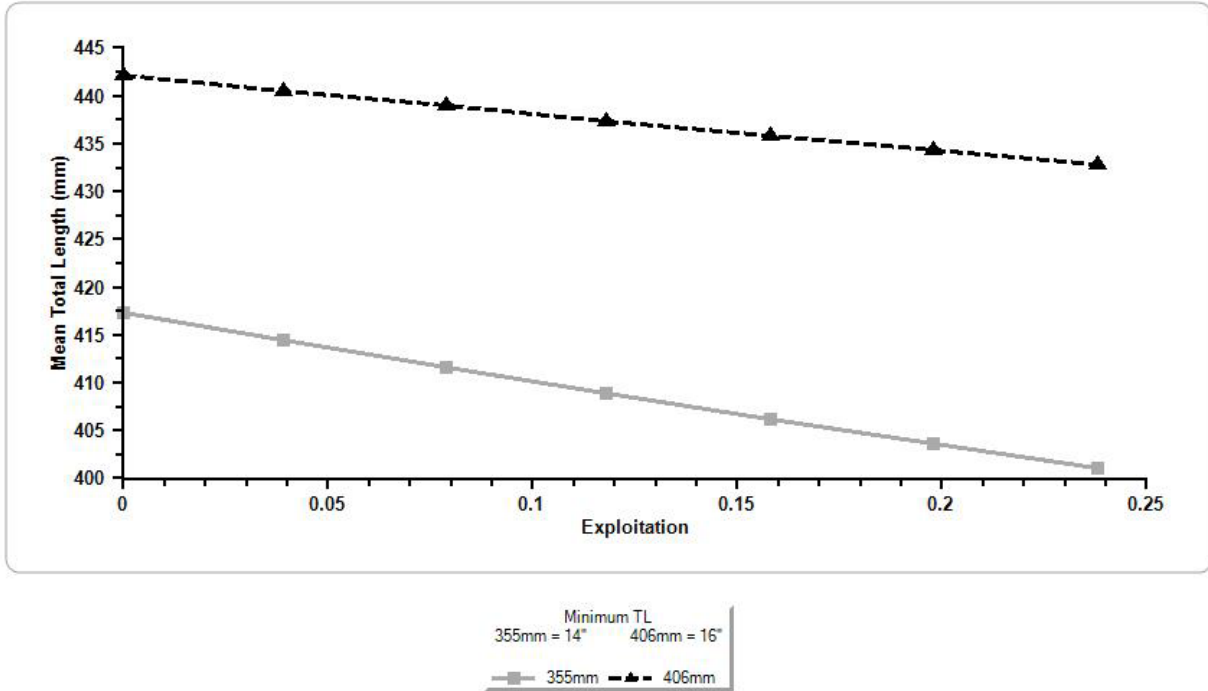


Figure 15. Projected mean length of Largemouth Bass from Lake Conroe under a 14-inch or 16-inch minimum length limit. Exploitation on Lake Conroe was estimated to be between 5% and 15% in the 2017 creel survey.

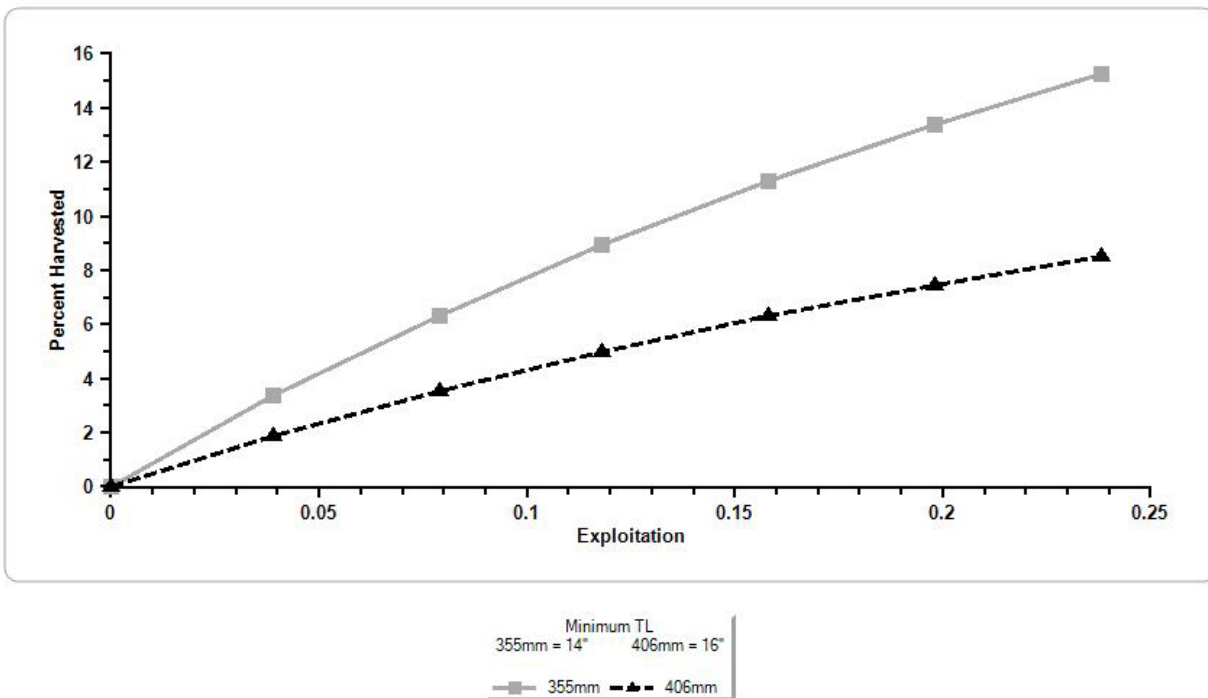


Figure 16. Projected number of Largemouth Bass that would be harvested from Lake Conroe under a 14-inch or 16-inch minimum length limit. Exploitation on Lake Conroe was estimated to be between 5% and 15% in the 2017 creel survey.

Crappies

Table 16. Creel survey statistics for White Crappie and Black Crappie at Lake Conroe, Texas, from June 2008 through May 2009, June 2012 through May 2013, and June 2016 through May 2017. Total catch per hour is for anglers targeting crappies. Total harvest is the estimated number of White Crappie and Black Crappie harvested by all anglers, and percent legal released is the percentage of legal-sized White Crappie or Black Crappie that were released. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2008/2009	2012/2013	2016/2017
Surface area (acres)	20,118	20,118	20,118
Directed effort (h)	23,492.85 (25)	14,101.81 (28)	22,088 (22)
Directed effort/acre	1.17 (25)	0.70 (28)	1.10 (22)
Total catch per hour	2.45 (27)	0.64 (55)	2.74 (80)
Total harvest	17,585 (63)	7,543 (163)	75,000 (56)
Harvest/acre	0.87 (63)	0.37 (163)	3.73 (56)
Total percent legal released	7 %	5 %	7 %

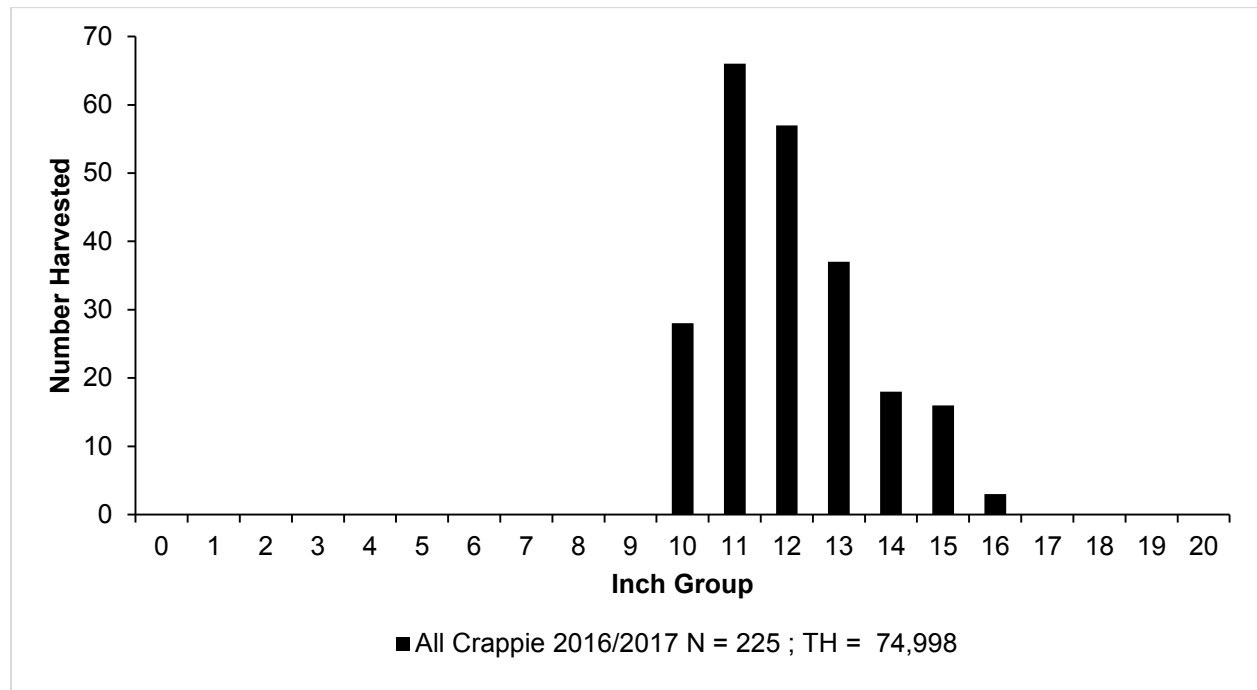


Figure 17. Length frequency of harvested White Crappie and Black Crappie observed during creel surveys at Lake Conroe, Texas, June 2016 through May 2017, all anglers combined. N is the number of harvested crappies observed during creel surveys, and TH is the total estimated harvest for the creel period.

Proposed Sampling Schedule

Table 17. Proposed sampling schedule for Lake Conroe, Texas. Survey period is June through May. Gill netting surveys are conducted in the spring while electrofishing and trap netting surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

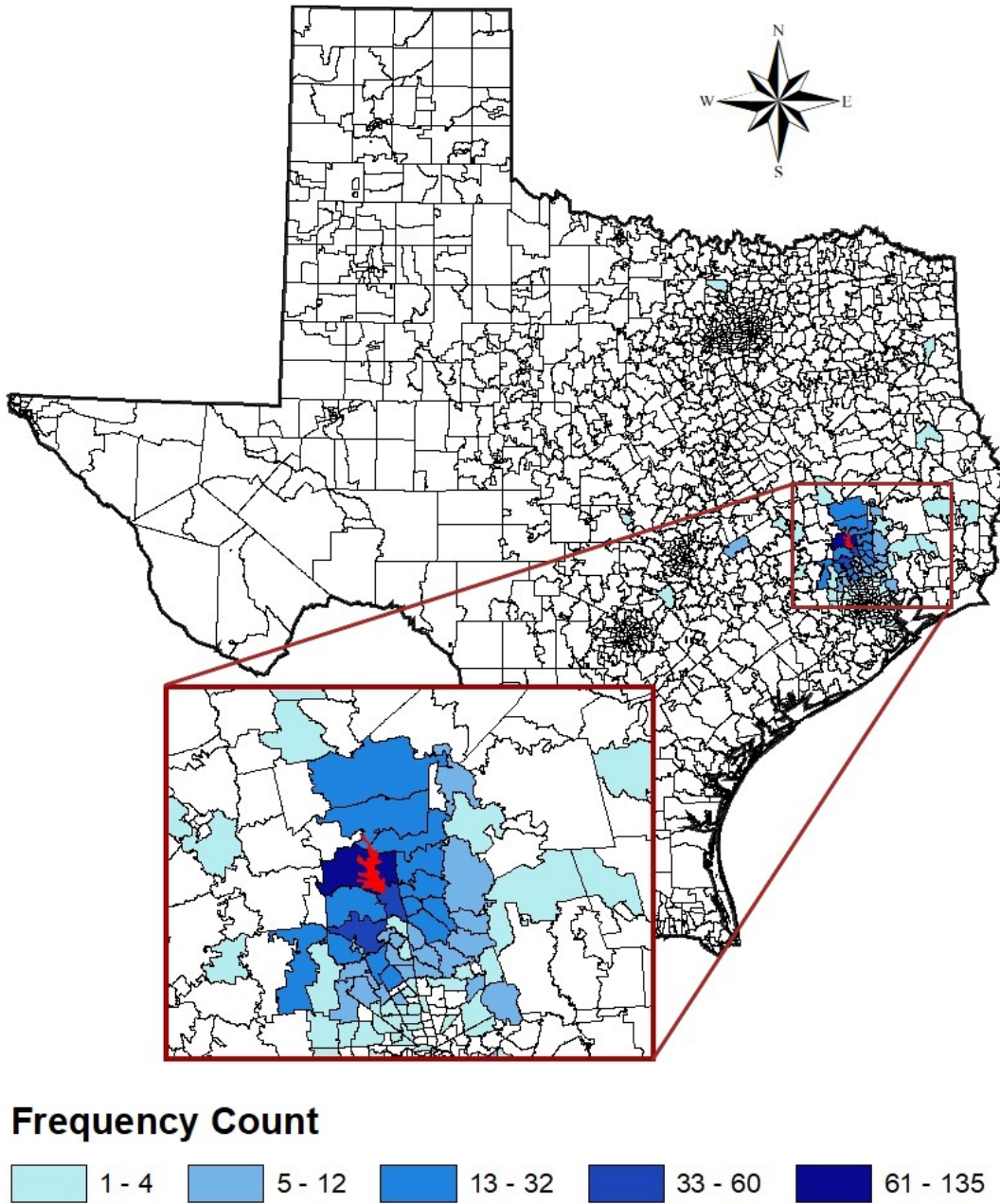
	Survey year			
	2018-2019	2019-2020	2020-2021	2021-2022
Angler Access				S
Structural Habitat				S
Vegetation – Fall (Spring)	A (A)	A (A)	A (A)	S (A)
Electrofishing – Fall		A		S
Trap netting				A
Gill netting		A		S
Creel survey			A	
Report				S

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

Catch rate (CPUE, RSE in parentheses) and number (N) of all species collected from all gear types from Lake Conroe, Texas, 2017-2018. Sampling effort was 15 net nights for gill netting, 15 net nights for trap netting, and 2 hours for electrofishing.

Species	Electrofishing		Gill Netting		Trap netting	
	N	CPUE	N	CPUE	N	CPUE
Spotted Gar			8	0.5 (44)		
Gizzard Shad	152	76.0 (12)	342	22.8 (12)		
Threadfin Shad	624	300.0 (28)	1	0.1 (100)		
Common Carp			5	0.3 (48)		
Bullhead Minnow	23	11.0 (32)				
Pugnose Minnow	1	0.5 (100)				
Inland Silverside	9	4.3 (95)				
Brook Silverside	1	0.5 (100)				
Blacktail Shiner	2	1.0 (100)				
Blue Catfish			142	9.5 (16)		
Black Bullhead	1	0.5 (100)				
Channel Catfish			296	19.7 (11)		
Blackspotted Topminnow	1	0.5 (100)				
White Bass			3	0.2 (72)		
Yellow Bass			22	1.5 (46)		
Hybrid Striped Bass (Striped X White Bass hybrid)			6	4.3 (31)		
Orangespotted Sunfish	1	0.5 (100)				
Bluegill	656	314.9 (22)	4	0.3 (77)		
Longear Sunfish	125	60 (34)				
Redear Sunfish	21	10.1 (35)				
Spotted Bass	1	0.5 (100)				
Largemouth Bass	161	77.3 (19)				
White Crappie	3	1.4 (55)	7	0.5 (41)	6	0.4 (30)
Black Crappie	4	1.9 (59)	16	1.1 (36)	5	0.3 (79)
Logperch	7	3.4 (48)				
Freshwater Drum			1	0.1 (100)		

APPENDIX C – reporting of creel ZIP code data



Location, by ZIP code, and frequency of anglers that were interviewed at Lake Conroe, Texas, during the June 2016 through May 2017 creel survey.



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