PERFORMANCE REPORT

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FEDERAL AID PROJECT F-221-M-6

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2015 Survey Report

Lake Tyler West

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Lake Tyler West were surveyed in 2015 using electrofishing. Vegetation and angler access surveys were conducted in August 2015. A roving creel survey, conducted from March through May 2016, collected angler use and harvest information. This report summarizes results of the surveys and contains a management plan based on the findings.

- **Reservoir Description:** Lake Tyler West is a 2,224-acre reservoir on Prairie Creek, a tributary of the Angelina River in Texas. The reservoir was built to provide water for municipal and industrial purposes. Boat and bank access were adequate. Although facilities were generally accessible to the physically-challenged, none were specifically marked as ADA approved. Native emergent vegetation has formed a fringe around most of the reservoir. Native submersed vegetation is recovering following the 2010-2014 drought; no hydrilla was detected. Lake Tyler West and Lake Tyler East are connected by a canal and share common harvest regulations.

- **Management History: S**port fishes present include Channel Catfish, White Bass, Largemouth Bass, and Crappies. The reservoir is currently managed under the statewide fishing regulations. Biennial electrofishing surveys were conducted to assess the reservoir's Largemouth Bass population. Advanced fingerling Channel Catfish stockings were conducted from 2004-2010. Supplemental Largemouth Bass sampling was conducted in 2013, and fingerling stockings were conducted in 2008, 2009, 2011, 2012, 2013, and 2015.

- **Fish Community**
  - **Prey species:** Threadfin Shad and Gizzard Shad were present in the reservoir, with a combined catch rate of 615/h. Electrofishing catch rate of sunfishes was 633/h and combined with shad provide excellent prey availability for all sport fishes.

  - **Catfishes:** Channel Catfish continue to support a minor fishery but overall abundance is likely low. In the past this fishery was supported by cooperative stocking by TPWD and the City of Tyler Water Utilities (TWU) rather than by natural recruitment.

  - **White Bass:** Persistence of White Bass was confirmed by electrofishing and they appeared to recruit at some level annually. However, no directed angler effort was documented in the spring 2016 creel survey.

  - **Largemouth Bass:** Largemouth Bass continued to be the most sought after species by anglers at Lake Tyler West. Strong year classes were produced in 2011 and 2015, and size structure (PSD) was within the target range. Growth was average, and body condition was good.

  - **Crappie:** Crappie were the second-most sought after sportfish group during creel surveys. Both White Crappie and Black Crappie were present with White Crappie the most abundant in angler harvest.

  - **Management Strategies:** Initiate necessary steps to manage Tyler West and Tyler East as one water body. Continue biennial electrofishing, and stock Florida strain Largemouth Bass as warranted. Re-evaluate use of rearing ponds to produce advanced- size Channel Catfish. Continue annual vegetation monitoring. Promote Lake Tyler angling opportunities through news releases. Continue providing TWU with information about the threat of invasive species.

INTRODUCTION

This document is a summary of fisheries data collected from Lake Tyler West from June 2015 through May 2016. 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 fish was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2015 and 2016 data for comparison where appropriate.

Reservoir Description

Lake Tyler West is a 2,224-acre reservoir on Prairie Creek, a tributary of the Angelina River in Texas. The reservoir was built to provide water for municipal and industrial purposes. Lake Tyler West is classified as eutrophic with a mean TSI *chl-a* of 51 (Texas Commission on Environmental Quality 2011). Historically, a narrow fringe of native emergent vegetation (primarily maidencane {*Panicum* hemitomon*}*) has been present along the reservoir margin and spatterdock *(Nuphar Luteum)* has been present in the upper end of the reservoir. Prolonged drought reduced reservoir level below conservation pool from summer 2010 through spring 2014 (Figure 1). During low water conditions maidencane seed germinated on exposed substrate and persisted after the water level recovered in late fall of 2014. Hydrilla *(Hydrilla verticillata)* was problematic in the past but has been undetected since 2012. Other descriptive characteristics for Lake Tyler West are found in Table 1.

Angler Access

Boater access is typically good with three public ramps (Table 2) and bank angler access available at several city parks and a fishing barge. Access was compromised during low water levels from summer 2011 through winter 2014 (Figure 1). Access was again restricted in spring 2016 when unusually heavy rain and flooding prompted Tyler Water Utilities (TWU) to issue safety closures to boating temporarily in March and May (Appendix C). Although facilities were generally accessible to handicapped persons, none of the facilities provided were specifically marked as American Disabilities Act (ADA) approved.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Ott and Bennett 2012) included:

1. Conduct biennial electrofishing surveys to monitor Largemouth Bass *(Micropterus salmoides)* and prey populations; conduct genetic analysis of the population in 2015. Request Florida strain Largemouth Bass *(M. s. floridanus)* for stocking as available.
   Action: Additional electrofishing was conducted in fall 2013. Standard electrofishing and genetic analysis was conducted in fall 2015. Stocking was conducted in 2012, 2013, and 2015.
2. Re-evaluate the possibility of rearing of fingerling Channel Catfish *(Ictalurus punctatus)* to an advanced size (9-12 inches TL) and release into Lake Tyler West; discuss the possibility of constructing catch kettles.
   Action: Due to changes in TWU personnel the advanced size Channel Catfish program was put on temporary hold until 2016. Fingerlings were requested for rearing ponds in spring 2016. No action has been taken on rearing pond improvement.
3. Continue annual monitoring of Lake Tyler West vegetation community; provide TWU with information regarding overall coverage and Aquatic Nuisance Species control.
   Action: Vegetation surveys were conducted annually from 2012-2015; results were reported to TWU. No hydrilla control has been necessary, but alligatorweed flea beetles *(Agasicles Hygrophila)* were released in 2015 for alligatorweed *(Alternanthera philoxeroides)* control.
4. Increase promotion of the White Bass *(Morone chrysops)* fishery.
   Action: Lake-specific regulation posters were provided to vendors of angling-oriented

businesses serving the Lake Tyler West vicinity. Local outdoor writers were provided with news releases and information regarding the fishery.

5. Coordinate with TWU regarding aquatic invasive species; post appropriate signage at access points around the reservoir. Educate the public about invasive species through the use of media and the internet.

   Action: Signage was distributed and outreach programs have been implemented.

Harvest regulation history: Sport fishes in Lake Tyler West were currently managed with statewide harvest regulations (Table 3). Regulations have not changed since the last survey in 2011.

Stocking history: Channel Catfish and Florida Largemouth Bass were the most frequently stocked species at Lake Tyler West. Adult Channel Catfish were stocked annually from 2004-2010 through a cooperative effort with TWU to compensate for limited natural recruitment. After 2010, stocking was temporarily discontinued due to poor returns in rearing ponds. Florida Largemouth Bass were initially stocked in 1997 and have been stocked periodically (most recently in 2015) to enhance the trophy potential of the fishery. White Bass *(Morone chrysops)* were collected from Lake Tawakoni in 1993 and transported to Lake Tyler West. A complete stocking history is found in Table 4.

Vegetation/habitat management history: Aquatic vegetation in Lake Tyler West has historically been less abundant than it was in Lake Tyler East. Hydrilla became locally abundant in the Hill Creek arm during the mid-1990s but disappeared without treatment. In 2006, hydrilla was re-discovered near Langeley Island and expanded to 204 acres reservoir-wide by 2010; the expansion prompted Tyler Water Utilities to contract for an herbicide treatment in fall of that year. In a compromise plan between TWU and local anglers, control was limited to a maximum of 200 feet from shore and only in front of residences. However a prolonged drought reduced reservoir level below conservation pool from summer 2010 through spring 2014 (Figure 1). Lowest water level (7.7 ft. below conservation pool) occurred in November 2011 when over 650 acres of the lake bottom was exposed (Texas Water Development Board 2016) and most submersed species were lost to desiccation. Therefore, no additional herbicide treatments have been conducted. Beginning in 2014 alligatorweed become problematic and flea beetles were released in April 2015. Several small scale dredging operations have required property owners to submit aquatic vegetation treatment proposals for physical removal; these proposals have been reviewed and approved. However, widespread un-permitted physical removal of native aquatic vegetation also occurs. Water hyacinth *(Eichhornia crassipes)* was identified at the marina ramp in late March 2008 and was removed by hand; no further infestation has been reported.

Water transfer: Lake Tyler West is used primarily as a water supply for municipal and industrial purposes, and for flood control. The pump station for TWU is located on Lake Tyler West. A canal connects Lake Tyler East to Lake Tyler West, facilitating flow to the pump station and allowing raw reservoir water to be pumped directly to the treatment facility. Tyler Water Utilities maintains a second permanent pump station and treatment facility on Lake Palestine. Prior to distribution, water from the two sources is blended after leaving the treatment facilities. Tyler Water Utilities provides treated water to the City of Whitehouse.

METHODS

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Lake Tyler West (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 *(Lepomis spp.)* Gizzard Shad *(Dorsoma cepedianum),* and Threadfin Shad (*D. petenense)* were collected by electrofishing (1 hour at 12, 5-min stations). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual

electrofishing. Ages for Largemouth Bass were determined using otoliths from 13 randomly-selected fish (range 13.0 to 14.9 inches).

Genetics – Genetic analysis of Largemouth Bass was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015). Micro-satellite DNA analysis was used to determine genetic composition of individual fish from 2005 through 2015 and by electrophoresis for previous years.

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

Creel survey – A roving creel survey was conducted in 2016. The creel period was March through May. 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). Ages for White Bass were determined using otoliths from 26 randomly-selected fish provided by an angler (length range was 9.9 to 15.7 inches).

Habitat - Vegetation surveys were conducted annually from 2012 through 2015 to monitor expansion of hydrilla; 2014 survey was for Aquatic Nuisance Species (ANS) only. 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 2016).

RESULTS AND DISCUSSION

Habitat: Littoral habitat has historically been sparse consisting mainly of featureless shoreline with boat docks (Ott and Bister 2004). Prolonged drought resulted in water levels remaining below conservation pool from summer 2010 through spring 2014 (Figure 1). After the drought ended, flooding and highly turbid water from mid 2014 through present limited light penetration in the littoral zone further delaying recovery of some submersed plant species. The rooted algal species Chara *(Chara vulgaris)* and Coontail *(Ceratophyllum demersum)* which covered a combined area of 485 acres in 2012 were reduced to 60 acres by 2013 but had recovered to 79 acres by 2015 (Table 6). Pondweed *(potamogeton spp.)* appears to have benefitted from the water level fluctuation and increased from only 1 acre in 2012 to 47 acres by 2015. Germination of several emergent plant species in the moist substrate along the reservoir margin during the drought shifted community dominance. When reservoir elevation recovered in 2014 these species persisted. By 2015 maidencane/panicum in combination with spatterdock, water primrose *(Ludwigia spp.),* and bulrush *(Scirpus spp.)* were the dominant species, covering approximately 250 acres. Hydrilla has not been detected since 2012. Alligatorweed covered 66 acres in 2014 but was reduced to 30 acres in combination with water primrose *(Ludwigia spp.)* following alligatorweed flea beetle release in April 2015.

Creel: Although the percentage distribution of angling effort directed toward different species was similar to previous surveys (Table 7), overall angling pressure (9,152 hours) was only approximately ½ of historical surveys (Table 8). Direct angling expenditures for the creel period ($63,947) was also only ½ to 1/3 of the historical values. Although all of the reasons for the decrease in angling pressure and expenditures are difficult to resolve, part of it may be related to **El Niño** based weather patterns over the past year. Torrential rains and flooding (Appendix C) led TWU to close the reservoir to boating for safety reasons twice during the creel period;.one of these closures fell on a scheduled weekend creel and resulted in a zero day (reducing overall effort estimates).

Prey species: Both Threadfin Shad and Gizzard Shad were present in Lake Tyler West (Appendix A).

The Gizzard Shad electrofishing catch rate (109/h) was higher than the previous two surveys in 2011 and 2013 (29 and 68/h respectively) but IOV continues to be low (32). Most of the Gizzard Shad present were too large to be of suitable prey size (Figure 2). Threadfin Shad catch rate was relatively high (506/h). Combined electrofishing catch rate for all sunfish species *(Lepomis* spp.*)* was 633/h (Appendix A), and most collected were ≤5 inches in length (Figures 3-5) and likely offer greater prey availability than Gizzard Shad. Bluegill *(L. macrochirus)* were the most common sunfish species, and their relative abundance (385/h) was similar to 2011 (443/h) and was greater than in the middle of the drought in 2013.

Catfish: Lake Tyler West has traditionally supported a low-density Channel Catfish population with poor natural recruitment. From 2004-2010, Channel Catfish were stocked annually through a cooperative effort with TWU to increase abundance in the reservoir (Table 4), but stocking was temporarily discontinued due to poor returns in rearing ponds. Gill net sampling was discontinued in 2016 under the OBS protocol so no current fishery-independent data is available. Directed angling effort for catfish was not documented during the 2008 spring creel survey but made up 5% and 4% respectively of the directed effort during the 2012 and 2016 surveys (Table 7). The magnitude of directed effort for catfish (339 hours; 0.2 h/acre) continued to be low (Table 9). All of the legal-length Channel Catfish caught by anglers were harvested and all were large (≥14 inch) (Figure 6).

White Bass: White Bass were first introduced to Lake Tyler West in 1993 (Table 4) and were first documented in gill net samples conducted in 2004 (Ott and Bennett 2011). Although gill net sampling was discontinued at Lake Tyler West in 2016 under the OBS protocol, persistence of White Bass was documented through electrofishing (Appendix A) and anecdotal evidence provided by anglers. A sample of 26 White Bass collected by angling in January 2016 also suggested that recruitment (at some level) had occurred annually from 2010 through 2015 (Figure 9). Apparent variability in year-class strength was likely related to spring flow (Figure 1). Although some angler harvest existed, no directed angler effort for White Bass was documented in the 2016 creel survey (Table 6).

Largemouth Bass: Total electrofishing catch rate of Largemouth Bass in 2015 (186/h) was similar to 2011 (182/h), but substantially higher than it was in 2013 in the middle of the drought (81/h) (Figure 11). Particularly strong year classes were evident in fall 2011 and 2015 (as represented by fish 4-8 inches in length) and were likely related to availability of submersed aquatic vegetation in 2011 and emergent vegetation in 2015 (Table 6). Despite fluctuation in relative abundance, size distribution (PSD) has remained within the target range of 40–70 (Anderson 1980) for the past three surveys. Mean relative weight (W_r) was at or above 90 for most length classes, indicating adequate prey availability. Growth rate of Largemouth Bass at Lake Tyler West was within the expected range; average age at 14 inches was 2.6 years (N=13; range = 2-5). Florida Largemouth Bass allele frequency was 55%; no pure Florida strain or Northern strain fish were collected (Table 11). Although the Largemouth Bass fishery at Tyler West is still the most popular of any species (representing 72% of the directed angling effort during the spring 2016 creel survey), total effort for Largemouth Bass (6,630 hours; 3.0 h/acre) was less than half of the historical range (Table 10). Directed effort was evenly distributed between tournament and non-tournament angling and estimated harvest was very low; non-tournament anglers released 89% of the legal-length fish caught.

Crappie: Trap net sampling has historically been ineffective at Lake Tyler West and was discontinued in 2015 under the OBS protocol. However, continued persistence of both White Crappie *(P. annularus)* and Black Crappie *(P. nigromaculatus)* was documented through creel survey harvest results (Table 12, Figures 11 & 12). Crappie continue to account for a substantial proportion (17%) of the directed angling effort (Table 7). Directed angling effort (1,802 angler hours) was only ½ that recorded in spring 2008 (3,707 angler hours) or 2012 (3,337). Angling catch rate (2.8/h) was intermediate between 1.7/h in 2008 and 4.8/h in 2012. (Table 12). White Crappie were the dominant species represented in the harvest and the majority of fish harvested were just at or above the legal minimum-length (≥10 inches) (Figure 12).

Fisheries management plan for Lake Tyler West, Texas

Prepared – July 2016

ISSUE 1: Since impoundment of Lake Tyler East in 1967 Lake Tyler West has traditionally been sampled and managed separately from Lake Tyler East. However, because both water bodies are connected by a canal and fish move freely back and forth (both naturally and as transported by anglers) management of both reservoirs has been very similar. Conducting sampling and management as one water body would simplify regulations for anglers and is consistent with the water body definition currently used for Angler Recognition.

MANAGEMENT STRATEGIES

1. Initiate measures to combine historical datasets from the two separate reservoirs into one water body with a unique water body code.
2. Conduct all future sampling, stocking, and regulatory changes based on the revised water body code.

ISSUE 2: Lake Tyler West has traditionally provided a high-quality Largemouth Bass fishery, and it is important to local anglers.

MANAGEMENT STRATEGIES

1. Continue to conduct biennial electrofishing surveys to monitor Largemouth Bass and prey populations; conduct genetic analysis of the population in 2019.
2. Continue requesting Florida strain Largemouth Bass for stocking based on exhibited potential to produce trophy specimens.

ISSUE 3: The Channel Catfish population is of low density and continues to be hindered by recruitment problems. A cooperative effort between the Tyler Water Utilities and TPWD had produced and stocked 27,765 advanced fingerling Channel Catfish prior to temporarily discontinuing the program for re-evaluation. Fingerlings were requested in fall 2015 for stocking ponds in summer 2016.

MANAGEMENT STRATEGIES

1. Evaluate success of survival when ponds are harvested in 2017.
2. Base future requests for 2-inch fingerlings on results.

ISSUE 4: Hydrilla has shown the potential to be problematic, and TWU has shown a desire to control abundance near shore and in residential areas by herbicide. Alligatorweed has responded well to previous releases of flea beetles.

MANAGEMENT STRATEGIES

1. Continue annual monitoring of the combined Lake Tyler West and East vegetation community as necessary.
2. Continue providing Tyler Water Utilities with information on overall coverage and spatial distribution of plant species.
3. Continue requesting flea beetles for release as necessary.

ISSUE 4: Continued recruitment of White Bass offers the opportunity for an additional fishery but has the potential to be an issue of concern to some anglers.

MANAGEMENT STRATEGY

1. Continue promoting the White Bass fishery in news releases in the greater Tyler area. Provide information to the public that clarifies issues regarding inter-specific competition with Largemouth Bass.

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. Invasive vegetation species such as giant salvinia (*Salvinia molesta*) 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 inter-basin transfer of water is a serious threat to all public waters of the state.

MANAGEMENT STRATEGIES

1. Coordinate with TWU to maintain signage already posted at access points around the reservoir.
2. Continue to educate local outdoor-oriented businesses about invasive species, and provide posters, literature, etc. so that they are able to educate their customers.
3. Continue educating 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. Map existing and future inter-basin water transfers to facilitate potential invasive species responses.
6. Conduct a quantitative assessment of the aquatic plant community during routine habitat survey in 2019.

Objective Based Sampling Plan for Lake Tyler (West) FY 2016-2020

Sport fishes in Lake Tyler include Channel Catfish, White Bass, Largemouth Bass and both Black and White Crappie; White Crappie predominate. Important forage species include sunfishes, and Threadfin and Gizzard Shad.

Negligible fisheries

All sport species at Lake Tyler contribute to the overall fishery and justify some level of sampling effort.

Survey objectives, fisheries metrics, and sampling objectives

Channel Catfish: Channel Catfish only accounted for 5% of directed angler effort during the most recent creel survey in spring 2012; no directed effort was documented in the spring 2008 or winter 2004-2005 surveys. Historically Channel Catfish have been monitored every 4 years with 5 multi-panel experimental design gill nets set randomly in spring , however this sampling intensity has not been sufficient to estimate CPUE and PSD with the desired level of precision (N> 50, RSE <25). CPUE of stock length Channel Catfish was 7.0/nn in the most recent survey in 2012 but was only 4.6/nn and 2.8/nn in 2004 and 2008; RSE's have ranged from 18 to 29 respectively. Bootstrap analysis of this data predict it would require 15 randomly set gill-net nights to obtain estimates of population metrics with the desired level of precision (CPUE; RSE<25, PSD and Wr; N>50 stock size individuals). Given the low level of directed effort it is difficult to justify the expense necessary to obtain these metrics. Continued presence/absence could still be documented through the creel survey and review of social media **(this is the survey objective)**. Five weekend days and four week days will be surveyed during spring (March-May 2020) quarters to provide direct estimates of pressure, catch rate, and estimated harvest by length **(this is the sampling objective).**

White Bass: White Bass are present in the reservoir, but of the past creel surveys (2004 - 2005, 2008, and 2012) directed angling effort was only documented in the most recent (0.1 hour/acre); representing 1% of the directed effort. Historically, White Bass have been monitored every 4 years with 5 multi-panel gill nets set randomly in spring. Although gill net catch rates have ranged from 12.2/nn in 2008 to 0.2/nn in 2004, clumped distribution has resulted in high variance from net to net. Bootstrap analysis of data from the last two surveys (2008, 2012) predicted 28 randomly-selected gill net nights would be required to obtain a minimum of 50 stock-sized specimens and provide CPUE estimates with RSE < 25. Estimates of general structural indices (i.e. PSD and Wr) could be obtained with 18 gill-net nights. Given the low level of directed effort, it is difficult to justify the expense necessary to obtain these population metrics. However, continued presence/absence of the species and occurrence of individual year classes could be documented through the creel survey and through review of social media without the added expense of gill net sampling (this is the survey objective). Five weekend days and four week days will be surveyed during spring quarter to provide direct estimates of pressure, catch rate, and estimated harvest by length (this is the sampling objective). To document presence/absence of individual year classes we will attempt to obtain otoliths from angler volunteers during the creel survey in 2020. Otoliths will be collected from all sizes of legal-length fish to document individual year classes (this is the secondary sampling objective). However, if specimens are not obtained during the spring 2020 creel survey no additional collections will be conducted.

Largemouth Bass: Largemouth Bass are by far the primary sport species at Lake Tyler West accounting for 31% (1.8 hours/acre) of the directed during the winter quarter 2004-2005 creel survey and 72-75% (6.7-6.6 hours/acre) in the spring quarters 2008 and 2012 respectively. Due to the importance of this fishery electrofishing surveys were conducted every two years from 2001-2013 and every three years prior

to that. Relative abundance is lower than Tyler East Lake but is still high with stock-length CPUE's ranging from 21-67/h with RSE's from 19 to 25 over the past three surveys (2009, 2011, and 2013). Bootstrap analysis of the past two surveys predict reliable population metrics (CPUE; RSE<25, PSD and Wr; N>50 stock size individuals) could be obtained with 12 randomly selected 5-minute electrofishing stations. Therefore, Largemouth Bass population trend data will be monitored in the fall of 2017 and 2019 for relative abundance, size distribution, growth (2019 only), and condition (**this is the survey objective**). A total of 18, 5-minute electrofishing stations will be randomly generated. Twelve individual stations, will be sampled initially; if a minimum of 50 stock-length individuals are not collected and RSE is $\geq$25; up to six additional stations will be sampled (**this is the sample objective)**. Because an extensive age-and-growth sample was collected in 2011 only mean age at legal length will be estimated in 2019. If a minimum of 13 specimens 13.0-14.9 inch specimens are not collected in the 12 random stations, additional biologist selected sites will be sampled as necessary **(this is the secondary sample objective)**. Additional specimens will not be used in estimates of population metrics. Long-term trend data of the Largemouth Bass fishery, for tournament and non-tournament anglers, will be monitored with a spring creel survey in 2020 **(this is the survey objective)**. Five weekend days and four week days will be surveyed during March-May 2020 to provide direct estimates of pressure, catch rate, and estimated harvest by length **(this is the sampling objective).**

Sunfishes and shad: Sunfish species, and to a lesser extent, Threadfin and Gizzard Shad, are the primary forage species at Lake Tyler East. Relative abundance, size distribution, PSD, and IOV have been collected every other year since 2001 and every third year prior to that. Bluegill CPUE has been variable but high (517/h in 2009 to 443/h in 2009, and 231/h in 2013). Variability in total CPUE appears to be related to reservoir elevation, but RSE for Bluegill has been well below 25 during the last three surveys based on 12 randomly selected 5-minute stations. CPUE for Gizzard Shad has been lower than Bluegill and RSE higher, but 12 randomly selected 5-minute electrofishing stations still provided > 50 stock-size individuals and RSE < 30 in two of the three most recent surveys. Sunfishes and Gizzard Shad will be sampled in fall 2017 and 2019 to estimate CPUE, PSD, and IOV **(this is the survey objective)**. Sampling intensity will be the same as is proposed for Largemouth Bass. All specimens will be sorted by inch group, counted, and tabulated (**this is the sampling objective)**.

Crappie: Crappie represented approximately 17 - 18% (0.7 - 1.7 hours/acre) of the directed angler effort. Although both White and Black crappie were harvested, Black Crappie were the most abundant in angler creels. Historically, crappie have been sampled every four years with five single-cod, shoreline set trap nets in late fall, with combined species catch rates ranging from 0.6-4.2/nn (2003 – 2011). While CPUE was relatively high in the 2003 and 2011 samples confidence intervals surrounding estimates of abundance and PSD have fluctuated considerably. Based on bootstrap analysis of historical data, it would take >50 trap-net nights to attain acceptable precision (RSE < 25, N > 50) at least 80% of the time. A more cost effective method is to monitor crappie growth and the fishery directly through a spring quarter roving creel survey in 2020 **(this is the survey objective)**. Five weekend days and four week days will be surveyed in the quarter to provide direct estimates of pressure, catch rate, and harvest, and mean age at length (13 specimens between 9.0 and 10.9 in from otoliths obtained from angler volunteers during the creel survey **(this is the sampling objective)**.

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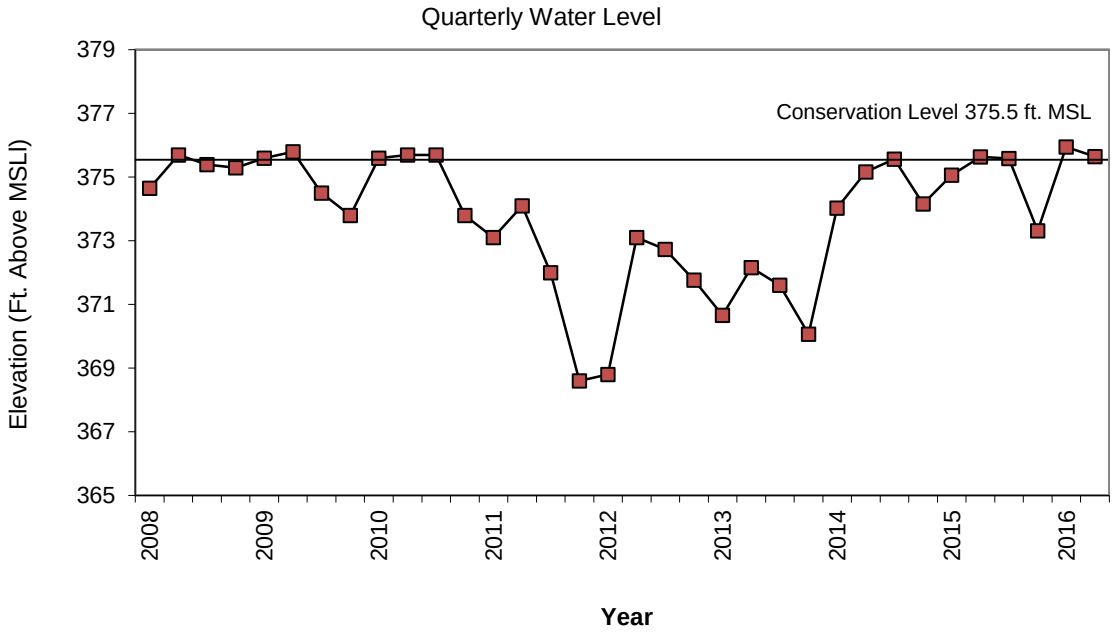


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Lake Tyler West, Texas. Horizontal line represents conservation level.

Table 1. Characteristics of Lake Tyler West, Texas.

Characteristic	Description
Year completed	1951
Controlling authority	Tyler Water Utilities
Counties	Smith (dam)
Reservoir type	City Lake
Shoreline Development Index (SDI)	3.7
Conductivity	100 umhos/cm

Table 2. Boat ramp characteristics for Lake Tyler West, Texas, August, 2015. Reservoir elevation at time of survey was 375 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Lake Tyler Marina	32.21456 -95.18102	Y (fee)	50	367.0	Excellent, no access issues
Hill Creek Ramp	32.23319 -95.17985	Y	30	368.5	Excellent, no access issues
Old Marina #2	32.24436 -99.17369	Y	30	369.0	Excellent, no access issues

Table 3. Harvest regulations for Lake Tyler West, Texas.

Species	Bag Limit	Minimum-maximum length (inches)
Catfish: Channel and Blue, their hybrids and subspecies	25 (in any combination)	12-inch minimum
Catfish, Flathead	5	18-inch minimum
Bass, White	25	10-inch minimum
Bass, Largemouth	5	14-inch minimum
Crappie: White and Black, their hybrids and subspecies	25 (in any combination)	10-inch minimum

Table 4. Stocking history of Lake Tyler West, Texas. Size categories are FGL = fingerlings; ADL = adult; UNK = unknown.

Species	Year	Number	Size
Blue Catfish	1975	25,000	FGL
		25,000	
Channel Catfish	2004	8,000	ADL
	2005	5,000	ADL
	2006	4,450	ADL
	2007	5,000	ADL
	2008	1,990	ADL
	2009	2,475	ADL
	2010	850	ADL
		27,765	
White Bass	1993	192	ADL*
		192	
Palmetto Bass	1975	25,000	UNK
	1977	36,136	UNK
	1979	24,500	UNK
	1980	276	UNK
		85,903	
Largemouth Bass	1974	98,9000	FGL
		98,9000	FGL
Florida Largemouth Bass	1997	124,593	FGL
	1998	122,647	FGL
	2004	111,663	FGL
	2005	112,507	FGL
	2008	112,007	FGL
	2009	117,125	FGL
	2011	113,007	FGL
	2012	112,906	FGL
	2013	116,595	FGL
	2015	57,367	FGL
		1,100,417	
Green X Redear Sunfish	1974	25,000	FGL
		25,000	

* Management stocking: adults collected and transported from Lake Tawakoni, TX.

Table 5. Objective-based sampling plan components for Lake Tyler West, Texas 2015 – 2016.

Gear/target species	Survey objective	Metrics	Sampling objective
Electrofishing			
Largemouth Bass	Abundance	CPUE – stock	RSE-Stock ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock
	Age-and-growth	Age at 14 inches	N = 13, 13.0 – 14.9 inches
	Condition	W_r	10 fish/inch group (max)
	Genetics	% FLMB	N = 30, any age
Bluegill [a]	Abundance	CPUE – Total	
	Size structure	PSD, length frequency	N ≥ 50
Gizzard Shad [a]	Abundance	CPUE – Total	
	Size structure	PSD, length frequency	N ≥ 50
	Prey availability	IOV	N ≥ 50
Creel Survey [b]			
Channel Catfish	Trend information on angler effort, catch, and harvest	Angler effort, CPUE, total harvest, and size composition of harvest	
White Bass	Trend information on angler effort, catch, and harvest	Angler effort, CPUE, total harvest, and size composition of harvest	
Largemouth Bass	Trend information on angler effort, catch, and harvest	Angler effort, CPUE, total harvest, and size composition of harvest	
Crappies	Trend information on angler effort, catch, and harvest	Angler effort, CPUE, total harvest, and size composition of harvest	

[a] No additional effort will be expended to achieve an RSE ≤ 25 or CPUE or N $\underline{>}$ 50 for Bluegill and Gizzard Shad if not reached from designated Largemouth Bass sampling effort. Instead, Largemouth Bass body condition can provide information on forage abundance, vulnerability, or both relative to predator density.
[b] Angler utilization data and associated statistics will be calculated for all sport fish and non-game species.

Table 6. Surveys of aquatic vegetation, Lake Tyler West, Texas, 2012 – 2015. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Vegetation	2012	2013	2014[A]	2015
Chara	285 (12.8)	60 (3.2)		79 (3.5)
Coontail	200 (9.0)			tr
Pondweed	1 (tr)	3 (0.1)		47 (2.1)
Bladderwort	10 (0.4)			tr
Spatterdock	20 (9.0)	30 (1.6)		23 (0.1)
American lotus	30 (1.3)	18 (0.9)		4 (0.2)
Maidencane/panicum				154 (6.9)
Bulrush	3 (0.1)	3 (0.1)		3 (0.1)
Water primrose/Alligatorweed				16 (0.7)
Square-stem spikerush				tr
Non-native				
Alligatorweed (Tier II)*			66 (3.0)	14 (0.6)
Hydrilla (Tier II)*	4 (0.2)			

[A] ANS survey only

*Tier I is immediate Response, Tier II is management status, Tier III is watch status.

Table 7. Percent directed angler effort by species for Lake Tyler West, Texas 2008-2016. Survey periods were from March 1 through 31 May

Species	Year		
	2008	2012	2016
Largemouth Bass	72	75	72
Crappie spp.	18	17	17
Sunfish spp.	0	1	0
Catfish spp.	0	5	4
White Bass	0	1	0
Anything	10	1	7

Table 8. Total fishing effort (h) for all species and total directed expenditures at Lake Tyler West Texas, 2008-2016. Survey periods were March 1 through May 31.

Creel Statistic	2008	2012	2016
Total fishing effort	20,794	19,677	9,152
Total directed expenditures	$149,463	$180,203	$63,947

Gizzard Shad

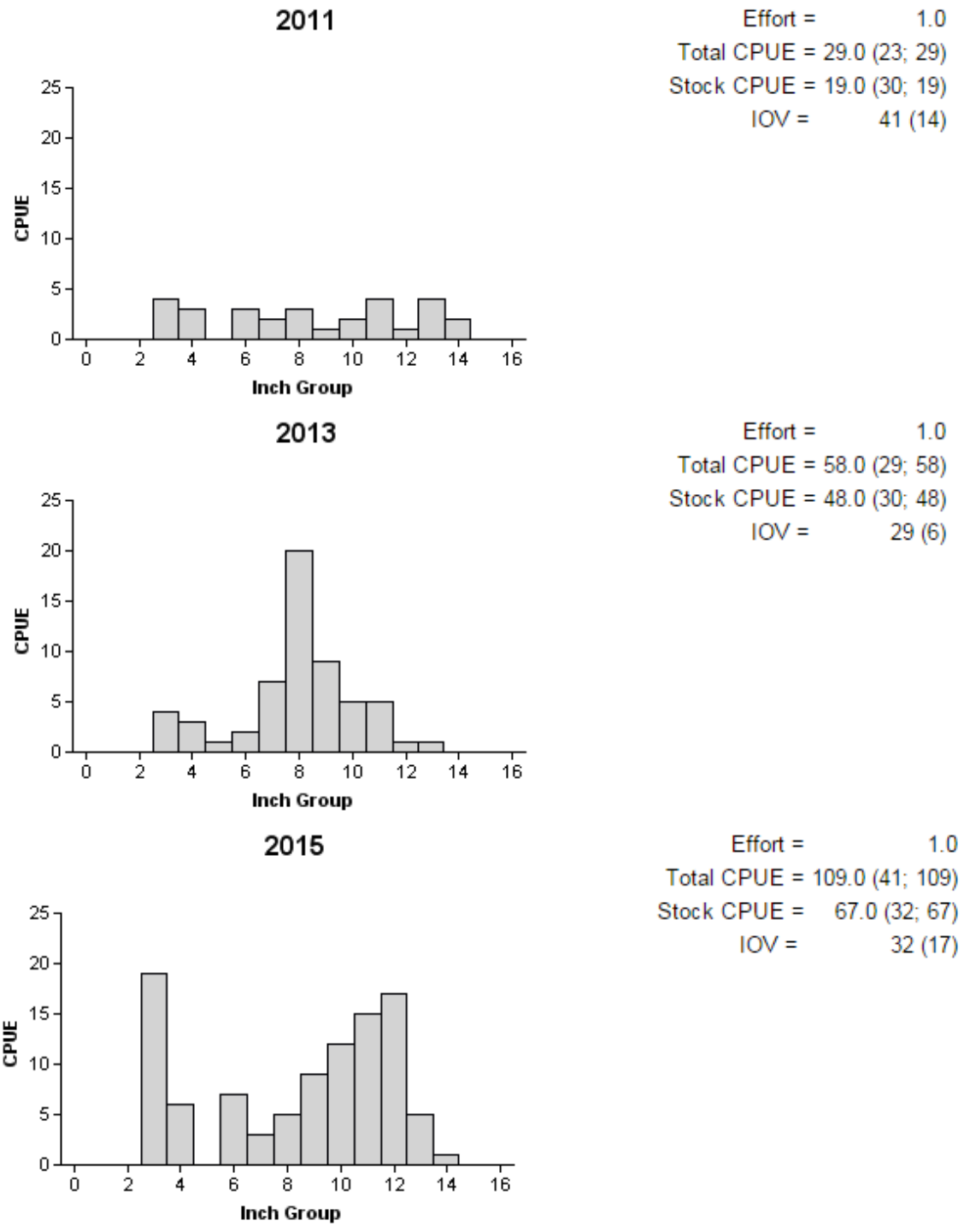


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Lake Tyler West, Texas, 2011, 2013, and 2015.

Redbreast Sunfish

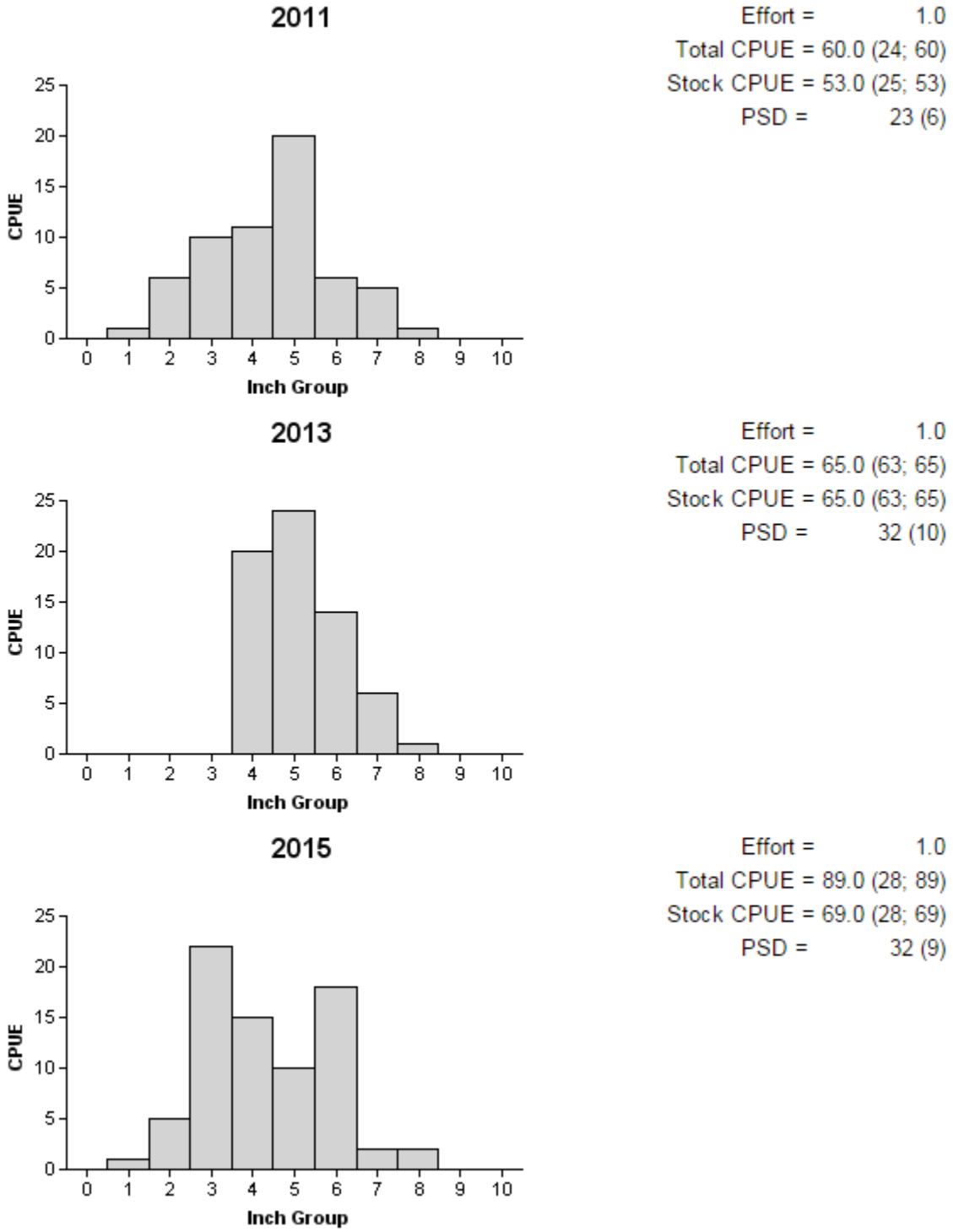


Figure 3. Number of Redbreast Sunfish caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Tyler West, Texas, 2011, 2013, and 2015.

Bluegill

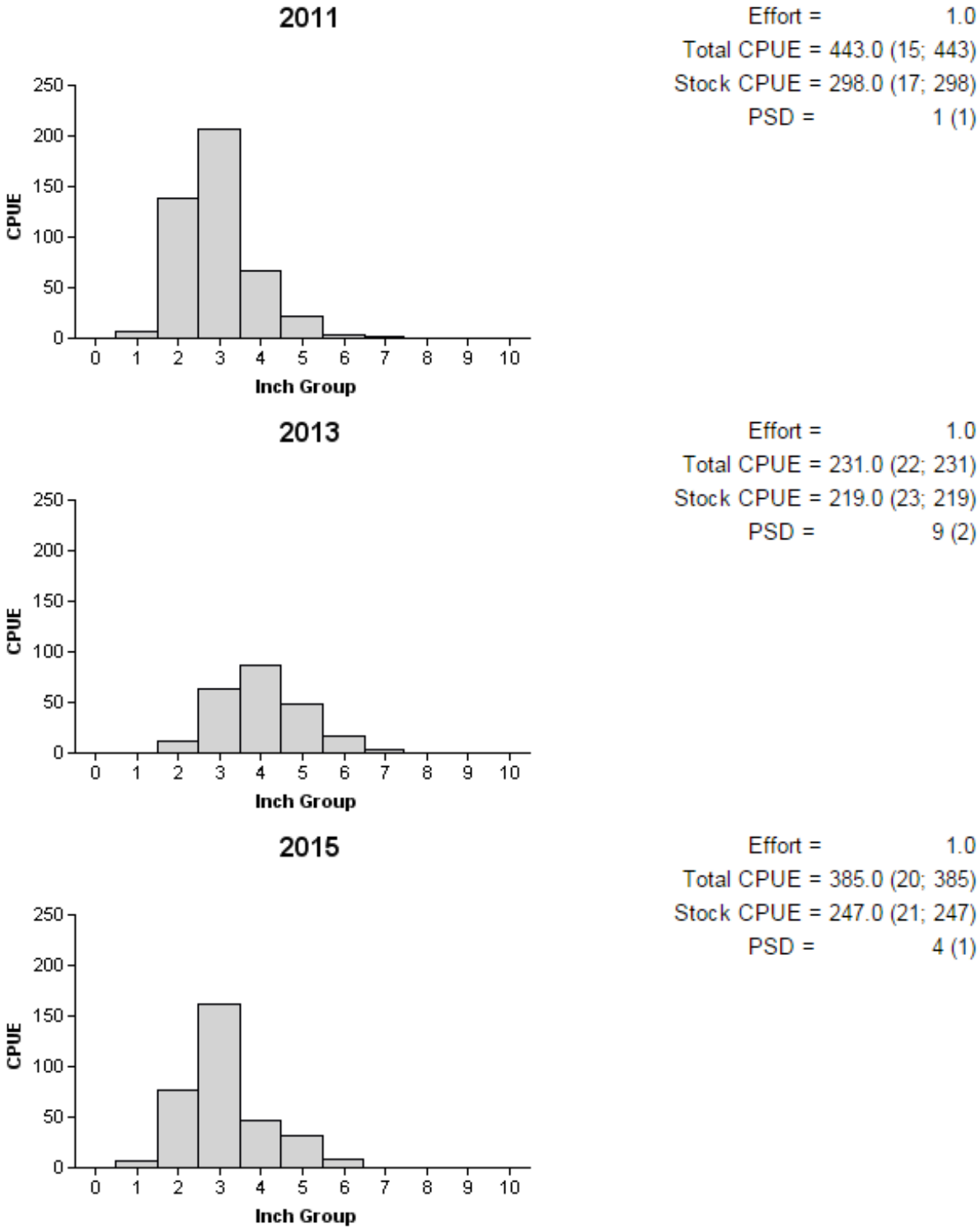


Figure 4. Number of Bluegill caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Tyler West, Texas, 2011, 2013, and 2015.

Redear Sunfish

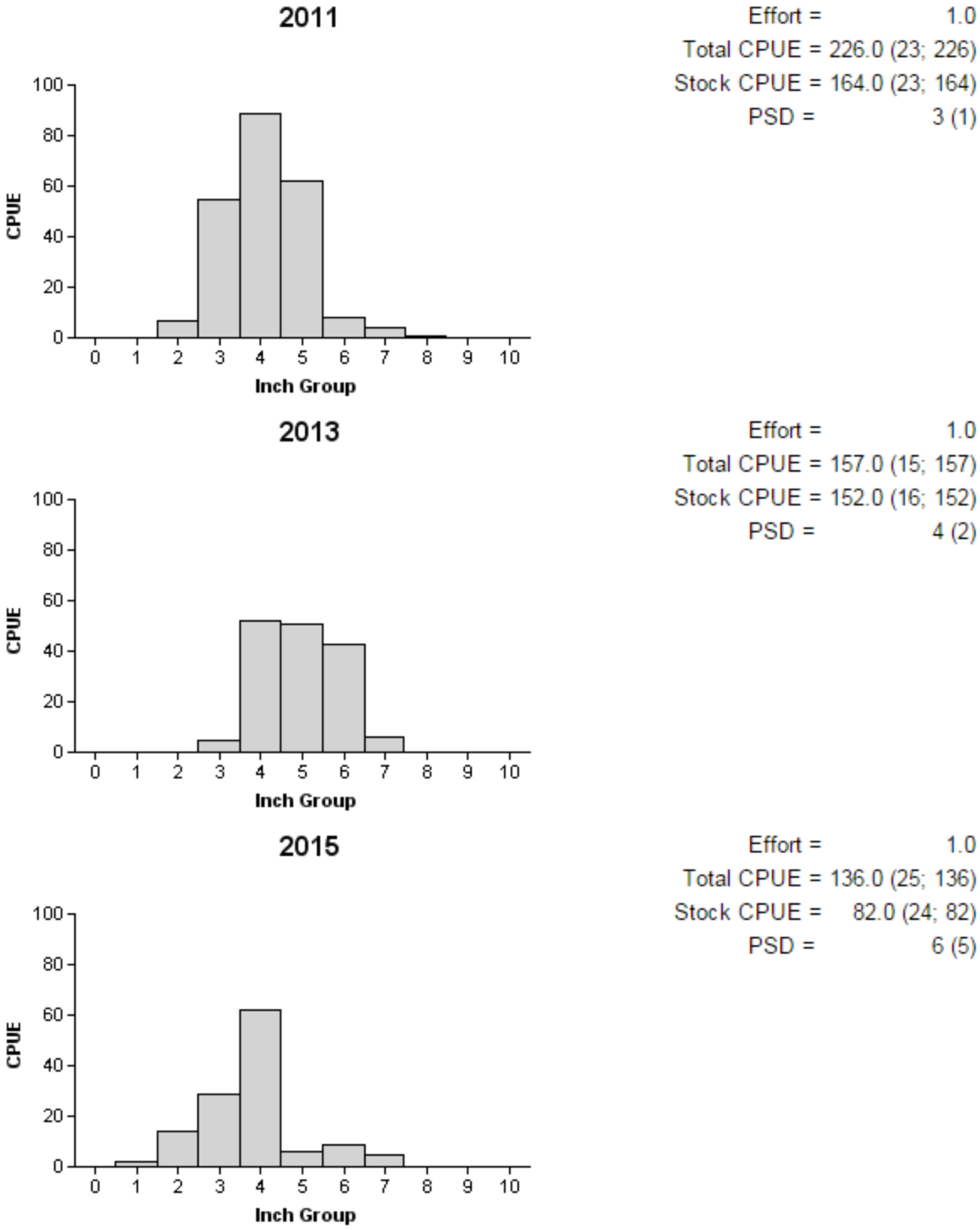


Figure 5. Number of Redear Sunfish caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Tyler West, Texas, 2011, 2013, and 2015.

Channel Catfish

Table 9. Creel survey statistics for Channel Catfish at Lake Tyler West from March-May, 2008, 2012, and 2016. Total catch per hour is for anglers targeting Channel Catfish and total harvest is the estimated number of Channel Catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year		
	2008	2012	2016
Surface area (acres)	2,224	2,013	2,224
Directed effort (h)	0	928 (58)	339 (68)
Directed effort/acre	0	0.4 (58)	0.2 (68)
Total catch per hour	0	0	0.2 (5)
Total harvest	251 (219)	413 (170)	89 (461)
Harvest/acre	0.1 (219)	0.2 (162)	<0.1 (461)
Percent legal released	14	0	0

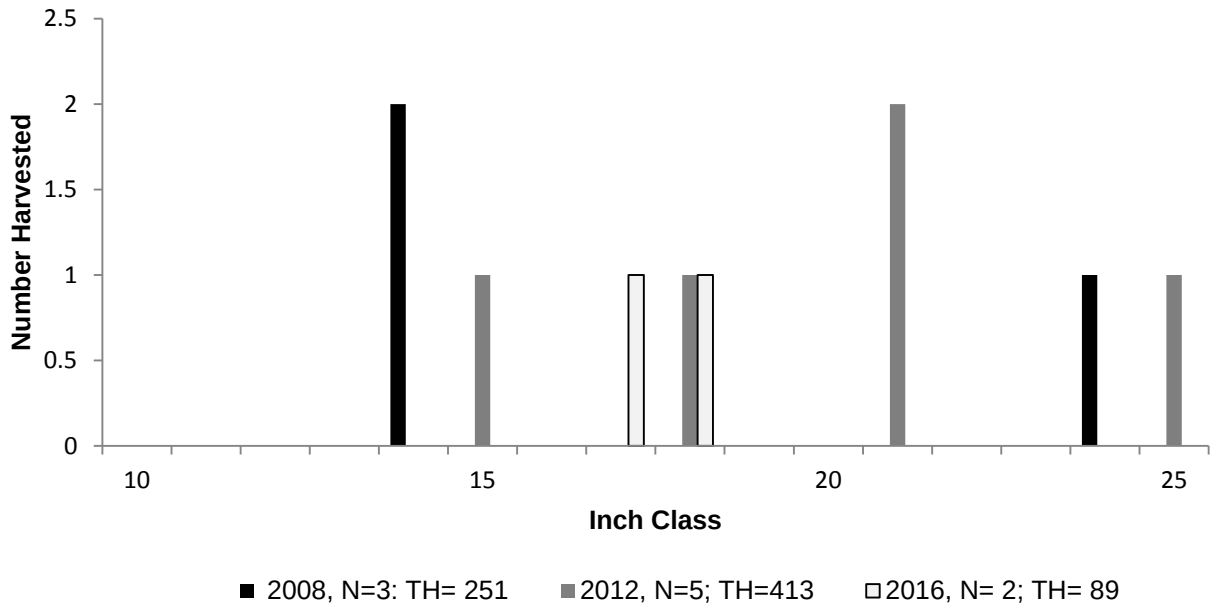


Figure 6. Length frequency of harvested Channel Catfish observed during creel surveys at Lake Tyler West, Texas, March–May, 2008, 2012, and 2016, all anglers combined. N is the number of harvested Channel Catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

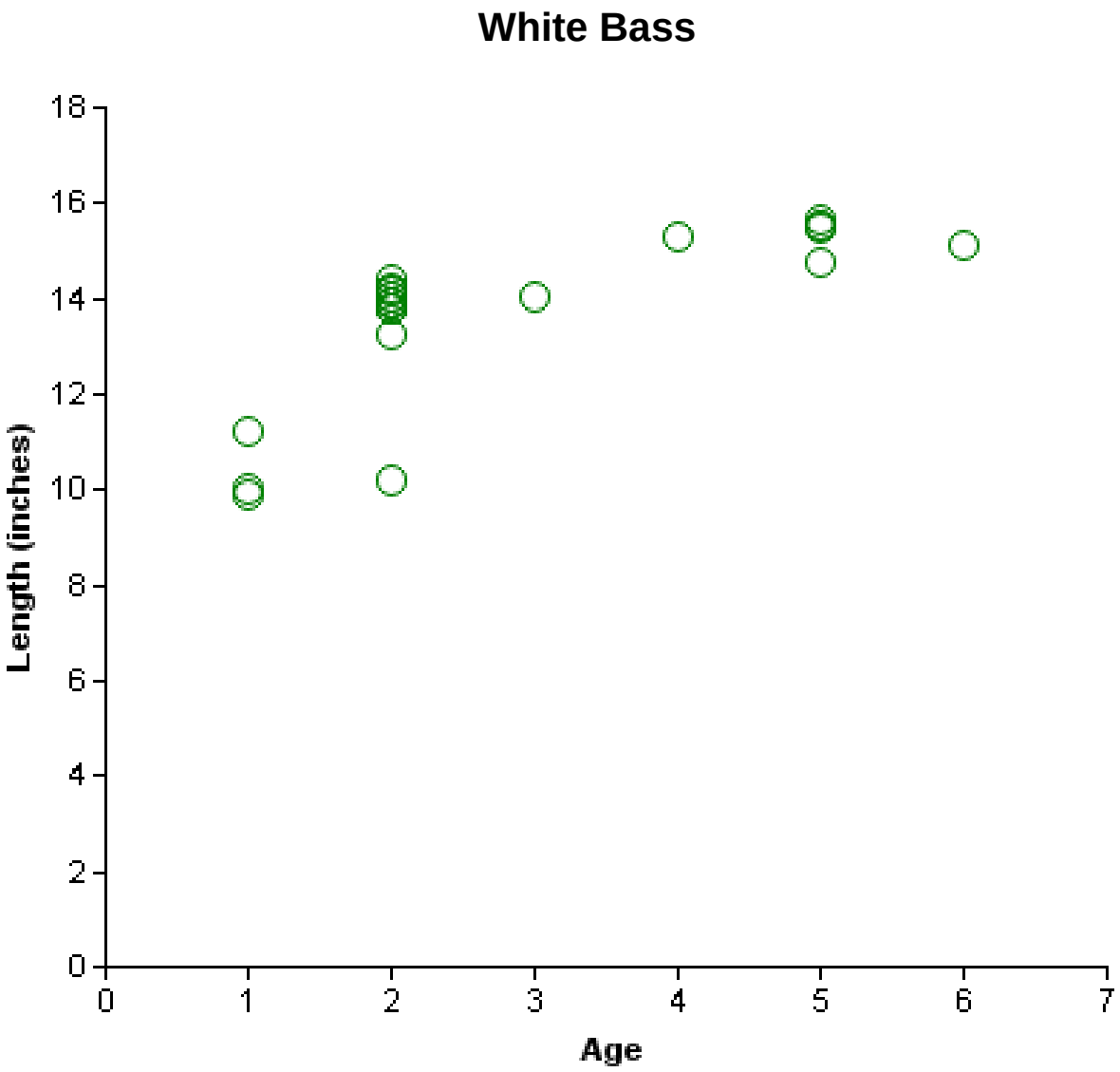


Figure 7. Length at age (inches) of all White Bass (N=26) (sexes combined) collected by angling, Lake Tyler West, Texas, January 2016.

Largemouth Bass

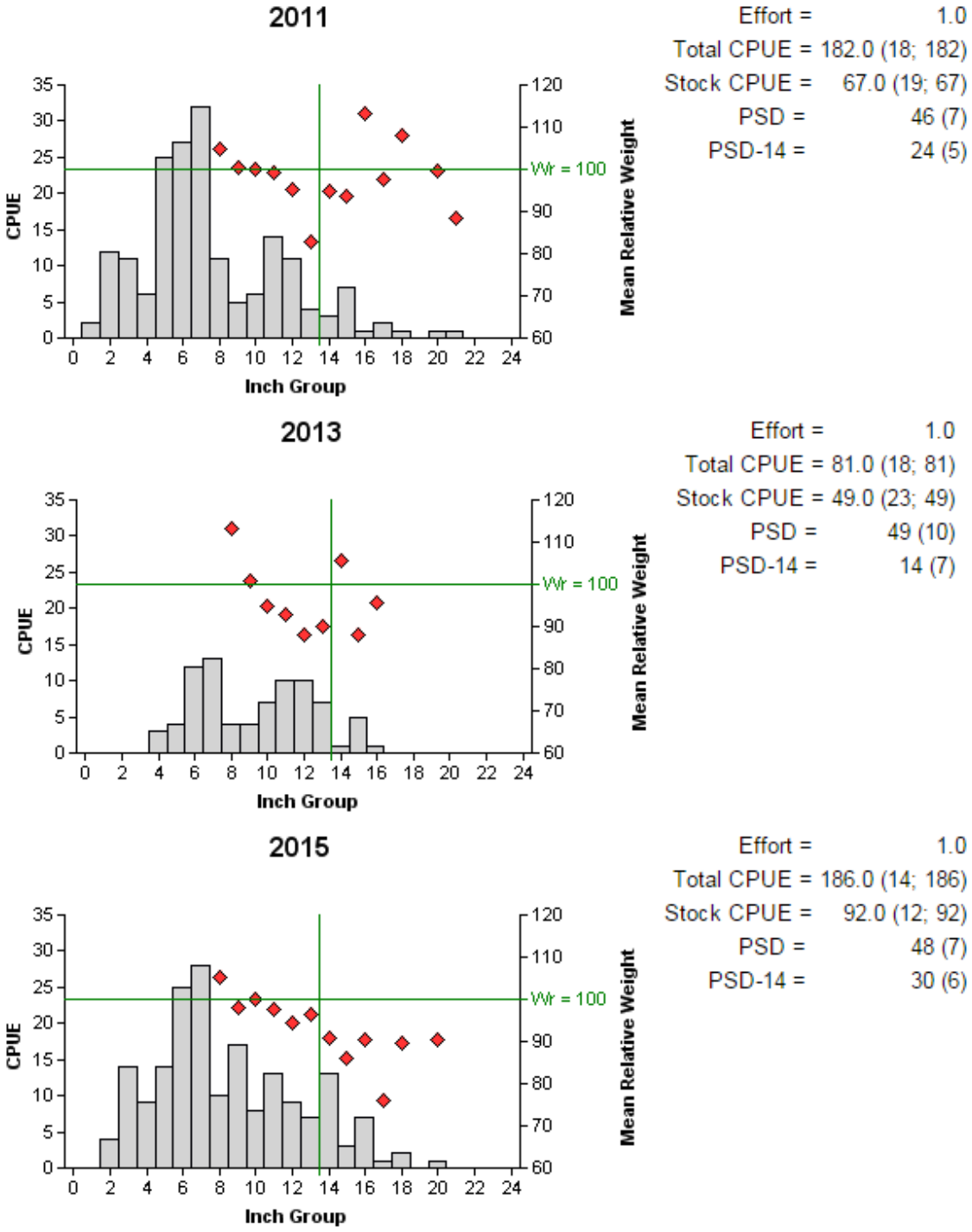


Figure 8. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Tyler West, Texas, 2011, 2013, and 2015. Vertical line represents length limit at time of survey.

Largemouth bass

Table 10. Creel survey statistics for Largemouth Bass at Lake Tyler West, Texas, from March through May 2008, 2012, and 2016. 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. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2008	2012	2016
Surface area (acres)	2,224	2,013	2,224
Directed effort (h)			
Tournament	NA	8,401 (22)	3,151 (41)
Non-tournament	NA	6,192 (24)	3,480 (35)
All black bass anglers combined	15, 039 (22)	14,593 (28)	6,630 (34)
Directed effort/acre	6.7 (22)	7.2 (28)	3.0 (34)
Total catch per hour	0.5 (41)	0.9 (16)	0.9 (16)
Harvest	3,898 (72)		
Non-tournament harvest	na	154 (508)	222 (290)
Harvest/acre	1.8 (72)	>0.1 (508)	0.1 (290)
Tournament weigh-in and release	na	3,037 (57)	2,575 (50)
Percent legal released (non-tournament)	82	83	89

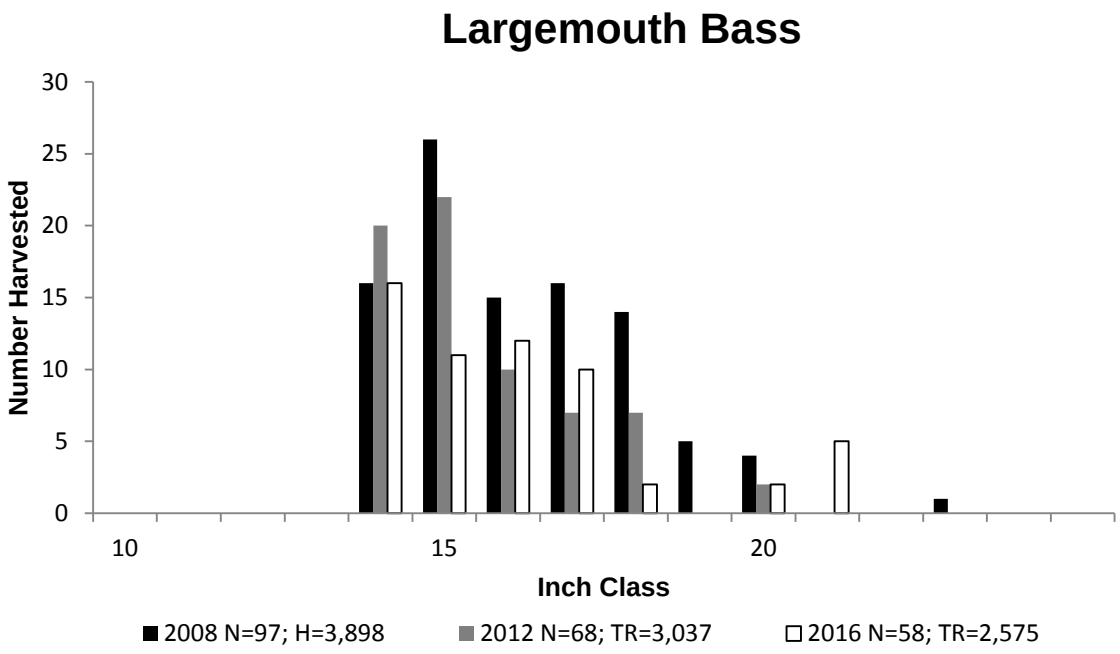


Figure 9. Length frequency of Largemouth Bass observed during creel surveys at Lake Tyler West, Texas, March-May 2008, 2012, and 2016, all anglers combined. N is the number of Largemouth Bass observed during creel surveys, H is the estimated total harvest for the period, and TR is the estimated tournament retained fish for the creel period.

Table 11. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Lake Tyler West, Texas. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, F1 = first generation hybrid between a FLMB and a NLMB, Fx = second or higher generation hybrid between a FLMB and a NLMB. Genetic composition was determined with micro-satellite DNA analysis.

Year	Sample size	Number of fish				% FLMB alleles	% pure FLMB
		FLMB	F1	Fx	NLMB		
2007	30	0			0	42.6	0.0
2011*	30	1	0	28	1	40.0	3.3
2015*	30	0	0	30	0	55.0	0.0

* Samples taken from multiple cohorts.

Crappie

Table 12. Creel survey statistics for Crappie at Lake Tyler West from March through May, 2008, 2012, and 2016 where total catch per hour is for anglers targeting all crappie and total harvest is the estimated number of crappie harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2008	2012	2016
Surface Area (acres)	2,224	2,013	2,224
Directed effort (h)	3,707 (30)	3,337 (31)	1,544 (46)
Directed effort/acre	1.7 (30)	1.4 (31)	0.7 (46)
Total catch per hour	1.7 (38)	4.8 (50)	2.6 (109)
Total harvest			
White crappie	987 (83)	1,546 (88)	1,820 (58)
Black crappie	2,310 (45)	3,631 (63)	178 (456)
Harvest/acre			
White crappie	0.4 (83)	2.0 (70)	0.8 (58)
Black crappie	1.0 (45)	1.4 (63)	<0.1 (456)
Percent legal released	<1	3	3

Figure 10. Length frequency of harvested White Crappie observed during creel surveys at Lake Tyler West, Texas, March-May 2008, 2012, and 2016, all anglers combined. N is the number of harvested White Crappie observed during creel surveys, and TH is the total estimated harvest for the creel period.

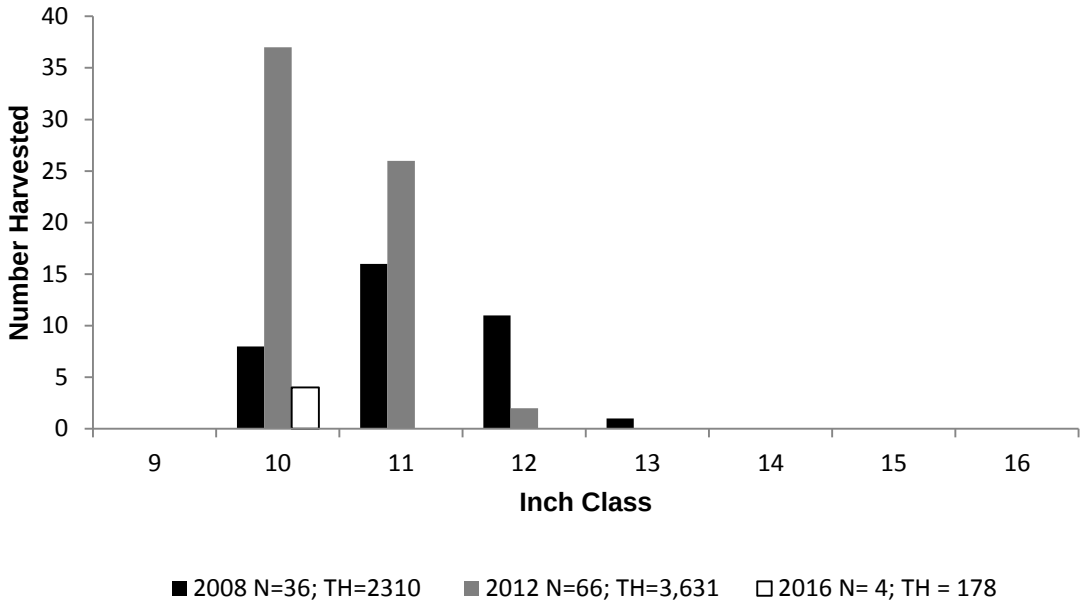


Figure 11. Length frequency of harvested Black Crappie observed during creel surveys at Lake Tyler West, Texas, March-May 2008, 2012, and 2016 all anglers combined. N is the number of harvested Black Crappie observed during creel surveys, and TH is the total estimated harvest for the creel period.

Table 13. Proposed sampling schedule for Lake Tyler Texas. Access and habitat surveys are conducted during the summer, electrofishing is conducted in the fall and creel surveys are conducted during the spring. Standard survey denoted by S and additional survey denoted by A.

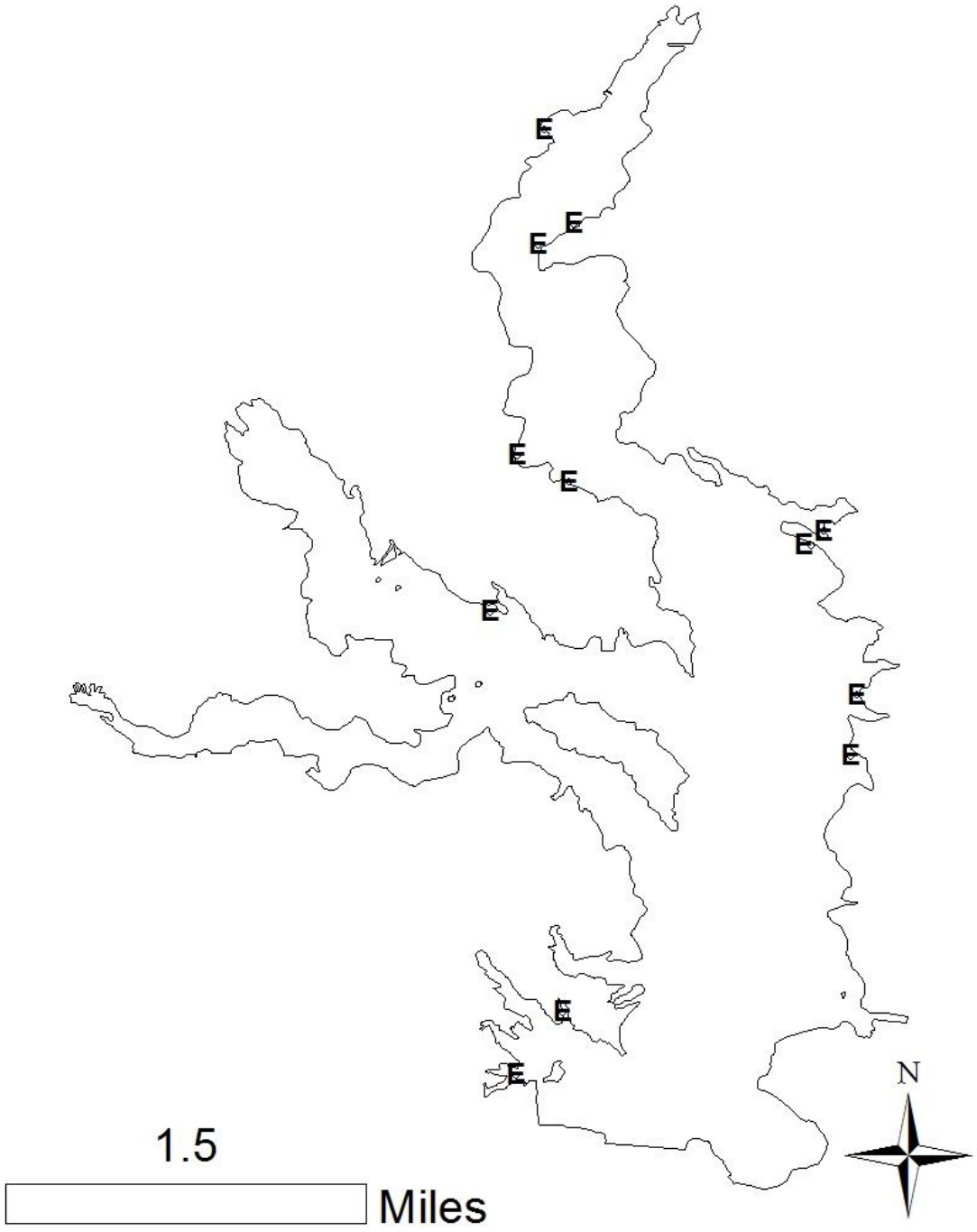
Survey Year	Electrofishing	Access	Habitat	Creel	Report
2016-2017			A		
2017-2018	A		A		
2018-2019			A		
2019-2020	S	S	S	A	S

APPENDIX A

Number (N) and catch rate (CPUE) of all target species collected by electrofishing from Lake Tyler West, Texas, 2015.

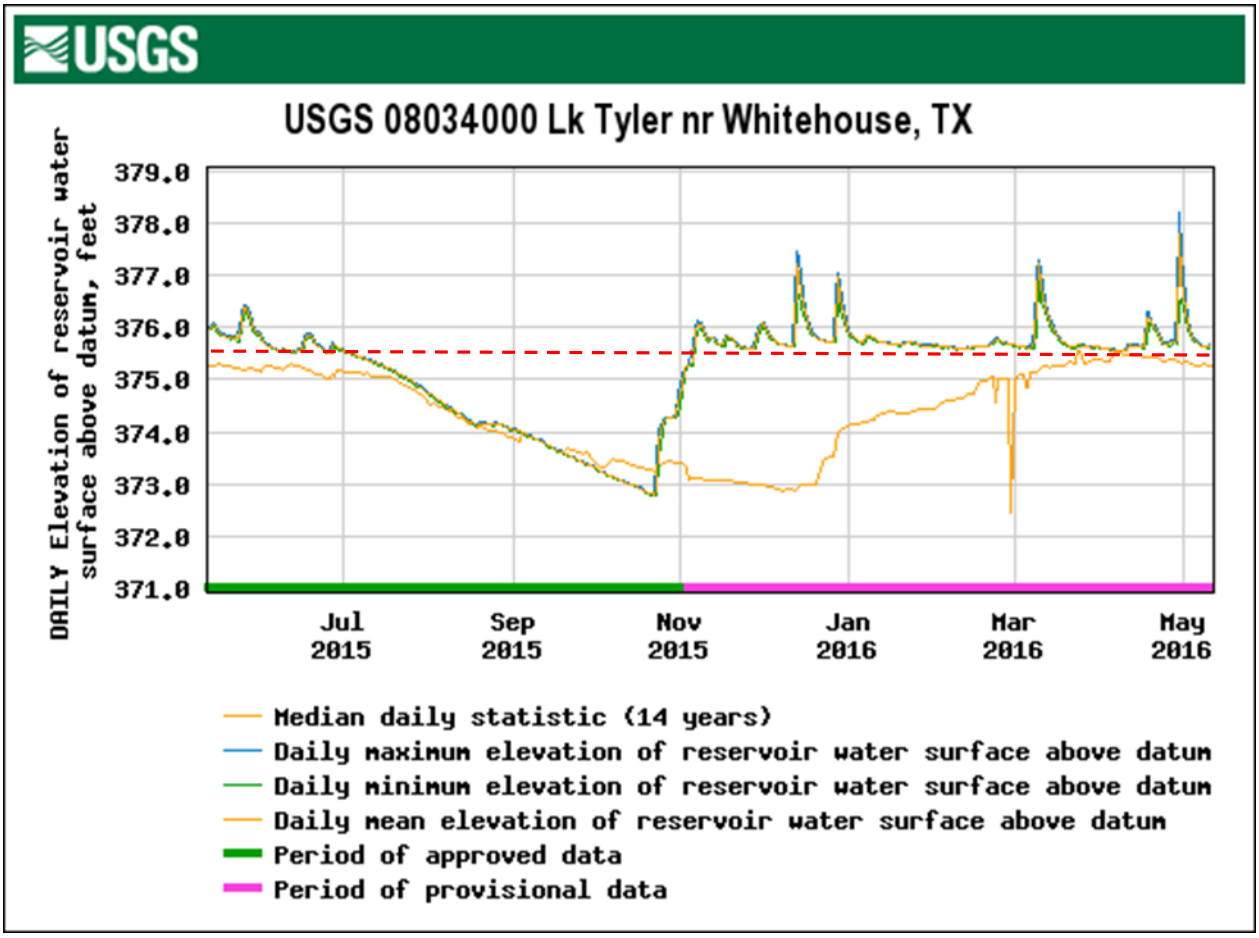
Species	Electrofishing	
	N	CPUE
Gizzard Shad	109	109.0
Threadfin Shad	506	506.0
White Bass	6	6.0
Redbreast Sunfish	89	89.0
Warmouth	21	21.0
Bluegill	385	385.0
Longear Sunfish	2	2.0
Redear Sunfish	136	136.0
Spotted Bass	2	2.0
Largemouth Bass	186	186.0

APPENDIX B



Location of electrofishing sampling sites, Lake Tyler West, Texas, 2015. Water level at the time of sampling was 1.5 feet below conservation pool.

APPENDIX C



Detailed water level fluctuation in feet above mean sea level (MSL) recorded for Lake Tyler East, Texas June 2015 – May 2016. Horizontal hatched line represents conservation level (375.5 MSL).