PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-6

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2015 Survey Report

Lake Tyler East

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Lake Tyler East were surveyed in 2015 using electrofishing. Vegetation and angler access surveys were conducted in August 2015. A roving creel survey, conducted from March 1 through May 31, 2016, collected angler use and harvest information. Historical data are presented with the 2015-2016 data for comparison. This report summarizes results of the surveys and contains a management plan based on those findings.

- **Reservoir Description:** Lake Tyler East is a 2,276-acre reservoir on Mud Creek, Texas, a tributary of the Angelina River. Boat access was excellent at the three boat ramps during the survey due to stable water conditions. Bank access was available at several city parks. Although facilities are generally accessible to handicapped, none of the facilities provided were specifically marked as ADA approved. A substantial fringe of native emergent vegetation (primarily maidencane) provided littoral habitat around most of the reservoir. Lake Tyler East and Lake Tyler are connected by a canal and share common harvest regulations.

- **Management History:** Important sport fish include Largemouth Bass, White Bass, Channel Catfish, White Crappie, and Black Crappie. Additional Largemouth Bass sampling was conducted in 2013, and stockings were conducted annually from 2012 through 2015. A hydrilla management plan was submitted to Tyler Water Utilities (TWU) in July 2006 and was revised in 2008. Littoral hydrilla treatments (up to 200 feet from shore) were conducted in 2007 and annually from 2009-2011; no additional treatments have been conducted since that time. A roving creel survey was conducted from March 1 through May 31, 2016.

- **Fish Community**
  - **Prey species:** Bluegill and other sunfishes were the dominant prey species and electrofishing catch rates of sunfishes ≤ 4 inches were very high; thus, providing sufficient forage to predator fishes. Threadfin and Gizzard Shad were present but most Gizzard Shad were too large for predators to consume.

  - **Catfishes**: Channel Catfish received little directed angling effort but harvest of Channel Catfish documented during the creel survey indicate they remain in the reservoir.

  - **Largemouth Bass:** Electrofishing catch rate of Largemouth Bass ≥ 8 inches was higher than previous surveys and suggests improved recruitment compared to drought years. Size distribution is expected to improve as individuals grow to harvestable size. Largemouth Bass continued to be the most sought after species by anglers at Lake Tyler East but directed fishing effort was reduced compared to past surveys.

  - **Crappie:** Crappie were the second-most sought sport fish group during the spring creel survey in 2016. No trap net sampling was conducted but persistence of both white crappie and black crappie were documented in the creel survey**.**

Management Strategies: Initiate necessary steps to manage Tyler and Tyler East as one water body. Continue biennial electrofishing; stock Florida Largemouth Bass as warranted. Continue annual vegetation monitoring and maintain invasive plant species control. Promote Lake Tyler angling opportunities through news releases. Continue providing TWU with information about the threats of invasive species.

INTRODUCTION

This document is a summary of fisheries data collected from Lake Tyler East 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 fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2015-2016 data for comparison.

Reservoir Description

Lake Tyler East is a 2,276-acre reservoir on Mud Creek, a tributary of the Angelina River in Texas. The reservoir was built by Tyler Water Utilities (TWU) to provide water for municipal and industrial purposes. Lake Tyler East is eutrophic with a mean TSI *chl-a* of 51 (Texas Commission on Environmental Quality 2011). Historically, a narrow fringe of maidencane (*Panicum hemitomon)* has been present above the SH 64 Bridge and in the back of coves along the east side of the reservoir. The reservoir experienced a prolonged drought during most of 2010 – 2014, and water level remained 2 – 7 feet below conservation pool (Figure 1). This benefitted maidencane which now forms a ring around most of the reservoir. Although hydrilla *(Hydrilla verticillata)* was problematic in the past, only a trace amount is now present. Other descriptive characteristics for Lake Tyler East are found in Table 1.

Angler Access

Boater access is typically good with three public ramps (Table 2) and bank angler access is available at several city parks. However, access was compromised during low water levels from summer 2011 through spring 2014 (Figure 1), and anglers were required to launch from Lake Tyler West and enter Lake Tyler East via the canal. Access was again restricted in spring 2016 when unusually heavy rain and flooding prompted TWU to issue safety closures to boating temporarily in March and May 2016 (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. Continue to conduct biennial electrofishing surveys to monitor Largemouth Bass *(Micropterus salmoides)* and prey populations and to conduct genetic analysis of the population. Continue requesting Florida Largemouth Bass (FLMB) *(M. s. floridanus)* for stocking based on exhibited ability to produce trophy specimens.
   Action: Supplemental electrofishing was conducted in 2013, and standard electrofishing was conducted in 2015. Florida Largemouth Bass have been stocked annually.
2. Continue annual monitoring of Lake Tyler East vegetation community; provide TWU with information regarding overall coverage and aquatic nuisance species (ANS) 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.
3. Promote the newly established White Bass *(Morone chrysops)* population in news releases in the greater Tyler area. Give presentations to groups and area residents.
   Action: News releases have been prepared and submitted. No presentations specific to the fishery have been requested or offered.
4. Coordinate with TWU regarding ANS. Post appropriate signage at access points around the reservoir. Educate the public about ANS 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 East are currently managed with statewide

harvest regulations (Table 3).

Stocking history: Florida Largemouth Bass are the most frequently stocked species at Lake Tyler East. Florida Largemouth Bass were initially stocked in 1979 and were restocked in 2002 and 2003, 2008 and 2009, and annually since 2011. A complete stocking history is found in Table 4.

Vegetation/habitat management history: Aquatic vegetation at Lake Tyler East has traditionally occupied ~10% of the reservoir. Hydrilla was identified in trace amounts in 2003 but rapidly expanded, occupying 1,328 acres (58% coverage) by August 2006 (Beck and Ott 2008). A combination of herbicide treatments conducted by TWU, followed by severe flooding in summer 2007, reduced coverage to trace amounts by August of that year; no control was necessary in 2008. Hydrilla began expanding again in 2009 and was controlled by herbicide annually from 2009-2011. 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, prolonged drought reduced reservoir level below conservation pool from summer 2010 through spring 2014 (Figure 1). The lowest water level (7.7 feet below conservation pool) occurred in November 2011 when over 650 acres of the reservoir bottom was exposed (Texas Water Development Board 2016) and most submersed plant species were desiccated well beyond the 200-feet treatment zone. Therefore, no additional treatment has been conducted. Alligatorweed has been locally abundant above the SH 64 Bridge and in the back of coves along the east side. Alligatorweed flea beetles were released in April 2015. Several small scale dredging operations during the drought 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 has occurred. The physical habitat types have remained consistent over the last decade; the rate of shoreline development has stabilized.

Water transfer: Lake Tyler East is used primarily as a water supply for municipal and industrial purposes and secondarily for flood control and recreation. 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. TWU maintains a second permanent pump station and treatment facility on Lake Palestine. Water from the two sources is blended after leaving the treatment facilities but prior to distribution. TWU also provides treated water to the City of Whitehouse. No inter-basin transfers are known to exist.

METHODS

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Lake Tyler East (TPWD unpublished). Primary goals 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 cepetanium)* 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 seven randomly-selected fish (range 13.8 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 2007 through 2015.

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 1 through May 31. Angler interviews were conducted on 5 weekend days and 4 weekdays to assess angler use and fish catch/harvest statistics in accordance with the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Habitat - Vegetation surveys were conducted annually from 2012 through 2015; the 2014 survey was for ANS only. Habitat was assessed using 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) and TWU.

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 level remaining below conservation pool from summer 2010 through spring 2014 (Figure 1). Littoral zone exposure resulted in desiccation and severe reduction of submersed aquatic plant coverage and diversity. After the drought ended, high, turbid water limited light penetration in the littoral zone and combined with pulse-flood events (Appendix C) has further delayed recovery of submersed plant species. The rooted algal species Chara *(Chara vulgaris)* became abundant (Table 6) but at only approximately 50% of the total coverage of 492 acres reported in 2011 (Ott and Bennett 2012). Coontail *(Ceratophyllum demersum)* and pondweed *(Potamogeton spp.)* were still present but at trace coverage. Germination of several emergent plant species in the moist substrate along the reservoir margin during the drought shifted community dominance from submersed to emergent species. When reservoir elevation recovered in 2014 these species persisted. By 2015, maidencane/panicum in combination with spatterdock *(Nuphar luteum)* and water primrose *(Ludwigia spp.)* were the dominant species, covering approximately 250 acres (10.9%). Although hydrilla was detected at trace levels in 2012 and 2014, it has not become problematic. Alligatorweed has been locally problematic (restricting access) and is currently under control using flea beetles released in April 2015.

Creel: Total angling effort for all species declined substantially from 35,111 h in 2008 to 18,843 h in 2012 and only 5,352 h in 2016 (Table 8). Total directed angling expenditures followed a similar trend declining from $237,881 in 2008 to $192,004 in 2012 and only $19,162 in 2016. 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 and expenditure estimates).

Prey species: Both Threadfin Shad and Gizzard Shad were present in Lake Tyler East (Figure 2; Appendix A), but combined electrofishing catch rate was < 200/h. Index of Vulnerability for Gizzard Shad (28) had declined compared to previous surveys (Figure 2), indicating that few were of suitable prey size.Bluegill *(L. macrochirus)* continued to be the dominant prey species with electrofishing catch rates of 1,167/h in fall 2015. Redbreast Sunfish (*L. auritus*) and Redear Sunfish (*L. microlophus)* were also collected but at lower catch rates (196 and 188/h, respectively). The size distributions of sunfish were skewed toward fish < 5 inches (Figures 3-5) which primarily function as prey. However, Sunfishes represented an important component of the fishery to recreational anglers; sunfishes accounted for 10% of the total angling effort in spring 2016 (Table 7).

Catfish: Lake Tyler East has traditionally supported a low abundance of Channel Catfish (*Ictalurus punctatus)* with limited natural recruitment. Although no gill net sampling was conducted in 2016, continued persistence of Channel Catfish was documented by electrofishing (Appendix A) and in the creel

(Table 9 and Figure 6). Approximately 1% of the total angling effort was directed toward Channel Catfish in spring 2016, and estimated harvest was only 350 fish. Photographs of a large (> 40 pound) Blue Catfish *(I. furcatus)* caught from Lake Tyler have been posted to social media and indicate that this species is present at some level.

White Bass: Although gill net sampling was discontinued at Lake Tyler East in 2016 under the OBS protocol, persistence of White Bass was documented through anecdotal evidence provided by anglers. No directed angler effort or catch of White Bass was documented in the 2016 creel survey.

Black bass: Spotted Bass *(M. punctulatus)* were collected by electrofishing but at low abundance; size distribution (Figure 7) suggests their contribution to the fishery was minimal. Overall electrofishing catch rate of Largemouth Bass in 2015 (170/h) was higher than in 2013 (73/h) or in 2011 (115/h) (Figure 8) and approached the catch rate recorded in the flood year of 2007 (268/h) reported by Beck and Ott (2008). Low recruitment of sub-stock length ($\leq$ 8 inch) fish was evident in fall 2013 relative to the other years and was likely a function of the deleterious effect of drought and low water levels from mid 2010 through early 2014 (Figure 1) on aquatic vegetation (Table 6). By spring 2014 and 2015, water level recovered enough to inundate emergent plant species and year-class strength improved. Proportional size distribution (PSD) was 33 in fall 2015 which is slightly lower than the target range of 40–70. However, PSD should improve as the strong 2014 and 2015 year classes grow above 12-inches. Otoliths collected from a sample of seven largemouth bass collected in fall 2015 indicated that fish recruit to the 14-inch minimum length by an average age of 2.4; therefore, 2014 and 2015 year classes should begin contributing to the fishery by 2016-2018, respectively. Mean relative weight (W_r) was above 90 for all length classes in 2015 and showed no size related trend. This indicates adequate prey availability and low intra-specific competition. FLMB alleles were present in all of the fish in a 30 specimen (mixed cohort) collection conducted in fall 2015 and 7.0 % of the fish collected were pure FLMB (Table 11). Percent FLMB alleles (59) have increased through time; indicating ability to increase trophy potential of the LMB population at the reservoir through regular stockings.

The Largemouth Bass fishery at Lake Tyler East continued to be the most popular of any species but the percentage of directed effort declined to only 64% in spring 2016 compared to $\geq$ 80% in previous surveys (Table 7). The magnitude of directed effort for Largemouth Bass (3,414 h) was only 11-22% of the effort expended during the previous two survey periods (Table 10). Furthermore, the ratio of tournament and non-tournament angling effort which had been roughly 1:1 in the 2008 creel survey declined substantially in 2016. Despite reduction in effort, angler success measured as fish caught per hour (1.4/h) was similar to previous surveys (Table 10). Harvest was low, as only an estimated 394 Largemouth Bass were harvested during the creel period (Figure 10) and none were reported as temporarily retained for weigh-in and release. Percent legal released for non-tournament anglers was high.

Crappie: Trap net sampling has historically been ineffective at Lake Tyler East and was discontinued in 2015 under the Objective Based Sampling protocol (Table 5). However, continued persistence of both White Crappie *(P. annularus)* and Black Crappie *(P. nigromaculatus)* were documented through anecdotal evidence provided by anglers and creel survey harvest results; crappie were the second most popular fishery and comprised 24% of total angler effort (Table 7 and 12, Figures 10 and 11). Directed angler effort for crappie (1,310 h) was less than that reported in 2008 (2,208 h), or 2012 (1,999 h), but angler catch rate (2.0/h) was intermediate to both previous surveys. Harvest was evenly distributed between White and Black Crappie and most were at or slightly above the legal length of 10 inches.

Fisheries management plan for Lake Tyler East, Texas

Prepared – July 2016.

ISSUE 1: Since impoundment in 1967 Lake Tyler East has traditionally been sampled and managed separately from Lake Tyler West. 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 East 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 and conduct genetic analysis of the population.
2. Continue requesting FLMB for stocking based on exhibited ability to produce trophy specimens.

ISSUE 3: Hydrilla has historically been problematic, occupying 60% of the reservoir in 2006. Annual herbicide treatments were conducted from 2009-2011 but no additional treatments have been necessary. Alligatorweed has been locally problematic and release of flea beetles was conducted in 2015.

MANAGEMENT STRATEGIES

1. Continue annual monitoring of the combined Lake Tyler vegetation community as necessary.
2. Continue providing TWU with information regarding overall coverage and spatial distribution of plant species.
3. Continue requesting alligatorweed flea beetles from US Army Corps of Engineers as available.

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

MANAGEMENT STRATEGY

1. Promote this fishery in news releases in the greater Tyler area. Make information available to the public to clarify issues relating to 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. Continue to coordinating with TWU to maintain appropriate signage 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 can in turn educate their customers.
3. Educate the public about invasive species through the use of media and the internet.
4. Make a speaking point about invasive species when presenting to constituents 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 East 2016-2020

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

Low-density fisheries

All sport species at Lake Tyler East 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 a maximum of 2% of directed angler effort during any of the last three creel surveys (November 2004-January 2005 or March-May 2008 and 2012). 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 provided estimates of CPUE and PSD with the desired level of precision (N> 50, RSE <25). CPUE has ranged from 0.6/nn in 2008 to 4.4/nn in 2004 with RSE ranging from 41 to 50 respectively. Bootstrap analysis of the most recent two surveys predict it would require 15 randomly set gill net nights to obtain reliable estimates of CPUE and over 50 net nights to obtain population index estimates with the desired precision. Continued presence/absence could still be determined through the creel survey and 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 and 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 no directed angling effort has been documented in creel surveys. 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 23.8/nn in 2008 to 4.8/nn in 2012, clumped distribution has resulted in high variance from net to net. Bootstrap analysis of data from the last two surveys (2008, 2012) suggest 30 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) would still require 15 net nights. However, continued presence/absence of the species and occurrence of individual year classes could be documented through the creel survey in 2020 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 in 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. 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 no additional collection will be conducted.

Largemouth Bass: Largemouth Bass are by far the primary sport species at Lake Tyler East accounting for 52% (2.9 hours/acre) of the directed effort during the winter quarter (2004-2005) creel survey and over 80% (13.0 hours /acre and 6.6 hours/acre) in the spring quarters (2008 and 2012 respectively). Due to the importance of this fishery electrofishing surveys have been conducted every two years from 2001-2013 and every three years prior to that. Relative abundance has been high with stock-length CPUE's ranging from 40-49/h with RSE's from 18 to 22 over the past three surveys (2009, 2011, and 2013). Bootstrap analysis of this data suggests reliable population metrics (CPUE; RSE<25, PSD and Wr; N>50 stock size individuals) would require 12-18 randomly selected 5-minute electrofishing stations. Therefore,

Largemouth Bass population trend data will be monitored in the fall of 2017 and fall of 2019 for relative abundance, size distribution, growth, and condition (**this is the survey objective**). A total of 18, 5-minute electrofishing stations will be randomly generated. Twelve, individual stations will initially be sampled. If the minimum of 50 stock-length individuals are not collected or RSE is $\geq$25 the additional 6 stations will be sampled **(this is the sample objective)**. If sampling objectives are not met using the 18 stations no additional stations will be generated. Mean age at legal length will be estimated in 2019; this will allow us to continue monitoring long-term trends in growth. If a minimum of 13 specimens 13.0-14.9 inch specimens are not collected in the 18 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, Threadfin Shad, and to a lesser extent, 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 ranging from 204/h in 2009 to 1,333 in 2011, and 555/h in the last survey 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 $\leq$ 25 in the most recent surveys. Sunfishes and Gizzard Shad will be sampled in fall 2015 and 2017 to estimate CPUE, PSD, and IOV **(this is the survey objective)**. Sampling intensity and schedule will be the same as is proposed for Largemouth Bass. All specimens will be sorted by inch group, counted, and recorded (**this is the sampling objective)**.

Crappie: During the March through May 2012 creel survey crappie represented 11% (0.9 hours/acre) of the directed angler effort. During the November 2004 through January 2005 creel survey effort was higher (2.5 hours/acre) and represented 46% of the directed 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 5 single-cod, shoreline set trap nets in late fall, with combined species catch rates ranging from 0.8-5.6/nn (2003 – 2011). While CPUE was relatively high in the 2003 sample more recent samples have been much lower; confidence intervals surrounding estimates of abundance and PSD have fluctuated considerably. Based on bootstrap analysis of historical data, it would take 25-40 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 **(this is the survey objective)**. Five weekend days and four week days will be surveyed in spring quarter to provide direct estimates of pressure, catch rate, and harvest. Mean age at length (13 specimens between 9.0 and 10.9 in) will be estimated from otoliths obtained from angler volunteers during the creel survey **(this is the sampling objective)**.

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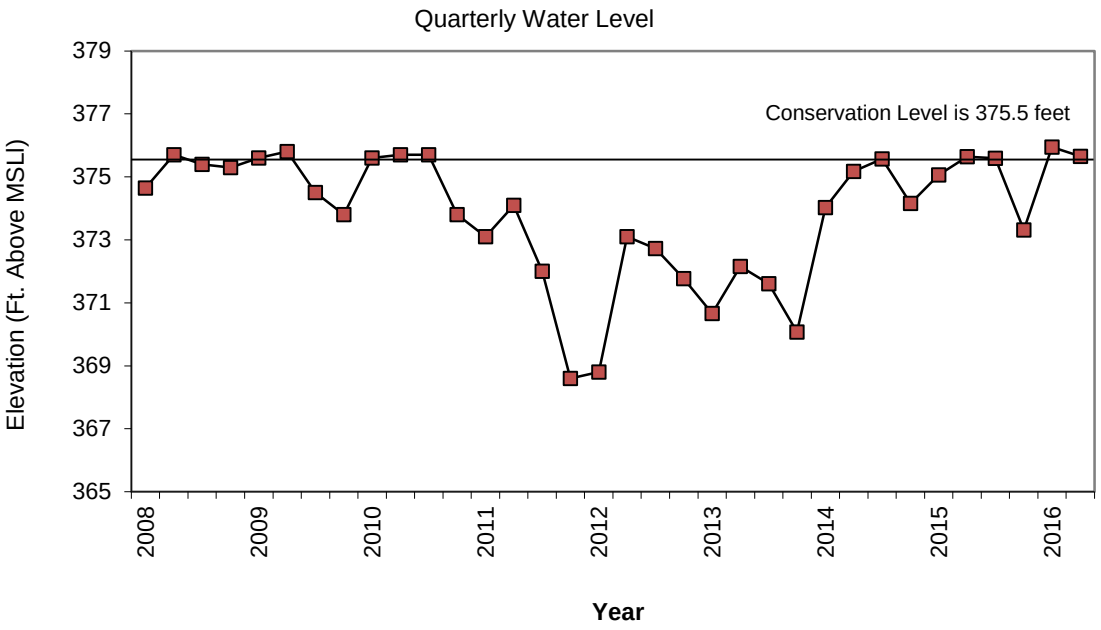


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Lake Tyler East, Texas. Horizontal line represents conservation level.

Table 1. Characteristics of Lake Tyler East, Texas.

Characteristic	Description
Year completed	1967
Controlling authority	Tyler Water Utilities
Counties	Smith (dam)
Reservoir type	City Lake
Shoreline Development Index (SDI)	5.0
Conductivity	100 umhos/cm

Table 2. Boat ramp characteristics for Lake Tyler East, 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
SH 64	32.27777 -95.11380	Y	50	372.5	Access compromised when elevation drops ≥3 ft. below conservation pool. Extension is not feasible.
Omen Road East	32.22931 -95.11660	Y	20	372.5	Usable at near full pool only. Extension is feasible
Omen Road West	32.23743 -99.91345	Y	30	369.5	Excellent, no access issues

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

Species	Bag limit	Length limit
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 East, Texas. FGL = fingerling; ADL = adult.

Species	Year	Number	Size
Blue Catfish	1971	8,569	FGL
	1975	25,000	FGL
		33,569	
Channel Catfish	1967	24,000	FGL
	1969	137,600	FGL
		161,600	
Palmetto Bass	1975	25,000	FGL
	1977	13,840	FGL
	1979	25,000	FGL
	1983	25,930	FGL
		89,770	
Largemouth Bass	1967	120,200	FGL
		120,200	
Florida Largemouth Bass	1979	2,470	ADL
	2002	120,824	FGL
	2003	34,040	FRY
	2003	113,812	FGL
	2008	113,819	FGL
	2009	113,780	FGL
	2011	115,650	FGL
	2012	120,448	FGL
	2013	123,493	FGL
	2014	117	ADL
	2015	66,443	FGL
		924,896	
ShareLunker LMB	2014	26	ADL

Table 5. Objective-based sampling plan components for Lake Tyler East, 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 $\underline{\geq}$ 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. Survey of aquatic vegetation, Lake Tyler East, Texas, 2012 – 2015. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Vegetation	2012	2013	2014[A]	2015
Chara/southern naiad	644 (28.3)			
Chara		279 (12.0)		260 (1.1)
Coontail	<1 (<0.1)			tr
Pondweed		2 (<0.1)		2 (<0.1)
Variable-leaf watermilfoil	3 (0.1)			
Spatterdock	7 (0.3)	22 (0.1)		23 (1.0)
Spatterdock/maidencane/ coontail				70 (3.0)
American lotus	4 (0.2)	46 (2.0)		
Maidencane/panicum	27 (1.2)			174 (7.6)
Softrush				<1 (<0.1)
Water primrose				4 (0.2)
Non-native				
Alligatorweed (Tier II)*	50 (2.2)	50.0 (0.7)	5 (0.2)	4 (0.2)
Hydrilla (Tier II)*	<1 (<0.1)		Tr.	

[A] Aquatic Nuisance Species 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 East, Texas 2008, 2012, and 2016. Survey periods were from March 1 through 31 May.

Species	2008	2012	2016
Channel Catfish	1	2	1
Largemouth Bass	84	80	64
Sunfishes	<1	1	10
Crappies	6	11	24
Anything	8	6	1

Table 8. Total fishing effort (h) for all species and total directed expenditures at Lake Tyler East, Texas, 2008, 2012, and 2016. Survey periods were March 1 through May 31.

Creel statistic	2008	2012	2016
Total fishing effort	35,111	18,843	5,352
Total directed expenditures	$237,881	$192,004	$19,162

Gizzard Shad

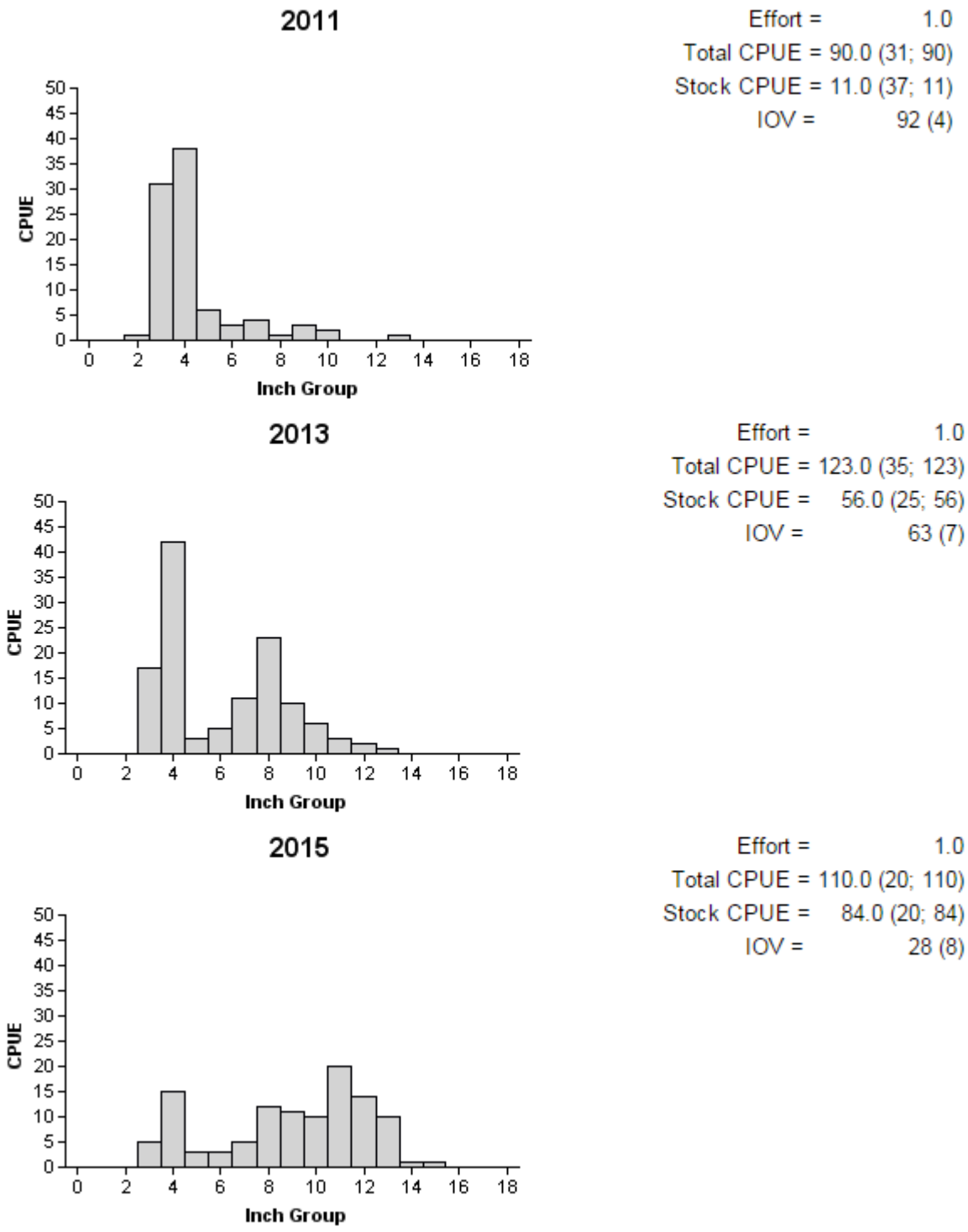


Figure 2. Number of Gizzard Shad caught per hour (CPUE, bars), and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Lake Tyler East, Texas, 2011, 2013, and 2015.

Redbreast Sunfish

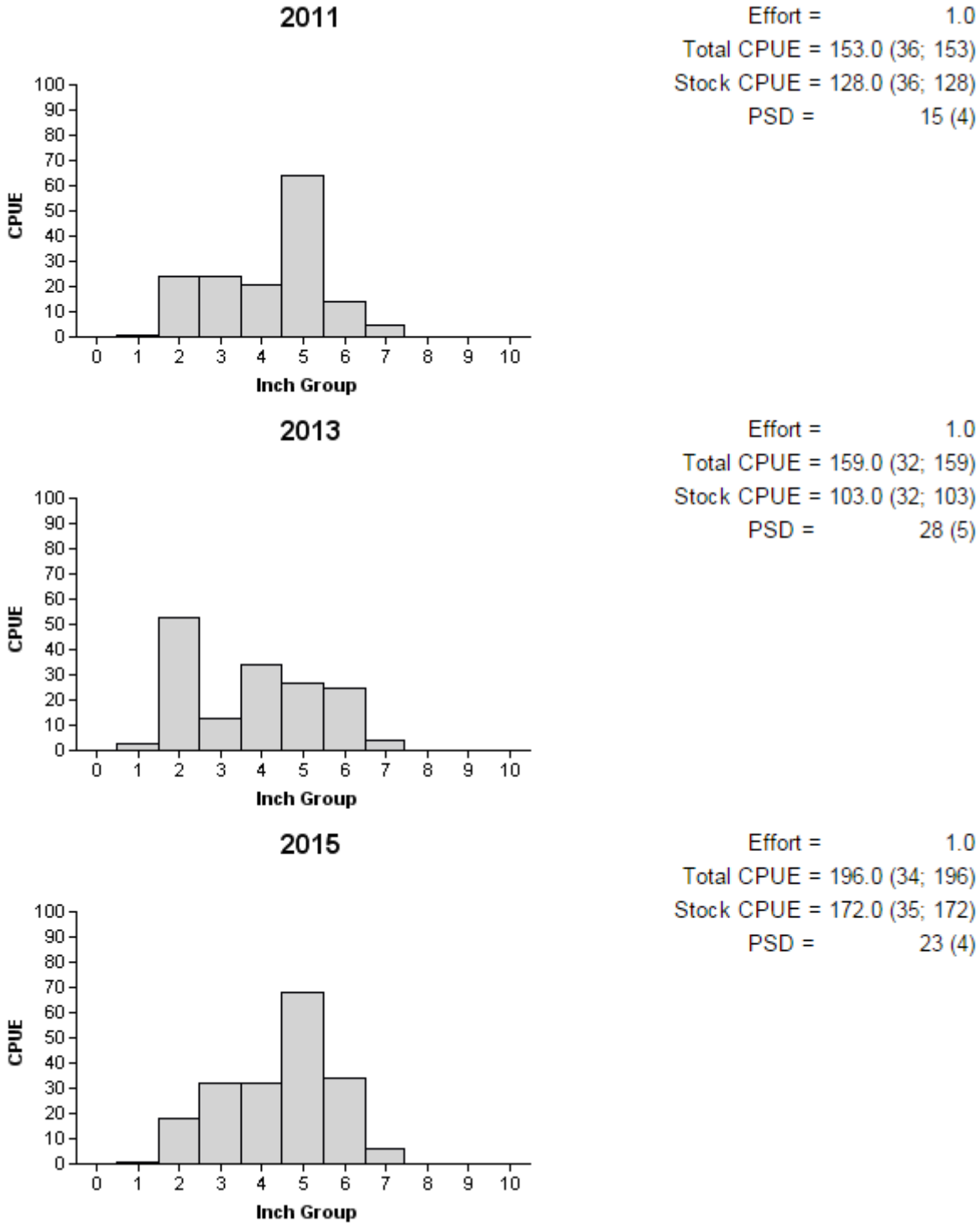
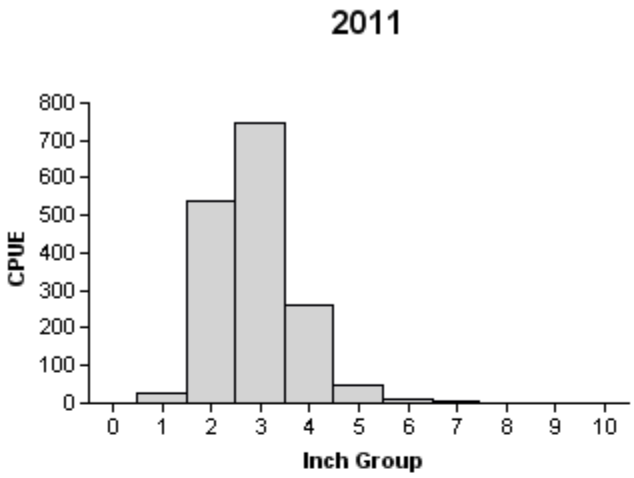
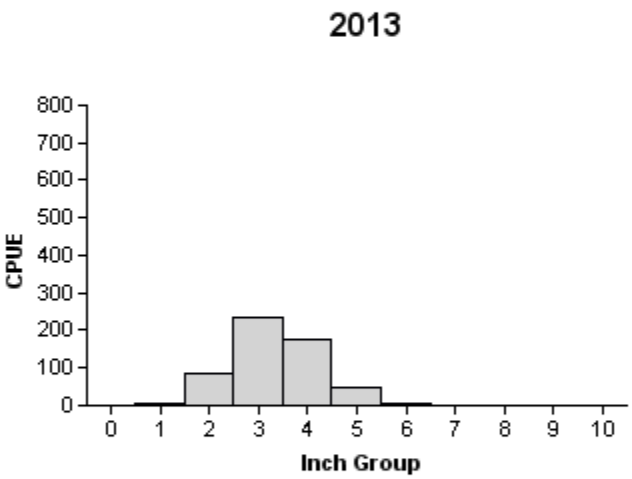


Figure 3. Number of Redbreast Sunfish caught per hour (CPUE, bars), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Tyler East, Texas, 2011, 2013, and 2015.

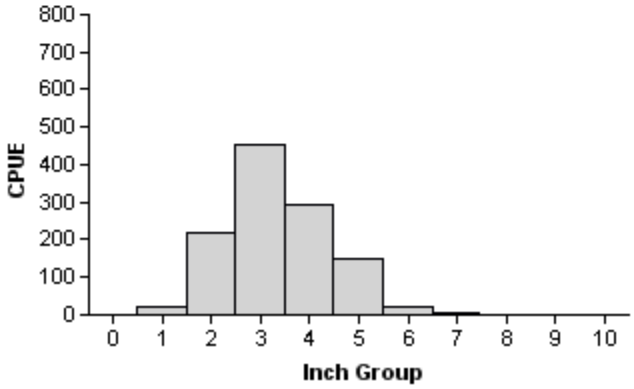
Bluegill



Effort = 1.0
Total CPUE = 1,633.0 (8; 1633)
Stock CPUE = 1,070.0 (12; 1070)
PSD = 1 (0)



Effort = 1.0
Total CPUE = 555.0 (16; 555)
Stock CPUE = 462.0 (17; 462)
PSD = 2 (1)



Effort = 1.0
Total CPUE = 1,167.0 (18; 1167)
Stock CPUE = 922.0 (18; 922)
PSD = 3 (1)

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 East, Texas, 2011, 2013, and 2015.

Redear Sunfish

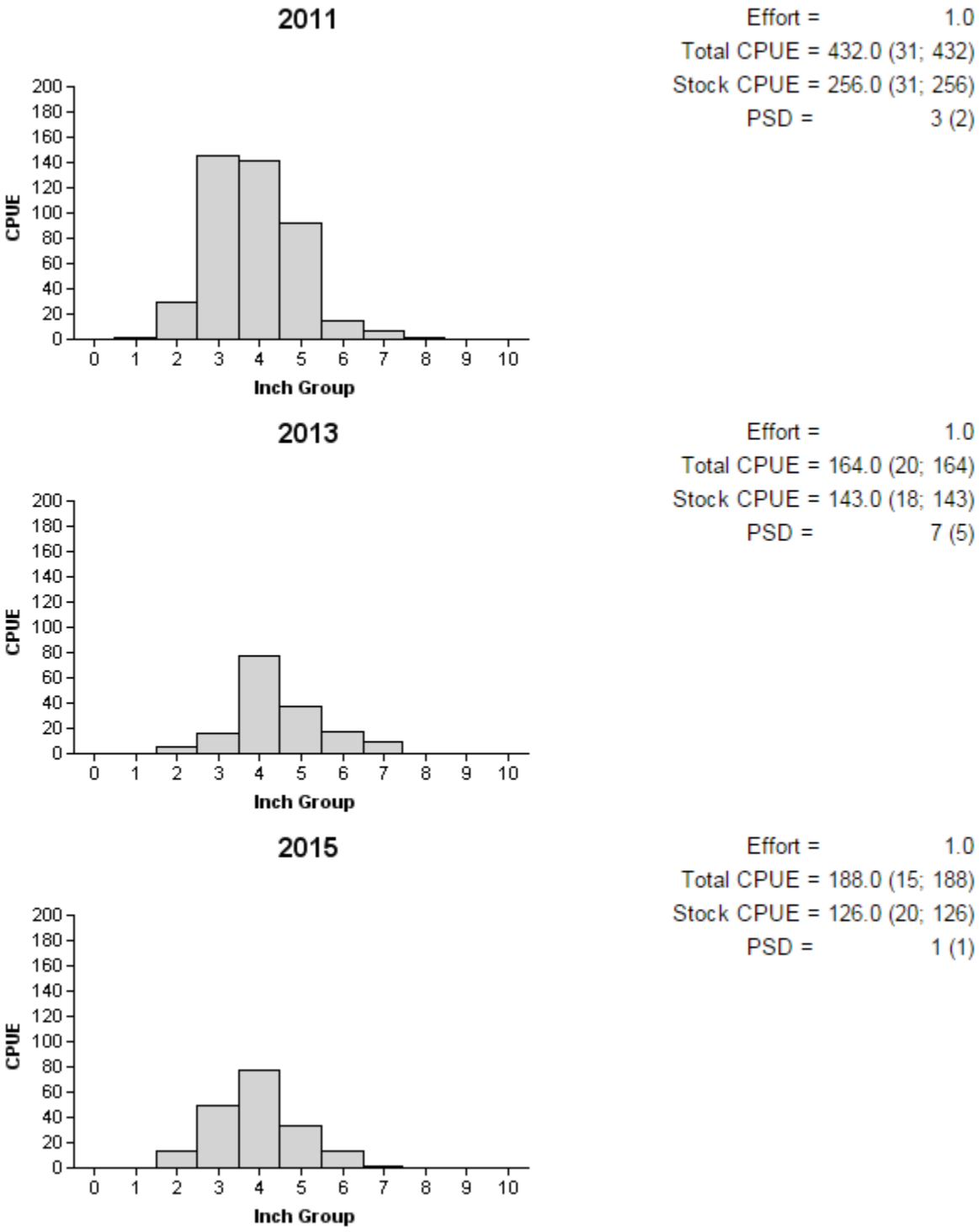


Figure 5. Number of Redear Sunfish caught per hour (CPUE, bars), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Tyler East, Texas, 2011, 2013, and 2015.

Channel Catfish

Table 9. Creel survey statistics for Channel Catfish at Lake Tyler East 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)	2,276	2,057	2,276
Directed effort (h)	450 (84)	367 (79)	73 (119)
Directed effort/acre	0.2	0.2	<0.1
Total catch per hour	0	0	1.2 (Na.*)
Total harvest	80 (975)	103 (830)	350 (100)
Harvest/acre	<0.4 (975)	<0.1 (830)	0.2 (100)
Percent legal released	0	0	0

*Incidental catch by angler not targeting that species

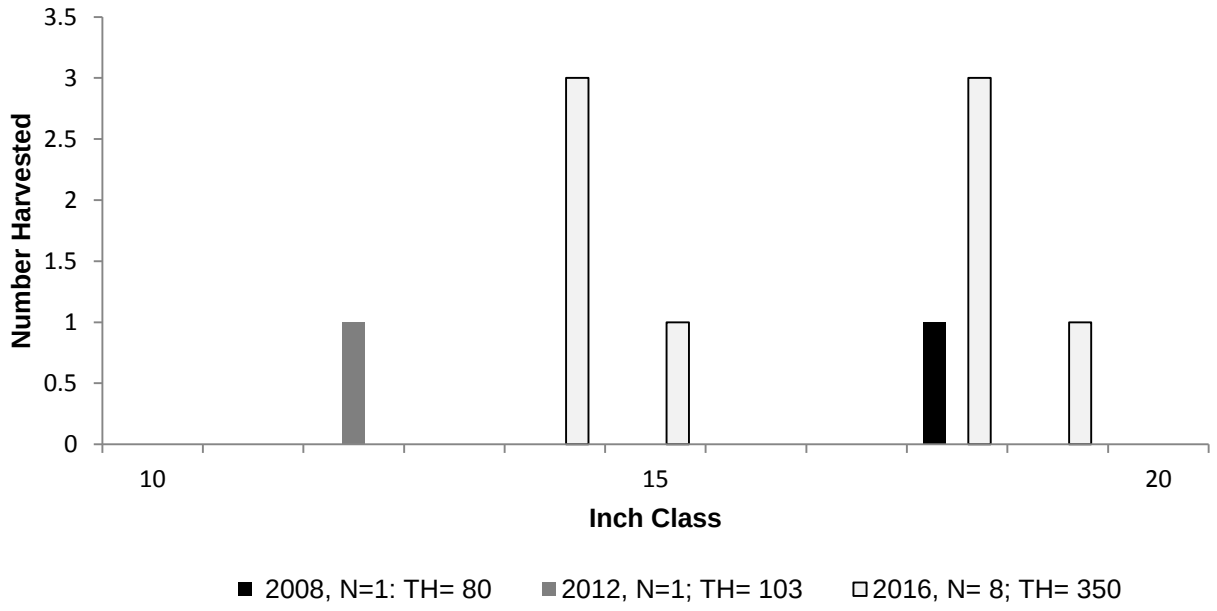


Figure 6. Length frequency of harvested Channel Catfish observed during creel surveys at Lake Tyler East, Texas, March–May, 2008, 2012, and 2016, all anglers combined. N is the number of harvested Channel Catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

Spotted Bass

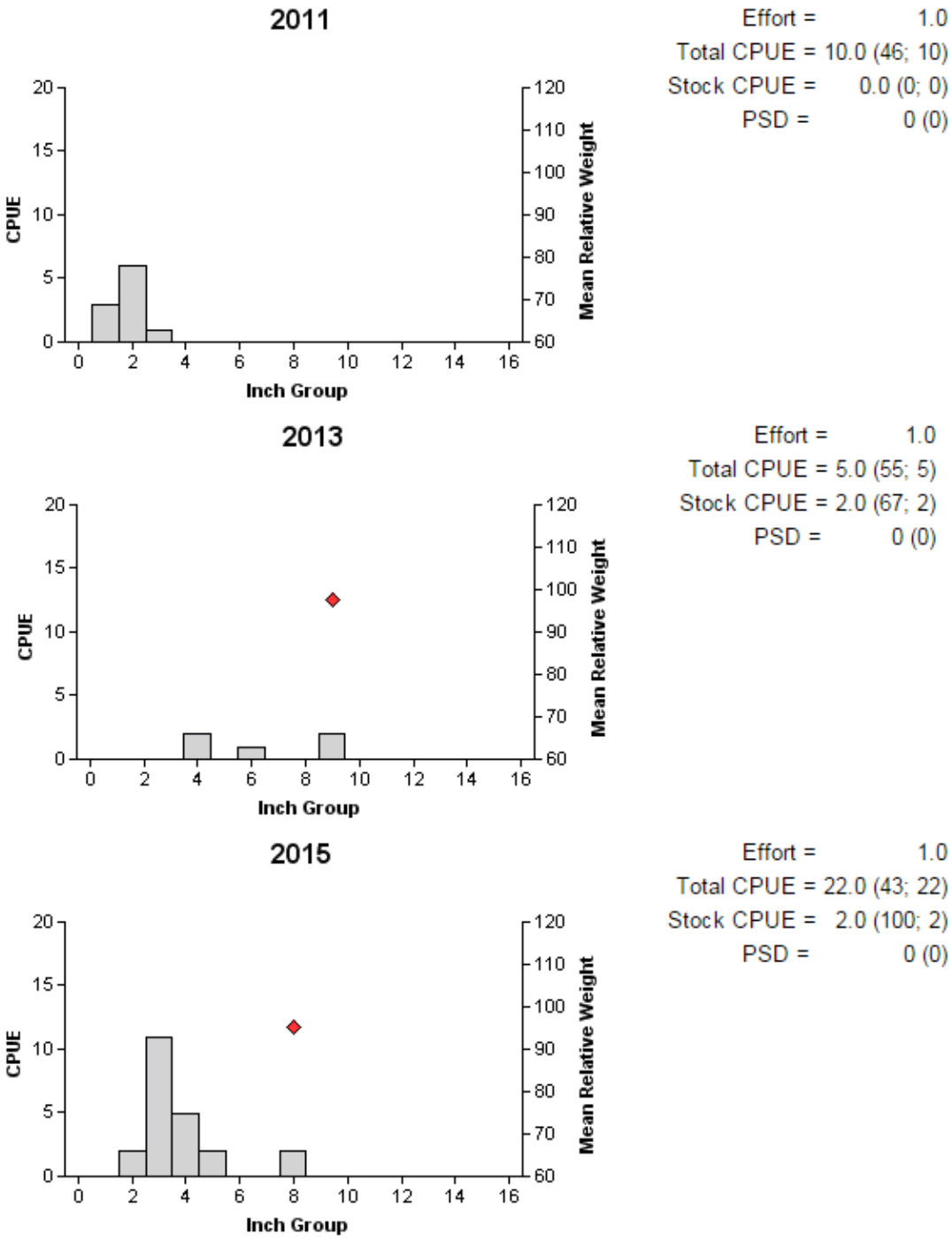


Figure 7. Number of Spotted Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Tyler East, Texas, 2011, 2013, and 2015.

Largemouth Bass

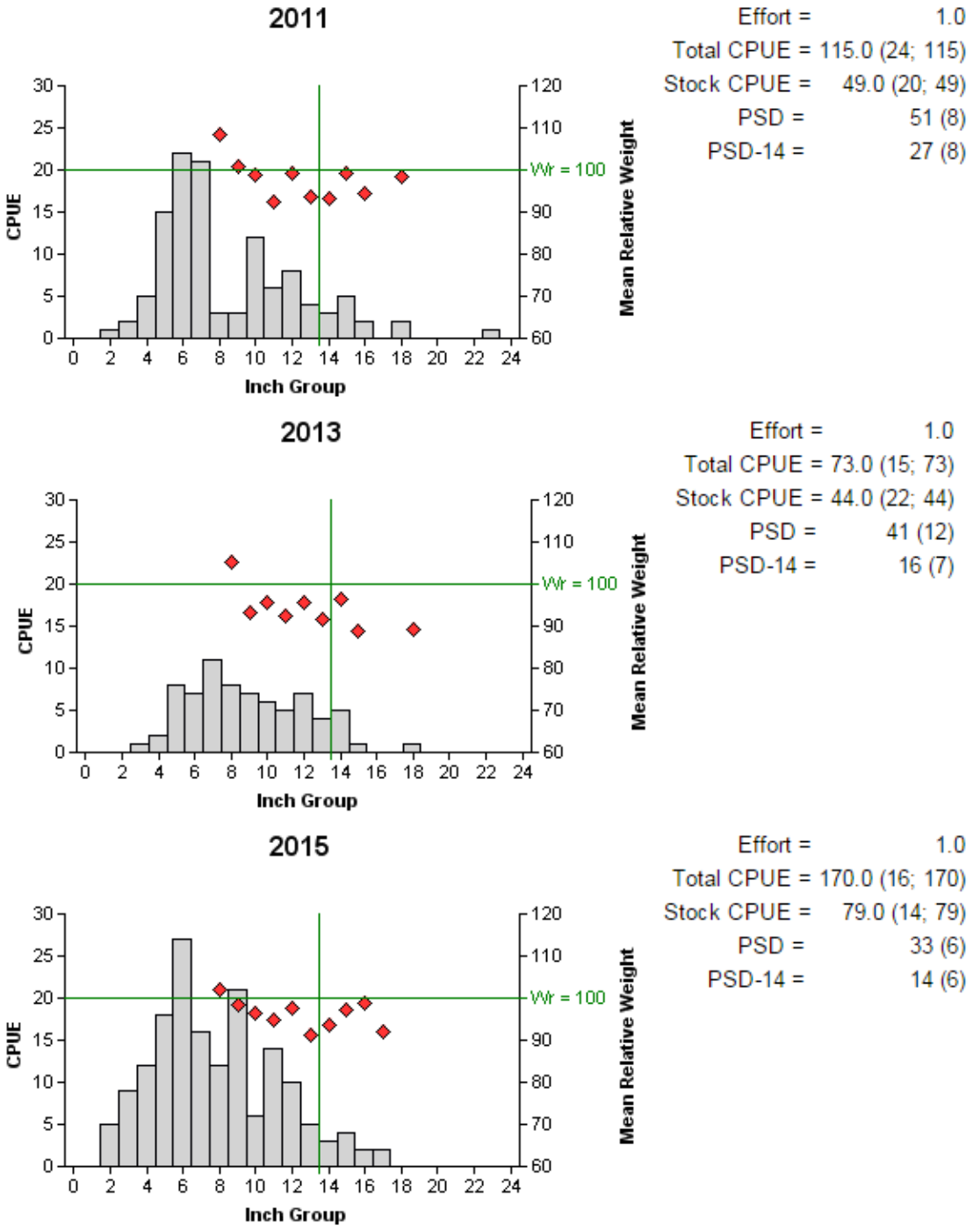


Figure 8. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Tyler East, Texas, 2011, 2013, and 2015. Vertical line represents length limit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

Largemouth Bass

Table 10. Creel survey statistics for Largemouth Bass at Lake Tyler East, 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)	2,276	2,057	2,276
Directed effort (h)			
Tournament	NA	7,424 (26)	258 (67)
Non-tournament	NA	7,704 (25)	3,157 (29)
All black-bass anglers combined	29,598 (19)	15,128 (25)	3,414 (29)
Directed effort/acre	13.0 (19)	7.4 (26)	1.5 (29)
Total catch per hour	0.9 (20)	1.3 (29)	1.4 (33)
Total harvest	6,284		
Non-tournament harvest	NA	910 (115)	394 (95)
Harvest/acre	2.7 (58)	0.4 (115)	0.1 (95)
Tournament weigh-in and release	NA	3,199 (55)	0 (Na.)
Percent legal released (non-tournament)	NA	83	82

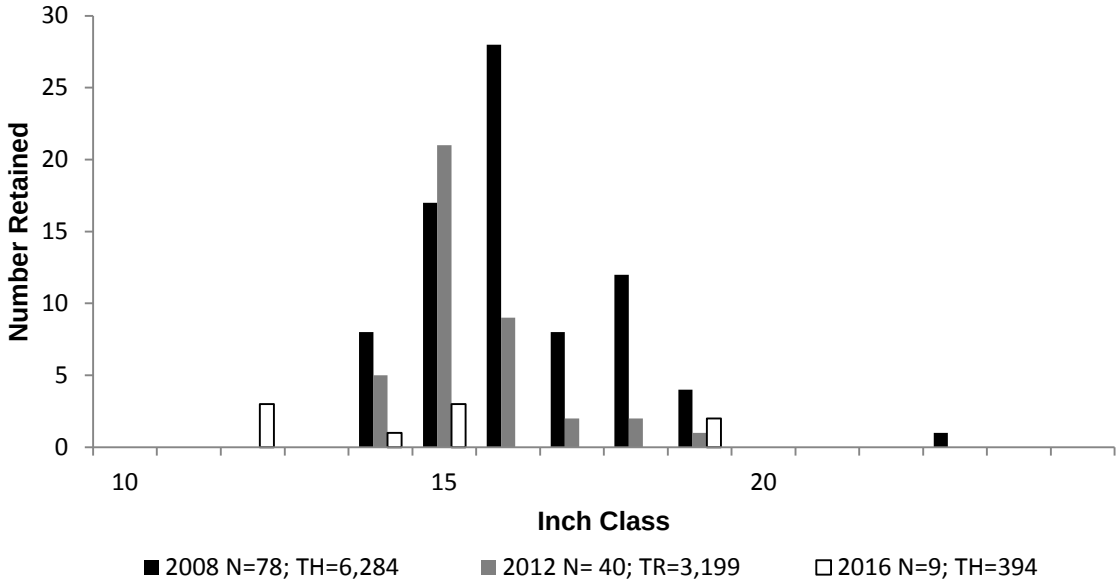


Figure 9. Length frequency of Largemouth Bass observed during creel surveys at Lake Tyler East, Texas, March-May 2008, 2012, and 2016, all anglers combined. N is the number of harvested Largemouth Bass observed during creel surveys, H is the estimated total harvest for the period, and TR is the estimated tournament retained and released 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	Genotype				% FLMB alleles	% pure FLMB
		FLMB	F1	Fx	NLMB		
2007	30	0	Na.	Na.	0	42.6	0.0
2011*	30	0	1	29	0	50.0	0.0
2015*	30	2	1	27	0	59.0	7.0

* Samples taken from multiple cohorts.

Crappie

Table 12. Creel survey statistics for crappie at Lake Tyler East March–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)	2,276	2,057	2,276
Directed effort (h)	2,208 (42)	1,999 (36)	1,310 (35)
Directed effort/acre	0.9 (42)	0.9 (47)	0.6 (35)
Total catch per hour	1.0 (52)	5.7 (39)	2.0 (38)
Total harvest	2,981 (99)	5,160 (85)	1,544 (70)
White Crappie	966(133)	929 (193)	787 (67)
Black Crappie	2,236 (84)	4,231 (57)	757 (72)
Harvest/acre	1.3 (99)	2.3 (85)	0.7 (70)
White Crappie	0.4 (133)	0.4 (276)	0.3 (67)
Black Crappie	1.0 (84)	1.9 (61)	0.3 (72)
Percent legal released	0	0	0

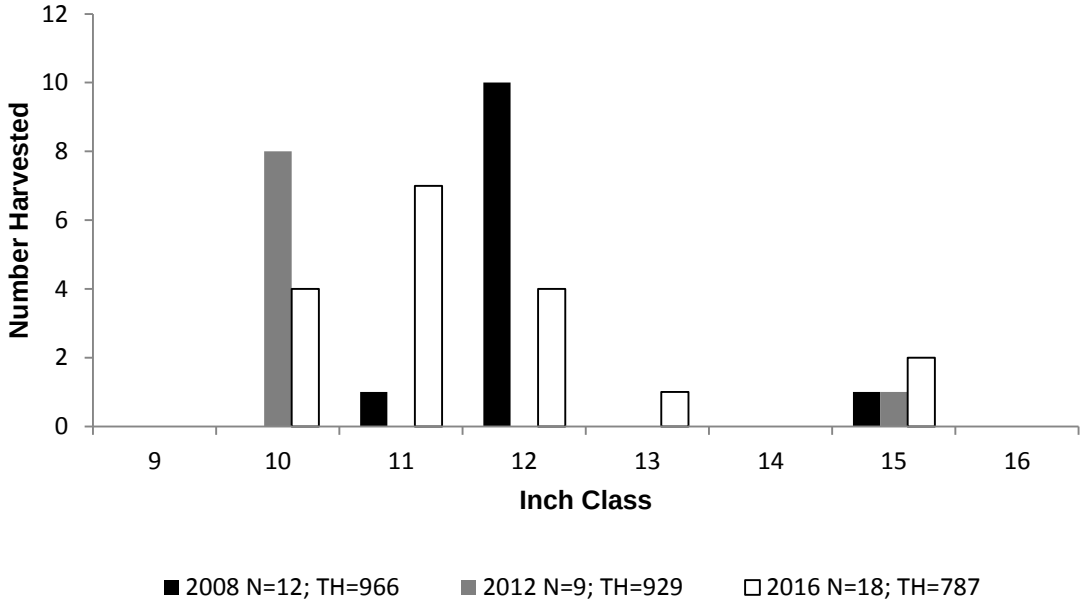


Figure 10. Length frequency of harvested White Crappie observed during creel surveys at Lake Tyler East, Texas, March-May 2008, 2012, and 2016, all anglers combined. N is the number of harvested White Crappie observed during creel surveys, and TH is the total estimated harvest for the creel period.

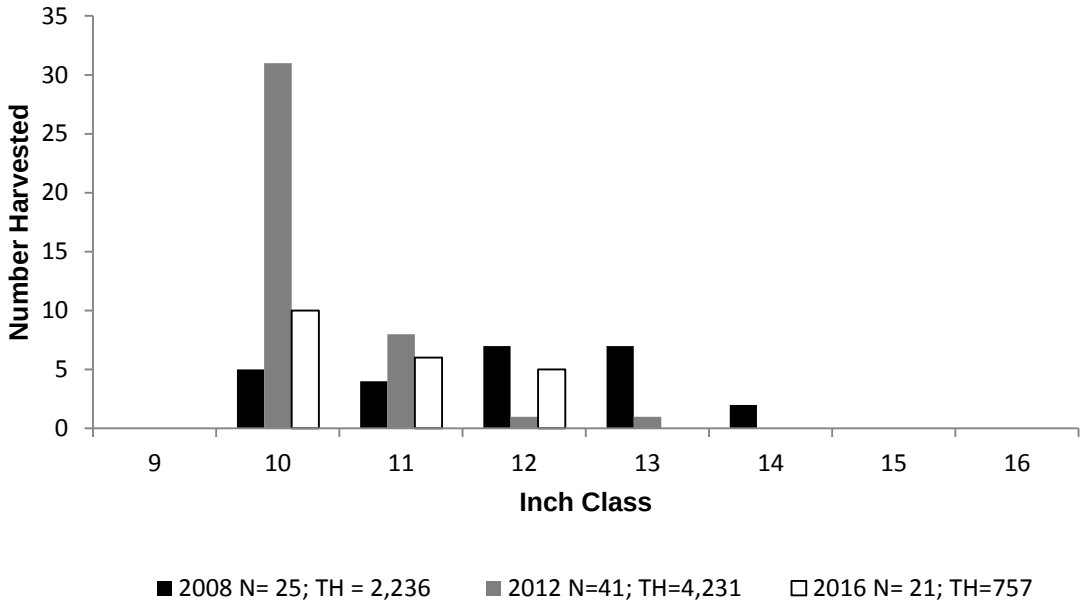


Figure 11. Length frequency of harvested Black Crappie observed during creel surveys at Lake Tyler East, Texas, March-May 2008, 2012, and 2016, all anglers combined. N is the number of harvested Black Crappie observed during creel surveys, and TH is the total estimated harvest for the creel period.

Table 13. Proposed sampling schedule for Lake Tyler East, Texas. Access and habitat surveys are conducted during the summer, electrofishing is in the fall. 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

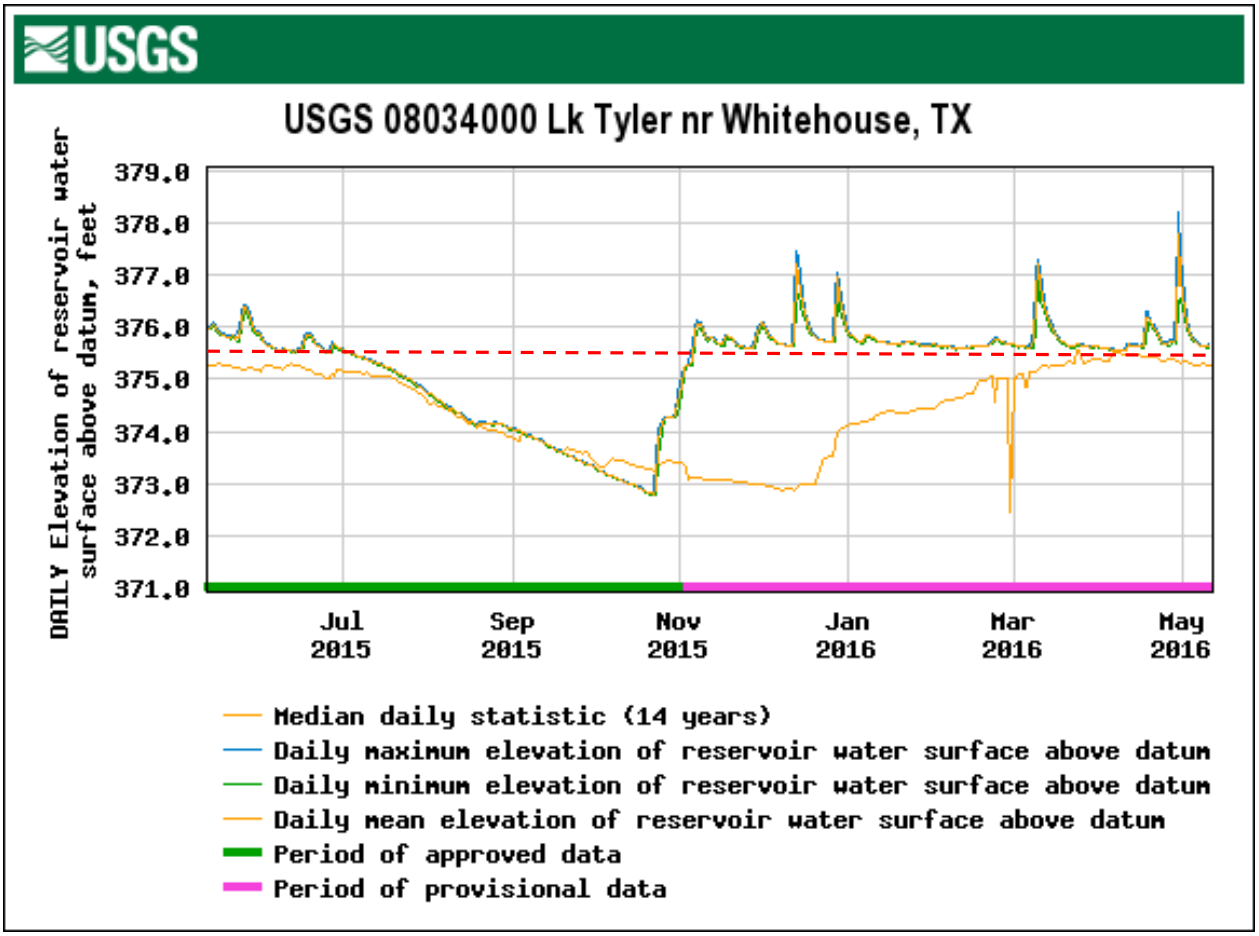
Number (N) and catch rate (CPUE) of all target species collected by electrofishing from Lake Tyler East, Texas, 2015.

Species	N	CPUE
Gizzard Shad	110	110.0
Threadfin Shad	91	91.0
Channel Catfish	2	2.0
Redbreast Sunfish	196	196.0
Warmouth	37	37.0
Bluegill	1,167	1,167.0
Longear Sunfish	40	40.0
Redear Sunfish	188	188.0
Spotted Bass	22	22.0
Largemouth Bass	170	170.0

APPENDIX B

Locations of electrofishing sampling sites, Lake Tyler East, 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 pool level.