

# Lake Palestine

## 2017 Fisheries Management Survey Report

PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-3

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

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## Survey and Management Summary

Fish populations in Lake Palestine were surveyed in 2017 using electrofishing, and 2018 using low-frequency electrofishing and gill netting. Anglers were surveyed at the Highway 31 Neches River access point from February 2018 through April 2018 with a creel survey. Historical data are presented with the 2017-2018 data for comparison. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

**Reservoir Description:** Lake Palestine is a 23,434 acre impoundment located on the Neches River approximately 15 miles southwest of Tyler, Texas. Water level has remained within 3 feet of conservation pool since 2012. Lake Palestine has high productivity. Habitat features consisted of standing timber, rocks, native submersed and emergent aquatic plants.

**Management History:** Important sport fish include White Bass, Palmetto Bass, Largemouth Bass, White and Black Crappie, and Blue, Channel and Flathead Catfish. The management plan from the 2014 survey report included stocking Palmetto Bass at 10 fish/acre every year and Florida Largemouth Bass at 50 fish/acre in 2015 and 2016. Flathead Catfish were intensively sampled in 2013, 2014 and again in 2018 to identify any population level changes within the reservoir following the legalization of hand-fishing. Efforts have been made to establish desirable native species of aquatic vegetation in the reservoir with a series of plantings within enclosure cages. Improvements were made to the Saline Bay boat ramp in 2017.

### Fish Community

- **Prey species:** Threadfin Shad were present in the reservoir. Electrofishing catch of Gizzard Shad was moderate and almost 75% of Gizzard Shad were available as prey to most sport fish. Electrofishing catch of Bluegill was high and most were less than 6-inches long.
- **Catfishes:** Blue, Channel and Flathead Catfish are present within the reservoir; all three species were abundant and have the potential to provide excellent angling opportunities.
- **Temperate basses:** White Bass and Hybrid Striped Bass (Palmetto Bass and Sunshine Bass) were present in the reservoir. The spring spawning run is a popular fishery for both species in the reservoir's upper tributaries.
- **Largemouth Bass:** Largemouth Bass were abundant and displayed good body condition. Largemouth Bass growth to legal length was fast (age at 14 inches long was 1.7 years) and almost 30% of fish were legal-length.
- **Crappie:** Black and White Crappie are present in the reservoir and historically have provided a popular fishery.

**Management Strategies:** Continue stocking Palmetto Bass at 10 fish/acre and Florida Largemouth Bass at 1000/km of shoreline. Inform the public about the negative impacts of aquatic invasive species. Work with TPWD Kills and Spills Team to improve communication and collaborative efforts for potential fish kill investigations.

## Introduction

This document is a summary of fisheries data collected from Lake Palestine in 2017-2018. The purpose of the document is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2017-2018 data for comparison.

## Reservoir Description

Lake Palestine is a 23,434-acre impoundment constructed in 1962 (enlarged to current size in 1971) on the Neches River. It is located in Cherokee, Anderson, Henderson and Smith Counties 15 miles southwest of Tyler, Texas and is operated and controlled by the Upper Neches Municipal River Authority. Primary water uses included municipal water supply and recreation. Lake Palestine was hypereutrophic with a mean TSI chl-a of 61.46 (Texas Commission on Environmental Quality 2011). Habitat at time of sampling consisted of rocks, standing timber, and native and non-native submersed and emergent vegetation. Water level has been high and stable since 2012; drought conditions in 2011-2012 reduced water levels to 5 feet below conservation pool (Figure 1). Other descriptive characteristics for Lake Palestine are in Table 1.

## Angler Access

Lake Palestine has five public boat ramps and ten pay boat ramps. Additional boat ramp characteristics are in Table 2. Shoreline access for most of the reservoir is limited to the public boat ramp areas and the fishing dock located at Deep End Ramp. The Chandler River Park offers excellent bank access along the Neches River above and below Highway 31.

## Management History

**Previous management strategies and actions:** Management strategies and actions from the previous survey report (Ott and Norman 2014) included:

1. Monitor the Largemouth Bass population with biennial electrofishing and the Blue and Channel Catfish populations with biennial gill netting.
 

**Action:** Largemouth Bass were monitored in 2015 with day-time electrofishing and in 2017 with traditional night-time electrofishing. Gill netting was conducted in 2016 and 2018.
2. Evaluate Florida Largemouth Bass (FLMB) allele frequencies (N = 30) during 2017 fall electrofishing.
 

**Action:** Due to consistently stable FLMB allele frequencies in the reservoir, no genetic analysis was conducted.
3. Stock Palmetto Bass at 10 fish/acre annually to maintain fishery.
 

**Action:** Palmetto Bass were stocked from 2015-2017 at a reduced rate (4.8-8.5 fish/acre).
4. Stock FLMB fingerlings in 2015 and 2016 at 50 fish/acre to replace the stocking request that wasn't met in 2013.
 

**Action:** Lake Palestine received partial stockings of FLMB in 2015-2016 and a complete stocking in 2017
5. Continue to collect data on Flathead Catfish in continuation of the 2013-2014 Flathead exploitation study.

**Action:** Flathead Catfish were monitored with low-pulse electrofishing in 2018.

6. Inform anglers about the Blue Catfish fishery and methods of targeting trophy Blue Catfish.

**Action:** Local news outlets and district Facebook page were utilized when appropriate to promote the fishery.

7. Work with reservoir controlling authority to ensure fulfillment of boat ramp improvement grant.

**Action:** Saline Bay boat ramp improvements were completed in 2017.

8. Monitor the aquatic macrophyte community in the reservoir and maintain enclosure cages designed to reestablish native vegetation within the reservoir.

**Action:** A comprehensive vegetation survey was conducted in 2017. Efforts to maintain the enclosure cages were discontinued in 2017 due to limited plant growth within the cages and the need for constant cage maintenance.

**Harvest regulation history:** An experimental 12-inch minimum-length limit was established for White Bass on September 1, 1992, but it reverted to the statewide 10-inch minimum-length limit on September 1, 2003. Beginning September 1, 2011, the 12-inch minimum-length, 25/day bag limit on Blue and Channel Catfish was revised to allow harvest of 50 per day of which no more than 5 could be 20 inches in length or longer. Current regulations are found in Table 3.

**Stocking history:** Palmetto Bass and Florida Largemouth Bass have been the most frequently stocked species at Lake Palestine. Palmetto bass fingerlings were first stocked in 1987. Stocking continues to maintain the fishery. Largemouth Bass were stocked in 1971 and FLMB were initially stocked in 1981 and have been stocked periodically since then to enhance the trophy potential of the fishery. Lake Palestine was initially stocked with Channel and Blue Catfish in 1971. Supplemental stockings of Blue Catfish were conducted in the late-1970s and mid-1980s. Walleye were stocked in the mid-1970s, but the population did not persist and additional stockings were not conducted. Approximately 19,000 ShareLunker Largemouth Bass fingerlings were stocked between 2013 and 2014. The complete stocking history is in Table 4.

**Vegetation/habitat management history:** Prior to discovering a substantial amount of giant salvinia in 2017, small patches were found in 2008 and 2009 around the boat ramps at FM 315 and the Villages Marina. The plants were removed by hand on both occasions and no further infestation was detected. Water hyacinth was also detected in 2009 and removed.

**Water transfer:** No interbasin 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 Palestine (TPWD unpublished). Primary components of the OBS plan are listed in Table 5. All survey sites were randomly selected and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

**Electrofishing** – Largemouth Bass, sunfishes, Gizzard Shad, and Threadfin Shad were collected by electrofishing (1.5 hours at 18, 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 14.8 inches).

**Gill netting** – Blue and Channel Catfish, White Bass, and Hybrid Striped Bass (Palmetto and Sunshine Bass) were collected by gill netting (15 net nights at 15 stations). CPUE for gill netting was recorded as the number of fish caught per net night (fish/nn).

**Low-frequency electrofishing** – Flathead Catfish were collected by low-frequency electrofishing using the methods described by Bodine et al 2016. CPUE for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing.

**Statistics** – Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD), terminology modified by Guy et al. 2007], and condition indices [relative weight ( $W_r$ )] were calculated for target fishes according to Anderson and Neumann (1996). Palmetto Bass PSD was calculated according to Dumont and Neely (2011). Index of Vulnerability (IOV) was calculated for Gizzard Shad (DiCenzo et al. 1996). Standard error (SE) was calculated for structural indices and IOV. Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE and creel statistics.

**Creel survey** – A specialized access-point creel survey was conducted from February 2018 through April 2018 at the upper Neches River Highway 31 access (Chandler River Park) to evaluate the White Bass fishery during their spawning migration. While traditional creel survey questions were asked and all species were included in the creel analysis, data on White Bass was the primary objective of the survey. Creel statistics requiring spatial distribution (area) were omitted from the creel analysis; calculating specific area within the creel location was not possible. Angler interviews were conducted on 8 weekend days and 6 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** – A vegetation survey was conducted in 2017. Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

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

## Results and Discussion

**Habitat:** Aquatic vegetation within Lake Palestine continues to be limited (<1% of total reservoir surface area) to isolated areas of the reservoir; likely attributable to substrate composition and wind/wave action. American lotus was the most abundant (95 acre) species in the most recent survey, but was only found in the upper portion of the reservoir in protected backwaters (Table 6). Emergent species including maidencane and panicum sp. were present along much of the southern shoreline, however the majority of the plants were out of the water at the time of the survey. Giant salvinia was discovered in October 2017 in the very back of Saline Bay and rapid response efforts were initiated to eradicate it. A containment boom was deployed by TPWD at the FM 344 bridge to prevent expansion of the plant into Saline Bay. Following the boom installation, the TPWD Aquatic Habitat Enhancement (AHE) team began herbicide treatments (combination of Clipper, Galleon SC and Tribune) within the infested area. Approximately 11 acres were identified and treated during the first herbicide application. A second containment boom was

deployed further east of the FM 344 bridge closer to the primary infestation following the initial treatment. The affected area of Saline Bay was treated seven times in 2017 before cold air temperatures halted giant salvinia growth. Following an extremely cold winter, very little living giant salvinia has been identified in the back of Saline Bay. The last herbicide application by the AHE team was in April of 2018 when less than 0.5 acre required treatment. A second small infestation of giant salvinia was discovered in November 2017 above the FM 315 bridge on Kickapoo Creek; the prolonged cold winter seemingly killed off the small affected area as no giant salvinia has been found in 2018.

**Creel:** Traditionally, a roving creel survey was conducted on Lake Palestine every four years to monitor the major fisheries within the reservoir. The spring White Bass spawning migration in the Neches River has always been very popular with anglers, however the traditional creel survey did not include this fishery. The access creel conducted at the Chandler River Park was designed specifically to obtain estimates of angler pressure and harvest of White Bass during the spring spawning run. As expected, directed fishing effort by anglers was highest for White Bass (40.0%), followed by opportunistic anglers not targeting a specific species (30.0%) (Table 7). The total fishing effort for the Chandler River Park access area was estimated to be 21,718 hours during the 3-month creel period; total direct expenditures were \$89,854 (Table 8).

**Prey species:** Electrofishing catch rates of Bluegill and Gizzard Shad were 261.3/h and 165.3/h, respectively. Index of Vulnerability (IOV) for Gizzard Shad was moderate and similar to previous night-time surveys, indicating that 73% of Gizzard Shad were available to existing predators (Figure 2). Total CPUE of Gizzard Shad was similar to the previous night-time survey (2013). Total CPUE of Bluegill was also similar to the 2013 night-time survey; size structure continued to be dominated by small individuals (Figure 3).

**Catfish:** The 2018 gill net catch rate of Blue Catfish (17.4/nn) was higher than the previous two surveys conducted in 2016 and 2014 (8.9/nn and 10.4/nn, respectively) (Figure 4). Size structure has been consistent over the last three surveys, composed primarily of fish from 10 to 20 inches and a few larger fish (PSD range: 17-34). Body condition was moderate (average  $W_r$  of 85) for smaller fish and appeared to improve (average  $W_r$  of 95) for fish  $\geq 17$  inches. This fishery provides good opportunities for angler harvest. The gill net catch rate of Channel Catfish was 9.5/nn in 2018, down from 12.8/nn and 15.3/nn in 2016 and 2014, respectively (Figure 5). Size structure continues to be dominated by smaller individuals (PSD = 0). Body condition was moderate (average  $W_r$  of 85). Low-frequency electrofishing conducted in 2018 as a follow up to an exploitation study in 2013-2014 indicated that Flathead Catfish size structure has remained stable following the legalization of hand-fishing in 2011 (Appendix C).

Directed fishing effort, catch per hour, and total harvest for Channel Catfish was 2,230 h, 3.0 fish/h, and 5,530 fish, respectively, from February–April, 2018 (Table 9). Anglers released approximately 10% of legal length fish; harvested fish ranged in length from 6–15 inches (Figure 6). Blue Catfish were not specifically targeted during the 2018 creel and harvest was negligible. Catfish accounted for 34% of total directed fishing effort in the last complete-reservoir creel survey (2013-2014; Ott and Norman 2014).

**Temperate Bass:** Catch rates for White Bass have historically been variable in Lake Palestine, however the 2018 creel survey results suggest White Bass were abundant in the reservoir. The gill net catch rate of White Bass was 0.3/nn in 2018; no White Bass were collected in the 2016 survey (Figure 7). The poor gill net catch rates can likely be attributed to survey timing; a majority of the White Bass had migrated into the upper tributaries to spawn during the gill net survey. The majority of the randomly generated gill net sites fell primarily within the lower, main lake region, away from the inflowing tributaries (Appendix B). Following the gill net survey, a substantial White Bass fish kill was observed in May 2018. The exact cause and extent of the kill was not determined. The 2018 gill net survey also indicated Hybrid Striped Bass were still present within the reservoir (Figure 8). Catch rates for Hybrid Striped Bass have followed the same variable trend as White Bass, again likely the result of survey timing and location of fish within the reservoir.

Directed fishing effort, catch per hour, and total harvest for White Bass was 8,696/h, 1.4 fish/h, and 5,450 fish, respectively, from February–April, 2018 (Table 10). Anglers released and estimated 53% of legal length fish; several anglers interviewed during the creel reported difficulty in identifying their fish as either White Bass or sub-legal Hybrid Striped Bass and subsequently released them to avoid potentially harvesting sub-legal fish. This likely increased the overall estimate of percent legal-released Temperate Bass. Hybrid Striped Bass were not specifically targeted during the 2018 creel however 7 fish from 19–21 inches were harvested. Temperate Bass accounted for 2.5% of total directed fishing effort in the last complete-reservoir creel survey (2013-2014)

**Largemouth Bass:** The 2017 electrofishing catch rate (73.3/h) was higher than the previous two night-time surveys (2011 and 2013; Figure 9). Size structure from the 2011 and 2017 surveys were similar (PSD = 59 and 48, respectively); the 2013 survey contained primarily sub-legal fish (PSD-14 = 11). The abundance of smaller fish in 2013 can likely be attributed to strong year classes and subsequent high recruitment as littoral habitat improved following recovery from the drought during 2010 to 2012 (Figure 1). Body condition of Largemouth Bass was good ( $W_r$  range = 85-115) and increased with increasing fish size. Growth was fast; average age at 14 inches (13.0 to 14.8 inches) was 1.7 years ( $N = 13$ ; range = 1–3 years).

Largemouth Bass angling accounted for 5% of total directed fishing effort along the Upper Neches River at Chandler Park during the 2018 creel and 25% of total directed fishing effort in the last complete-reservoir creel survey.

**Crappie:** Black and White Crappie are present in the reservoir and have provided a popular fishery. Directed fishing effort, catch per hour, and total harvest for Crappie was 3,036 h, 0.9 fish/h, and 2,029 fish, respectively, from February–April, 2018 (Table 11). Harvested fish ranged in length from 10–14 inches (Figure 10). Crappie accounted for 11% of total directed fishing effort in the last complete-reservoir creel survey.

# Fisheries Management Plan for Lake Palestine, Texas

Prepared – July 2018

**ISSUE 1:** Palmetto Bass have been a consistent part of the fishery at Lake Palestine since the early 1990's. Stocking requests have frequently not been met resulting in a boom-or-bust, cycling fishery. Annual stocking of Palmetto Bass is required to sustain the population and maintain the fishery.

## MANAGEMENT STRATEGY

1. Stock Palmetto Bass annually at 10 fish/acre.
2. Consider substituting and/or supplementing Sunshine Bass fingerlings for Palmetto bass, dependent on availability, to reach a combined annual stocking rate of 10 fish/acre.

**ISSUE 2:** The Largemouth Bass fishery at Lake Palestine continues to be popular (as apparent through creel data and anecdotal tournament results). Data available from a few large tournament formats (big bass events, Media Bass, Texas Team Trail) over the last two years (2016-2017) recorded 28 largemouth bass > 8lbs, up from 15 over the previous two years. Stable water levels have allowed substantial littoral habitat to persist, providing excellent habitat for young of the year and juvenile fish each year.

## MANAGEMENT STRATEGIES

1. Stock Florida Largemouth Bass annually at 1,000/km of shoreline while littoral habitat is present within the reservoir.

**ISSUE 3:** Lake Palestine experienced a substantial White Bass fish kill in May 2018 and quickly became a highly publicized public concern. The cause and the extent of the fish kill were unable to be determined.

## MANAGEMENT STRATEGIES

1. Work with controlling authority, local game wardens, marina operators and home owners to identify future fish kills and coordinate with spills and kills biologists to determine the strategy to address the fish kill in a timely manner.
2. Work with local news outlets and inform social media if future fish kills occur.

**ISSUE 4:** Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels can multiply rapidly and attach themselves to any available hard structure, restricting water flow in pipes, fouling swimming beaches, and plugging engine cooling systems. Giant salvinia and other invasive vegetation species can form dense mats, interfering with recreational activities like fishing, boating, skiing, and swimming. The financial costs of controlling and/or eradicating these types of invasive species are significant. Additionally, the potential for invasive species to spread to other river drainages and reservoirs via watercraft and other means is a serious threat to all public waters of the state.

## MANAGEMENT STRATEGIES

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

## Objective-Based Sampling Plan and Schedule (2018–2022)

Sport fishes in Lake Palestine include Largemouth Bass, Blue, Channel and Flathead Catfish, White Bass, Hybrid Striped Bass, and both Black and White Crappie. Important forage species include Gizzard and Threadfin Shads, and sunfishes.

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

**Crappie:** Historical trap net data has fluctuated among survey years; catch rates were very dependent upon sample location resulting in overall poor survey precision. The results of the last two trap net surveys suggest at least 48 net nights may be necessary to estimate relative abundance with an acceptable level of precision ( $RSE < 25$ ). Due to the unpredictability of trap net survey success and the large sample size required to reliably estimate crappie trend data (CPUE, PSD, Wr), trap net surveys will no longer be conducted on Lake Palestine. Inferences about the crappie population and identification of potential applied management actions will be made from data collected with creel surveys in 2020.

**Catfish:** Historical survey results indicate gill net surveys are effective at monitoring Blue and Channel Catfish trend data (CPUE, PSD, Wr) on Lake Palestine. Gill net surveys will be conducted every four years to continue monitoring both species for large-scale changes in the population that may spur further investigation. In the spring of 2022 a minimum of 10 randomly selected gill net sites will be sampled, with up to 5 additional sites if necessary, to estimate relative abundance with an  $RSE < 25$  along with relative weights and size structure of at least 50 stock-size fish, for both catfish species. No additional effort will be conducted if survey objectives are not met after 15 total net nights. However, lower precision ( $RSE < 35$ ) of CPUE estimates will be acceptable, if necessary, to make historical comparisons and determine further sampling needs (e.g. age and growth analysis).

**Largemouth Bass:** While Lake Palestine contains very diverse littoral habitat within some areas of the reservoir, including submersed and emergent vegetation, timber, riprap, boat docks and natural shoreline, there are several areas that contain large shallow flats that typically offer very little habitat when the reservoir is at or below full pool. Similar to crappie, sampling location greatly influences the overall catch rate during electrofishing surveys. Historical data suggests it could take at least 32, 5-minute electrofishing stations to estimate relative abundance, size structure and body condition with acceptable precision. Beginning in the fall of 2019, Largemouth Bass trend data on relative abundance, size structure, growth (see below), and body condition (CPUE, PSD, Wr) will be monitored with biennial electrofishing to determine large-scale changes in the population. A minimum of 12 randomly-selected 5-minute electrofishing sites will be sampled, with up to 24 additional sites if needed, to estimate relative abundance ( $RSE \leq 25$ ) and size structure of at least 50 stock-sized fish. We believe the large sample size (up to 36 stations) will account for the poor catch rates likely encountered during some of the

randomly selected sites with poor habitat and provide a reliable estimate of Largemouth Bass population indices within the reservoir. Thirteen fish between 330-381 mm will be selected from the survey every four years and aged to determine the average age at legal length (14 inches).

**Temperate Bass:** Temperate Bass represented 2.5% (Hybrid Striped Bass and White Bass combined) of the directed angler effort during the most recent reservoir-wide creel survey at Lake Palestine in 2013-2014, slightly down from the previous two creel surveys (2.7% and 7.7%). The last three gill net catch rates have been low for both White Bass and Hybrid Striped Bass, varying from 0.0–6.3 fish/nn and 0.2–2.1 fish/nn, respectively. Catch rates are likely a result of survey timing for both species and reduced or complete lack of stocking for hybrids. The recent survey results suggest a large amount of effort (>72 gill-net nights) would be required to estimate relative abundance and size structure with acceptable precision. While trend data will be extremely difficult to estimate, it will still be necessary to document the survival of stocked hybrids within the Reservoir and their overall body condition ( $W_r$ ). White Bass and Hybrid Striped Bass population data (length and weight to calculate  $W_r$ 's) will be collected every four years during catfish gill net surveys. Survival of stocked hybrids will be documented simply as presence/absence of stock-size fish. Results of gill net surveys will be used to determine if any further investigations into the White Bass or Hybrid Striped Bass populations are necessary.

**Prey Species:** Gizzard Shad, Threadfin Shad and sunfish are important prey species in Lake Palestine. Long-term monitoring trend data is desired for these populations to evaluate their relative abundance (CPUE) and size structure (PSD). Relative weights of the Largemouth Bass population, along with size structure of Bluegill and the IOV of Gizzard Shad, will be used to gauge prey fish availability for sport fishes from electrofishing sampling conducted in fall 2021. No sampling objectives will be set for prey species.

**Angler Data:** Historically, the Lake Palestine fishery has been monitored through angler creel surveys in order to monitor angling trends (species targeted, effort, catch and directed expenditures). Angler trend data will continue to be monitored with year-long (4 quarter) creel from June, 2021 through May, 2022. Each quarter of the creel will consist of 5 randomly selected weekend creel days and 4 randomly selected weekday creel days.

**Habitat:** Aquatic invasive plants are a serious issue at Lake Palestine. Giant salvinia, specifically, potentially poses a threat to angler and boater access as well as outcompete desirable native vegetative species. Annual aquatic vegetation monitoring is required to identify potential threats to boating and angling access so control and rapid response efforts can be implemented to reduce or eliminate threats associated with invasive aquatic plants. Due to the recent discovery of giant salvinia an annual Aquatic Nuisance Survey (ANS) will be conducted within the affected areas of the reservoir. The results of each survey will be used to determine further giant salvinia management efforts (e.g. expanded survey, herbicide treatments, containment booms,). A complete-reservoir comprehensive vegetation survey will be conducted every four years, beginning in 2021, to monitor the littoral habitat within the reservoir

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## Tables and Figures

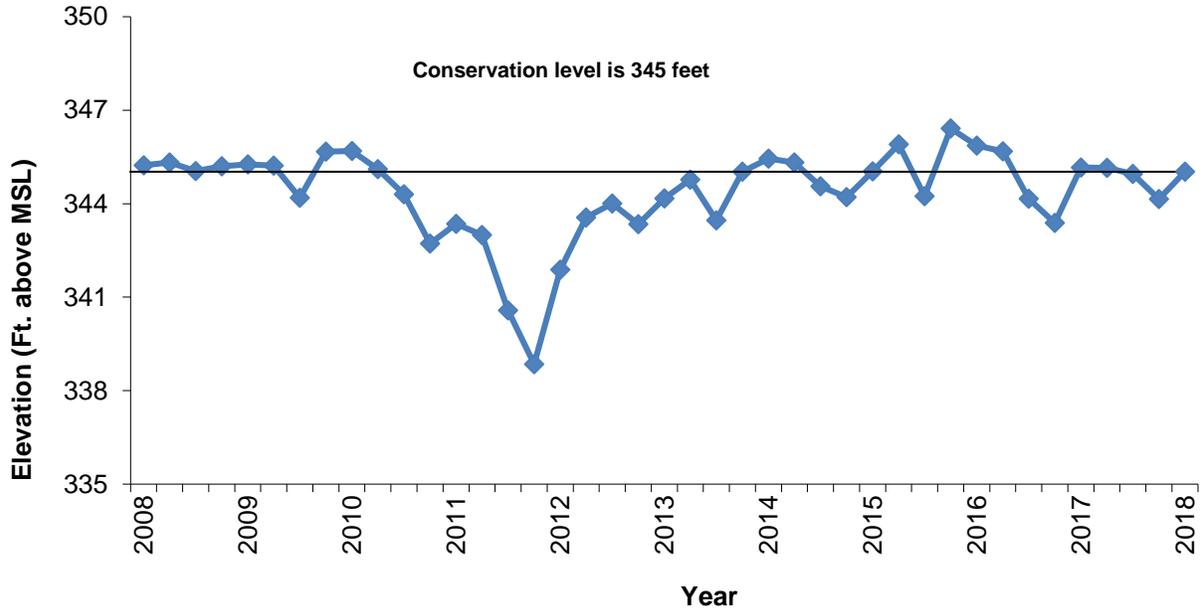


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Lake Palestine, Texas.

Table 1. Characteristics of Lake Palestine, Texas.

Characteristic	Description
Year constructed	1962, enlarged to present size in 1971
Controlling authority	Upper Neches River Municipal Water Authority
Counties	Cherokee, Anderson, Henderson and Smith
Reservoir type	Mainstream
Shoreline Development Index	6.1
Conductivity	150 $\mu$ S/cm

Table 2. Boat ramp characteristics for Lake Palestine, Texas, July, 2017. Reservoir elevation at time of survey was 345 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft.)	Condition
Chandler River Park	35.31508 -95.45243	Y	100		Accessible, shallow slope
Westberry Landing	32.27371 -95.45450	Y	15	342	Accessible, shallow slope
Villages Marina	32.21769 -95.46845	Y	200	337	Accessible
Kickapoo Public Ramp	32.26883 -95.50222	Y	50	339	Accessible, shallow slope
Flat Creek Public Ramp	32.19642 -95.51115	Y	40	338	Accessible
Flat Creek Marina	32.19383 -95.50816	Y	75		Accessible
Lake Palestine Marina	32.16607 -95.42659	Y	50		Accessible
Saline Bay Public Ramp	32.17317 -95.44653	Y	50	339	Accessible at full pool, limited access during low water
Lakeside Getaway	32.17026 -95.45250	Y	20		Accessible
Camper's Cove	32.15462 -95.44998	Y	30		Accessible
Palestine Pines	32.15711 -95.46541	Y	40		Accessible
Lake Palestine Motor Inn	32.13105 -95.48400	Y	30		Temporarily out of service
Lake Palestine Resort	32.12325 -95.48809	Y	40	337	Accessible
Big Steve's RV Resort & Marina	32.68353 -95.47359	Y	10		Accessible, shallow slope
Deep End Public Ramp	32.05373 -95.44238	Y	75	338	Accessible

Table 3. Harvest regulations for Lake Palestine, Texas.

Species	Bag limit	Length limit
Catfish: Channel and Blue Catfish, their hybrids and subspecies	50 <sup>b</sup> (in any combination)	No minimum length
Catfish, Flathead	5	18-inch minimum
Bass, White	25	10-inch minimum
Bass, Palmetto	5	18-inch minimum
Bass, Largemouth	5 (only 1 > 24 inches)	16- to 24-inch slot
Bass: Spotted and Guadalupe	5 <sup>a</sup>	None
Crappie: White and Black crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum

<sup>a</sup> Daily bag for Largemouth Bass, Spotted Bass, and Guadalupe Bass = 5 fish in any combination.

<sup>b</sup> No more than 5 Blue or Channel Catfish fish  $\geq$  20 inches

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

Species	Year	Number	Size
Threadfin Shad	1984	<u>2,500</u>	ADL
		2,500	
Blue Catfish	1971	35,960	FGL
	1978	5,400	FGL
	1979	7,830	FGL
	1986	<u>250,140</u>	FGL
		299,330	
Channel Catfish	1971	154,746	FGL
	1972	45,000	FGL
	1973	<u>126,940</u>	FGL
		326,686	
Palmetto Bass	1978	139,615	FGL
	1979	227,800	FGL
	1982	295,035	FGL
	1991	257,270	FGL
	1992	390,867	FGL
	1993	1,093,700	FGL & FRY
	1994	385,747	FGL
	1995	385,400	FGL
	1996	281,670	FGL
	1997	255,021	FGL
	1998	255,217	FGL
	2002	191,250	FGL
	2003	58,530	FGL
	2004	122,131	FGL
	2005	101,117	FGL
	2007	1,195,830	FRY
	2007	100,000	FGL
	2008	143,907	FGL
	2009	100,937	FGL
	2011	101,611	FGL
2013	653,517	FGL & FRY	
2014	127,967	FGL	
2015	199,014	FGL	
2016	124,256	FGL	
2017	<u>111,998</u>	FGL	
		7,042,075	
Largemouth Bass	1971	<u>1,600,000</u>	FGL
		1,600,000	

Table 4. Stocking history (continued).

Florida Largemouth Bass	1981	21,410	FGL
	1982	19,000	FGL
	1983	25,500	FGL
	1984	292,310	FGL
	1997	255,500	FGL
	1998	256,518	FGL
	1999	255,000	FGL
	2000	255,472	FGL
	2004	441,191	FGL
	2005	589,360	FGL
	2008	499,961	FGL
	2009	651,015	FGL
	2012	642,967	FGL
	2013	1,923	FGL
	2014	72,676	FGL
	2015	223,897	FGL
	2016	172,901	FGL
2017	<u>351,589</u>	FGL	
	5,043,400		
ShareLunker Largemouth	2013	4,558	FGL
	2014	<u>14,332</u>	FGL
		18,890	
Sunshine Bass	2014	<u>108,399</u>	FGL
		108,399	
Walleye	1974	2,580,000	FRY
	1975	2,250,000	FRY
	1976	<u>1,000,000</u>	FRY
	5,830,000		

Table 5. Objective-based sampling plan components for Lake Palestine, Texas 2017–2018.

Gear/target species	Survey objective	Metrics	Sampling objective
<i>Electrofishing</i>			
Largemouth Bass	Relative Abundance	CPUE–Stock	RSE-Stock $\leq 25$
	Size structure	PSD, length frequency	$N \geq 50$ stock
	Age-and-growth	Age at 14 inches	$N = 13, 13.0 - 14.9$ inches
	Condition	$W_r$	10 fish/inch group (max)
Bluegill <sup>a</sup>	Relative Abundance	CPUE–Total	RSE $\leq 25$
	Size structure	PSD, length frequency	$N \geq 50$
Gizzard Shad <sup>a</sup>	Relative Abundance	CPUE–Total	RSE $\leq 25$
	Prey availability	IOV	$N \geq 50$
<i>Gill netting</i>			
Blue Catfish	Abundance	CPUE–stock	RSE-Stock $\leq 25$
	Size structure	PSD, length frequency	$N \geq 50$ stock
Channel Catfish	Abundance	CPUE–stock	RSE-Stock $\leq 25$
	Size structure	PSD, length frequency	$N \geq 50$ stock
Temperate Bass	Presence-absence		

<sup>a</sup> No additional effort will be expended to achieve an RSE  $\leq 25$  for CPUE of Bluegill and Gizzard Shad if not reached from designated Largemouth Bass sampling effort. Instead, Largemouth Bass body condition can provide information on forage abundance, vulnerability, or both relative to predator density.

Table 6. Survey of aquatic vegetation, Lake Palestine, Texas, 2013–2017. Surface area (acres) is listed with percent of total reservoir surface area in parentheses; tr = trace.

Vegetation	2013	2017
Native submersed		
Muskgrass	4 (<0.1)	
Pondweed	7 (<0.1)	
Wild celery	tr	
Water stargrass	tr	
Native floating-leaved		
Spatterdock	15 (<0.1)	45 (<0.1)
Native emergent		
American lotus	203 (0.9)	95 (<0.1)
Cattail	4 (<0.1)	
Giant cutgrass	13 (<0.1)	35 (<0.1)
Maidencane	2 (<0.1)	5 (<0.1)
Square stem spike rush		tr
Panicum sp.	1 (<0.1)	2 (<0.1)
Water primrose	10 (<0.1)	
Water willow	6 (<0.1)	7 (<1)
Non-native		
Alligatorweed (Tier III)		2 (<0.1)
Hydrilla (Tier III)	tr	

\*Tier I is immediate Response, Tier III is Watch Status

Table 7. Percent directed angler effort by species for upper Neches River Highway 31 access (Chandler River Park), Lake Palestine, Texas, 2018. Survey period was from 1 February through 30 April.

Species	
Channel Catfish	10
White Bass	40
Sunfishes	1
Largemouth Bass	5
Crappie	14
Anything	30

Table 8. Total fishing effort (h) for all species and total directed expenditures at upper Neches River Highway 31 access (Chandler River Park) Lake Palestine, Texas, 2018. Survey period was from 1 February through 30 April.

Creel statistic	
Total fishing effort	21,718 (26)
Total directed expenditures	\$89,854 (47)

## Gizzard Shad

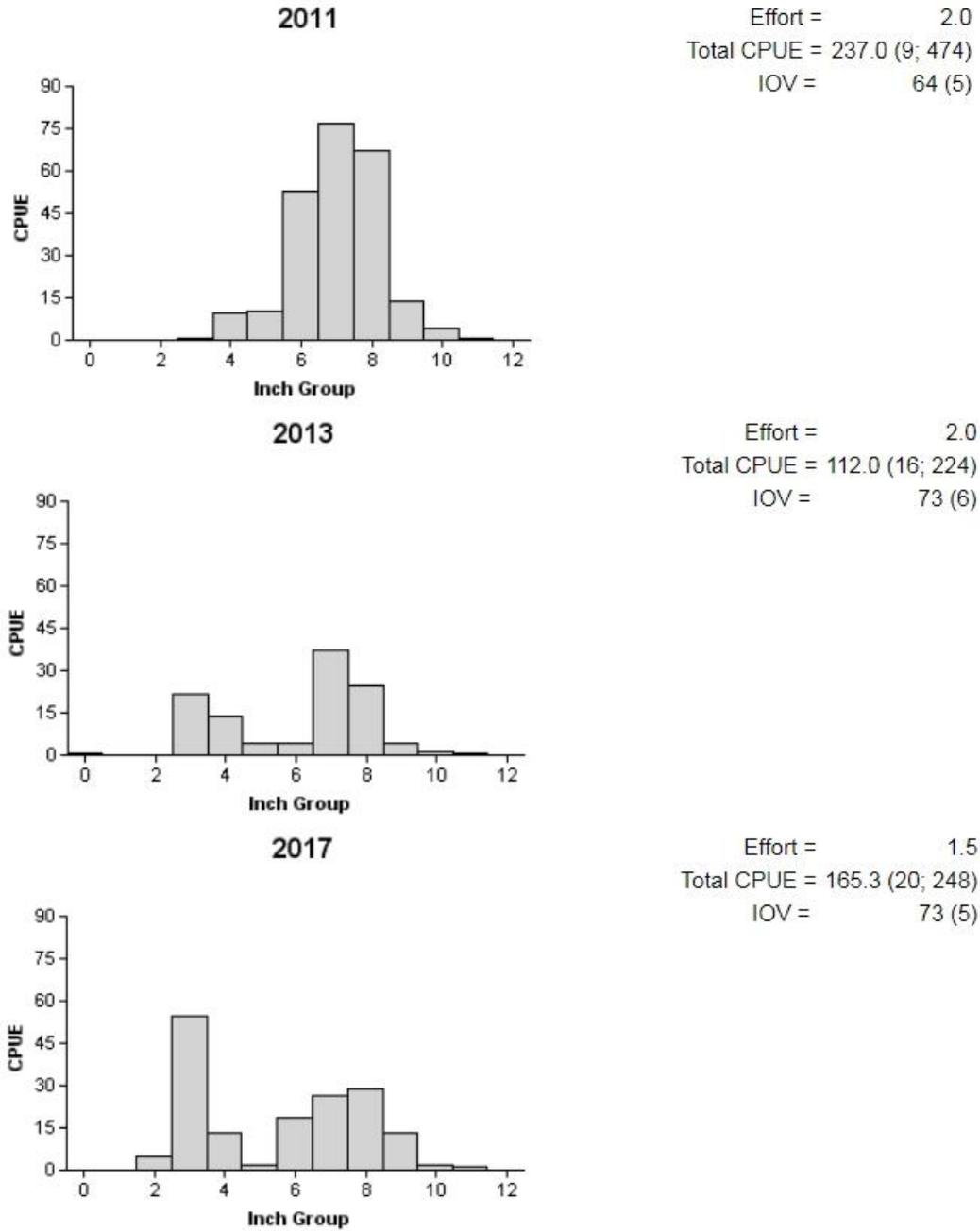


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Lake Palestine, Texas, 2011, 2013 and 2017.

## Bluegill

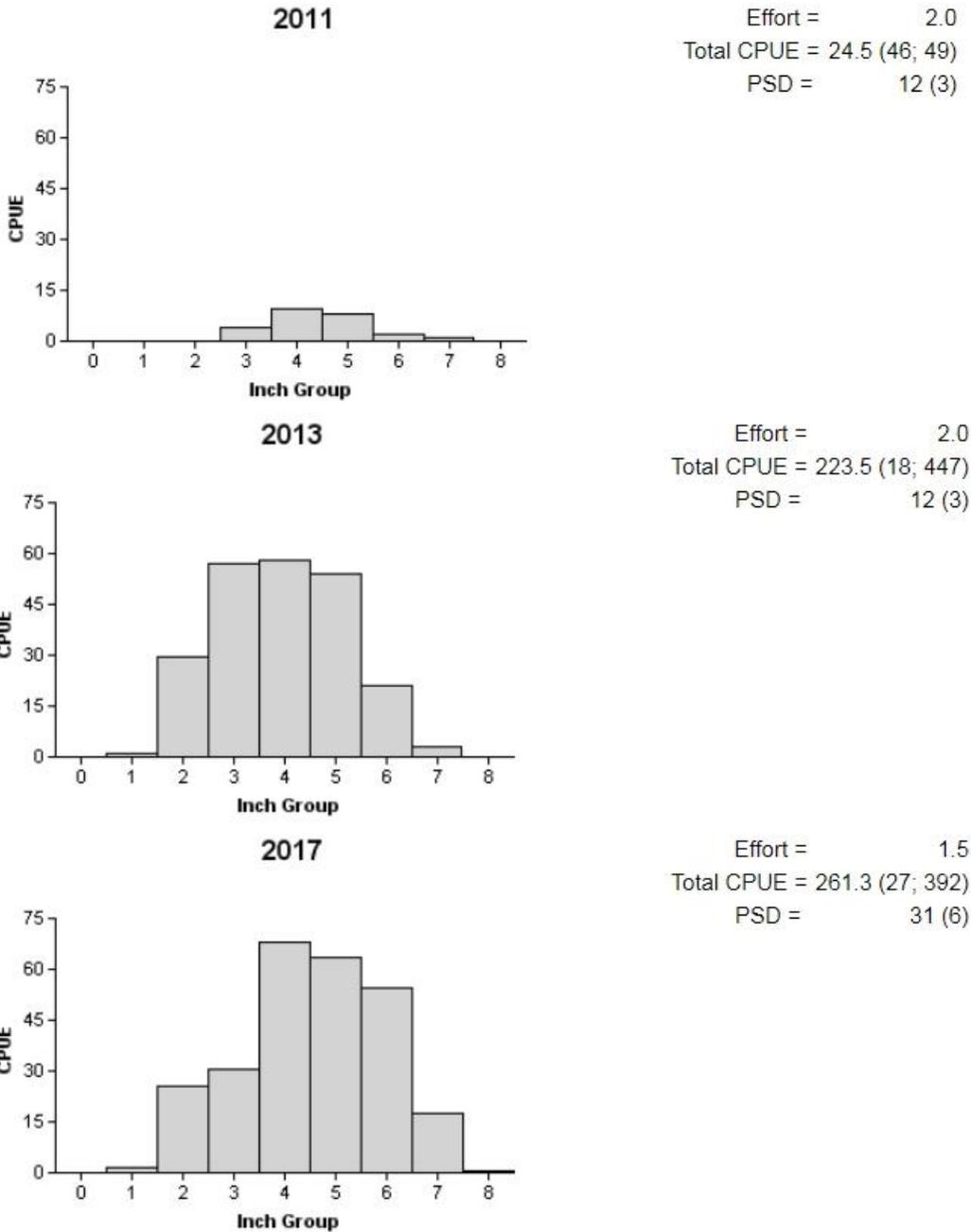


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Palestine, Texas, 2011, 2013 and 2017.

## Blue Catfish

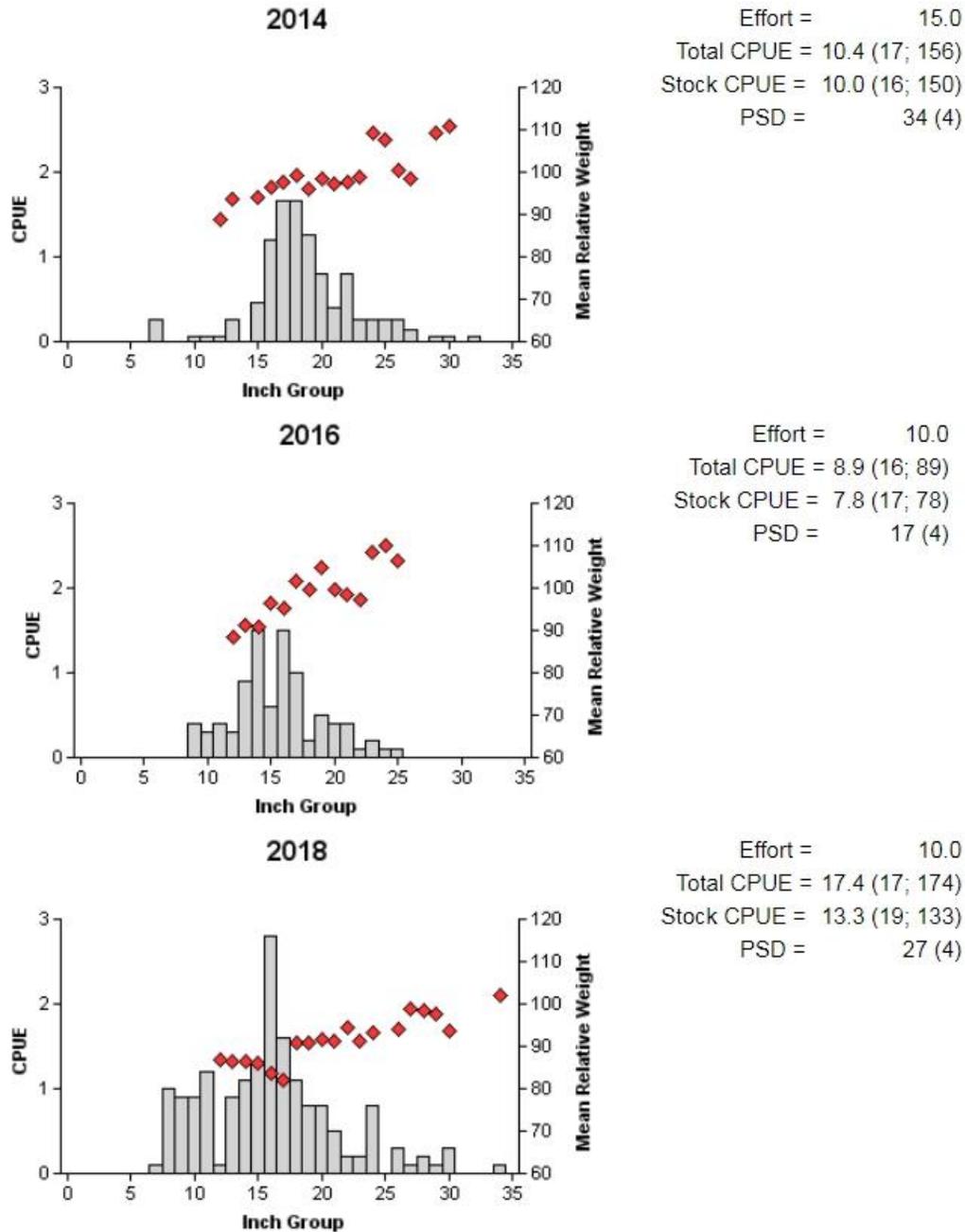


Figure 4. Number of Blue Catfish caught per net night (CPUE), mean relative weight (diamonds) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Palestine, Texas, 2014, 2016 and 2018.

## Channel Catfish

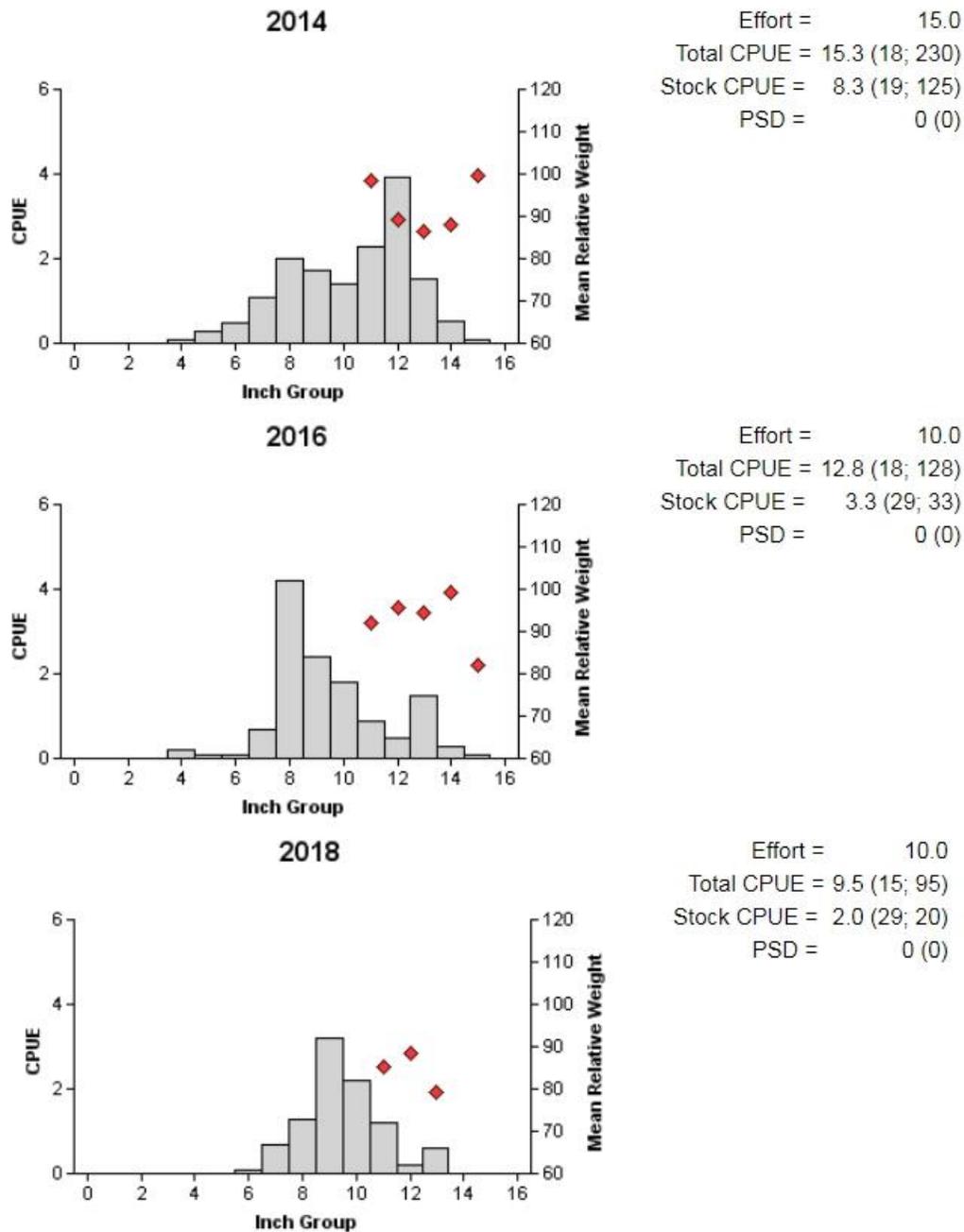


Figure 5. Number of Channel Catfish caught per net night (CPUE), mean relative weight (diamonds) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Palestine, Texas, 2014, 2016 and 2018.

Table 9. Creel survey statistics for Channel Catfish at upper Neches River Highway 31 access (Chandler River Park) Lake Palestine, Texas, 2018. Survey period was from 1 February through 30 April. 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 Statistic	
Directed effort (h)	2,229.8 (55)
Total catch per hour	3.0 (66)
Total harvest	5,530 (70)
Percent legal released	10.0

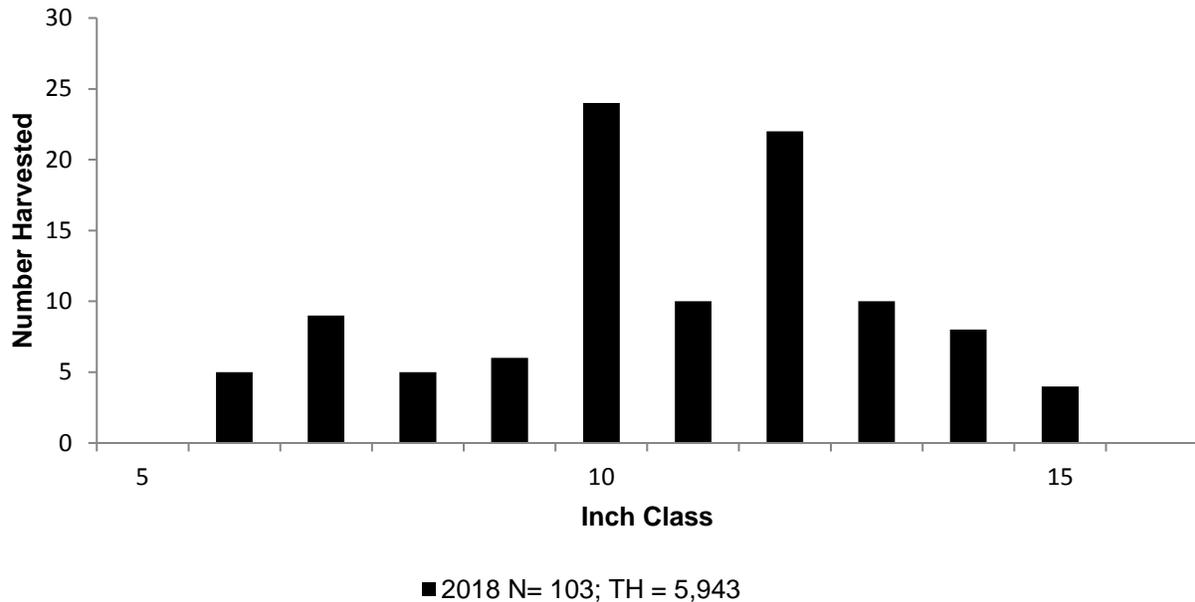
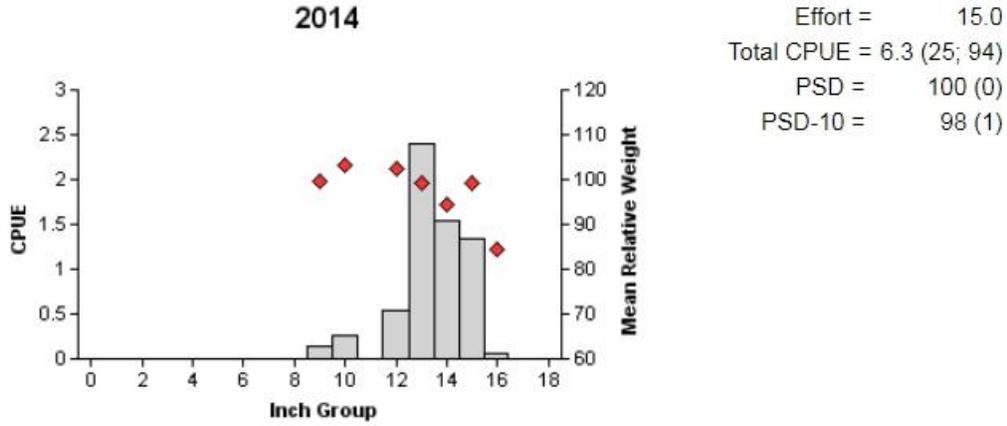


Figure 6. Length frequency of harvested Channel Catfish observed during creel survey at upper Neches River Highway 31 access (Chandler River Park) Lake Palestine, Texas, 2018. Survey period was from 1 February through 30 April. N is the number of harvested Channel Catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

### White Bass



(No White Bass collected in 2016 Survey)

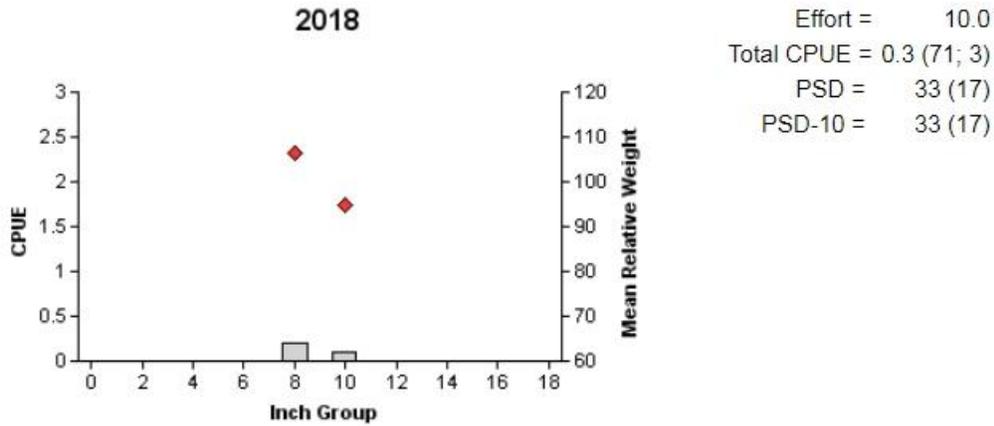


Figure 7. Number of White Bass caught per net night (CPUE), mean relative weight (diamonds) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Palestine, Texas, 2014 and 2018.

Table 10. Creel survey statistics for White Bass at upper Neches River Highway 31 access (Chandler River Park) Lake Palestine, Texas, 2018. Survey period was from 1 February through 30 April. Total catch per hour is for anglers targeting White Bass and total harvest is the estimated number of White Bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Statistic	
Directed effort (h)	8,696 (30)
Total catch per hour	1.4 (74)
Total harvest	5,450 (46)
Percent legal released	53.2

### Hybrid Striped Bass

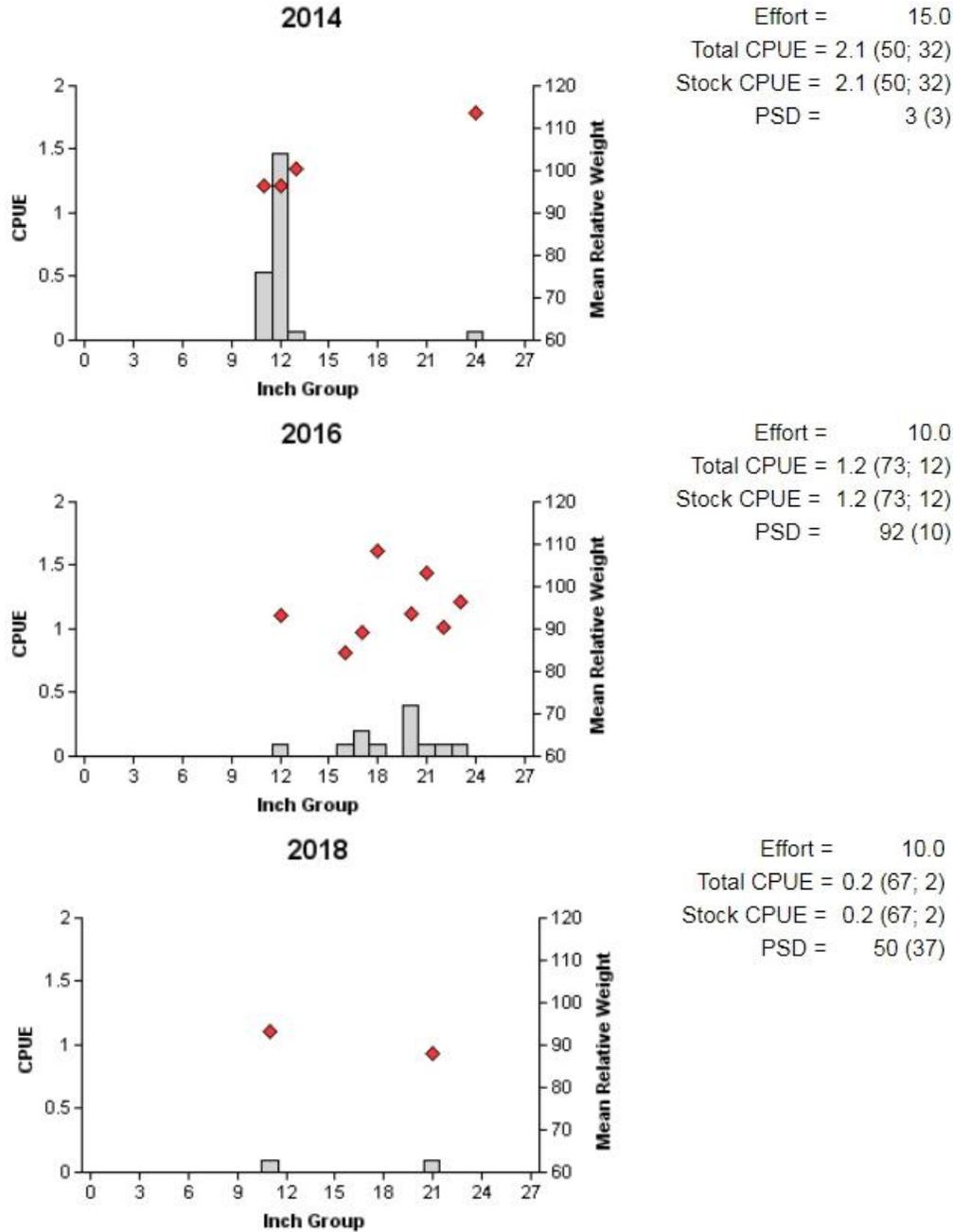


Figure 8. Number of Hybrid Striped Bass caught per net night (CPUE), mean relative weight (diamonds) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Palestine, Texas, 2014, 2016 and 2018.

## Largemouth Bass

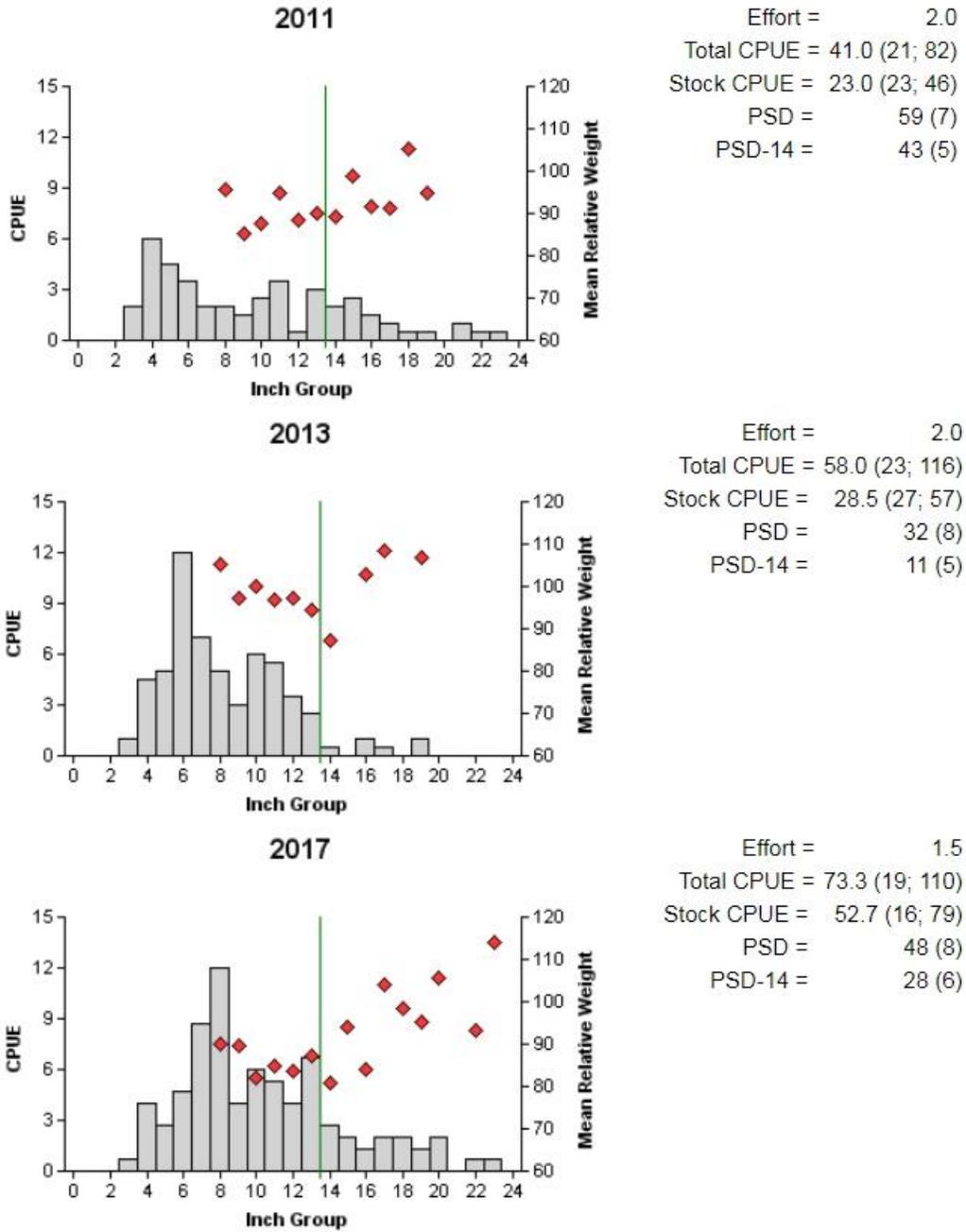


Figure 9. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Palestine, Texas, 2011, 2013 and 2017. Vertical line represents minimum length limit.

## Crappie

Table 11. Creel survey statistics for Crappie (species combined) at upper Neches River Highway 31 access (Chandler River Park) Lake Palestine, Texas, 2018. Survey period was from 1 February through 30 April. Total catch per hour is for anglers targeting Crappie and total harvest is the estimated number of Crappie harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Statistic	
Directed effort (h)	3,036 (46)
Total catch per hour	0.9 (135)
Total harvest	2,029 (115)
Percent legal released	7.2

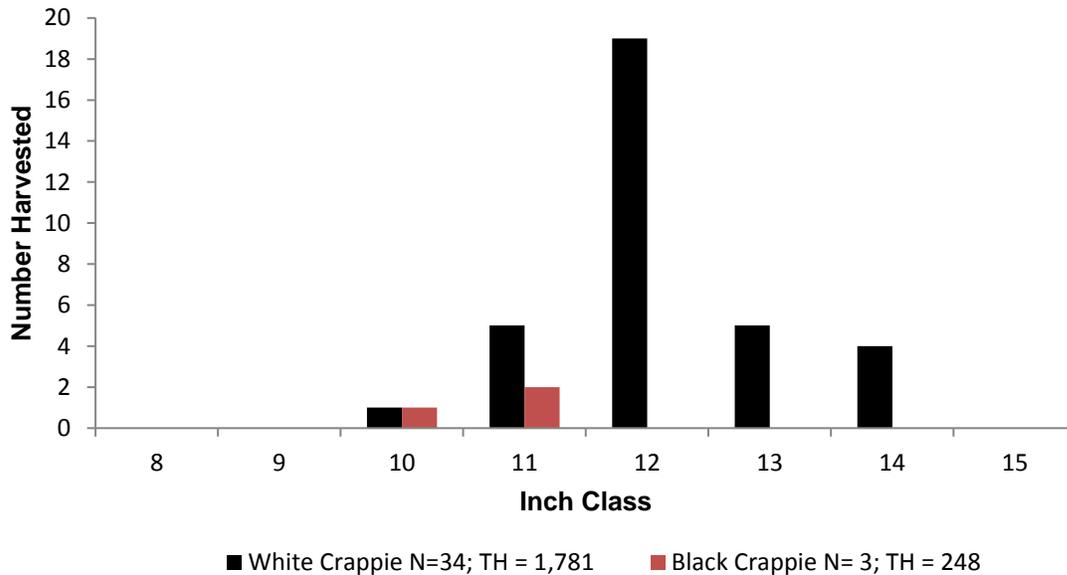


Figure 10. Length frequency of harvested White and Black Crappie observed during creel survey at upper Neches River Highway 31 access (Chandler River Park) Lake Palestine, Texas, 2018. Survey period was from 1 February through 30 April. N is the number of harvested Crappie observed during creel survey, and TH is the total estimated harvest for the creel period.

## Proposed Sampling Schedule

Table 12. Proposed sampling schedule for Lake Palestine, Texas. Survey period is June through May. Gill netting surveys are conducted in the spring, while electrofishing and trap netting surveys are conducted in the fall. ANS = Aquatic Nuisance Species. Standard survey denoted by S and additional survey denoted by A.

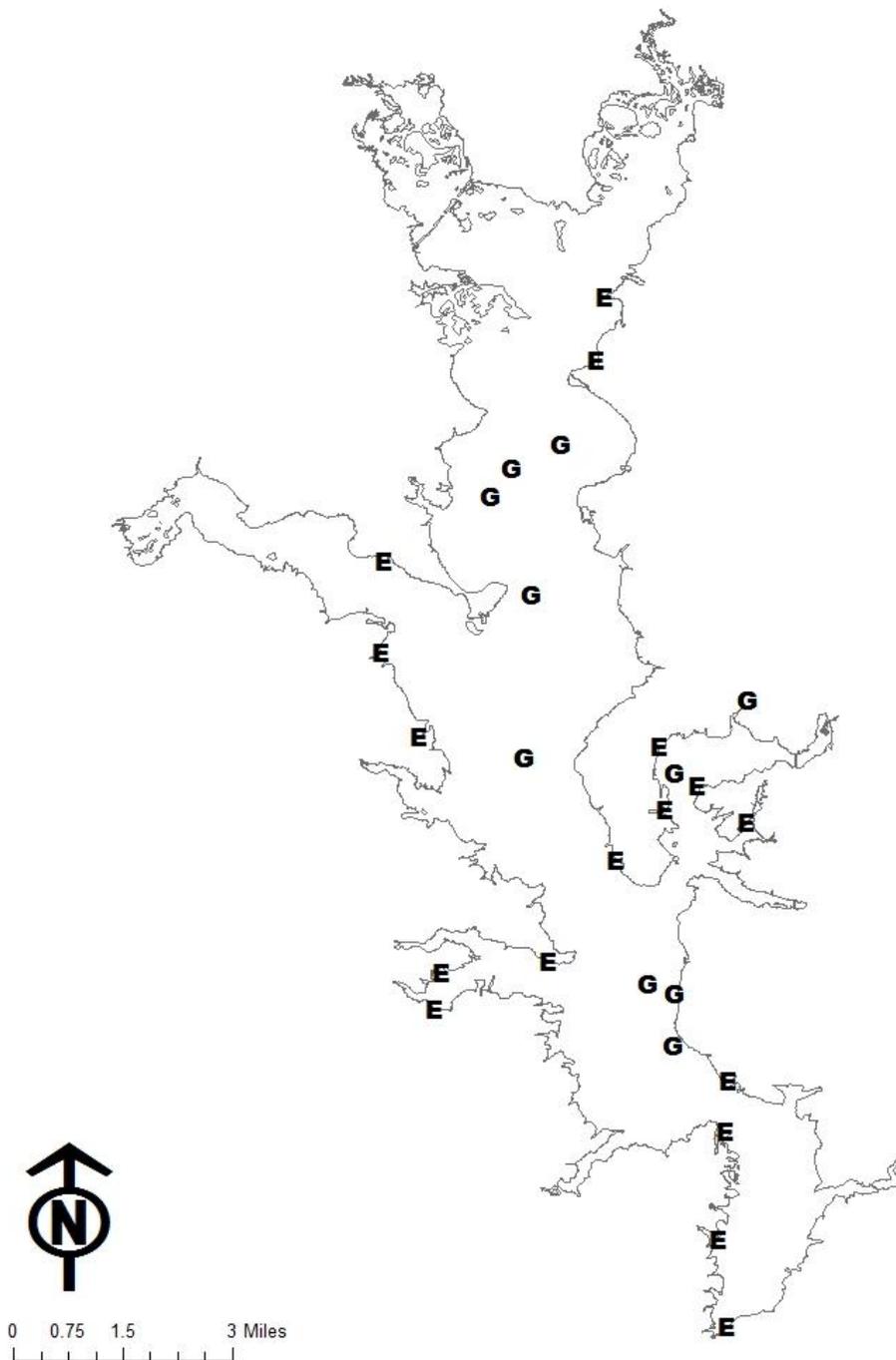
	Survey year			
	2018-2019	2019-2020	2020-2021	2021-2022
Angler Access				S
Vegetation - ANS	A	A	A	
Vegetation - Comprehensive				S
Electrofishing – Fall				S
Electrofishing – (Bass Only)		A		
Gill netting				S
Creel survey			S	
Report				S

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

Number (N) and catch rate (CPUE) (RSE in parentheses) of all target species collected from all gear types from Lake Palestine, Texas, 2017-2018. Sampling effort was 10 net nights for gill netting and 1.5 hours for electrofishing.

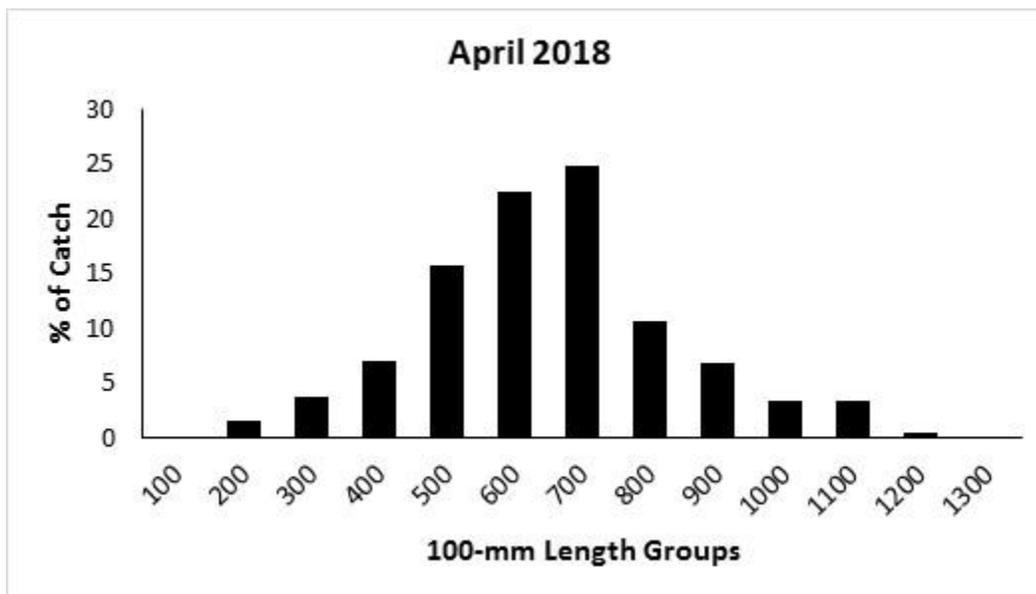
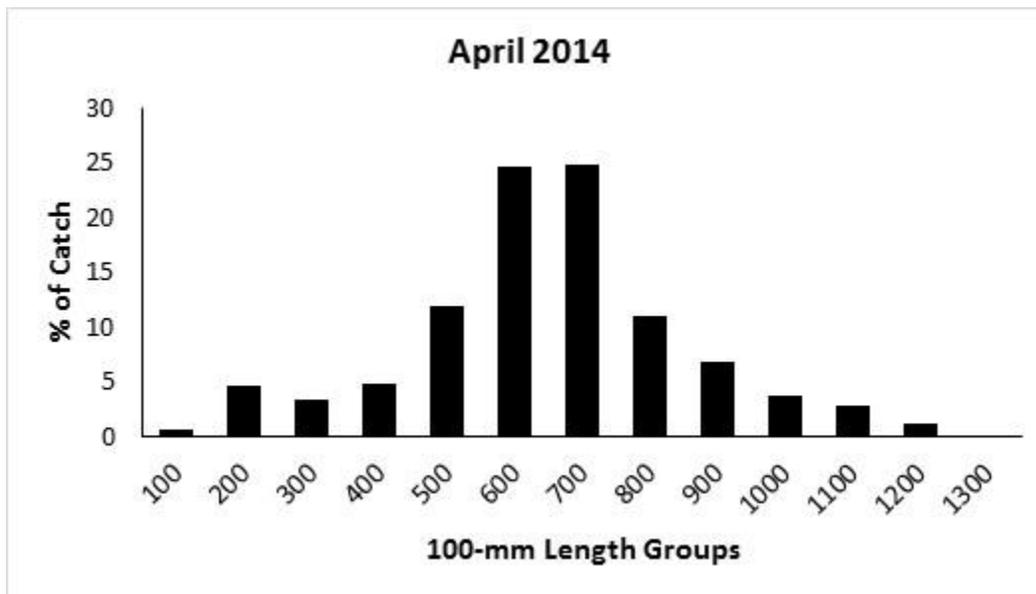
Species	Gill Netting		Electrofishing	
	N	CPUE	N	CPUE
Gizzard Shad			248	165.3 (20)
Threadfin Shad			226	151.7 (29)
Blue Catfish	174	17.4 (17)		
Channel Catfish	95	9.5 (15)		
Flathead Catfish	1	0.1 (100)		
White Bass	3	0.3 (71)		
Palmetto Bass	2	0.2 (67)		
Redbreast Sunfish			28	18.7 (41)
Warmouth			3	2.0 (54)
Bluegill			392	261.3 (27)
Longear Sunfish			154	102.7 (49)
Redear Sunfish			13	8.7 (365)
Largemouth Bass			110	73.3 (19)

## APPENDIX B – Map of sampling locations



Location of sampling sites, Lake Palestine, Texas, 2017-2018. Gill net and Electrofishing stations are indicated by G and E, respectively. Water level was near full pool at time of sampling.

## APPENDIX C – Flathead Catfish



Size structure of Flathead Catfish collected during low-frequency electrofishing surveys, Lake Palestine, Texas, 2014 (N = 538) and 2018 (N = 524).



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