

PERFORMANCE REPORT

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INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2015 Fisheries Management Survey Report

Fort Phantom Hill Reservoir

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Fort Phantom Hill Reservoir were surveyed in 2015 by electrofishing and trap netting and in 2016 by gill netting. Historical data are presented with the 2015-2016 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:** Fort Phantom Hill Reservoir is a 4,246-acre impoundment constructed on Elm Creek about 15 miles north of Abilene, Texas. It is located in the Brazos River Basin and is primarily used for municipal water supply and recreation. The power plant was closed in 2012. Installation of a breakwater structure was completed in 2012 to reduce wave-action at the boat ramp, and extension of the boat dock and two boat-ramp lanes was completed in 2012. In 2014, an effluent water discharge system was installed on the central eastern side of the reservoir. Water level substantially fluctuated from 2007 to 2015. After getting nearly 18 feet low, rainfall during 2015-2016 refilled the reservoir and increased water level to over conservation pool elevation. Habitat was primarily flooded terrestrial vegetation, black willow, woody debris/ brush, and smartweed. Invasive salt cedar was also present.
- **Management History:** Important sport fish include White Crappie, White Bass, Hybrid Striped Bass, Largemouth Bass, and catfishes. Walleye were stocked 10 times from 1973 to 1995 before requests were discontinued because of poor stocking success and failure to establish a fishery. Blue Catfish were introduced in 1974. An 18-inch minimum length limit on Blue Catfish existed from 1993 to 1999 before reinstatement to the statewide regulation. Threadfin Shad were introduced in 1984 and the population is self-sustaining. Florida Largemouth Bass were introduced in 1976 and have been stocked eight times from 1976 to 2001. A 16-inch minimum length limit on Largemouth Bass, in effect from 1994 to 2012, was changed to the statewide 14-inch minimum length limit on September 1, 2012. Palmetto Bass were introduced in 1977 and have since been stocked nearly annually until 2014. Sunshine Bass were introduced in 2014. Palmetto Bass were also stocked in 2014. Sunshine Bass were stocked again in 2015 and 2016.
- **Fish Community**
 - **Prey Species:** Gizzard Shad were numerous throughout the survey period and continued to be the dominant prey species. Bluegill, Longear Sunfish, and Inland Silversides were also relatively abundant and support the prey species community.
 - **Catfishes:** Blue Catfish were relatively abundant in the low-frequency electrofishing and gill netting surveys. However, most individuals were of sub-legal size. Blue Catfish were estimated to reach legal length in five years. Channel Catfish continued to have low relative abundance in gill netting surveys. Flathead Catfish were also present.
 - **White Bass:** White Bass relative abundance in 2016 declined since previous gill netting surveys, and few legal-sized fish were observed in the most recent gill netting survey.
 - **Hybrid Striped Bass:** Hybrid Striped Bass were relatively abundant in the reservoir, but their catch rates declined since the last survey period. All legal fish captured were Palmetto Bass, and all Sunshine Bass captured were from the 2015 stocking.
 - **Largemouth Bass:** Largemouth Bass relative abundance in electrofishing surveys was variable during the survey period and was correlated with water level fluctuations. Only two legal-sized bass were caught during the 2015 electrofishing survey.
 - **White Crappie:** White Crappie catch in trap net surveys increased during the survey period. Crappie production appeared correlated with water level fluctuations. While White Crappie were relatively abundant, fewer legal-sized fish were observed in the 2015 survey compared to prior surveys.

Management Strategies: Continue to stock Hybrid Striped Bass, and evaluate growth between Palmetto and Sunshine Bass. Work with City of Abilene to improve bank angler access. Monitor salt cedar coverage and identify possible control measures. Educate public about invasive species threats.

INTRODUCTION

This document is a summary of fisheries data collected from Fort Phantom Hill Reservoir in 2015-2016. The purpose of the document is to provide fisheries information and make management recommendations to protect and improve existing sport fisheries. While information on other fisheries 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

Fort Phantom Hill Reservoir is a 4,246-acre impoundment constructed on Elm Creek, approximately 15 miles north of Abilene, Texas. The reservoir is located in the Brazos River Basin, and is controlled by City of Abilene for municipal water supply and recreation uses. Power generation was reduced to peak use in 2003, and dismantling of the plant began in 2011 and was completed in 2012. Water level fluctuated substantially from 2007 to 2015 (Figure 1). Heavy rains in 2015 refilled the reservoir to near full capacity, and rainfall in spring 2016 increased water level over conservation pool elevation. Habitat was primarily inundated terrestrial vegetation, black willow, woody debris/ brush, and smartweed. Invasive salt cedar was also present. Other descriptive characteristics for Fort Phantom Hill Reservoir are in Table 1.

Angler Access

Fort Phantom Hill Reservoir has six public boat ramps. From 2013 to late spring 2015, five ramps were closed, and boater access was limited to a low-water ramp at Johnson Park. Heavy rains in 2015 increased water level to near full, and the remaining ramps were useable as of spring 2016; the low-water ramp was inundated and is no longer useable. Installation of a breakwater structure was completed in 2012 to reduce wave action at the main boat ramp. Two lanes at the main ramp were also extended to allow for better access during periods of low water level. Additional boat ramp characteristics are displayed in Table 2. Bank fishing access was plentiful in various areas throughout the reservoir, but access was better during periods of low water level. One privately-operated pay-for-fishing dock and one public fishing dock were available.

Management History

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

1. Stock Palmetto Bass annually at a rate of 15 fish/acre since they cannot naturally reproduce.
Action: Since 1983, Palmetto Bass have been stocked almost annually. Beginning in 2014, both Palmetto and Sunshine Bass were stocked to support the Hybrid Striped Bass fishery. In 2015 and 2016, only Sunshine Bass were stocked.
2. Publicize fishing opportunities and results of fish population surveys via print and social media.
Action: Various popular press articles and social media updates have been published to highlight fishing opportunities at Fort Phantom Hill Reservoir.
3. Educate public about invasive species and their threats to Texas water bodies.
Action: Various efforts have been made to educate several groups and individuals about invasive species. Examples include social media posts, popular press articles, providing literature, posting signage at boat ramps, and making speaking points while speaking to groups and individuals.

Harvest regulation history:

From September 1, 1993 to August 31, 1999, Blue Catfish were managed with an 18-inch minimum length limit (MLL). However, the regulation reverted to the statewide 12-inch MLL because of low angler support and extremely slow growth of Blue Catfish. Largemouth Bass harvest was regulated with a 16-inch MLL from September 1, 1994 to August 31, 2012, and the population has since been managed by the statewide 14-inch MLL. Other sport fishes have been managed with statewide regulations (Table 3).

Stocking History:

Walleye fry were stocked 10 times from 1973-1995. Blue Catfish fingerlings were introduced in 1974. Redear Sunfish fingerlings were introduced in 1981. Adult Threadfin Shad were introduced in 1984. Florida Largemouth Bass were introduced in 1976 and were stocked eight times from 1976-2001 and again in 2014. Palmetto Bass were introduced in 1977 and were stocked nearly every year until 2014. In 2014, both Sunshine Bass and Palmetto Bass fingerlings were stocked. Only Sunshine Bass fingerlings were stocked in 2015 and 2016. The complete stocking history is displayed in Table 4.

Vegetation/habitat management history:

Fort Phantom Hill Reservoir has no significant vegetation/habitat management history. In spring 2016, 60 recycled Christmas trees were deployed at three different locations to create brush piles in an effort to increase angler catch rates.

Water transfer:

Fort Phantom Hill is primarily used for municipal water supply for the City of Abilene as well as for recreation, and flood control. A single, permanent pumping station exists at the reservoir which transfers water from the Clear Fork of the Brazos River to the reservoir during periods of high stream flows. Water can also be transferred, at very low rates, from Hubbard Creek Reservoir. An effluent water discharge was constructed near the southeast boat ramp to divert treated wastewater to the reservoir from the Hamby Waste Water Treatment Plant, and it became fully operational in 2015.

METHODS

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for this waterbody (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 and prey species were collected by electrofishing (2 hours at 24, 5-minute stations). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing. Ages for Largemouth Bass 13.0-14.9 inches were determined by using otoliths.

Low-frequency electrofishing - Blue Catfish were collected by low-frequency electrofishing for 1 hour at 20, 3-minute 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 Blue Catfish 11.0-12.9 inches were determined by using otoliths.

Trap netting - Crappie were collected using trap nets (10 net nights at 10 stations). Catch per unit effort (CPUE) for trap netting was recorded as the number of fish caught per net night (fish/nn). Ages for White Crappie were determined by using otoliths collected from 18 fish ranging from 9.0-10.9 inches.

Gill netting - Blue Catfish, Channel Catfish, White Bass, and Hybrid Striped Bass were collected by gill netting (15 net nights at 15 stations). Catch per unit effort (CPUE) for gill netting was recorded as the number of fish caught per net night (fish/nn). Ages for White Bass 9.0-10.9 inches as well as all Hybrid Striped Bass collected were determined by using otoliths.

Genetics - Genetic analysis of Largemouth Bass was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015). Micro-satellite DNA analysis was used to determine genetic composition of individual fish from 2005 through 2015 and by electrophoresis for previous years. Genetic analysis was conducted for discriminating between Palmetto Bass and Sunshine Bass \leq 18 inches in total length (TL). Tissue samples (n = 56) were collected during 2016 gill netting. Following DNA isolation, each tissue sample was evaluated by using the reaction MPX1-Morone (Msa5-11 and Msa5-71) to verify the hybrid status of each fish (Dijar Lutz-Carrillo, personal

communication). Each fish was evaluated with a single base extension (SBE-Morone) assay using Cytochrome Oxidase Subunit-1 as a substrate to amplify single nucleotide polymorphisms (SNPs) at three sites, which this allowed for the resolution of species specific SNPs which identified the maternal contributor to the hybrid.

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_t)] 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 = $100 \times \text{SE of the estimate/estimate}$) was calculated for all CPUE statistics.

Habitat - In July 2015, a roving survey was conducted to determine salt cedar coverage at the reservoir. Water level was approximately 14 feet below conservation pool elevation at the time of the survey. The water body perimeter was circumnavigated, and salt cedar coverage at the reservoir was spatially recorded by using Global Positioning Systems (GPS) equipment. GPS waypoints were converted to shapefiles. Shapefiles were then overlaid on digital maps by using Global Information Systems (GIS) software and satellite imagery (USDA 2014). Salt cedar coverage in acres was calculated by using GIS software.

Vegetation and structural habitat surveys were conducted in August 2015; water level was approximately seven feet below conservation pool elevation at the time of the survey. The habitat survey was conducted by selecting 243 random points throughout the reservoir, and presence/absence was determined for vegetative and structural habitat types identified at or below the waterline at all stations. Percent occurrence ($\% = [\# \text{ stations present} / \text{total stations sampled}] \times 100$) and associated Wald 95% confidence intervals (AusVet Animal Health Services 2015) were calculated for each habitat feature type (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Water level - Source for water level data was the United States Geological Survey (USGS 2016).

RESULTS AND DISCUSSION

Habitat: The 2015 habitat survey indicated that most sample locations were featureless (Table 6). However, flooded terrestrial vegetation occurred at 30% of the random locations sampled. Other notable habitat features observed included black willow, dead herbaceous vegetation/brush, woody debris, and smartweed. Other structural habitat features observed included some boat docks, as well as cobble and pebble substrates. Salt cedar observed in the July 2015 roving survey covered roughly 51.8 acres of the reservoir; most has since been inundated, but some areas of coverage remained.

Prey species: In 2015, the prey base of Fort Phantom Hill Reservoir was comprised primarily of sub-stock-sized Gizzard Shad, Bluegill, Longear Sunfish, and Inland Silversides. Inland Silversides are likely an important source of forage for sport fish in the reservoir, and they appeared to be numerous during 2015 sampling but could not be effectively captured and quantified. Threadfin Shad were not captured in the 2015 electrofishing survey but were expected to be present within the reservoir. From 2011 to 2015, catch rates of Gizzard Shad were high and improved from 551.3 fish/h to 877.0 fish/h (Figure 2). Similar to prior surveys, most Gizzard Shad were sub-stock size, and the IOV was 92. Mean IOV from 1995-2015 fall electrofishing surveys was 90.4 (SE=1.5), which suggested that the Gizzard Shad population consistently had a size structure dominated by smaller fish of optimal prey size for sport fishes. From 2011-2015, electrofishing catch rates for Bluegill were variable (Figure 3). Electrofishing CPUE-Total for Bluegill decreased from 140.7 fish/h in 2011 to 14.8 fish/h in 2013, but increased to 211.5 fish/h in 2015. Bluegill size structure has been consistent and comprised primarily of fish ≤ 6 inches. Relative abundance of Longear Sunfish has been variable from 2009-2015 (Figure 4). Electrofishing catch rates for Longear Sunfish decreased from 47.2 fish/h in 2009 to 0.0 fish/h in 2011, but it increased to 23.1 fish/h in 2013 and 146.0 fish/h in 2015. In 2015, size structure of the Longear Sunfish sample was similar to previous surveys, which all individuals were ≤ 5 inches. In most years from 1996-2015, sub-stock Gizzard Shad were the most relatively abundant forage species encountered during fall electrofishing surveys (Figure

5). Relative abundance for each prey species fluctuated throughout the last 20 years. However, total relative abundance for all prey species exceeded 500 fish/h for most years, suggesting adequate prey availability.

Blue Catfish: Low-frequency electrofishing total catch rate of Blue Catfish increased from 96.0 fish/h in 2003 to 275.0 fish/h in 2015 (Figure 6). Sizes ranged from 3-18 inches in the 2015 sample, in which most individuals were not of legal size and the sample mode was 10 inches. Catch of stock-sized fish was 42.0 fish/h in 2015. Mean age at legal length for Blue Catfish caught in the low-frequency electrofishing survey was 5.0 years (n=24; range = 4-6 years). From 2012-2016, gill net catch rate decreased from 15.6 fish/nn to 6.5 fish/nn (Figure 7). Gill net catch rate of stock-sized fish was 4.5 fish/nn in 2016. In 2016, sizes ranged from 8-33 inches, and most individuals were 11-12 inches. Despite catching lower total number of fish during gill netting compared to 2015 electrofishing, the 2016 gill net sample yielded a wider size distribution. The PSDs from 2012-2016 gill netting surveys were variable and ranged from 4-33, and samples were dominated by mostly smaller, sub-legal fish; PSD in 2016 was 9.

Channel Catfish: Channel Catfish are present in the reservoir, but they have commonly been in low relative abundance in gill net surveys and are considered a negligible sport fish species. From 2004-2016, catch of Channel Catfish ranged from 0.3 fish/nn to 1.8 fish/nn (Figure 8). In spring 2016, catch of Channel Catfish was 0.3 fish/nn, and all individuals caught were legal-sized.

White Bass: Gill net catch rates for White Bass declined from 5.0 fish/nn in 2012 to 1.5 fish/nn in 2016 (Figure 9). A similar decline was evident for catch of legal-sized (i.e., ≤ 10 inches) fish, which only 0.7 fish/nn were caught in the 2016 gill net survey. Sizes of fish in the 2016 sample ranged from 7-13 inches. Adequate sample size for estimation of age-at-legal length was not achieved during 2016 sampling.

Hybrid Striped Bass: Palmetto Bass catch in gill net surveys decreased from 23.1 fish/nn in 2010 to 1.4 fish/nn in 2014 (Figure 10). A similar trend was observed in catch of legal-sized fish. Reduced catch rates during the 2012 and 2014 gill net surveys could be partially attributed to reduction in stocking frequency. In 2016, gill net catch rate of Hybrid Striped Bass was 4.9 fish/nn, and catch of legal-sized fish was 2.2 fish/nn (Figure 11). Individuals caught during the 2016 gill net survey ranged from 8-26 inches, which most individuals were 17 inches. Despite additional sampling effort, the Category III age sample was not achieved, and age data for only individuals ≤ 18.9 inches are reported (Figure 12). Analyses with MPX1-Morone confirmed that all 56 tissue samples were collected from Hybrid Striped Bass. Analyses with SBE-Morone indicated that 41 fish were Palmetto Bass, 11 were Sunshine Bass; four fish's samples were unresolved due to failed reactions. However, three of four unresolved fish were predicted to be Sunshine Bass and the remaining unresolved fish was likely a Palmetto Bass (Dijar Lutz Carrillo, personal communication). Palmetto Bass ranged from 15.3-26.0 inches, and estimated year classes ranged from 2007-2014 (Figure 12). All 14 Sunshine Bass collected were from the 2015 stocking and ranged from 8.6-12.0 inches (Figure 12). Poor representation of individuals from the 2014 stocking may be attributed to the reduced stocking rate during that year, poor stocking success, or possibly gear selectivity bias.

Largemouth Bass: Electrofishing CPUE-Total of Largemouth Bass varied from 2011-2015 (Figure 13). In 2011, CPUE-Total was 126.7 fish/h but decreased to 21.2 fish/h in 2013, and it increased to 78.5 fish/h in 2015. Stock CPUE decreased from 116.7 fish/h in 2011 to 10.5 fish/h in 2015. Electrofishing CPUE-14 decreased from 35.3 fish/h in 2011 to 7.4 fish/h in 2013, and it lowered to 1.0 fish/h in 2015. Size structures from 2011-2015, were variable as indicated by PSDs ranging from 62 (SE=5) in 2011 to 19 (SE=10) in 2015; the reduction in the PSD in 2015 suggested that the population's size structure was shifted towards being comprised of mostly smaller individuals. Mean relative weights in 2015 appeared to improve since 2011 and were >100 . Increased relative abundance of smaller individuals and improvement of body conditions could be attributed to increased available habitat and fish production after the reservoir caught substantial water in spring 2015. Florida Largemouth Bass (FLMB) genetic influence has been consistent, prevalence of FLMB alleles ranged from 41.4-61.9%, and prevalence of pure FLMB in samples ranged from 2.8-9.7% (Table 7). The target sample size was not achieved during sampling for assessing age at legal length, and only one 14-inch bass was observed. Production of Largemouth Bass in the reservoir has likely been linked to the periodic increases of water level after prolonged drought (Dumont 2012). Specifically, increases in relative abundance of sub-stock bass

occurred in years following substantial rainfall and increases in water level (Figure 14). Conversely, declines of sub-stock bass were seen in periods of prolonged drought and drops in water level which could be further attributed to reduction in crucial structural habitat and vegetation.

White Crappie: Catch of White Crappie in fall trap net surveys increased from 15.4 fish/nn in 2011 to 31.5 fish/nn in 2015 (Figure 15). Similarly, Stock CPUE increased from 13.2 fish/nn in 2011 to 18.0 fish/nn in 2015. Catch of legal-sized crappie in fall trap net surveys has been consistent since 1996 except for a boost in catch in 2009 (Figure 16); since 2009, catch of legal-sized crappie has decreased. Sizes of White Crappie caught in the 2015 survey ranged from 3-14 inches. Between 2011-2015, the size structure, as indicated by PSD, was variable. The 2015 sample was dominated by smaller fish compared to the previous two samples, but it was more balanced and suggests that White Crappie production has been the strongest since 1996. Similar to the 2011 sample, mean relative weights of fish caught in 2015 increased with length, which individuals ≥ 9 inches were in good condition. Average age for White Crappie at 10 inches (9.0-10.9 inches) was 2.1 years (N=18; range = 1-3 years). Similar to other centrachids (i.e., Largemouth Bass and sunfishes), White Crappie production in Fort Phantom Hill Reservoir has likely been influenced by the extreme fluctuations in water level (Figure 17). Catch of sub-stock White Crappie in fall trap net surveys appeared to increase in years following rises in water level, and declines in catch rates were observed during years when substantial water level drops occurred. Such declines in crappie production could be a result of reduced availability of important structural habitat and vegetation during periods of low water level.

Fisheries management plan for Fort Phantom Hill Reservoir

Prepared – July 2016

ISSUE 1: Hybrid Striped Bass have provided a popular fishery at Fort Phantom Hill Reservoir since 1977. Annual stockings of Hybrid Striped Bass are necessary to maintain the fishery. Both Palmetto and Sunshine Bass have been stocked to support the Hybrid Striped Bass fishery at Fort Phantom Hill Reservoir. Differences in growth and catchability between the hybrid types are poorly understood.

MANAGEMENT STRATEGIES

1. Continue to stock both Palmetto and Sunshine Bass equally and annually at 15 fingerlings/acre.
2. Conduct a study to evaluate growth, gear susceptibility, and angler catch between Palmetto and Sunshine Bass.
3. Conduct a creel survey to assess angler-directed effort and harvest of Hybrid Striped Bass.

ISSUE 2: Bank anglers are abundant at Fort Phantom Hill Reservoir, but multiple access points have been closed or are in need of repair by City of Abilene.

MANAGEMENT STRATEGY

1. Meet with City of Abilene to discuss access point closures, as well as discuss needed repairs to the fishing pier and main boat ramp dock, and identify potential bank angler access improvement strategies such as funding through a boater access grant.

ISSUE 3: Invasive salt cedar is now present at Fort Phantom Hill Reservoir. A roving survey was conducted in summer 2015 to estimate coverage, but many of the areas containing salt cedar have since been inundated. No control measures for remaining salt cedar are currently being implemented.

MANAGEMENT STRATEGY

1. Meet with City of Abilene and TPWD invasive species experts to discuss salt cedar establishment, potential problems, possible monitoring efforts, as well as prospective measures for control.

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

MANAGEMENT STRATEGIES

1. Cooperate with the controlling authority to post signage at access points around the reservoir.
2. Contact and educate private access owners about invasive species, and provide them with materials 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

Sport fish, prey fish, and other important fishes: Sport fishes present in Fort Phantom Hill Reservoir include White Crappie, Blue Catfish, Channel Catfish, Flathead Catfish, Hybrid Striped Bass (i.e., Palmetto Bass and Sunshine Bass), Largemouth Bass, and White Bass. Important prey species include Gizzard Shad, Threadfin Shad, Bluegill, Longear Sunfish, and Inland Silversides.

Low-density fishery: Channel Catfish are present in the reservoir, but they have been in low relative abundance in gill netting surveys. From 2004-2016, catch of Channel Catfish in gill net surveys ranged from 0.3 fish/nn to 1.8 fish/nn. Sampling for Channel Catfish is unnecessary during 2017-2020.

Survey objectives, fisheries metrics, and sampling objectives

Prey Species: Sunfishes (i.e., Bluegill and Longear Sunfish), Gizzard Shad, Threadfin Shad, and Inland Silversides are the primary prey species at Fort Phantom Hill Reservoir. Monitoring surveys have traditionally been conducted every four years for prey species. The next electrofishing surveys will be conducted in fall 2017 and 2019 at 18, 5-minute randomly selected stations (Table 8). Trend data for CPUE and size structure (PSD and IOV) will be collected during fall 2017 and 2019 electrofishing. During sampling, target precision of RSE $\leq 25\%$ will be attempted for CPUE-Total for Gizzard Shad and Bluegill. Index of vulnerability will be calculated for Gizzard Shad to assess the relative proportion of individuals in the population that are of suitable prey sizes for sport fish. PSD will be determined for Bluegill by collecting ≥ 50 fish. Additional sampling may be conducted to improve sample sizes to achieve desirable sample size for IOV and PSD. No additional sampling effort will be expended to achieve precision of RSE ≤ 25 for relative abundance data for prey species. Instead, Largemouth Bass body condition can provide information on forage abundance, vulnerability, or both relative to predator density.

Blue Catfish: Blue Catfish are the most abundant of the catfishes in the reservoir and anglers have reported specifically targeting them more (i.e., 4% of directed effort) than other catfishes. During the most recent biennial monitoring surveys (2008-2016), Blue Catfish were sampled by gill nets set at differing effort which resulted in variable catch and precision. Gill net surveys from 2008-2014, CPUE-Total increased from 9.3 fish/nn (6 stations; RSE = 13) in 2008 to 18.3 fish/nn (7 stations; RSE = 42) in 2010, then slightly decreased to 15.6 fish/nn (5 stations; RSE = 40) in 2012, and then decreased to 4.2 fish/nn (5 stations; RSE = 66) in 2014. In 2016, 6.5 fish/nn were caught during gill netting. Past gill netting surveys yielded poor representation of larger and quality-sized (≥ 20 -inches) fish, and only 12 fish ≥ 20 inches were caught during most recent surveys from 2008-2016. Three low-frequency electrofishing surveys have been conducted since 2003. During the fall 2003 survey, CPUE-Total was 96.0 fish/h (8, 5-minute stations; RSE = 31), and CPUE-12 was 16.5 fish/h (RSE = 45). In spring 2010, Blue Catfish were sampled by low-frequency electrofishing, which produced high CPUE-Total of 619.0 fish/h (20, 3-minute stations; RSE = 11) and CPUE-12 of 177.0 fish/h (RSE = 17). Size distribution of the 2010 sample ranged from 3-33 inches, with most individuals $<$ stock-size (PSD = 7). Catch of Blue Catfish in the fall 2015 survey was 275.0 fish/h, and the catch rate of legal fish was 42.0 fish/h. Given that low-frequency electrofishing produced higher numbers of Blue Catfish, daytime low-frequency electrofishing will be used to monitor trends in relative abundance, size structure, and body condition for the population. Sampling in the late spring/early summer may yield improved size distribution in comparison to the prior fall surveys. Sampling once every four years should be adequate to monitor changes in relative abundance, size structure, and body conditions. Low-frequency electrofishing will be conducted during late spring/early summer 2019 for 1-hour in duration at 20, 3-minute randomly selected stations (Table 8), and a target precision RSE $\leq 25\%$ will be attempted for relative abundance data (i.e., CPUE-Total and CPUE-12). A target of 50 Blue Catfish \geq stock-length (i.e., ≥ 12 inches) will be sampled to achieve an estimate of size structure (PSD), and ≥ 5 fish per inch group \geq stock-size will be measured for length and weight to assess body condition. If objectives are not met, additional random stations may be sampled (up an hour additional) if deemed feasible.

Flathead Catfish: Flathead Catfish are present in the reservoir, but population demographics and dynamics are poorly understood because individuals have not been adequately sampled in previous surveys. Specifically, data pertaining to relative abundance, size structure, age at legal length (i.e., 18

inches), and body condition are missing for the Flathead Catfish population. Previous creel surveys suggest anglers seldom reported specifically targeting Flathead Catfish. However, because nearly 20% of anglers at Fort Phantom Hill Reservoir target catfishes, Flathead Catfish may provide an excellent fishing resource for anglers to catch large catfish. Baseline relative abundance data (i.e., CPUE-Total, Stock CPUE, and CPUE-18) will be collected for the Flathead Catfish population by exploratory use of daytime low-frequency electrofishing at 20 randomly selected 3-minute stations within depths of <15 feet. Sampling will be conducted early summer 2017 (Table 8).

White Bass: White Bass are present in the reservoir, CPUE-Total ranged from 3.3 fish/nn - 5.0 fish/nn from 2004-2016. Relative abundance (CPUE-Total and CPUE-10) data for White Bass can be collected in conjunction with surveying for Hybrid Striped Bass during spring 2017 and 2019 (Table 8). Extra sampling effort will not be conducted to achieve better precision for relative abundance unless it is conducted while sampling for Hybrid Striped Bass.

Hybrid Striped Bass: Hybrid Striped Bass are a popular fishery in Fort Phantom Hill Reservoir, and frequent stockings have been necessary to maintain the fishery at the reservoir. From 2003 to 2007, reported angling effort directed towards Hybrid Striped Bass increased from 3% to 10% of the total reported effort for all species. Palmetto Bass have been stocked frequently since 1977, with the longest periods without stockings occurring between 1979-1983 and 1999-2002. The last stocking of solely Palmetto Bass occurred in 2013. In 2014, the reservoir received stockings of both Palmetto Bass and Sunshine Bass. Sunshine Bass were also stocked in 2015 and 2016. Since these stockings have occurred, Palmetto Bass have been relatively abundant in the reservoir. CPUE-Total catch rates in gill netting surveys increased from 8.8 fish/nn in 2008 (6 stations; RSE=54) to 18.2 fish/nn in 2012 (5 stations; RSE = 44); catch of fish ≥ 18 inches increased from 6.3 fish/nn in 2008 (RSE=46) to 7.8 fish/nn in 2012 (RSE = 38). Lower stocking rates and missed stockings occurring in 2011 and 2012 likely was the cause of the lower than normal catch rates in 2014 (5 stations; CPUE-Total=1.4 fish/nn and CPUE-18=1.2 fish/nn). In 2016 gill netting, 56 Hybrid Striped Bass ≤ 18 inches were captured. Genetic analysis determined that only 11 of these fish were Sunshine Bass and all were from the 2015 stocking; 3 additional fish were unconfirmed but predicted to be Sunshine Bass from this cohort. Two Palmetto Bass caught in the survey were the only fish from the 2014 stocking. Growth between the two hybrid types has not been evaluated at Fort Phantom Hill Reservoir. Gill netting surveys will be conducted in spring 2017 and 2019 (Table 8) to collect data pertaining to relative abundance, size structure, and growth of Hybrid Striped Bass. During sampling, experimental gill nets will be deployed at 15 random stations at depths ≤ 25 ft. to collect relative abundance data, and target precision will be $RSE \leq 25$ for CPUE-Total and CPUE-18. A sample of ≥ 200 fish will be attempted evaluating size structure of the Hybrid Striped Bass population as well as collecting specimens for estimating age and growth. During the 2019 gill net survey, a Category III age sample will be attempted to determine the age distribution, estimate the population's total mortality rate and to predict maximum growth (i.e., von Bertalanffy growth estimator). During the 2017 and 2019 gill net surveys, fin clips will be collected from all fish collected to determine the genetic prevalence of each hybrid type. Genetics data will be used to determine a) if one hybrid type is more susceptible to catch by gill nets, and b) if growth differed between hybrid types, particularly growth rate to legal length. If these objectives are not achieved, up to 30 additional random stations may be sampled if deemed feasible. Additional sampling objectives may be added in conjunction as part of possible research project to evaluate this fishery.

Largemouth Bass: Largemouth Bass are relatively abundant in Fort Phantom Hill Reservoir. Creel surveys conducted from 2003-2007 suggested that anglers began targeting them less than reported in prior creel surveys. Specifically, angling effort towards Largemouth Bass declined slightly from 8% to 5% of the total angling effort for all species. However, Largemouth Bass are likely an important fishery for numerous anglers, particularly those that report targeting "anything" at the reservoir. Catch of Largemouth Bass in 2011 was 126.7 fish/h (18, 5-minute stations; RSE = 18), which was higher than 100.8 fish/h in 2009 (15, 5-minute stations; RSE=19) and 114.0 fish/h in 2007 (24, 5-minute stations; RSE = 17). To monitor Largemouth Bass and their prey, evening electrofishing surveys will be conducted in the fall 2017 and 2019 (Table 8) to maintain trend data for relative abundance (CPUE-Total, Stock CPUE, and CPUE-14), size structure, body condition, genetics, and age-at-legal length. Electrofishing will be conducted for 1.5 hours at 18, 5-minute stations. A target for precision of $RSE \leq 25\%$ for relative abundance data of

CPUE-Total, Stock CPUE, and CPUE-14 will be attempted during sampling. A target of 50 fish \geq stock-size will be sampled to assess size structure (PSD), and \geq 5 fish per inch group \geq stock-size will be measured for length and weight to assess body condition. Fin clips from a random sample of 30 Largemouth Bass will be collected for microsatellite DNA genetic analysis. Otoliths will be collected from a sample of 13, 13-15-inch fish to assess age at legal-length. If precision objectives are not achieved, up to one hour of additional sampling (12, 5-minute stations) may be added. If additional fish are needed for age and growth, daytime bass-only electrofishing may be conducted during the same season to improve the sample size.

White Crappie: White Crappie were relatively abundant and support the most popular sport fishery in Fort Phantom Hill Reservoir. The 2007 creel results showed directed angling effort towards White Crappie increased to 31% from 27% in 2004 and 26% in 2003. From 2007-2008, 12,966 White Crappie were estimated to be caught and harvested by anglers; only 6% of legal-sized (i.e., \geq 10 in) fish caught were estimated to be released. The popularity of this species among anglers warrants sampling time and effort. The fishery is managed under the statewide 10-inch minimum length limit and 25-fish (in combination) bag limit. Since 2009, White Crappie CPUE-Total in trap netting surveys has declined from 33.1 fish/nn in 2009 (10 stations; RSE = 18) to 15.4 fish/nn in 2011 (10 stations; RSE = 23) and to 12.4 fish/nn in 2013 (10 stations; RSE = 34). However, CPUE-Total improved to 31.5 fish/nn in 2015. The population appeared to have adequate recruitment, but fewer legal fish were caught in the most recent trap net survey. Anecdotally, anglers have reported catching less crappie in 2016, likely attributed to the substantial water level increase. Continuation of biennial trap netting to maintain trend data will allow for determination of any large-scale changes in the crappie population that may warrant further investigation as well as allow for better communication about the fishery to our constituents. Ten (10) trap nets will be deployed at 10 randomly selected stations in fall 2017 and 2019 (Table 8) to achieve data precision at $RSE \leq 25$ for CPUE-Total, Stock CPUE, and CPUE-10. A target of 50 White Crappie \geq stock-size will be collected to monitor trends in size structure, and 10 fish \geq stock-size per inch group will be measured and weighed to assess body condition. 10 additional random stations may be added if data objectives are not met and if additional sampling is deemed feasible.

Creel: Creel data were last collected during 2007 in the spring and summer seasons. Current creel data would be useful to assess any changes in angler effort towards popular sport fishes in the reservoir and to refine management strategies. Beginning in spring 2016, a year-long roving creel study was started to obtain data pertaining to directed effort towards sport fishes as well as anglers' catches, harvests, releases, as well as expenditures and demographics. Roving creel surveys will be conducted on at least 5 weekend days and 4 weekdays each quarter (≥ 36 survey days for the year). The creel study will be repeated beginning spring 2018 (Table 8), particularly to observe any changes to allocated effort towards Hybrid Striped Bass, White Bass, and White Crappie.

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Water Level

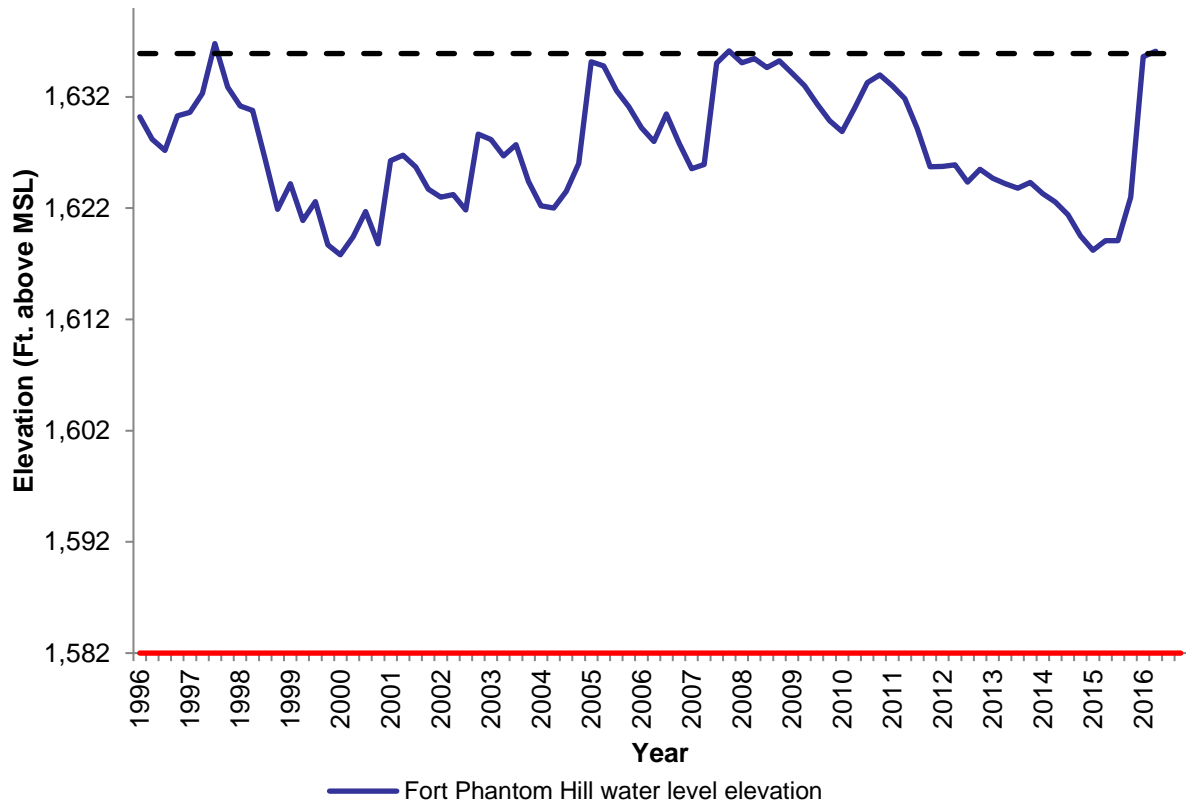


Figure 1. Mean daily water level elevations in feet above mean sea level (MSL; blue line) recorded for Fort Phantom Hill Reservoir, Texas, October 1, 2007-June 1, 2016. Conservation pool elevation (dashed line) is 1,636 feet above MSL. Dead pool elevation (red line) is 1,582 feet above MSL.

Table 1. Characteristics of Fort Phantom Hill Reservoir, Texas.

Characteristic	Description
Year Constructed	1938
Controlling Authority	City of Abilene
County	Jones
Reservoir Type	Tributary
River Basin	Brazos
USGS 8-Digit Hydrologic Unit Watershed	12060102 (Upper Clear Fork Brazos)
Shoreline Development Index	2.0
Conservation Pool Elevation (ft. above mean sea level)	1,636
Dead Pool Elevation (ft. above mean sea level)	1,582
Conductivity	572-650 $\mu\text{S}/\text{cm}$

Table 2. Boat ramp characteristics for Fort Phantom Hill Reservoir, Texas, June 2016. Reservoir elevation at the time of the survey was 1,635 feet above mean sea level. NA= Not Available

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	No. of Lanes	Elevation at end of boat ramp (ft.)	Condition
Main Boat Ramp	32.609646° -99.685285°	Y	30	NA	1,626	Excellent; no access issues
Johnson Park Low- water Ramp	32.612061° -99.680364°	Y	15	1	1,619	Inundated; no access
White Elephant Ramp	32.615709° -99.666595°	Y	10	2	1,621	Excellent, no access issues
Sail Boat Club Ramp	32.602651° -99.678928°	Y	10	1	1,627	Repairs needed
East Lake Road Boat Ramp	32.557539° -99.690366°	Y	30	3	1,628	Excellent; no access issues
Seabee Park Ramp	32.542811° -99.708241°	Y	10	1	1,629	Repairs needed

Table 3. Harvest regulations for Fort Phantom Hill, Reservoir, Texas.

Species	Bag limit	Length limit
Catfish: Channel and Blue Catfish, their hybrids and subspecies	25 (in any combination)	12-inch minimum
Catfish, Flathead	5	18-inch minimum
Bass, White	25	10-inch minimum
Bass, Hybrid Striped	5	18-inch minimum
Bass, Largemouth	5	14-inch minimum
Crappie: White and Black Crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum

Table 4. Stocking history for Fort Phantom Hill Reservoir, Texas. FGL= fingerlings; ADL = adults; UNK= Unknown

Species	Year	Number	Size
Threadfin Shad	1984	1,000	ADL
Blue Catfish	1974	10,000	FGL
Palmetto Bass	1977	55,440	UNK
	1979	43,000	UNK
	1983	43,000	UNK
	1984	100,575	FGL
	1986	63,690	FRY
	1987	105,950	FGL
	1988	87,094	FGL
	1989	102,955	FGL
	1991	64,180	FGL
	1992	44,480	FGL
	1993	35,960	FGL
	1994	65,800	FGL
	1995	63,960	FGL
	1996	65,760	FGL
	1997	51,756	FGL
	1998	42,733	FGL
	1999	20,018	FGL
	2002	32,200	FGL
	2003	63,209	FGL
	2004	64,777	FGL
2005	63,400	FGL	
2006	65,346	FGL	
2007	64,145	FGL	
2008	63,453	FGL	
2009	63,728	FGL	
2011	29,498	FGL	
2013	63,334	FGL	
2014	16,922	FGL	
	Total	1,646,363	
Sunshine Bass	2014	18,513	FGL
	2015	63,248	FGL
	2016	76,889	FGL
	Total	158,650	
Largemouth Bass	1973	2,500	UNK
Florida Largemouth Bass	1976	210,087	FGL
	1977	65,280	FGL
	1979	10,000	FGL
	1986	152,000	FRY
	1994	213,334	FGL
	1995	10,000	FGL
	1997	213,179	FGL
	2001	212,650	FGL
2014	196,956	FGL	
	Total	1,283,486	

Table 5. Stocking history continued.

Species	Year	Number	Size
Walleye	1973	770,000	FRY
	1974	700,000	FRY
	1975	800,000	FRY
	1979	6,797,500	FRY
	1982	335,738	FRY
	1983	6,996,441	FRY
	1985	8,637,242	FRY
	1991	2,440,295	FRY
	1993	8,520,000	FRY
	1995	8,500,000	FRY
	Total	44,497,216	
Redear Sunfish	1981	42,800	UNK

Table 5. Objective-based sampling plan components for Fort Phantom Hill Reservoir, Texas 2015–2016.

Gear/target species	Survey Objective	Metrics	Sampling Objective
<i>Electrofishing</i>			
Gizzard Shad ^a	Relative Abundance	CPUE-Total	RSE ≤ 25
	Size Structure	Length frequency	N ≥ 50
	Prey Availability	IOV	N ≥ 50
Bluegill ^a	Relative Abundance	CPUE-Total	RSE ≤ 25
	Size Structure	PSD, Length frequency	N ≥ 50 stock
Largemouth Bass	Relative Abundance	CPUE-Total, Stock-CPUE, CPUE-14	RSE ≤ 25
	Size Structure	PSD, Length frequency	N ≥ 50 stock
	Age and Growth	Age at 14 inches TL	N = 13, 13.0-14.9 inches
	Condition	W_r	10 fish/inch group
<i>Low-frequency electrofishing</i>			
Blue Catfish	Relative Abundance	CPUE-Total, CPUE-12	RSE-Stock ≤ 25
	Size Structure	Length frequency	N ≥ 50 stock
	Body Condition	W_r	10 fish/inch group
	Age and Growth	Age at 12 inches TL	N = 13, 11.0-12.9 inches
<i>Trap netting</i>			
Crappie	Relative Abundance	CPUE-Total, Stock-CPUE, CPUE-10	RSE ≤ 25
	Size Structure	PSD, Length frequency	N ≥ 50 stock
	Body Condition	W_r	10 fish/inch group
	Age and Growth	Age at 10 inches TL	N = 13, 9.0-10.9 inches

Table 5. Objective-based sampling plan for Fort Phantom Hill Reservoir, Texas continued.

<i>Gill netting</i>			
Blue Catfish	Relative Abundance	CPUE-Total, CPUE-12, CPUE-20	RSE \leq 25
	Size Structure	PSD, Length frequency	N \geq 50 stock
Channel Catfish	Relative Abundance	CPUE-Total, CPUE-12	Practical effort
	White Bass	Relative Abundance	CPUE-Total, CPUE-10
White Bass	Age and Growth	Age at 10 inches TL	RSE \leq 25 N = 13, 9.0-10.9 inches
	Hybrid Striped Bass	Relative Abundance	CPUE-Total, CPUE-18
Hybrid Striped Bass	Size Structure	Length frequency	RSE \leq 25 N \geq 50
	Age and Growth	Category III	N \geq 200
	Genetics	% Palmetto and % Sunshine Bass	All \leq 18.9 inches TL

^aNo additional effort will be expended to achieve prey species survey objectives if sampling objectives 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.

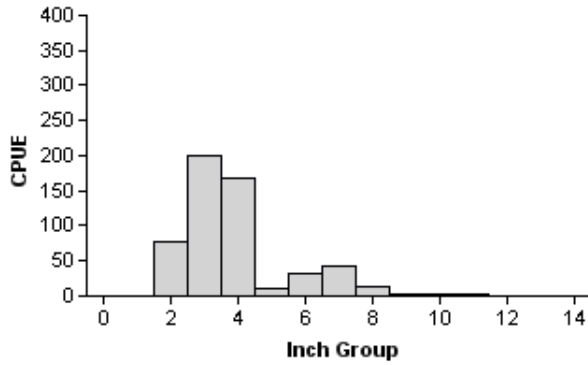
Table 6. Percent occurrence with lower and upper 95% confidence limits (CL) of habitat features at 243 random sites in Fort Phantom Hill Reservoir, Texas, August 2015. Water level at the time was 6.4 feet below conservation pool elevation.

Habitat Features	Percent Occurrence	Lower CL	Upper CL
Featureless	63.0	55.0	71.0
Flooded Terrestrial Vegetation	30.0	24.2	35.8
Black Willow	13.2	8.9	17.5
Woody Debris/Brush	11.9	7.8	16.0
Smartweed	9.5	5.8	13.2
Docks	4.1	1.6	6.6
Salt Cedar	3.3	1.1	5.6
Duckweed	1.2	0.0	2.6
Buttonbush	1.2	0.0	2.6
Cattail	0.8	0.0	2.0
Pebbles	4.1	1.6	6.6
Cobble	3.3	1.1	5.6
Small Boulders	2.5	0.5	4.5
Bedrock	1.2	0.0	2.6
Large Boulders	0.4	0.0	1.1

Gizzard Shad

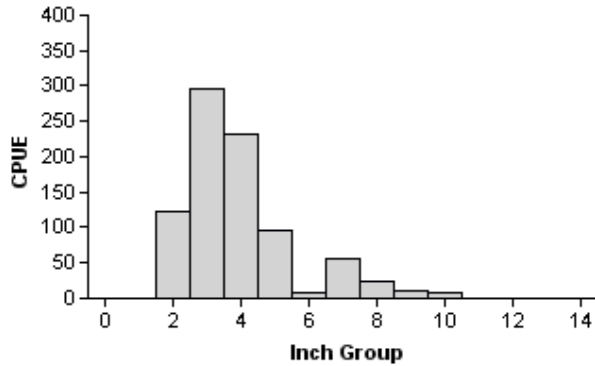
2011

Effort = 1.5
 Total CPUE = 551.3 (18; 827)
 IOV = 96 (1)



2013

Effort = 1.1
 Total CPUE = 857.5 (41; 929)
 IOV = 95 (3)



2015

Effort = 2.0
 Total CPUE = 877.0 (16; 1,754)
 IOV = 92 (2)

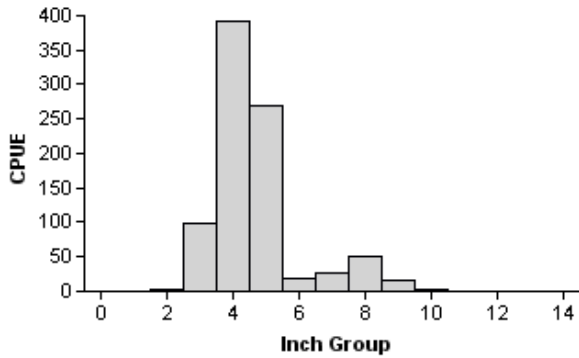


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Fort Phantom Hill Reservoir, Texas, 2011, 2013, and 2015.

Bluegill

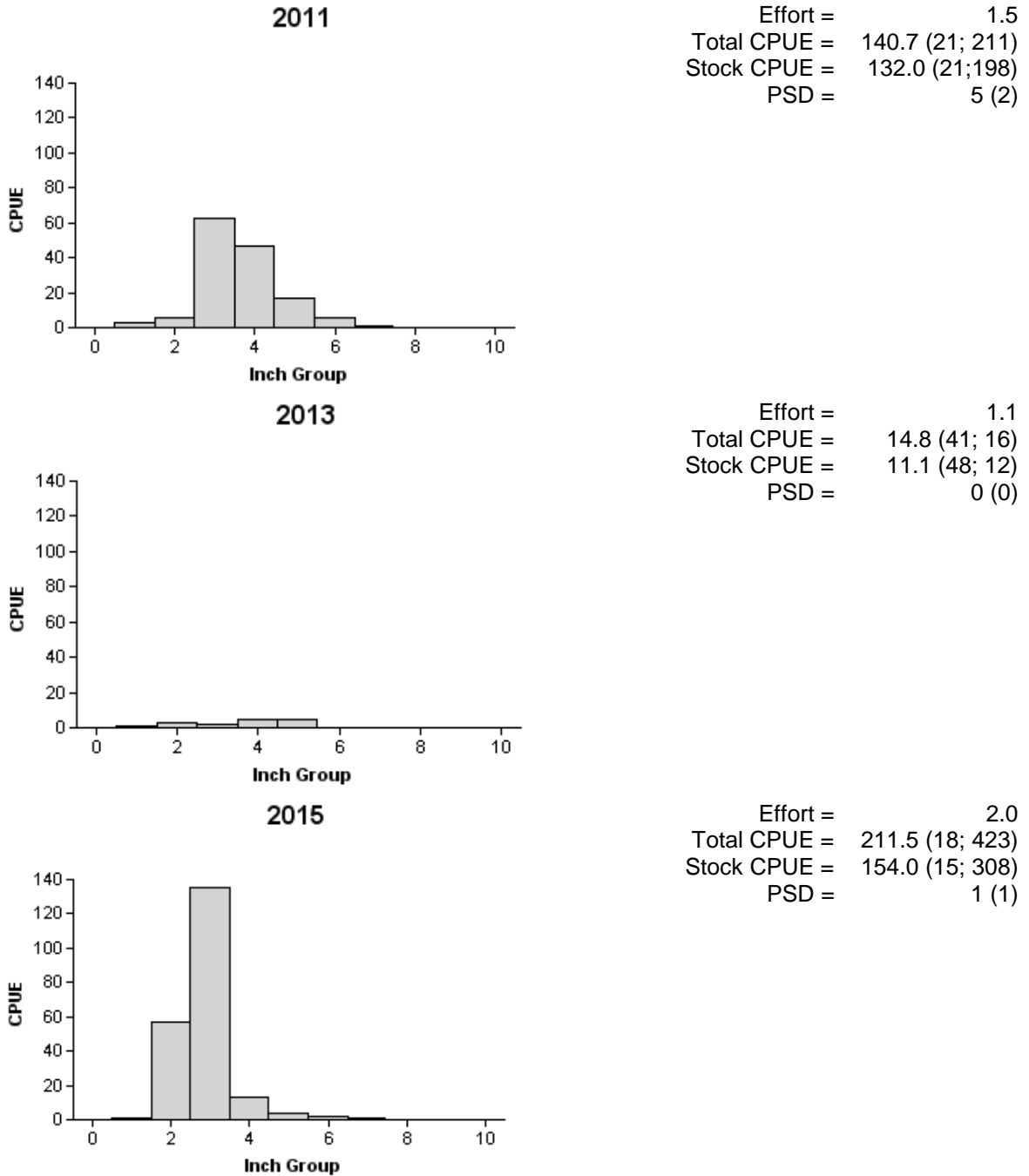
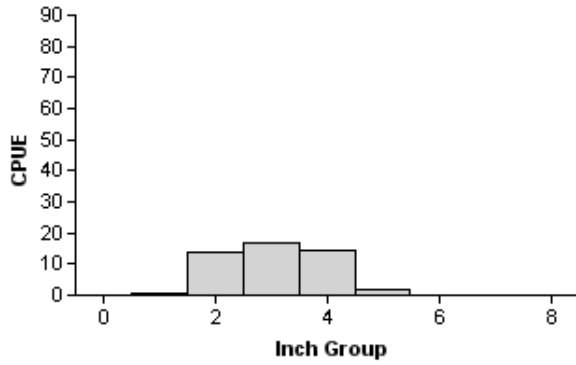


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Fort Phantom Hill Reservoir, Texas, 2011, 2013, and 2015.

Longear Sunfish

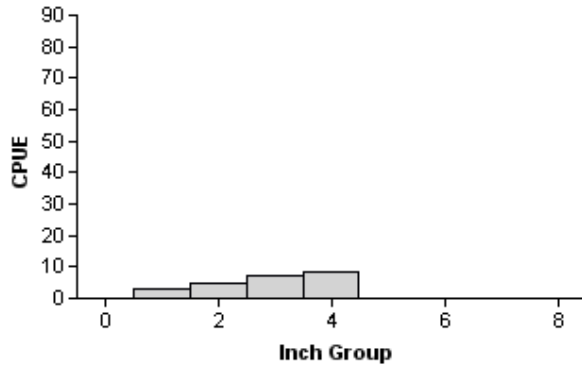
2009

Effort = 1.3
 Total CPUE = 47.2 (34; 59)



2013

Effort = 1.1
 Total CPUE = 23.1 (37; 25)



2015

Effort = 2.0
 Total CPUE = 146.0 (25; 292)

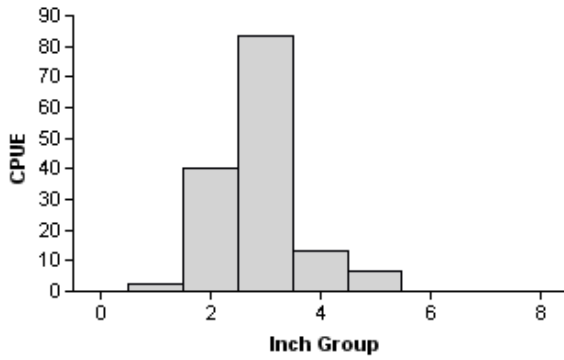


Figure 4. Number of Longear Sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE are in parentheses) for fall electrofishing surveys, Fort Phantom Hill Reservoir, Texas, 2009, 2013, and 2015. No Longear Sunfish were captured in the 2011 electrofishing survey.

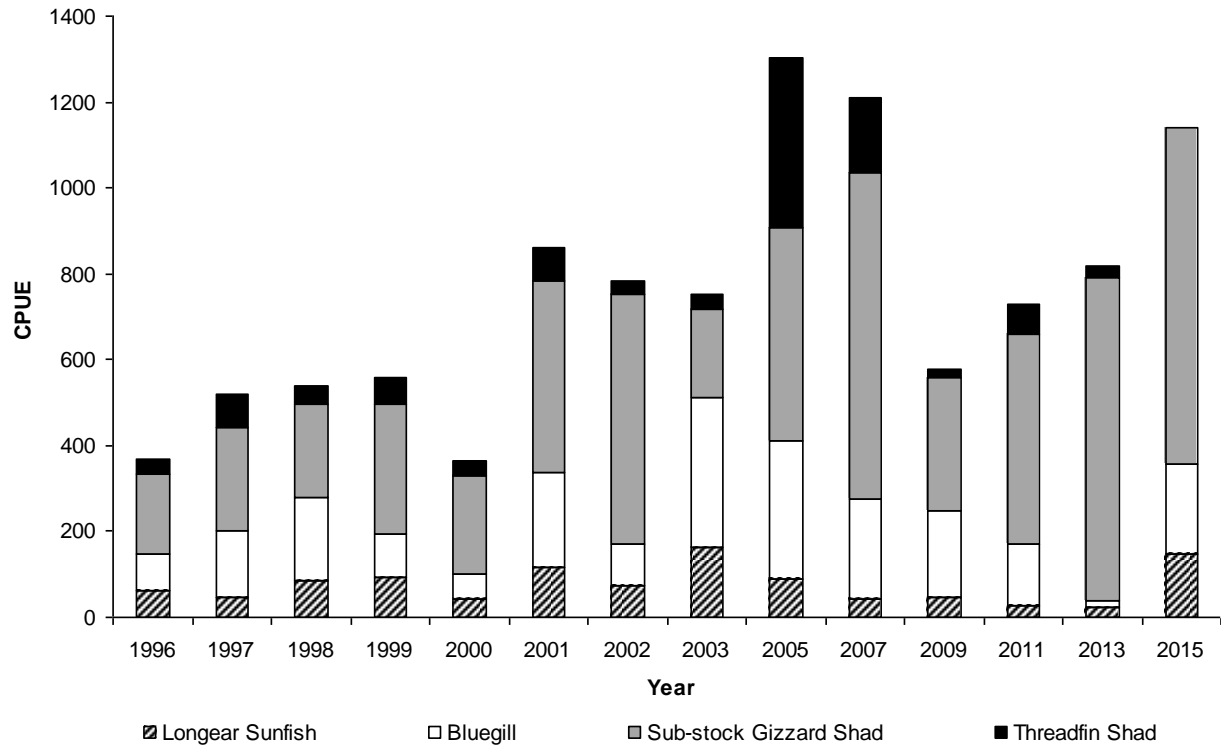


Figure 5. Cumulative number of Threadfin Shad, sub-stock (< 7 inches) Gizzard Shad, Bluegill, and Longear Sunfish caught per hour (CPUE) during fall electrofishing surveys, Fort Phantom Hill Reservoir, Texas, 1996-2015.

Blue Catfish

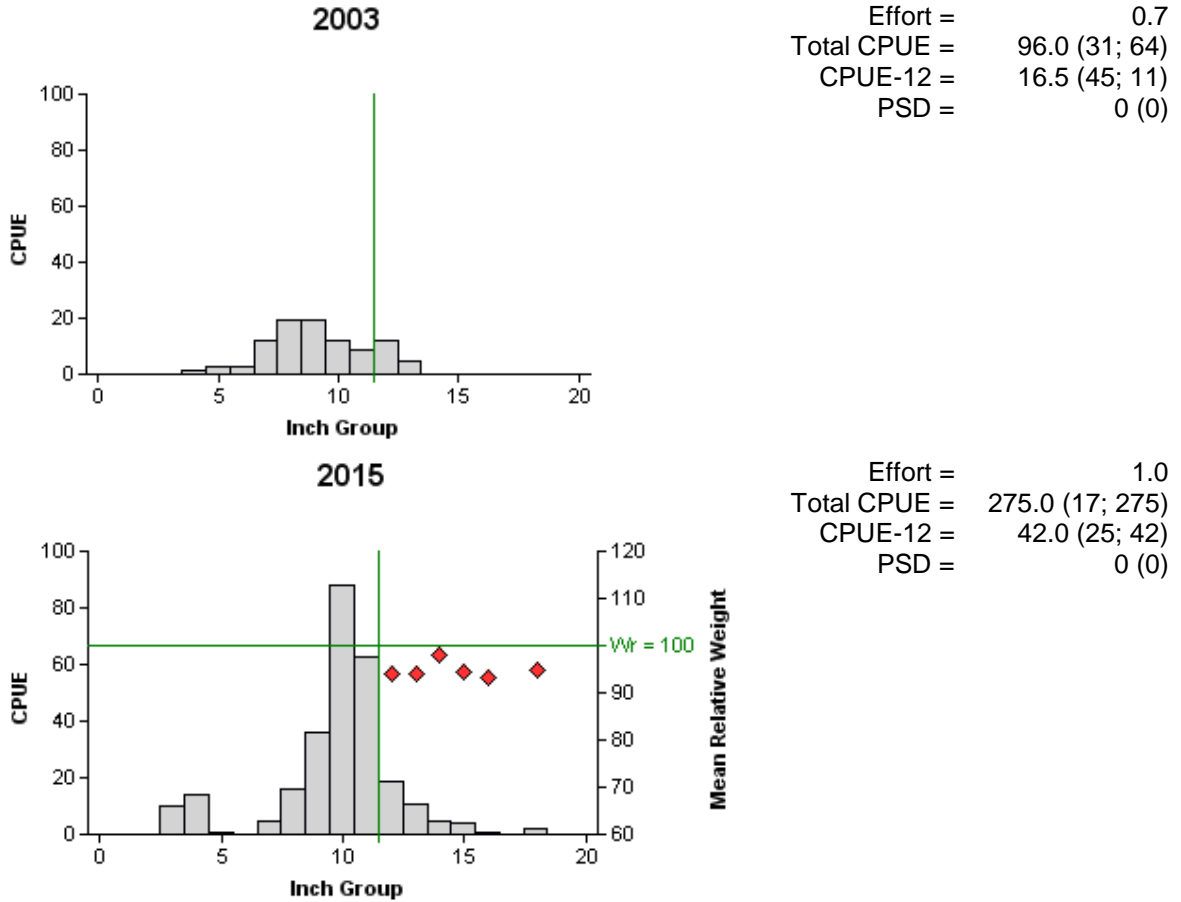
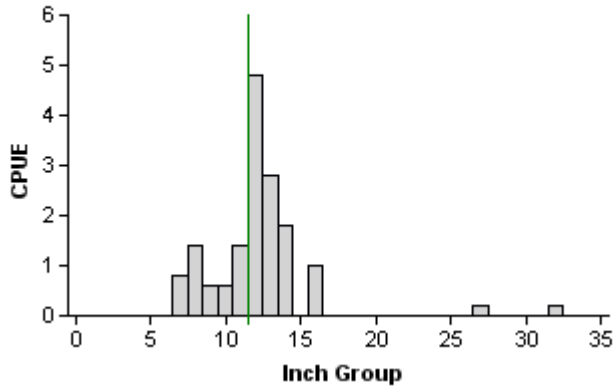


Figure 6. Number of Blue Catfish caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall low-frequency electrofishing surveys, Fort Phantom Hill Reservoir, Texas, 2003 and 2015. The vertical green line indicates the 12-inch minimum length limit, and the horizontal green line represents the relative weight index of 100.

Blue Catfish

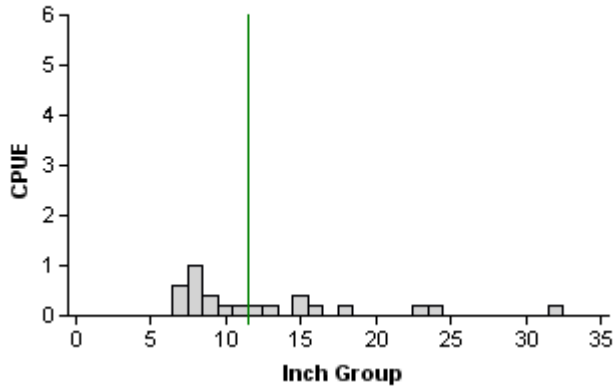
2012

Effort = 5.0
 Total CPUE = 15.6 (40; 78)
 CPUE-12 = 10.8 (32; 54)
 CPUE-20 = 0.4 (100; 2)
 PSD = 4 (4)



2014

Effort = 5.0
 Total CPUE = 4.2 (66; 21)
 CPUE-12 = 1.8 (41; 9)
 CPUE-20 = 0.6 (67; 3)
 PSD = 33 (23)



2016

Effort = 15.0
 Total CPUE = 6.5 (24; 97)
 CPUE-12 = 4.5 (22; 67)
 CPUE-20 = 0.4 (59; 6)
 PSD = 9 (6)

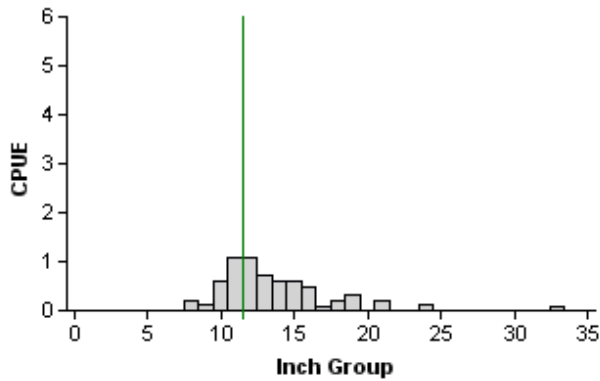
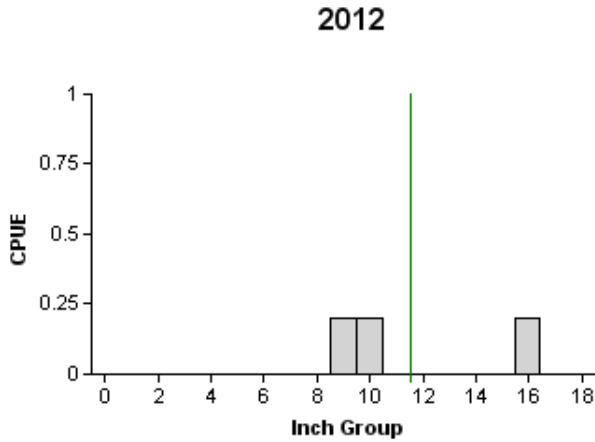
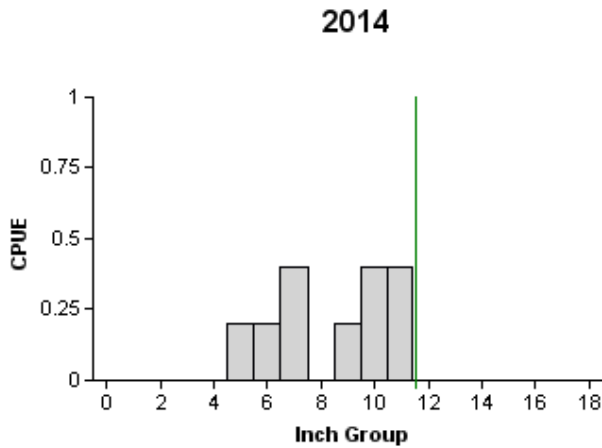


Figure 7. Number of Blue Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Fort Phantom Hill Reservoir, Texas, 2012, 2014, and 2016. The vertical green line indicates the 12-inch minimum length limit.

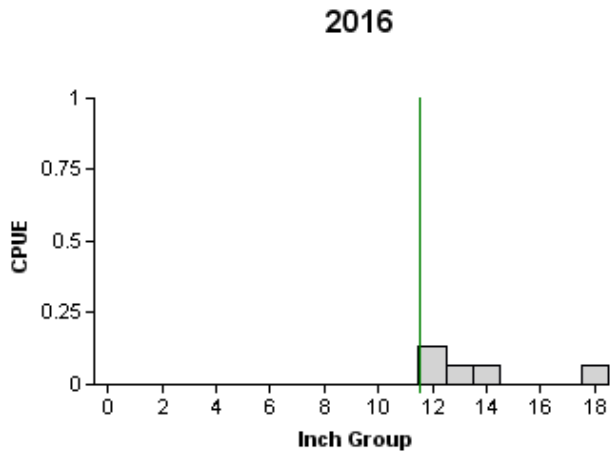
Channel Catfish



Effort = 5.0
 Total CPUE = 0.6 (67; 3)
 Stock CPUE = 0.2 (100; 1)
 CPUE-12 = 0.2 (100; 1)
 PSD = 100 (0)



Effort = 5.0
 Total CPUE = 1.8 (41; 9)
 Stock CPUE = 0.4 (61; 2)
 CPUE-12 = 0.0 (0; 0)
 PSD = 0 (0)



Effort = 15.0
 Total CPUE = 0.3 (63; 5)
 Stock CPUE = 0.3 (63; 5)
 CPUE-12 = 0.3 (63; 5)
 PSD = 20 (10)

Figure 8. Number of Channel Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Fort Phantom Hill Reservoir, Texas, 2012, 2014, and 2016. The vertical green line indicates the 12-inch minimum length limit.

White Bass

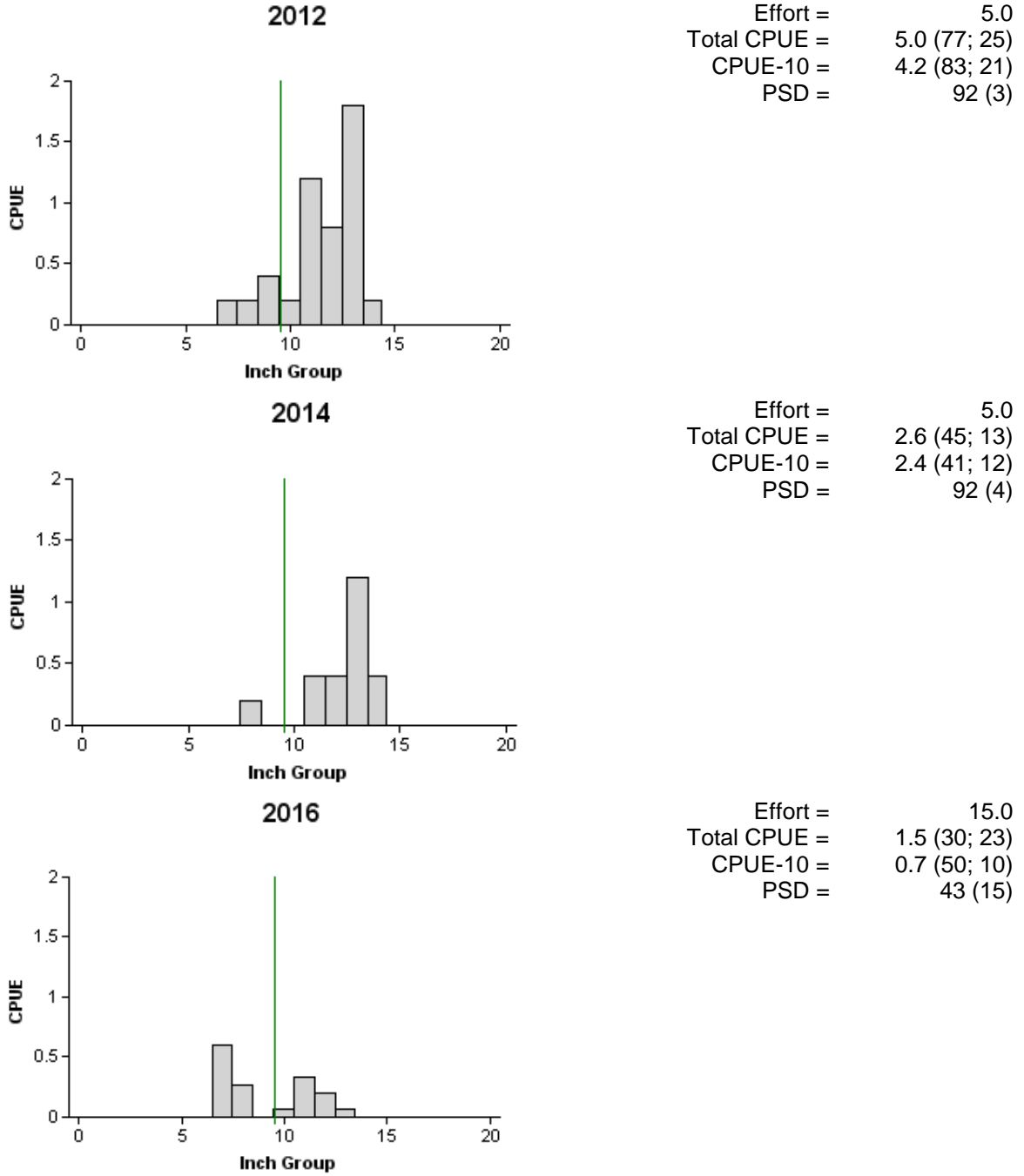


Figure 9. Number of White Bass caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Fort Phantom Hill Reservoir, Texas, 2012, 2014, and 2016. The vertical green line indicates the 10-inch minimum length limit.

Palmetto Bass

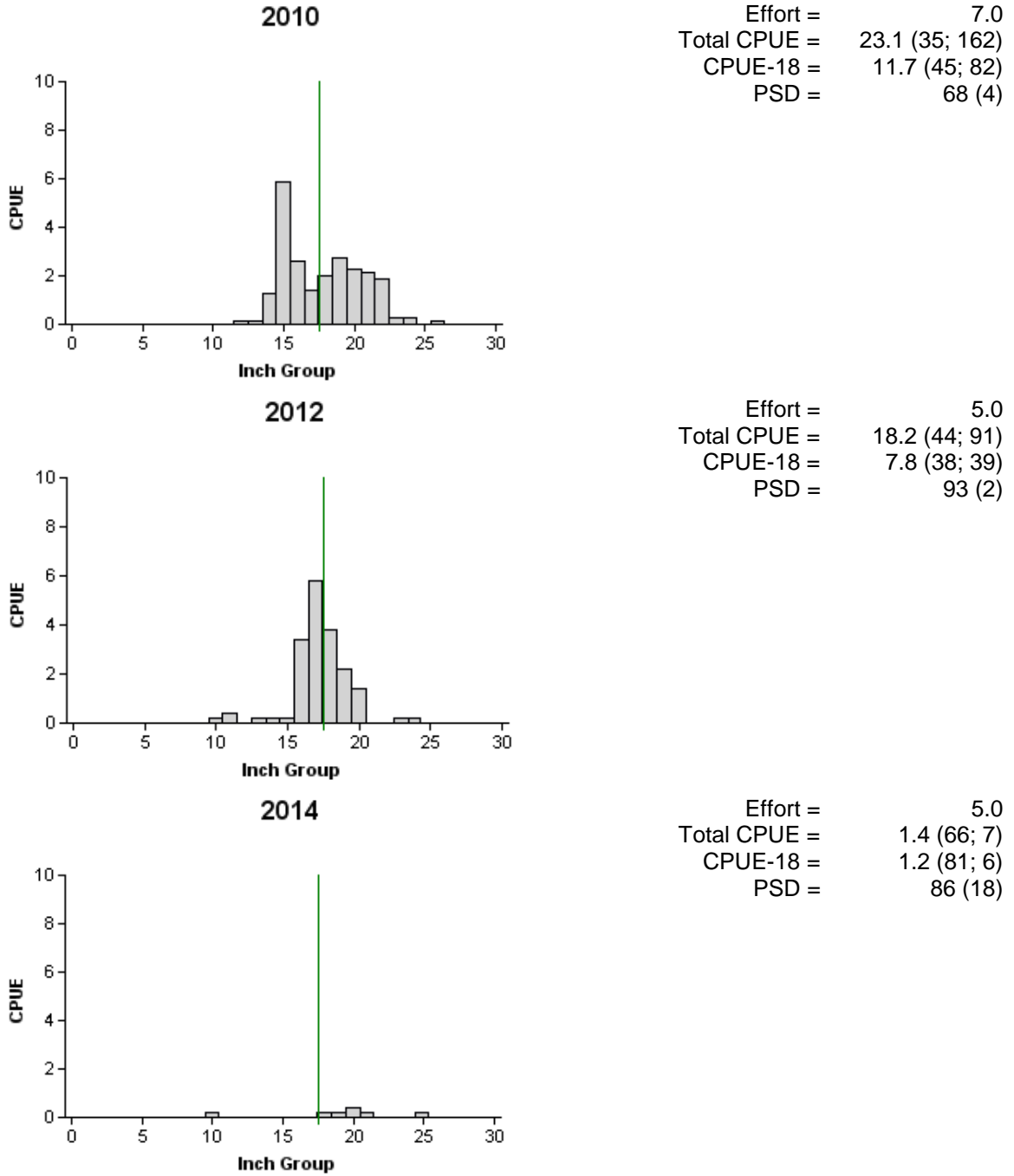


Figure 10. Number of Palmetto Bass caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Fort Phantom Hill Reservoir, Texas, 2012, 2014, and 2016. The vertical green line indicates the 18-inch minimum length limit.

Hybrid Striped Bass

2016

Effort = 15.0
 Total CPUE = 4.9 (25; 74)
 CPUE-18 = 2.2 (28; 33)

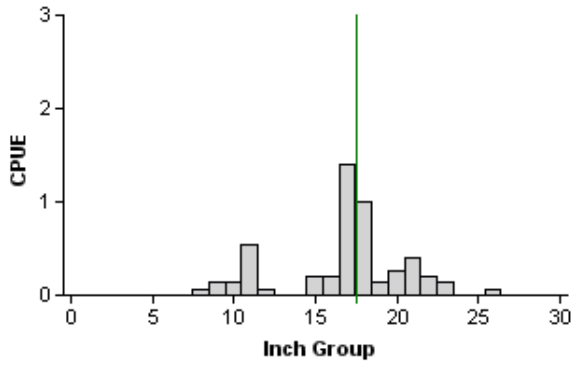


Figure 11. Number of Hybrid Striped Bass (both Palmetto Bass and Sunshine Bass) caught per net night (CPUE) and population indices (RSE and N for CPUE are in parentheses) for spring gill net surveys, Fort Phantom Hill Reservoir, Texas, 2016. The vertical green line indicates the 18-inch minimum length limit.

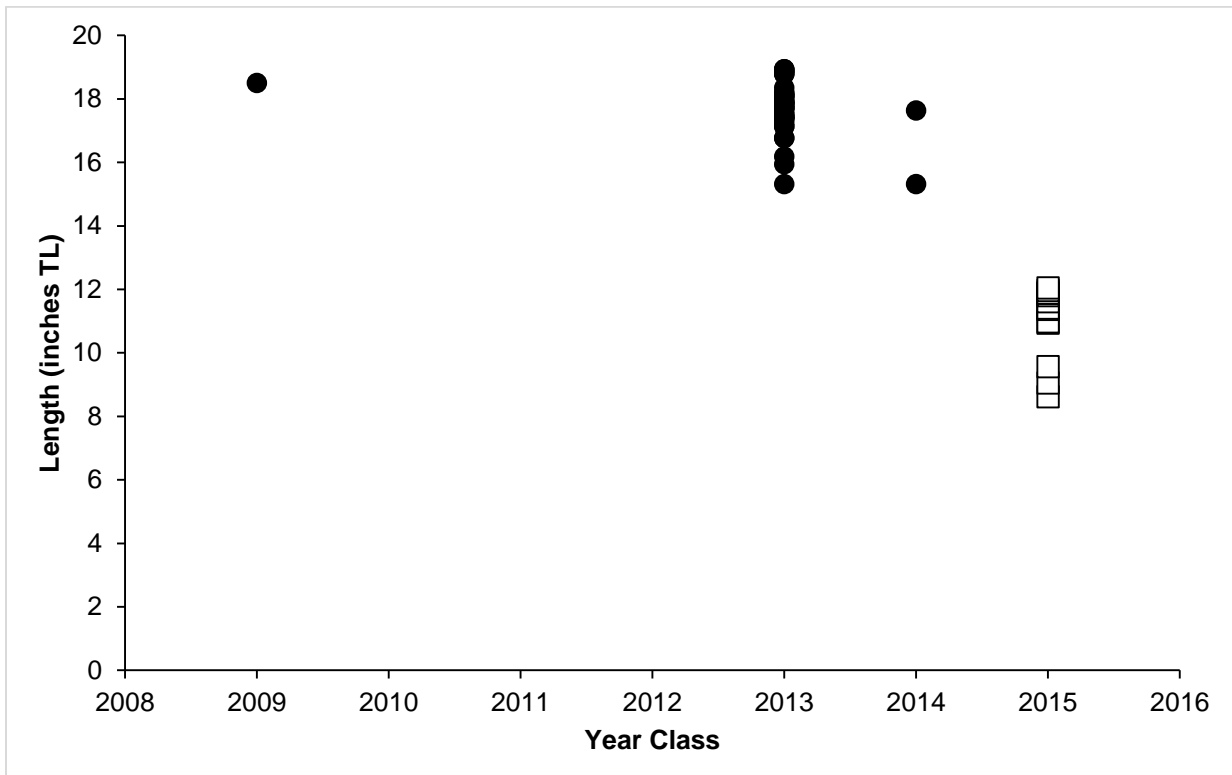


Figure 12. Lengths-at-age for Palmetto Bass (black circles) and Sunshine Bass (white squares) ≤ 18.9 inches for spring gill net survey, Fort Phantom Hill Reservoir, Texas 2016.

Largemouth Bass

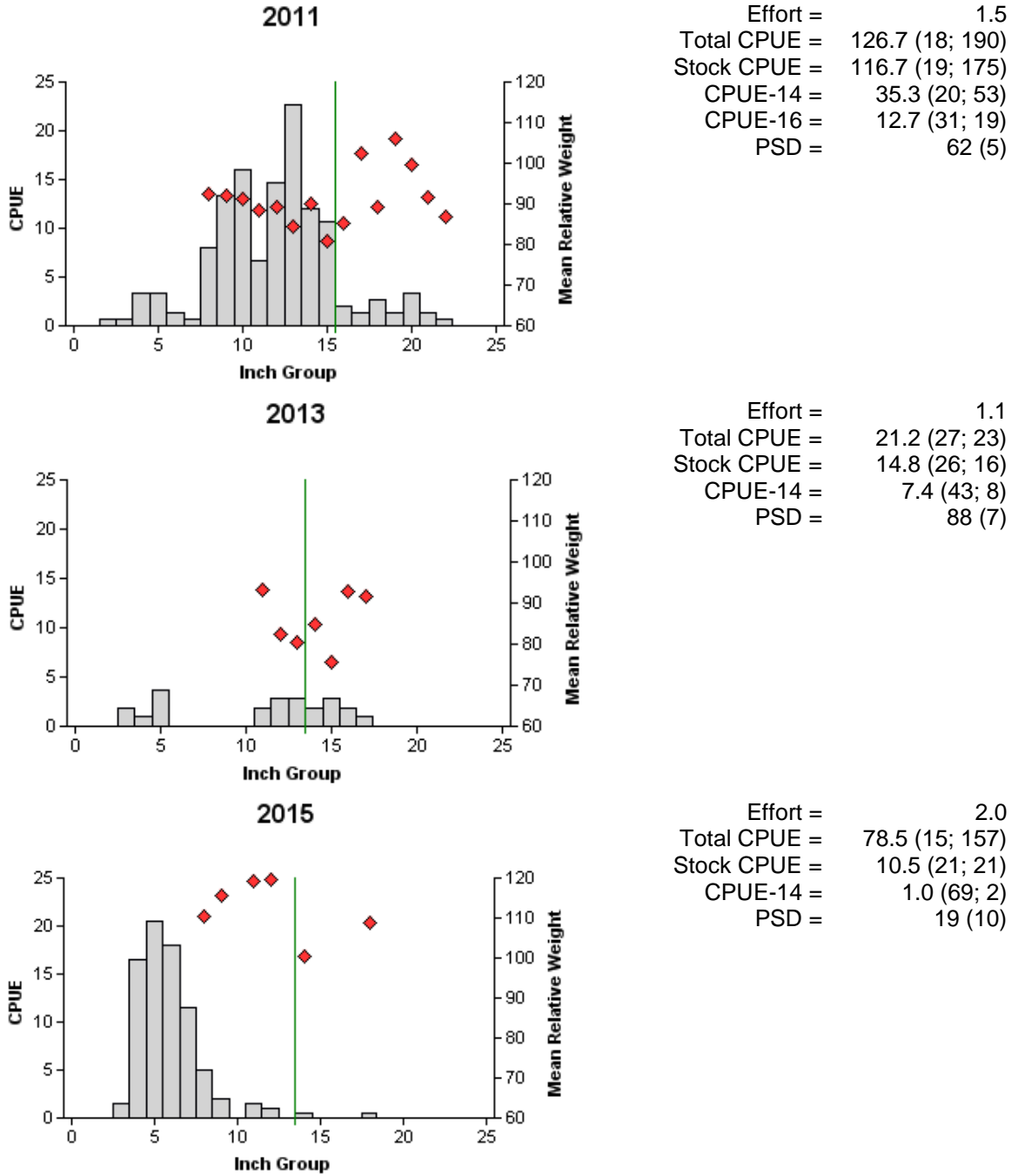


Figure 13. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Fort Phantom Hill Reservoir, Texas, 2011, 2013, and 2015. The vertical green line indicates the minimum length limit.

Largemouth Bass

Table 7. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Fort Phantom Hill Reservoir, Texas, 1998, 2003, 2005, 2011, and 2015. FLMB = Florida Largemouth Bass; NLMB = Northern Largemouth Bass; Fx = second or higher generation hybrid between a FLMB and a NLMB. Genetic composition was determined by electrophoresis prior to 2005 and with micro-satellite DNA analysis since 2005.

Year	Sample size	Number of fish			% FLMB alleles	% pure FLMB
		FLMB	Fx	NLMB		
1998	29	2	24	3	41.4	6.9
2003	31	3	28	0	61.9	9.7
2005	72	2	70	0	56.8	2.8
2011	30	2	28	0	56.8	6.7
2015	30	2	27	1	60.0	6.7

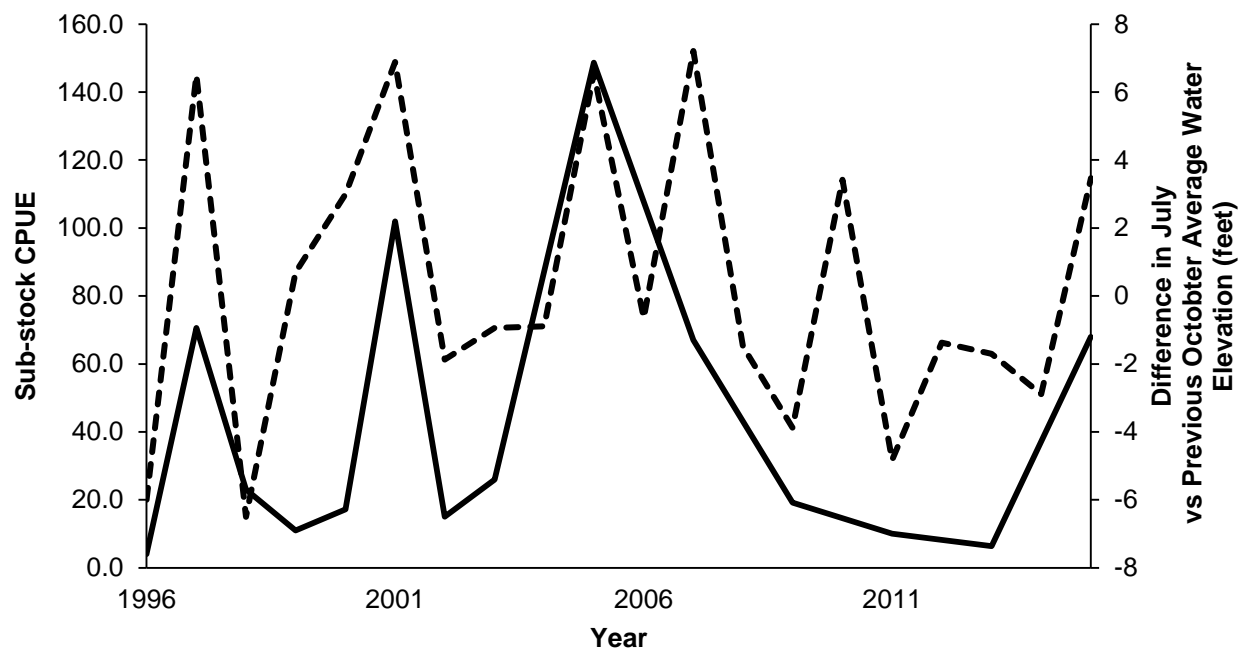


Figure 14. Sub-stock CPUE of Largemouth Bass (solid line) and difference between July and previous October mean water level elevations (dashed line), Fort Phantom Hill Reservoir, Texas, 1996-2015.

White Crappie

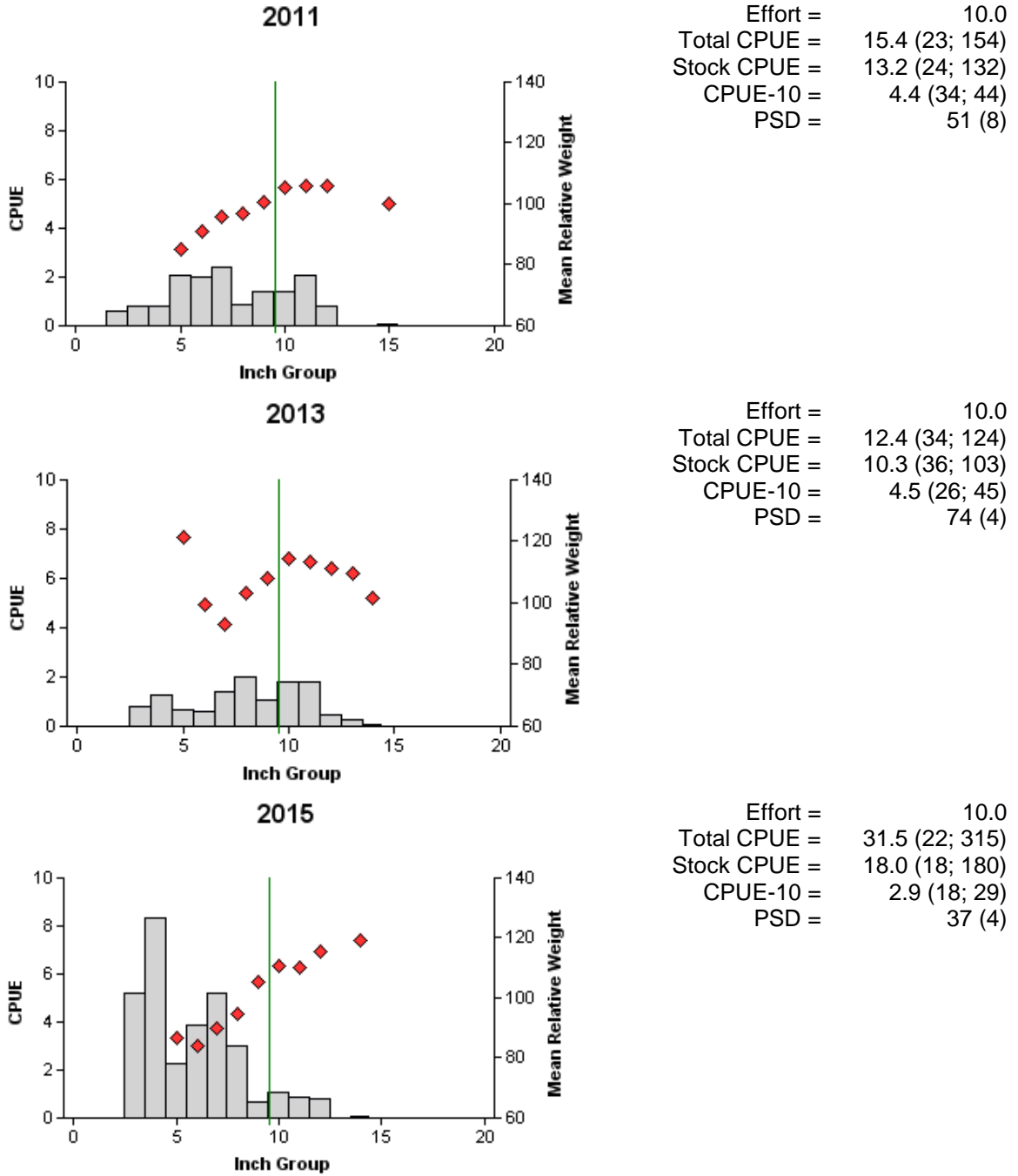


Figure 15. Number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap net surveys, Fort Phantom Hill Reservoir, Texas, 2011, 2013, and 2015. The vertical green line indicates the 10-inch minimum length limit.

White Crappie

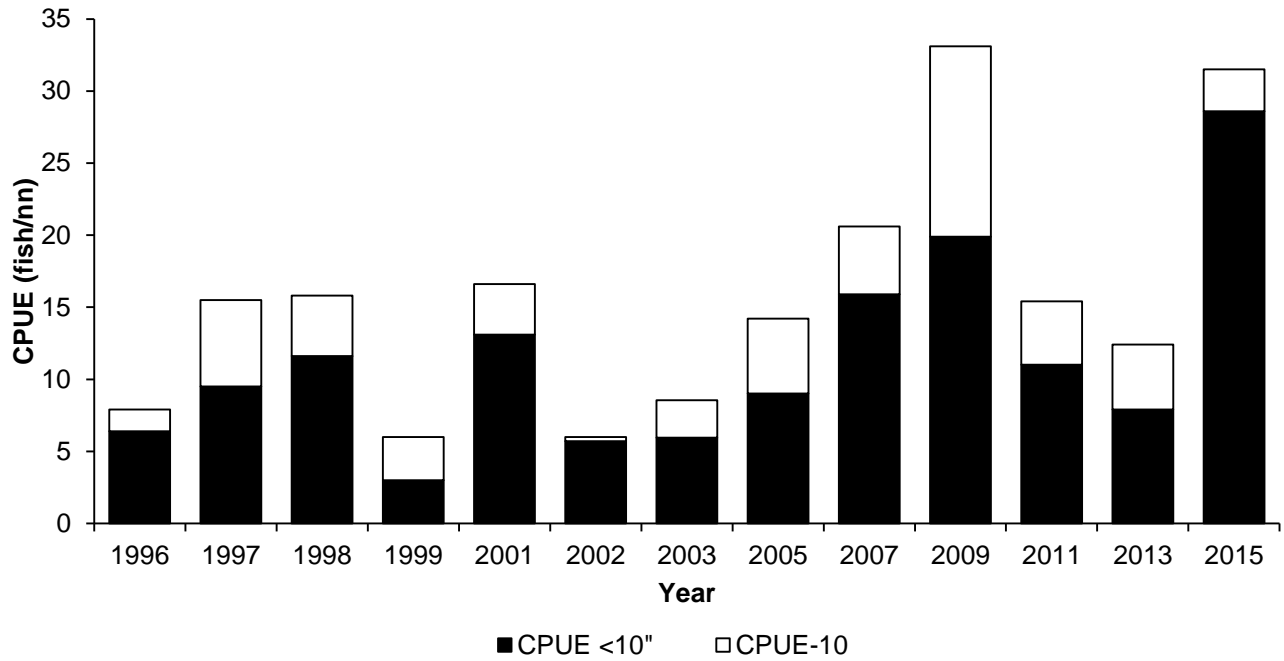


Figure 16. Cumulative catch rates of sub-legal (<10 inches TL) and legal-sized (≥10 inches TL) White Crappie caught per net night during fall trap netting surveys, Fort Phantom Hill Reservoir, Texas, 1996-2015.

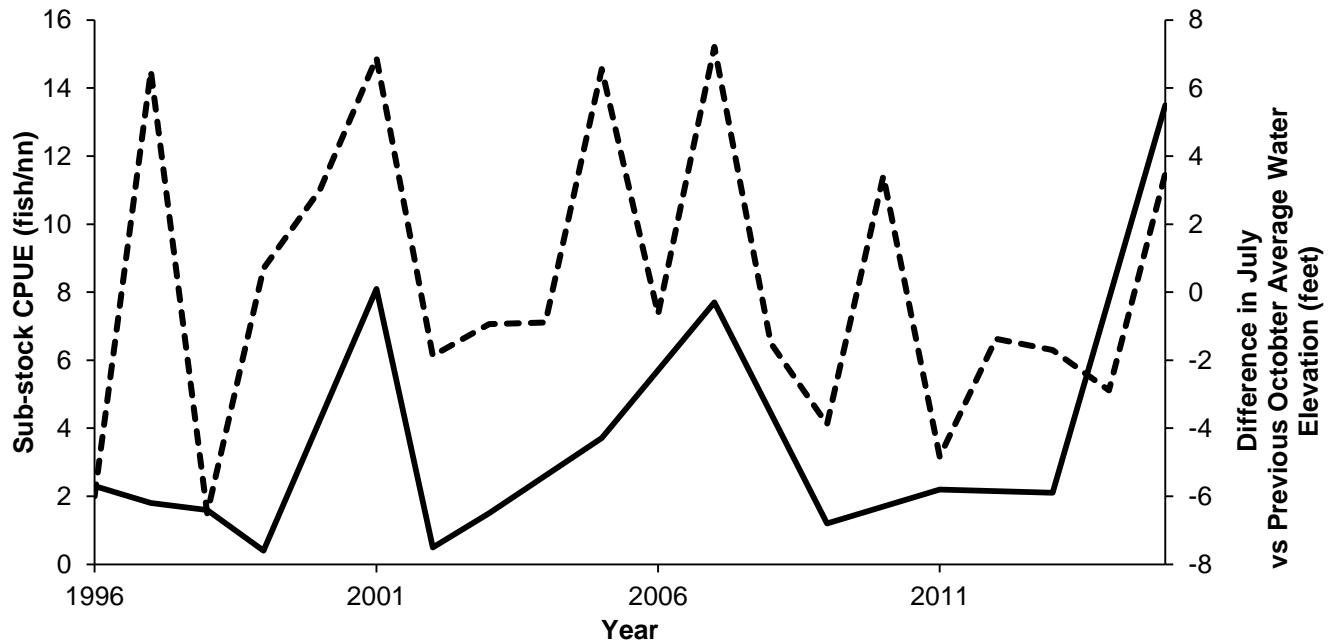


Figure 17. Sub-stock CPUE (fish/nn) of White Crappie (solid line) caught during fall trap netting surveys and difference between July and the previous October mean water level elevations (dashed line; feet above mean sea level [MSL]), Fort Phantom Hill Reservoir, Texas, 1996-2015.

Table 8. Proposed sampling schedule for Fort Phantom Hill Reservoir, Texas. Survey period is June through May. Gill netting surveys are conducted in the spring, while low-frequency electrofishing is conducted in the summer, and electrofishing and trap netting surveys are conducted in the fall. Standard surveys and reporting to be completed are denoted by S; additional surveys are denoted by A.

Survey year	Electrofishing	Trap net	Gill net	Low-frequency electrofishing	Habitat/Vegetation	Access	Creel survey	Report
2016-2017			A				A	
2017-2018	A	A	A	A				
2018-2019							A	
2019-2020	S	S	S		S	S		S

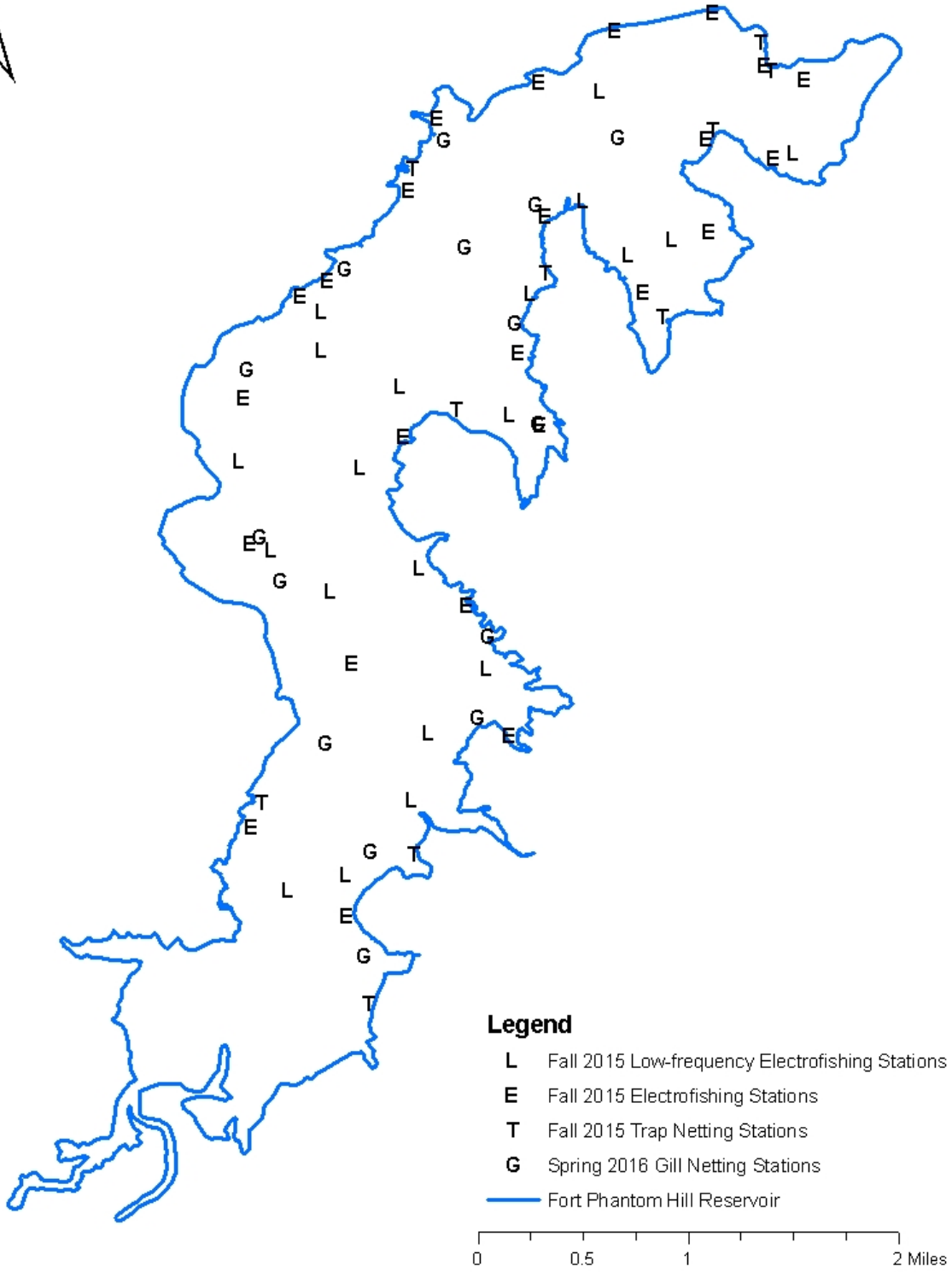
Appendix A

Number (N) and catch rate (CPUE) and associated relative standard error (RSE) of all target species collected from all gear types from Fort Phantom Hill Reservoir, Texas, 2015-2016. Sampling effort was 1 hour for low-frequency electrofishing, 2 hours for electrofishing, 10 net nights for trap netting, and 15 net nights for gill netting.

Species	Low-Frequency Electrofishing		Electrofishing		Gill Netting		Trap Netting	
	CPUE	N/RSE	CPUE	N/RSE	CPUE	N/RSE	CPUE	N/RSE
Gizzard Shad			877.0	1,754/16				
Common Carp ¹			2.0	4/47				
Golden Shiner			0.5	1/100				
Bullhead Minnow			1.0	2/69				
Inland Silverside			35.0	70/33				
River Carpsucker			3.0	6/55				
Blacktail Shiner			0.5	1/100				
Smallmouth Buffalo			1.0	2/100				
Blue Catfish	275.0	275/17			6.5	97/24		
Channel Catfish					0.3	5/63		
Flathead Catfish					0.3	5/48		
White Bass			50.0	100/30	1.5	23/30		
Green Sunfish			10.0	20/41				
Warmouth			2.0	4/59				
Orangespotted Sunfish			4.5	9/45				
Bluegill			211.5	423/18				
Longear Sunfish			146.0	292/25				
Redear Sunfish			1.5	3/55				
Largemouth Bass			78.5	157/15				
White Crappie			19.5	39/40			31.5	315/22
Logperch			0.5	1/100				
Freshwater Drum			26.5	53/31				
Hybrid Striped Bass			17.0	34/50	4.9	74/25		

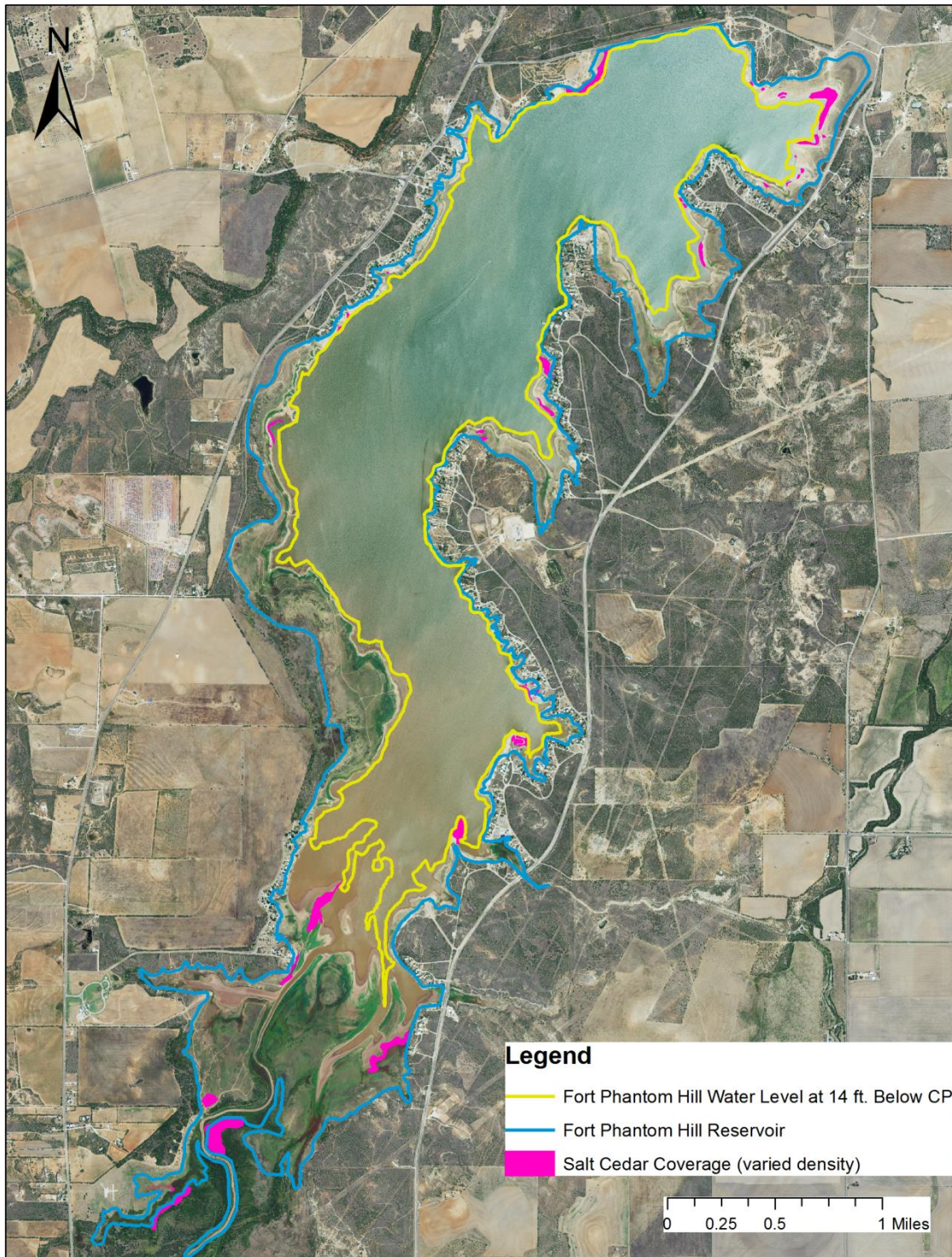
¹ Common Carp ≤ 6 inches

Appendix B



Map of fisheries sampling stations, Fort Phantom Hill Reservoir, Texas, 2015-2016.

Appendix C



Aerial photograph (1:35,000; USDA National Agricultural Imagery Program 2014) and observed salt cedar coverage during a roving survey conducted during summer 2015, Fort Phantom Hill Reservoir, Texas. Water level was approximately 14 ft. below (yellow line) conservation pool elevation (blue line) at the time of the survey.