

Inks Reservoir

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 Inks Reservoir were surveyed in 2017 using electrofishing and in 2018 using gill netting. Historical data are presented with the 2017-2018 data for comparison. This report summarizes the results of the surveys and contains a fisheries management plan for the reservoir based on those findings.

Reservoir Description: Inks Reservoir is a 768-acre impoundment of the Colorado River. It was constructed in 1938 by the Lower Colorado River Authority (LCRA) hydroelectric power, recreation, and water supply. The reservoir is located within the Llano uplift eco-region, and its shoreline length is 20.5 miles. Public access is only available through the state park. This stable-level rocky reservoir has plenty of structural fish habitat and some cover in the form of timber, emergent aquatic vegetation, and artificial fish attractors.

Management History: Sport fish include Largemouth Bass, sunfish species, *Morone* species, and catfish species. Recent management plans have recommended continuing monitoring populations under existing regulations. The Florida subspecies of Largemouth Bass was stocked in the reservoir in the late 1980s and early 1990s to increase Florida Largemouth Bass genetic influence in the population. Channel Catfish have been stocked by the Inks Dam National Fish Hatchery through an agreement with the LCRA or when surplus fish become available. Efforts to develop a trophy Sunshine Bass fishery were started in 2016. Recent efforts to mitigate the loss of fish habitat, due to reservoir aging, have included installing artificial and natural cover habitat, sunfish spawning gravel beds, and underwater green lights.

Fish Community

- **Prey species:** Gizzard Shad, Threadfin Shad, Bluegill, and Redbreast Sunfish were the predominant sources of forage. Shad abundance declined significantly, possibly due to immigrating predators during flood events.
- **Catfishes:** Channel and Blue Catfish were present in low-to-moderate abundance. Flathead Catfish were present in low abundance.
- **Temperate basses:** White Bass abundance remained low since the last survey. Striped Bass and Sunshine Bass have been historically present in low abundance. Immigration from Lake Buchanan during flood releases has been responsible for the Striped and Sunshine Bass population occurring in Inks Reservoir. Both species are stocked at Buchanan Reservoir. A major flood event in 2016 likely accounted for increased immigration from Buchanan Reservoir to establish at Inks. Anecdotal reports of high concentrations of moronid species followed the flood event.
- **Black basses:** Largemouth Bass were present in moderate to high numbers. Total catch rates and catch rates for fish ≥ 14 inches increased, respectively, since the previous survey. Largemouth Bass growth rate remained similar since the last survey. Presence of trophy-size individuals adds an appealing component to the fishery. Inks Reservoir also contained Guadalupe Bass.

Management Strategies: Resume stocking Sunshine Bass fry at low densities, if needed in 2020. Stock Florida Largemouth Bass in 2019. Continue to refurbish aquatic fish habitat sites and promote the fishery. Inform the public about the negative impacts of aquatic invasive species. Conduct additional gill netting surveys in 2019 and 2020, and general monitoring surveys with gill nets and electrofishing in 2021-2022. Access and vegetation surveys will be conducted in 2021.

Introduction

This document is a summary of fisheries data collected from Inks Reservoir in 2015-2018. 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 2015-2018 data for comparison.

Reservoir Description

Inks Reservoir is a 768-acre impoundment of the Colorado River. It was constructed in 1938 by the Lower Colorado River Authority (LCRA) for hydroelectric power, recreation and water supply. Inks Reservoir is eutrophic with a mean TSI chl-*a* of 57.56, which is slightly higher than previous samples (Texas Commission on Environmental Quality 2018). The reservoir is located within the Llano Uplift eco-region, and its shoreline length is 20.5 miles. Public access is only available through Inks Lake State Park. This stable-level, rocky reservoir has plenty of structural fish habitat and some cover in the form of timber, emergent aquatic vegetation, and artificial fish attractors. Native emergent aquatic vegetation consisted mainly of American waterwillow. Water level is maintained stable, but flood events in 2016 lead to short-lived elevated water levels (5 feet above full conservation pool), which caused damage to fish habitat features at the fishing piers. Scheduled drawdowns are put into effect occasionally to allow for shoreline and pier maintenance. Other descriptive characteristics for Inks Reservoir are in Table 1 Table 1.

Angler Access

Inks Reservoir has only one public boat ramp; however, there are private residential access points around the reservoir. The two-lane public ramp is in the state park. Additional boat ramp characteristics are in Table 2. Inks Lake State Park borders the reservoir and provides access to approximately 30 percent of the shoreline. The remaining shoreline has been developed by private property owners or is under the control of LCRA. The state park has ample shoreline access and two fish-habitat-enhanced fishing piers, open 24 hours daily to guests.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (De Jesus and Farooqi 2014) included:

1. Conduct a supplemental gill net survey in 2016 to monitor White Bass abundance and determine if the population rebounded from the 2011-2015 drought conditions.

Action: Supplemental gill netting surveys were conducted in 2015 and 2017, in which White Bass were collected.
2. Promote Inks Lake State Park as a good fishing destination and perform a visitor survey to determine if the fish habitat enhancements attracted anglers.

Action: Inks Lake was promoted as a good fishing destination through social media. It was selected more than once as one of the nation's top 100 lakes for boating and fishing by the Recreational Boating and Fishing Foundation. A visitation survey was administered March through December 2014.
3. Request Florida Bass fingerling stockings in 2015 at a rate of 25/acre to supplement genetic influence for trophy-size fish production.

Action: 20,000 Florida Largemouth Bass were stocked in 2015.
4. Cooperate with management authorities and educate the public on the prevention of the spread of aquatic invasive species.

Action: Worked with the controlling authority to monitor for zebra mussels and install informational signage to create awareness for boaters.

Harvest regulation history: Sport fishes in Inks Reservoir have been managed using statewide regulations (Table 3).

Stocking history: Inks Reservoir was stocked with Sunshine Bass fry in 2016 to jump start a low-density, trophy fishery. Florida Largemouth Bass were stocked in 2015, and Channel Catfish in 2016. Largemouth Bass were first stocked in 1969, while Florida Largemouth Bass in 1989 to increase Largemouth Bass growth potential through genetic influence. Blue Catfish were introduced in 1968. The complete stocking history is in Table 4.

Vegetation/habitat management history: Inks Reservoir has historically had poor submersed aquatic vegetation communities due to its rocky nature, but has periodically supported Eurasian watermilfoil (Tier-3 status) under favorable conditions. An artificial fish habitat program was established to increase fish cover and improve angling success.

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 Inks Reservoir (De Jesus and Farooqi 2014). Primary components of the OBS plan are listed in Table 5. All survey sites were randomly selected (Appendix A) 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 hour at 12, 5-min stations). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing. Ages for Largemouth Bass were determined using otoliths from 13 fish (range 13.0 to 14.9 inches).

Gill netting – Blue Catfish, Channel Catfish, White Bass, and Sunshine Bass were collected by gill netting (10 net nights at 10 stations). CPUE for gill netting was recorded as the number of fish caught per net night (fish/nn).

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). 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.

Habitat – A structural habitat survey was conducted in 2017. A vegetation survey was conducted in 2017. Habitat and vegetation were assessed using the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Results and Discussion

Habitat: Littoral zone structural habitat consisted primarily of natural shoreline and rocky shoreline, followed by bulkhead shoreline in 2017 (Table 6). Aquatic vegetation was present throughout the reservoir, but coverage was well below optimal levels (10% to 30%) for fish production (Durocher 1984 and Dibble 1996). Coverage consisted primarily of three native emergent vegetation species (cattail *Typha* sp., American waterwillow *Justicia americana*, and bulrush *Scirpus* sp.), and accounted for only 6.6 acres (< 1% coverage; Table 7). Non-native submersed Eurasian watermilfoil *Myriophyllum spicatum* was present in trace amounts.

The Lake Buchanan Conservation Corporation (LBCC), a Friends of Reservoirs Chapter, teamed with TPWD to restore existing fish habitat locations with Ashe juniper brush in 2017. The number of fish habitat sites was expanded to 11 locations (Appendix B), with their reference coordinates publicly available on the TPWD website. A lake drawdown in early 2018 allowed the team to restore habitat features at the state park piers, which included clearing gravel beds, adding brush, and replacing underwater green lights with a new LED system.

A state park visitor survey (Appendix C) was developed for Inks Lake State Park to evaluate how much our enhanced habitat structures enticed anglers to fish at Inks Lake. The survey was intended to last a full year, but was restricted to a little over 9 months (March 1, 2014 to December 12, 2014). During this period, 237 completed surveys were submitted by visiting parties. This was a low response rate (0.3%), in relation to the number of visiting vehicles (81,578) estimated during the survey period. Vehicle count was estimated from actual counted visitors (187,630) divided by an average-people-per-vehicle factor of 2.3.

Of the 237 respondents, only 24% (58) were aware of fish habitat enhancements at the lake. However, 56% (132) of respondents had planned to fish during their visit to the park. The remaining portion of the survey only addressed those that claimed that they would fish during their visit (anglers). Of the 132

responding anglers, 43% (57) claimed it was their first time fishing at the state park; 53% (70) said it wasn't their first time fishing at the state park; and 4% (5) didn't respond to the question.

When asked to rate (1 to 5 scale) how much the fish habitat enhancement efforts influenced their decision to fish at the lake; 23% rated 5 (absolutely); 16% rated 4 (a lot); 18% rated 3 (somewhat); 8% rated 2 (very little); 34% rated 1 (not at all); and 3% didn't respond. The average Likert scale reading was 2.9 out of 5, indicating that anglers overall were somewhat influenced to fish by the fish habitat enhancement efforts at Inks Reservoir.

When asked to reveal which enhanced habitat structures they would target during that visit; 21% said the north pier; 22% said the south pier; 13% said open water structures (brush piles); 27% said a combination of structures; 17% said none of the enhanced structures; 13% didn't respond to the question. Overall, 83% of responding anglers targeted enhanced fish habitat features during their visit.

ZIP code data from responding anglers revealed that most anglers resided within a 100-mile radius of the reservoir (Appendix D). Only one out-of-state angler responded to the survey.

Prey species: Electrofishing catch rate of Gizzard Shad was 75.0/h, approximately half of what was collected in previous surveys (Figure 1). Index of Vulnerability (IOV) for Gizzard Shad was poor, indicating that 0% of Gizzard Shad were available to existing predators. IOV estimates have always been low. Total CPUE of Threadfin Shad was also low (2.0/h; Appendix E) compared to previous surveys. A reduction in relative abundance of shad species might indicate an impact from a potentially-significant increase in pelagic predators immigrating from Buchanan Reservoir during a 2016 flood event, when 3 flood gates were opened on Buchanan Dam. Anecdotal angler reports mention large numbers of moronids establishing in the reservoir after the flood event. Total CPUE of Redbreast Sunfish and Bluegill were 264.0/h and 337.0/h, respectively. Redbreast relative abundance remained similar to previous surveys (Figure 2), while Bluegill relative abundance almost doubled from the previous survey (Figure 3). Inks Reservoir has a history of producing a diverse, abundant sunfish population, with large (>7 inches) individuals available for anglers to target. Other sunfish species collected were Redear Sunfish, Longear Sunfish, Redspotted Sunfish, Green Sunfish, and Warmouth. (Appendix A).

Channel Catfish: The gill net catch rate of Channel Catfish was 0.4/nn in 2018 (Figure 4), decreasing since it peaked in 2010 at 5.4/nn. Historically, Channel Catfish relative abundance has been low in this reservoir: so, occasional supplemental stockings by the local federal fish hatchery have been approved in hopes of helping with occasional bumps in abundance. So far, our sampling efforts haven't registered a bump in relative abundance. Like the large sunfishes, this species presents harvest opportunities for state park bank anglers seeking a fresh fish meal during their camping experiences.

White Bass: White Bass relative abundance seems to be recovering from prolonged drought impacts reported in De Jesus and Farooqi (2014), when a historic low catch rate of 0.6/nn was recorded. The impact followed a stretch of surveys showing an increasing relative abundance trend to historic highs (Appendix F). Additional gill netting surveys in 2015 and 2017 revealed total CPUE values of 4.4/nn and 1.3/nn, respectively. The standard gill netting survey in 2018 revealed no change in relative abundance since 2017, with a 1.3/nn catch rate also recorded (Figure 5). This indicates that there are still breeding individuals in the population even though a year-class-strength study in 2015 revealed that recruitment was below expected levels during the drought years (Appendix G).

Largemouth Bass: The electrofishing catch rate of stock-length Largemouth Bass was 112.0/h in 2017, an increase from 67.8/h in 2013 (Figure 6). Size structure in 2017 remained similar to the 2013 survey as PSD was 51, versus 49 recorded in 2013. Memorable- and trophy-size individuals have been consistently captured during standard and non-standard electrofishing surveys, and reported by anglers during bass tournaments and through the angler recognition program in recent years; indicating the opportunity for trophy Largemouth Bass fishing. Body condition in 2017 was adequate (W_t exceeded 90) for most size classes of fish, and was similar to body condition in previous surveys (Figure 6). Growth of Largemouth Bass in Inks Reservoir was also good; average age at 14 inches of length was between 2 and 3 years ($N = 13$; range = 1 – 3 years; Figure 7). Florida Largemouth Bass were stocked in 2015, but

a genetic analysis was not conducted in 2017. However, De Jesus and Farooqi (2014) reported Florida Largemouth Bass influence declined from from 75% in 2009 to 26% in 2013.

Sunshine Bass: In 2016, 30,000 Sunshine Bass fry were stocked into Inks Reservoir to pilot a low-density, trophy fishery management approach. Within a few weeks of the stocking, torrential rain events led to flood conditions in the Colorado River Basin. Three floodgates at Buchanan Dam were opened to pass flood waters downstream. Sporadic flood events have historically replenished the lake with low numbers of Striped Bass and Hybrid Striped Bass at Inks Reservoir. As a eutrophic system, shad production was adequate to sustain the low densities of Morone species. With seemingly low directed effort and harvest rates, these fish have been able to grow to trophy sizes at Inks Reservoir, as reported by anglers and found during non-standard surveying. These observed results encouraged our new management approach. The 2016 flood event was greater than normal, potentially causing high rates of Morone immigration from Buchanan Reservoir. Anecdotal reports by anglers suggest that this might have been the case. High abundance of Sunshine Bass would likely deviate the management direction, so an additional general monitoring gill net survey was conducted in 2017 to determine Sunshine Bass presence/abundance at Inks Reservoir. Ten net nights of effort failed to capture a single Sunshine Bass in 2017. Similar gill netting efforts in 2018 only led to the capture of one Sunshine Bass (Figure 8). The possibility exists that Sunshine Bass (especially the stocked fry) at Inks Reservoir could have emigrated the lake during these same flood events, somewhat leveling off immigration impacts from Buchanan Reservoir. Exploratory gill netting would have helped us determine future sampling goals, but with recent negative results, we will have to continue general monitoring. Age at length was not evaluated as planned, due to just one specimen collected.

Fisheries Management Plan for Inks Reservoir, Texas

Prepared – July 2018

ISSUE 1: Angler reports and non-standard fish surveys have shown trophy-size (≥ 25 inches) Sunshine Bass have been produced at Inks Reservoir under low abundance and low harvest rates. TPWD has considered managing for a harvest-restricted, trophy Sunshine Bass fishery at Inks Reservoir. The Lake Buchanan Conservation Corporation (LBCC) is willing to partner with TPWD to help sustain the Sunshine Bass fishery via stockings, as part of the new management scheme. Thirty-thousand Sunshine Bass fry were stocked into Inks Reservoir in 2016 to pilot this management approach. Unfortunately, a hundred-year flood event potentially led to significant immigration of Sunshine Bass and Striped Bass from Buchanan Reservoir, according to angling reports. A decrease in shad abundance was observed during the last electrofishing survey. Low forage availability would impede practical growth. The potential shift of predator/prey ratio has posed challenges to the progress of the trophy management approach.

MANAGEMENT STRATEGIES

1. Conduct additional general monitoring gill netting surveys in 2019 and 2020 to determine Sunshine Bass presence and relative abundance. Increase sampling effort to 15 net nights.
2. Conduct an additional electrofishing survey in fall 2018 to look at prey abundance.
3. Permit the LBCC to stock Sunshine Bass fry in 2020 only if sampling or angling reports indicate low relative abundance.
4. Evaluate the need to propose a restrictive harvest limit for Sunshine Bass to protect fish through trophy size.

ISSUE 2: Inks Reservoir has the potential to produce memorable and trophy-size Largemouth Bass, as confirmed by our historic survey results, recent tournaments, and angler recognition entries at the state park. Florida Largemouth Bass genetic influence within our samples has plummeted from 75% to 26% in 2014. With constant water levels, improved aquatic fish habitat, and high sunfish forage abundance, conditions are favorable for supplemental stockings of Florida Largemouth Bass to help increase the genetic influence for growth potential within the population. In 2015, 20,000 Florida Largemouth Bass were stocked to increase the potential to produce larger fish at Inks Reservoir, but genetic analysis was not conducted in 2017.

MANAGEMENT STRATEGIES

1. Collect genetic samples from 30 Largemouth Bass during an additional electrofishing survey in 2018 and the 2021 standard fall electrofishing survey.
2. Request Florida Largemouth Bass fingerling stockings in 2019 at a rate of 25/acre.

ISSUE 3: Inks Lake State Park offers the only public access to Inks Reservoir. Excellent bank and pier access for anglers is available within Inks Lake State Park. Plans to develop new access points (ramps and piers) are underway. State Parks leadership has requested fisheries expertise to guide them through this process. Elaborate habitat and pier enhancement projects were completed to improve angling opportunities at the reservoir;

yet, they require ongoing restoration due to degradation. Electrofishing surveys revealed the effectiveness of these enhancements. A visitor survey suggested that 84% of anglers utilized these enhanced fish habitat sites when fishing at Inks Reservoir.

MANAGEMENT STRATEGIES

1. Continue to partner with the local Friends of Reservoirs chapter and state park to restore existing or create new fish habitat sites around the lake.
2. Support Inks Lake State Park leadership with fisheries expertise to help them develop the best-possible fishing and boating access amenities at the state park.
3. Continue to promote Inks Lake State Park as a great fishing destination.

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 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 fish, forage fish, and other important fishes

Sport fishes in Inks Reservoir include Largemouth Bass, Guadalupe Bass, Sunshine Bass, White Bass, White Crappie, Black Crappie, Channel Catfish, Blue Catfish and Flathead Catfish. Forage fish species include Gizzard Shad, Threadfin Shad, Redbreast Sunfish, and Bluegill.

Low-density or underutilized fisheries

Blue Catfish: Blue Catfish are present in low density at Inks Reservoir. The gill net catch rate of Blue Catfish ranged between 1.4/nn to 4.4/nn since 2006. All individuals were of harvestable size (≥ 12 inches); and exhibited good condition ($W_r \geq 85$) at all lengths during the last survey in 2018. Trophy-size specimens have been recorded caught by anglers in previous years, but effort is expected to be low for this species. General monitoring with no established sampling objectives during targeted gill netting for Sunshine Bass will be sufficient for this species.

Channel Catfish: Channel Catfish are present in low density at Inks Reservoir, based on relevant abundance estimates from our monitoring program. The gill net catch rate of Channel Catfish ranged between 0.4/nn to 5.5/nn since 2006. All individuals were of harvestable size (≥ 12 inches); and exhibited good condition ($W_r \geq 85$) at all lengths during the last surveys in 2017 and 2018. Channel Catfish can provide state park campers an option for those who might want to make a meal out of their fresh catch. However, directed effort for this species is expected to be low overall. General monitoring with no established sampling objectives during targeted gill netting for Sunshine Bass will be sufficient for this species.

Flathead Catfish: Flathead Catfish are present in low density at Inks Reservoir. Large specimens have been caught by anglers in previous years, but effort is expected to be low for this species. General monitoring with no established sampling objectives during targeted gill netting for Sunshine Bass will be sufficient for this species.

Guadalupe Bass: Guadalupe Bass are present in low density in Inks Reservoir, based on historic electrofishing catch rates. Few anglers, if any, target them at this reservoir. General monitoring with no established sampling objectives during targeted electrofishing for Largemouth Bass will be sufficient for this species.

White Bass: White Bass offer seasonal fishing opportunities at Inks Reservoir. The spring spawning run has been a popular option for locals and state park visitors. A year-class strength evaluation completed in 2015 confirmed low recruitment during drought years. Supplemental and standard gill netting in 2017 and 2018, respectively, revealed that White Bass were present in low density and potentially recovering with recent elevated flows. Still, this fishery is less lucrative than the nearby White Bass fishery at Buchanan Reservoir, just above Inks Reservoir. Most White Bass anglers in the region direct their efforts at Buchanan Reservoir. The fluctuating nature of this population in a small reservoir makes it hard to monitor with precision. General monitoring with no objectives or precision during targeted gill netting for Sunshine Bass will be sufficient for this species.

Crappie: White and Black Crappie are present in low densities at Buchanan Reservoir. Historic trap netting surveys failed to capture enough fish to generate a confident estimate. Gill netting and electrofishing have confirmed their presence, but never at rates worthy of confidence. Some anglers report catching them off habitat structures in the lake, but directed effort is expected to be low for this species. Directed sampling effort for this population is not a priority; however, field observations will be taken during multiple sampling techniques at the reservoir and from angling reports.

Survey objectives, fisheries metrics, and sampling objectives

Sunshine Bass: Sunshine Bass fry were stocked into Inks Reservoir in 2016 by the Lake Buchanan Conservation Corporation with TPWD approval. The effort was to help establish a low-density trophy fishery, geared towards a catch-and-release experience. The lake has shown high trophic levels that support a healthy shad community. Historic immigration from Buchanan Reservoir have hinted that these hybrids perform well in low abundance along with low directed effort and harvest at Inks Reservoir. Reports of trophy-size specimens have been documented often at the reservoir. A significant flood event in 2016 caused the management authority to open several flood gates at the Buchanan Dam for several days, potentially allowing for significant emigration of temperate basses into Inks Reservoir. Angler reports of increased catch rates for Sunshine Bass and Striped Bass after the flood triggered a supplemental gill netting survey in spring 2017. While we didn't sample Sunshine Bass during the 10 net nights set, we did collect 7 Striped Bass (0.7/nn), which did not deviate significantly from values seen during historic surveys. The standard survey in 2018 only captured one Sunshine Bass (0.1/nn). Many fish caught by anglers after the flood were reported as "very skinny," causing concern about potential predator overstock in the system. Extra monitoring will be required to determine relative abundance more precisely and help refocus our management objective.

Historic gill netting surveys have never captured Sunshine Bass at Inks Reservoir despite their known presence from angler reports and electrofishing efforts; so, determining a catch objective would be difficult. A general monitoring effort of 15 gill nets will be conducted in spring 2019 and 2020 to try to determine relative abundance and condition.

Age and growth of all Sunshine Bass collected will be assessed to determine survival of stocked year classes (Category 1 evaluation, TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Largemouth Bass: Largemouth Bass is one of the most targeted species by anglers at Inks Reservoir. The reservoir does attract small bass tournaments, while historic electrofishing surveys and angler recognition entries at the park reveal the availability of trophy-sized individuals. Trend data on CPUE, size structure, and body condition have been collected every four years since 2001 with fall nighttime electrofishing. The survey in 2013 revealed the highest total CPUE and CPUE-21 ever. A 12.5-pound fish was officially weighed at the state park's official weigh station in February 2017. This fish became the new lake record. An extensive effort to deploy a network of fish habitat/attractor sites around the reservoir will likely augment catch opportunities for bass and attract bass anglers to the reservoir.

After reviewing historical data, electrofishing catch rates of stock-size Largemouth Bass since 1999 (except in 2005) were sufficient to meet minimal objectives in 12 stations, which should result in a mean weighted CV of 0.25 or less. A minimum of 12 randomly selected 5-min electrofishing sites will be sampled in 2021, but sampling will continue at random sites until 50 stock-size fish are collected and the RSE of CPUE-S is ≤ 25 . Exclusive of the original 12 random stations, 6 additional random stations will be pre-determined in the event some extra sampling is necessary the same evening. If failure to achieve either objective has occurred after 18 stations, and objectives can be attained with up to 6 additional random stations, another night of effort will be expended, to complete a total of 24 stations.

An age and growth sample of 13 fish between 13.0 and 14.9 inches in length will be collected to assess the time required for Largemouth Bass to grow to the minimum length limit (Category 2 evaluation, TPWD, Inland Fisheries Division, unpublished manual revised 2015).

A genetic sample from 30 fish from the span of the reservoir will be collected to determine Florida Largemouth Bass influence in the population (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Gizzard Shad, Threadfin Shad, and sunfishes: Gizzard Shad, Threadfin Shad, Redbreast Sunfish, and Bluegill are the primary forage at Inks Reservoir. Like Largemouth Bass, trend data on CPUE and size structure of these sunfish have been collected every four years since 2001. Abundance of Threadfin Shad was also measured as a function of CPUE during those surveys, and will remain the main sampling

objective to measure Threadfin Shad abundance. Continuation of sampling, as per Largemouth Bass above, will allow for monitoring of large-scale changes in sunfish relative abundance and size structure. Sampling effort based on achieving sampling objectives for Largemouth Bass will result in sufficient numbers of sunfish for size structure estimation (PSD and IOV; 50 fish minimum at 5-12 stations with 80% confidence) but not for relative abundance estimates ($RSE \leq 25$ of CPUE-Total; anticipated effort is 25-30 stations). At the sampling effort needed to achieve sampling objectives for Largemouth Bass, the expected RSE for CPUE-T is 30 for sunfish species combined. No additional effort will be expended to achieve an RSE25 for CPUE of sunfish. Instead, Largemouth Bass body condition could indirectly gauge forage availability. Relative weight of Largemouth Bass ≥ 8 inches TL will be determined from their length/weight data (maximum of 10 fish weighed and measured per inch class).

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Tables and Figures

Table 1. Characteristics of Inks Reservoir, Texas.

Characteristic	Description
Year constructed	1938
Controlling authority	LCRA
Counties	Burnet and Llano
Reservoir type	Colorado River mainstem
Shoreline Development Index	10.8
Conductivity	365 μ S/cm

Table 2. Boat ramp characteristics for Inks Reservoir, Texas, September 2017. Reservoir elevation at time of survey was 887 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Inks Lake State Park	30.74306 -98.36744	Y	18	882	Good

Table 3. Harvest regulations for Inks 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, Striped and their hybrids	5 (in any combination)	18-inch minimum
Bass, Largemouth	5 ^a	14-inch minimum
Bass: Guadalupe	5 ^a	None
Crappie: White and Black Crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum

^a Daily bag for Largemouth Bass and Guadalupe Bass = 5 fish in any combination.

Table 4. Stocking history of Inks Reservoir, Texas. FGL = fingerling; AFGL = advanced fingerling; ADL = adults; UNK = unknown life stage/size.

Species	Year	Number	Life Stage	Mean TL (in)
Blue Catfish	1968	4,000	UNK	UNK
	Total	4,000		
Channel Catfish	1969	45,100	AFGL	7.9
	1971	28,000	AFGL	7.9
	1984	5,487	AFGL	11.0
	1986	12,448	AFGL	8.0
	1987	1,957	AFGL	11.0
	1994	3,080	ADL	14.0
	2000	1,250	ADL	13.0
	2006	111	ADL	24.0
	2011	363,109	FRY	0.8
	2013	12,469	AFGL	4.6
	2015	100,000	FRY	1.0
	2016	50,624	FGL	1.1
	Total	623,635		
Coho Salmon	1974	1,245	UNK	UNK
	Total	1,245		
Florida Largemouth Bass	1989	9,389	FGL	2.0
	1989	4,648	FRY	1.0
	1991	80,480	FGL	1.2
	2015	20,000	FGL	1.6
	Total	114,517		
Largemouth Bass	1969	200,000	UNK	UNK
	1988	25,000	FRY	1.0
	Total	225,000		
Muskellunge	1976	70	UNK	UNK
	Total	70		
Northern Pike	1974	4,212	UNK	UNK
	Total	4,212		
Palmetto Bass (Striped X White Bass hybrid)	1978	4,950	UNK	UNK
	1980	12,350	UNK	UNK
	1984	16,148	FGL	2.0
	1986	32,105	FRY	1.0
	Total	65,553		
Rainbow Trout	1974	4,293	UNK	UNK
	Total	4,293		
Striped Bass	1983	8,010	UNK	UNK
	1991	34,200	FGL	1.2

Species	Year	Number	Life Stage	Mean TL (in)
	1991	86,250	FRY	1.0
	Total	128,460		
Sunshine Bass (White Bass x Striped Bass hybrid)	2016	30,000	FRY	0.2
	Total	30,000		
Walleye	1976	10,000	FRY	0.2
	1978	4,067,000	FRY	0.2
	Total	4,077,000		

Table 4. Objective-based sampling plan components for Inks Reservoir, Texas 2017–2018.

Gear/target species	Survey objective	Metrics	Sampling objective
<i>Electrofishing</i>			
Largemouth Bass	Abundance	CPUE–Stock	RSE–Stock ≤ 25
	Size structure	PSD, length frequency	$N \geq 50$ stock
	Age-and-growth	Age at 14 inches	$N = 13, 13.0 - 14.9$ inches
	Condition	W_r	10 fish/inch group (max)
Bluegill ^a	Abundance	CPUE–Total	RSE ≤ 25
	Size structure	PSD, length frequency	$N \geq 50$
Gizzard Shad ^a	Abundance	CPUE–Total	RSE ≤ 25
	Size structure	Length frequency	$N \geq 50$
	Prey availability	IOV	$N \geq 50$
<i>Gill netting</i>			
Sunshine Bass	Abundance	CPUE–Total	General monitoring
	Age-and-growth	Age at any size	All fish

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

Table 5. Survey of structural habitat types, Inks Reservoir, Texas, 2017. Shoreline habitat type units are in miles and standing timber is acres.

Habitat type	Estimate	% of total
Bulkhead	0.2 miles	0.9
Bulkhead with boat docks	6.4 miles	30.5
Natural	9.0 miles	43.0
Rocky	4.2 miles	10.0
Standing timber	10.0 acres	1.3

Table 6. Survey of aquatic vegetation, Inks Reservoir, Texas, 2014–2017. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Vegetation	2014	2015	2016	2017
Native submersed	-	-	-	0.2 (0.03)
Native emergent	-	-	-	6.7 (0.86)
Non-native	-	-	-	
Eurasian watermilfoil (Tier III)*				Present in minor quantity

*Tier III is Watch Status

Gizzard Shad

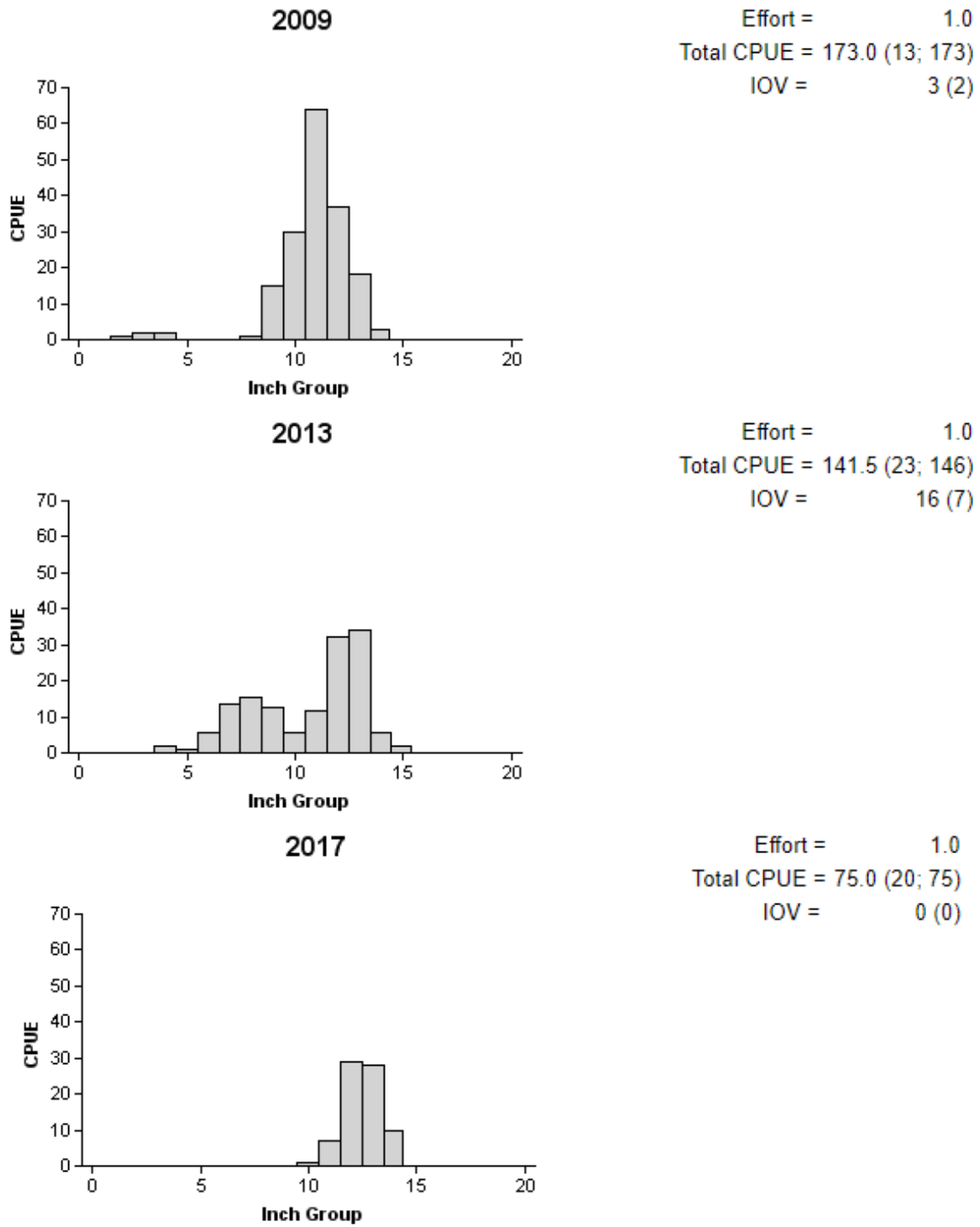


Figure 1. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Inks Reservoir, Texas, 2009, 2013, and 2017.

Redbreast Sunfish

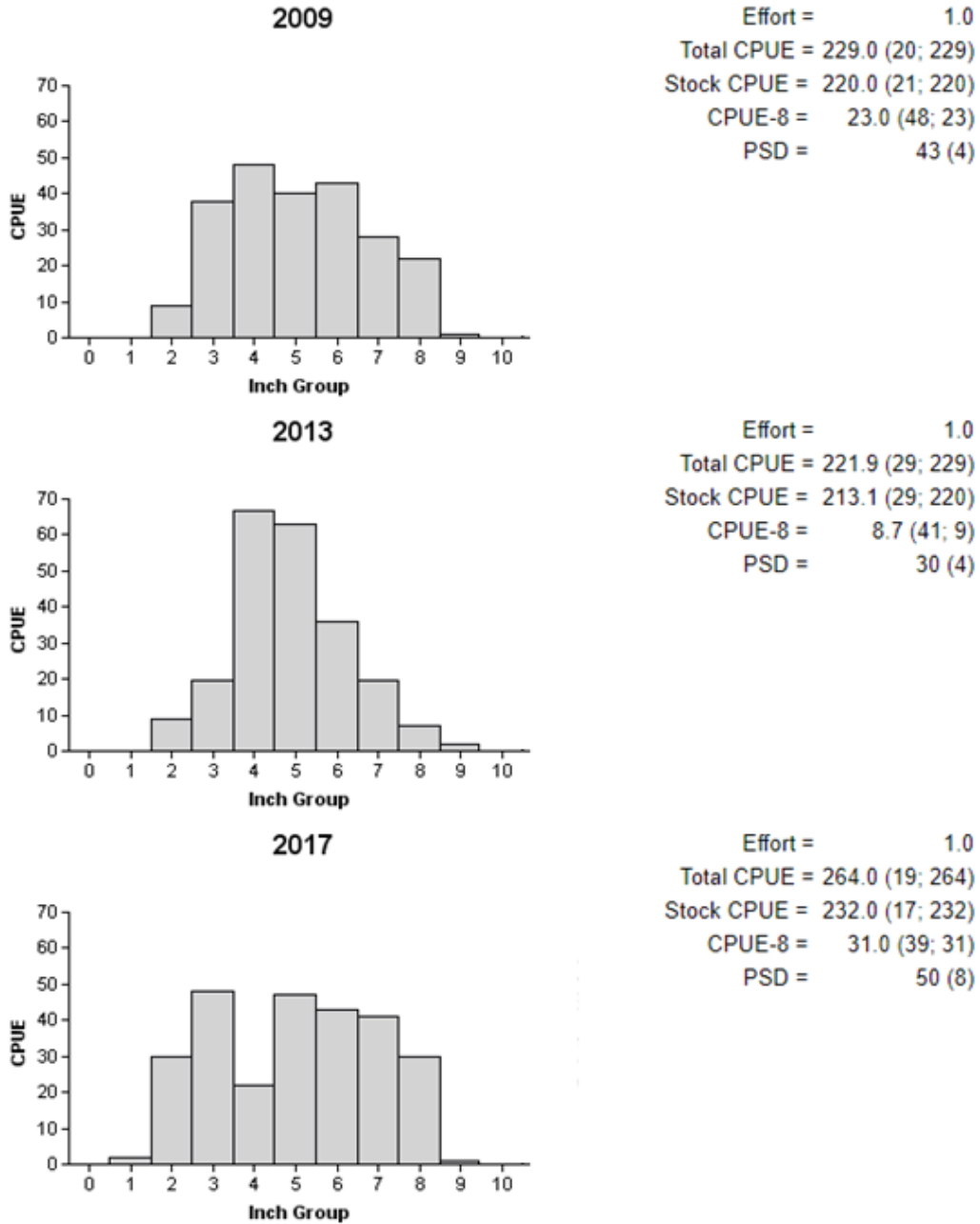


Figure 2. Number of Redbreast Sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Inks Reservoir, Texas, 2009, 2013, and 2017.

Bluegill

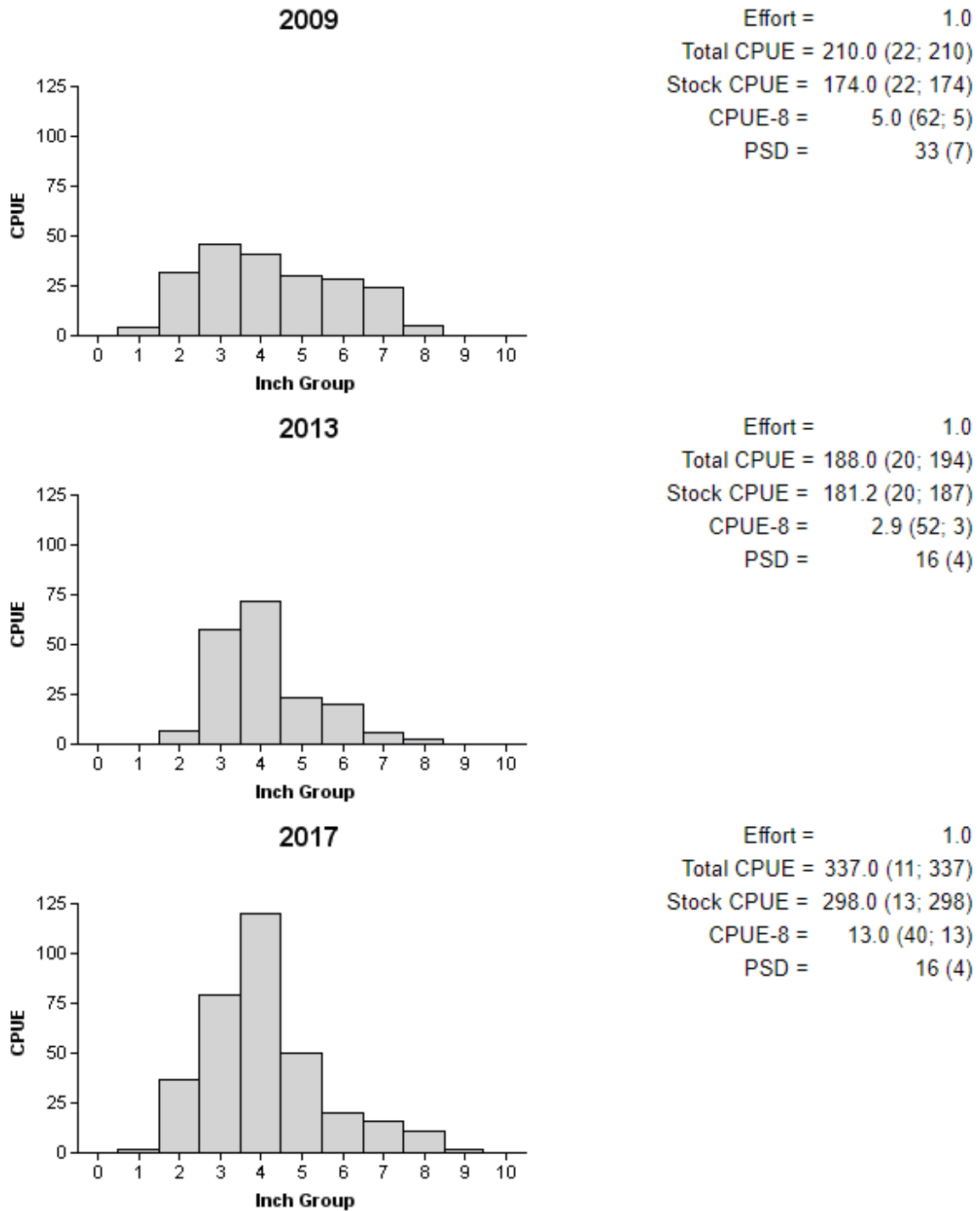


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Inks Reservoir, Texas, 2009, 2013, and 2017.

Channel Catfish

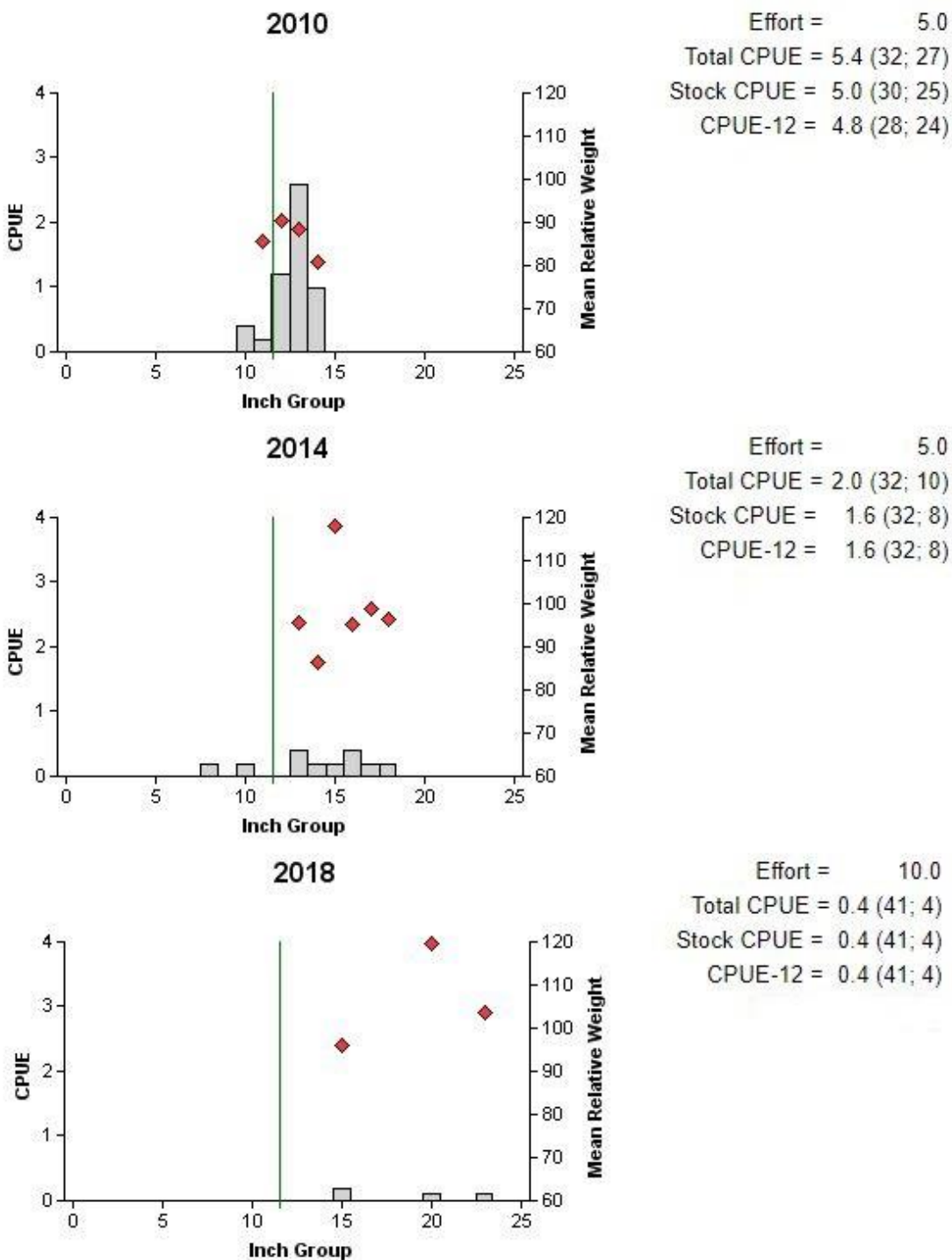


Figure 1. Number of Channel Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE are in parentheses), mean relative weight (diamonds), for spring gill net surveys, Inks Reservoir, Texas, 2010, 2014, and 2018. Vertical line represents minimum length limit at the time of survey.

White Bass

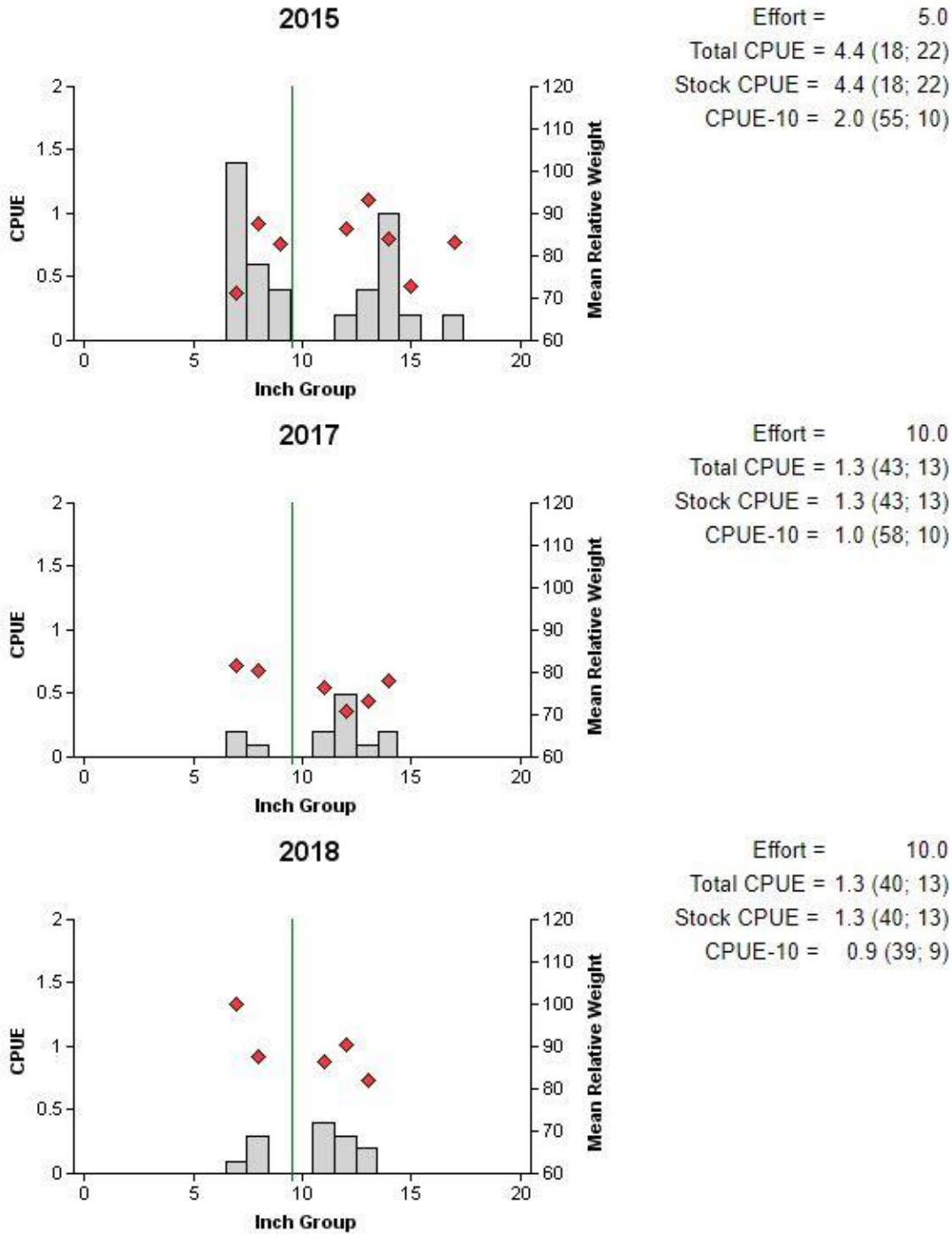


Figure 5. Number of White Bass caught per net night (CPUE) and population indices (RSE and N for CPUE are in parentheses), mean relative weight (diamonds), for spring gill net surveys, Inks Reservoir, Texas, 2015, 2017, and 2018. Vertical line represents minimum length limit at the time of survey.

Largemouth Bass

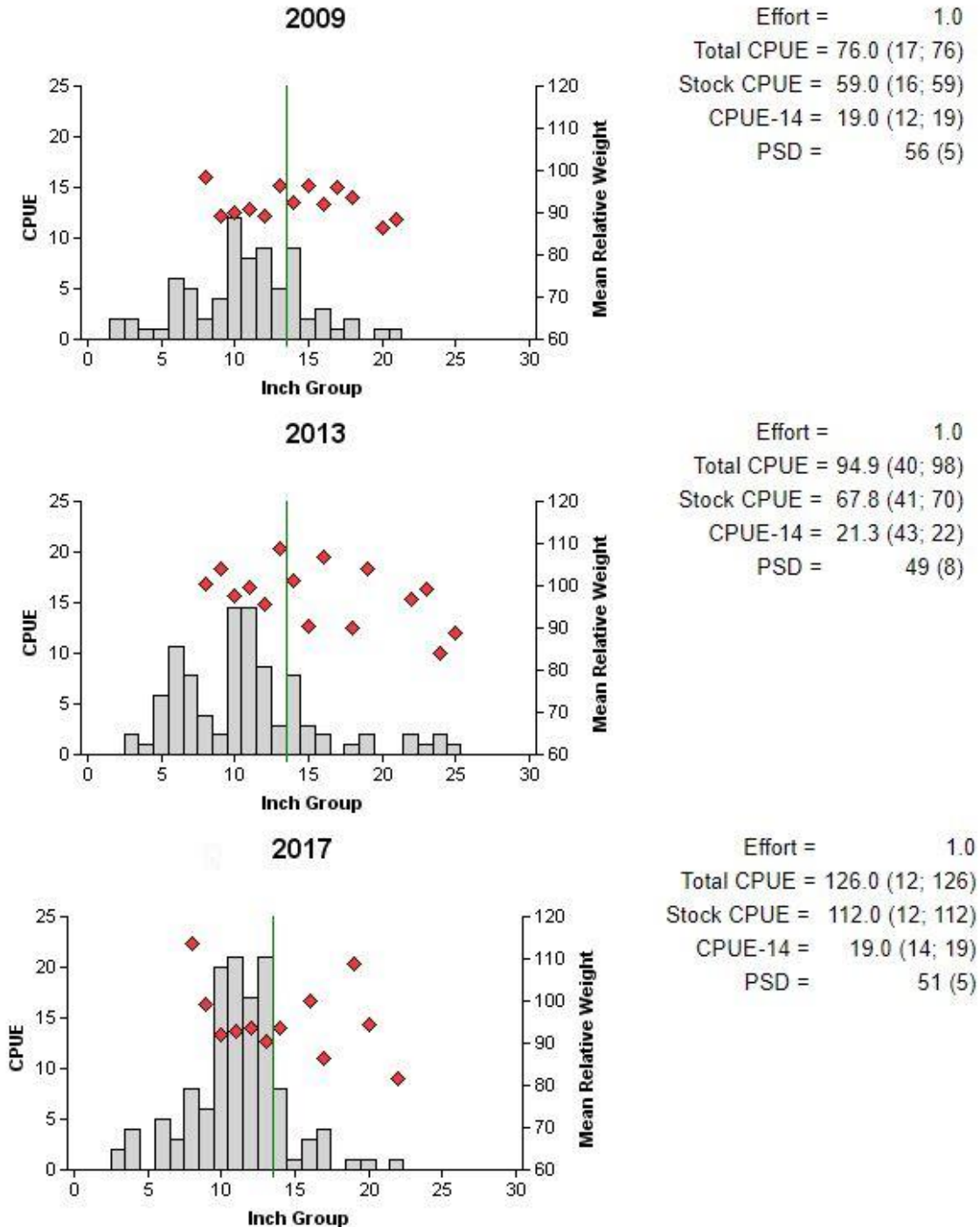
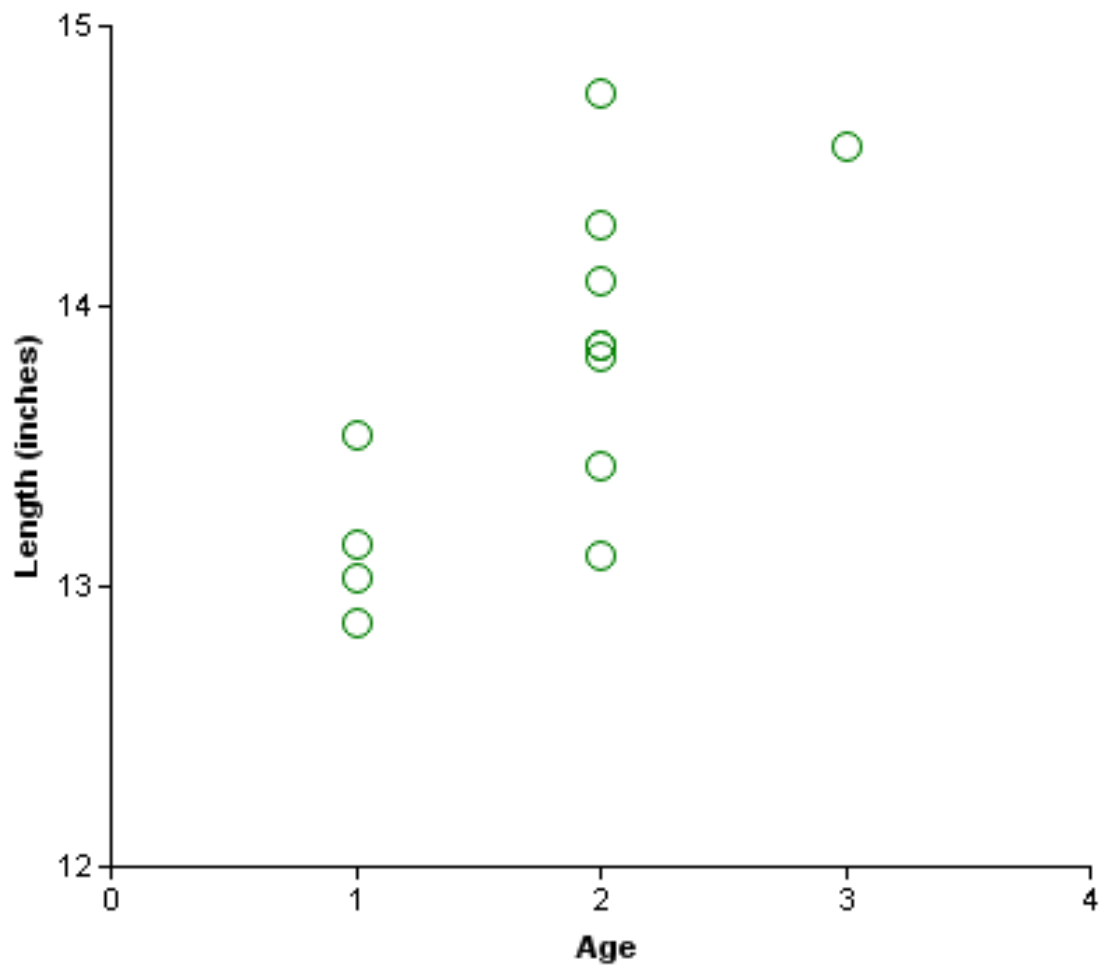


Figure 6. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Inks Reservoir, Texas, 2009, 2013, and 2017. Vertical line represents minimum length limit at the time of survey.

Largemouth Bass



Total Length	Survey Year	Age	Number of Fish
13.149606	2017	1	4
13.902558	2017	2	8
14.566929	2017	3	1

Figure 7. Length at age for Largemouth Bass collected (N = 13; range = 13.0 to 14.9 inches) from electrofishing at Inks Reservoir, Texas, November 2017.

Sunshine Bass

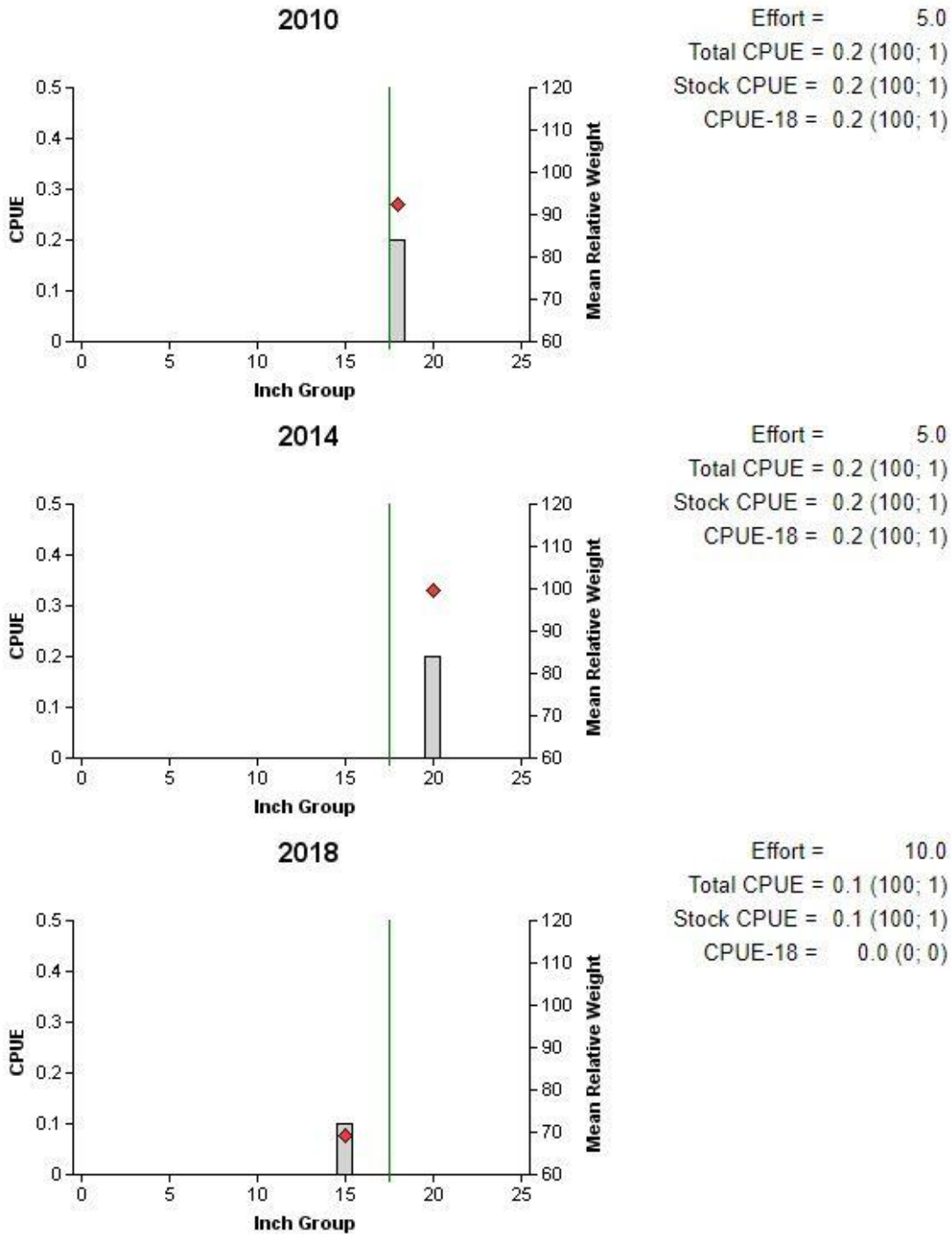


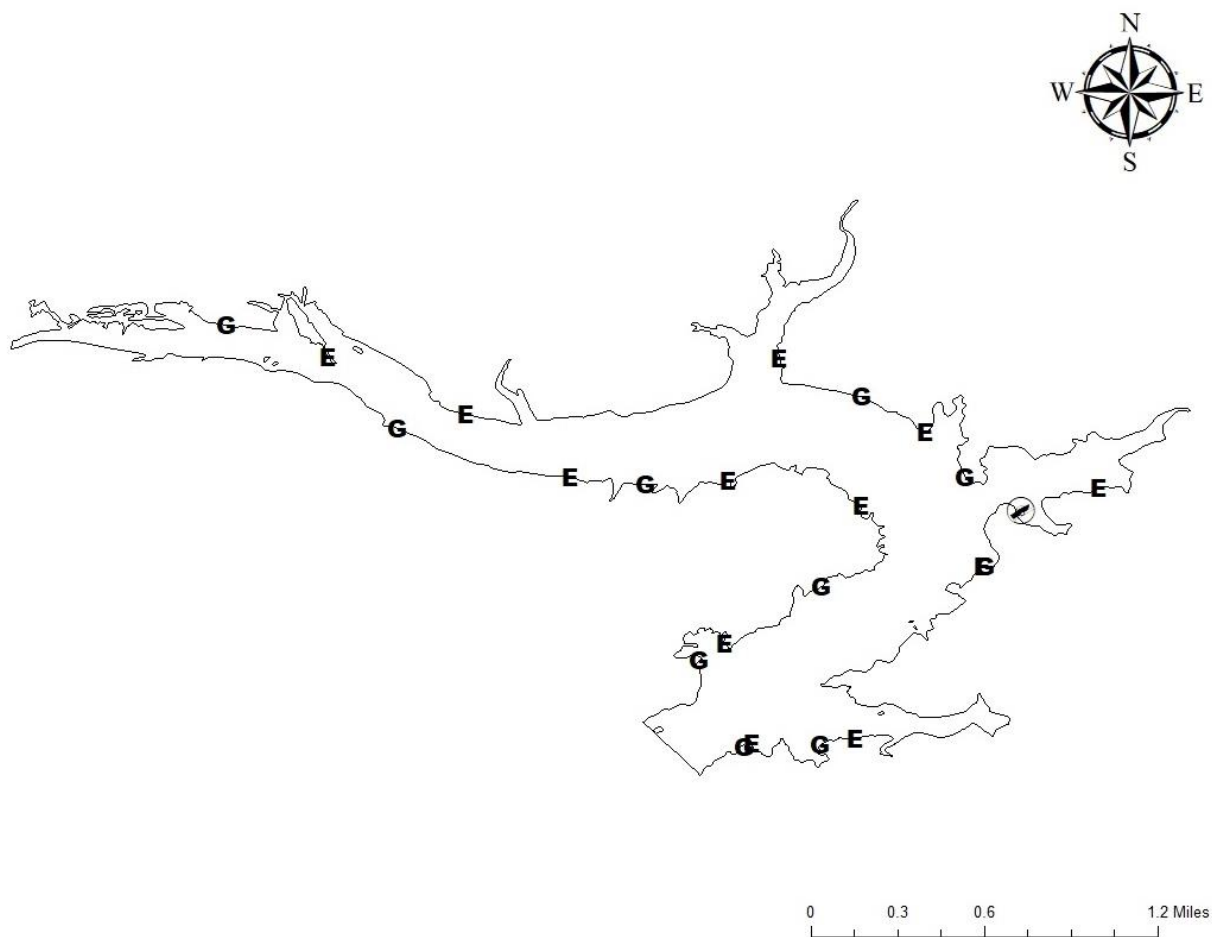
Figure 8. Number of Sunshine Bass caught per net night (CPUE) and population indices (RSE and N for CPUE are in parentheses) for spring gill net surveys, Inks Reservoir, Texas, 2010, 2014, and 2018. No Sunshine Bass were sampled during the 2017 survey. Vertical line represents minimum length limit at the time of survey.

Proposed Sampling Schedule

Table 8. Proposed sampling schedule for Inks Reservoir, Texas. Survey period is June through May. Gill netting surveys are conducted in the spring, while electrofishing is conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

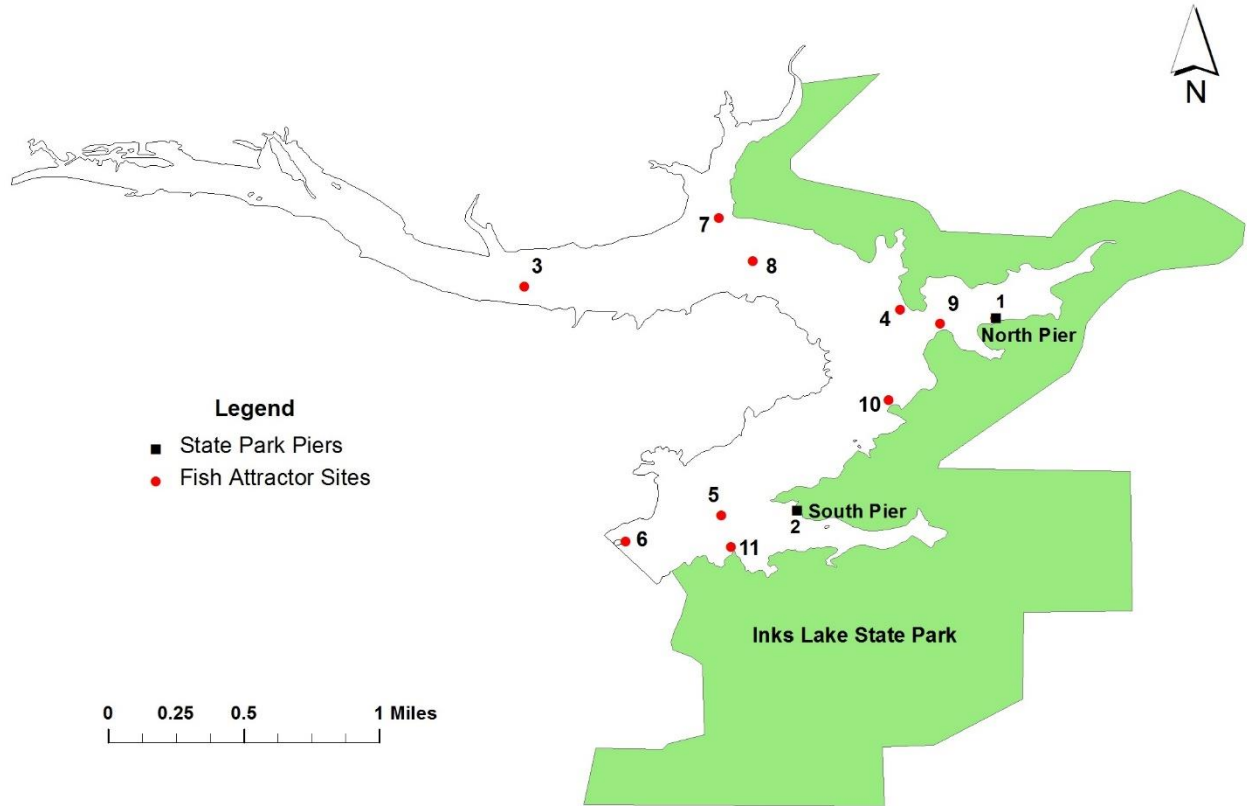
	Survey year			
	2018-2019	2019-2020	2020-2021	2021-2022
Angler Access				S
Structural Habitat				S
Vegetation				S
Electrofishing – Fall	A			S
Electrofishing – Spring				
Electrofishing – Low frequency				
Trap netting				
Gill netting	A	A		S
Baited tandem hoop netting				
Creel survey				
Report				S

APPENDIX A – Map of sampling locations



Location of sampling sites, Inks Reservoir, Texas, 2017-2018. Gill net, and electrofishing stations are indicated by G and E, respectively. Public boat ramp marked by boat symbol. Water level was near full pool at time of sampling.

APPENDIX B – Artificial Fish Habitat Enhancement Sites



Location of fish habitat improvement sites at Inks Reservoir, Texas. Red dots mark submersed brush pile and artificial attractor locations, while black squares mark the north pier, enhanced with brush, gravel beds; and the south pier, enhanced with underwater green LED lights and artificial attractors.

APPENDIX C – Inks Lake State Park visitation survey form

Inks Lake State Park Entry Survey

Please take a minute to fill out this short survey upon park registration. This information will help evaluate enhancement projects at this park. Thank you for participating.

DATE _____

ZIP CODE _____

1. Are you aware of recent fishery enhancement projects performed at Inks Lake by Texas Parks and Wildlife Department?

Yes or No

2. Is fishing a planned activity during this visit at Inks Lake State Park?

Yes or No

(If “Yes”, please continue survey)

3. Which enhancement site(s) are you planning to fish? (Check all that apply)

Open-water brushpile fish attractors (accessible by boat only)

North pier brushpile and gravel bed fish attractors

South pier underwater green lights

None of the above

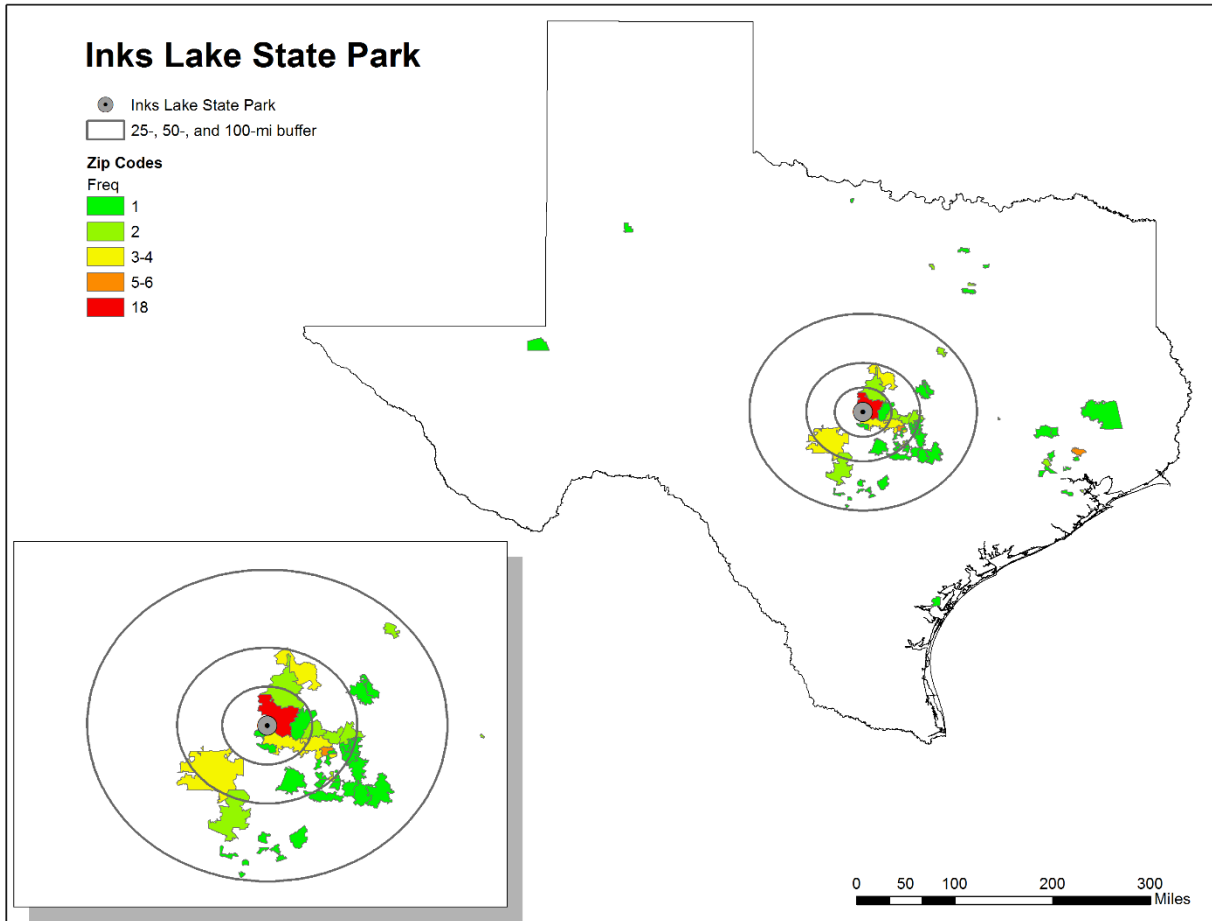
4. Will this be your first time fishing at Inks Lake State Park?

Yes or No

5. Rate how much the presence of enhanced fishing structures influenced your decision to fish during your visit to Inks Lake State Park today? (1 = not at all; 3 = somewhat; 5 = most definitely)

1 2 3 4 5

APPENDIX D – Inks Lake State Park visitation survey ZIP code data



Inks Lake State Park angling visitors ZIP code distribution, gathered from visitor surveys from March 1, 2014 to December 12, 2014. Concentric rings represent 25-mile increments in distance from the state park. ZIP code frequencies represented by color chart (N = 126 valid entries out of 131 angling in-state respondents).

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

Species	Gill Netting		Electrofishing	
	N	CPUE	N	CPUE
Gizzard Shad			75	75.0 (20)
Threadfin Shad			2	2.0 (100)
Common Carp			2	2.0 (100)
Inland Silverside			5	5.0 (46)
Blue Catfish	38	3.8 (19)		
Channel Catfish	4	0.4 (41)		
Flathead Catfish	12	1.2 (32)		
White Bass	13	1.3 (40)		
Redbreast Sunfish			264	264.0 (19)
Green Sunfish			2	2.0 (100)
Warmouth			2	2.0 (67)
Bluegill			337	337.0 (11)
Longear Sunfish			18	18.0 (50)
Redear Sunfish			14	14.0 (25)
Redspotted Sunfish			2	2.0 (100)
Largemouth Bass			126	126.0 (12)
Guadalupe Bass			4	4.0 (56)
Sunshine Bass	1	0.1(100)		

Number (N) and catch rate (CPUE; RSE in parentheses) of all target species collected from all gear types from Inks Reservoir, Texas, 2017-2018. Sampling effort was 10 net nights for gill netting and 1 hour for electrofishing.

APPENDIX F – White Bass historic gill netting at Inks Reservoir

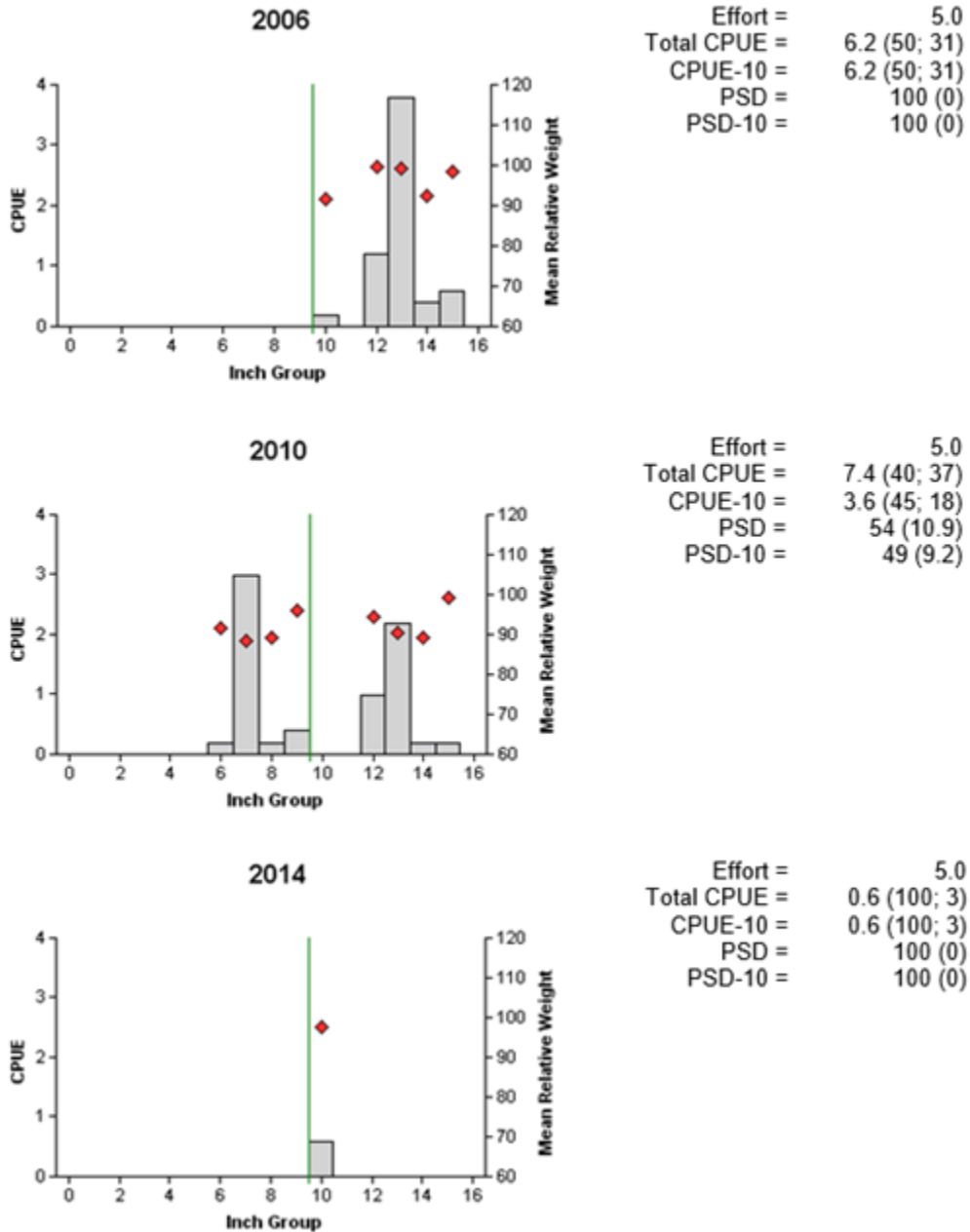
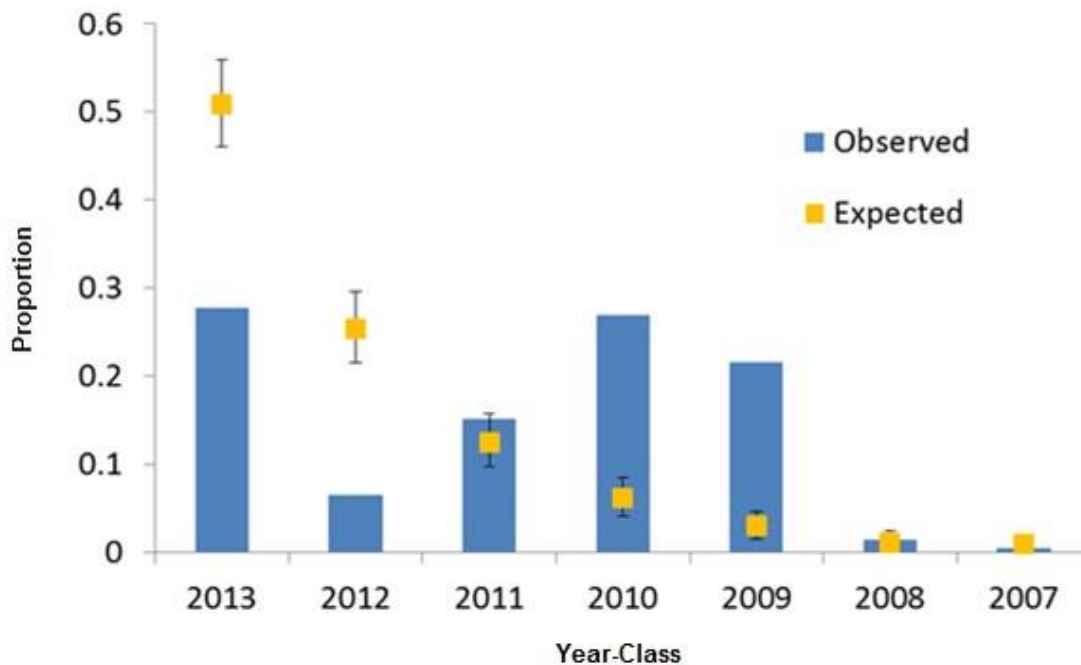


Figure 5. Number of White Bass caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses), mean relative weight (diamonds), for spring gill net surveys, Inks Reservoir, Texas, 2006, 2010, and 2014. Vertical line represents minimum length limit at the time of survey.

APPENDIX G – White Bass year-class strength



White Bass year-class strength distribution from 2015 collection efforts. Data modified using Bayesian statistical modeling. The 2014 fish were omitted due to unreliable recruitment to collection gear of one-year-old fish. Still, a very low number of White Bass were collected in 2014 gill netting survey, which prompted this evaluation to determine the effects of the prolonged drought at Inks Reservoir on this population.



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