

PERFORMANCE REPORT

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INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2015 Fisheries Management Survey Report

**Choke Canyon Reservoir**

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## SURVEY AND MANAGEMENT SUMMARY

Fish populations were surveyed in 2015 using electrofishing and baited tandem hoop netting, and in 2016 using gill netting to assess population trends for important sport fishes. Anglers were surveyed from 1 June 2015 to 31 May 2016. Historical data are presented with the 2015-2016 data for comparison. This report summarizes the survey results and contains a management plan for the reservoir based on those findings.

- **Reservoir Description:** Choke Canyon is a 25,989-acre reservoir (averaged 13,744 acres in 2015-2016) located on the Frio River in the Nueces River Basin, approximately 80 miles south of San Antonio. Its main purposes are water supply and recreation. The reservoir has a history of substantial water level fluctuations. The substrate is composed primarily of silt, sand, clay, and some gravel/rock. Littoral habitat consisted of native aquatic vegetation, periodically flooded terrestrial vegetation, standing timber, and seasonally abundant water hyacinth and hydrilla.
- **Management History:** Important sport fish species include Largemouth Bass, Blue and Channel catfishes, White Bass, and crappie. Recent management efforts have focused on control of nuisance aquatic vegetation, compiling catch and harvest statistics on important sport fish species, documenting catch of trophy Largemouth Bass, and supplementing the Largemouth Bass population through stockings in 2009-2011, 2013, and 2016. The district has worked with the City of Corpus Christi to develop and implement a water hyacinth control program. District staff conducted herbicide treatments on water hyacinth in 2008 (195 acres), 2009 (80 acres), 2010 (525 acres), 2011 (45 acres), 2012 (51 acres), and 2015 (30 acres). Staff annually monitored access areas where hydrilla could restrict use. Angler harvest of all sport fishes has been regulated according to statewide size and bag limits.
- **Fish Community**
  - **Prey species:** Gizzard and Threadfin Shad, Bluegill, and Redear sunfish formed the reservoirs forage base. Population size structure of prey species was suitable to support sport fish populations.
  - **Alligator Gar:** Anglers harvested an estimated 337 Alligator Gar in 2015/2016 and angler catch rate 0.3/fish per hour of effort.
  - **Catfishes:** Blue Catfish abundance remained high and size structure comprised a wide size-range of fish. Angler success for Blue Catfish was high and anglers harvested an estimated 106,283 fish. Channel Catfish were also present, but in low numbers.
  - **White Bass:** Abundance of White Bass was low throughout the survey period; however, the majority of fish collected in 2016 were > 10 inches and thus available for angler harvest. Anglers harvested an estimated 14,504 fish in 2015/2016 and angling catch rate averaged 1.9/fish per hour.
  - **Largemouth Bass:** Largemouth Bass abundance increased in 2015 relative to prior years; however, size structure was dominated by smaller individuals. Mean age at legal length was 2.7 years. Largemouth Bass continued to be the most sought individual sport fish species in the reservoir.
  - **Crappie:** White Crappie was the fourth most sought sport fish species in the reservoir and was an important component to the overall sport fishery.
- **Management strategies:** Continue to manage sport fish populations under existing harvest regulations. Conduct a creel survey to collect quantitative data on angler use. Continue to assist the City of Corpus Christi with the water hyacinth control program. Monitor access areas where hydrilla could restrict use. Stock Florida Largemouth Bass when water level increases.

## INTRODUCTION

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

### *Reservoir Description*

Choke Canyon is a 25,989-acre reservoir (averaged 13,744 in 2015-2016) located in the Nueces River Basin on the Frio River. The reservoir was impounded in 1982 and lies approximately 80 miles south of San Antonio. The controlling authority is the City of Corpus Christi. Its main purposes are water supply and recreation. The reservoir has a history of substantial water level fluctuations (Figure 1). During the 2015-2016 sampling season the reservoir averaged 22.6 feet below conservation pool. Shoreline and boat access were adequate with six public boat ramps and substantial area for shoreline angling. Handicap (ADA) access was limited to the State Park Calliham Unit. Secchi disc measurements of water clarity ranged from 13 to 56 centimeters. The substrate was composed primarily of silt, clay, sand, and small rock. Littoral habitat consisted of timber stands, periodically flooded terrestrial vegetation, native aquatic vegetation, and seasonally abundant non-native vegetation. Native aquatic vegetation and hydrilla reestablished and became more widespread in the reservoir after refilling in 2002. Water hyacinth became established in 2006 and was treated with herbicides annually, excluding 2014. Over the current survey period, substantial losses in vegetative habitat have occurred. Other descriptive characteristics of this reservoir are in Table 1.

### *Angler Access*

Choke Canyon Reservoir has six public boat ramps and no private boat ramps. Three public ramps were unavailable to anglers in 2015/16 because the end of the boat ramp was above the waterline or needed dredging or repair. Additional boat ramp characteristics are in Table 2. Shoreline access is adequate and available at all boat ramp launch sites as well as extensive shoreline located at Southshore and Calliham units within Choke Canyon State Park. An extended fishing jetty is also available at Calliham state park unit. The Calliham ramp courtesy dock was replaced in 2013. Southshore boat ramp is scheduled for repair to be completed in 2017.

### *Management History*

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

1. The reservoir continues to be a popular destination for anglers. Collection of quantitative angler data is necessary to evaluate trends in angler effort, catch, and harvest.

**Action:** A creel survey was conducted 1 June 2015 through 31 May 2016. Continued to collect data for LMB trophy database.

2. Choke Canyon is valued for its high quality Largemouth Bass fishery and for catches of trophy-size fish and stocking Florida Largemouth Bass maintains Florida genetics and trophy production potential.

**Action:** Florida Largemouth Bass (FLMB) fingerlings were stocked in 2016 at a rate of 1,000/km.

3. Preserve the 1/fish daily bag on Alligator Gar to further enhance the trophy characteristics of the population and promote the fishery through press releases.

**Action:** The one-fish daily bag was maintained and press releases were disseminated to local media.

4. Discuss potential for boat ramp improvement projects with the City of Corpus and TPWD State Parks and provide information about the Boating Access Grant program.

**Action:** District staff met with TPWD Choke Canyon State Park staff on ramp improvement needs and assisted TPWD Infrastructure in measuring elevations for boat ramp repair project at Southshore unit. Project completion is scheduled for summer 2017.

5. Cooperate with the controlling authority to post appropriate signage at access points around the reservoir. Contact and educate marina owners about invasive species, and provide them with posters, literature, etc... so that they can in turn educate their customers. Educate the public about invasive species through the use of media and the internet. Make a speaking point about invasive species when presenting to constituent and user groups. Keep track of (i.e., map) existing and future inter-basin water transfers to facilitate potential invasive species responses. Monitor water hyacinth and other exotic nuisance vegetation through vegetation surveys. Revisit the water hyacinth control program and continue to cooperate with the city of Corpus Christi on all vegetation control activities.

**Action:** Invasive vegetation was monitored through several vegetation surveys and routine fisheries surveys. Maintained working relationship with the City of Corpus Christi and advised on all vegetation control activities. District staff conducted water hyacinth herbicide treatment in 2015 (30 acres).

**Harvest regulation history:** Harvest of sport fishes in Choke Canyon Reservoir have always been managed with statewide regulations (Table 3).

**Stocking history:** Florida Largemouth Bass fingerlings were stocked in the reservoir in 2016. Additionally, FLMB were stocked over a three year period from 2009-2011 and in 2013. This included stockings of ShareLunker Largemouth Bass in 2009 (5,151) and 2010 (2,220). Prior to 2009, the most recent stocking of FLMB occurred in 2003. Northern Largemouth Bass (NLMB) were stocked from 2003 to 2005 as part of a research project examining the potential for increasing NLMB alleles in reservoirs with high FLMB introgression. Blue and Channel Catfish, Striped Bass, and White Crappie have been stocked in the past. A complete stocking history can be found in Table 4.

**Vegetation/habitat management history:** Historically, growth of hydrilla at boat ramps has been controlled with herbicides. However, over the current survey period, hydrilla did not negatively impact boat and angler access. Isolated colonies of water hyacinth were found on the reservoir from 1998 through 2005. These colonies were initially removed by hand. However, in 2006, water hyacinth expanded and coverage was too great to mechanically remove, thus herbicide treatments were initiated. District staff conducted herbicide treatments on water hyacinth in 2008 (195 acres), 2009 (80 acres), 2010 (525 acres), 2011 (45 acres), 2012 (51 acres), and in 2015 (30 acres). Abundance of nuisance vegetation has decreased substantially since 2011/2012 as water level began to recede.

**Water Transfer:** Choke Canyon Reservoir is primarily used for municipal/industrial water supply, recreation, and to lesser extent, flood control. Fifty-eight acre-feet of water were released daily to downstream Lake Corpus Christi Reservoir. Intermittent larger releases of water were dependent on water level at Lake Corpus Christi. There was one permanent pumping station on the reservoir transferring water to the municipality of Three Rivers. There are currently no proposals to install additional pumping stations. No inter-basin transfers are known to exist.

## METHODS

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Choke Canyon Reservoir (TPWD, unpublished data). 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 revised manual 2015).

*Electrofishing* – Largemouth Bass, Sunfishes, Gizzard Shad, and Threadfin Shad were collected by electrofishing (2 hour at 24, 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. Mean age at length for Largemouth Bass were determined using otoliths from 13 randomly-selected fish (TL range 13.0 to 14.9 inches) from 2015.

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

*Tandem hoop nets* – Channel Catfish were collected using 16 tandem hoop-net series at 16 stations. Nets were baited with soap and deployed for 2-night soak durations. CPUE for tandem hoop netting was recorded as the number of fish caught per tandem hoop net series (fish/series).

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

*Statistics* – Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD), terminology modified by Guy et al. 2007], and condition indices [relative weight ( $W_t$ )] 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 =  $100 \times \text{SE of the estimate/estimate}$ ) was calculated for all CPUE and creel statistics.

*Creel survey* – An annual access-point creel survey was conducted in 2011/2012, 2013/2014, and 2015/2016. The creel period was June through May. Angler interviews were conducted on 5 weekend days and 4 weekdays per quarter to assess angler use and fish catch/harvest statistics in accordance with the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015). Additional information was obtained from interviewed anglers including Largemouth Bass angler type and weight class data of Largemouth Bass that were caught and released.

*Habitat* –Vegetation surveys were conducted 2014 and 2015 to monitor expansion of water hyacinth. Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

*Water level* – Source for water level data was the Nueces River Authority (NRA) website (<http://www.nueces-ra.org/CP/CITY/day.php>).

## RESULTS AND DISCUSSION

**Habitat:** A structural habitat survey was last conducted in 2005 (Findeisen and Binion 2008). In 2015, total native vegetation coverage was 259 acres (1.9% coverage), similar to coverage in 2011 (300 acres; 1.4% coverage), (Table 6). Coontail and water stargrass were the most abundant native vegetation species in 2015. Total non-native vegetation coverage was 138 acres (1.0%) in 2015; substantially lower than the 656 acres (3.1%) in 2011. Hydrilla and water hyacinth were the only two exotic plants species observed during the 2015 vegetation survey and were present in 133 acres (1.0%) and 5.0 acres (< 1.0%) of water, respectively (Table 6). Substantial losses in submersed vegetative habitat were observed to occur over the survey period, likely attributed to decreased water level. However, an eight foot water level rise in May-June 2015 flooded substantial terrestrial vegetation; mitigating some losses in aquatic vegetative habitat and supplementing total aquatic habitat.

**Creel:** Directed fishing effort by anglers in 2015-2016 was highest for any catfish species (42%), followed by Largemouth Bass (22%; combined tournament [4%] and non-tournament [18%] anglers), Blue Catfish (16%), no species preference (6%), White Bass (5%), and White Crappie (5%); (Table 7). Notable trends in directed fishing effort in 2015-2016 included decreased effort for Largemouth Bass and increased directed effort for all catfish species. White Bass and White Crappie directed effort was similar compared to 2013-2014 (Table 7). Total fishing effort for all species was an estimated 199,722 hours with total estimated expenditures of \$1,518,961 in 2015-2016 (Table 8). This represented increases in total fishing effort (32%) and direct expenditures (26%) relative to 2013-2014 (Table 8). While some anglers traveled great distances (> 250 miles) to fish at the reservoir, the majority (85%) resided within 100 miles (Appendix E).

**Prey Species:** Gizzard Shad abundance fluctuated over the survey period, yet remained high. Catches were relatively similar in 2014 (214.0/h) and 2015 (160.5/h), both higher than in 2013 (120.5/h; Figure 2). Population size structure of Gizzard Shad was consistent among years (IOV range: 87 – 93); indicating the majority of individuals collected were of suitable size as prey to predator fishes. Threadfin Shad CPUE in 2015 was 171.5/h, further contributing to the shad forage base (Appendix A). Bluegill abundance increased over the study period. The electrofishing catch rate of Bluegill in 2015 was 207.5/h, substantially higher than values in 2013 (66.0/h) and 2014 (55.5/h) (Figure 3). The majority of Bluegill collected were < 6 in total length and thus should provide excellent forage to predator species. However, sampling indicated several large Bluegill (CPUE-6 = 31.0/h) were present; adding recreational value for anglers. Abundance of Redear Sunfish was high and size structure was suitable for most predators (Figure 4). The increase in sunfish abundance is likely attributed an associated increase in inundated terrestrial vegetation. Overall, survey results indicated ample prey base for sport fish and that availability of prey should not be a limiting factor to the growth and condition of sport fish in the reservoir.

**Alligator Gar:** Alligator Gar are an important component to the overall sport fishery at the reservoir. Total directed effort for Alligator Gar was 1.0% (Table 7), but is likely underrepresented due to night time fishing effort and bow fishing tournaments that are not captured in the standard creel survey. Total harvest for Alligator Gar in 2015-2016 was estimated at 337 individuals and angler catch rate was 0.3/hour (Table 9).

**Blue Catfish:** Blue Catfish abundance remained high over the study period (CPUE range: 27.8 – 62.5/nn; Figure 5). Record catches were recorded in 2015 (62.5/nn), while 2016 catches (27.8/nn) declined to more historical values. Proportional size distribution was low, consistent across years, and indicated a Blue Catfish population comprised primarily of smaller individuals. However, roughly 51% of the fish sampled were  $\geq 12$  in total length and available to angler harvest. Few (N = 2) quality-sized ( $\geq 20$  in) individuals were collected in 2016 and CPUE-20 declined over the survey period (Figure 5). Condition of fish greater than 12-in total length remained consistent across years for most size classes and increased with length (Figure 5).

Blue Catfish directed effort increased substantially over the study period and was 31,332 h in 2015/2016 (Table 10). Angling success, represented by angler catch rate (fish/h) increased and was high (2.5/h).

Total estimated harvest was substantially higher in 2015/2016 (106,283) relative to 2013/2014 (40,637) and 2010/2011 (38,366). Angler compliance was excellent and harvested fish ranged in length between 12 – 44 inches and the majority of harvest occurred between 12 – 18 inches, all years combined (Figure 6).

**Channel Catfish:** An exploratory baited tandem hoop net survey was conducted in 2015. Hoop net catches (2.0/fish-series; Figure 7) yielded little improvement over gill netting catches in 2016 (1.5/nn: Appendix A) and was consistent with historical gill net catch rates (2.5/nn). The size composition among the two sampling gears was similar and was dominated by smaller individuals (PSD = 0; Figure 7). Only two fish in the 2015 hoop net catch were legal size ( $\geq 12$  in).

Channel Catfish directed effort in 2015/2016 increased compared to previous years, as did angler catch rate (Table 11). Anglers spent 4,525 h targeting Channel Catfish and harvest was estimated at 15,480 fish in 2015/2016. Fish 12 – 14 inches comprised the majority of harvest (Figure 8).

**White Bass:** White Bass abundance increased marginally over the survey period. White Bass catch rates were 2.8/nn in 2016, higher than in 2014 (0.4/nn) and 2015 (0.5/nn) (Figure 9). Relative weight values ranged from 81 – 93 and tended to decrease with increased fish length. The majority (86%) of fish collected in 2016 were  $\geq$  the 10-in length limit and available for angler harvest (Figure 9).

Angling effort for White Bass was 8,498 h in 2015/2016, similar to directed effort in 2013/2014 (7,215 h; Table 12). Angler success also increased through time, evidenced by increased angling catch rate (1.9/h) and total harvest (14,504). Harvested fish ranged between 10 – 15 inches total length (Figure 10).

**Largemouth Bass:** Relative abundance of Largemouth Bass increased over the survey period. The electrofishing catch rate of Largemouth Bass was 207.5/h in 2015, markedly higher than 65.5/h in 2013 and 83.0/h in 2014 (Figure 11). Catch rates of stock-size fish were consistent with a slight increase in 2015 (72.5/h). Catch of legal-size fish remained similar, while CPUE-18 declined over the study period. Population size structure was poor (PSD = 18) in 2015 and indicated a population dominated by small size classes. This is attributed to a strong 2015 year class produced with coincident water level rise (Figure 1). In 2015, relative weights of Largemouth Bass were high ( $W_r \geq 100$ ) for smaller size classes (i.e.,  $\leq 12$ -in) but tended to decrease with length (Figure 11). Mean age at legal length in 2015 was 2.7 years ( $N = 13$ ; range: 1 – 5). Growth was considered adequate but has slowed since 2008 (Table 13). Introgression of FLMB genetics in the population has remained high over the past decade (%FLMB allele; mean = 82 [3.4], range: 78 – 89,  $n = 12$  years). In 2015, 20% of the sample had the Florida Largemouth Bass genotype (Table 14).

Largemouth Bass were the most sought individual fish species in the reservoir; however, directed effort has dropped considerably since 2010/2011 (Table 15). Largemouth Bass angling effort comprised 22% of total directed effort in 2015/2016, representing a 58% drop in Largemouth Bass directed effort when compared to 2010/2011. Tournament activity on the reservoir also dropped considerably. Tournament anglers spent only 7,531 h fishing for Largemouth Bass compared to 30,262 h in 2010/2011; representing a 75% decline in tournament participation (Table 15). Angling catch rate remained similar across years (range: 0.5 – 1.0/h). The majority (67%) of legal Largemouth Bass caught were released and percent legal released values were consistent across the study period (Table 15). Harvest increased since 2013/2014; 4,669 fish were harvested in 2015/2016. Angler compliance was excellent and harvested fish ranged from 14 – 24 inches total length and the majority of observed harvest occurred in the 14 – 18 in size range, all years combined (Figure 12). Over the creel survey periods, 218 Largemouth Bass weighing >10 lbs. and 353 fish weighing between 7 and 10 lbs. were caught and released by anglers, yet no trophy catches were recorded in 2015/2016 (Table 15).

**White Crappie:** Directed effort increased over the study period (Table 16). Total harvest in 2013/2014 and 2015/2016 were similar and much higher compared to 2010/2011. Angler success improved through time and angling catch rate in 2015/2016 was 1.99/h, higher than values in previous years (Table 15).

Angler compliance was excellent and harvested fish ranged in length between 10 – 14 inches, all years combined (Figure 13). Creel statistics (directed effort, angler catch rate, and total harvest) indicated a healthy White Crappie population and ample opportunity for angling success.

### **Fisheries management plan for Choke Canyon Reservoir, Texas.**

Prepared – July 2016

**Issue 1:** The reservoir continues to be a popular destination for anglers. Collection of quantitative data such as angler effort, catch, and harvest is necessary to evaluate trends in fishery statistics.

#### MANAGEMENT STRATEGIES

1. Move from a full annual creel period to a seasonal 6-month creel period. On average, roughly 70% of fishing effort at Choke Canyon Reservoir occur in the spring and summer months.
2. Conduct an access point creel survey spanning 1 March 2018 through 31 August 2018.
3. Maintain and continue to collect data for Largemouth Bass trophy database.

**Issue 2:** Choke Canyon is valued for its high quality Largemouth Bass fishery and for catches of trophy-size fish. From 2009 – 2016, 339 Largemouth Bass weighing >10 lbs. and 957 fish weighing between 7 and 10 lbs. were caught and released by anglers. The reservoir has produced a total of 13 ShareLunkers. Further, the lake record was broken in 2009 and currently stands at 15.45 pounds.

#### MANAGEMENT STRATEGIES

1. Request FLMB fingerlings annually for stocking to maintain a high level Florida Bass introgression and thus maximize production of trophy fish.

**Issue 3:** Choke Canyon Reservoir supports a robust and healthy population of Alligator Gar in terms of number and size of fish. The reservoir exhibited potential for management of an Alligator Gar trophy fishery.

#### MANAGEMENT STRATEGIES

1. Maintain the 1/fish daily bag to further promote and enhance the trophy characteristics of the Alligator Gar population at the reservoir.
2. Promote the Alligator Gar fishery and Alligator Gar angling opportunities by disseminating press releases to local and statewide media.

**Issue 4:** Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, giant salvinia and other invasive vegetation species can form dense mats, interfering with recreational activities like fishing, boating, skiing and swimming. The financial costs of controlling and/or eradicating these types of invasive species are significant. Additionally, the potential for invasive species to spread to other river drainages and reservoirs via watercraft and other means is a serious threat to all public waters of the state. Exotic plants such as water hyacinth and hydrilla have historically been a severe problem, primarily in the upper end and tributaries of the reservoir. These exotic plants restrict recreational use and can impact the quality of fish

and wildlife habitat restricting growth and colonization of native vegetation.

## 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.
6. Monitor water hyacinth and other exotic nuisance vegetation through vegetation surveys on an annual basis.
7. Re-evaluate the water hyacinth control program and continue to cooperate with the City of Corpus Christi on all vegetation control activities.

### **Objective-Based Sampling Plan for Choke Canyon Reservoir**

**2016 – 2020**

#### Sport fish, forage fish, and other important fishes

Sport fish in Choke Canyon Reservoir include Alligator Gar, Blue, Channel, and Flathead Catfish, White Bass, Largemouth Bass, and Black and White Crappie. Important forage species include Gizzard and Threadfin Shad, and Bluegill.

#### Low Density Fisheries

**Channel Catfish:** Channel Catfish are present, but abundance is relatively low compared to the predominant catfish species (Blue Catfish) in the reservoir. Since 1989, the mean gill net CPUE was 2.5/nn. An exploratory baited tandem hoop net survey was conducted in the summer 2015 and yielded a catch rate of 2.0 fish/series. Further, directed fishing effort for anglers specifically targeting Channel Catfish is low (< 1.0%) based on the last three creel surveys. Presence/absence will be noted in standard gill net samples and large-scale changes in angler effort and harvest will be monitored with the 2018/2019 creel survey (Table 17). At this time, the population does not warrant expending additional sampling effort.

**Flathead Catfish:** Flathead Catfish are present in the reservoir in low abundance. Since 1989, the mean gill net CPUE was 0.3/nn. Historically, directed fishing effort is low (< 1.0%) and only 34 fish have been harvested indicated from creel periods between 2009 – 2016. Presence/absence will be noted in standard gill net samples and large-scale deviations in angler effort and harvest will be monitored with the 2018/2019 creel survey (Table 17). At this time, the population does not warrant expending additional sampling effort.

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

**Alligator Gar:** Alligator Gar represent an important component to the overall sport fishery at the reservoir. A mark-recapture, exploitation, and population dynamics study completed on the reservoir in 2013 revealed a robust population (> 5,000 adult individuals) with trophy potential and that rates of exploitation are low (range: 0 – 2.3%). While total directed fishing effort estimated by creel surveys has been historically low (< 1.0%), anecdotal reports and night time bowfishing tournaments suggest a popular fishery that is utilized by anglers. Directed effort, angler catch, and angler harvest will be monitored with the standard creel survey conducted in 2018/2019 to assess large-scale changes in Alligator Gar fishing effort, catch, and harvest; lending important insight into population dynamics and potential problems that may warrant more intensive sampling (Table 17).

**Blue Catfish:** Blue Catfish are present in Choke Canyon Reservoir in high abundance and represent a popular recreational fishery. Annual gill net total CPUE since 1989 has averaged 22.4/nn (N = 26; standard deviation = 12.5; range: 0.4 – 62.5/nn) and mean stock size CPUE is 9.6/nn (N = 26; standard deviation = 20.1; range: 0.4 – 18.5/nn). Further, Blue Catfish and catfishes as a group were the most popular sport fish sought (combined directed effort = 57.5%) by anglers in the 2015/2016 creel survey and anglers harvested 106,283 fish during this time period. Trend data on CPUE, size structure, and body condition have been collected annually since 1989 (excluding 1990) with spring gill netting. Currently, the population appears to be in good shape, and anglers are anecdotally satisfied with the fishing. Collection of biennial trend data with spring gill netting will allow for determination of large-scale changes in basic population dynamics (relative abundance, size frequency, and body condition) that may warrant further investigation and more intensive sampling. A minimum of 15 randomly selected gill net sites will be sampled. Sampling will continue at additional random sites until 100 stock-size fish are collected and the RSE of CPUE-S is  $\leq 25$ . Finally, directed effort and angler catch and harvest will be monitored with a creel survey conducted in 2018/2019 to assess large-scale changes in angler effort, catch, and harvest; lending important insight into overall population dynamics and potential problems that may warrant more thorough study (Table 17).

**White Bass:** White Bass are present in the reservoir, but population metrics and relative abundance are highly variable from sample to sample. Depending on reservoir conditions (e.g., water level, flood pulses, etc.) and population characteristics (i.e., abundance), White Bass are often an important component to the overall sport fishery (directed effort = 5.2% & harvest = 14,504 in 2015/2016) at the reservoir. However, minimal conclusions regarding the trend data on CPUE, size structure, and body condition of White Bass can be made due to high variability in the gill net catch data. Therefore, directed effort, angler catch, and angler harvest will be monitored with a creel survey conducted in 2018/2019 to detect any large-scale shifts in White Bass angling effort, catch, and harvest; lending important insight into overall population status and dynamics that may justify more intensive investigation. Additionally, presence/absence will be noted in standard gill net samples (Table 17).

**Largemouth Bass:** Historically, Largemouth Bass have been present in the reservoir in good numbers and supported a very popular fishery. The mean historical total CPUE for Largemouth Bass is 135.4/h (N = 23; standard deviation = 91.7; range: 25.5 – 421.5/h) and mean stock-size CPUE is 70.4/h (N = 23; standard deviation = 49.1; range: 21.0 – 241.0/h). Relative abundance of LMB has been reduced in recent years evidenced by low catch rates over the last three of the last four electrofishing surveys (well below historical mean). This is likely attributed to decreased water levels and associated loss of critical habitat. Anglers have responded as directed fishing effort for Largemouth Bass has decreased

substantially in recent years (21.6% in 2015/2016 compared to 59.8% in 2010/2011). Trend data on CPUE, size structure, and body condition has been collected annually since 1995 with fall electrofishing. The continued collection of annual trend data with fall electrofishing will allow for determination of large-scale changes in basic population dynamics (abundance, size structure indices, body condition, age-at-length) that may warrant further investigation with more intensive sampling and/or management action. A minimum of 24 randomly selected electrofishing sites will be sampled annually to collect 50 stock-size fish for PSD indices and relative weight. The desired level of precision is  $RSE \leq 25$  for CPUE-S. Further, category 2 age and growth analysis [mean age at legal length (14 in),  $N =$  minimum of 13 fish between 13.0 – 14.9 in] will be conducted for each sample year to assess any changes in growth to the minimum length limit. Sampling will continue up to an additional 12 stations until all objectives are attained. Directed effort, angler catch, and angler harvest will be monitored with a creel survey conducted in 2018/2019 to monitor for any large-scale changes in angling effort, catch, and harvest to gain further insight into overall population status (Table 17). Largemouth Bass catch data recorded from creel surveys will be categorized by weight (<4, 4 – 6.9, 7 – 9.9, >10) to document catches of trophy-sized fish and to maintain the trophy LMB database at the reservoir.

**White Crappie:** White Crappie are present in the reservoir but trap net samples have yielded mixed results and low catches (historical mean CPUE = 2.6/nn;  $N = 17$ ; standard deviation = 1.3; range: 0.7 – 4.8/nn). Based on anecdotal reports and the 2015/2016 creel survey, White Crappie represent an important component to the overall sport fishery (directed fishing effort = 4.8% and harvest = 6,923 in 2015/2016) at the reservoir. However, due to low catches and inconsistent, highly variable trap net data (CPUE-T mean  $RSE = 37.2$ ) and the inability to assess trends in important population metrics, creel survey data collected in 2018/2019 will be utilized to monitor large-scale deviations in crappie angler effort, catch, and harvest; lending important insight into overall crappie population dynamics (Table 17). Otoliths ( $N = 13$  between 9.0 – 10.9 inches) will be collected from angler-caught fish to determine and monitor growth to the minimum length limit.

**Shad and Bluegill:** Gizzard Shad and Bluegill are the primary forage at Choke Canyon Reservoir. Like Largemouth Bass, trend data on CPUE and size structure of Gizzard Shad and Bluegill have been collected annually since 1995 with fall electrofishing. Continuation of sampling, as per Largemouth Bass above, will allow for monitoring of large-scale changes in Gizzard Shad and Bluegill relative abundance and size structure. Sampling effort based on achieving sampling objectives for Largemouth Bass will result in sufficient numbers for size structure estimation (Gizzard Shad IOV; 50 fish minimum, Bluegill PSD; 50 fish minimum at 24 randomly selected 5-minute stations with 90% confidence) and relative abundance estimates (Gizzard Shad and Bluegill CPUE-Total;  $RSE \leq 25$ ). Threadfin Shad presence/absence will be noted in electrofishing collections. No additional effort will be expended beyond sampling effort conducted for Largemouth Bass data collection.

## LITERATURE CITED

- Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated indices. Pages 447-482 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, second edition. American Fisheries Society, Bethesda, Maryland.
- DiCenzo, V.J., M.J. Maceina, and M.R. Stimpert. 1996. Relationships between reservoir trophic state and Gizzard Shad population characteristics in Alabama reservoirs. North American Journal of Fisheries Management 16:888-895.
- Binion, G. R. and J. A. Findeisen. 2012. Statewide freshwater fisheries monitoring and management program survey report for: Choke Canyon Reservoir, 2011. Texas Parks and Wildlife Department, Federal Aid Report F-221-M, Austin.
- Binion, G. R. and J. A. Findeisen. 2014. Statewide freshwater fisheries monitoring and management program survey report for: Choke Canyon Reservoir, 2013. Texas Parks and Wildlife Department, Federal Aid Report F-221-M-4, Austin.
- Findeisen, J. A., and G. R. Binion. 2008. Statewide freshwater fisheries monitoring and management program survey report for: Choke Canyon Reservoir, 2007. Texas Parks and Wildlife Department, Federal Aid Report F-30-R, Austin.
- Guy, C. S., R. M. Neumann, D. W. Willis, and R. O. Anderson. 2007. Proportional size distribution: A further refinement of population size structure index terminology. Fisheries 32: 348.
- Nueces River Authority (NRA) website (<http://www.nueces-ra.org/CP/CITY/day.php>). Accessed May 2016.

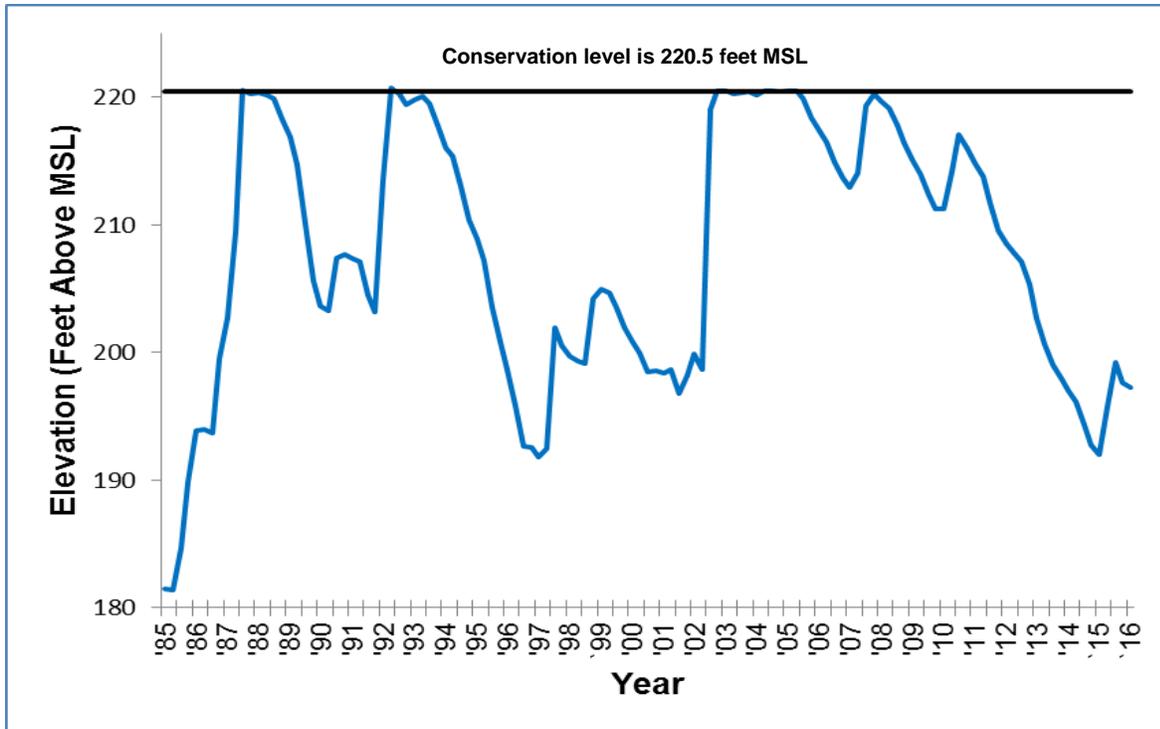


Figure 1. Mean quarterly water elevations in feet above mean sea level (MSL) recorded for Choke Canyon Reservoir, Texas, 1985 through March 2016.

Table 1. Characteristics of Choke Canyon Reservoir, Texas.

Characteristic	Description
Year constructed	1982
Controlling authority	City of Corpus Christi, Nueces River Authority, U.S. Bureau of Reclamation, TPWD (surrounding lands)
Counties	Live Oak, McMullen
Reservoir type	Mainstem
Shoreline Development Index	7.1
Conductivity (umhos/cm)	600
Access: Boat	Good – 6 public ramps
Bank	Adequate – 6 public ramp areas, 1 fishing jetty, Wildlife Management Area access, State Park shoreline access
Physically challenged	Adequate – Calliham State Park – concrete jetty Inadequate – South Shores State Park

Table 2. Boat ramp characteristics for Choke Canyon Reservoir, Texas, August, 2015. Reservoir elevation at time of survey was 196.5 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Southshore Unit	28.47328° -98.25134°	Y	72	194.0	Unusable. Under repair
Calliham Unit	28.48221° -98.35354°	Y	128	190.0	Excellent, no access issues
Mason Point	28.48047° -98.37375°	Y	28	194.0	Excellent, no access issues
FM 99 Bridge	28.52331° -98.38835°	Y	20	192.0	Excellent, no access issues
Daughtery WMA	28.50895° -98.44010°	Y	15	UNK	Out of water. Extension not feasible
Bracken	28.47658° -98.50475°	Y	16	UNK	Out of water. Extension not feasible

Table 3. Harvest regulations for Choke Canyon Reservoir, Texas.

Species	Bag Limit	Length Limit
Gar, Alligator	1	none
Catfish: Channel and Blue, their hybrids and subspecies	25 (in any combination)	12-inch minimum
Catfish, Flathead	5	18-inch minimum
Bass, White	25	10-inch minimum
Bass, Largemouth	5	14-inch minimum
Crappie: White and Black, their hybrids and subspecies	25 (in any combination)	10-inch minimum

Table 4. Stocking history at Choke Canyon Reservoir, Texas. Size categories are: FRY = fry, FGL = fingerling and ADL = adults.

Species	Year	Number	Size
Threadfin Shad	1981	10,000	ADL
	1982	4,000	ADL
	1983	8,000	ADL
	Total	22,000	
Fathead Minnow	1981	Unknown	ADL
	Total	Unknown	
Blue Catfish	1982	98,800	FGL
	1983	102,088	FGL
	Total	200,888	
Channel Catfish	1981	92,200	FGL
	1982	307,000	FGL
	1983	91,256	FGL
	Total	490,456	
Coppernose Bluegill	1981	2,500	UNK
	1982	659,034	UNK
	1983	112,000	UNK
	Total	773,534	
Striped Bass	1983	102,600	FGL
	Total	102,600	
Largemouth Bass	2003	107,137	FGL
	2004	99,632	FGL
	2005	102,314	FGL
	Total	309,083	
Florida Largemouth Bass	1981	19,906	FGL
	1982	146,030	FGL
	1983	143,368	FGL
	1990	375,790	FRY
	1998	383,565	FGL
	2002	384,236	FGL
	2003	180,014	FGL
	2009	5,151	FGL
	2010	526,015	FGL
	2011	653,297	FGL
	2013	423,378	FGL
	2016	214,362	FGL
	Total	3,455,112	
White Crappie	1992	148,294	FRY
	1992	33,380	FGL
	Total	181,674	

Table 5. Objective-based sampling plan components for Choke Canyon Reservoir, Texas 2015 – 2016.

Gear/target species	Survey objective	Metrics	Sampling objective
<i>Electrofishing</i>			
Largemouth Bass	Abundance	CPUE – stock	RSE-Stock $\leq 25$
	Size structure	PSD, length frequency	$N \geq 50$ stock
	Age-and-growth	Age at 14 inches	$N = 13$ , 13.0 – 14.9 inches
	Condition	$W_r$	10 fish/inch group (max)
	Genetics	% FLMB	$N = 30$ , any age
Bluegill <sup>a</sup>	Abundance	CPUE – Total	RSE $\leq 25$
	Size structure	PSD, length frequency	$N \geq 50$
Gizzard Shad <sup>a</sup>	Abundance	CPUE – Total	RSE $\leq 25$
	Size structure	PSD, length frequency	$N \geq 50$
	Prey availability	IOV	$N \geq 50$
<i>Gill netting</i>			
Blue Catfish	Abundance	CPUE – stock	RSE-Stock $\leq 25$
	Size structure	PSD, Length frequency	$N \geq 50$ stock
	Condition	$W_r$	10 fish/inch group (max)
<i>Creel Survey</i> <sup>b</sup>			
Alligator Gar	Collect fisheries dependent data	Angler CPUE, total harvest, and size composition of harvest	Detect 50% increase or decrease in angler CPUE and/or harvest
White Bass	Collect fisheries dependent data	Angler CPUE, total harvest, and size composition of harvest	Detect 50% increase or decrease in angler CPUE and/or harvest
Crappies	Collect fisheries dependent data	Angler CPUE, total harvest, and size composition of harvest	Detect 50% increase or decrease in angler CPUE and/or harvest

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

<sup>b</sup> Angler utilization data and associated statistics will be calculated for all sport fish and non-game species.

Table 6. Survey of aquatic vegetation, Choke Canyon Reservoir, Texas, 2011 and 2015. Surface area (acres) is listed with percent of total reservoir surface area in parentheses. 2011 surface area = 14,393 acres; 2015 surface area = 13,744 acres.

Vegetation	2011	2015
Native submersed	300 (1.4)	259 (1.9)
Native floating-leaved		< 1 (<0.01)
Native emergent		
Non-native	656 (3.1)	138 (1.0)
Hydrilla (Tier II) <sup>a</sup>	616 (2.9)	133 (1.0)
Water hyacinth (Tier II) <sup>a</sup>	40 (0.1)	5 (< 1.0)

<sup>a</sup>Tier II is Maintenance Status

Table 7. Percent directed angling effort by species at Choke Canyon Reservoir, Texas, 2010/2011, 2013/2014, and 2015/2016. Survey periods were from 1 June through 31 May.

Species	Year		
	2010/2011	2013/2014	2015/2016
Alligator Gar	0.0	<1.0	1.0
Any catfish species	32.7	39.4	41.8
Blue Catfish	2.7	11.0	15.7
Channel Catfish	<1.0	<1.0	2.3
Flathead Catfish	<1.0	0.0	0.0
White Bass	1.0	5.3	5.2
Largemouth Bass	59.8	27.6	21.6
White Crappie	<1.0	5.0	4.8
Freshwater Drum	0.0	<1.0	1.3
Anything	2.8	10.6	6.5

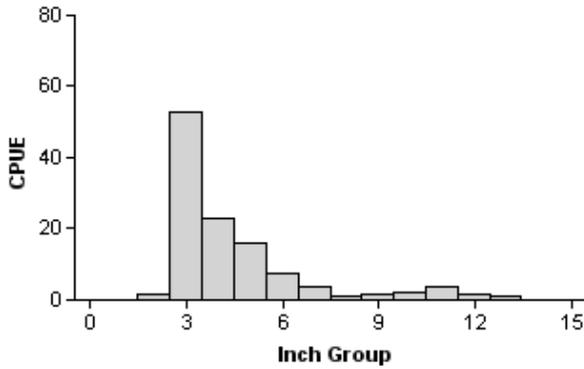
Table 8. Total angling effort (h) for all species and total directed expenditures for Choke Canyon Reservoir, Texas, 2010/2011, 2013/2014, and 2015/2016. Survey periods were from 1 June through 31 May. Relative standard error is in parentheses.

Creel Statistic	Year		
	2010/2011	2013/2014	2015/2016
Total fishing effort	222,710 (14)	137,258 (23)	199,722 (14)
Total directed expenditures	\$2,601,509 (23)	\$1,127,986 (31)	\$1,518,961 (37)

## Gizzard Shad

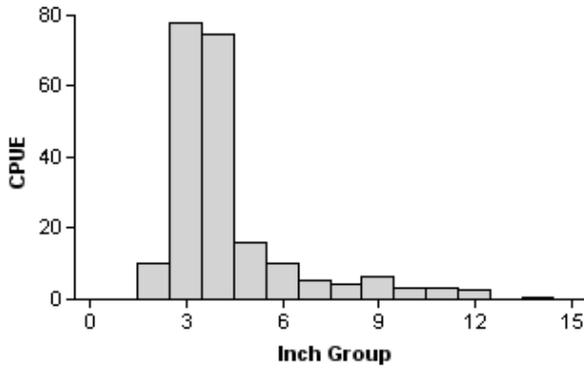
2013

Effort = 2.0  
 Total CPUE = 120.5 (22; 241)  
 IOV = 87 (3)



2014

Effort = 2.0  
 Total CPUE = 214.0 (21; 428)  
 IOV = 91 (3)



2015

Effort = 2.0  
 Total CPUE = 160.5 (24; 321)  
 IOV = 93 (2)

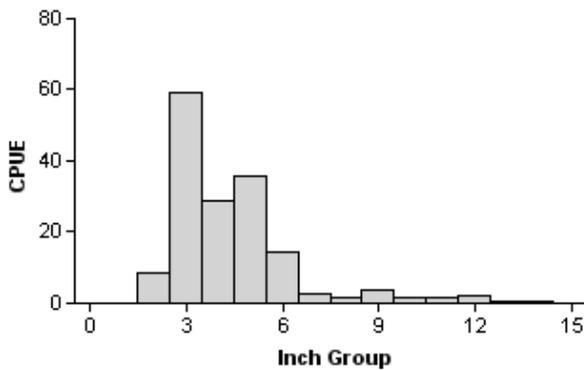
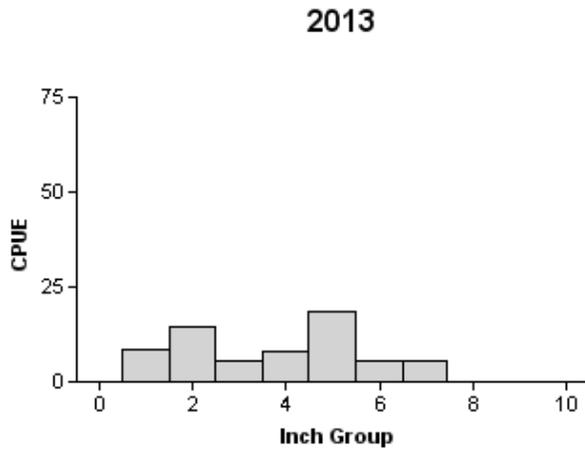
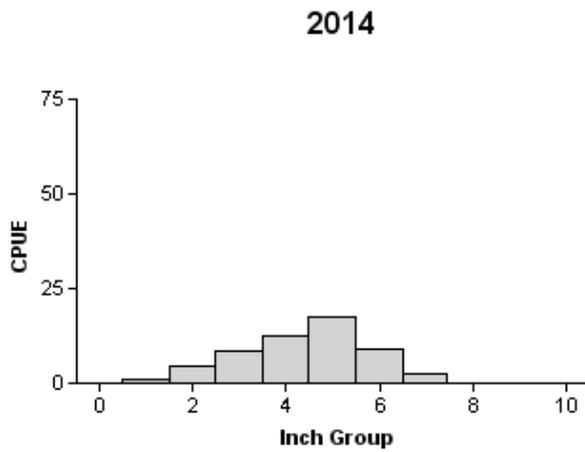


Figure 2. Number of Gizzard Shad caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Choke Canyon Reservoir, Texas, 2013, 2014, and 2015.

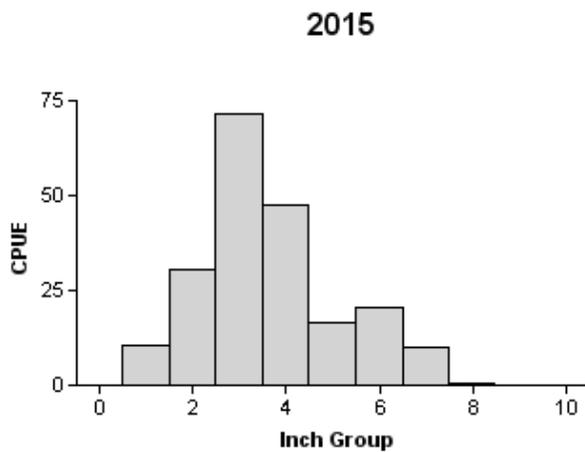
# Bluegill



Effort = 2.0  
 Total CPUE = 66.0 (21; 132)  
 Stock CPUE = 43.0 (26; 86)  
 CPUE-6 = 11.0 (32; 22)  
 PSD = 26 (4)



Effort = 2.0  
 Total CPUE = 55.5 (23; 111)  
 Stock CPUE = 50.0 (22; 100)  
 CPUE-6 = 11.5 (34; 23)  
 PSD = 23 (6)



Effort = 2.0  
 Total CPUE = 207.5 (17; 415)  
 Stock CPUE = 166.5 (19; 333)  
 CPUE-6 = 31.0 (34; 62)  
 PSD = 19 (4)

Figure 3. Number of Bluegill caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Choke Canyon Reservoir, Texas, 2013, 2014, and 2015.

## Redear Sunfish

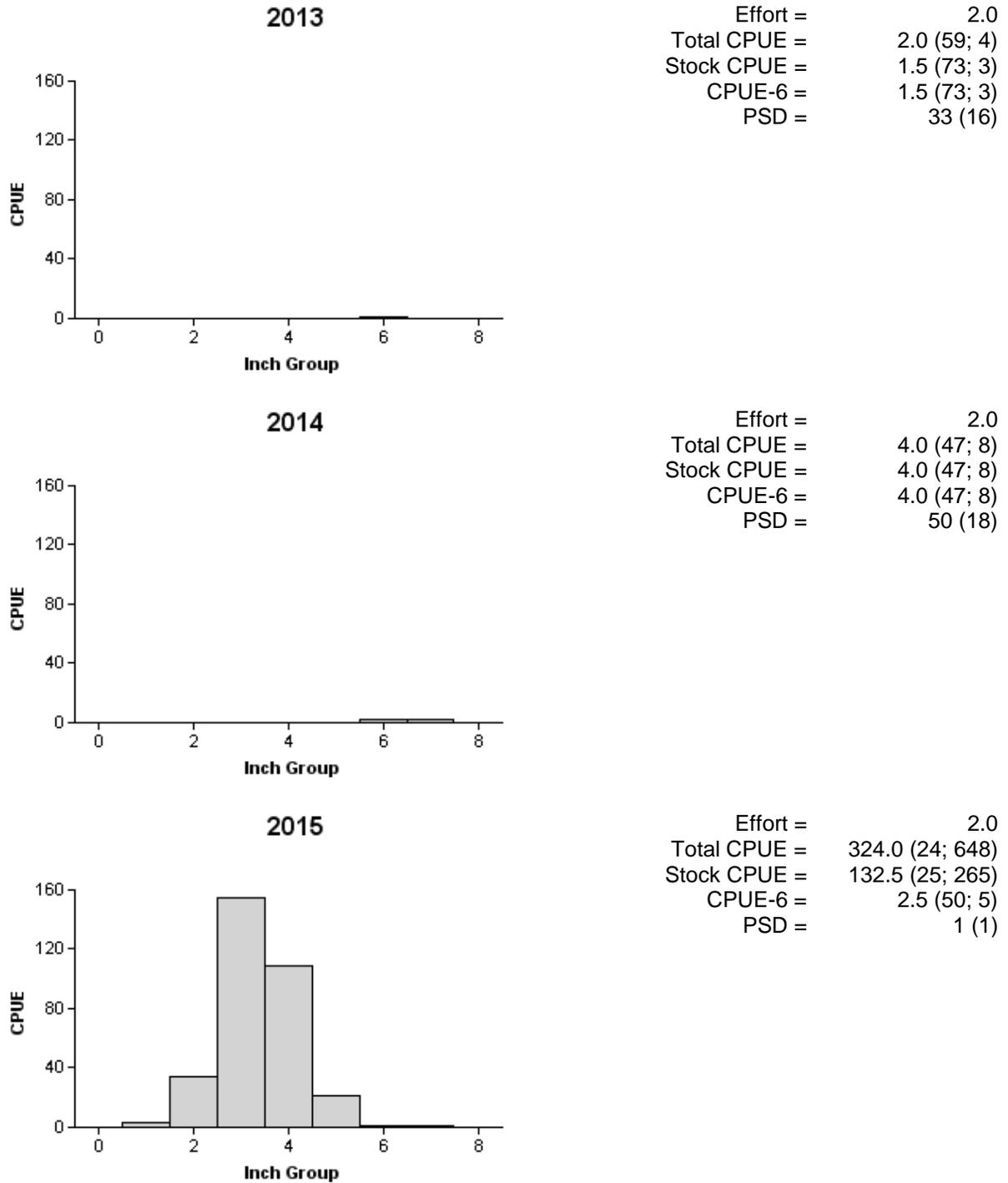


Figure 4. Number of Redear Sunfish caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Choke Canyon Reservoir, Texas, 2013, 2014, and 2015.

## Alligator Gar

Table 9. Creel survey statistics for Alligator Gar at Choke Canyon Reservoir from June 2010 through May 2011, June 2013 through May 2014, and June 2015 through May 2016. Total catch per hour represents anglers targeting Alligator Gar and total harvest is estimated number of Alligator Gar harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year		
	2010/2011	2013/2014	2015/2016
Surface area (acres)	23,225	14,393	13,744
Directed effort (h)	668 (73)	765 (65)	1,878 (72)
Directed effort/acre	0.03 (73)	0.05 (65)	0.14 (72)
Total catch per hour	-	0.11 (2441)	0.29 (616)
Total harvest	-	86 (2441)	337 (694)
Harvest/acre	-	0.01 (2441)	0.02 (694)
Percent legal released	-	0.0	39.1

# Blue Catfish

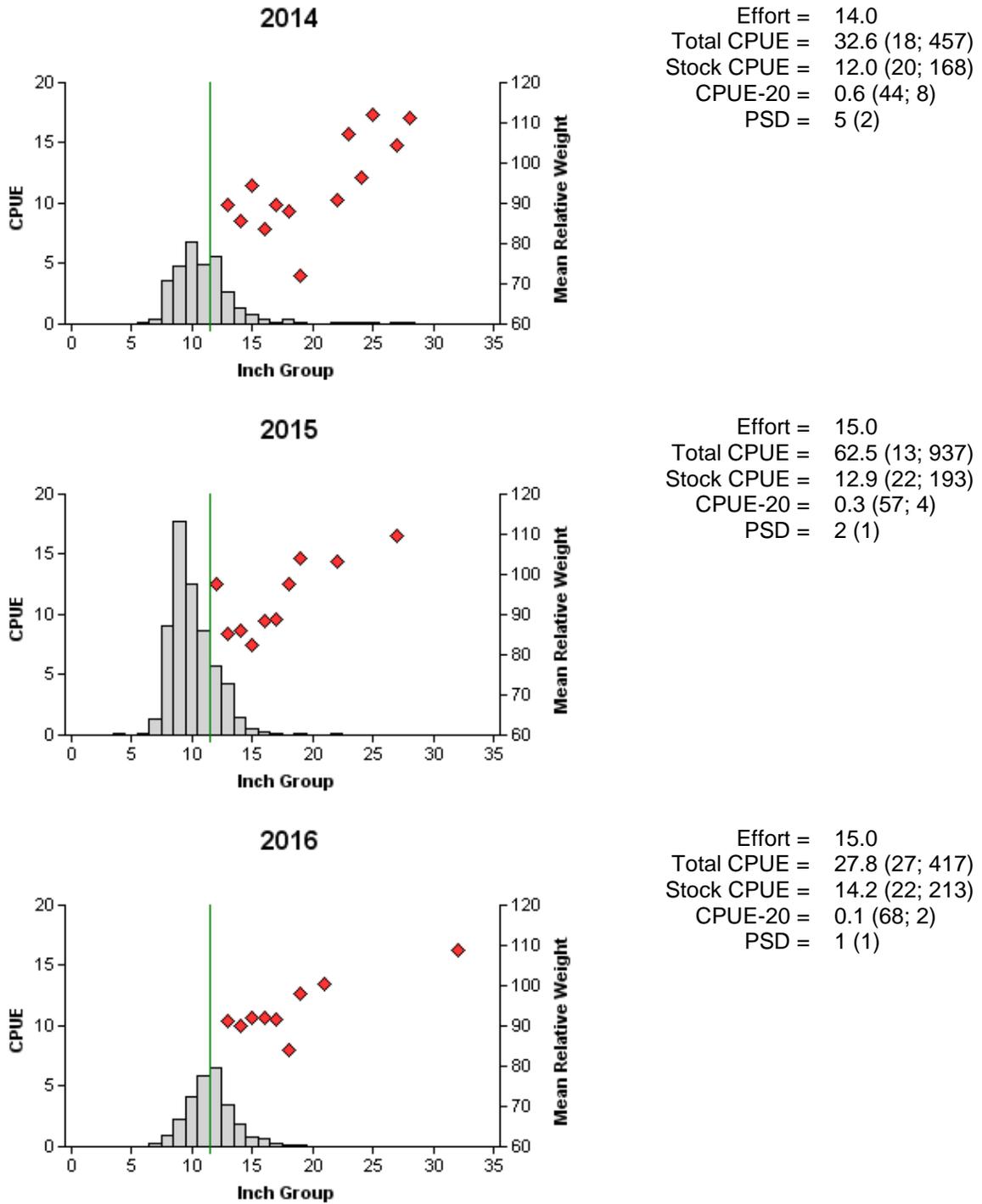


Figure 5. Number of Blue Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Choke Canyon Reservoir, Texas, 2014, 2015, and 2016. Vertical line denotes 12-inch minimum length limit.

## Blue Catfish

Table 10. Creel survey statistics for Blue Catfish at Choke Canyon Reservoir from June 2010 through May 2011, June 2013 through May 2014, and June 2015 through May 2016. Total catch per hour represents anglers targeting Blue Catfish and total harvest is estimated number of Blue Catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year		
	2010/2011	2013/2014	2015/2016
Surface area (acres)	23,225	14,393	13,744
Directed effort (h)	6,118 (29)	15,132 (27)	31,332 (18)
Directed effort/acre	0.26 (29)	1.05 (27)	2.28 (18)
Total catch per hour	1.14 (51)	0.92 (40)	2.50 (17)
Total harvest	38,366 (25)	40,637 (43)	106,283 (28)
Harvest/acre	1.65 (25)	2.82 (43)	7.73 (28)
Percent legal released	21	10	11

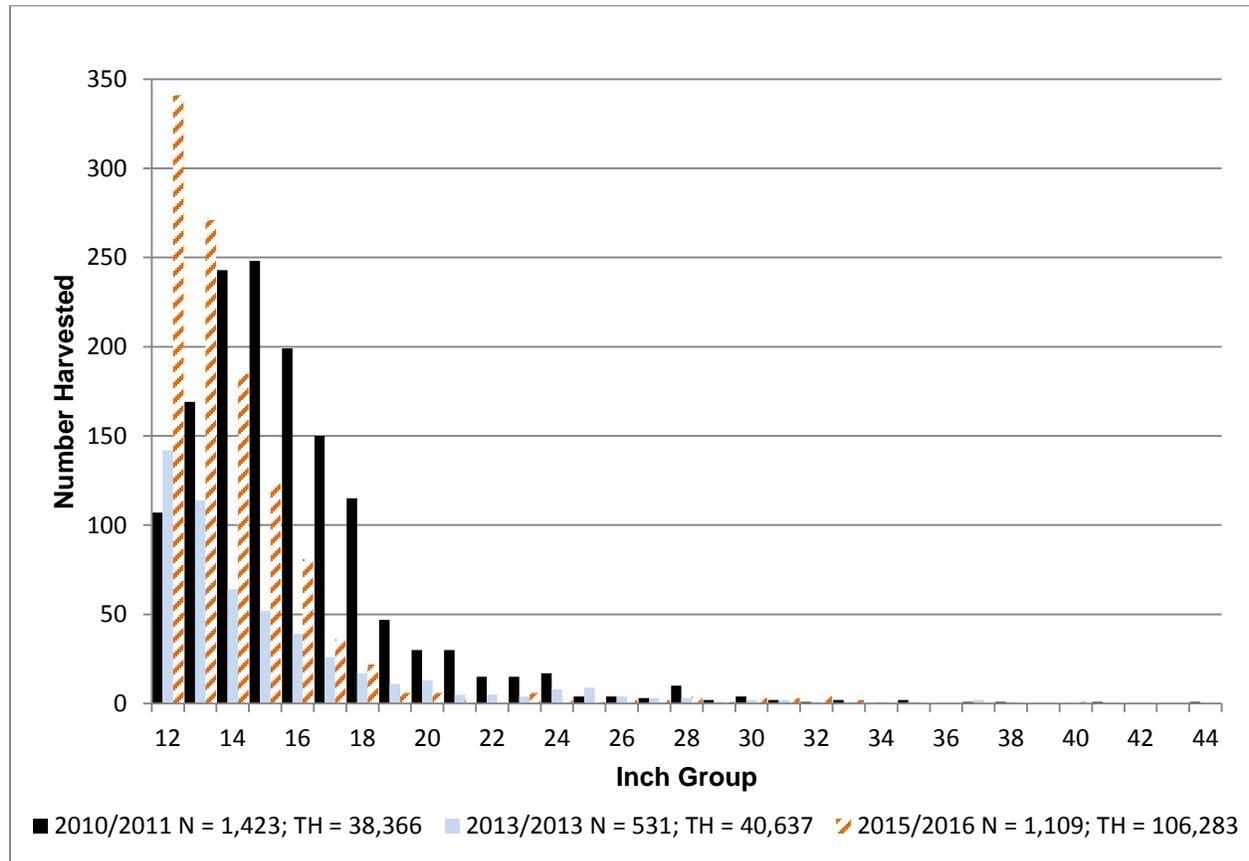


Figure 6. Length frequency of harvested Blue Catfish observed during creel surveys at Choke Canyon Reservoir, Texas, June 2010 through May 2011, June 2013 through May 2014, and June 2015 through May 2016, all anglers combined. N is the number of harvested Blue Catfish observed during creel surveys and TH is the total estimated harvest for the creel period.

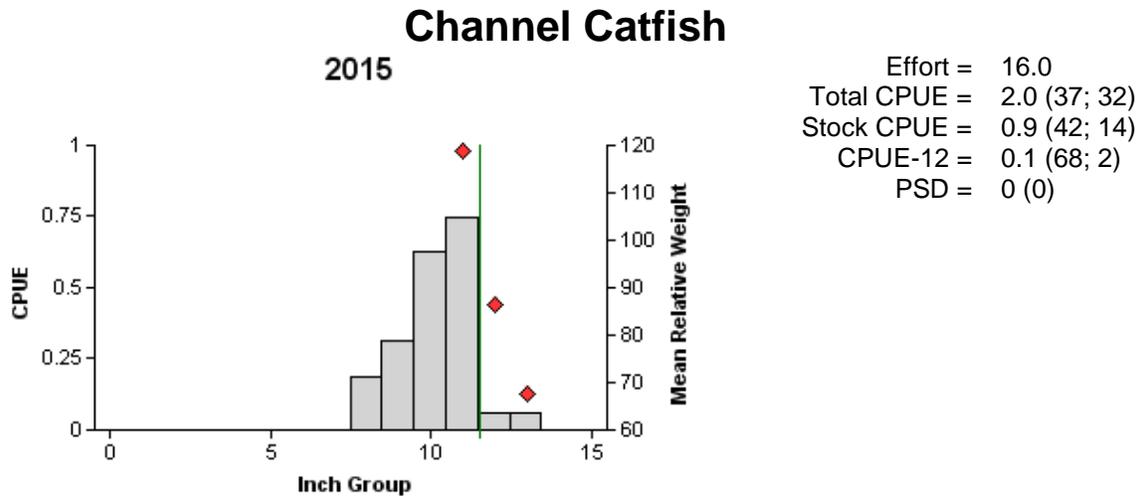


Figure 7. Number of Channel Catfish caught per hoop net series (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for summer baited tandem hoop net surveys, Choke Canyon Reservoir, Texas, 2015. Vertical line denotes 12-inch minimum length limit.

## Channel Catfish

Table 11. Creel survey statistics for Channel Catfish at Choke Canyon Reservoir from June 2010 through May 2011, June 2013 through May 2014, and June 2015 through May 2016. Total catch per hour represents anglers targeting Channel Catfish and total harvest is estimated number of Channel Catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year		
	2010/2011	2013/2014	2015/2016
Surface area (acres)	23,225	14,393	13,744
Directed effort (h)	188 (116)	629 (75)	4,525 (47)
Directed effort/acre	0.01 (116)	0.04 (75)	0.33 (47)
Average angler catch rate (#/h)	0.32 (50)	0.33 (43)	0.62 (25)
Total harvest	2,862 (44)	5,657 (60)	15,480 (38)
Harvest/acre	0.12 (44)	0.39 (60)	1.13 (38)
Percent legal released	39	5	18

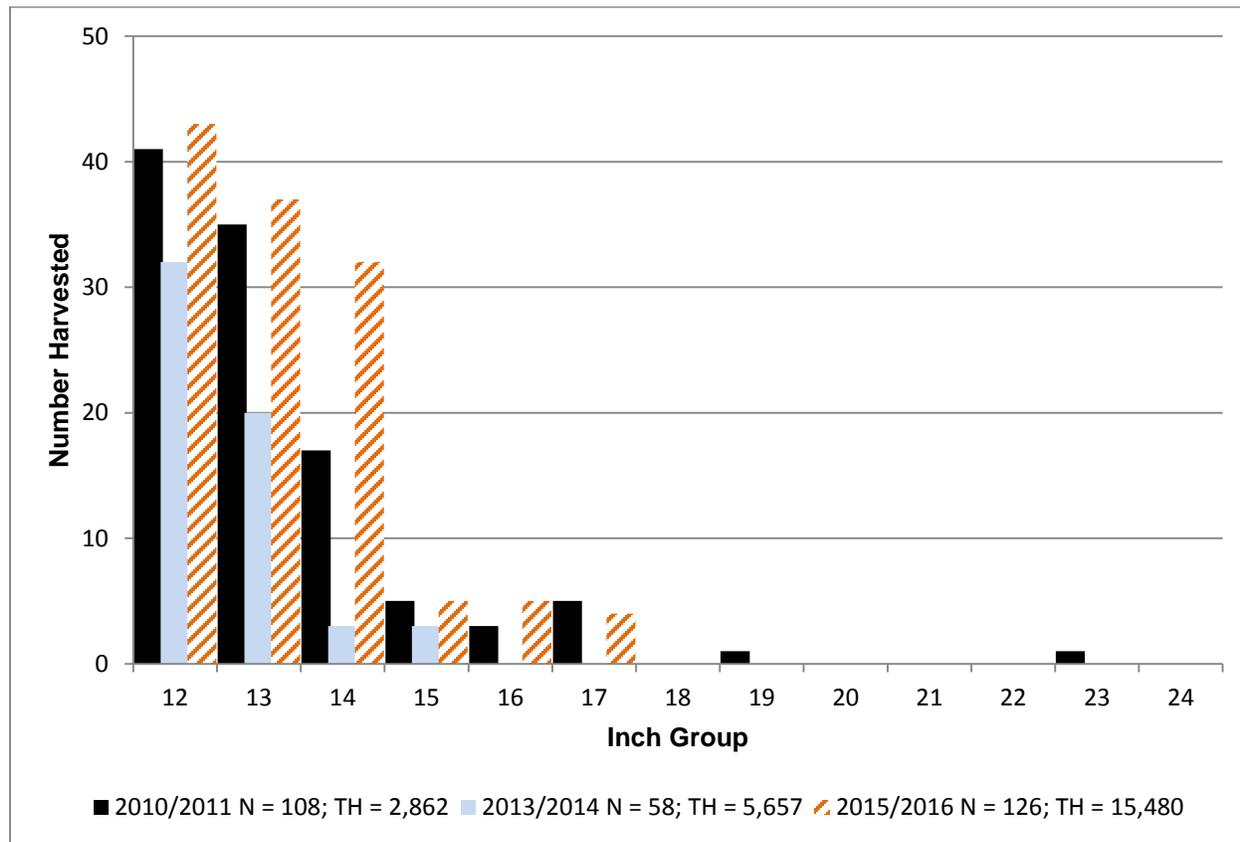


Figure 8. Length frequency of harvested Channel Catfish observed during creel surveys at Choke Canyon Reservoir, Texas, June 2010 through May 2011, June 2013 through May 2014, and June 2015 through May 2016, all anglers combined. N is the number of harvested Channel Catfish observed during creel surveys and TH is the total estimated harvest for the creel period.

# White Bass

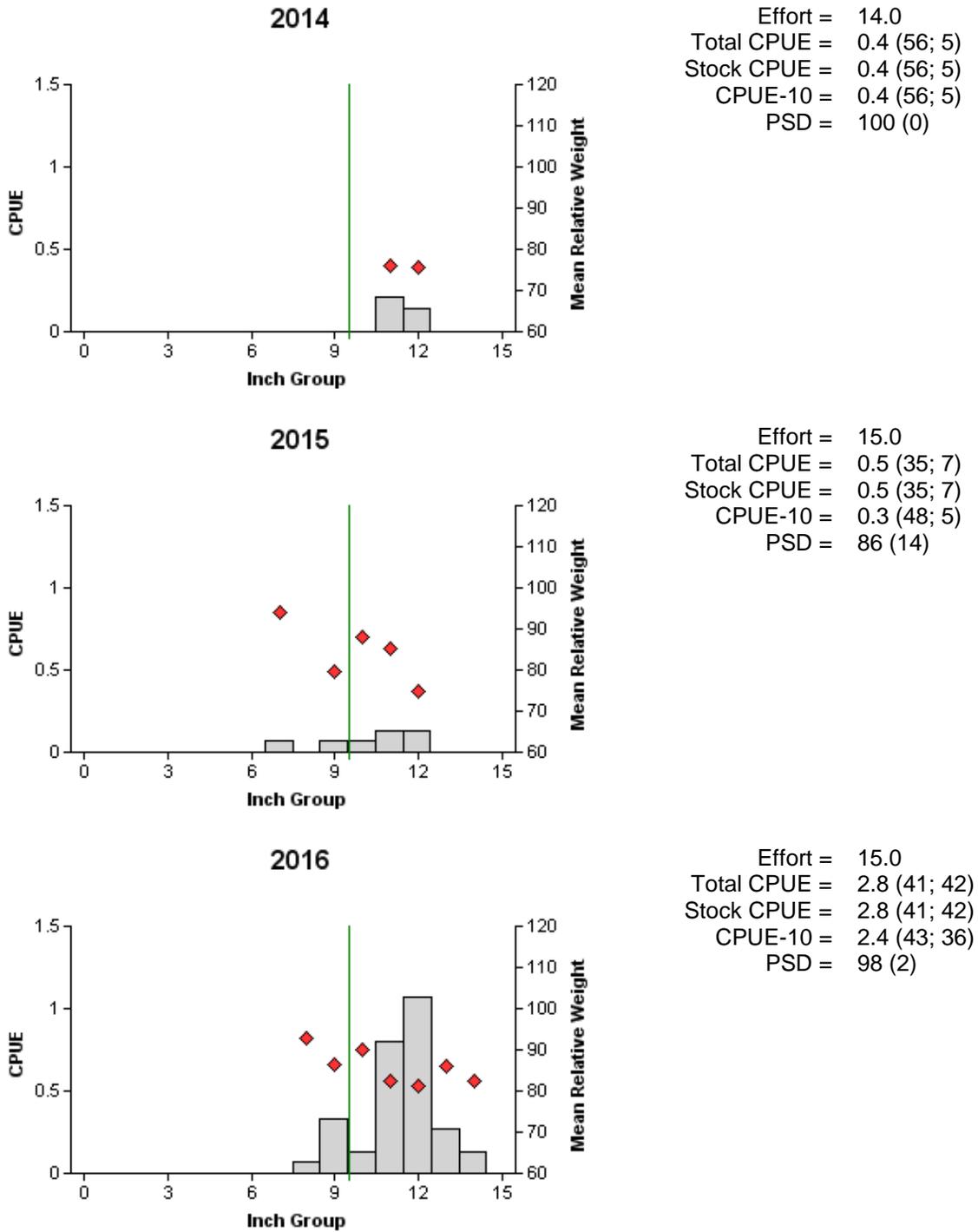


Figure 9. Number of White Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Choke Canyon Reservoir, Texas, 2014, 2015, and 2016. Vertical line denotes 10-inch minimum length limit.

## White Bass

Table 12. Creel survey statistics for White Bass at Choke Canyon Reservoir from June 2010 through May 2011, June 2013 through May 2014, and June 2015 through May 2016. Total catch per hour represents anglers targeting White Bass and total harvest is estimated number of White Bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year		
	2010/2011	2013/2014	2015/2016
Surface area (acres)	23,225	14,393	13,744
Directed effort (h)	2,128 (49)	7,215 (30)	8,498 (32)
Directed effort/acre	0.09 (49)	0.50 (30)	0.62 (32)
Total catch per hour	0.06 (43)	1.47 (58)	1.93 (57)
Total harvest	755 (189)	17,010 (42)	14,504 (72)
Harvest/acre	0.03 (189)	1.18 (42)	0.74 (72)
Percent legal released	18	13	38

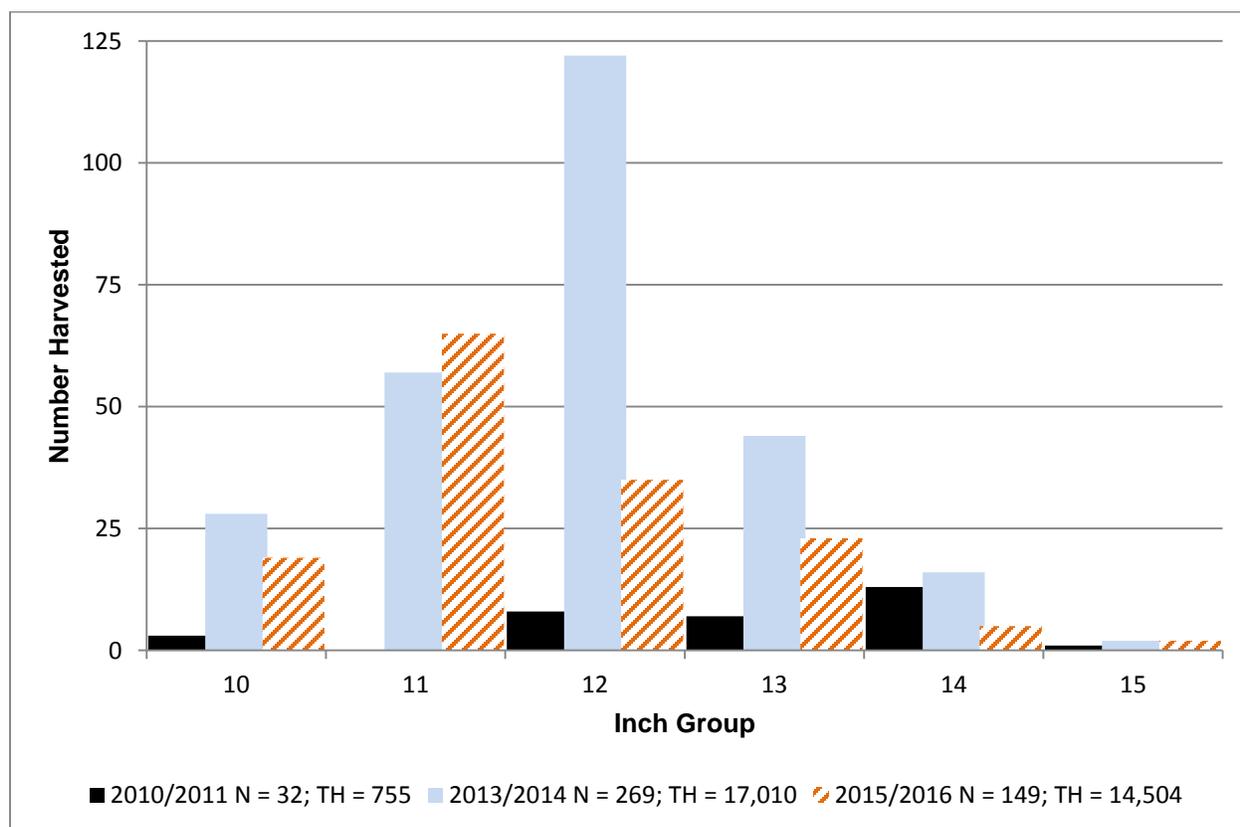


Figure 10. Length frequency of harvested White Bass observed during creel surveys at Choke Canyon Reservoir, Texas, June 2010 through May 2011, June 2013 through May 2014, and June 2015 through May 2016, all anglers combined. N is the number of harvested White Bass observed during creel surveys and TH is the total estimated harvest for the creel period.

## Largemouth Bass

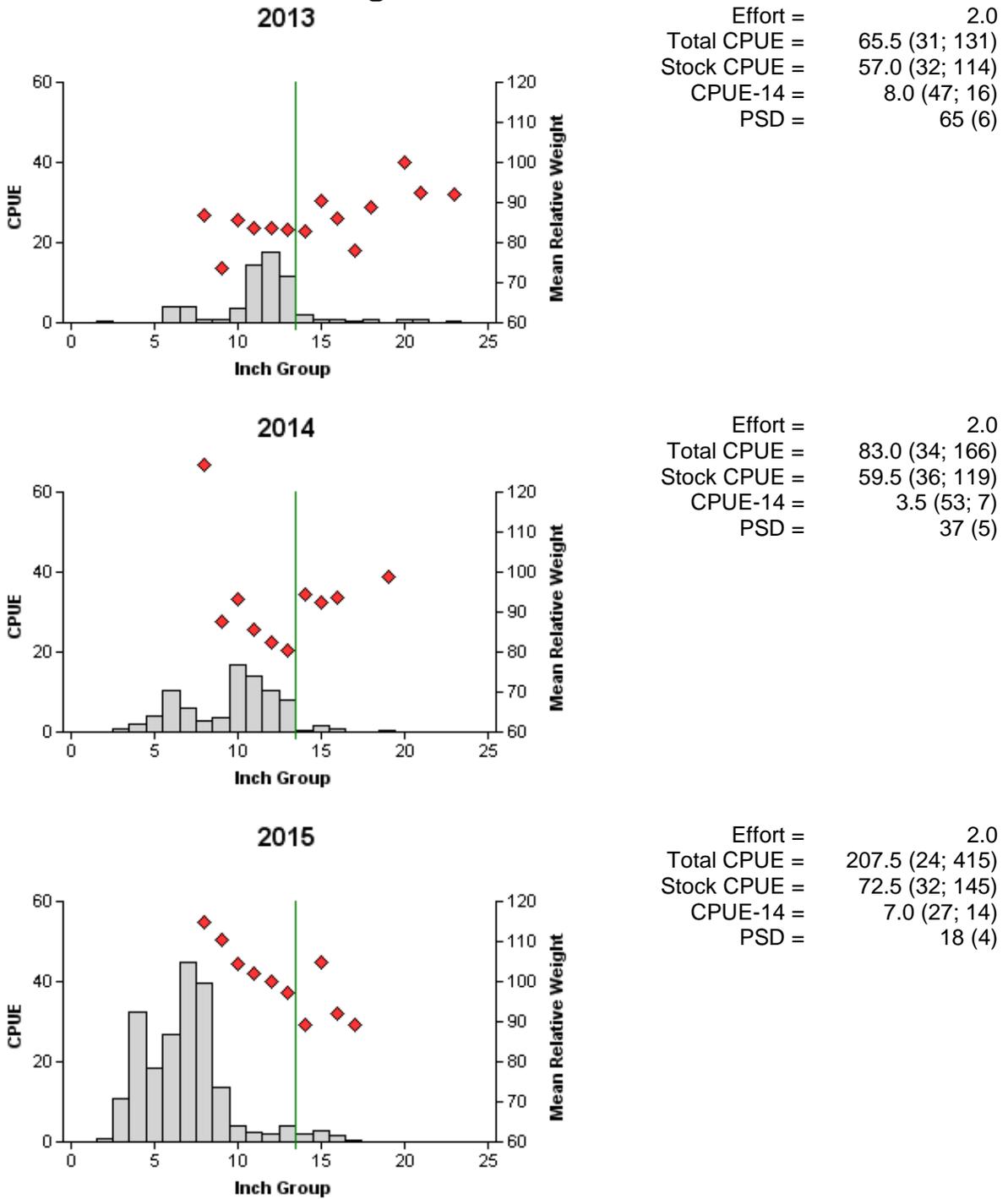


Figure 11. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Choke Canyon Reservoir, Texas, 2013, 2014, and 2015. Vertical line denotes 14-inch minimum length limit.

## Largemouth Bass

Table 13. Mean age at legal length (14 in) for Largemouth Bass collected by fall electrofishing, Choke Canyon Reservoir, Texas. Standard deviations are in parenthesis.

Year	N	Age Range	Age-at-Length
2008	53	1 – 4	1.7 (0.79)
2009	13	1 – 3	2.0 (0.40)
2010	15	1 – 3	2.2 (0.77)
2011	13	1 – 4	2.4 (0.86)
2012	13	1 – 4	2.3 (0.75)
2013	14	1 – 4	2.8 (0.70)
2014	14	2 – 4	2.9 (0.62)
2015	13	1 – 5	2.7 (1.03)

Table 14. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Choke Canyon Reservoir, Texas, 2005 – 2007, 2009 – 2013, and 2015. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB. Largemouth Bass genetic composition was determined with micro-satellite DNA analysis.

Year	Sample size	Number of fish			% FLMB alleles	% NLMB alleles
		FLMB	Intergrade	NLMB		
2005	30	15	15	0	78	22
2006	30	3	27	0	80	20
2007	30	8	22	0	83	17
2009	30	5	25	0	82	18
2010	30	3	27	0	80	20
2011	30	5	25	0	83	17
2012	30	1	29	0	79	21
2013	30	5	25	0	80	20
2015	30	6	24	0	86	14

## Largemouth Bass

Table 15. Creel survey statistics for Largemouth Bass at Choke Canyon Reservoir Reservoir, TX from June 2010 through May 2011, June 2013 through May 2014, and June 2015 through May 2016. Catch rate is for all anglers targeting Largemouth Bass. Harvest is partitioned by the estimated number of fish harvested by non-tournament anglers and the number of fish retained by tournament anglers for weigh-in and release. The estimated number of fish released by weight category is for anglers targeting Largemouth Bass. Relative standard errors (RSE) are in parentheses.

Statistic	2010/2011	2013/2014	2014/2015
Surface area (acres)	23,225	14,393	13,744
Directed angling effort (h)			
Non-tournament	103,155 (15)	32,736 (22)	35,572 (18)
Tournament	30,262 (19)	5,090 (42)	7,531 (32)
All black bass anglers combined	133,417	37,826	43,103
Angling effort/acre	5.74 (15)	2.63 (22)	3.14 (18)
Catch rate (number/h)	0.69 (10)	0.49 (22)	0.96 (34)
Harvest			
Non-tournament harvest	5,040 (32)	1,843 (84)	4,669 (68)
Harvest/acre	0.22 (32)	0.13 (84)	0.34 (68)
Tournament weigh-in and release	12,871 (38)	368 (377)	1,032 (327)
Release by weight			
<4.0 lbs	31,743	21,684 (70)	35,216 (62)
4.0-6.9 lbs	2,934	91 (113)	312 (86)
7.0-9.9 lbs	240	113 (86)	0 (*)
≥10.0 lbs	112	106 (102)	0 (*)
Percent legal released (non-tournament)	66	66	67

## Largemouth Bass

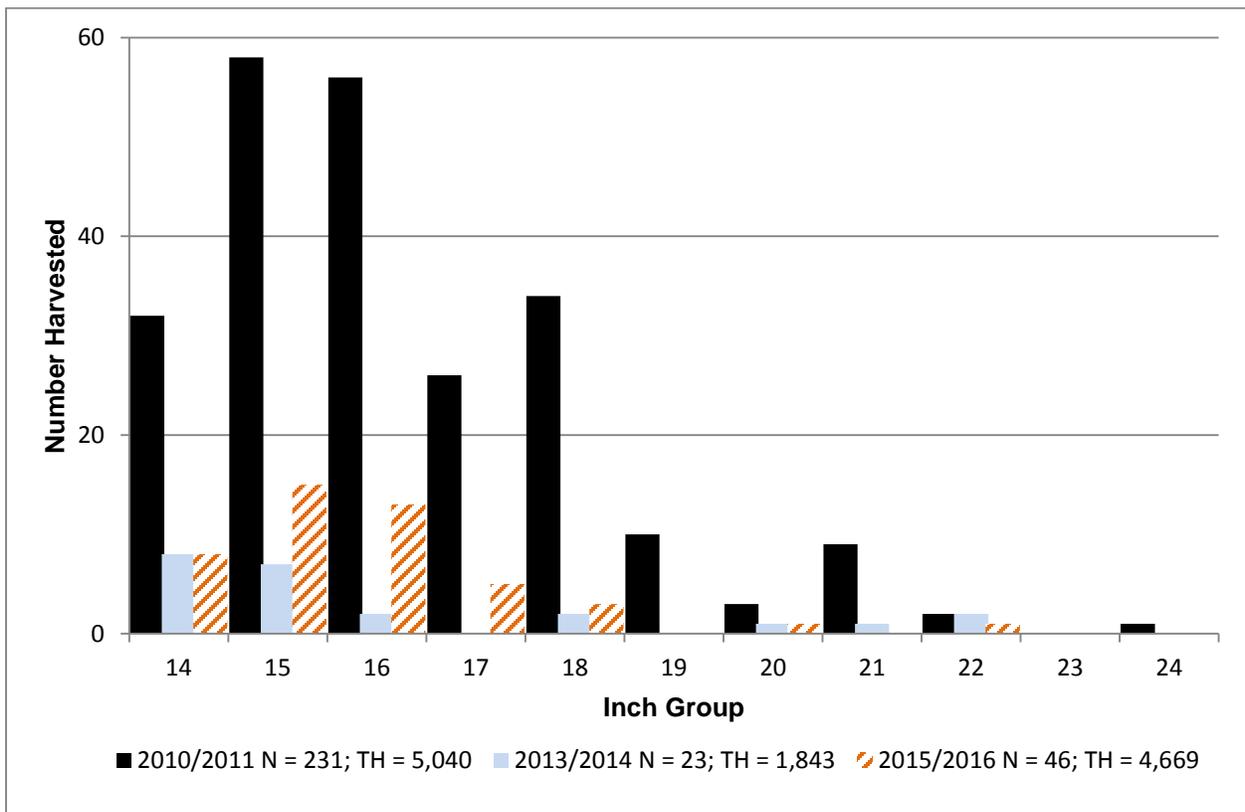


Figure 12. Length frequency of harvested Largemouth Bass observed during creel surveys at Choke Canyon Reservoir, Texas, June 2010 through May 2011, June 2013 through May 2014, and June 2015 through May 2016, all anglers combined. N is the number of harvested Largemouth Bass observed and TH is the total estimated harvest for the creel period.

## White Crappie

Table 16. Creel survey statistics for White Crappie at Choke Canyon Reservoir from June 2010 through May 2011, June 2013 through May 2014, and June 2015 through May 2016. Total catch per hour represents anglers targeting White Crappie and total harvest is estimated number of White Crappie harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year		
	2010/2011	2013/2014	2015/2016
Surface area (acres)	23,225	14,393	13,744
Directed effort (h)	743 (65)	6,897 (35)	9,559 (36)
Directed effort/acre	0.03 (65)	0.48 (35)	0.70 (36)
Average angler catch rate (#/h)	0.04 (242)	0.80 (43)	1.99 (61)
Total harvest	612 (219)	8,420 (63)	6,923 (87)
Harvest/acre	0.03 (219)	0.59 (63)	0.50 (87)
Percent legal released	7	3	5

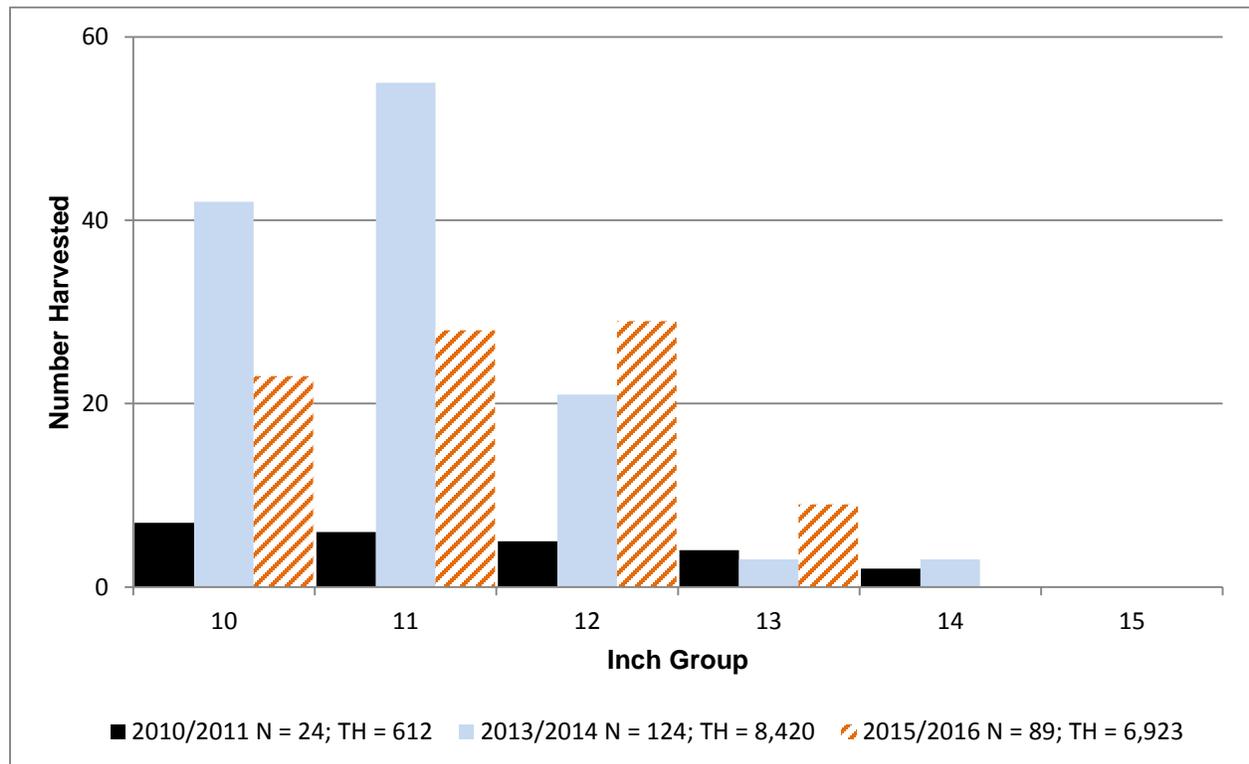


Figure 13. Length frequency of harvested White Crappie observed during creel surveys at Choke Canyon Reservoir, Texas, June 2010 through May 2011, June 2013 through May 2014, and June 2015 through May 2016, all anglers combined. N is the number of harvested White Crappie observed during creel surveys and TH is the total estimated harvest for the creel period.

Table 17. Proposed survey schedule for Choke Canyon Reservoir, Texas. Survey period is June through May. Creel surveys are conducted over a 6 month period with a total of 18 creel days. Trap netting and electrofishing surveys are conducted in the fall while gill netting surveys are conducted in the spring. Standard surveys are denoted by S and additional surveys denoted by A.

Survey year	Electrofishing Fall(Spring)	Trap net	Gill net	Habitat			Creel survey	Report
				Structural	Vegetation	Access		
2016-2017	A				A			
2017-2018	A		A		A			
2018-2019	A				A		S	
2019-2020	S		S		S	S	S	

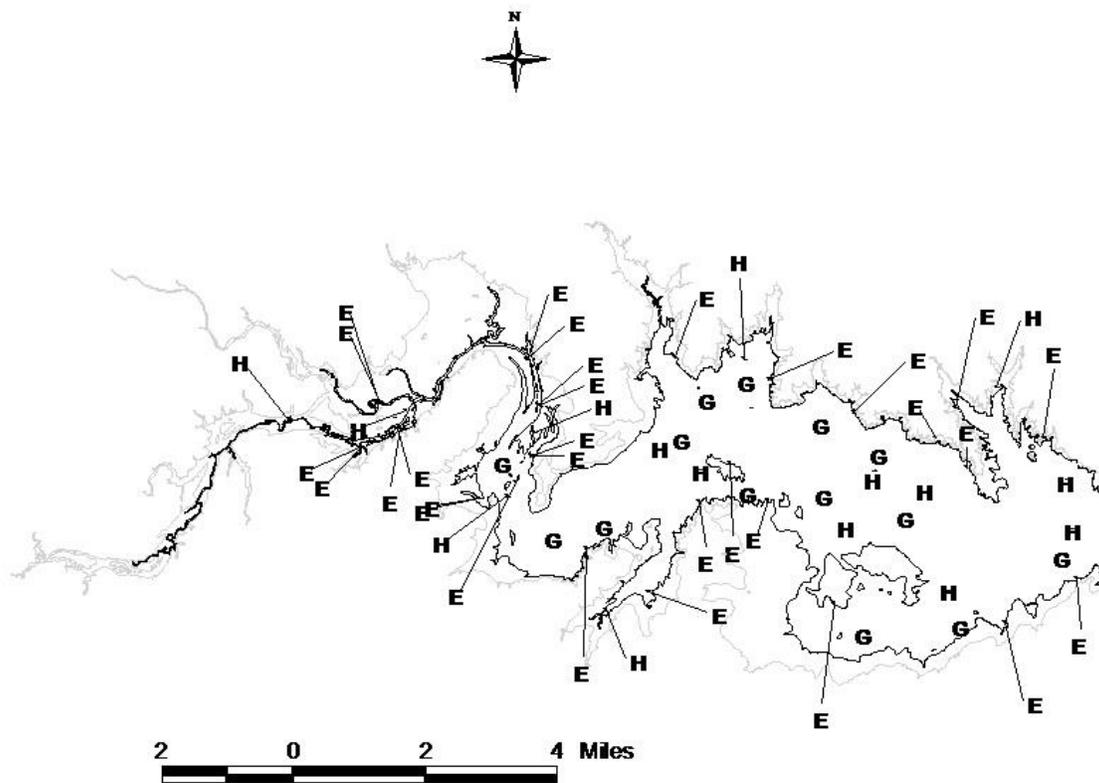


**APPENDIX A**

Number (N) and catch rate (CPUE) of all species collected from all gear types from Choke Canyon Reservoir, Texas, 2015-2016. Sampling effort was 15 net nights for gill netting, 16 tandem hoop net series, and 2 hours for electrofishing.

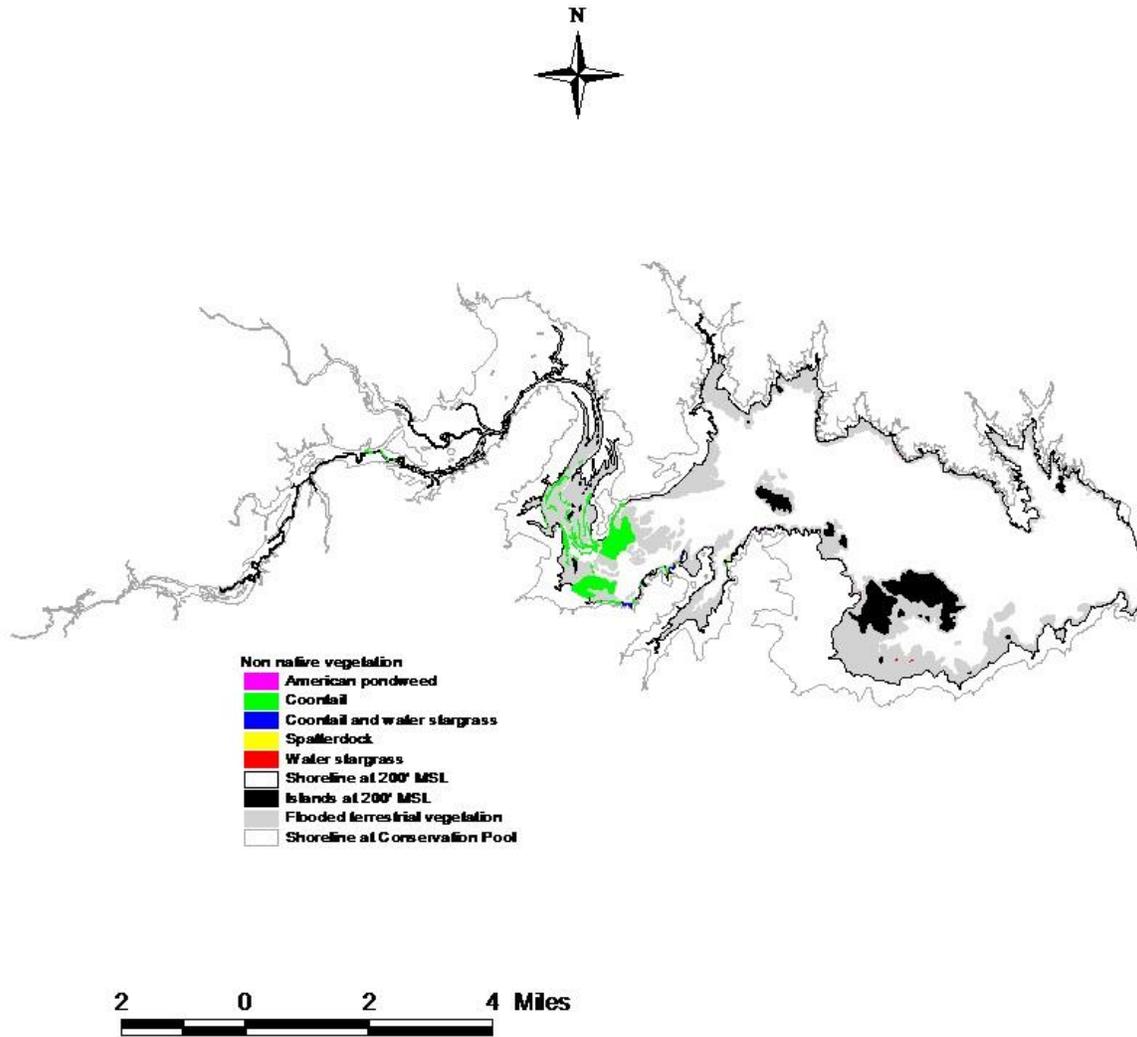
Species	Electrofishing		Gill Netting		Hoop Netting	
	CPUE	N	CPUE	N	CPUE	N
Spotted Gar			3.9	59		
Longnose Gar			0.5	8		
Alligator Gar			0.1	2		
Gizzard Shad	160.5	321	23.8	357		
Threadfin Shad	171.5	343				
Common Carp			3.1	46		
Inland Silverside	4.5	9				
Smallmouth Buffalo			4.8	72		
Blue Catfish			27.8	417		
Channel Catfish			1.5	22	2.0	32
White Bass	4.0	8	2.8	42		
Bluegill	207.5	415	0.3	4		
Longear Sunfish	14.0	28				
Redear Sunfish	324.0	648	0.2	3		
Largemouth Bass	207.5	415	0.6	9		
White Crappie			0.7	11		
Black Crappie	1.5	3	0.6	9		
Freshwater Drum			9.1	137		
Rio Grande Cichlid	2.0	4				

APPENDIX B



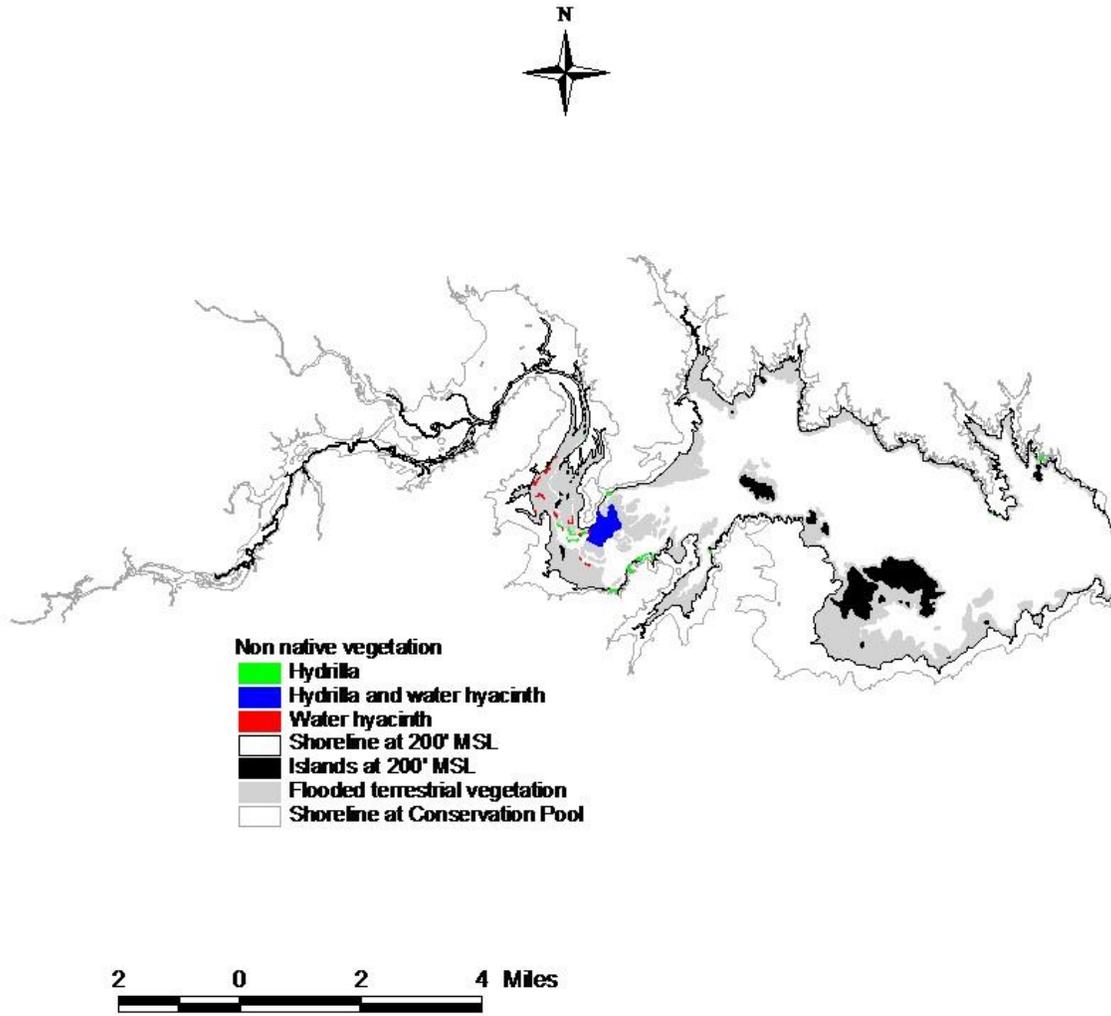
Location of sampling sites, Choke Canyon Reservoir, Texas, 2015-2016. Electrofishing, hoop net, and gill net stations are denoted by E, H, and G, respectively. The reservoir was 23.0 feet below conservation pool at time of sampling. Dark line indicates elevation at time of sampling, light line indicates full pool elevation.

APPENDIX C



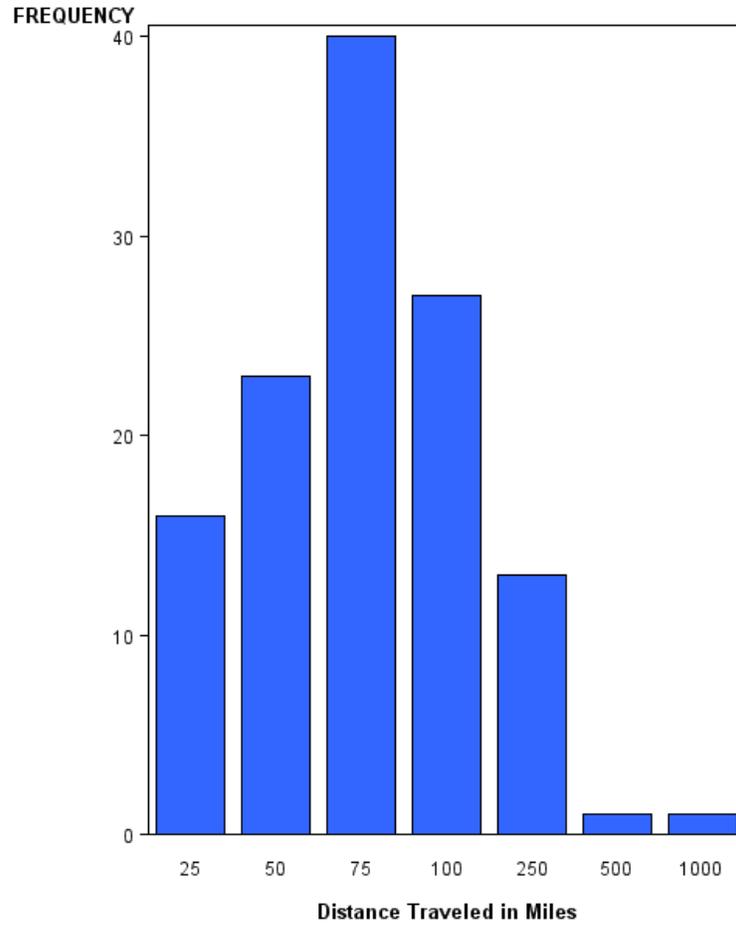
Map of native aquatic vegetation, Choke Canyon Reservoir, Texas, 2015.

APPENDIX D

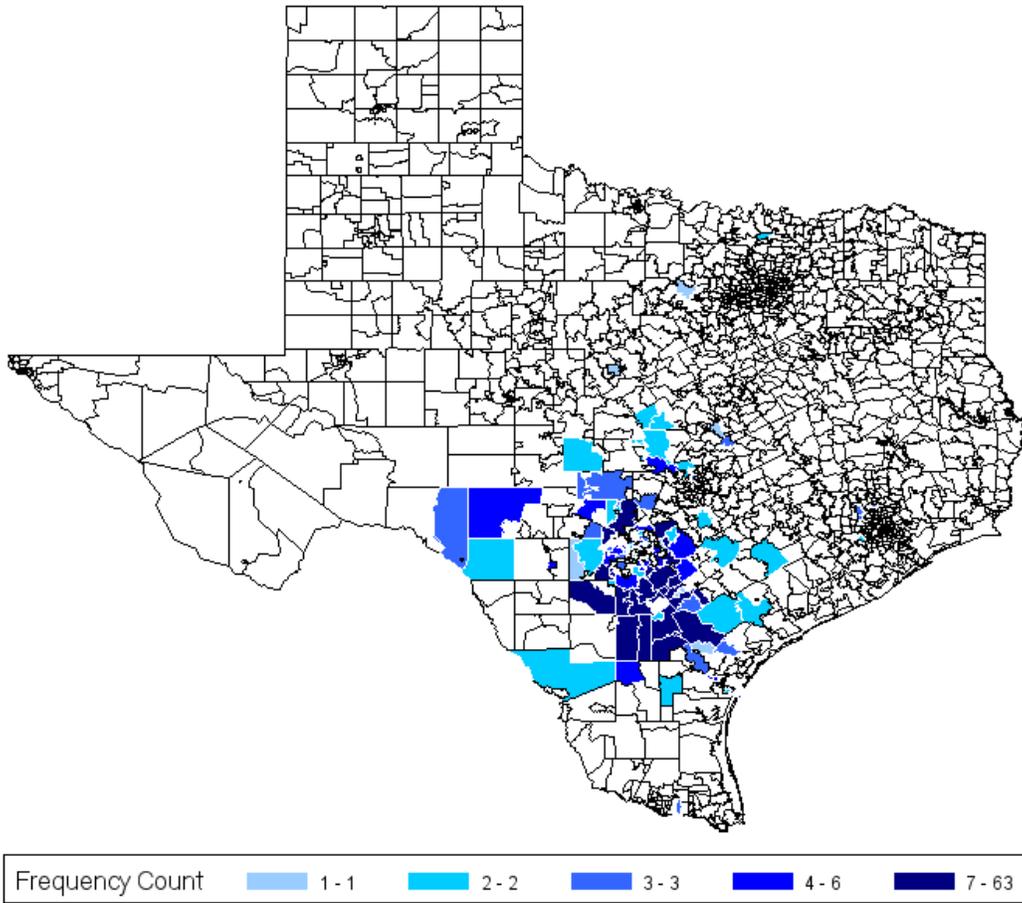


Map of non-native aquatic vegetation, Choke Canyon Reservoir, Texas, 2015.

**APPENDIX E**



Distance traveled (miles) by frequency to Choke Canyon Reservoir, Texas, as determined from June 2015 through May 2016 creel survey.



Location, by ZIP code, and frequency of anglers that were interviewed at Choke Canyon Reservoir, Texas, during June 2015 through May 2016 creel survey.