PERFORMANCE REPORT

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INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2015 Fisheries Management Survey Report

Hubbard Creek Reservoir

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Hubbard Creek Reservoir were surveyed by electrofishing and trap netting in 2015, and gill netting in 2016. Historical data are presented with the recent data for comparison. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir Description:** Hubbard Creek Reservoir is a 15,250-acre impoundment constructed in 1962 on Sandy Creek and Hubbard Creek, in the Brazos River Basin. The reservoir is used for municipal water supply, flood control, and recreation. The reservoir is controlled by the West Central Texas Municipal Water District and has a history of extreme water level fluctuations. Hubbard Creek was nearly full in 2008 but dropped to record low water level in May 2015. Fish habitat in the most recent survey consisted of smartweed, flooded terrestrial vegetation, salt cedar, and standing timber. Since the last survey period, boater access was limited to one public boat ramp. As of April 2016, all boat ramps were useable after a substantial water level increase from heavy rains. Bank-fishing access was limited to the boat ramp areas as well as near the US-180 Bridge.

- **Management History:** Important sport fish include Largemouth Bass, White Bass, White Crappie, and catfishes. Sport fishes are regulated by statewide harvest regulations. Threadfin Shad were introduced in 1984. Channel Catfish were introduced in 1970. Palmetto Bass were stocked in 1979 and 1984. Florida Largemouth Bass were introduced in 1979, stocked during the early 1990's, stocked in 2003, and they were last stocked in 2011 and 2012.

- **Fish Community**
  - **Prey species:** Electrofishing catch of prey species was low and consisted primarily of Gizzard Shad, Bluegill, and Longear Sunfish. Other fish species were also available as prey. Sunfish species were of sizes that were available to most sport fish. Gizzard Shad < 7 inches were present in high relative abundance and were available to most sport fish.

  - **Catfishes:** Channel Catfish, Blue Catfish, and Flathead Catfish were present in the reservoir. Blue Catfish were the most abundant catfish species observed during gill net surveys. Most of the Blue Catfish were of harvestable size.

  - **White Bass:** In 2016, White Bass relative abundance was low, and all fish sampled were harvestable size.

  - **Largemouth Bass:** In 2015, Largemouth Bass relative abundance and number of large fish were low. Legal-sized fish were not relatively abundant in the survey.

  - **White Crappie:** In 2015, White Crappie relative abundance was low. Mean relative weight for most inch classes ranged from 90-110. Legal-sized White Crappie were not relatively abundant in the survey.

Management Strategies: Largemouth Bass and prey items will be surveyed in fall 2017. Trap netting, gill netting, and electrofishing surveys will be conducted in 2019-2020 for relative abundance, size structure, and mean relative weight data. Access and habitat surveys will be conducted in summer 2019. Inform the public of the threat and impact of invasive species.

INTRODUCTION

This document is a summary of fisheries data collected from Hubbard Creek 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 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

Hubbard Creek Reservoir is a 15,250-acre impoundment constructed in 1962 on Sandy Creek and Hubbard Creek, in the Brazos River Basin. Hubbard Creek Reservoir is located in Stephens County approximately 55 miles northeast of Abilene, Texas and is controlled by the West Central Texas Municipal Water District. The reservoir was built primarily for municipal water supply, flood control, and recreation. Hubbard Creek Reservoir experienced long periods of reduced water level. From 1999 to 2007, the water level fluctuated from approximately 4.3 to 19.0-feet below conservation pool (CP). Water level was within 0.5-feet below CP in May 2008, but rapidly declined in years following. A historic low water level occurred in May 2015 when water level was approximately 31.0-feet below CP (Figure 1). During 2015 sampling, water level varied from 14.1 to 18.3-feet below CP. As of June 2016, Hubbard Creek Reservoir was full. Other descriptive characteristics for Hubbard Creek Reservoir are in Table 1.

Angler Access

Hubbard Creek Reservoir boat access consisted of one useable public boat ramp during most of the sampling period with others out of the water. After heavy rains in spring 2016, water level increased enough so all ramps were usable. Bank-fishing access was limited to the boat ramp area and the area by the U.S. Highway 180 Bridge. Additional boat ramp characteristics can be seen in Table 2.

Management History

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

1. Annually survey hydrilla, an invasive plant species, coverage in the reservoir and submit updates to controlling authority.
   Action: Annual monitoring has been completed to determine presence/absence of hydrilla and approximate coverage. Controlling authority was notified of any hydrilla findings.
2. Stock Florida Largemouth Bass in Hubbard Creek Reservoir once a substantial increase in littoral habitat has occurred.
   Action: Florida Largemouth Bass were stocked in 2012 and 2016. Genetic testing was conducted in 2015.
3. Educate the public about the threats of invasive species.
   Action: Press releases were distributed to local and statewide media. Signage was posted at Hubbard Creek Reservoir to notify users of the potential threats of invasive species.

Harvest regulation history: All sport fish are regulated with statewide harvest regulations (Table 3).

Stocking history: Threadfin Shad were stocked in 1984. Channel Catfish were stocked in 1970. Palmetto Bass were stocked in 1979 and 1984; however, stockings have been discontinued. Florida Largemouth Bass were first stocked in 1979 and were most recently stocked in 2016. The complete stocking history is displayed in Table 4.

Vegetation/habitat management history: Hydrilla was first documented in Hubbard Creek Reservoir in 1998, and the estimated coverage was 25 acres in 1999. During the next survey conducted in 2003, no hydrilla was found. However, hydrilla was found in surveys between 2008-2012, during which coverage substantially declined nearly each year. No hydrilla has been discovered since 2012. Previously, there

have not been attempts to control hydrilla at Hubbard Creek Reservoir by the West Central Texas Municipal Water District or by Texas Parks and Wildlife Department.

Water transfer: There was one permanent pumping station on the reservoir which can transfer water to Fort Phantom Hill Reservoir. No interbasin water transfers exist.

METHODS

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Hubbard Creek Reservoir (TPWD unpublished). Primary components of the OBS plan are listed in Table 5. All survey sites were randomly selected and all surveys were conducted according to the Fisheries Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Electrofishing – Largemouth Bass, sunfishes, and Gizzard Shad were collected by electrofishing (1.5 hours at 18, 5-minute stations in 2013 and 2.0 hours at 24, 5-minute stations in 2015). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing.

Trap Netting – White Crappie were collective using trap nets (15 net nights at 15 stations). CPUE for trap netting was recorded as the number of fish caught per net night (fish/nn). Otoliths were collected from White Crappie 9.0-11.9 inches for age and growth to determine age at legal-length.

Gill netting – Channel Catfish, Blue Catfish, White Bass, and Flathead Catfish were sampled by gill netting (20 net nights at 20 stations). CPUE for gill netting was recorded as the number of fish caught per net night (fish/nn). Fish were not weighed during the gill net surveys.

Genetics – Genetic analysis of Largemouth Bass was conducted in accordance with 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_r)] were calculated for target fishes according to Anderson and Neumann (1996). Index of vulnerability (IOV) was calculated for Gizzard Shad (DiCenzo et al. 1996). Standard error (SE) was calculated for structural indices and IOV. Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE statistics.

Habitat – Habitat surveys were conducted during summer 2013 and 2015. In August 2013, habitat composition was determined by assessing the habitat at 130 random stations throughout the reservoir. In July 2015, habitat was documented at 354 random stations distributed throughout the reservoir. During each survey, plants and habitat types were identified at or below the waterline and marked as “1” for present or “0” for absent. Percent occurrence (% = [# stations present / total stations sampled] X 100) and associated 95% confidence intervals were calculated for habitat. No structural habitat survey was conducted in 2015-2016 since structural features have not changed since the 2011 sampling period.

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

RESULTS AND DISCUSSION

Habitat: In 2013, water level at the time of the habitat survey was 20.7-feet below CP and was 18.3-feet below CP during the 2015 habitat survey. Of the structural habitat features found in the survey, small boulders were encountered the most followed by large boulders, pebbles, cobbles, docks, rip-rap, bridge pylons, and bedrock (Table 6). Structural habitat types have a higher percent occurrence in 2013 compared to 2015 for most habitat types. Smartweed was the most prevalent of the vegetation found in

the survey. In 2015, other vegetation such as salt cedar, *Chara* sp., black willow, and cattail were also present. Percent coverage of smartweed and salt cedar increased from 2013 to 2015. Most of the reservoir consisted of non-descriptive or featureless bank in 2013 and 2015. Flooded terrestrial and standing timber were also present (Table 7). Dumont (2012) noted hydrilla, pondweed, brittle naiad, and stargrass were observed in the 2011 survey when water level was about 5-feet higher than it was during the 2015 survey. No hydrilla was observed since the 2012 survey.

Prey species: The prey base primarily consisted of Gizzard Shad, Bluegill, and Longear Sunfish. Catch rate of Gizzard Shad in 2015 had decreased to 120.0/h from 164.0/h in 2013 and 180.0/h in 2011. In 2015, IOV was high (91) compared to 2011 (64; Figure 2), indicating that the majority of Gizzard Shad were of suitable prey size for sport fish. Bluegill CPUE declined from 2011 (103.5/h) to 2013 (10.0/h). Catch rates increased in 2015 (36.0/h) compared to 2013, yet relative abundance was still lower in 2015 than in 2011. Similar patterns in CPUE-Stock were observed (Figure 3). Size structure of Bluegill consisted primarily of fish 2-4 inches, which most fish in the sample were of adequate prey size for sport fish (Figure 3).

Blue Catfish: Blue Catfish were the most relatively abundant of the catfishes sampled with gill nets. Blue Catfish catch rate was similar from 2008-2016, ranging from 2.4-3.8/nn. The relative abundance of fish ≥ 12 inches also remained similar from 2008 (1.9/nn) to 2012 (3.7/nn) and 2016 (3.0/nn; Figure 4). Most of the fish sampled with gill nets were of harvestable size and size structure was favorable for anglers as the PSD was 49. Despite additional sampling effort to collect needed fish, no Blue Catfish were collected for determining age at legal length because only two fish 11.0-13.9 inches were sampled.

Channel Catfish: Channel Catfish catch rate in the gill netting surveys remained low from 2008 (0.9/nn), to 2012 (2.4/nn) and 2016 (0.5/nn). The catch rate of fish ≥ 12 inches remained low from 2008 (0.6/nn) to 2012 (2.3/nn) and 2016 (0.5/nn). All of the fish collected were of harvestable size and size structure was favorable for anglers as PSD was 89 (Figure 5).

Flathead Catfish: Flathead Catfish were present in gill netting surveys conducted at Hubbard Creek Reservoir. Catch rates were low in 2008 (0.3/nn) and 2016 (0.3/nn).

White Bass: White Bass catch rates in gill net surveys declined from 8.0/nn in 2008 to 2.1/nn in 2012. Catch rate increased to 3.7/nn in 2016 from 2012; however, catch rate was still less in 2016 compared to 2008. Relative abundance of White Bass ≥ 10 inches was variable from 6.5/nn in 2008, 1.2/nn in 2012, and 2.0/nn in 2016 (Figure 6). Harvestable size fish were available to anglers and PSD was 58 (Figure 6).

Largemouth Bass: Electrofishing catch rate for all Largemouth Bass was 21.5/h in 2015, which was lower than the catch reported in 2013 (39.3/h) and in 2011 (93.5/h; Figure 7). Relative abundance of Largemouth Bass ≥ stock-size (≥ 8 inches) declined to 4.5/h in 2015 from 35.3/h in 2013, and from 59.0/h in 2011 (Figure 7). Relative abundance of Largemouth Bass ≥ 14 inches decreased from 24.0/h in 2011 to 2.0/h in 2015. The low water level between 2012-2015 likely reduced critical habitat and thus reduced Largemouth Bass spawning success and recruitment. No fish in the 13.0-15.9 inch size range were collected during the electrofishing survey, and age at legal length could not be determined. One Florida Largemouth Bass was sampled during 2015 electrofishing survey, and all other Largemouth Bass collected were intergrades (Table 8).

White Crappie: White Crappie CPUE in the trap net surveys decreased from 2007 (12.0/nn), to 2011 (6.8/nn), to 2015 (1.9/nn). Catch of CPUE-10 of White Crappie increased from 2.0/nn in 2007 to 2.5/nn in 2011, then decreased to 0.2/nn in 2015 (Figure 8). In 2015, PSD for White Crappie decreased to 54 from 82 and 88 reported in the 2007 and 2011 surveys, respectively. In the 2015 survey, White Crappie of legal-size were in low relative abundance. Only 6 fish between 9.0-11.9 inches were collected to determine age at legal-length in 2015. White Crappie grew to harvestable size within 0.8 years in 2015 (N=6, range = 0-1 years) and 1.4 years in 2003 (N = 21, range = 1-2 years).

Fisheries management plan for Hubbard Creek Reservoir, Texas

Prepared – July 2016

ISSUE 1: Largemouth Bass, crappie, and sunfishes populations support popular fisheries at Hubbard Creek Reservoir, and they experienced decreased relative abundance during prolonged low water conditions between 2008 and 2015.

MANAGEMENT STRATEGIES

1. Continue to monitor Largemouth Bass to determine trends in relative abundance, size structure, and body condition by conducting biennial electrofishing surveys.
2. Continue to monitor White Crappie to determine trends in relative abundance, size structure, and body condition by conducting trap net survey.
3. Determine trends in Gizzard Shad and Bluegill relative abundance and size structure by conducting biennial electrofishing.
4. Stock Florida Largemouth Bass when habitat is suitable.
5. Monitor genetic influence of fish ≤ 8 inches to determine stocking successes by collecting samples for genetic analysis during the 2017 electrofishing survey.
6. Monitor genetic influence of existing Florida Largemouth Bass by collecting samples for genetic analysis during the 2019 electrofishing survey.
7. Consider ways to improve fish habitat at low water level that would increase relative abundance of centrarchid species.

ISSUE 2: During the last survey period, Hubbard Creek Reservoir dropped to a record low water level, and only one boat ramp was usable.

MANAGEMENT STRATEGY

1. Meet with the West Central Texas Municipal Water District to discuss the potential of ramp improvement projects during periods of low water, specifically the extension of the Peeler Park Ramp.

ISSUE 3: Invasive salt cedar has extensive coverage throughout the reservoir. In July 2015, an aerial survey was conducted to document salt cedar coverage at the reservoir. Currently, control measures have not been implemented by West Central Texas Municipal Water District or Texas Parks and Wildlife Department.

MANAGEMENT STRATEGY

1. Meet with the controlling authority and consult Texas Parks and Wildlife Department invasive species experts to discuss salt cedar establishment, potential management efforts, and possible control strategies.

ISSUE 4: Golden alga (*Prymnesium parvum*) was first detected in the reservoir during fall 2014. While golden alga has not caused a fish kill at Hubbard Creek Reservoir, its existence poses a threat to sport fisheries.

MANAGEMENT STRATEGY

1. Collect periodic water samples during the cold season to monitor water quality, golden alga cell densities, and golden alga toxicity.

ISSUE 5: Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels (*Dreissena polymorpha*) can multiply rapidly and attach themselves to any available hard structure, restricting water flow in pipes, fouling swimming beaches, and plugging engine cooling systems. 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 were 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 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, and other informative materials so that they can in turn educate their customers.
3. Educate the public about invasive species through the use of media and the internet.
4. Make a speaking point about invasive species when presenting to constituents.
5. Map existing and future interbasin water transfers to facilitate potential invasive species responses.

Objective-based Sampling Plan for Hubbard Creek Reservoir

Sport fish, forage fish, and other important fishes: Main prey species in Hubbard Creek Reservoir include Gizzard Shad, Bluegill, and Longear Sunfish. Sport fish present in the reservoir include Blue Catfish, Channel Catfish, Flathead Catfish, White Bass, Largemouth Bass, and White Crappie.

Low-density fisheries: A creel survey has not been conducted at the reservoir. Thus, to deem a fishery as "negligible" would be inappropriate for this sampling plan.

Survey objectives, fisheries metrics, and sampling objectives

Prey species: Gizzard Shad, Bluegill, and Longear Sunfish comprise the majority of the prey species community in the reservoir. Prey populations have been traditionally monitored by biennial fall electrofishing surveys conducted at 24, 5-minute random stations (2 hours total). The biennial electrofishing schedule has been appropriate for monitoring prey species, and sampling will resume in fall 2017 and fall 2019 (Table 9) to collect data that will allow for monitoring large-scale changes to relative abundance and size structure. A target RSE ≤ 25 will be attempted during sampling for relative abundance data (i.e., CPUE-Total) for Gizzard Shad and Bluegill. IOV will be sampled for Gizzard Shad and Bluegill will be sampled for size structure (PSD) by collecting ≥ 50 fish. No additional sampling effort will be conducted if objectives are not met during designated Largemouth Bass sampling. Instead, Largemouth Bass body condition can provide information on prey vulnerability to predation and prey relative abundance.

Blue Catfish: Blue Catfish are managed by the statewide 12-inch minimum length limit (MLL) and 25-fish (in combination with Channel Catfish) bag limit. Antidotal evidence suggests that Blue Catfish are a popular sport fish at Hubbard Creek Reservoir. Gill netting has been used to monitor the population, which previous surveys have indicated Blue Catfish were slightly more abundant in the reservoir than Channel Catfish, but catches were low for both species. From 2008-2016, CPUE-Total had marginally increased from 2.4/nn to 3.1/nn and fish ≥12 inches slightly increased from 1.9/nn to 3.0/nn during that time period. Blue Catfish have been sampled once every four years in conjunction with Channel Catfish and White Bass sampling. Gill netting will be conducted in spring 2020 (Table 9) to maintain trend data for relative abundance and size structure. Gill netting will be conducted at 10 random stations. A target RSE ≤ 25 will be attempted for relative abundance data (CPUE-Total and CPUE-12) and a target of 50 fish ≥ stock-size (≥ 12 inches) will be collected to determine size structure (PSD). If these objectives are not achieved, 10 additional random sampling stations may be added if deemed feasible. During gill netting, 13 fish, 11-12.9 inches will be collected and used for estimating age at legal-length.

Channel Catfish: Channel Catfish are present in the reservoir and have been managed with the statewide 12-inch MLL and 25-fish (in combination with Blue Catfish) daily bag limit. Traditionally, Channel Catfish have been sampled by gill nets (with varying effort; 10-20 stations) and have been in low relative abundance in the reservoir. In the most recent surveys from 2008-2016, CPUE-Total increased slightly from 0.9/nn in 2008 (15 stations; RSE=32) to 2.4/nn in 2012 (10 stations; RSE=32) but declined to 0.5/nn in 2016 (20 stations; RSE=30). Catch of fish ≥ 12 inches increased from 0.6/nn in 2008 (15 stations; RSE=36) to 2.3/nn in 2012 (10 stations; RSE=32) but decreased to 0.5/nn in 2016 (20 stations; RSE=30). Continuation of gill netting surveys once every four years is necessary to maintain trends in relative abundance and size structure. Gill netting will be conducted during spring 2020 (Table 9) at 10 random stations to maintain trend data for relative abundance. A target RSE ≤ 25 will not be attempted for relative abundance data (CPUE-Total, CPUE-S, and CPUE-12). Due to the high number of stations needed to achieve a RSE ≤ 25 for CPUE-Total (an estimated 36 net nights) or RSE ≤ 25 for CPUE-Stock (an estimated 36 net nights) all sampling for Channel Catfish will be exploratory until catch rates and abundance increases. Due to the high number of net nights needed to achieve a target sample size of 50 fish ≥ stock-size (85 net nights; net night estimations were calculated using the 2016 gill net data), sampling for size structure will be exploratory. Catch rates using gill nets have yielded very poor catch of Channel Catfish. Tandem-hoop netting has not been conducted to sample Channel Catfish at Hubbard Creek Reservoir and could produce more precise relative abundance data and more stock-size fish sampled. Use of exploratory tandem-hoop netting to sample Channel Catfish at Hubbard Creek Reservoir

in summer 2019 will be considered if the schedule allows. During gill netting or tandem-hoop netting, 13 fish 11-12.9 inches will be collected and used for estimating age at legal-length.

Flathead Catfish: Flathead Catfish are present in Hubbard Creek Reservoir, and have been managed with the 18-inch MLL and 5-fish daily bag limit. Historically, Flathead Catfish have been monitored for presence/absence in gill net and standard electrofishing surveys. However, catch rates by use of both gear types has yielded very poor catch of Flathead Catfish. Low-frequency electrofishing has not been conducted to sample Flathead Catfish at Hubbard Creek Reservoir. Exploratory use of low-frequency electrofishing to sample Flathead Catfish will be conducted during summer 2019 (Table 9) for 1 hour at 20, 3-minute random shoreline stations. During this survey, baseline data for relative abundance (CPUE-Total, CPUE-Stock, and CPUE-18), size structure, and body condition will be obtained. Data collected during this survey will help determine if this population has adequate relative abundance to support a sport fishery.

White Bass: White Bass are managed with the statewide 10-inch MLL and 25-fish daily bag limit. Traditionally, White Bass have been sampled by gill net surveys with varying effort (10-20 stations). In the most recent surveys, 2008-2016, CPUE-Total and CPUE-Stock in 2008 were 8.0/nn (15 stations; RSE=28) then decreased to 2.1/nn in 2012 (10 stations; RSE=51) to 3.7/nn in 2016 (20 stations; RSE=35). Continuation of gill netting surveys once every four years is necessary to maintain trends of White Bass relative abundance and size structure. Gill netting will be conducted during spring 2020 (Table 9) at 10 random stations to maintain trend data for relative abundance and size structure. A target RSE ≤ 25 will not be attempted for relative abundance data (CPUE-Total, CPUE-S, and CPUE-10). Due to the high number of net nights needed to achieve a RSE ≤ 25 for CPUE-Total (an estimated 42 net nights) or RSE ≤ 25 for CPUE-Stock (an estimated 42 net nights) all sampling for White Bass will be exploratory monitoring until the population increases in abundance. (All net night estimations were calculated using 2016 gill net data.) A target sample size of 50 fish ≥ stock-size (≥ 6 inches) will be collected to determine size structure (PSD). At least 10 fish per represented inch group ≥ stock-size will be measured and weighed for estimating body condition. If these objectives for PSD and body condition are not achieved, up to 10 additional random stations may be added if deemed feasible. During gill netting, 13 fish 9-10.9 inches will be collected and used for estimating age at legal-length.

Largemouth Bass: Largemouth Bass are present and are managed with the statewide 14-inch MLL and 5-fish daily bag limit. Traditionally, Largemouth Bass have been sampled with electrofishing with varying effort 1.5-2.0 h (18-24, 5-minute stations). Largemouth Bass relative abundance decreased between 2011-2015. CPUE-Total was 93.5/h in 2011 (2.0 h; RSE=21), 39.3/h in 2013 (1.5 h; RSE=31), and 21.5/h (2.0 h; RSE=29). Catch of fish ≥ 14 inches was 24.0/h in 2011 (2.0 h; RSE=26), and 1.3/h in 2013 (1.5 h; RSE=69) and 2.0/h in 2015 (2.0 h; RSE=59). Continuation of biennial electrofishing is necessary to maintain trends of Largemouth Bass relative abundance and size structure (Table 9). During each sampling event, electrofishing will be conducted for 2 hours at 24 random 5-minute stations to assess relative abundance (i.e., CPUE-Total and CPUE-Stock). A random sample of fin clips from 30 fish ≤ 8 inches will be collected for microsatellite DNA analysis to determine prevalence of Florida and northern Largemouth Bass allele in 2017 to determine stocking success and a random sample of fin clips from 30 fish of any size will be collected for microsatellite DNA analysis to determine prevalence of Florida Largemouth Bass allele in 2019.

White Crappie: White Crappie are managed with the statewide 10-inch MLL and 25-fish daily bag limit. Traditionally, crappie have been sampled with fall trap netting with varying effort from (10-20 stations). In 2007, White Crappie CPUE-Total was 12.0/nn (10 stations; RSE=30), 6.8/nn in 2011 (10 stations; RSE=29), and 1.9/nn in 2015 (15 stations; RSE=32). Catch of fish ≥ 10 inches was 2.0/nn in 2007 (10 stations; RSE=30), 2.5/nn in 2011 (10 stations; RSE=38), and 0.2/nn (15 stations; RSE=53). Continuation of trap netting every four years is necessary to maintain tends in White Crappie relative abundance, size structure (PSD), and body condition (mean relative weight). Trap netting will be conducted in fall 2019 (Table 9) at a minimum of 10 random stations. A target RSE ≤ 25 will not be attempted for relative abundance data (CPUE-Total, CPUE-S, and CPUE-10). Due to the high numbers of stations needed to achieve a RSE ≤ 25 for CPUE-Total (an estimated 30 net nights) or RSE ≤ 25 for CPUE-Stock (an estimated 28 net nights) all sampling for White Crappie will be exploratory. Due to the high number of net

nights needed to achieve a target sample size of 50 fish ≥ stock-size (≥ 5 inches; up to 45 stations), sampling for size structure and body condition will be exploratory. (All net night estimations were calculated using 2016 trap net data.) During sampling, 13 fish, 9-10.9 inches will be collected and their otoliths will be used for age estimation at legal length and assess growth. If these objectives are not achieved, up to 10 additional random sampling stations may be added if deemed feasible.

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, 2nd 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.

Dumont, S. C. 2012. Statewide freshwater fisheries monitoring and management program survey report for Hubbard Creek Reservoir, 2011. Texas Parks and Wildlife Department, Federal Aid Report Grant F-30-R, Austin, Texas.

Guy, C. S., R. M. Neumann, D. W. Willis, and R. O. Anderson. 2007. Proportional size distribution (PSD): a further refinement of population size structure index terminology. Fisheries 32(7): 348.

United States Geological Survey (USGS). 2016. National water information system: Web interface. Available: http://waterdata.usgs.gov/tx/nwis (July 2016).

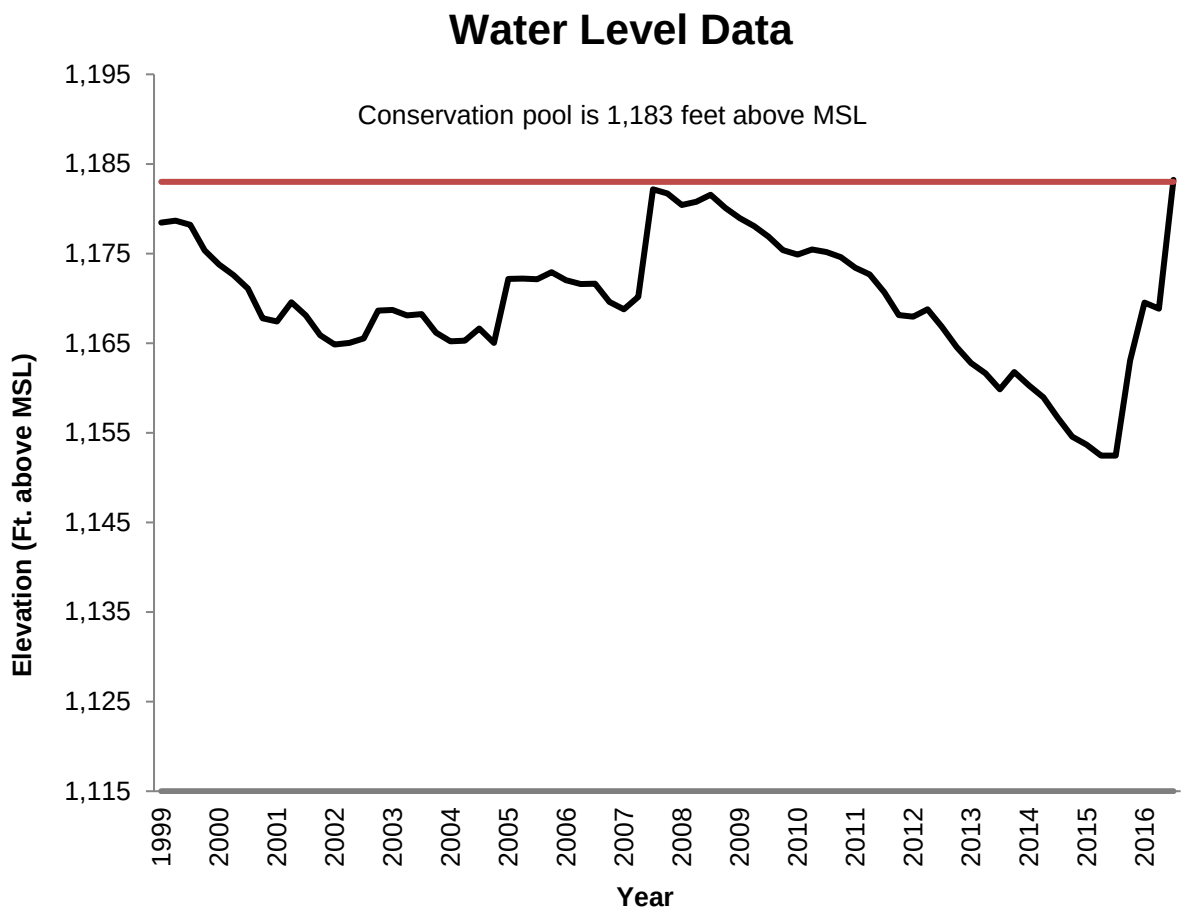


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Hubbard Creek Reservoir, Texas. Conservation pool is 1,183 feet above mean sea level, shown in red. Dead pool is approximately 1,115 feet above mean sea level.

Table 1. Characteristics of Hubbard Creek Reservoir, Texas.

Characteristic	Description
Year constructed	1962
Conservation pool	1,183 feet above mean sea level
Dead pool	1,115 feet above mean sea level
Controlling authority	West Central Texas Municipal Water District
County	Stephens
Reservoir type	Tributary
River basin	Brazos River Basin
Shoreline Development Index	8.60
USGS 8-Digit HUC Watershed	12060105 (Hubbard)
Conductivity	282-1,913 µS/cm

Table 2. Boat ramp characteristics for Hubbard Creek Reservoir, Texas, April, 2016. Reservoir elevation at time of survey was 1,174.4 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Hwy 180/ Bob Clark Landing	32.767802 -99.014456	Y	40	1,169	Good, Usable
Dam/ Paul Prater Landing	32.817885 -98.954127	Y	30	1,155	Good, Usable
Game Warden Slough/ Corley Ramp	32.836155 -98.976140	Y	20	1,170	Good, Usable
Peeler Park	32.768639 -99.073083	Y	20	1,170	Good, Usable

Table 3. Harvest regulations for Hubbard Creek Reservoir, Texas.

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

Table 4. Stocking history of Hubbard Creek Reservoir, Texas. Size categories were: ADL = Adult; UNK = unknown; FRY = < 1 inch; FGL = (fingerling) 1-3 inches.

Species	Year	Number	Size
Threadfin Shad	1984	1,500	ADL
Channel Catfish	1970	100,000	UNK
Palmetto Bass	1979	132,450	UNK
	1984	3,090,000	FRY
	Total	3,222,450	
Largemouth Bass	1967	18,000	UNK
	1968	200,000	UNK
	1971	100,000	UNK
	Total	318,000	
Florida Largemouth Bass	1979	80,425	FGL
	1986	135,500	FGL
	1990	157,265	FRY
	1990	225,834	FGL
	1991	382,989	FGL
	2003	355,520	FGL
	2011	373,397	FGL
	2012	377,199	FGL
	2016	86,842	FGL
	Total	2,174,971	

Table 5. Objective-based sampling plan components for Hubbard Creek Reservoir, Texas 2015-2016.

Gear/target species	Survey objective	Metrics	Sampling objective
Electrofishing			
Largemouth Bass	Abundance	CPUE – Total	RSE-Total ≤ 25
	Abundance	CPUE – Stock	RSE-Stock ≤ 25
	Abundance	CPUE – 14	RSE-14 ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock
	Age-and-growth	Age at 14 inches	N = 13, 13.0 – 15.9 inches
	Condition	W_r	10 fish/inch group (max)
	Genetics	% FLMB	N = 30, any age
Gizzard Shad [a]	Abundance	CPUE – Total	RSE-Total ≤ 25
	Prey availability	IOV	N ≥ 50
Bluegill [a]	Abundance	CPUE – Total	RSE-Total ≤ 25
Trap netting			
White Crappie	Abundance	CPUE – Total	RSE-Total ≤ 25
	Abundance	CPUE – Stock	RSE-Stock ≤ 25
	Abundance	CPUE – 10	RSE-10 ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock
	Age-and-growth	Age at 10 inches	N = 13, 9.0 – 11.9 inches
	Condition	W_r	10 fish/inch group (max)
Gill netting			
Blue Catfish	Abundance	CPUE – Total	RSE-Total ≤ 25
	Abundance	CPUE – 12	RSE-12 ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock
	Age-and-growth	Age at 12 inches	N = 13, 11.0-13.9 inches
Channel Catfish	Abundance	CPUE – Total	RSE-Total ≤ 25
	Abundance	CPUE – Stock	RSE-Stock ≤ 25
	Abundance	CPUE – 12	RSE-12 ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock
White Bass	Abundance	CPUE – Total	RSE-Total ≤ 25
	Abundance	CPUE – Stock	RSE-Stock ≤ 25
	Abundance	CPUE – 10	RSE-10 ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock

[a] No additional effort will be expended to achieve survey objectives for Gizzard Shad or Bluegill if they are not reached during designated Largemouth Bass sampling effort. Instead, Largemouth Bass body condition can provide information on forage abundance, vulnerability, or both relative to predator density.

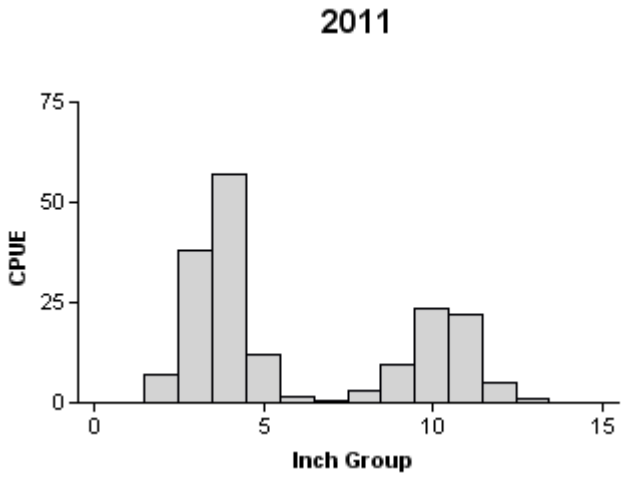
Table 6. Comparison of the percent occurrence and associated 95% confidence levels for habitat sampled at random throughout the reservoir (N=354) in Hubbard Creek Reservoir, Texas, 2013 and 2015. Size categories were: pebbles 0.01-2.5 inches, cobble 2.5-10.0 inches, small boulders 10.0-24.0 inches, and large boulders ≥ 24.0 inches. Water level at time of survey in 2013 was approximately 20.7-feet below conservation level and was approximately 18.3-feet below conservation pool in 2015.

	2013			2015		
Structural habitat type	Percent Occurrence	Lower CL	Upper CL	Percent Occurrence	Lower CL	Upper CL
Small boulders	9.2	4.3	14.2	2.8	1.1	4.6
Large boulders	4.6	1.0	8.2	1.4	0.2	2.6
Cobbles	6.2	2.0	10.3	0.8	0.0	1.8
Pebbles				0.8	0.0	1.8
Docks				0.6	0.0	1.3
Rip-rap	1.5	0.0	3.7	0.3	0.0	0.8
Bridge pylons	0.8	0.0	2.3	0.3	0.0	0.8
Bedrock				0.3	0.0	0.8

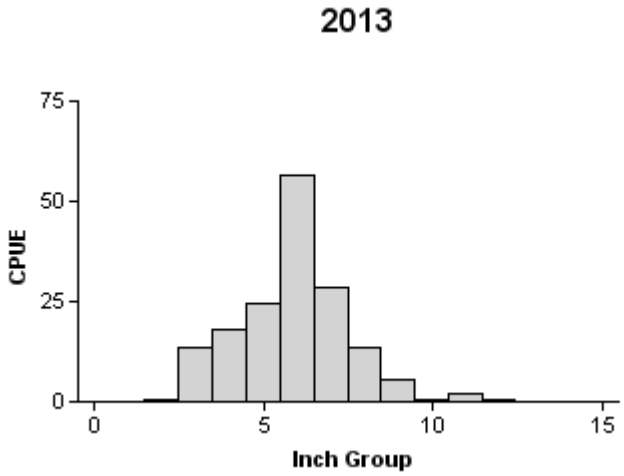
Table 7. Comparison of the percent occurrence and associated 95% confidence levels for vegetative species/habitat types sampled at random stations throughout the reservoir (N=354) in Hubbard Creek Reservoir, Texas, 2013 and 2015. Water level at time of survey in 2013 was approximately 20.7-feet below conservation level and was approximately 18.3-feet below conservation pool in 2015.

	2013			2015		
Vegetative/species habitat type	Percent Occurrence	Lower CL	Upper CL	Percent Occurrence	Lower CL	Upper CL
Non-descriptive/featureless	71.5	63.8	79.3	65.3	60.3	70.2
Smartweed	13.1	7.3	18.9	29.9	25.2	34.7
Flooded terrestrial vegetation	2.3	0.0	4.9	14.1	10.5	17.8
Salt cedar	4.6	1.0	8.2	11.0	7.8	14.3
Standing timber	9.2	4.3	14.2	5.1	2.8	7.4
Chara sp.	6.2	2.0	10.3	2.0	0.5	3.4
Black willow				2.0	0.5	3.4
Cattail				0.6	0.0	1.3
Fallen timber	1.5	0.0	3.7			

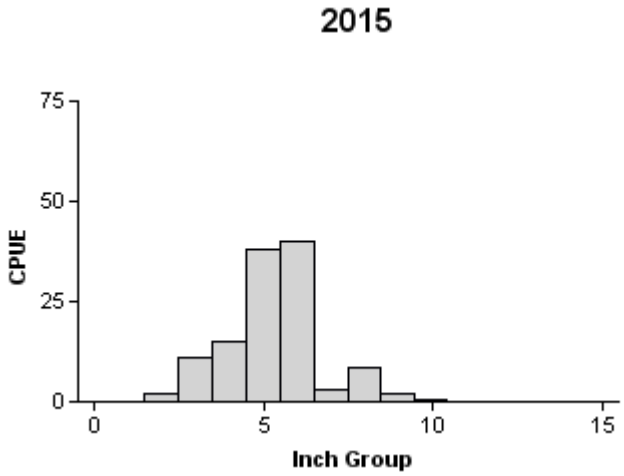
Gizzard Shad



Effort = 2.0
Total CPUE = 180.0 (28; 360)
IOV = 64 (6)



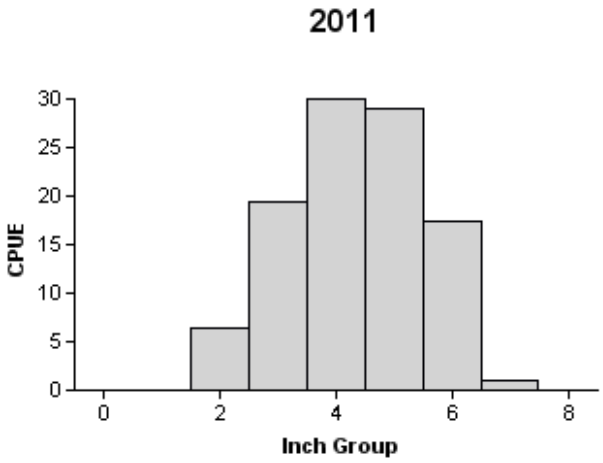
Effort = 1.5
Total CPUE = 164.0 (25; 246)
IOV = 87 (3)



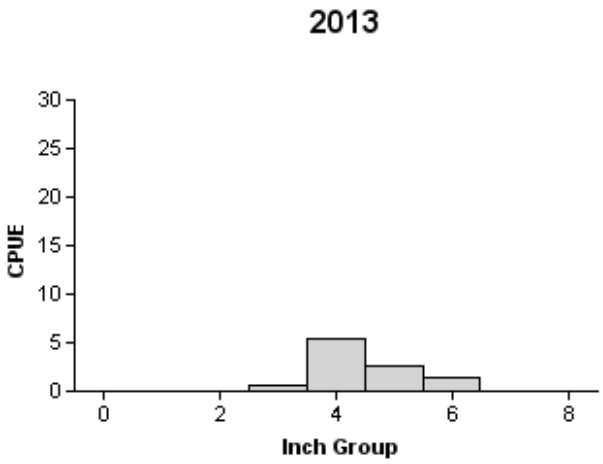
Effort = 2.0
Total CPUE = 120.0 (23; 240)
IOV = 91 (5)

Figure 2. Comparison of the 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, Hubbard Creek Reservoir, Texas, 2011, 2013, and 2015.

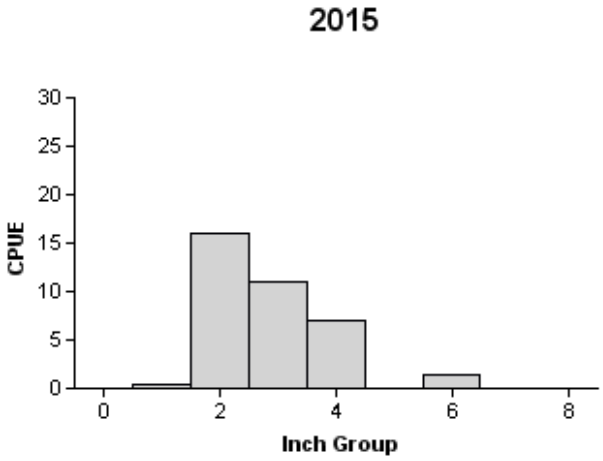
Bluegill



Effort = 2.0
Total CPUE = 103.5 (15; 207)
Stock CPUE = 97.0 (15; 194)
PSD = 19 (3)



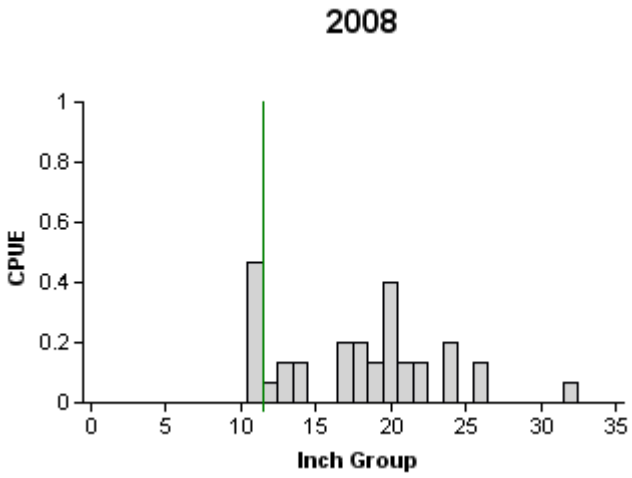
Effort = 1.5
Total CPUE = 10.0 (48; 15)
Stock CPUE = 10.0 (48; 15)
PSD = 13 (9)



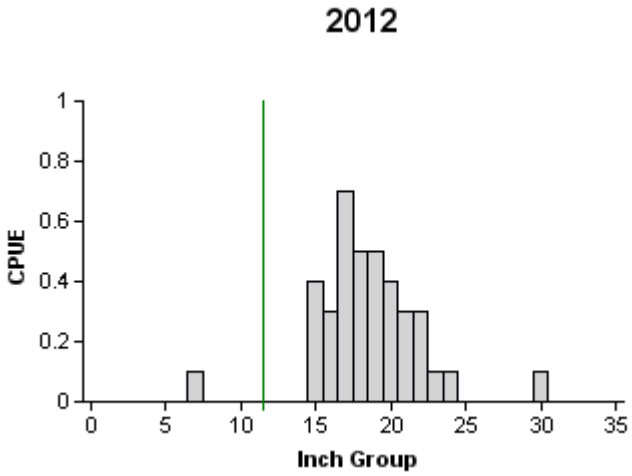
Effort = 2.0
Total CPUE = 36.0 (23; 72)
Stock CPUE = 19.5 (24; 39)
PSD = 8 (5)

Figure 3. Comparison of the 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, Hubbard Creek Reservoir, Texas, 2011, 2013, and 2015.

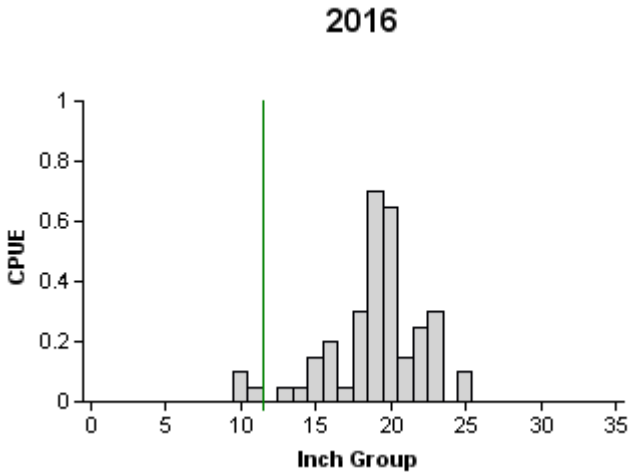
Blue Catfish



Effort =	15.0
Total CPUE =	2.4 (20; 36)
CPUE-12 =	1.9 (20; 29)
PSD =	55 (10)



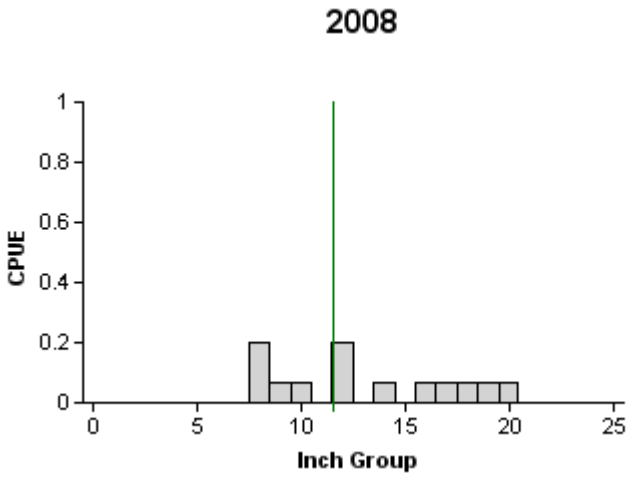
Effort =	10.0
Total CPUE =	3.8 (22; 38)
CPUE-12 =	3.7 (24; 37)
PSD =	35 (12)



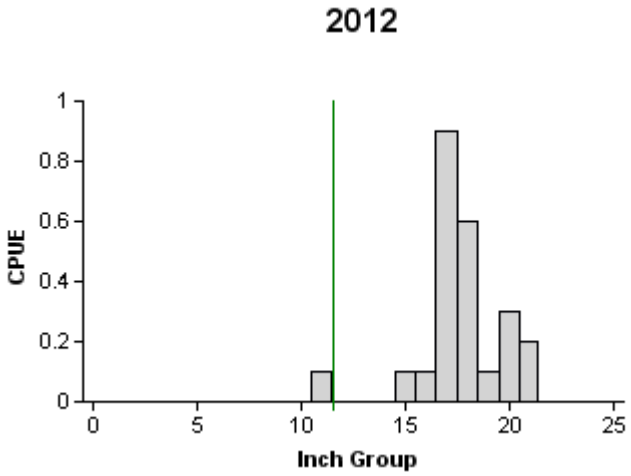
Effort =	20.0
Total CPUE =	3.1 (13; 62)
Stock CPUE =	3.0 (14; 59)
PSD =	49 (6)

Figure 4. Comparison of the number of Blue Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Hubbard Creek Reservoir, Texas, 2008, 2012, and 2016. The vertical line denotes the 12-inch minimum length limit.

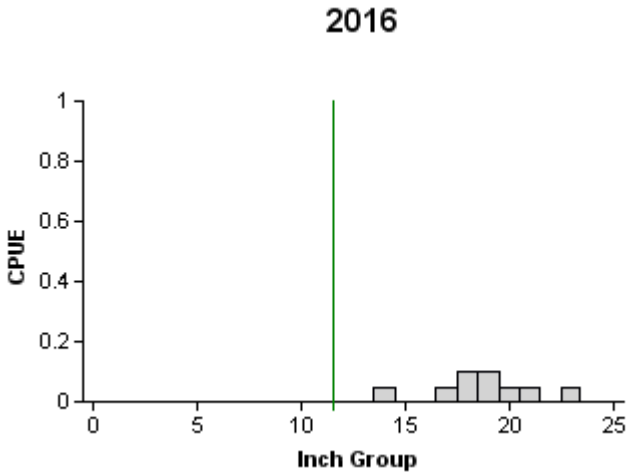
Channel Catfish



Effort =	15.0
Total CPUE =	0.9 (32; 14)
Stock CPUE =	0.6 (36; 9)
CPUE-12 =	0.6 (36; 9)
PSD =	56 (16)



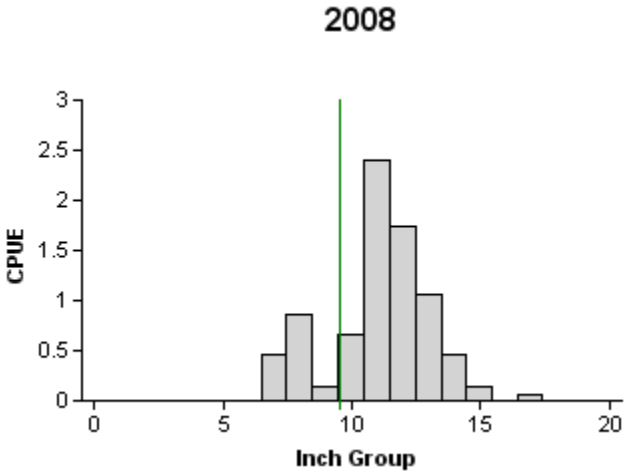
Effort =	10.0
Total CPUE =	2.4 (32; 24)
Stock CPUE =	2.4 (32; 24)
CPUE-12 =	2.3 (32; 23)
PSD =	92 (5)



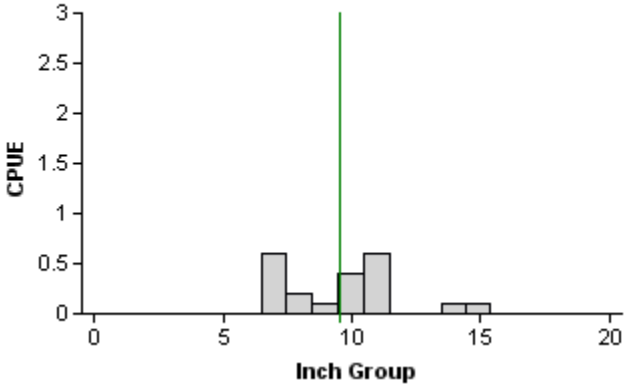
Effort =	20.0
Total CPUE =	0.5 (30; 10)
Stock CPUE =	0.5 (30; 9)
Stock 12 =	0.5 (30; 9)
PSD =	89 (11)

Figure 5. Comparison of the number of Channel Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Hubbard Creek Reservoir, Texas, 2008, 2012, and 2016. The vertical line denotes the 12-inch minimum length limit.

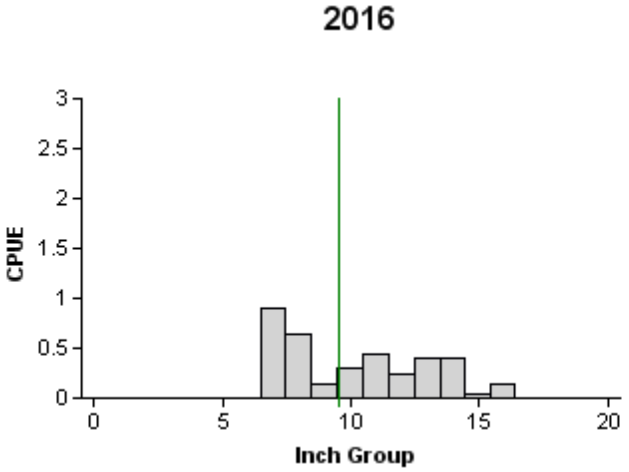
White Bass



Effort =	15.0
Total CPUE =	8.0 (28; 120)
Stock CPUE =	8.0 (28; 120)
CPUE-10 =	6.5 (28; 98)
PSD =	83 (7)



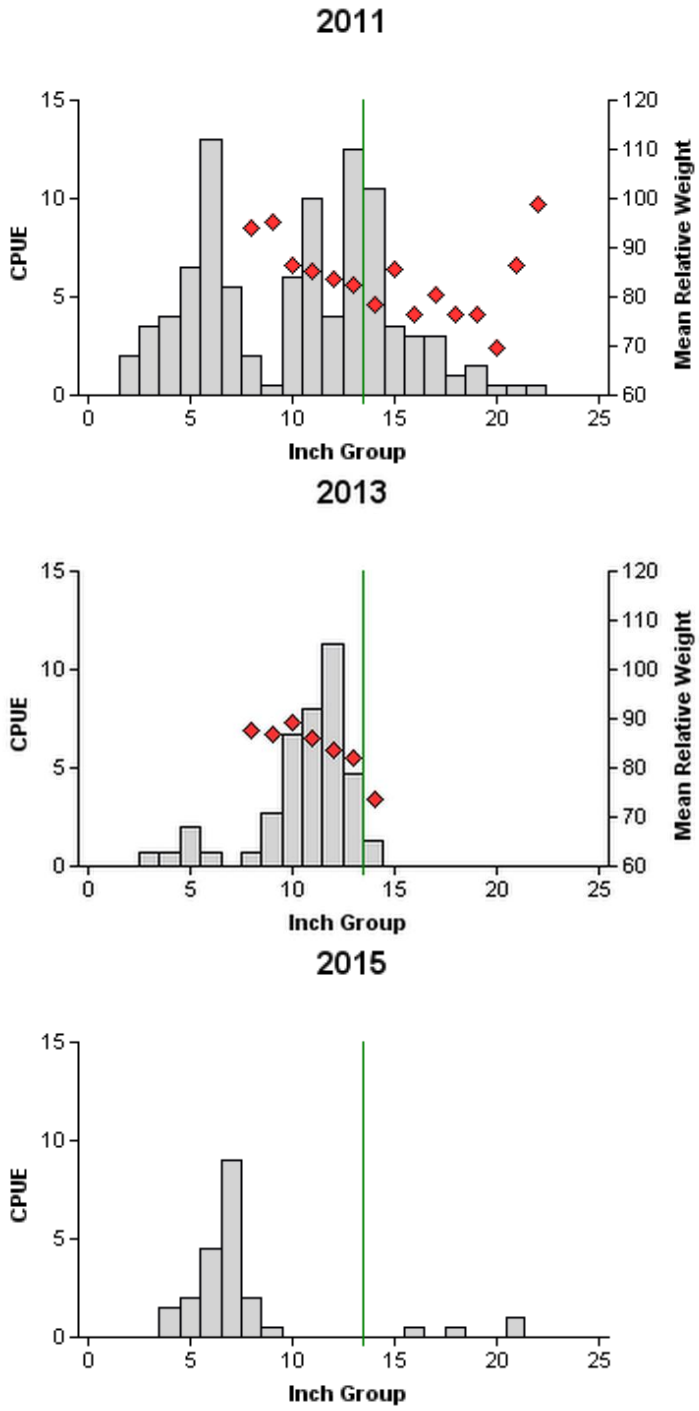
Effort =	10.0
Total CPUE =	2.1 (51; 21)
Stock CPUE =	2.1 (51; 21)
CPUE-10 =	1.2 (65; 12)
PSD =	62 (13)



Effort =	20.0
Total CPUE =	3.7 (35; 74)
Stock CPUE =	3.7 (35; 74)
CPUE-10 =	2.0 (47; 40)
PSD =	58 (8)

Figure 6. Comparison of the number of White Bass caught per net night (CPUE), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Hubbard Creek Reservoir, Texas, 2008, 2012, and 2016. The vertical line denotes the10-inch minimum length limit.

Largemouth Bass



Effort =	2.0
Total CPUE =	93.5 (21; 187)
Stock CPUE =	59.0 (20; 118)
CPUE-14 =	24.0 (26; 48)
PSD =	69 (5)

Effort =	1.5
Total CPUE =	39.3 (31; 59)
Stock CPUE =	35.3 (35; 53)
CPUE-14 =	1.3 (69; 2)
PSD =	49 (9)

Effort =	2.0
Total CPUE =	21.5 (29; 43)
Stock CPUE =	4.5 (39; 9)
CPUE-14 =	2.0 (59; 4)
PSD =	44 (19)

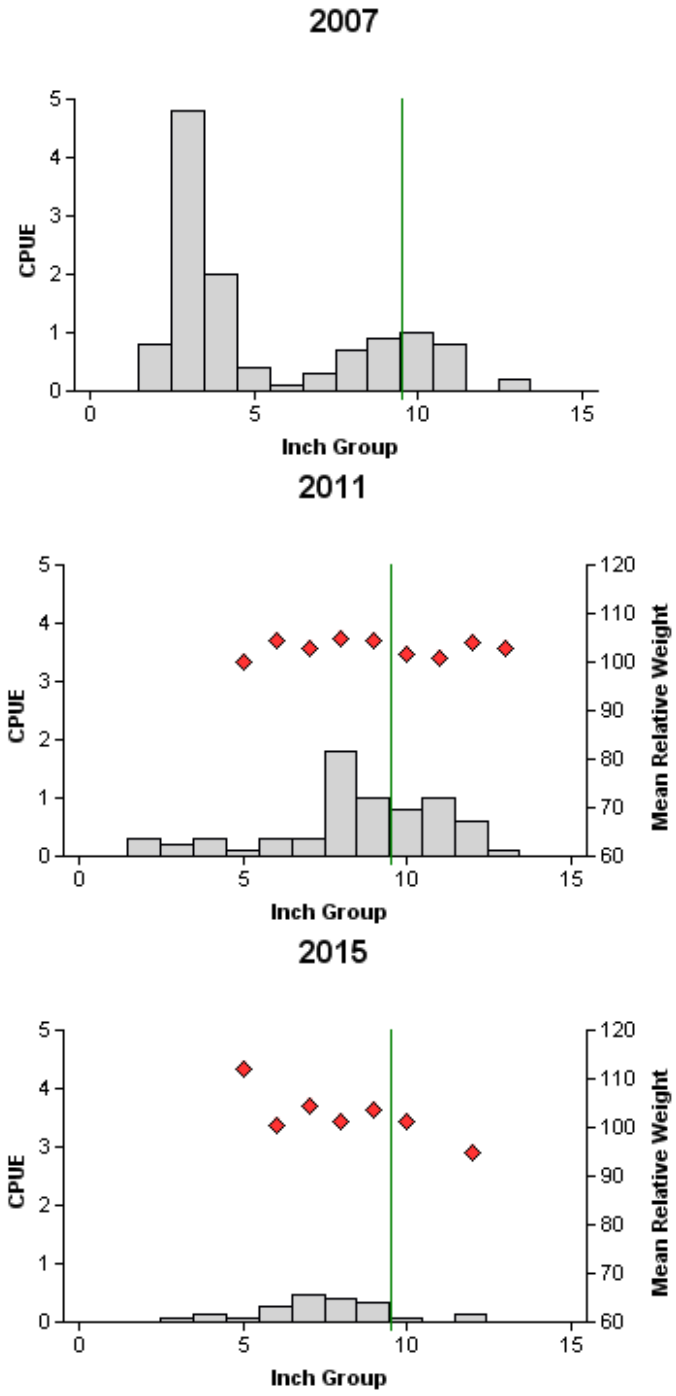
Figure 7. Comparison of the number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Hubbard Creek Reservoir, Texas, 2011, 2013, and 2015. No mean relative weights were determined in 2015. The vertical line denotes the 14-inch minimum length limit.

Largemouth Bass

Table 8. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Hubbard Creek Reservoir, Texas, 1993, 1996, 1999, 2005, 2011, and 2015. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB. Genetic composition was determined by electrophoresis prior to 2005 and with micro-satellite DNA analysis since 2005.

		Number of fish				
Year	Sample size	FLMB	Intergrade	NLMB	% FLMB alleles	% FLMB
1993	40	1	25	14	30.6	2.5
1996	29	10	16	3	68.9	34.5
1999	30	4	26	0	59.2	13.3
2005	32	1	28	3	45.5	3.1
2011	40	2	37	1	54.4	5.0
2015	36	1	35	0	58.0	2.8

White Crappie



Effort =	10.0
Total CPUE =	12.0 (30; 120)
Stock CPUE =	4.4 (32; 44)
CPUE-10 =	2.0 (30; 20)
PSD =	82 (6)

Effort =	10.0
Total CPUE =	6.8 (29; 68)
Stock CPUE =	6.0 (25; 60)
CPUE-10 =	2.5 (38; 25)
PSD =	88 (5)

Effort =	15.0
Total CPUE =	1.9 (32; 29)
Stock CPUE =	1.7 (33; 26)
CPUE-10 =	0.2 (53; 3)
PSD =	54 (13)

Figure 8. Comparison of the number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Hubbard Creek Reservoir, Texas, 2007, 2011, and 2015. No mean relative weights were determined in 2007. The vertical line denotes the 10-inch minimum length limit.

Table 9. Proposed sampling schedule for Hubbard Creek Reservoir, Texas. Survey period is June through May. Gill netting surveys are conducted in the spring, while low-frequency electrofishing is conducted in the summer, and electrofishing and trap netting surveys are conducted in the fall. Surveys and reporting to be completed are denoted by A for additional survey and S for standard survey.

Survey year	Electro-fish	Trap net	Gill net	Low-frequency electrofish	Tandem Hoop net	Habitat/ Vegetation	Access	Report
2016-2017						S		
2017-2018	A					S		
2018-2019						S		
2019-2020	S	S	S	A	A	S	S	S

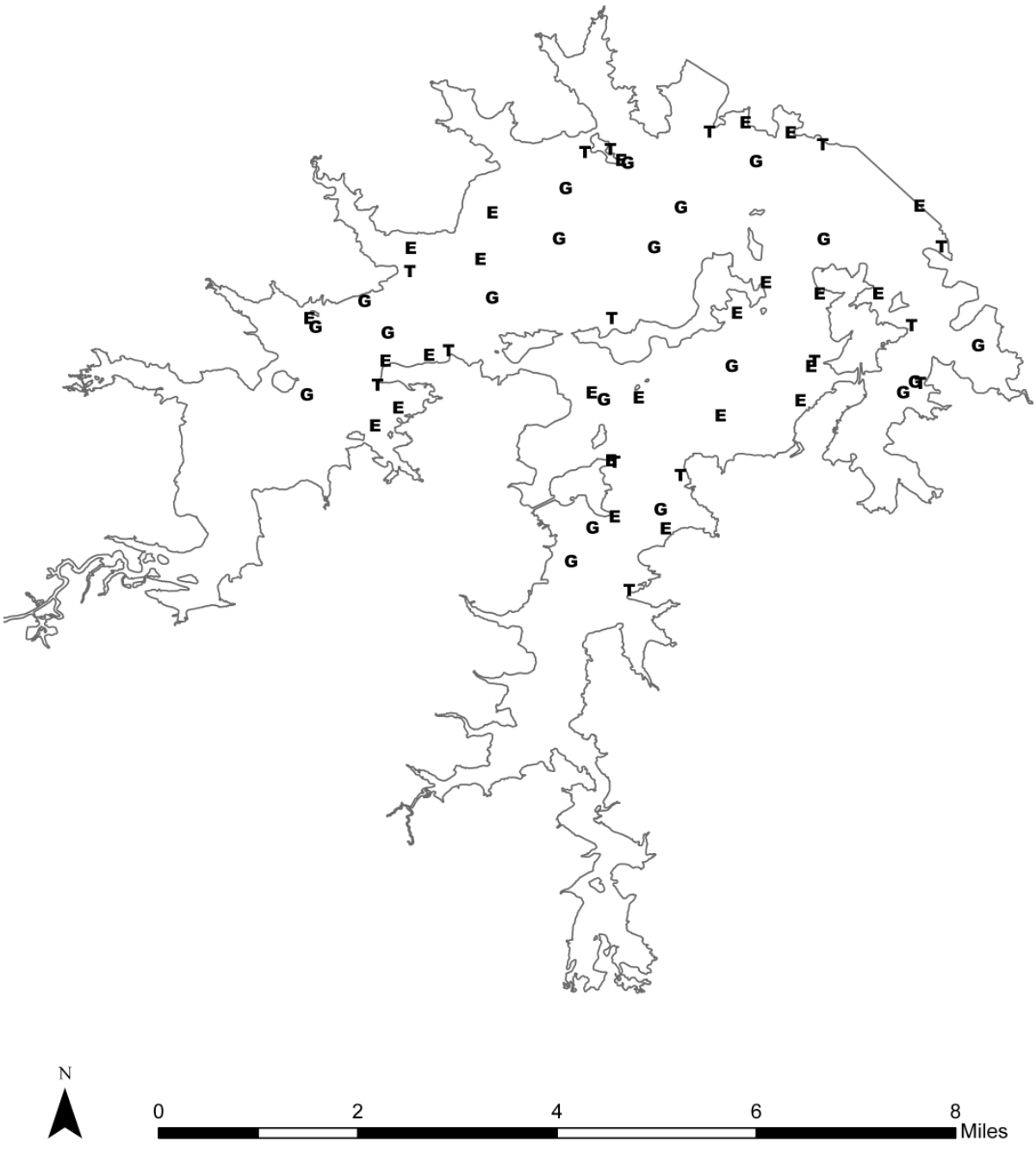
APPENDIX A

Number (N) and catch rate (CPUE) and associated relative standard error (RSE) of all target species collected from standard gear types from Hubbard Creek Reservoir, Texas, 2015-2016. Sampling effort was 2.0 hours for electrofishing, 20 net nights for gill netting, and 15 net nights for trap netting.

Species	Electrofishing		Gill Netting		Trap Netting	
	N	CPUE/RSE	N	CPUE/RSE	N	CPUE/RSE
Gizzard Shad	240	120.0/23				
Common Carp[1]	5	2.5/50				
Inland Silverside	2	1.0/69				
River Carpsucker[1]	23	11.5/41				
Blacktail Shiner	1	0.5/100				
Smallmouth Buffalo[1]	3	1.5/100				
Blue Catfish			62	3.1/13		
Channel Catfish	1	0.5/100	10	0.5/31		
Flathead Catfish			5	0.3/49		
White Bass	249	124.5/38	74	3.7/35		
Green Sunfish	6	3.0/43				
Warmouth	6	3.0/50				
Orangespotted Sunfish	3	1.5/55				
Bluegill	72	36.0/23				
Longear Sunfish	79	39.5/40				
Redear Sunfish	1	0.5/100				
Largemouth Bass	43	21.5/29				
White Crappie	1	0.5/100			29	1.9/32
Logperch	1	0.5/100				
Freshwater Drum	6	3.0/36				

[1]Fish sampled ≤ 6 inches TL.

APPENDIX B



Location of sampling sites, Hubbard Creek Reservoir, Texas, 2015-2016. Electrofishing (E), gill netting (G), and trap netting (T) stations are displayed. Reservoir outline at conservation pool is displayed by a gray line. Throughout the sampling period, the reservoir was approximately 15.7 feet below conservation pool on average at time of sampling.