PERFORMANCE REPORT

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INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2013 Fisheries Management Survey Report

Kirby Reservoir

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TABLE OF CONTENTS

SURVEY AND MANAGEMENT SUMMARY

From 2010-2014, fish populations in Kirby Reservoir were surveyed with various methods including electrofishing, low-frequency electrofishing, tandem hoop netting, trap netting, and gill netting. Anglers were interviewed during June 2010-May 2011 and September 2013- May 2014 with roving creel surveys. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir Description:** Kirby Reservoir is a 740-acre impoundment at conservation pool located within the city limits of Abilene, Texas. The reservoir is an impoundment on Cedar Creek within the Brazos River Basin. During fall 2000, the lake went completely dry but refilled by July 2002. Since September 2001, treated effluent water has been pumped into the reservoir to help manage the water level. Habitat features consist of mud flats, rocks, brush, and vegetation consisted of bulrush, black willow, and exotic salt cedar. Two boat ramps and one handicap-accessible fishing pier are available, and bank-fishing access is plentiful.

- **Management History:** Sport fish include Blue Catfish, Channel Catfish, White Crappie, saugeye, Largemouth Bass, and sunfishes. All sport fishes, with the exception of Blue and Channel catfish, are managed under current statewide harvest regulations. In 2011, Blue and Channel catfish harvest regulations were modified to allow for harvest without a minimum length limit and a daily bag limit increase from 25 to 50 fish/day in combination with no more than 5 fish ≥20 inches.

- **Fish Community**
  - **Prey species:** Gizzard Shad and Bluegill were the dominant prey in the reservoir. In 2013, electrofishing catch of Gizzard Shad was high and similar to the 2011 survey, but lower than in 2009. Bluegill catch remained high in 2013 but slightly lower than previous surveys. Bluegill was the most dominant prey sampled during the 2013 electrofishing survey, and most fish were available as prey for sport fish.

  - **Catfishes:** In 2014, Blue Catfish gill net catch was similar to previous surveys. Channel Catfish gill net catch was greater than previous surveys. Flathead Catfish were present in the reservoir. Creel surveys from 2010-2011 and 2013-2014 indicated that anglers targeted catfishes more than other species, and most fish caught were being released. Blue Catfish were the most targeted species by anglers at Kirby Reservoir.

  - **Largemouth Bass:** Largemouth Bass had lower catch in 2013 than previous survey years, and less legal-size fish were available to anglers compared to 2011. Creel surveys indicated that few anglers at Kirby Reservoir fished for Largemouth Bass. Harvest of Largemouth Bass was greater during the 2013-2014 creel period than in 2010-2011.

  - **Saugeye:** Saugeye were caught in lower numbers in both fall 2013 electrofishing and spring 2014 gill netting surveys than previous surveys. Saugeye stockings have ceased as a result of poor directed angling effort. Creels indicated that anglers rarely target saugeye, and none were caught during the two most recent creel periods.

  - **White Crappie:** White Crappie catch was consistently low in comparison to previous surveys. Crappie supported a small angler base at Kirby Reservoir according to the angler creel surveys, and most legal size fish were harvested.

- **Management Strategies:** Monitor catfishes by low-frequency electrofishing, tandem hoop netting, and gill netting. Conduct electrofishing surveys to monitor trends of Largemouth Bass and forage species. Conduct biennial trap netting surveys to monitor White Crappie. Conduct a creel survey to obtain directed effort and harvest data for fishes. Collaborate with the City of Abilene to improve angler access and aesthetics. Educate public about invasive species introductions. Conduct access and vegetation/habitat surveys.

INTRODUCTION

This document is a summary of fisheries data collected from Kirby Reservoir in 2013-2014. 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 2013-2014 data for comparison.

Reservoir Description

Kirby Reservoir is a 740-acre reservoir located within the city limits of Abilene, Texas and is controlled by the City of Abilene. The reservoir is located in Taylor County and is an impoundment on Cedar Creek within the Brazos River Basin. During fall 2000, the lake went completely dry, but refilled to full pool by July 2002. A treated effluent water discharge permit was approved in 2001, and the City of Abilene began pumping reuse water into Kirby Reservoir in September 2001. Kirby Reservoir's water level elevation has fluctuated within about five feet below conservation pool elevation from 2004-2011, but the reservoir dropped to about eight feet low from fall 2011-spring 2012. The reservoir has remained within five feet below conservation pool elevation since fall 2012 (Figure 1). Primary reservoir water uses included non-potable municipal water supply, water storage, and recreation. Vegetative habitat consisted of native emergent plants such as bulrush, black willow, common cattail, button bush as well as non-native salt cedar. Structural habitat was comprised primarily of featureless area and surface water, dead brush and stumps, pebbles, cobble, and riprap. Other descriptive characteristics for Kirby Reservoir are in Table 1.

Angler Access

Two public boat ramps were the only available boater access points at Lake Kirby Park; however, one ramp is in need of repair. Bank access was available nearly over the entire shoreline. One handicap-accessible fishing pier was available. Boat ramp characteristics are detailed in Table 2.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Neely and Dumont 2010) included:

1. Evaluate poor White Crappie recruitment with increased trap net effort.
   Action: Biennial trap net surveys were conducted with double effort in 2011 and 2013. White Crappie relative abundance continued to be low with few individuals under 10 inches. Causes low relative abundance of White Crappie are poorly understood and warrant further investigation.

2. Promote the saugeye (i.e., Walleye x Sauger hybrids) fishery and stockings as well as collect creel data for angler-directed effort to assess the feasibility of the saugeye stocking program.
   Action: A creel survey was conducted from fall 2010 to summer 2011. Similar to prior creels conducted at Kirby Reservoir, the data indicated that angler effort for saugeye was low. Hatchery production of saugeye and stockings were discontinued after 2011.

3. Investigate predator-prey interactions for saugeye and determine if crappies were the primary prey.
   Action: A saugeye diet study was started but not completed because the saugeye stocking program was discontinued after 2011. Most fish captured in the study had no stomach contents to identify.

4. Evaluate the effectiveness of jug lines, gill nets, and low-frequency electrofishing for targeting Blue Catfish and Channel Catfish and collecting population demographic information.
   Action: During May-August 2009, Neely and Dumont (2011) evaluated the effects of

tandem hoop net soak times on precision of Channel Catfish catch at Kirby Reservoir and two other reservoirs. The results of this study were presented at Catfish 2010 meeting in St Louis, Missouri (June 19-22, 2010) and published in the meeting's proceedings. In 2011, a study was conducted to evaluate the use of jug lines to sample Blue Catfish, and results indicated that jug lines were a suitable gear to sample fish ≥20 inches. Low-frequency electrofishing was conducted during spring 2011. Gill netting was conducted during spring 2012 and spring 2014.

5. Collect creel and population demographic information for the catfish fishery to evaluate catfish management strategies and determine exploitation of large fish.

   Action: In 2010, Neely and Dumont (2012) developed and distributed a mail survey to 1,000 licensed anglers in eight counties to obtain information regarding their motivations and opinions of Blue Catfish harvest and management scenarios. The survey had a reporting rate of 29% and indicated that anglers preferred to harvest fish <24 in total length (TL), approved of the 25 fish/day bag limits, and would overall support an increase in the minimum length limit; they did not support a reduction in bag size or a protected slot limit.

Harvest regulations history:
Prior to September 2011, all sport fishes were managed with the statewide harvest regulations. Catfish harvest regulations were changed to allow harvest of Blue Catfish and Channel Catfish without a minimum length limit, and the bag limit was increased from 25 to 50 fish in combination, with no more than 5 fish/day at 20 inches or greater. Other sport fishes are still managed with the statewide harvest regulations (Table 3).

Stocking history:
After Kirby Reservoir went completely dry in 2000 and water levels returned to a suitable level for stocking, prey species including Threadfin Shad, Golden Shiners, Bluegill, Fathead Minnows, and Inland Silversides were stocked. Sport fish stockings were conducted to restore Blue Catfish, Channel Catfish, Flathead Catfish, and Largemouth Bass. A saugeye stocking and fishery evaluation study was conducted from 2001-2011, and stockings ceased after creel surveys indicated poor utilization of the fishery. The complete stocking history for the reservoir from 2000-2013 is described in Table 4.

Vegetation/habitat management history:
In 2000, Kirby Reservoir went completely dry. Vegetation and habitat management has been limited to a few projects for constructing and deploying artificial habitat structures.

Water transfers:
Kirby Reservoir is primarily used for municipal water supply for the City of Abilene. The reservoir is also used for boating activities and fishing. A pumping system is currently being installed to divert effluent water from the reservoir to a water treatment facility in Abilene, which will pump the water to Ft. Phantom Hill Reservoir in north Abilene. There are no existing interbasin water transfers for Kirby Reservoir.

METHODS

Fishes were collected by electrofishing (1 hour at 12, 5-min stations), gill netting (5 net nights at 5 stations), and trap netting (10 net nights at 10 stations). All standard survey stations were randomly selected and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2011) (Appendix A). Additional surveys for catfish were conducted by low-frequency electrofishing (1 h at 20, 3-min stations) and hoop netting (2 net nights per tandem series; 3 series total). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing; CPUE for gill and trap nets were recorded as the number of fish per net night (fish/nn)(Appendix B).

Roving creel surveys were conducted from September 2010-August 2011 and again from September 2013-May 2014. However, for direct comparisons to the data collected during 2013-2014 creel period,

only data from the September 2010-May 2011 creel surveys are mentioned for that year in this report. 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 2011).

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 and creel statistics. For age estimation, a sample of Blue Catfish 10- 20 inches were collected during spring 2014 gill netting, and ages were estimated by counting annuli from transverse sections of otoliths (Buckmeier et al. 2002).

Genetic analysis of Largemouth Bass was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2011). Micro-satellite DNA analysis was used to determine genetic composition of individual fish from 2005-2013 and by electrophoresis for previous years.

A habitat survey was conducted during August 2013 by selecting 100 random points throughout the reservoir. Fifty additional random stations were selected along the shoreline to include vegetative and structural shoreline habitat for a total of 150 random stations. Shoreline and main reservoir stations were analyzed separately. Plants and structural 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 native and exotic plant species and structural habitat types.

Water level data were collected from the U.S. Geological Survey website for the Kirby Reservoir water level elevation gauge (USGS 2014).

RESULTS AND DISCUSSION

Habitat: Shoreline vegetative habitat found during the habitat survey at Kirby Reservoir consisted of native emergent species such as bulrush (28%), black willow (26%), cattails (22%), buttonbush (8%), and exotic salt cedar (26%) (Table 5). Vegetative habitat found within the reservoir consisted of bulrush (11%), black willow (4%), buttonbush (2%), cattail (2%), and rice cutgrass (2%). Structural habitat found along the shoreline during the survey consisted primarily of featureless land with silty sand or clay substrate with standing water (38%), pebbles (16%), cobble (16%), and stumps (12%). Structural habitat found within the reservoir included featureless open water with silty sand or clay substrate (77%), small boulders (3%), stumps (3%), emergent salt cedar (3%), and riprap (2%). Additional habitat characteristics are detailed in Table 5.

Creel: From September 2013-May 2014, anglers spent 25,762 h fishing at Kirby Reservoir (Table 6), which was a decrease in the effort reported from September 2010-May 2011 (31,042 h). Bank anglers contributed 27,748 h (89%) of angling effort from 2010-2011 and 22,060 h (86%) of angling effort from 2013-2014. Anglers spent the most hours targeting catfish in both 2013-2014 (80% total effort) and 2010-2011 (56%) of total effort creel periods, followed by fishing for anything (Table 7). During both creel periods, catfishes were the most targeted species group by both bank and boat anglers. However, from 2010-2011, White Crappie was second-most targeted species by boat anglers (11%), whereas from 2013-2014, the second-most targeted species by boat anglers was Largemouth Bass (17%). Bank anglers contributed the second-most amount of their effort targeting anything during both the 2010-2011 (37%) and 2013-2014 (12%) creel surveys. During both creel surveys, most anglers reported traveling within 25 miles to fish at Kirby Reservoir (Appendix C).Total angling effort for all species/species groups at Kirby Reservoir is displayed in Table 7, and additional creel data is found in Appendix C.

Prey species: Gizzard Shad and Bluegill were the dominant prey species in Kirby Reservoir. Total

CPUE of Gizzard Shad was similar in 2013 (506.0/h) compared to the 2011 survey (548.0/h), but lower than in 2009 (648.0/h) (Figure 2). Index of vulnerability (IOV) remained consistently high for Gizzard Shad captured in the fall electrofishing surveys in 2009 (IOV=91), 2011 (IOV=91), and 2013 (IOV=95); a majority of these fish were available as prey (Figure 2). Total CPUE of Bluegill in 2013 (684.0/h) was high, but was lower than total CPUE from surveys in 2011 (991.0/h) and 2009 (865.0/h) (Figure 3). Size structure for Bluegill in 2013 was comprised mostly of fish <6 inches, which most fish were suitable as prey for sport fish.

Blue Catfish: Blue Catfish CPUE from gill nets (22.4/nn) was similar to CPUE reported in 2012 (25.2/nn) (Figure 4). In the 2014 gill net catch, longer fish were captured than reported in 2012 and 2010, with sizes ranging from 10 to 32 inches. Catch of Blue Catfish ≥20 inches was similar in 2012 (3.6/nn) and in 2014 (4.2/nn). During the spring low-frequency electrofishing surveys, catch of Blue Catfish was variable and increased from 176.0/h in 2010 to 275.0/h in 2011, and then CPUE declined to 67.0/h in 2012 (Figure 5).

Thirty-nine (39) Blue Catfish from 10-20 inches TL were aged. Estimated ages ranged from 3-9 years old (Figure 6). All fish at stock length (11 inches) were estimated to be age-4 (2010 year class). Of the two 20-inch Blue Catfish caught and aged, one was estimated to be age-9 (2005 year class), and the other was estimated to be age-7 (2007 year class). A majority of the fish in the sample were estimated to be age-6 (2008 year class).

Creel surveys conducted from 2010-2011 and 2013-2014 indicated that Blue Catfish were the most targeted species at Kirby Reservoir. From 2010-2011, anglers spent 7,876 h solely targeting Blue Catfish, whereas from September 2013-May 2014, 2,536 h were directed towards the species (Table 8). Prior to the catfish regulation change in 2011, anglers were estimated to have harvested 2,181.1 Blue Catfish during the 2010-2011 creel period (Figure 7). However, 1,734.8 fish were estimated to have been harvested during the 2013-2014 creel period. From 2010-2011, 103 fish ranging from 12-34 inches were observed and measured during the creel; whereas, 22 fish ranging from 12-36 inches were measured during the 2013-2014 creel period.

Channel Catfish: The gill net catch rate of Channel Catfish in 2014 was 20.8/nn, which was an increase from the rates 7.0/nn in 2012 and 4.8/nn in 2010 (Figure 8). Catch of stock-size fish increased in 2014 (7.0/nn) from the rates reported in 2012 (1.0/nn) and 2010 (1.4/nn). Tandem hoop net catches have been variable. Catch rates in tandem hoop nets during 2012 was 37.7/ set, which was lower than rates of 101.3/set reported in 2009 and 62.0/set reported in 2007 (Figure 9). Catch of stock-sized fish declined from 47.3/set in 2007, to 17.3/set in 2009, and 16.7/set in 2012.

During the September 2010-May 2011 creel period, anglers reported spending 71 h targeting Channel Catfish, whereas effort increased during the 2013-2014 creel period to 338 h (Table 9). Despite the creel not demonstrating a high percentage of direct targeting effort (i.e., 0.2% from September 2010-May 2011 and 1.3% from 2013-2014), anglers reported the greatest angling effort towards catfishes as a group during both creel periods. During the 2010-2011 creel period and prior to the 2011 catfish regulation change, an estimated 13,686 Channel Catfish were caught, which 5,847.0 fish were estimated harvested by anglers and the remaining fish were released. From 2013-2014, an estimated 14,215 Channel Catfish were captured, which 5,218.7 fish were harvested and the remaining fish were released (Figure 10). During the 2010-2011 creel period, 119 fish ranging from 10-23 inches were measured, and 78 fish ranging from 8-18 inches were measured in the 2013-2014 creel period

Flathead Catfish: Flathead Catfish were present in the spring 2014 gill net survey. Flathead Catfish CPUE was similar in 2010 (0.2/nn) and 2014 (1.2/nn) (Figure 11). Creel surveys from 2010-2011 and from 2013-2014 did not indicate any direct angling effort towards Flathead Catfish. During the September 2010-May 2011 creel period, 24.7 Flathead Catfish were caught in and all were harvested. However, an estimated 56.6 fish were caught and released during the September 2013-May 2014 creel period.

Largemouth Bass: Electrofishing catch of Largemouth Bass was much lower in 2013 (35.0/h) than in 2011 (286.0/h) and 2009 (94.0/h); similar trends were seen with stock-sized fish (Figure 12). In 2013, size structure was comprised mostly of fish ≥14 inches, with few fish sampled under the 14-inch minimum. In

2013, relative weights were good (mean relative weight ≥90) for nearly all size classes of fish and were similar to relative weights reported from samples caught in 2011 and 2009.

Largemouth Bass did not receive much angling pressure at Kirby Reservoir according to the 2010-2011 and 2013-2014 creel surveys (Table 10). Directed effort was similar during the 2010-2011 (654 h) and 2013-2014 (641 h) creel periods. Estimated harvest was also similar between the 2010-2011 (335.9 fish) and 2013-2014 (549.6 fish) creel periods. Approximately 310 (33%) of the 952 Largemouth Bass caught from 2013-2014 were of legal size (≥14 inches) and released, which was an increase from the 76 legally sized fish (estimated to be released during the 2010- 2011 creel period). Seven Largemouth Bass ranging from 9-22 inches were observed and measured during the 2010-2011 creel period, whereas only one fish at 15 inches was measured and observed during the 2013-2014 creel period (Figure 13).

Since 2005, Florida Largemouth Bass genetic influence has declined. Florida alleles have declined from 82% in 2005 to 62% in 2013, and the number of pure Florida Largemouth Bass in samples declined from 16 in 2005 to 2 in 2013 (Table 11).

Saugeye: Saugeye were captured both in fall electrofishing and spring gill net surveys. Saugeye CPUE in the 2013 fall electrofishing survey was 1.0/h, which was lower than rates reported in 2011 (6.0/h) and 2009 (51.0/h) (Figure 14). Similarly, CPUE of saugeye in 2014 gill net survey was low (0.6/nn) and had decreased from the 8.0/nn reported in 2012 and 13.0/nn in 2010 (Figure 15). A decrease in relative abundance was expected because of the cessation of saugeye stockings. No fish <18 inches were captured during the fall 2013 electrofishing or 2014 gill net survey. Creels conducted from 2010-2011 and 2013-2014 indicated that anglers rarely target saugeye, and none were caught during either creel periods (Table 12).

White Crappie: The CPUE of White Crappie was consistently low in 2013 (1.1/nn), 2011 (3.4/nn), and 2009 (4.1/nn). From 2009-2013, PSDs of White Crappie caught in the trap net surveys were variable (75-100), but length distributions were primarily comprised of larger fish (i.e., >5 inches). No fish ≤10 inches size were captured in 2013, and mean relative weight was over 100 for all size classes in the sample (Figure 16). As reported in Neely and Dumont (2010), the lack of White Crappie <10 inches suggests that reproduction and recruitment are limited in Kirby Reservoir and causes are poorly understood.

Total angling effort for targeting White Crappie declined from the 1,025 h reported the 2010-2011 creel period to about 619 h reported in the 2013-2014 creel period. Both the 2010-2011 and 2013-2014 creel periods had similar estimates for harvest (381.4 fish and 331.8 fish, respectively). However, an estimated 1.7 fish/hour were released during the 2010-2011 creel period, and no fish were estimated to have been released during the 2013-2014 creel period. During the 2010-2011 creel period, 8 White Crappie ranging from 10-13 inches were observed and measured, and 13 fish ranging from 10-14 inches were measured and observed during the 2013-2014 creel period (Figure 17).

Fisheries management plan for Kirby Reservoir, Texas

ISSUE 1: Catfishes, are the most targeted species group in Kirby Reservoir. In 2011, a new regulation was enacted to protect quality-sized or fish. The regulation allows for no minimum size restrictions and increased daily bag limits for Blue Catfish and Channel Catfish ≤20 inches, and no more than 5 fish ≥ 20 inches. The regulation needs to be evaluated to determine if it is being effective at allowing more fish to reach quality size and/or if relative abundance of Blue and Channel catfish are being affected.

MANAGEMENT STRATEGIES

1. Conduct biennial low-frequency electrofishing surveys to better assess relative abundance, size structure, age structure, and condition of Blue Catfish in Kirby Reservoir.
2. Conduct tandem hoop net survey in 2014 and 2016 to better assess relative abundance, size structure, age structure, and condition of Channel Catfish in Kirby Reservoir.
3. Conduct a quarterly creel survey from June 2017-May 2018 to determine angler-directed effort for catfishes, specifically individuals of quality-size.
4. Conduct a mark-recapture study to estimate population size and calibrate accuracy of population estimate to low-frequency electrofishing CPUE.

ISSUE 2: While directed effort towards Flathead Catfish in Kirby Reservoir appeared low during the most recent creel survey, catfishes as a group are targeted more than any other species group at the reservoir. Flathead Catfish may increase potential to catch trophy catfish from the reservoir. Flathead Catfish are currently managed under the statewide harvest limit and have not been adequately sampled in gill netting surveys for monitoring trends in relative abundance and other population demographics.

MANAGEMENT STRATEGIES

1. Conduct biennial low-frequency electrofishing surveys to attain better estimates of relative abundance, relative weights, size structure, and age structure for Flathead Catfish.
2. If catch is high and size structure appears unbalanced (PSD < 40), consider conducting an exploitation study to determine if statewide regulation is sufficient for the management of Flathead Catfish in the reservoir.

ISSUE 3: Historically, White Crappie was a popular species targeted by anglers, but relative abundance has been low in Kirby Reservoir trap netting surveys for many years; previous surveys suggest that recruitment is poor.

MANAGEMENT STRATEGIES

1. Conduct trap netting in 2015 and 2017 with increased effort for White Crappie to assess recruitment and to determine if harvestable-sized White Crappie are available for anglers.
2. Conduct a Blue Catfish diet study to determine if White Crappie is a preferred prey species for Blue Catfish in Kirby Reservoir.

ISSUE 4: Largemouth Bass relative abundance in electrofishing surveys has been decreasing, and recruitment also appears to be poor. However, Bluegill relative abundance has remained high, which may indicate possible interspecific competition occurring between them and sub-stock Largemouth Bass.

MANAGEMENT STRATEGIES

1. Stock Florida Largemouth Bass fingerlings in 2014 and 2015 at about 100 fish/acre.
2. Conduct bass-only electrofishing in 2014 and 2015 to monitor relative abundance of Largemouth Bass, particularly sub-stock bass, to evaluate recruitment of stocked fish. Fin clips will be collected for genetic analysis to determine if age-0 bass collected in the fall were from stocking or

natural reproduction.

ISSUE 5: Lack of access and diminished aesthetics from litter have been demonstrated to be constraints to angling participation (Hunt 2005), and such constraints may be prevent potential anglers from fishing at Kirby Reservoir. Lake Kirby Park is the primary access location for the reservoir. The park's roadways and shoreline could use improvements for reservoir access and aesthetics. Bank anglers make up the majority of the anglers, and litter surrounding the shoreline and roadways may impede access and deter anglers from fishing. Road conditions, particularly on the southern and western regions of the park, are poor and need resurfacing and leveling.

MANAGEMENT STRATEGIES

1. Request that the City of Abilene install trash receptacles at the park to reduce litter issues.
2. Discuss with the City of Abilene needed repairs of the dirt roads.
3. Collaborate with Keep Abilene Beautiful, Boy Scouts of America, and other groups on beautification projects to improve aesthetics at the park as well as possible native vegetation plantings.

ISSUE 6: Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels (*Dreissena polymorpha*) can multiply rapidly and attach themselves to any available hard structure, restricting water flow in pipes, fouling swimming beaches, and plugging engine cooling systems. Giant salvinia (*Salvinia molesta*) and other invasive vegetation species can form dense mats, interfering with recreational activities like fishing, boating, skiing, and swimming. The financial costs of controlling and/or eradicating these types of invasive species are significant. Additionally, the potential for invasive species to spread to other river drainages and reservoirs via watercraft and other means is a serious threat to all public waters of the State.

MANAGEMENT STRATEGIES

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

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule includes additional low-frequency electrofishing in summer 2014 and 2016 to obtain better estimates of Flathead Catfish relative abundance, size structure, and relative weights (Table 14). Bass-only electrofishing will be conducted during fall 2014 and 2015 to evaluate recruitment of Largemouth Bass stocked during spring 2014 and spring 2015; fin clips will also be collected for genetic analysis to determine if age-0 bass are from stocking or natural reproduction. Trends in relative abundance and size structure of forage fish will be monitored during the 2017 electrofishing survey. Fall trap netting will be conducted in 2015 and 2017 to monitor relative abundance, size structure, and relative weights of White Crappie. Summer tandem hoop netting will be conducted during 2014 and 2016 to monitor the relative abundance, size structure, and relative weights of Channel Catfish. Vegetative habitat will be assessed in a survey during summer 2017. A gill netting survey will be conducted in spring 2018 for additional monitoring of catfishes in the reservoir. A roving creel survey will be conducted from June 2017-May 2018 to collect angler-directed effort, harvest, and release data for sport fish in the reservoir.

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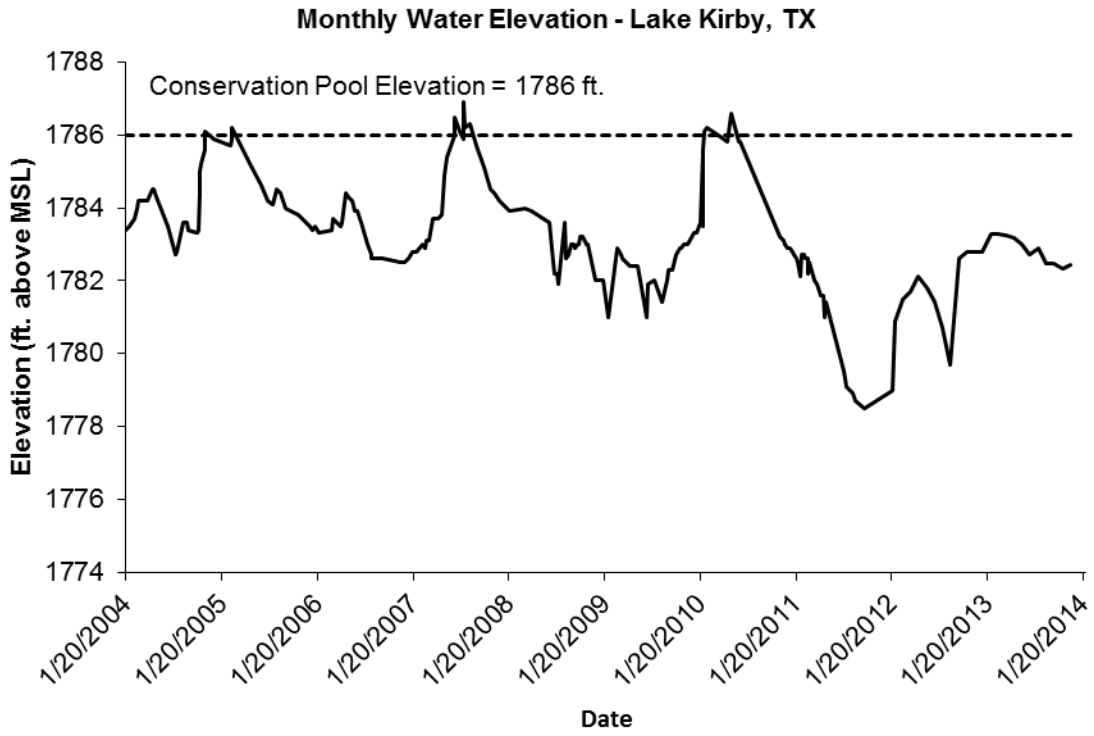


Figure 1. Monthly water level elevations in feet above mean sea level (MSL) recorded for Kirby Reservoir, Texas from January 2004 to January 2014. Conservation pool elevation (1,786 ft.) is displayed as the dotted line, and measured lake elevation is represented by the solid line.

Table 1. Characteristics of Kirby Reservoir, Texas.

Characteristic	Description
Year constructed	1928
Controlling authority	City of Abilene, Texas
County	Taylor
Reservoir type	Stream Impoundment
Geographic Coordinates	32° 23' N; 99° 44' W
Watershed	Cedar Creek within the Brazos River Basin
Maximum Depth	18.0 ft.
Average Depth	6.5 ft.
Secchi Disc Range	1-3 ft.
Shoreline Development Index (SDI)	2.18
Conductivity	1,700 µS/cm

Table 2. Boat ramp characteristics for Kirby Reservoir, Texas, April 2014.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	End of Ramp Elevation (ft. above MSL)	Condition
Kirby Park Ramp #1	32.38335º -99.72982º	Y	10	1,775	Good; no access issues
Kirby Park Ramp #2	32.38018º -99.72960º	Y	5	1,779	Ramp is in need of repair; poorly accessible

Table 3. Harvest regulations for Kirby Reservoir, Texas.

Species	Bag limit	Length limit
Catfish: Channel and Blue, their hybrids and subspecies	50; no more than 5 ≥ 20-inches (in any combination)	None
Catfish, Flathead	5	18-inch minimum
Bass, Largemouth	5	14-inch minimum
Crappie: White and Black, their hybrids and subspecies	25 (in any combination)	10-inch minimum
Saugeye	3	18-inch minimum

Table 4. Stocking history of Kirby Reservoir, Texas from 2000-2013; FGL = fingerlings; AFGL = advanced fingerlings; ADL = adults.

Species	Year	Number	Size
Threadfin Shad	2002	300	ADL
Golden Shiner	2000	100	ADL
Bluegill	2001	475	ADL
	2001	37,196	FGL
	Total	37,671	
Fathead Minnow	2000	500	ADL
Inland Silverside	2001	200	ADL
Blue Catfish	2001	74,000	FGL
Channel Catfish	2001	73,794	FGL
	2004	1,621	FGL
	Total	75,415	
Flathead Catfish	2003	44	ADL
Saugeye	2001	704,701	FRY
	2002	143,101	FRY
	2002	8,410	FGL
	2004	37,425	FGL
	2005	15,806	FGL
	2006	12,134	FGL
	2008	58,500	FGL
	2009	108,815	FGL
	2011	23,919	FGL
	Total	1,112,811	
Florida Largemouth Bass	2002	51,315	FGL
Largemouth Bass	2003	8,775	FGL
	2004	76,290	FGL
	Total	85,065	

Table 5. Percent occurrence with lower and upper 95% confidence limits (CL) of main reservoir and shoreline habitat at random stations in Kirby Reservoir, Texas, August, 2013.

	Main Reservoir Stations (n=100)			Shoreline Stations (n=50)		
Habitat type	Percent occurrence	Upper CL	Lower CL	Percent occurrence	Upper CL	Lower CL
Native Emergent Vegetation						
Bulrush	11.0	17.1	4.9	28.0	40.5	15.6
Buttonbush	2.0	4.7	0.0	8.0	15.5	0.5
Cattail	2.0	4.7	0.0	22.0	33.5	10.5
Black Willow	4.0	7.8	0.2	26.0	38.2	13.8
Rice Cutgrass	2.0	4.7	0.0	0.0	0.0	0.0
Sesbiana sp.	1.0	3.0	0.0	0.0	0.0	0.0
Flatsedge	1.0	3.0	0.0	0.0	0.0	0.0
Salt Cedar	3.0	6.3	0.0	26.0	38.2	13.8
Structural Habitat						
Dead brush	1.0	3.0	0.0	3.0	0.0	0.0
Pebbles (0.08-2.5 in)	1.0	3.0	0.0	16.0	26.2	5.8
Cobble (2.5-10 in)	0.0	0.0	0.0	16.0	26.2	5.8
Small Boulders (10-24 in)	3.0	6.3	0.0	0.0	0.0	0.0
Large Boulders (≥24 in)	1.0	3.0	0.0	0.0	0.0	0.0
Riprap	2.0	4.7	0.0	0.0	0.0	0.0
Stumps	3.0	6.3	0.0	12.0	21.0	3.0
Featureless w/ silty sand/clay substrates	77.0	85.3	68.8	38.0	51.5	24.6

Table 6. Total fishing effort (h) for all species at Kirby Reservoir, Texas, September 2010-May 2011 and September 2013-May 2014. Relative standard errors are in parentheses.

Creel statistic	2010/2011	2013/2014
Total fishing effort	31,042 (11)	25,762 (16)
Bank Anglers	27,748 (11)	22,060 (15)
Boat Anglers	3,294 (27)	3,702 (32)

Table 7. Percent directed angler effort by species/species group for Kirby Reservoir, Texas, periods September 2010-May 2011,and September 2013-May 2014.

Species	2010/2011	2013/2014
Anything	34.2	12.0
Catfishes	56.4	80.3
Common Carp	1.0	0.6
Largemouth Bass	2.1	2.5
Saugeye	0.5	0.0
Sunfishes	2.5	2.2
White Crappie	3.3	2.4

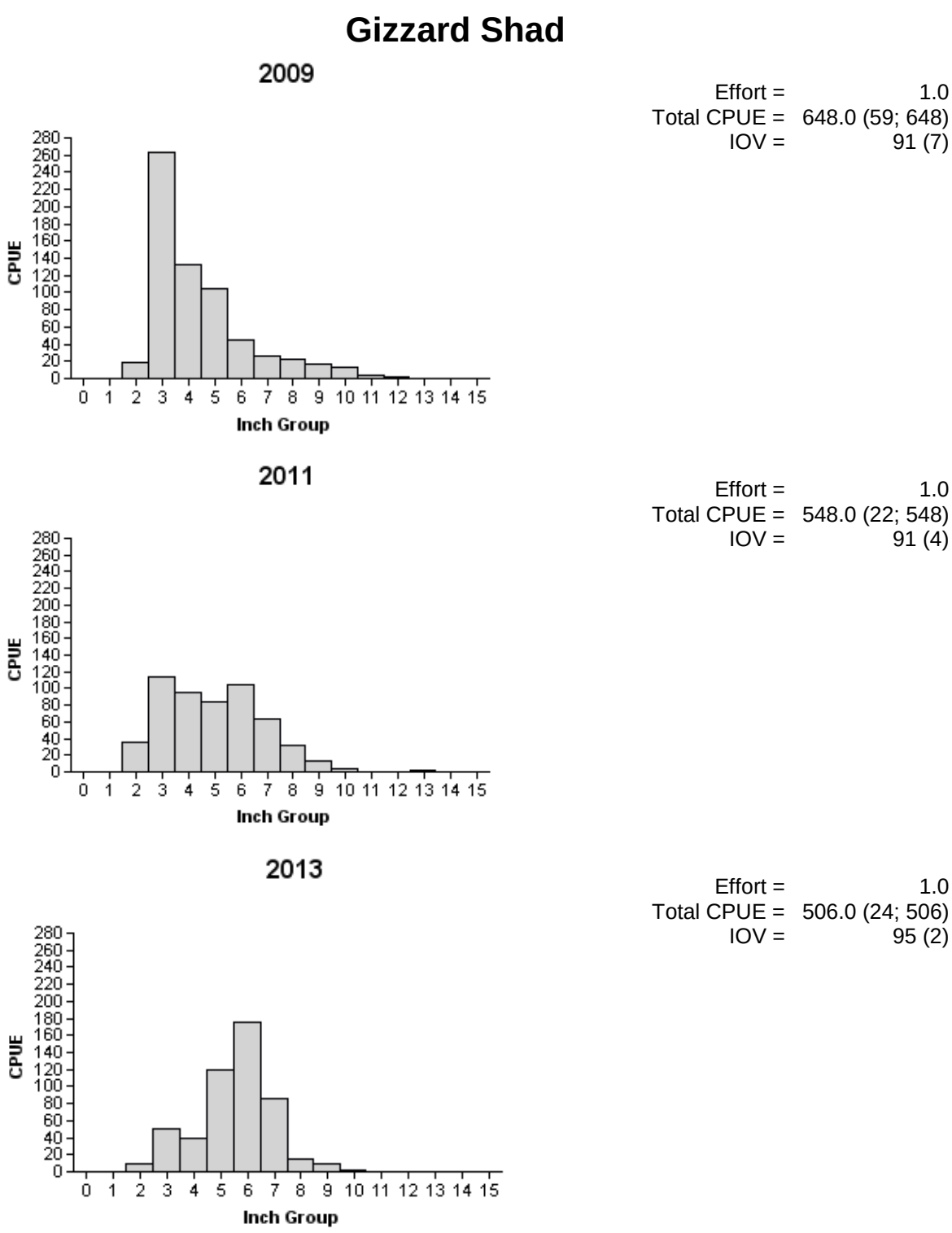
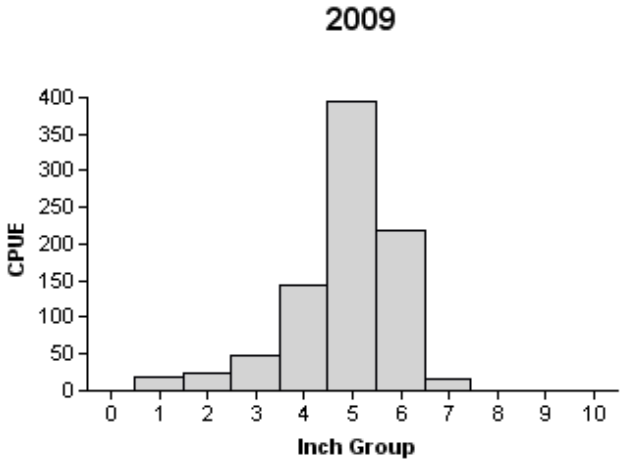
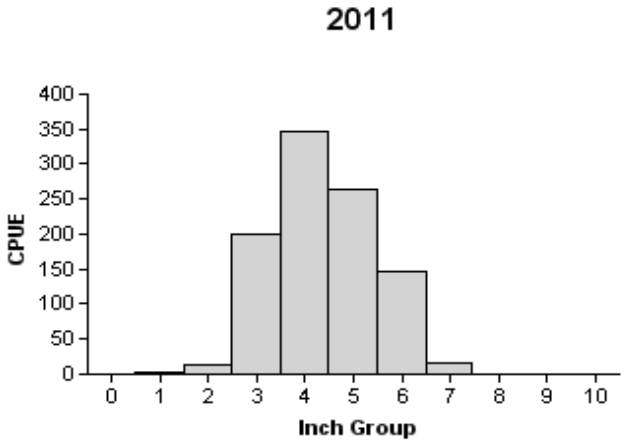


Figure 2. Number of Gizzard Shad caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Kirby Reservoir, Texas, 2009, 2011, and 2013.

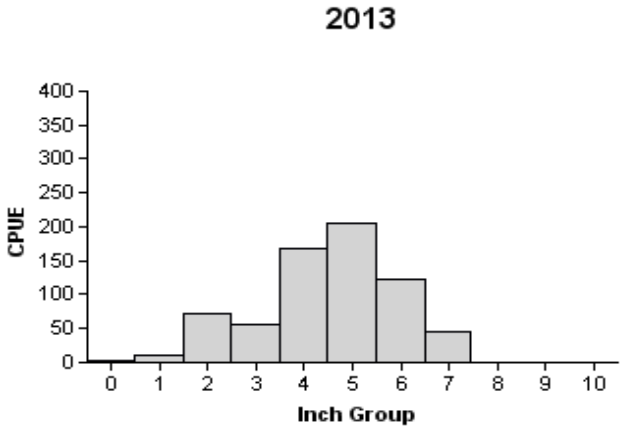
Bluegill



Effort = 1.0
Total CPUE = 865.0 (20; 865)
PSD = 29 (4)



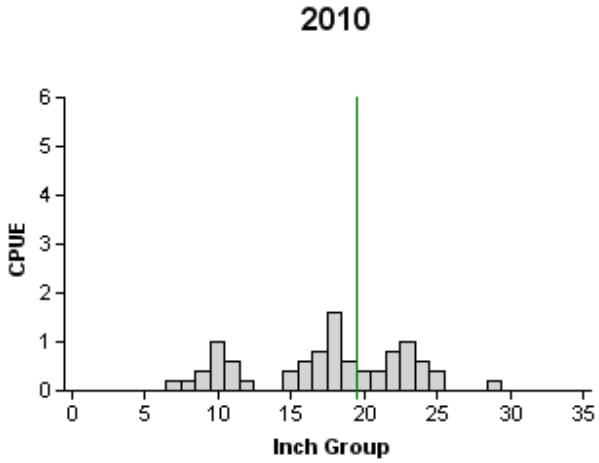
Effort = 1.0
Total CPUE = 991.0 (19; 991)
PSD = 17 (2)



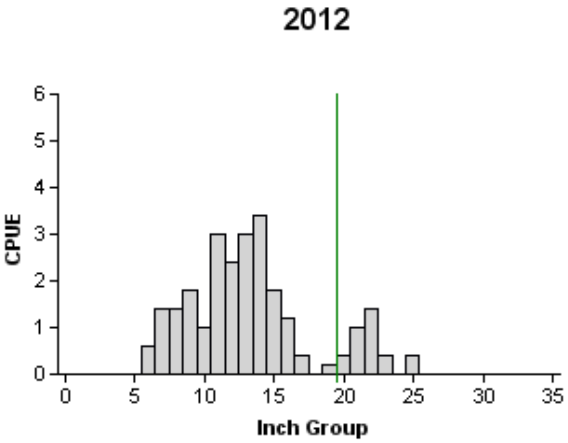
Effort = 1.0
Total CPUE = 684.0 (32; 684)
PSD = 28 (5)

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, Kirby Reservoir, Texas, 2009, 2011, and 2013.

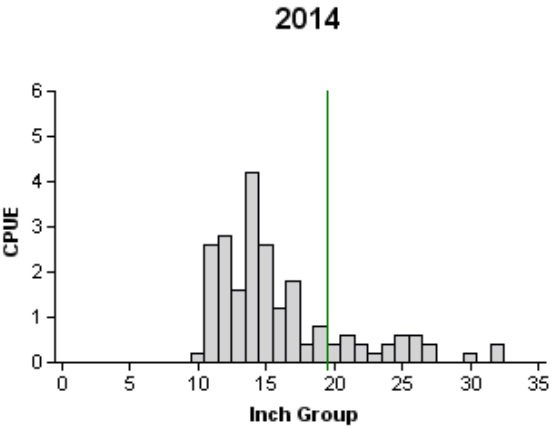
Blue Catfish



Effort =	5.0
Total CPUE =	10.4 (10; 52)
Stock CPUE =	8.0 (13; 40)
CPUE-20 =	3.8 (34; 19)
PSD =	48 (11)



Effort =	5.0
Total CPUE =	25.2 (22; 126)
Stock CPUE =	16.0 (21; 80)
CPUE-20 =	3.6 (54; 18)
PSD =	22 (10)



Effort =	5.0
Total CPUE =	22.4 (22; 112)
Stock CPUE =	19.6 (21; 98)
CPUE-20 =	4.2 (31; 21)
PSD =	21 (4)

Figure 4. Number of Blue Catfish caught per net night (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Kirby Reservoir, Texas, 2010, 2012, and 2014. The line displays the 20-inch size at which quality-sized fish are regulated for a five-fish maximum bag limit.

Blue Catfish

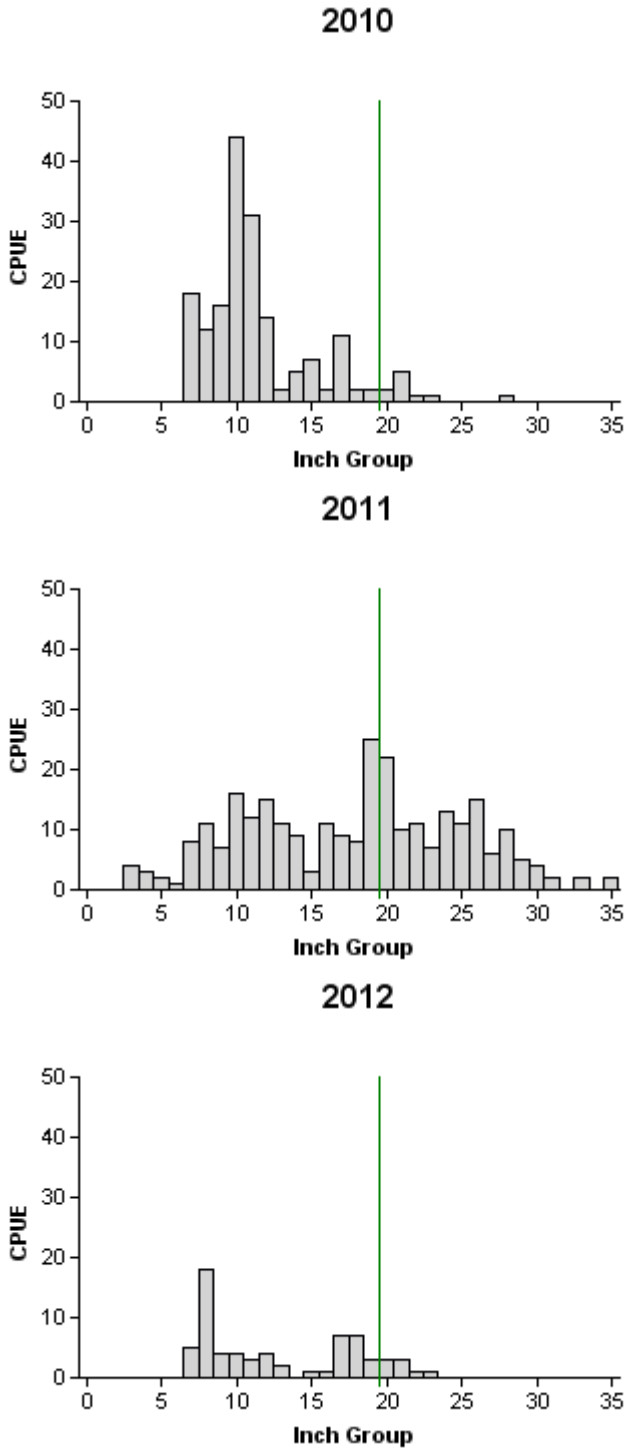


Figure 5. Number of Blue Catfish caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring low-frequency electrofishing surveys, Kirby Reservoir, Texas, 2010, 2011, and 2012. The line displays the 20-inch size at which quality-sized fish are regulated for a five-fish maximum bag limit.

Blue Catfish

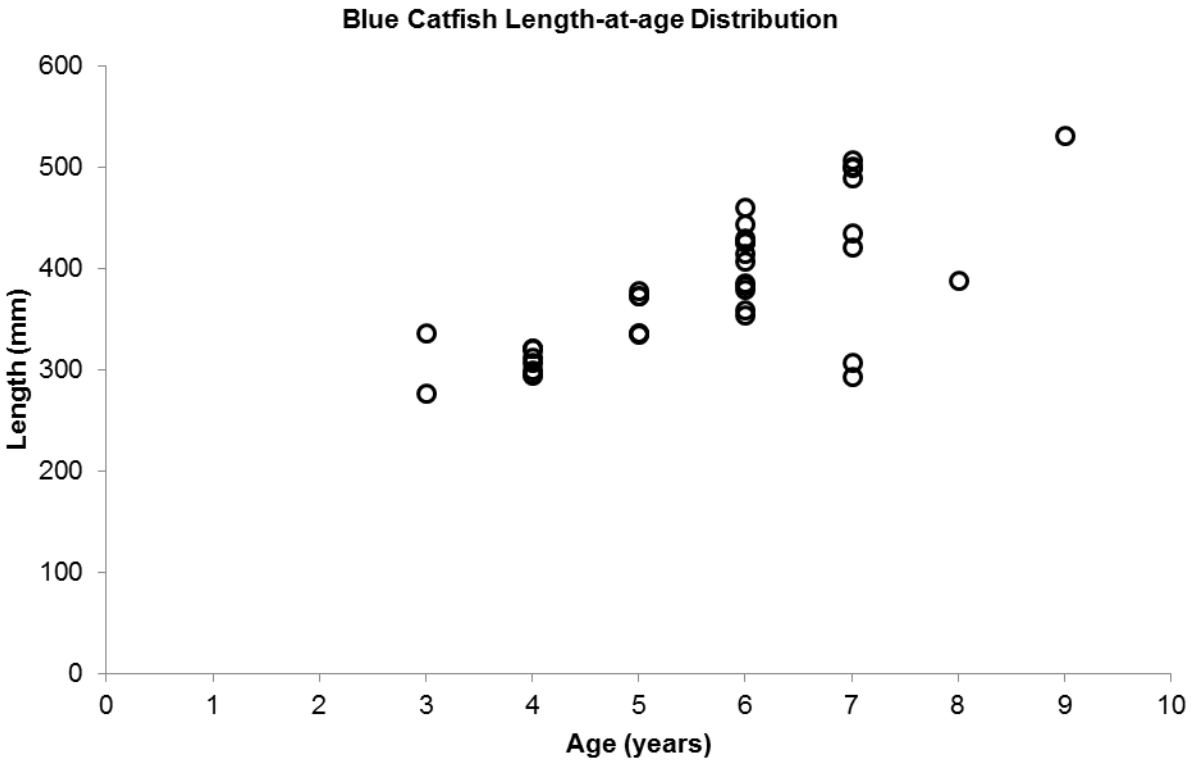


Figure 6. Length-at-estimated age distribution for a sample of 39 Blue Catfish ranging from 277-532 mm (10-20 inches) caught during spring 2014 gill netting at Kirby Reservoir, Texas.

Blue Catfish

Table 8. Creel survey statistics for Blue Catfish at Kirby Reservoir from September 2010 through May 2011 and September 2013 through May 2014. Total catch per hour is for anglers targeting Blue Catfish and total harvest is the estimated number of Blue Catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses. RSE for directed effort and total harvest is the same as directed effort/acre and total harvest/acre, respectively.

Creel survey statistic	Year	
	2010/2011[1]	2013/2014
Directed effort (h)	7,876.1 (12)	2,536.4 (30)
Directed effort/acre	10.6 (12)	3.4 (30)
Total catch per hour	0.4 (40)	0.3 (53)
Total harvest	2,181.1 (36)	1,734.8 (46)
Harvest/acre	2.9 (40)	2.3 (46)
Release/hour	0.2 (63)	0.1 (113)
Percent legal released	27.8	69.4

[1]Blue Catfish were managed under the previous harvest regulation of the 12-inch minimum size limit and 25-fish daily bag limit.

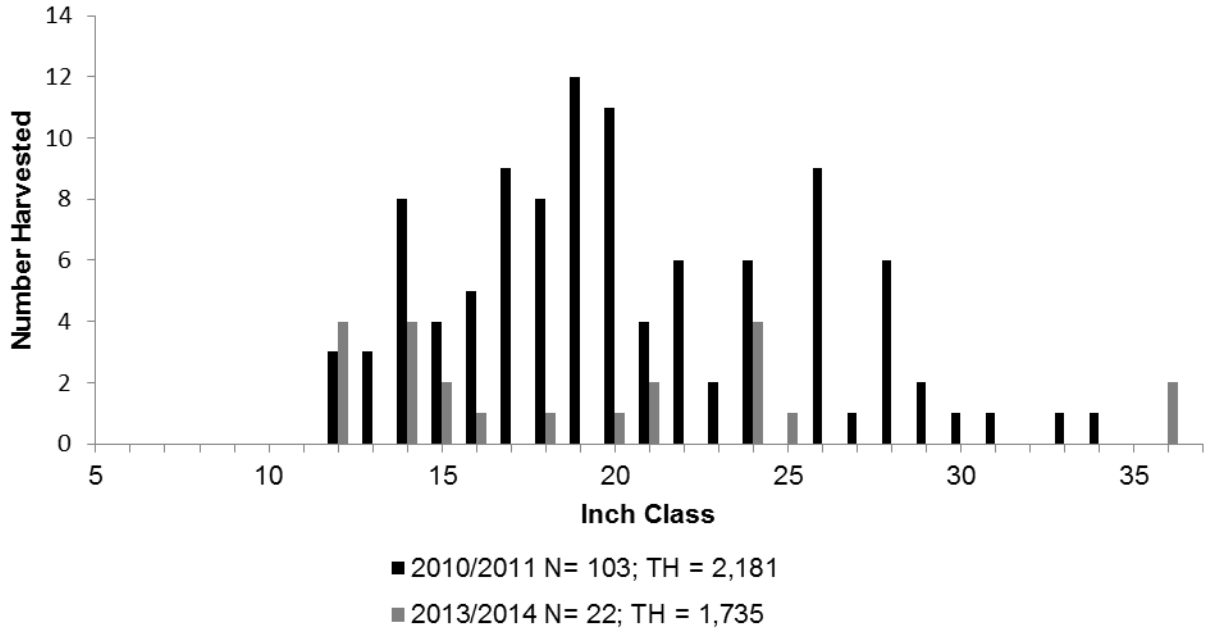
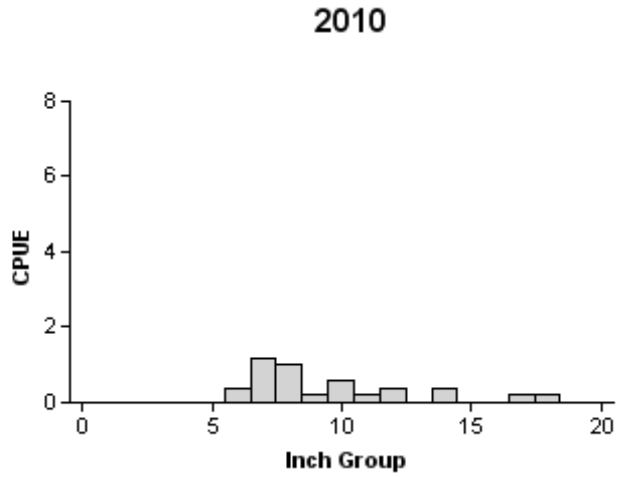
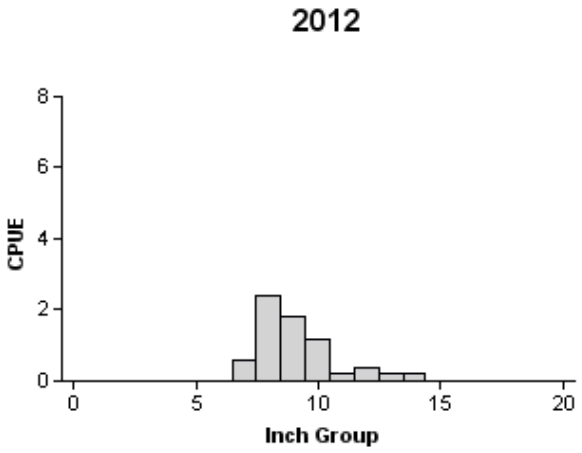


Figure 7. Length frequency of harvested Blue Catfish observed during creel surveys at Kirby Reservoir, Texas, September 2010-May 2011 (black bars) and through September 2013-May 2014 (gray bars), all anglers combined. N is the number of Blue Catfish observed measured during creel surveys, and TH is the total estimated harvest for the creel period.

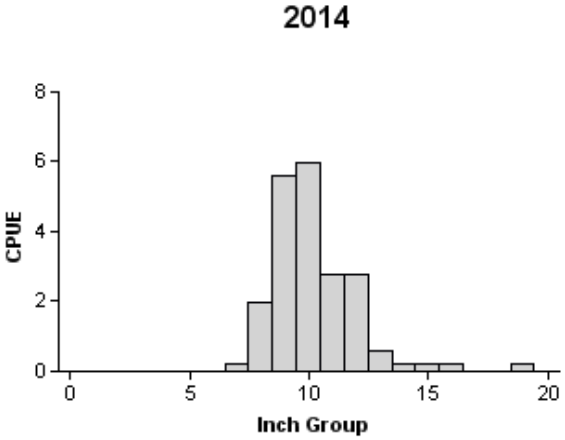
Channel Catfish



Effort =	5.0
Total CPUE =	4.8 (14; 24)
Stock CPUE =	1.4 (36; 7)
PSD =	29 (21)



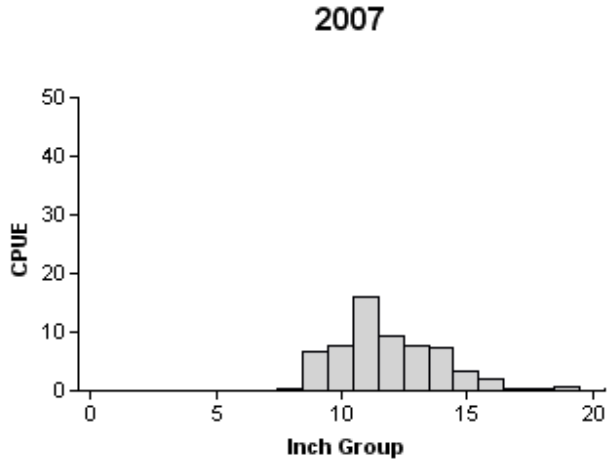
Effort =	5.0
Total CPUE =	7.0 (38; 35)
Stock CPUE =	1.0 (45; 5)
PSD =	0 (438)



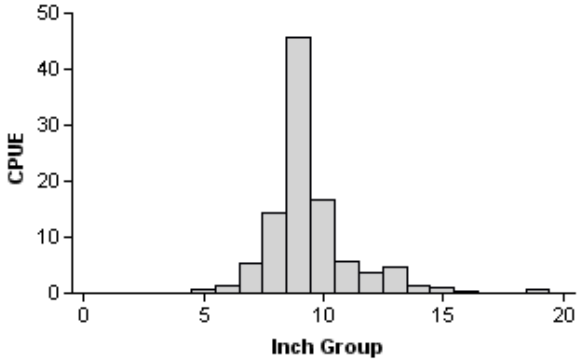
Effort =	5.0
Total CPUE =	20.8 (67; 104)
Stock CPUE =	7.0 (43; 35)
PSD =	6 (3)

Figure 8. Number of Channel Catfish caught per net night (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Kirby Reservoir, Texas, 2010, 2012, and 2014.

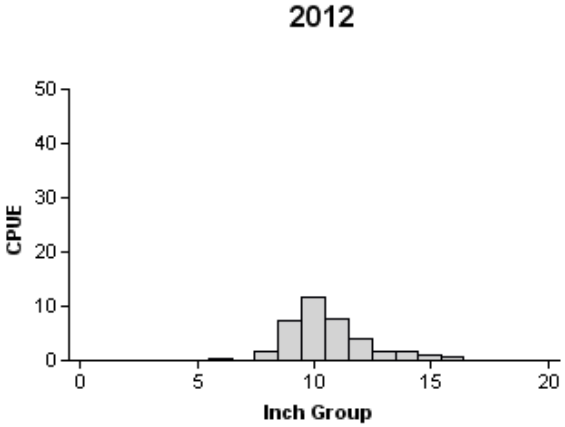
Channel Catfish



Effort =	3.0
Total CPUE =	62.0 (27; 186)
Stock CPUE =	47.3 (34; 142)
PSD =	8 (2)



Effort =	3.0
Total CPUE =	101.3 (53; 304)
Stock CPUE =	17.3 (35; 52)
PSD =	6 (3)



Effort =	3.0
Total CPUE =	37.7 (10; 113)
Stock CPUE =	16.7 (27; 50)
PSD =	4 (3)

Figure 9. Number of Channel Catfish caught per tandem set (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring hoop net surveys, Kirby Reservoir, Texas, 2007, 2009, and 2012.

Channel Catfish

Table 9. Creel survey statistics for Channel Catfish at Kirby Reservoir from September 2010 through May 2011 and September 2013 through May 2014. Total catch per hour is for anglers targeting Channel Catfish and total harvest is the estimated number of Channel Catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses. RSE for directed effort and total harvest is the same as directed effort/acre and total harvest/acre, respectively.

Creel survey statistic	Year	
	2010/2011[1]	2013/2014
Directed effort (h)	71.4 (117)	338.2 (73)
Directed effort/acre	0.1 (117)	0.5 (73)
Total catch per hour	1.7 (86)	2.1 (**)[1]
Total harvest	5,847.0 (41)	5,218.7 (37)
Harvest/acre	7.9 (41)	7.1 (37)
Release/hour	1.2 (122)	1.0 (**)[2]
Percent legal released	10.7	63.3

[1]Channel Catfish were managed under the previous harvest regulation of the 12-inch minimum size limit and 25-fish daily bag limit.
[2]Asterisks (**) indicate that a value could not be calculated.

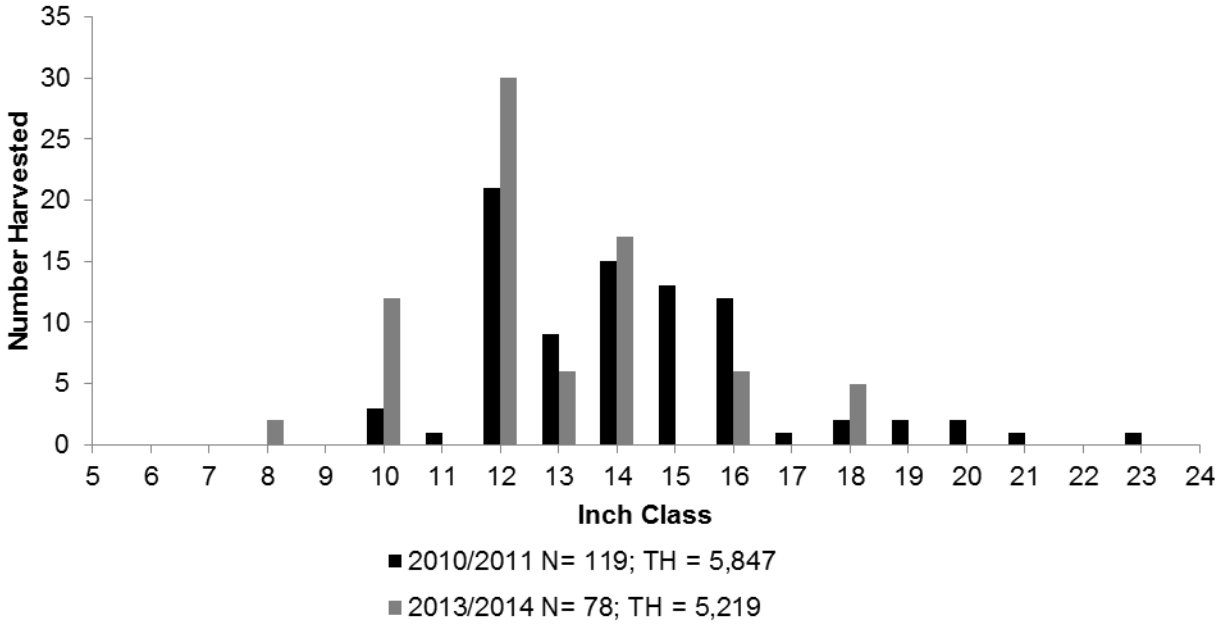
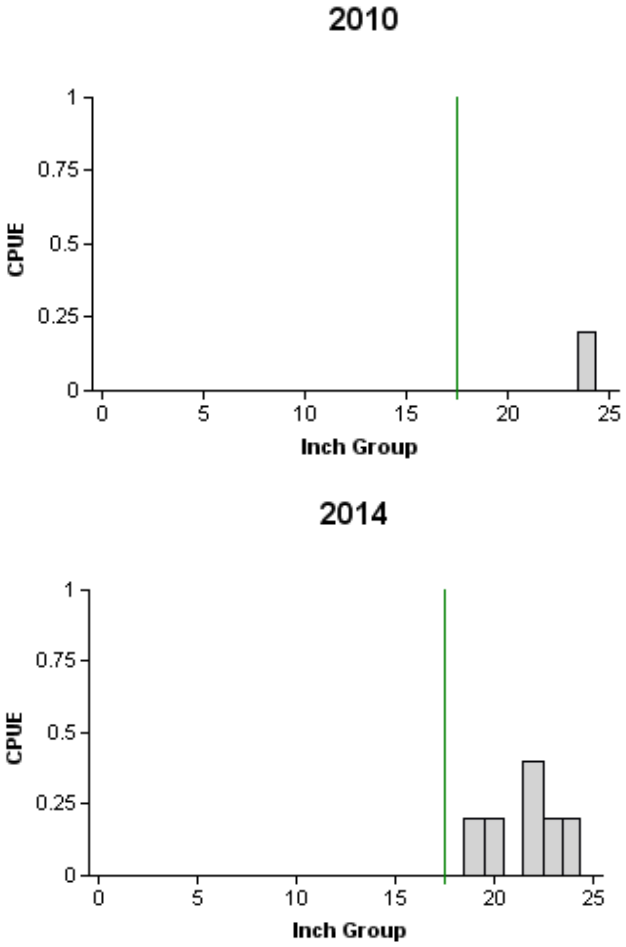


Figure 10. Length frequency of harvested Channel Catfish observed during creel surveys at Kirby Reservoir, Texas, September 2010-May 2011 (black bars) and through September 2013-May 2014 (gray bars), all anglers combined. N is the number of Channel Catfish measured during creel surveys, and TH is the total estimated harvest for the creel period.

Flathead Catfish

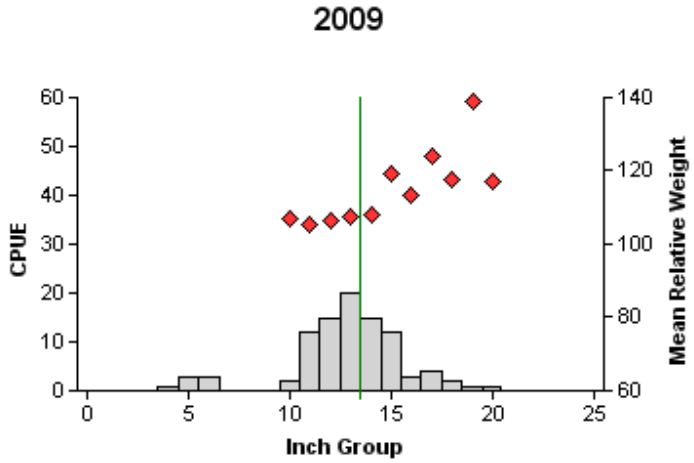


Effort =	5.0
Total CPUE =	0.2 (100; 1)
Stock CPUE =	0.2 (100; 1)
PSD =	100 (0)

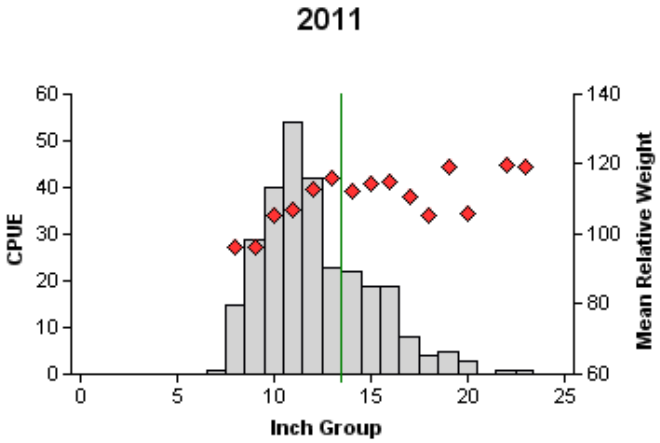
Effort =	5.0
Total CPUE =	1.2 (100; 6)
Stock CPUE =	1.2 (100; 6)
PSD =	83 (0)

Figure 11. Number of Flathead Catfish caught per net night (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Kirby Reservoir, Texas, 2010 and 2014. The line on the figure displays the 18-inch minimum length limit.

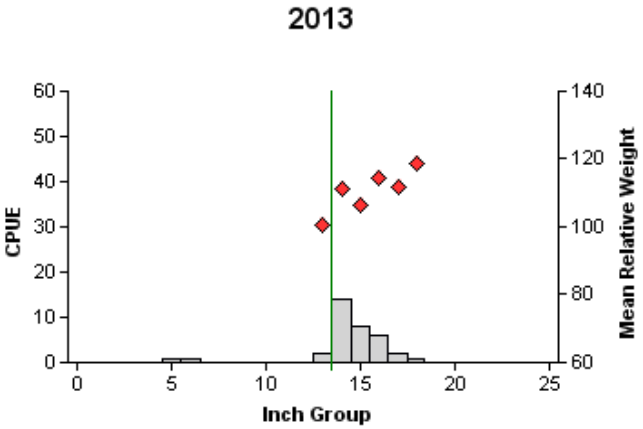
Largemouth Bass



Effort =	1.0
Total CPUE =	94.0 (21; 94)
Stock CPUE =	87.0 (23; 87)
CPUE-14 =	38.0 (23; 38)
PSD =	84 (5)



Effort =	1.0
Total CPUE =	286.0 (18; 286)
Stock CPUE =	285.0 (18; 285)
CPUE-14 =	82.0 (20; 82)
PSD =	52 (4)



Effort =	1.0
Total CPUE =	35.0 (27; 35)
Stock CPUE =	33.0 (29; 33)
CPUE-14 =	31.0 (28; 31)
PSD =	100 (0)

Figure 12. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weights (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Kirby Reservoir, Texas, 2009, 2011, and 2013. The line on the figure displays the 14-inch minimum length limit.

Largemouth Bass

Table 10. Creel survey statistics for Largemouth Bass at Kirby Reservoir from September 2010 through May 2011 and September 2013 through May 2014. Total catch per hour is for anglers targeting Largemouth Bass total harvest is the estimated number of Largemouth Bass harvested by all anglers. Relative standard errors (RSE) are in parentheses. RSE for directed effort and total harvest is the same as directed effort/acre and total harvest/acre, respectively.

Creel survey statistic	Year	
	2010/2011	2013/2014
Directed effort (h)	654.0 (39)	641.4 (54)
Directed effort/acre	0.9 (39)	0.9 (54)
Total catch per hour	0.5 (50)	0.6 (18)
Total harvest	335.9 (146)	549.6 (103)
Harvest/acre	0.5 (146)	0.7 (103)
Release/hour	0.5 (70)	0.6 (25)
Percent legal released	4.1	32.5

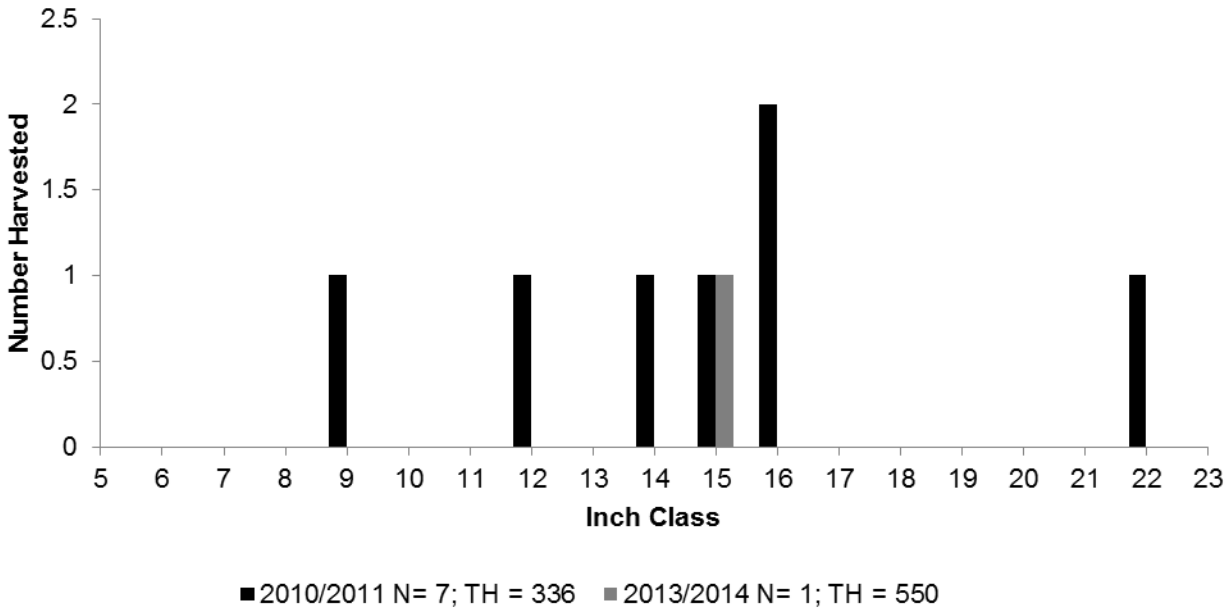


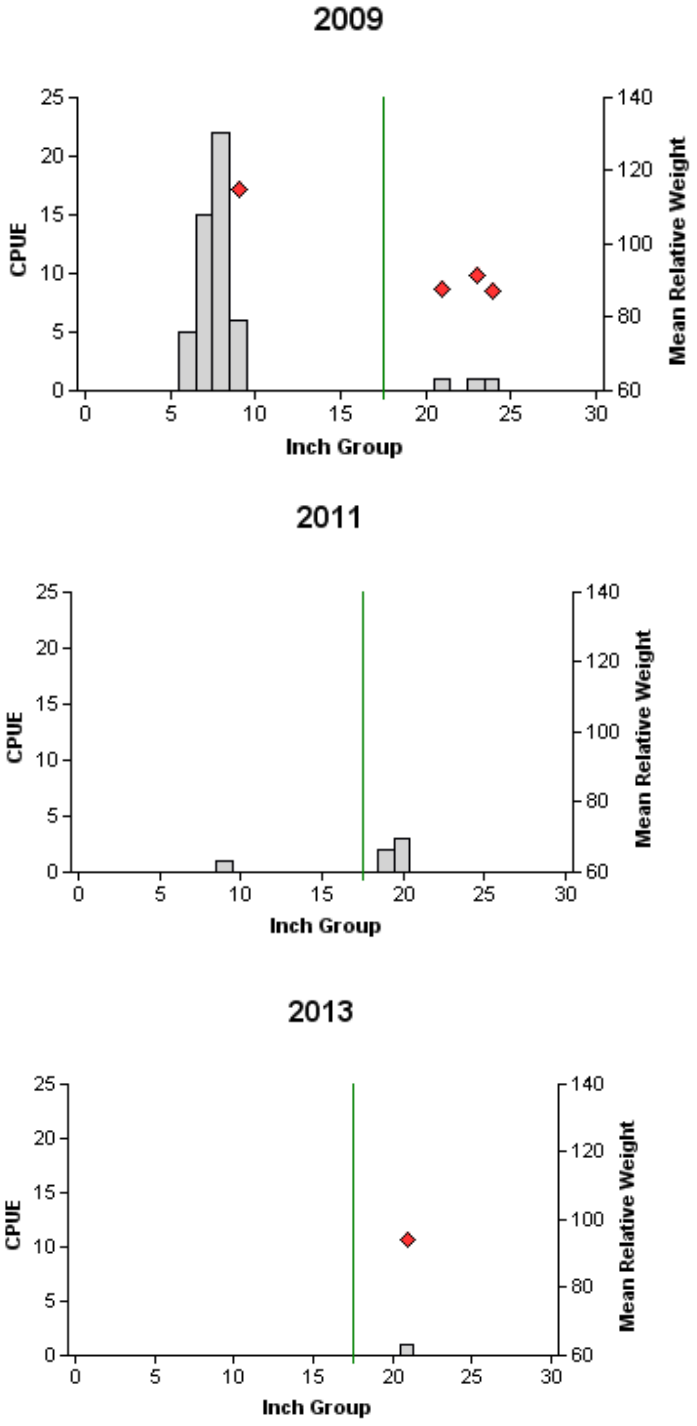
Figure 13. Length frequency of harvested Largemouth Bass observed during creel surveys at Kirby Reservoir, Texas, September 2010-May 2011 (black bars) and September 2013-May 2014 (gray bars), all anglers combined. N is the number of Largemouth Bass measured during creel surveys, and TH is the total estimated harvest for the creel period.

Largemouth Bass

Table 11. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Kirby Reservoir, Texas, 2005, 2007, and 2013. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB. Genetic composition has been determined by with micro-satellite DNA analysis since 2005.

		Number of fish				
Year	Sample size	FLMB	Intergrade	NLMB	% FLMB alleles	% FLMB
2005	31	16	15	0	81.6	51.6
2007	30	12	15	3	70.1	40.0
2013	30	2	25	3	62.0	7.0

Saugeye



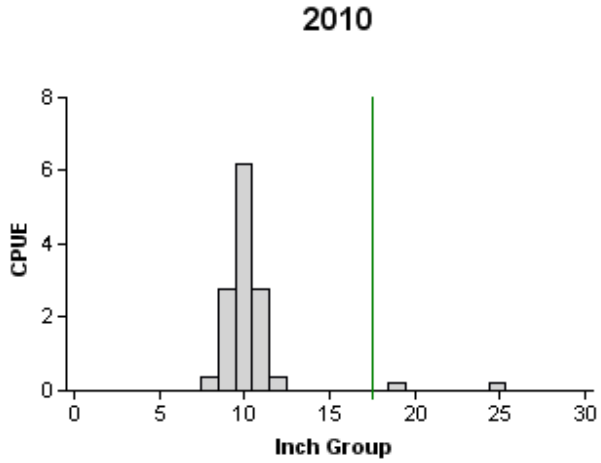
Effort =	1.0
Total CPUE =	51.0 (35; 51)
CPUE-18 =	3.0 (52; 3)
PSD =	33 (17)

Effort =	1.0
Total CPUE =	6.0 (39; 6)
CPUE-18 =	5.0 (46; 5)
PSD =	83 (16)

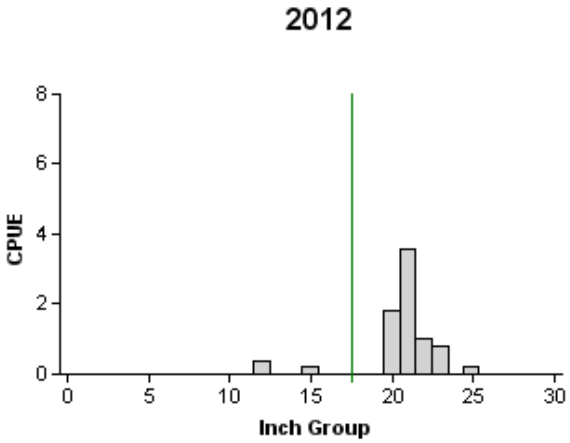
Effort =	1.0
Total CPUE =	1.0 (100; 1)
Stock CPUE =	1.0 (100; 1)
PSD =	100 (0)

Figure 14. Number of saugeye caught per hour (CPUE, bars), mean relative weights (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Kirby Reservoir, Texas, 2009, 2011, and 2013. The line on the figure displays the 18-inch minimum length limit.

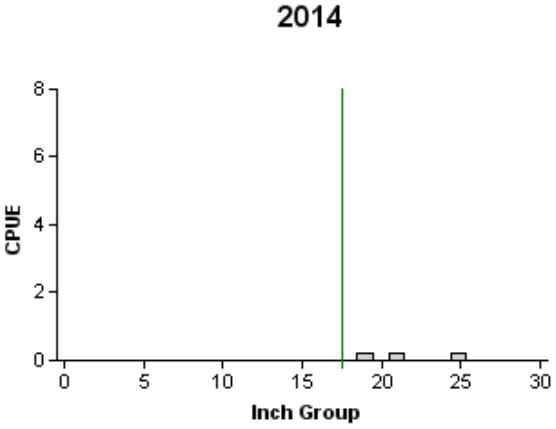
Saugeye



Effort =	5.0
Total CPUE =	13.0 (26; 65)
CPUE-18 =	0.4 (61; 2)
PSD =	3 (2)



Effort =	5.0
Total CPUE =	8.0 (64; 40)
CPUE-18 =	7.4 (68; 37)
PSD =	95 (5)



Effort =	5.0
Total CPUE =	0.6 (41; 3)
Stock CPUE =	0.6 (41; 3)
PSD =	100 (0)

Figure 15. Number of saugeye caught per net night (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Kirby Reservoir, Texas, 2007, 2009, and 2012. The line on the figure displays the 18-inch minimum length limit.

Saugeye

Table 12. Creel survey statistics for saugeye at Kirby Reservoir from September 2010 through May 2011, and September 2013 through May 2014. Total catch per hour is for anglers targeting saugeye and total harvest is the estimated number of saugeye harvested by all anglers. Relative standard errors (RSE) are in parentheses. RSE for directed effort and total harvest is the same as directed effort/acre and total harvest/acre, respectively.

Creel survey statistic	Year	
	2010/2011	2013/2014
Directed effort (h)	157 (72)	0 (0)
Directed effort/acre	0.21 (72)	0 (0)
Total catch per hour	0(0)	0 (0)
Total harvest	0 (0)	0 (0)
Harvest/acre	0 (0)	0 (0)
Release/hour	0 (0)	0 (0)
Percent legal released	0	0

White Crappie

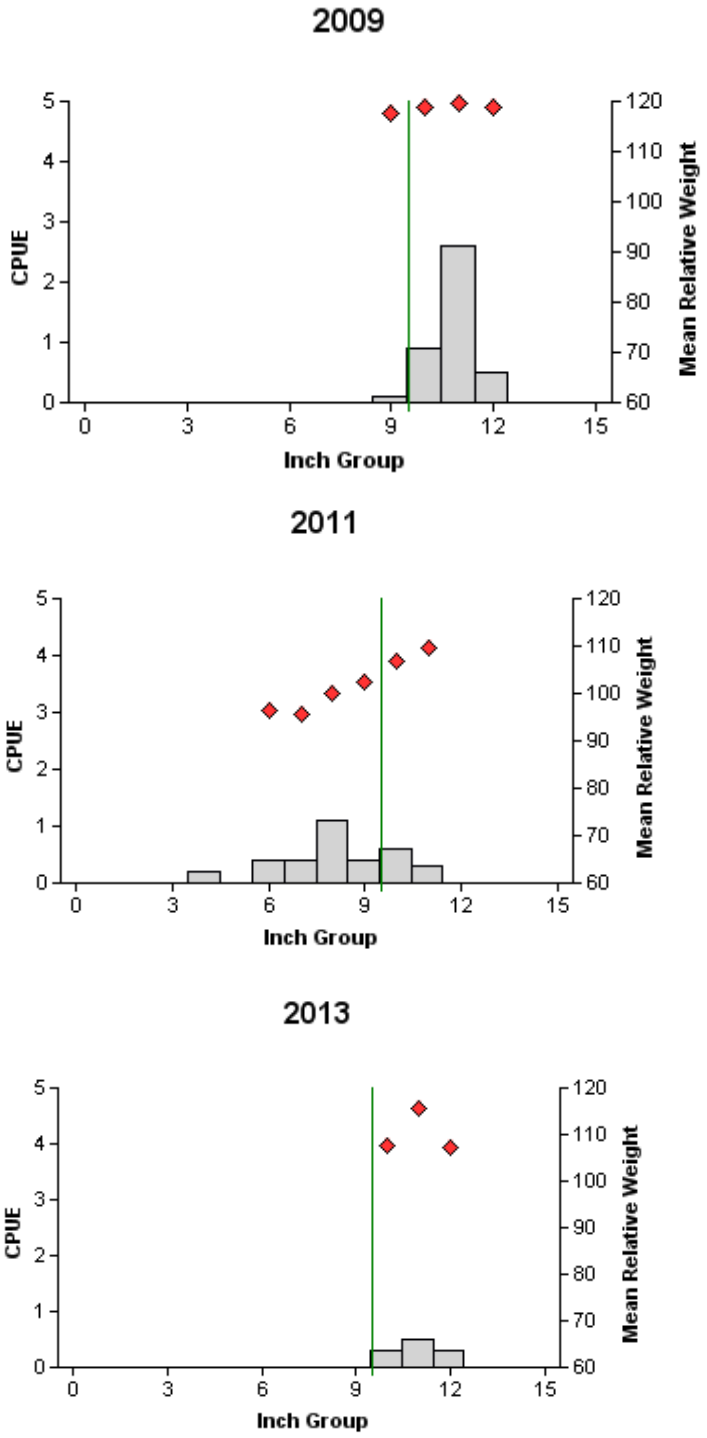


Figure 16. Number of White Crappie caught per net night (CPUE, bars), mean relative weights (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap net surveys, Kirby Reservoir, Texas, 2009, 2011, and 2013. The line represents the 10-inch minimum length limit.

White Crappie

Table 13. Creel survey statistics for White Crappie at Kirby Reservoir from September 2010 through May 2011 and September 2013 through May 2014. Total catch per hour is for anglers targeting White Crappie and total harvest is the estimated number of White Crappie harvested by all anglers. Relative standard errors (RSE) are in parentheses. RSE for directed effort and total harvest is the same as directed effort/acre and total harvest/acre, respectively.

Creel survey statistic	Year	
	2010/2011	2013/2014
Directed effort (h)	1,025.1 (37)	618.9 (51)
Directed effort/acre	1.4 (37)	0.8 (51)
Total catch per hour	2.0 (75)	0.8 (90)
Total harvest	381.4 (159)	331.8 (87)
Harvest/acre	0.5 (159)	0.4 (87)
Release/hour	1.7 (75)	0.0 (0)
Percent legal released	0.0	0.0

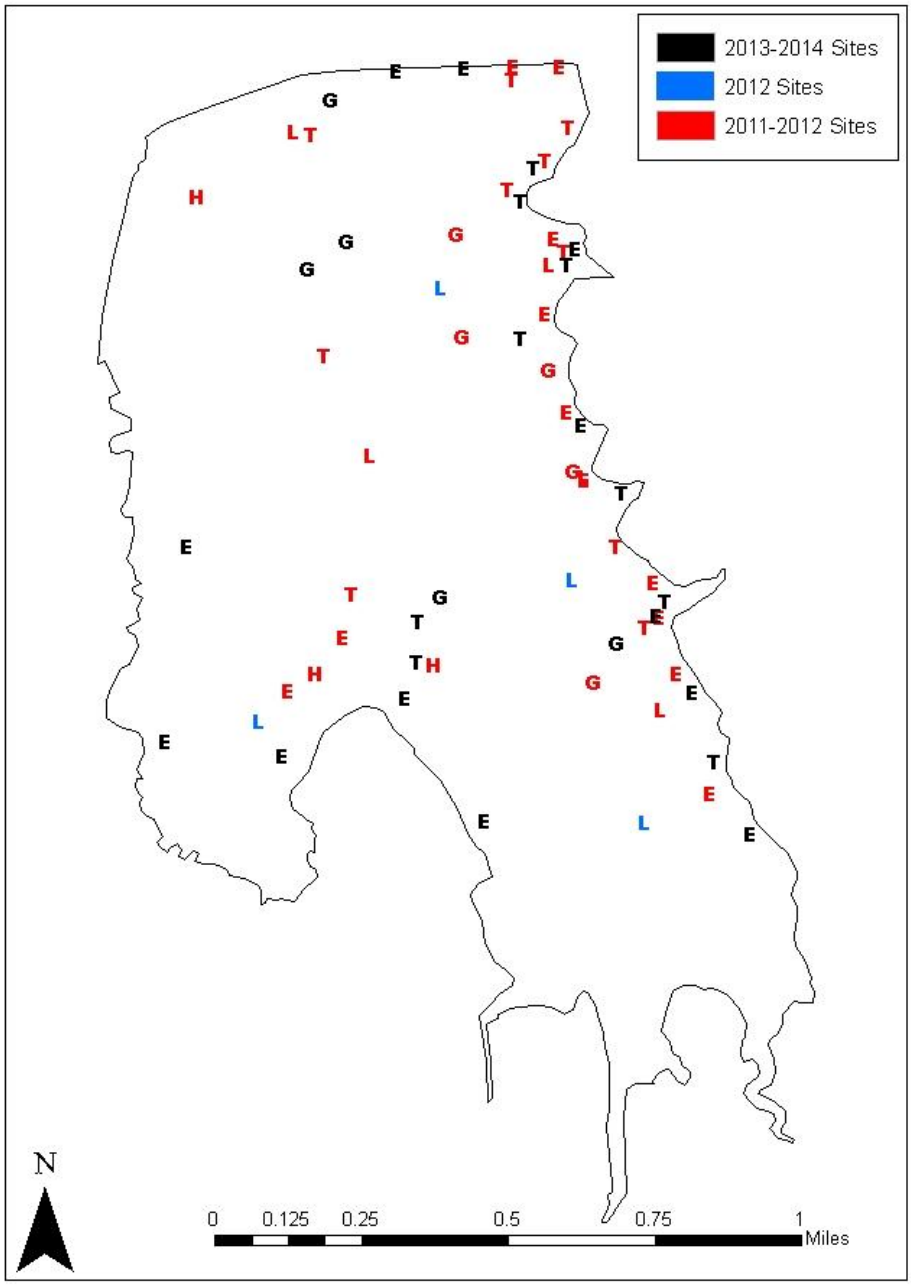
Figure 17 Length frequency of harvested White Crappie observed during creel surveys at Kirby Reservoir, Texas, September 2010-May2011 (black bars) and September 2013-May 2014 (gray bars), all anglers combined. N is the number of White Crappie measured during creel surveys, and TH is the total estimated harvest for the creel period.

Table 14. Proposed sampling schedule for Kirby Reservoir, Texas. Survey period is June through May. Gill netting, low-frequency electrofishing (LFE), and tandem hoop netting surveys are conducted in the spring. Electrofishing and trap netting surveys are conducted in the fall. Standard surveys are denoted by S and additional surveys are denoted by A.

Survey year	LFE	Electrofishing	Hoop Net	Trap net	Gill net	Habitat/ Vegetation	Access	Creel survey	Report
2014-2015	A	A[1]	A						
2015-2016		A[1]		A					
2016-2017	A		A						
2017-2018		S		S	S	S	S	S	S

[1]Bass-only electrofishing

APPENDIX A



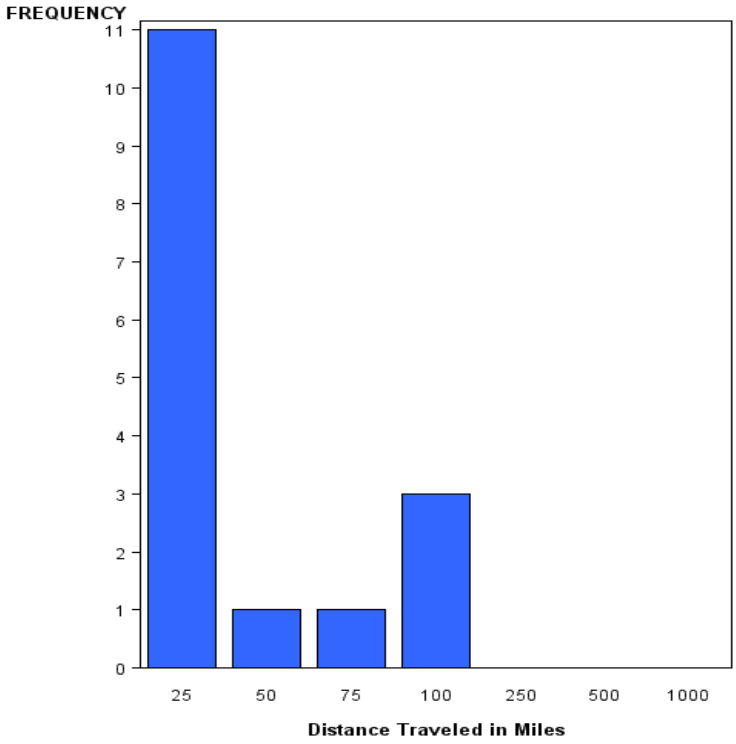
A map of electrofishing (E), trap netting (T), gill netting (G), low-frequency electrofishing (L), and tandem hoop netting (H) stations on Kirby Reservoir, Abilene, Texas, 2011-2014. Water levels fluctuated between 3-8 feet below conservation pool from 2011-2014.

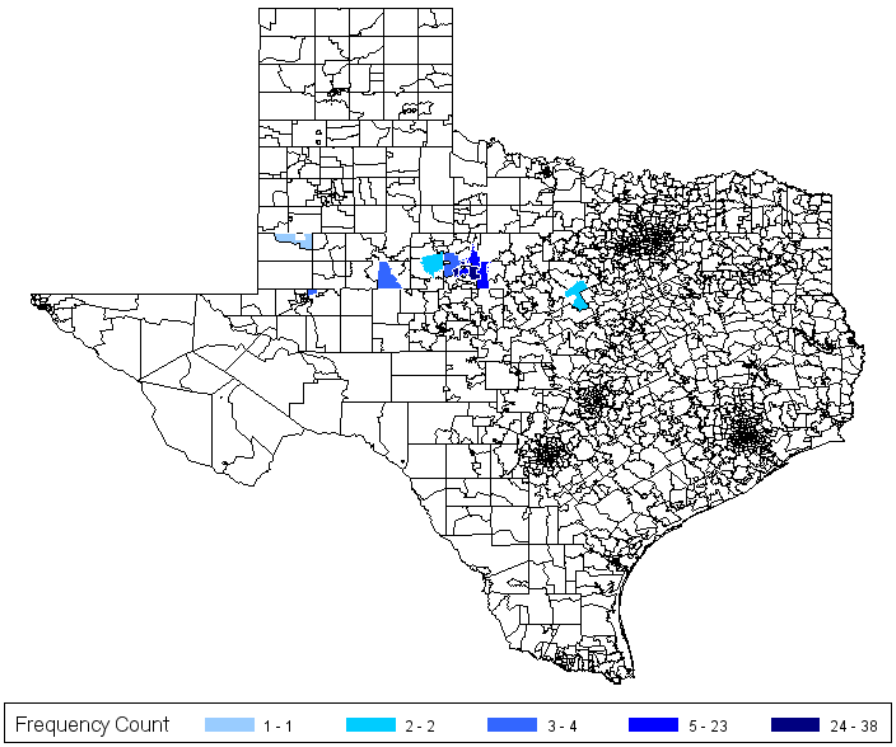
APPENDIX B

Number (N) and catch rate (CPUE) of all target species collected by gill nets, trap nets, and electrofishing from Kirby Reservoir, Texas, 2013-2014. Sampling effort was 5 net nights for gill netting, 10 net nights for trap netting, and 1 hour for electrofishing.

Species	Gill Netting		Trap Netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Gizzard Shad	360	72.0			506	506.0
Bluegill			764	76.4	684	684.0
Green Sunfish			7	0.7	129	129.0
Longear Sunfish			14	1.4	59	59.0
Orange-spotted Sunfish			106	10.6	24	24.0
Largemouth Bass					35	35.0
White Crappie	11	2.2	11	1.1		
Bullhead Minnow					3	3.0
Common Carp	19	3.8	20	2.0	2	
Blue Catfish	112	22.4				
Channel Catfish	104	20.8	2	0.2		
Flathead Catfish	6	1.2				
Inland Silverside					38	38.0
Saugeye	3	0.6	4	0.4	1	1.0

APPENDIX C





Top picture: Distance (miles) traveled by anglers during the 2013-2014 creel period. Bottom picture: a residency frequency map by ZIP code for anglers interviewed at Kirby Reservoir, 2013-2014.