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INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2014 Fisheries Management Survey Report

**Sam Rayburn Reservoir**

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## SURVEY AND MANAGEMENT SUMMARY

Fish populations in Sam Rayburn Reservoir were surveyed in 2014 using electrofishing and in 2015 using gill netting. Anglers were surveyed from June 2014 through May 2015 with a creel survey. Historical data are presented with the 2014-2015 data for comparison. This report summarizes the results of the surveys and contains a management plan for the reservoir.

- **Reservoir Description:** Sam Rayburn Reservoir is an 111,422-acre impoundment of the Angelina River in Angelina, Jasper, Nacogdoches, Sabine, San Augustine, and Tyler counties in southeast Texas. Water level fluctuations average 6 to 7 feet annually. Aquatic habitat consists of aquatic vegetation (primarily hydrilla and American lotus) and standing timber.
- **Management History:** The black bass fishery is the most popular at Sam Rayburn Reservoir (69 - 80% of annual angling effort, which includes over 400 bass tournaments per year). Approximately 10 - 15% of anglers target crappie and 5 - 10% target catfish. Angler interest in more restrictive length limits for Largemouth Bass and potential biological and economic impacts of bass tournaments prompted research from 2004 - 2009. Results indicated that the proportion of the Largemouth Bass population harvested was relatively low (9%) and more restrictive length limits would provide little benefit. In addition, impacts of tournaments on the Largemouth Bass population were low (only 5% of population retained by tournament anglers) but tournament expenditures were high (66% of total). Florida Largemouth Bass (FLMB) have been stocked annually since 1994 to increase abundance of large bass (>8 pounds). Giant salvinia was found in the reservoir in 2008, and is now present in a majority of creeks and embayments with coverage exceeding 4,000 acres in 2014.
- **Fish Community**
  - **Prey species:** Gizzard Shad, Threadfin Shad, and Bluegill were the most abundant prey species and provided ample forage for sport fish.
  - **Catfishes:** The relative abundance of Blue and Channel Catfish was stable compared to previous years. Angler catch rates averaged 1.7 fish/hour. Blue and Flathead Catfish provided trophy opportunities for anglers.
  - **Temperate basses:** Historically, White Bass abundance has been low. Gill net catch rates increased to 6.3 fish/nn in 2011, but declined to 1.2 fish/nn in 2015. Yellow Bass were present in moderate numbers. Few anglers target temperate bass.
  - **Black basses:** Few Spotted Bass were sampled with electrofishing. Largemouth Bass abundance increased over the last three survey years and was relatively high ( $\geq$  200 fish/hour). Size structure and fish condition were favorable. The black bass fishery was most popular (75% of anglers targeted bass) and angler catch rate was high (1.5/hour).
  - **Crappie:** White and Black Crappie were present in the reservoir. Angler catch (1.9/hour) reflected an abundant crappie population.
- **Management Strategies:** Stock FLMB annually to maintain and improve large fish abundance. Monitor Largemouth Bass population with biennial electrofishing and creel surveys every four years. Continue tournament monitoring program to more effectively monitor abundance of larger fish. Maintain information signs, conduct annual aerial vegetation surveys, and apply herbicides when appropriate to minimize impacts of giant salvinia. Monitor the crappie fishery via creel surveys. Monitor the catfish populations with biennial creel and gill net surveys. Publish monthly articles in the Lakecaster magazine highlighting TPWD activities.

## INTRODUCTION

This document is a summary of fisheries data collected from Sam Rayburn Reservoir from June 2014 through May 2015. 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 2014-2015 data for comparison.

### *Reservoir Description*

Sam Rayburn Reservoir is an impoundment of the Angelina River in Angelina, Jasper, Nacogdoches, Sabine, San Augustine, and Tyler counties in southeast Texas. The U.S. Army Corps of Engineers (USACE) constructed the reservoir in 1966 for flood control, generation of hydroelectric power, and for municipal, industrial, agricultural, and recreational uses. At conservation pool, Sam Rayburn Reservoir is 111,422 surface acres, has a shoreline length of 750 miles, and a mean depth of 20 feet. Water level fluctuations average 6 to 7 feet annually (Figure 1). The reservoir was eutrophic with a mean Trophic State Index chl-*a* of 48.1 (Texas Commission of Environmental Quality 2011). Habitat at time of sampling consisted of aquatic vegetation (primarily hydrilla and American lotus) and standing timber. Most of the land around the reservoir is used for timber production and agriculture. Other descriptive characteristics for Sam Rayburn Reservoir are in Table 1. The Texas Department of State Health Services (TDSHS) has a fish consumption advisory in effect due to dioxins and mercury. Species affected include Smallmouth Buffalo, gar, Blue and Flathead Catfish, and Spotted and Largemouth Bass (TDSHS 2013).

### *Angler Access*

Sam Rayburn Reservoir has 21 public boat ramps. Additional boat ramp characteristics are in Table 2. Shoreline access is limited to public boat ramp areas.

### *Management History*

**Previous management strategies and actions:** Management strategies and actions from the previous survey report (Driscoll and Ashe 2013) included:

1. Stock FLMB annually ( $\geq 500,000$  fingerlings) to maintain and improve the trophy Largemouth Bass population.  
**Action:** FLMB were stocked in 2013 and 2014.
2. Conduct biennial electrofishing and creel surveys to monitor status of Largemouth Bass population and examine growth every four years.  
**Action:** Electrofishing surveys were conducted in 2012 and 2014, and a creel survey was conducted in 2012/2013 and 2014/2015. Growth was examined in 2014.
3. Continue black bass tournament-monitoring program to increase information on relative abundance of large fish ( $> 20$  inches).  
**Action:** Since 2011, data from 146 tournaments were entered and are summarized in Appendix D.
5. Conduct annual vegetation surveys to monitor hydrilla abundance and locate giant salvinia coverage suitable for herbicide treatments.  
**Action:** Annual surveys were conducted in 2013 and 2014.
6. Conduct gill netting surveys every two years to monitor the status of catfish populations and examine growth every four years to ensure the 12-inch minimum length limit is appropriate.  
**Action:** Surveys were conducted in 2013 and 2015. Channel Catfish growth was examined in 2014.
7. Publish research related to November 2007 – October 2008 economic study in a peer-reviewed journal.

**Action:** A manuscript was published in the Proceedings of the 2013 Conference of the Southeastern Association of Fish and Wildlife Agencies.

8. Promote fish handling procedures that minimize tournament-related mortality, impacts on Largemouth Bass population, and conflicts with non-tournament anglers.  
**Action:** Discussions with numerous tournament organizers and presentations for several bass clubs promoted optimum fish care in livewells and at weigh-ins.
9. Deploy 72 plastic fish attractors as part of research exploring attractor shape and material type.  
**Action:** All 72 attractors were deployed and sampled monthly from June through October 2014 via SCUBA and underwater camera.
10. Minimize giant salvinia introductions and overall plant coverage.  
**Action:** The Aquatic Habitat Enhancement office has led giant salvinia monitoring and control efforts. Educational signs at access sites were maintained. In 2011 and 2012, annual aerial surveys and monthly access point surveys were conducted. Plant control methods included herbicide treatments (contract applicators funded by the USACE) and salvinia weevil releases.
11. Publish monthly popular articles in the Lakecaster, a newsletter distributed to 30 counties in Texas and Louisiana.  
**Action:** Articles highlighting TPWD activities at Sam Rayburn Reservoir have been published monthly since 2000.

**Harvest regulation history:** Historically, all sport fishes in Sam Rayburn Reservoir have been managed with statewide regulations (Table 3).

**Stocking history:** Since 1994, FLMB have been stocked annually (Table 4). From 1991 to 2000, Palmetto Bass were stocked annually but were discontinued due to low directed angler effort and harvest. The complete stocking history is in Table 4.

**Vegetation/habitat management history:** Historically, aquatic vegetation coverage at Sam Rayburn Reservoir (primarily hydrilla) has approached 20,000 surface acres and included over 25 plant species. Since 2000, hydrilla coverage has ranged from 3,584 (2010) to 14,695 surface acres (2000). During 2010 - 2012, hydrilla coverage declined due to low water levels, but increased during 2012 and 2013. Although hydrilla is an exotic, invasive species and is listed on the TPWD list of prohibitive plants, hydrilla has historically been considered beneficial habitat at Sam Rayburn Reservoir, as coverage has never been problematic or created access problems. Nuisance exotic species include common salvinia, giant salvinia, and water hyacinth. Common salvinia and water hyacinth have persisted in shallow backwaters of creeks and embayments and caused few problems. Giant salvinia was first documented in 2008, persists in a majority of the embayments and creeks, and reached a historic high coverage of 4,308 surface acres in 2014. The USACE funds herbicide treatments via a private applicator, and 1,530 and 1,619 acres were treated in 2013 and 2014, respectively.

**Water transfer:** Nearly 1,000,000 acre-feet of water rights are annually appropriated from Sam Rayburn Reservoir. The Lower Neches Valley Authority (LNVA) is the local sponsor of the reservoir and shared initial construction costs as well as annual reservoir operation expenses with the USACE. The LNVA has rights to 820,000 acre-feet annually to provide water via releases through the reservoir powerhouse. Municipal, agricultural, and industrial water is pumped from the lower Neches River and Pine Island Bayou and delivered to Jefferson, Chambers, and Liberty counties via a 400-mile canal system. The LNVA also contracts with Westvaco Corporation to provide their appropriated 50,000 acre-feet of water annually. The City of Lufkin has 56,000 acre-feet of water rights from Sam Rayburn Reservoir for future municipal and industrial use, but no infrastructure exists to pump water. The USACE has a contractual agreement with Southwest Power Corporation to produce hydropower throughout the year, independent of water rights.

## METHODS

Fishes were collected by electrofishing (1.3 hours at 16, 5-min stations during October) and gill netting (15 net nights at 15 stations during March). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing and for gill nets as the number of fish per net night (fish/nn). Surveys were conducted to achieve sampling objectives in accordance with an objective-based sampling (OBS) plan (Appendix E). All survey sites were randomly selected and surveys conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2014).

A roving creel survey (36 days; 9 days per quarter) was conducted from June 2014 through May 2015. 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 2014). Total angler catch of Largemouth Bass  $\geq$  4, 7, and 10 pounds was also estimated. Anglers were asked if released fish were within weight categories. Harvested fish lengths were converted to weights for classification (19 inches = 4 pounds; 23 inches = 7 pounds; 25 inches = 10 pounds). Harvested and released fish were combined to represent total catch for weight categories.

An aquatic vegetation survey was conducted in 2014 via airplane, and coverages were assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2014).

Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD), terminology modified by Guy et al. (2007)], and condition indices [relative weights ( $W_r$ )] 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. Ages for Largemouth Bass (Category 2 collection) and Channel Catfish (Category 3 collection) were determined using otoliths.

Genetic analysis of Largemouth Bass was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2014). Micro-satellite DNA analysis was used to determine genetic composition of individual fish.

Source for water level data was the USACE website (USACE 2015).

## RESULTS AND DISCUSSION

**Habitat:** A habitat survey conducted in 2002 indicated the littoral zone included primarily natural bank and standing timber (Driscoll and Parks 2003). Approximately 24,000 acres of standing timber were present. Abundant areas of torpedograss, buttonbush, and *Salix* spp. are inundated when water level is above 164 feet MSL. Prevalent aquatic vegetation providing beneficial fish habitat includes hydrilla and American lotus (Table 6). Low lake levels during 2011-2012 caused all historically prevalent species to decline in coverage, but hydrilla and American lotus abundance increased in 2013 and 2014. Typically during our September vegetation surveys, water levels are low enough to expose torpedograss on the banks, resulting in no recorded plant coverage. However, in 2014, water levels were abnormally high resulting in 1,872 surface acres of inundated torpedograss. Giant salvinia was first documented in 2008 and is present in the majority of embayments and creeks due to frequent introductions via boat trailers, plant growth, and wind dispersal. Since 2010, plant coverage has varied seasonally due to water level fluctuations, with maximum coverage during April/May and trace amounts during fall and winter. In 2014, relatively high water levels throughout the growing season resulted in significant expansion of giant salvinia (4,308 surface acres).

**Creel:** Similar to previous survey years, fishing effort at Sam Rayburn Reservoir was primarily directed at black basses (74.7%) (Table 7). Total fishing effort for all species increased to 441,709 hours, and directed expenditures were \$4,670,828 (Table 8). However, expenditures estimated from creel surveys from the last three survey years were much lower than total annual expenditures derived from economic research in 2008 (\$32,259,314) (Driscoll and Myers 2013).

**Prey species:** Primary prey species included Gizzard Shad, Threadfin Shad, and Bluegill. Gizzard Shad catch rates and IOV were relatively similar during the last three survey years (Figure 2). Historically, Threadfin Shad catch rates have been highly variable and likely not reflective of population status. The catch rate in 2012 was 459.0/h (Appendix A). During the last three survey years, Bluegill catch rates ranged from 171.0/h to 294.0/h (2014) (Figure 3). Prey species abundance was adequate, as relative weights of sport fish were within desired ranges. Few anglers targeted sunfish in 2014/2015 (Table 9).

**Catfish:** Historically, Blue Catfish recruitment has been relatively stable. During the last three survey years, catch rates ranged from 3.8 to 5.8/nn (Figure 4). In 2015, sampling objectives of the OBS plan (Appendix E) were met, as 54 stock-sized fish were collected with an RSE-S of 19. Although few Blue Catfish >25 inches were collected, anecdotal information indicates passive gear anglers frequently catch fish >30 pounds. Channel Catfish recruitment also appeared stable, and catch rates ranged from 4.7 to 8.3/nn (Figure 5). In 2015, gill net samples met the sampling objective of the OBS plan for the number of stock-sized fish collected (79) but the RSE-S (30) was higher than the target. Few fish > 15 inches were present, and growth rates were relatively slow. Fish reached the 12-inch minimum length limit at age-4 or age-5 (Table 10; Figure 6).

Directed rod and reel angler effort towards catfishes was similar from 2010 to 2015 (Table 11). Catfish anglers accounted for 9 to 10% of the total fishing effort during the last three survey years, and catch rates ranged from 1.7 to 3.0 fish/h. Total estimated harvest declined to 25,124 fish in 2014/2015; 100% of harvested fish were Channel Catfish (Figure 7).

**White Bass and Yellow Bass:** From 2004 to 2009, White Bass catch rates from gill net surveys were  $\leq 1.5$ /nn, indicating a low population density in the reservoir. In 2011, catch rates increased to 6.3/nn, reflecting an increase in recruitment (Figure 8). However, catch rates in 2013 and 2014 declined to 2.3 and 1.2/nn. Yellow Bass were present, and catch rates were 5.5, 8.8, and 1.7 fish/nn during the last three survey years. Few anglers target temperate bass in the reservoir (Table 12), but a fishery exists in the Angelina River above the reservoir during the spring spawning run.

**Black bass:** Historically, electrofishing catch rates of Spotted Bass have been low. Catch rates were <10.5/h from 2011 to 2014 (Figure 10). Few Spotted Bass >10 inches were collected. Estimated angler harvest was 8,041 fish in 2014/2015 (Figure 12).

Fall electrofishing catch rates of Largemouth Bass from 2011 to 2014 reflected relatively high recruitment rates (range = 177.0 - 282.5/h; Figure 11). In 2014, OBS objectives were met, as 202 stock-sized fish were collected with an RSE-S of 26. Population size structure varied across years (PSD range = 34 - 67; PSD-14 range = 18 - 33). Relative weights ranged from 82 to 108, indicating Largemouth Bass were in good condition. Growth rate was relatively high, as average age at 14 inches was 2.0 years.

The black bass fishery accounted for the majority of annual fishing effort (74.7%; Table 7). During the last three survey years, total angler directed effort (range = 257,825 - 329,368 h) and proportion tournament-related (range = 42 - 59%) was relatively stable (Table 13). Angler catch rates remained high and stable (range = 1.2 - 1.5 fish/h). In 2014/2015, total angler catch and non-tournament harvest were higher than the previous two survey years (356,748 and 27,847 fish, respectively). The proportion of legal fish released (non-tournament) ranged from 55 to 74%. The majority of harvested Largemouth Bass were 14 to 16 inches in length and 58% were retained during tournaments (Figure 13). The proportion of total

catch for all four weight categories was similar during the last three survey years. Fish from 4 to 6.9 pounds comprised 2.1 to 3.4% of catch, and 7 to 9.9 pound fish comprised 0.3 to 0.4%% of the catch each year.

Although the reservoir has been stocked with FLMB annually since 1994 (Table 4), reservoir-wide FLMB influence has remained low and relatively stable. Since 2007, FLMB alleles ranged from 43 to 53% and no pure FLMB were collected (Table 14).

A tournament-monitoring program was implemented in June 2003 to increase information on fish  $\geq 14$  inches and provide greater insight regarding large ( $> 20$  inches) fish abundance (Appendix D). Overall, most tournament variables were favorable and similar during 2011 - 2015. The percent of anglers catching 5-fish limits was  $> 40\%$  for the majority of years, indicating high and stable numbers of fish  $\geq 14$  inches. Average big bass weight in team tournaments was  $> 8$  pounds for all years, and average weight to win events ranged from 23.6 to 26.9 pounds, reflecting relatively high and stable numbers of large fish. Similarly, results of the 3-day Sealy Outdoors McDonald's Big Bass Splash tournaments also suggested high and stable numbers of large bass. In 2015, average weights of the top 10 fish/hour (6.8 pounds;  $N = 210$ ), top 10 fish/day (8.3 pounds,  $N = 30$ ), and overall top 10 (9.1 pounds,  $N = 10$ ) were the highest observed during the last five years.

**Crappie:** Creel data reflected an abundant crappie population. Total fishing effort has remained relatively stable during the last three survey years (range = 10.0 – 11.6%) (Table 7). In 2014/2015, directed effort and harvest increased to 46,659 h and 74,292 fish, respectively, and angler catch was highest over the last three survey years (3.7 fish/h) (Table 15).

## Fisheries management plan for Sam Rayburn Reservoir, Texas

Prepared – July 2015

**ISSUE 1:** Creel surveys indicate most sportfishing effort at Sam Rayburn Reservoir is for Largemouth Bass. The economic contribution of the Largemouth Bass fishery to the local area is high, as the total economic value of the recreational fishery was estimated at \$46.7 million. The reservoir also hosts over 400 bass tournaments per year with an economic value of \$31.1 million (Driscoll and Myers 2013). The reservoir also has a demonstrated potential for producing trophy fish.

### MANAGEMENT STRATEGIES

1. Continue annual stocking of FLMB (500,000 fingerlings/year) to maintain and improve the trophy Largemouth Bass population.
2. Continue the tournament monitoring program to collect information on fish  $\geq$  14 inches.
3. Conduct biennial electrofishing and creel surveys every four years to monitor status of Largemouth Bass population.
4. Examine Largemouth Bass growth every four years.
5. Continue to promote fish handling procedures that minimize tournament-related mortality to minimize impacts on Largemouth Bass population and reduce conflicts with non-tournament anglers.

**ISSUE 2:** In 2008, giant salvinia was documented in Sam Rayburn Reservoir. The plant is now present in a majority of embayments and creeks due to frequent introductions via boat trailers, plant growth, and wind dispersion. Relatively high water levels in 2014 resulted in an increase to 4,308 surface acres of giant salvinia, up from 200 acres in 2013.

### MANAGEMENT STRATEGIES

1. Support USACE efforts relative to herbicide treatments via private applicators to control plant coverage.
2. Support Aquatic Habitat Enhancement efforts with salvinia weevil research.
3. Maintain all educational signs at access points to minimize potential transport to other waters.
4. Conduct an annual reservoir-wide aerial survey and post-treatment surveys, when applicable, to monitor trends in giant salvinia coverage.

**ISSUE 3:** Historically, the crappie fishery at Sam Rayburn Reservoir was productive and popular. Directed effort and harvest has exceeded 3.0 h/acre and 400,000 fish, respectively. Since 2008, directed effort was  $<0.6$  h/acre and total harvest was  $< 100,000$  fish.

### MANAGEMENT STRATEGIES

1. Conduct creel surveys every four years to monitor the crappie fishery, as trap netting at Sam Rayburn Reservoir is not effective.
2. Complete sampling for research exploring fish attractor shape and material type in 2015. Provide attractor locations to public via maps and publish GPS coordinates on the TPWD web site and in local media to increase angler catch of crappie.

**ISSUE 4:** A considerable catfish fishery also exists. Although the rod and reel catfish fishery is negligible, the majority of the actual directed catfish effort is due to passive gear anglers.

### MANAGEMENT STRATEGY

1. Conduct gill netting surveys every two years to monitor catfish populations and examine growth every four years.

**ISSUE 5:** Area constituents are interested in TPWD activities and management actions related to Sam Rayburn Reservoir and need to be informed.

**MANAGEMENT STRATEGY**

1. Continue to publish monthly popular articles on TPWD activities in the Lakecaster, a newsletter distributed to approximately 30 counties in Texas and Louisiana.

**ISSUE 6:** The USACE is revising the Sam Rayburn Reservoir Master Plan. The Master Plan guides the management of the government lands bordering the reservoir, and affects future management of natural resources and recreational opportunities. The target date for completion is 2016.

**MANAGEMENT STRATEGY**

1. Assist the USACE with Master Plan revision and provide input at appropriate opportunities.

**ISSUE 7:** Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels 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 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 and literature so they can educate their customers.
3. Educate the public about invasive species through the use of media and the internet.
4. Discuss invasive species when presenting to constituent and user groups.
5. Document existing and future inter-basin water transfers to facilitate potential invasive species responses.

**Objective-Based Sampling Plan for Sam Rayburn Reservoir**  
**2015 - 2019**

Sport fish, forage fish, and other important fishes

Sport fishes in Sam Rayburn Reservoir include Largemouth Bass, Spotted Bass, crappies, Channel Catfish, Blue Catfish, Flathead Catfish, and White Bass. Important forage species include Bluegill, Gizzard Shad, and Threadfin Shad.

Negligible fisheries

Historically, White Bass catch rates from gill net surveys were  $\leq 1.5/n$ , indicating a low population density in the reservoir. In 2011, catch rates increased to  $6.3/n$ , reflecting an increase in recruitment, but catch rates in 2013 declined to  $2.3/n$ . Since 2008, creel surveys have not documented directed effort towards

temperate basses. Although no future directed sampling is planned, White Bass catch will be recorded from gill net surveys directed at catfishes (see below).

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

**Largemouth Bass:** Largemouth Bass are the most popular sport fish in Sam Rayburn Reservoir, accounting for approximately 75% of the annual angling effort. The reservoir supports a high-quality, nationally recognized fishery with substantial economic contributions. The annual economic value of the recreational fishery was estimated at \$47.1 million. The reservoir also hosts over 400 bass tournaments per year with an economic value of \$32.0 million. Largemouth Bass have always been managed with the statewide 14-in MLL regulation. For nearly 20 years, trend data on CPUE, size structure, and body condition were collected annually with fall electrofishing. Since 2013, fall electrofishing has been conducted biennially. The population is abundant, recruitment rates have been high and steady, and size structure has been desirable and stable. Continuation of biennial trend data with night electrofishing in the fall of 2016 and 2018 will allow for determination of any large-scale changes in the Largemouth Bass population that may spur further investigation. A minimum of 16 randomly selected 5-min electrofishing sites will be sampled, but sampling will continue at random sites until 50 stock-size fish are collected and the RSE of CPUE-S is  $\leq 25$  (the anticipated effort to meet both sampling objectives is 12-20 stations with 80% confidence). If failure to achieve either objective has occurred after one night of sampling and objectives can be attained with 6-12 additional random stations, another night of effort will be expended.

In addition, average age of Largemouth Bass between 330 and 381 mm (Category 2; N = 13) will be estimated in 2018, and every four years thereafter. If growth problems are detected from this cursory estimate, mean length-at-age will be estimated from a random population sample of 400 fish > 150 mm, subsampled at 10 fish per 10 mm strata (Category 4).

**Crappies:** The crappie fishery is the second most popular at Sam Rayburn Reservoir, accounting for 10 – 15% of the annual angling effort. Historically, standard, tandem, and offshore trap netting has resulted in low and variable catch rates. For over 10 years, creel surveys have been used to monitor the crappie fishery and make inferences about the population. Although directed effort and harvest have varied over the years, angler catch rates have remained relatively high since 2004 (range = 1.5 – 3.0 fish/h), reflecting an abundant crappie population. We will conduct a creel survey in 2018/2019 and every four years thereafter (4 quarters, 5 weekend and 4 week days/quarter) to detect any large-scale changes in the crappie population that may warrant additional sampling.

**Catfishes:** The rod and reel catfish fishery accounts for approximately 10% of the annual angling effort. Anecdotal information indicates that the passive gear fishery is more popular and accounts for frequent catches of Blue and Flathead Catfish > 30 pounds. Catfish populations have always been managed with statewide regulations.

Biennial gill netting data has indicated relatively stable Channel and Blue Catfish recruitment and abundance, and should provide adequate population-level insight relative to large-scale changes that would dictate further investigation. A minimum of 15 randomly selected gill netting sites will be sampled in 2017 and 2019, but sampling will continue at random sites until 50 stock-size fish are collected and the RSE of CPUE-S is  $\leq 25$  (the anticipated effort to meet both sampling objectives is 12-18 stations with 80% confidence). Additional sampling will occur (5-10 gill netting sites) if objectives are not attained. Average age of 280 – 330 mm Channel and Blue Catfish (N = 13) will be estimated in 2019, and every four years

thereafter. Similar to that of Largemouth Bass, mean length-at-age data (N = 400 fish) will be collected if growth problems are detected.

Currently, little is known about the Flathead Catfish population at Sam Rayburn Reservoir. During the summer of 2014, a low-frequency electrofishing survey was conducted to establish a baseline relative abundance estimate for trend comparisons over time. However, no Flathead Catfish were collected from 10 random electrofishing stations and no additional surveys are planned.

**Prey species:** Bluegill, Gizzard Shad, and Threadfin Shad are the primary forage at Sam Rayburn Reservoir. Like Largemouth Bass, trend data on CPUE and size structure were collected annually for 20 years with fall electrofishing. Since 2013, fall electrofishing has been conducted biennially. Continuation of biennial sampling, as per Largemouth Bass above, will allow for monitoring of large-scale changes in Bluegill and Gizzard Shad relative abundance and size structure. Effort based on achieving sampling objectives for Largemouth Bass will result in sufficient numbers of Bluegill for size structure (PSD; 50 fish minimum) and relative abundance ( $RSE \leq 25$  of CPUE-Total) and Gizzard Shad size structure (IOV; 50 fish minimum). At the effort needed to achieve sampling objectives for Largemouth Bass, the expected RSE for CPUE-T is 33 for Gizzard Shad and 60 for Threadfin Shad. No additional effort will be expended to achieve an RSE25 for Gizzard or Threadfin Shad, but Largemouth Bass body condition (fish  $\geq 8$ " TL) will be used to provide additional information on forage abundance and vulnerability.

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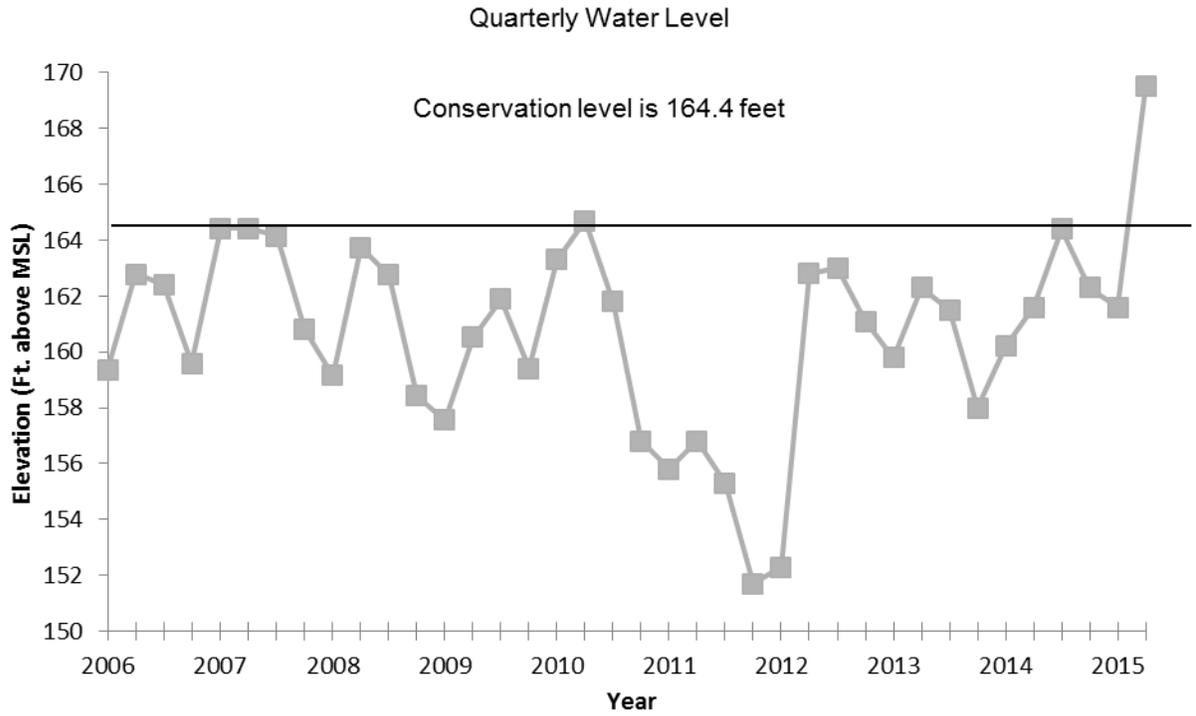


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Sam Rayburn Reservoir, Texas.

Table 1. Characteristics of Sam Rayburn Reservoir, Texas.

Characteristic	Description
Year constructed	1966
Controlling authority	U.S. Army Corps of Engineers
Counties	Angelina, Jasper, Nacogdoches, Sabine, San Augustine, and Tyler
Reservoir type	Mainstream
Shoreline Development Index (SDI)	16.25
Conductivity	120 uS/cm

Table 2. Boat ramp characteristics for Sam Rayburn Reservoir, Texas. Ramps rated in adequate condition would benefit from road and parking lot improvements.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of ramp (ft)	Condition
South Public	31.06760; -94.06395	Y	90	154	Excellent
Twin Dikes	31.07524; -94.06818	Y	220	154	Excellent
Sandy Creek	31.09588; -94.20363	Y	25	155	Adequate
Caney Creek	31.13540; -94.25561	Y	72	155	Excellent
Cassels-Boykin	31.21247; -94.35019	Y	144	153	Excellent
Monterey Park	31.21262; -94.31095	Y	50	154	Excellent
Hanks Creek	31.26812; -94.39908	Y	60	152	Excellent
Ewing Park	31.37201; -94.48117	Y	20	159	Adequate
Marion's Ferry	31.39718; -94.52679	Y	20	154	Excellent
Kingtown	31.40910; -94.51677	Y	15	154	Adequate
Etoile	31.37700; -94.46490	Y	45	158	Adequate
Shirley Creek	31.30942; -94.37302	Y	30	153	Adequate
Ralph McAllister	31.37532; -94.33169	Y	24	161	Excellent
Townsend	31.34788; -94.31304	Y	20	157	Excellent
Jackson Hill	31.27023; -94.32260	Y	40	154	Excellent
Harvey Creek	31.21371; -94.32260	Y	25	154	Adequate
Five Fingers	31.12935; -94.11796	Y	20	150	Adequate
Rayburn Park	31.10501; -94.11017	Y	75	152	Excellent
Powell Park	31.13034; -94.08379	Y	36	151	Excellent
Highway 83	31.26591; -94.11160	Y	15	161	Adequate
San Augustine Park	31.20293; -94.08047	Y	30	152	Excellent
Mill Creek	31.14974; -94.00761	Y	45	156	Excellent

Table 3. Harvest regulations for Sam Rayburn Reservoir, Texas.

Species	Bag limit	Length limit
Catfish: Channel and Blue Catfish, their hybrids and subspecies	25 (in any combination)	12-inch minimum
Catfish, Flathead	5	18-inch minimum
Bass, White	25	10-inch minimum
Bass, Largemouth	5 <sup>a</sup>	14-inch minimum
Bass, Spotted	5 <sup>a</sup>	None
Crappie: White and Black Crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum

<sup>a</sup>Daily bag for Largemouth and Spotted Bass = 5 fish in any combination.

Table 4. Stocking history of Sam Rayburn Reservoir, Texas. FGL = fingerling; AFGL = advanced fingerling; ADL = adult; UNK = unknown.

<b>Species</b>	<b>Year</b>	<b>Number</b>	<b>Size</b>
Blue Catfish	1966	105,100	UNK
	1987	199,870	FGL
	Total	304,970	
Channel Catfish	1966	74,600	AFGL
	1966	6,100	FGL
	1973	110,000	AFGL
	Total	190,700	
Florida Largemouth Bass	1975	25,000	FRY
	1976	60,000	FRY
	1977	60,000	FRY
	1978	165,000	FGL
	1978	47,000	FRY
	1980	361,840	FGL
	1983	1,200	AFGL
	1983	37,700	FGL
	1987	249,660	FRY
	1990	1,000	AFGL
	1994	159,360	FGL
	1994	782,966	FRY
	1995	232,392	FGL
	1996	948,017	FGL
	1996	276,051	FRY
	1997	317,729	FRY
	1998	229,200	FGL
	1999	1,329,160	FGL
	2000	510,735	FGL
	2001	500,783	FGL
	2001	273,407	FRY
	2002	42	ADL
	2002	1,066,781	FGL
2003	1,033,318	FGL	
2003	291,008	FRY	
2004	523,648	FGL	
2005	1,026,943	FGL	
2006	499,858	FGL	
2007	500,033	FGL	
2008	501,382	FGL	
2009	1,284,341	FGL	
2009	377,936	FRY	
2010	500,100	FGL	
2011	952,285	FGL	

<b>Species</b>	<b>Year</b>	<b>Number</b>	<b>Size</b>
	2012	1,466,043	FGL
	2013	522,120	FGL
	2014	500,331	FGL
	2014	96,250	FRY
	2015	501,113	FGL
	Total	18,211,732	
Largemouth Bass	1965	364,000	FGL
	1966	97,000	FGL
	1988	21	ADL
	Total	461,021	
Longear Sunfish	1965	40,000	
	Total	40,000	
Paddlefish	1990	3,581	
	1991	16,741	
	1992	43,584	
	1995	46,529	
	Total	110,435	
Palmetto Bass	1979	571,400	FRY
	1981	447,528	FRY
	1982	1,000,000	FRY
	1985	1,000,000	FRY
	1987	1,500,000	FRY
	1988	1,100,000	FRY
	1989	279,748	FGL
	1989	1,130,036	FRY
	1991	1,111,683	FRY
	1992	1,347,961	FRY
	1993	1,140,000	FRY
	1994	1,175,000	FRY
	1995	943,903	FGL
	1995	1,469,882	FRY
	1996	116,000	FGL
	1997	186,577	FGL
	1998	406,229	FGL
	1998	168,428	FRY
	1999	289,974	FGL
	2000	290,990	FGL
	Total	15,675,339	
Redear Sunfish	1966	1,400	
	1967	530,000	

<b>Species</b>	<b>Year</b>	<b>Number</b>	<b>Size</b>
	Total	531,400	
ShareLunker Largemouth Bass	2008	2,604	FGL
	Total	2,604	
Striped Bass	1976	115,108	UNK
	1977	843,161	UNK
	1978	182,800	UNK
	1979	215,490	UNK
	1983	1,000,000	UNK
	Total	2,356,559	
Walleye	1973	426,000	FRY
	1974	349,400	FRY
	1975	378,376	FRY
	1976	220,000	FRY
	Total	1,373,776	
Warmouth	1965	80,000	
	1966	800	
	Total	80,800	
White Crappie	1965	7,000	FGL
	Total	7,000	

Table 5. Aerial survey of prevalent aquatic vegetation, Sam Rayburn Reservoir, Texas, September 2009 - 2014. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Species	2009	2010	2011	2012	2013	2014
American lotus	1,959 (2)	1,970 (2)	99 (< 1)	997 (1)	793 (1)	2,112 (2)
Common salvinia	10 (<1)	trace	trace	trace	trace	trace
Giant salvinia	trace	trace	trace	trace	200 (<1)	4,308 (4)
Hydrilla	7,193 (6)	3,584 (3)	4,194 (4)	4,591 (4)	9,167 (8)	11,945 (11)
Pondweed	2,394 (2)	trace	trace	trace	trace	trace
Torpedograss	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1,872 (2)
Water hyacinth	trace	0 (0)	0 (0)	0 (0)	0 (0)	trace

Table 6. Percent directed angler effort by species for Sam Rayburn Reservoir, Texas, 2010 – 2015. Survey periods were from 1 June through 31 May for 2010/2011 and 2014/2015, and 1 June through 28 February for 2012/2013.

Species	Year		
	2010/2011	2012/2013	2014/2015
Catfishes	9.8	9.4	9.6
Sunfishes			0.2
Black basses	76.4	78.4	74.7
Temperate basses			1.0
Crappies	11.6	10.0	10.6
Anything	2.3	2.1	3.9

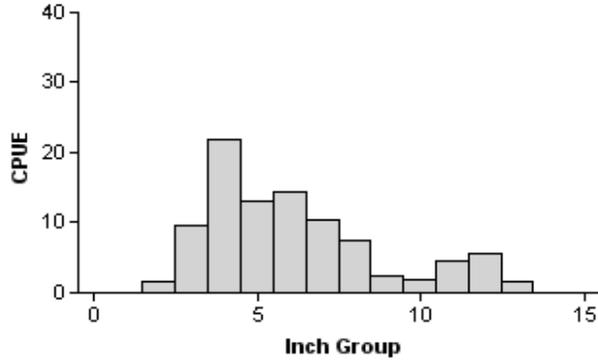
Table 7. Total fishing effort (h) for all species and total directed expenditures at Sam Rayburn Reservoir, Texas, 2010- 2015. Survey periods were from 1 June through 31 May for 2010/2011 and 2014/2015, and 1 June through 28 February for 2012/2013. Relative standard error is in parentheses.

Creel statistic	Year		
	2010/2011	2012/2013	2014/2015
Total fishing effort	350,874 (17)	328,874 (22)	441,709 (18)
Total directed expenditures	\$4,295,993 (24)	\$3,751,136 (26)	\$4,670,828 (29)

## Gizzard Shad

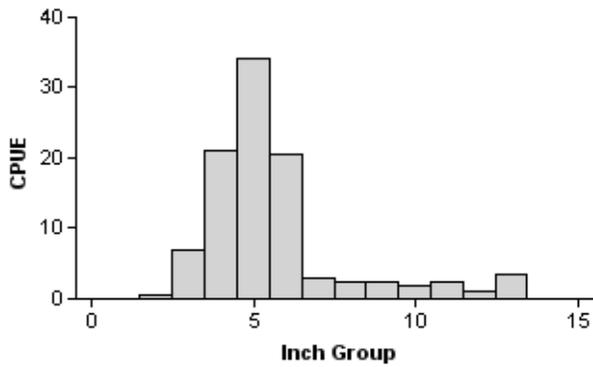
2011

Effort = 2.0  
 Total CPUE = 94.5 (34; 189)  
 IOV = 75 (10.5)



2012

Effort = 2.0  
 Total CPUE = 100.0 (33; 200)  
 IOV = 86 (4.6)



2014

Effort = 1.3  
 Total CPUE = 79.5 (38; 106)  
 IOV = 75 (13.6)

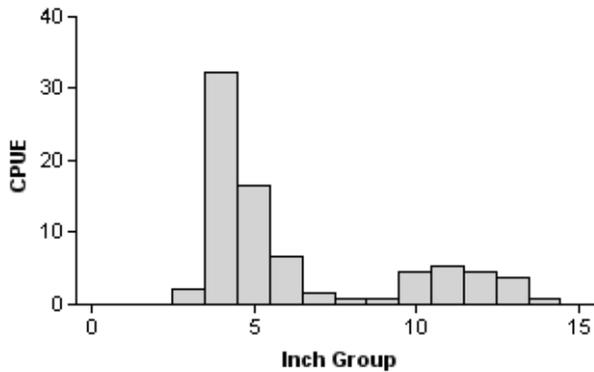
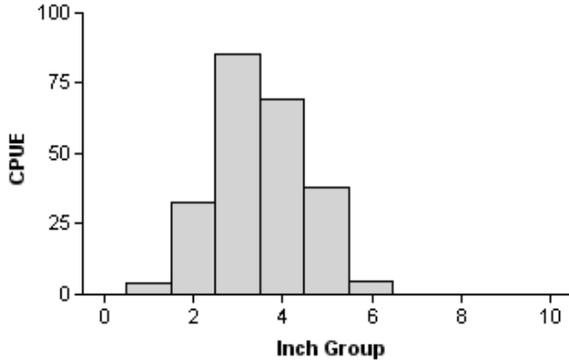


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Sam Rayburn Reservoir, Texas, 2011, 2012, and 2014.

# Bluegill

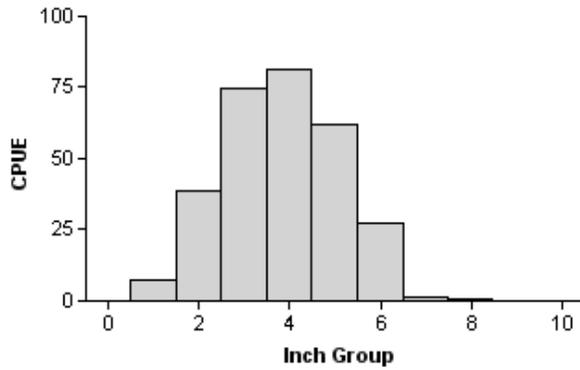
2011

Effort = 2.0  
 Total CPUE = 234.0 (14; 468)  
 PSD = 2 (0.8)



2012

Effort = 2.0  
 Total CPUE = 294.0 (13; 588)  
 PSD = 12 (2.1)



2014

Effort = 1.3  
 Total CPUE = 171.0 (26; 228)  
 PSD = 8 (2.5)

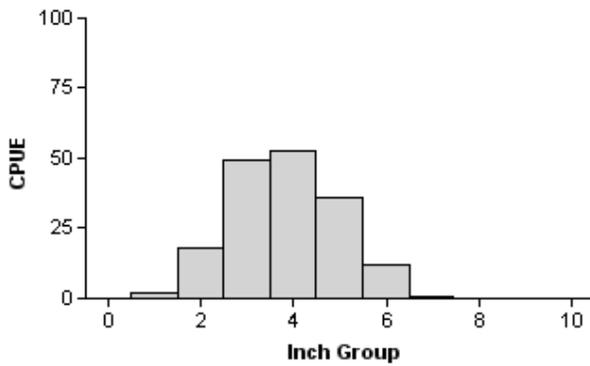


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Sam Rayburn Reservoir, Texas, 2011, 2012, and 2014.

## Sunfishes

Table 8. Creel survey statistics for sunfishes at Sam Rayburn Reservoir, Texas, from June 2010 through May 2011, June 2012 through February 2013, and June 2014 through May 2015. Total catch per hour is for anglers targeting sunfishes and total harvest is the estimated number of sunfishes harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2010/2011	2012/2013	2014/2015
Directed effort (h)			672 (121)
Directed effort/acre			0.01 (121)
Total catch per hour			1.3 (.)
Total harvest	2,103 (356)	3,208 (186)	0
Harvest/acre	0.02 (356)	0.02 (186)	0
Percent legal released	3	2	100

## Blue Catfish

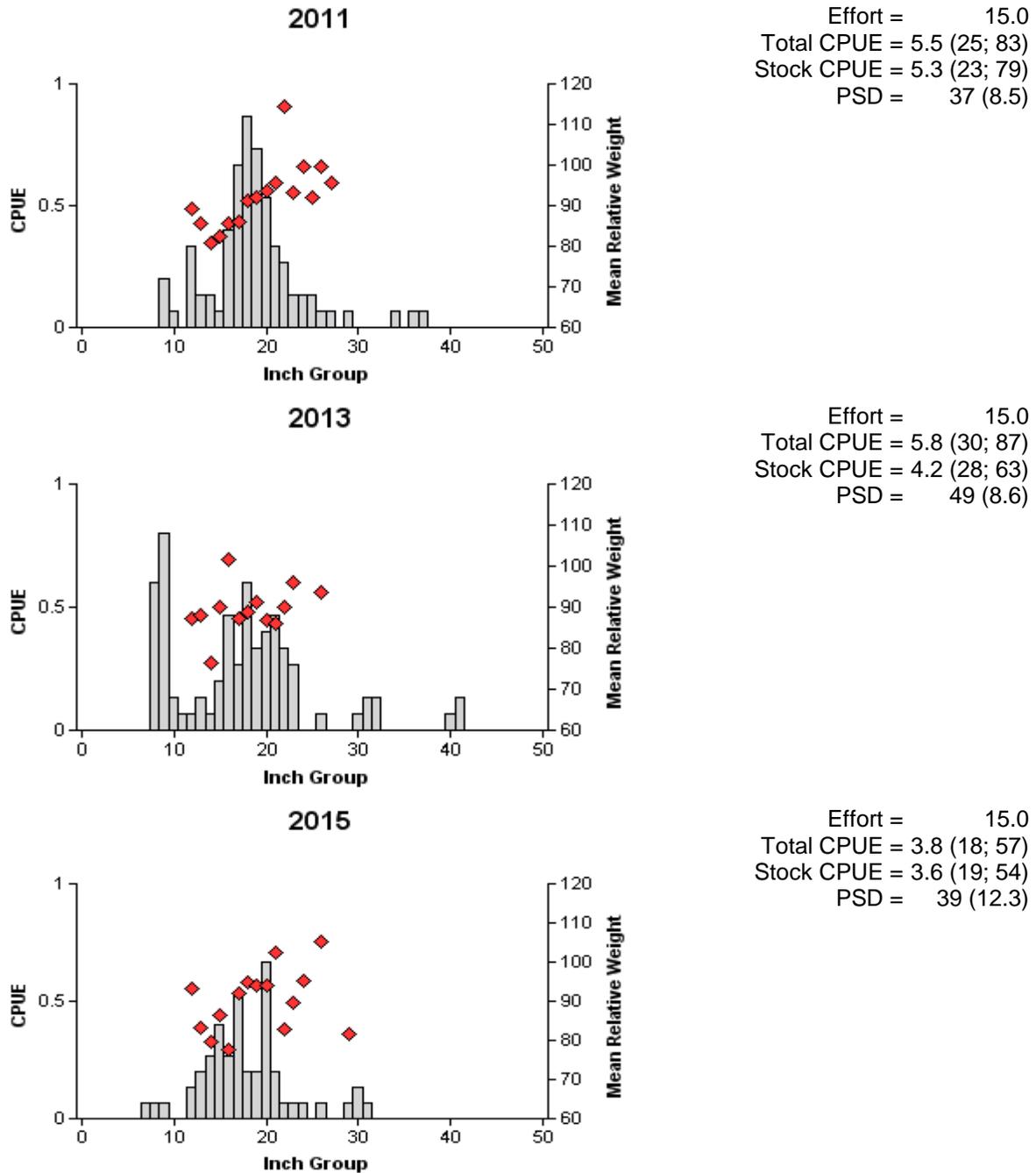


Figure 4. Number of Blue Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Sam Rayburn Reservoir, Texas, 2011, 2013, and 2015.

## Channel Catfish

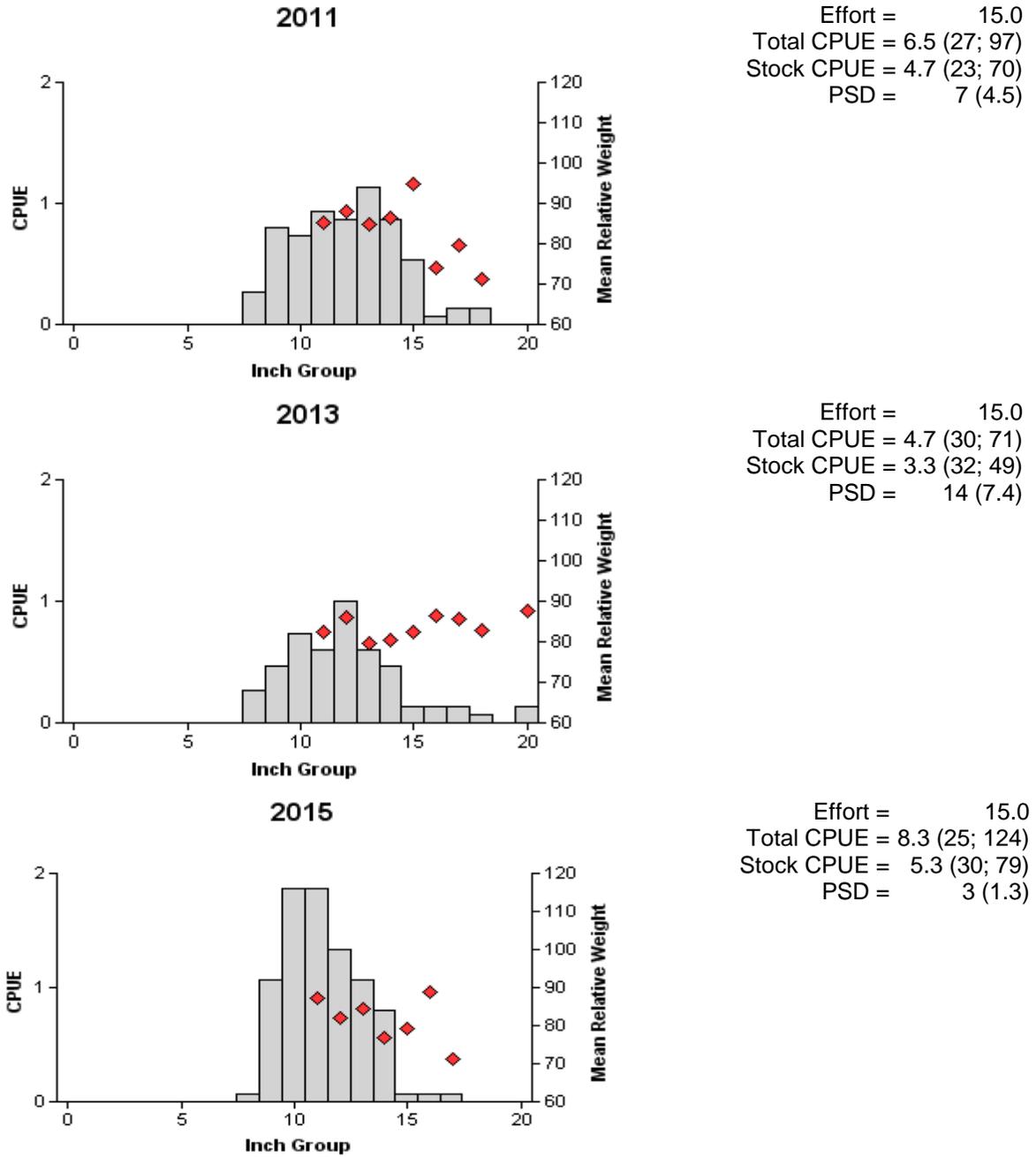


Figure 5. Number of Channel Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Sam Rayburn Reservoir, Texas, 2011, 2013, and 2015.

Table 9. Average length at capture for Channel Catfish (sexes combined) ages 3 – 8 collected from gill nets, Sam Rayburn Reservoir, Texas, 2015. Lengths are followed by the relative standard error and sample size in parentheses (RSE; N).

Sampling date	Length (inches) at capture for age					
	3	4	5	6	7	8
3/02/2015	9.8 (38; 19)	11.7 (35; 23)	12.8 (71; 11)	14.1 (50; 8)	14.4 (90; 8)	16.3 (1)

## Catfishes

Table 10. Creel survey statistics for catfishes at Sam Rayburn Reservoir, Texas, from June 2010 through May 2011, June 2012 through February 2013, and June 2014 through May 2015. Total catch per hour is for anglers targeting catfishes and total harvest is the estimated number of catfishes harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2010/2011	2012/2013	2014/2015
Directed effort (h)	34,191 (25)	30,926 (37)	42,431 (22)
Directed effort/acre	0.31 (25)	0.28 (37)	0.38 (22)
Total catch per hour	2.81 (27)	2.96 (20)	1.65 (39)
Total harvest	54,250 (38)	35,844 (29)	25,124 (52)
Harvest/acre	0.47 (38)	0.32 (29)	0.23 (52)
Percent legal released	1	1	1

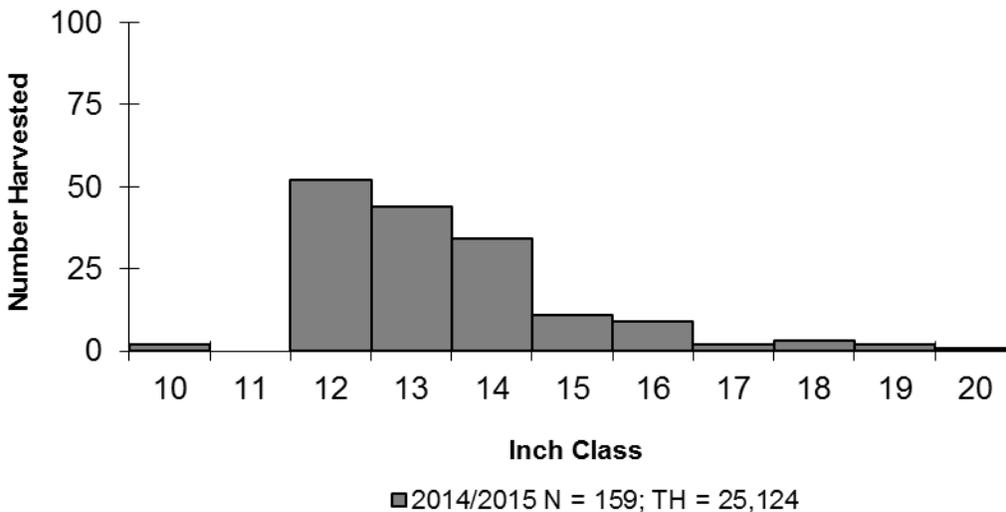


Figure 6. Length frequency of harvested Channel Catfish observed during creel surveys at Sam Rayburn Reservoir, Texas, June 2014 through May 2015, all anglers combined. N is the number of harvested Channel Catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

# White Bass

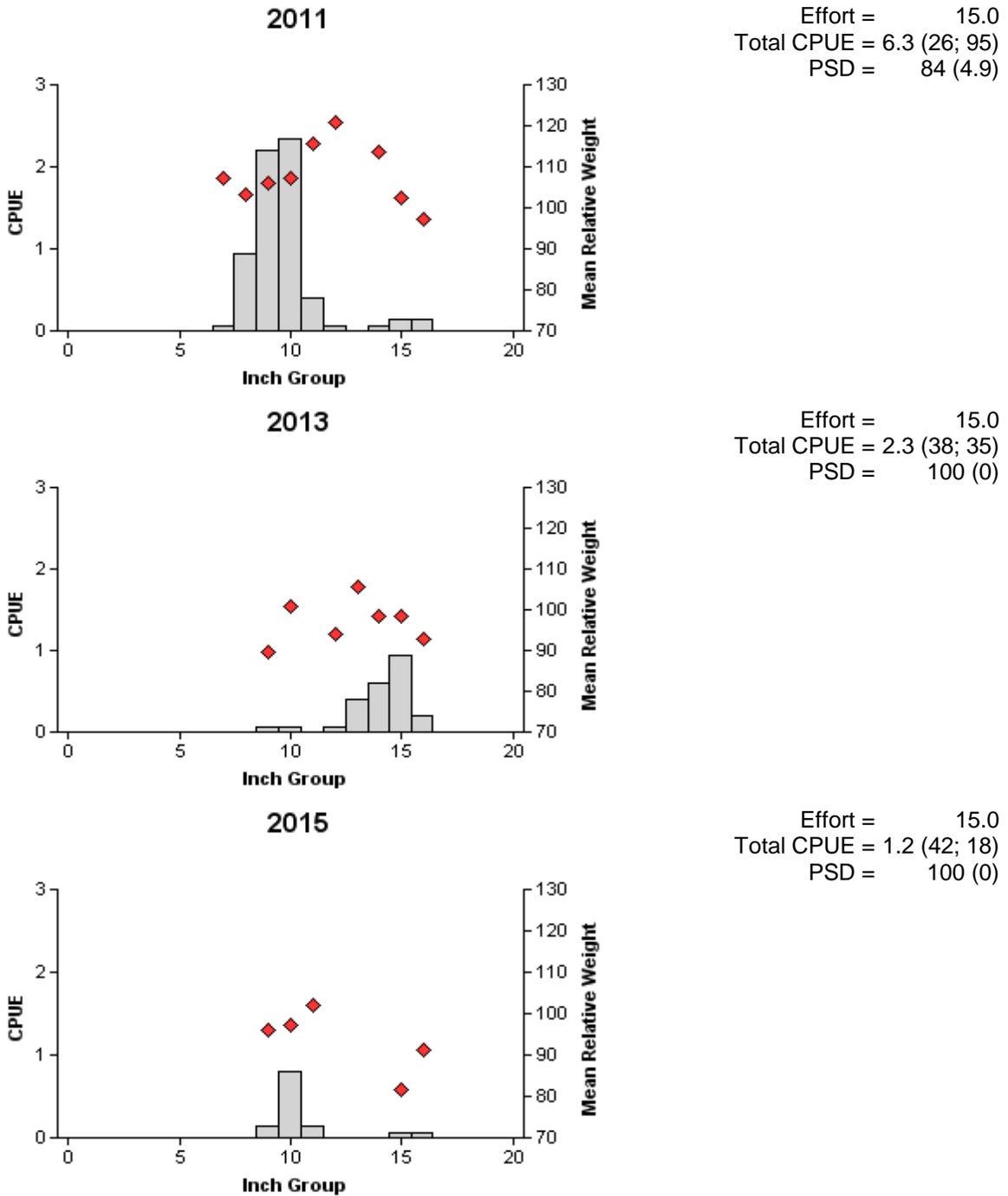


Figure 7. Number of White Bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N are in parentheses) for spring gill net surveys, Sam Rayburn Reservoir, Texas, 2011, 2013, and 2015.

## Temperate Basses

Table 11. Creel survey statistics for temperate basses at Sam Rayburn Reservoir, Texas, from June 2010 through May 2011, June 2012 through February 2013, and June 2014 through May 2015. Total catch per hour is for anglers targeting temperate basses and total harvest is the estimated number of temperate basses harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2010/2011	2012/2013	2014/2015
Directed effort (h)			4,569 (43)
Directed effort/acre			0.04 (43)
Total catch per hour			2.68 (45)
Total harvest	483 (1029)	398 (447)	15,715 (71)
Harvest/acre	<0.01 (1029)	<0.01 (447)	0.14 (71)
Percent legal released	57	87	32

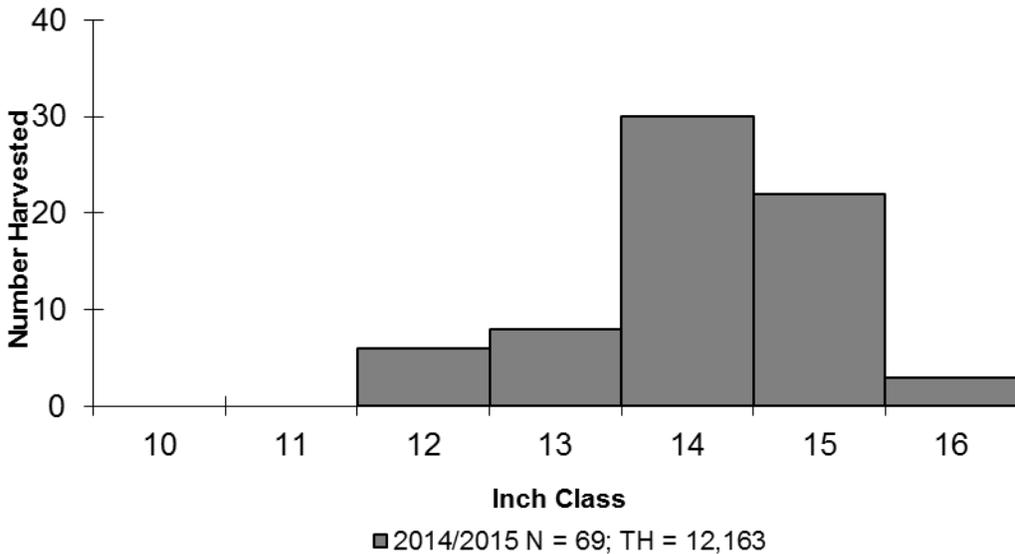


Figure 8. Length frequency of harvested White Bass observed during creel surveys at Sam Rayburn Reservoir, Texas, June 2014 through May 2015, all anglers combined. N is the number of harvested White Bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

## Spotted Bass

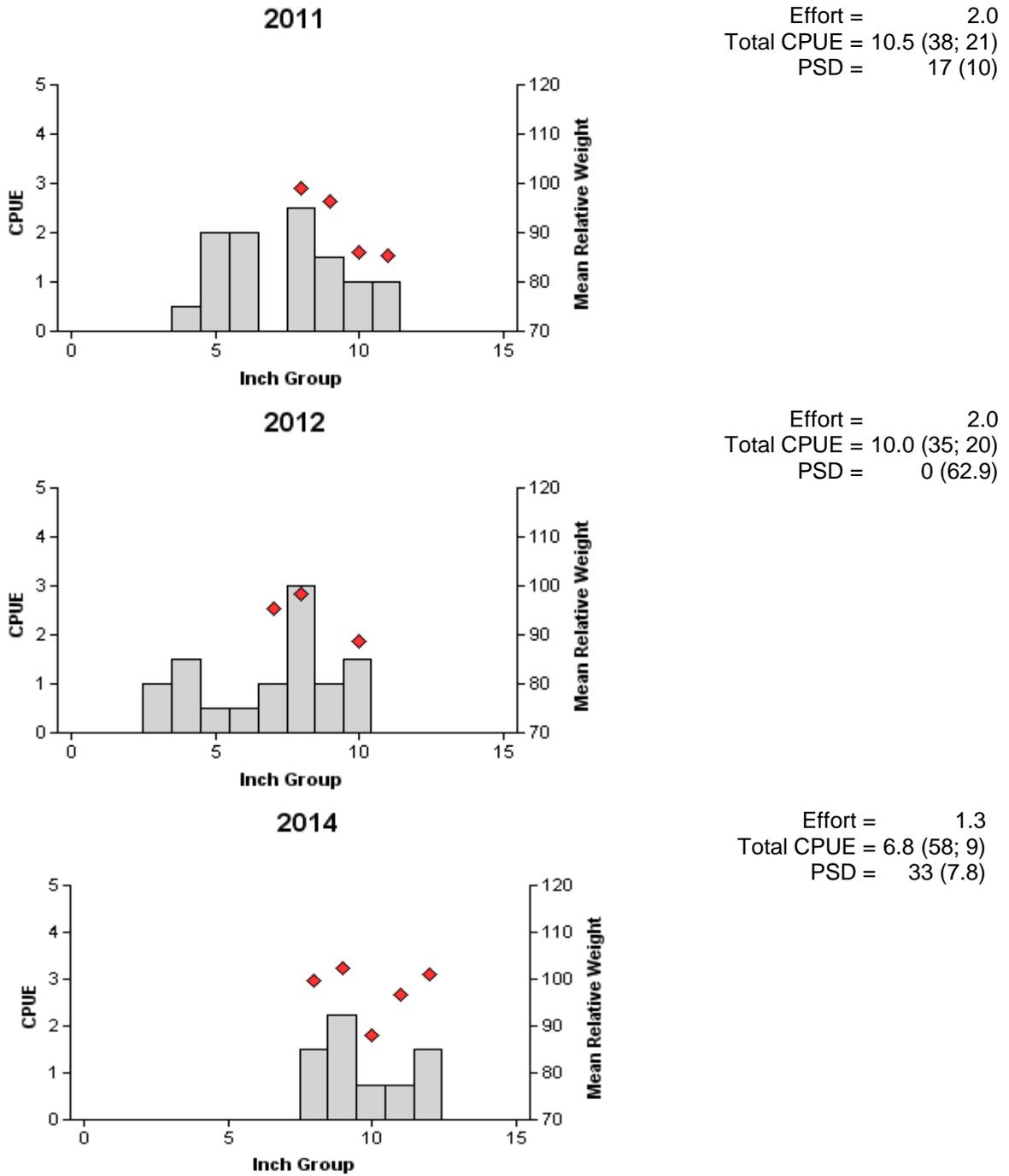


Figure 9. Number of Spotted Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE) for fall electrofishing surveys, Sam Rayburn Reservoir, Texas, 2011, 2012, and 2014.

## Largemouth Bass

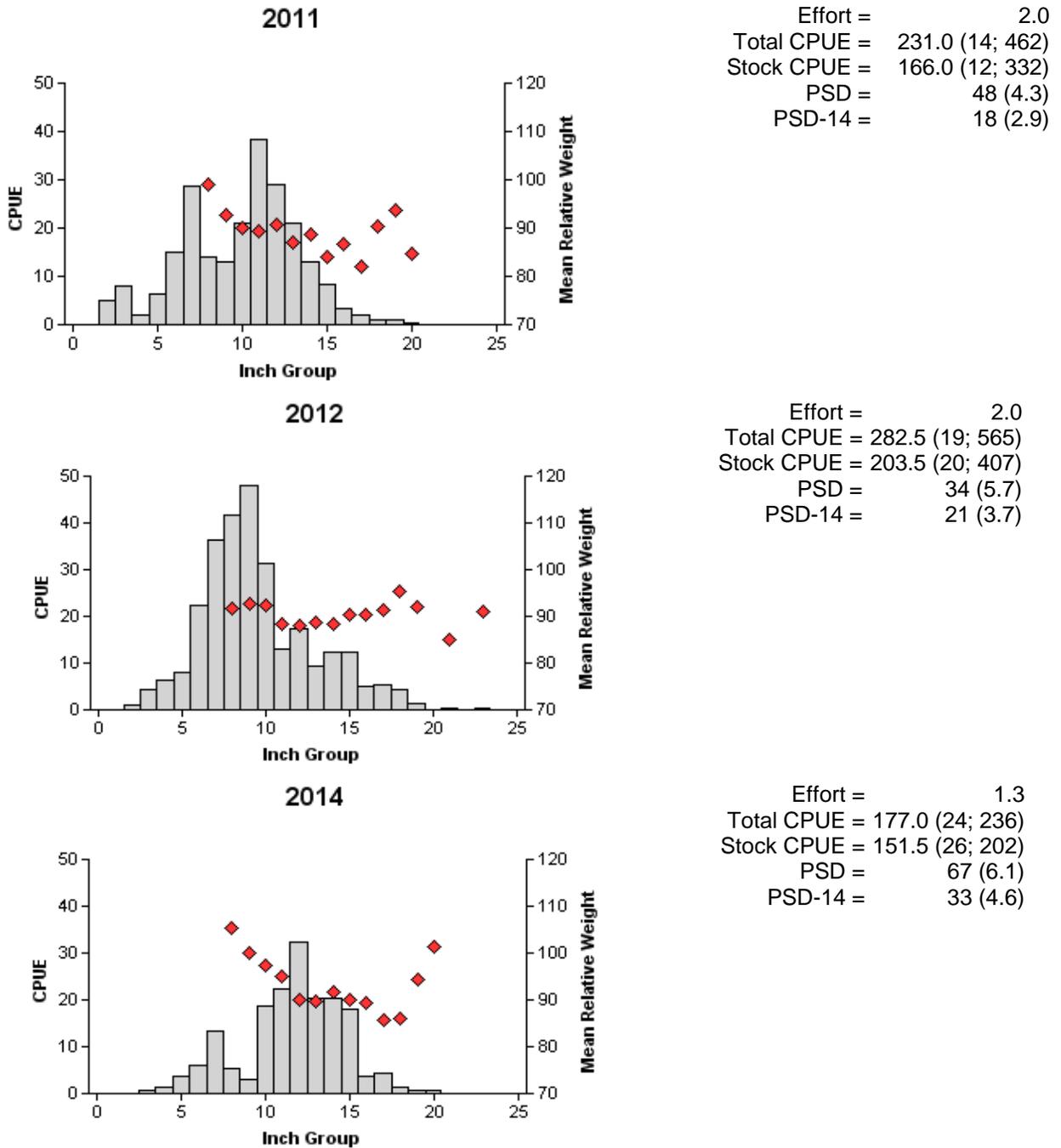


Figure 10. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Sam Rayburn Reservoir, Texas, 2011, 2012, and 2014. Vertical lines indicate minimum length limit at time of survey.

## Black Basses

Table 12. Creel survey statistics for black basses at Sam Rayburn Reservoir, Texas, from June 2010 through May 2011, June 2012 through February 2013, and June 2014 through May 2015. Catch rate is for all anglers targeting black basses. Harvest is partitioned by the estimated number of fish harvested by non-tournament anglers and the number of fish retained by tournament anglers for weigh-in and release. The estimated number of fish caught by weight category is for all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2010/2011	2012/2013	2014/2015
Directed angling effort (h)			
Tournament	157,750 (18)	135,145 (22)	136,741 (19)
Non-tournament	109,356 (19)	122,680 (22)	192,628 (22)
All black bass anglers combined	267,106 (18)	257,825 (22)	329,368 (21)
Angling effort/acre	2.4 (18)	2.3 (22)	3.0 (19)
Catch rate (number/h)	1.2 (16)	1.3 (12)	1.5 (16)
Harvest			
Non-tournament harvest	19,233 (54)	11,453 (51)	27,847 (38)
Harvest/acre	0.1 (54)	0.1 (51)	0.3 (38)
Tournament weigh-in and release	34,073 (29)	12,645 (43)	37,837 (28)
Total catch	275,270 (16)	262,560 (25)	356,748 (25)
< 4.0 lbs	265,000 – 96.2%	255,227 – 97.2%	347,823 – 97.5%
≥ 4-6.9 lbs	9,267 – 3.4%	6,525 – 2.5%	7,461 – 2.1%
≥ 7-9.9 lbs	872 – 0.3%	807 – 0.3%	1,464 – 0.4%
≥ 10 lbs	131 - <0.1%	0	0
Percent legal released (non-tournament)	55	74	60

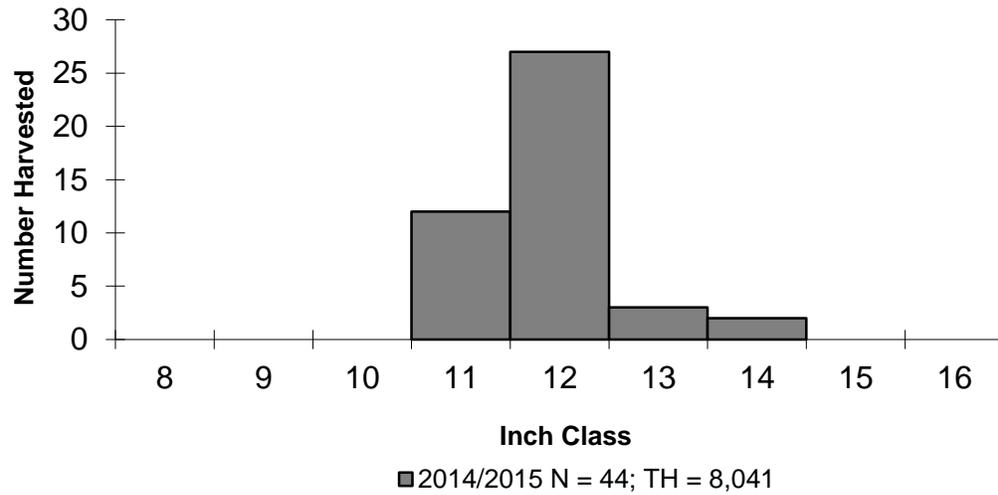


Figure 11. Length frequency of harvested Spotted Bass observed during creel surveys at Sam Rayburn Reservoir, Texas, June 2014 through May 2015, all anglers combined. N is the number of harvested Spotted Bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

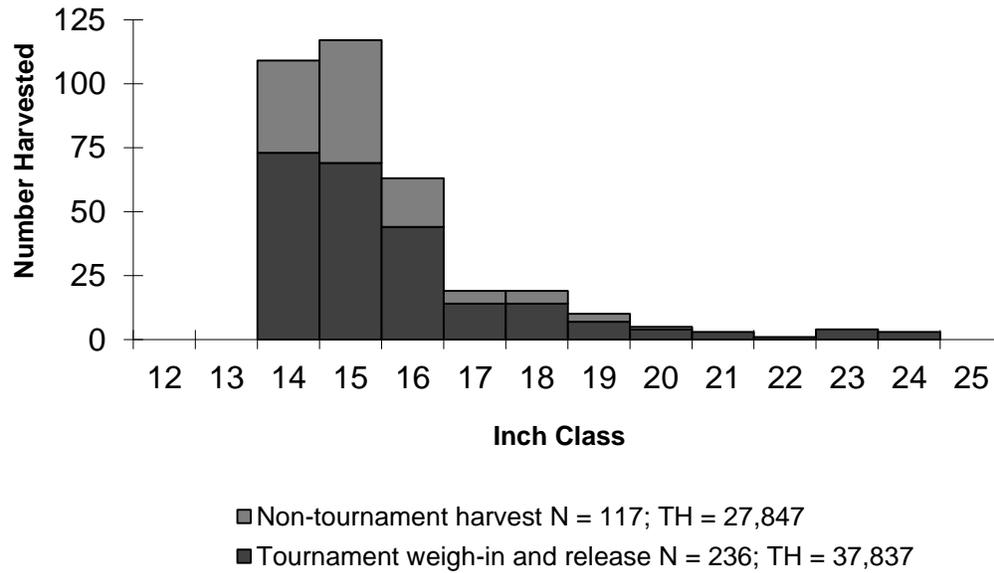


Figure 12. Length frequency of harvested Largemouth Bass observed during creel surveys at Sam Rayburn Reservoir, Texas, June 2014 through May 2015, all anglers combined. N is the number of harvested Largemouth Bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Table 13. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Sam Rayburn Reservoir, Texas, 2007, 2010, and 2014. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB.

Year	Sample size	Number of fish			% FLMB alleles	% FLMB
		FLMB	Intergrade	NLMB		
2007	30	0	27	3	53	0.0
2010	30	0	27	3	43	0.0
2014	30	0	29	1	48	0.0

## Crappies

Table 14. Creel survey statistics for crappies at Sam Rayburn Reservoir, Texas, from June 2010 through May 2011, June 2012 through February 2013, and June 2014 through May 2015, where total catch per hour is for anglers targeting crappies and total harvest is the estimated number of crappies harvested by all anglers. Relative standard errors (RSE) are in parentheses

Creel Survey Statistic	Year		
	2010/2011	2012/2013	2014/2015
Directed effort (h)	40,432 (21)	32,867 (32)	46,659 (21)
Directed effort/acre	0.36 (21)	0.29 (32)	0.42 (21)
Total catch per hour	2.57 (27)	1.93 (24)	3.68 (45)
Total harvest	89,576 (50)	46,243 (40)	74,292 (30)
Harvest/acre	0.80 (50)	0.42 (40)	0.67 (30)
Percent legal released	1	0	0

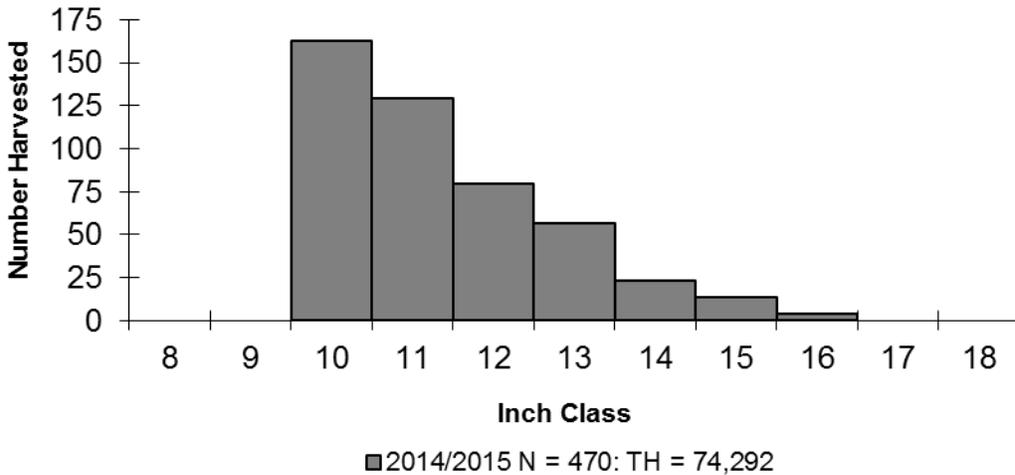


Figure 13. Length frequency of harvested crappie observed during creel surveys at Sam Rayburn Reservoir, Texas, June 2014 through May 2015, all anglers combined. N is the number of harvested crappies observed during creel surveys, and TH is the total estimated harvest for the creel period.

Table 15. Proposed sampling schedule for Sam Rayburn Reservoir, Texas. Survey period is June through May. Gill netting surveys are conducted in the winter, while electrofishing surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

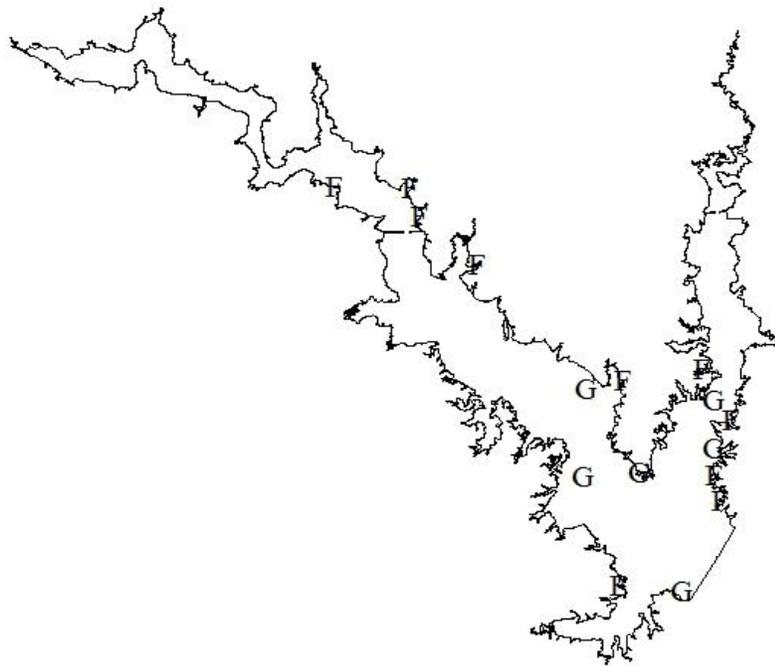
Survey year	Electrofishing Fall	Gill net	Habitat			Creel survey	Report
			Structural	Vegetation	Access		
2015-2016				A			
2016-2017	A	A		A			
2017-2018				A			
2018-2019	S	S		S	S	A	S

**APPENDIX A**

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Sam Rayburn Reservoir, Texas, 2014-2015. Sampling effort was 15 net nights for gill netting and 1.3 hours for electrofishing.

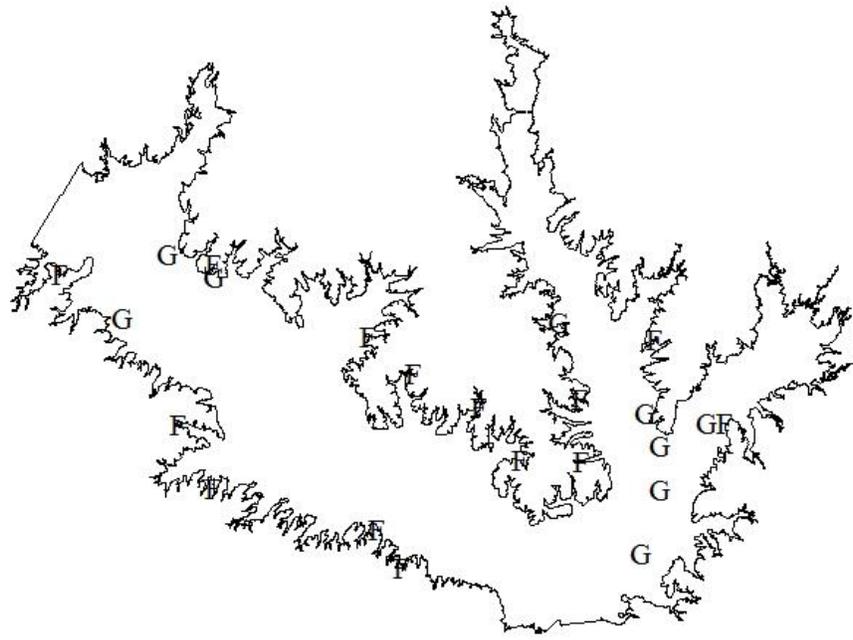
Species	Gill Netting		Electrofishing	
	N	CPUE	N	CPUE
Gizzard Shad			106	79.5
Threadfin Shad			612	459.0
Blue Catfish	57	3.8		
Channel Catfish	124	8.3		
White Bass	18	1.2		
Yellow Bass	25	1.7		
Redbreast Sunfish			8	6.0
Warmouth			1	0.8
Bluegill			228	171.0
Longear Sunfish			2	1.5
Redear Sunfish			70	52.5
Redspotted Sunfish			2	1.5
Spotted Bass			9	6.8
Largemouth Bass			236	177.0
White Crappie	3	0.2		
Black Crappie	35	2.3		

APPENDIX B



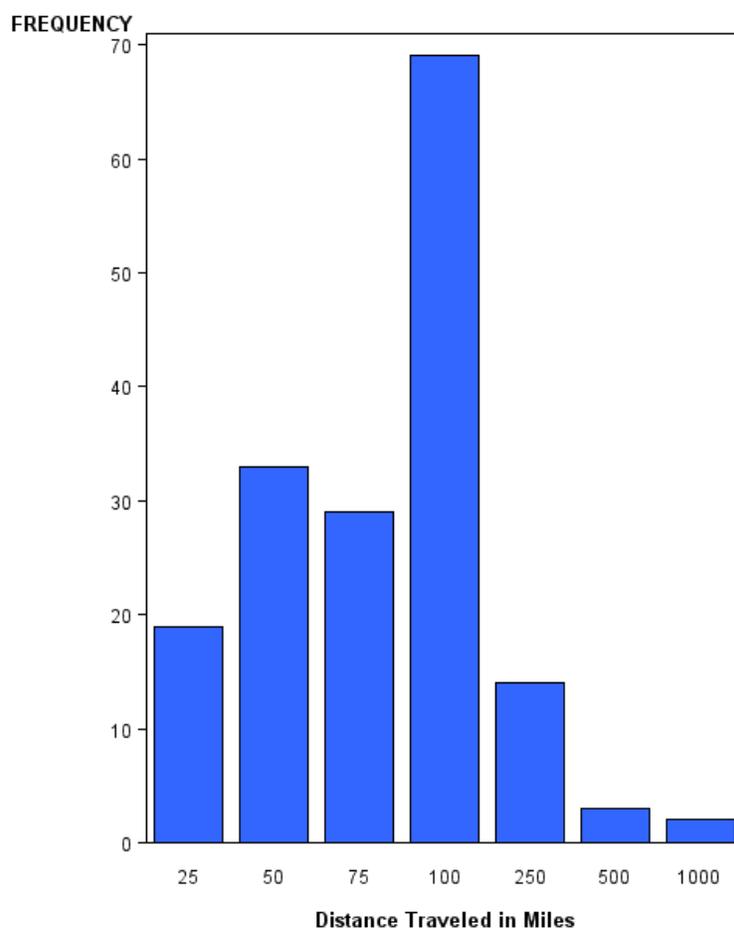
Location of sampling sites, north Sam Rayburn Reservoir, Texas, 2014-2015. Gill net and electrofishing stations are indicated by G and F, respectively. Water level was within 2 feet of full pool at time of sampling.

APPENDIX B



Location of sampling sites, south Sam Rayburn Reservoir, Texas, 2014-2015. Gill net and electrofishing stations are indicated by G and F, respectively. Water level was within 2 feet of full pool at time of sampling.

## APPENDIX C



Frequency of anglers that traveled various distances (miles) to Sam Rayburn Reservoir, Texas, as determined from the June 2014 through May 2015 creel survey.

**APPENDIX D**

Results from individual and team format black bass tournaments at Sam Rayburn Reservoir, 2011 - 2015. Only tournaments with 5-fish bag limits and > 50 participants or teams were included. Weights are expressed in pounds.

Year	N	1 <sup>st</sup> place weight	2 <sup>nd</sup> place weight	3 <sup>rd</sup> place weight	% total weights > 15 lbs.	% catching limit	Big bass weight
<b>Individual</b>							
2011	9	20.7	18.2	17.0	9.4	41.9	7.6
2012	8	20.4	16.7	16.1	3.4	45.9	7.3
2013	11	22.0	18.4	17.3	6.8	52.6	8.4
2014	15	21.4	19.5	18.2	8.4	30.5	8.1
2015	11	19.8	18.0	17.1	6.2	44.1	7.7
<b>Team</b>							
2011	28	25.1	22.5	21.3	21.7	60.6	8.7
2012	24	23.6	21.5	19.2	12.9	47.5	8.1
2013	13	24.3	22.6	21.0	17.0	56.4	8.9
2014	18	22.7	20.6	19.6	11.1	41.1	8.9
2015	8	26.9	21.8	20.7	12.2	40.6	10.0

Results of Sealy Outdoors McDonald's Big Bass Splash tournaments, Sam Rayburn Reservoir, 2011 – 2015. Weights are expressed in pounds.

Year	Average weight of Top 10 fish/hour	Average weight of Top 10 fish/day	Average weight of overall top 10 fish	Weight of overall big fish
2011	5.8 (240)	8.0 (30)	9.1 (10)	10.7
2012	5.2 (240)	7.4 (30)	8.3 (10)	10.8
2013	5.6 (240)	7.7 (30)	8.7 (10)	9.9
2014	6.5 (240)	8.3 (30)	9.0 (10)	9.8
2015	6.8 (210)	8.3 (30)	9.1 (10)	10.0

**APPENDIX E****Sampling Plan for Sam Rayburn Reservoir****2014 - 2015****Sport fish, forage fish, and other important fishes**

Sport fishes in Sam Rayburn Reservoir include Largemouth Bass, Spotted Bass, crappies, Channel Catfish, Blue Catfish, Flathead Catfish, and White Bass. Important forage species include Bluegill, Gizzard Shad, and Threadfin Shad.

**Negligible fisheries**

Historically, White Bass catch rates from gill net surveys were  $\leq 1.5/\text{nn}$ , indicating a low population density in the reservoir. In 2011, catch rates increased to  $6.3/\text{nn}$ , reflecting an increase in recruitment, but catch rates in 2013 declined to  $2.3/\text{nn}$ . Since 2008, creel surveys have not documented directed effort towards temperate basses. Although no future directed sampling is planned, White Bass catch will be recorded from gill net surveys directed at catfishes (see below).

**Survey objectives, fisheries metrics, and sampling objectives**

**Largemouth Bass:** Largemouth Bass are the most popular sport fish in Sam Rayburn Reservoir, accounting for approximately 75% of the annual angling effort. The reservoir supports a high-quality, nationally recognized fishery with substantial economic contributions. The annual economic value of the recreational fishery was estimated at \$47.1 million. The reservoir also hosts over 400 bass tournaments per year with an economic value of \$32.0 million. Largemouth Bass have always been managed with the statewide 14-in MLL regulation. For nearly 20 years, trend data on CPUE, size structure, and body condition were collected annually with fall electrofishing. Since 2013, fall electrofishing has been conducted biennially. The population is abundant, recruitment rates have been high and steady, and size structure has been desirable and stable. Continuation of biennial trend data with night electrofishing in the fall will allow for determination of any large-scale changes in the Largemouth Bass population that may spur further investigation. A minimum of 16 randomly selected 5-min electrofishing sites will be sampled in 2014, but sampling will continue at random sites until 50 stock-size fish are collected and the RSE of CPUE-S is  $\leq 25$  (the anticipated effort to meet both sampling objectives is 12-20 stations with 80% confidence). If failure to achieve either objective has occurred after one night of sampling and objectives can be attained with 6-12 additional random stations, another night of effort will be expended.

In addition, average age of Largemouth Bass between 330 and 381 mm (Category 2;  $N = 13$ ) will be estimated in 2014, and every four years thereafter. If growth problems are detected from this cursory estimate, mean length-at-age will be estimated from a random population sample of 400 fish  $> 150$  mm, subsampled at 10 fish per 10 mm strata (Category 4).

**Crappies:** The crappie fishery is the second most popular at Sam Rayburn Reservoir, accounting for 10 – 15% of the annual angling effort. Historically, standard, tandem, and offshore trap netting has resulted in low and variable catch rates. For over 10 years, creel surveys have been used to monitor the crappie fishery and make inferences about the population. Although directed effort and harvest have varied over the years, angler catch rates have remained relatively high since 2004 (range = 1.5 – 3.0 fish/h), reflecting an abundant crappie population. We will continue biennial creel surveys in 2014/2015 (4 quarters, 5

weekend and 4 week days/quarter) to detect any large-scale changes in the crappie population that may warrant additional sampling.

**Catfishes:** The rod and reel catfish fishery accounts for approximately 10% of the annual angling effort. Anecdotal information indicates that the passive gear fishery is more popular and accounts for frequent catches of Blue and Flathead Catfish > 30 pounds. Catfish populations have always been managed with statewide regulations.

Biennial gill netting data has indicated relatively stable Channel and Blue Catfish recruitment and abundance, and should provide adequate population-level insight relative to large-scale changes that would dictate further investigation. A minimum of 15 randomly selected gill netting sites will be sampled in 2015, but sampling will continue at random sites until 50 stock-size fish are collected and the RSE of CPUE-S is  $\leq 25$  (the anticipated effort to meet both sampling objectives is 12-18 stations with 80% confidence). Additional sampling will occur (5-10 gill netting sites) if objectives are not attained. Average age of 280 – 330 mm Channel and Blue Catfish (N = 13) will be estimated every four years. Similar to that of Largemouth Bass, mean length-at-age data (N = 400 fish) will be collected if growth problems are detected.

Currently, little is known about the Flathead Catfish population at Sam Rayburn Reservoir. We will conduct a summer, low-frequency electrofishing survey in 2014 to establish a baseline relative abundance estimate for trend comparisons over time. A minimum of 20 random electrofishing stations will be conducted in 2014 in an attempt to collect 50 stock-size fish with an RSE of  $\leq 25$  (the anticipated effort to meet both sampling objectives is unknown). If we fail to reach either objective, an additional 5-10 random stations will be conducted, assuming objectives are achievable.

**Prey species:** Bluegill, Gizzard Shad, and Threadfin Shad are the primary forage at Sam Rayburn Reservoir. Like Largemouth Bass, trend data on CPUE and size structure were collected annually for 20 years with fall electrofishing. Since 2013, fall electrofishing has been conducted biennially. Continuation of biennial sampling, as per Largemouth Bass above, will allow for monitoring of large-scale changes in Bluegill and Gizzard Shad relative abundance and size structure. Effort based on achieving sampling objectives for Largemouth Bass will result in sufficient numbers of Bluegill for size structure (PSD; 50 fish minimum) and relative abundance (RSE  $\leq 25$  of CPUE-Total) and Gizzard Shad size structure (IOV; 50 fish minimum). At the effort needed to achieve sampling objectives for Largemouth Bass, the expected RSE for CPUE-T is 33 for Gizzard Shad and 60 for Threadfin Shad. No additional effort will be expended to achieve an RSE25 for Gizzard or Threadfin Shad, but Largemouth Bass body condition (fish  $\geq 8$ " TL) will be used to provide additional information on forage abundance and vulnerability.