

PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

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INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2014 Fisheries Management Survey Report

**Leon Reservoir**

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## SURVEY AND MANAGEMENT SUMMARY

Fish populations in Leon Reservoir were surveyed in summer 2014 by tandem hoop netting, fall 2012 and 2014 by electrofishing and trap netting and in spring 2015 by gill netting. Anglers were surveyed from March 2013 through August 2013 with an access creel survey. Historical data are presented with the 2012-2015 data for comparison. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir Description:** Leon Reservoir is a 1,590-acre reservoir that was constructed in 1954 by impounding the Leon River. The reservoir is located in Eastland County, roughly seven miles south of the City of Eastland, and it is controlled by the Eastland County Water Supply District. Leon Reservoir for flood control, municipal and industrial water supply for the City of Eastland, and for recreation.
- **Management History:** Important sport fish include Largemouth Bass, White Crappie, Black Crappie, Channel Catfish, Flathead Catfish, and White Bass. Hydrilla was first documented in the 2010 vegetation survey and was mechanically removed in one northeastern cove; additional areas containing miniscule patches of hydrilla were not treated. From 2011-2014, hydrilla was monitored annually, and it did not cause any problems with angler and boater access. The most recent stocking (Florida Largemouth Bass) occurred in 2012.
- **Fish Community**
  - **Prey species:** Gizzard Shad, Bluegill, and Longear Sunfish comprised the majority of the forage base for the predator assemblage. Threadfin Shad, Bullhead Minnow, Green Sunfish, Warmouth, Orange-Spotted Sunfish, Redear Sunfish, and Inland Silversides were also present. Size structures of prey species were suitable to support sport fish populations.
  - **Catfishes:** Channel Catfish and Flathead Catfish were present in the reservoir. In 2015, relative abundance of Channel Catfish was similar to the 2011 gill net survey. The tandem hoop netting survey in 2014 yielded slightly higher catch than the survey in 2010, and catch was dominated by smaller fish (i.e.,  $\leq 15$  in.). One Flathead Catfish was collected during the gill net survey. Channel Catfish should provide good fishing opportunities.
  - **White Bass:** In 2015, Gill net CPUE for White Bass was higher than in 2011 but substantially lower than in 2007. Catch of legal-sized fish increased since 2011, but was still lower than in 2007. In 2015, size structure was comprised with most fish being  $\geq 10$  in. Despite low reported effort by anglers, gill netting catch of legal-size fish is promising to support a sport fishery.
  - **Largemouth Bass:** Largemouth Bass relative abundance has remained similar from 2010-2014. In 2014, higher presence of fish  $\leq$ stock-size and less legal-sized fish (i.e.,  $\geq 14$ -in) were collected compared to previous surveys. Similar to previous surveys, individuals captured in the 2014 survey had suboptimal body condition.
  - **Crappie:** Both White Crappie and Black Crappie were present in the reservoir, but White Crappie were more abundant. Fewer legal-size (i.e.,  $\geq 10$ -in.) crappie were caught in comparison to prior surveys. Body conditions of crappie were adequate ( $>90$ ).
- **Management Strategies:** Biennial electrofishing will be conducted to monitor Largemouth Bass in fall 2016 and fall 2018; forage species will be sampled concurrently in fall 2018. Trap netting will be used in fall 2018 to monitor for White Crappie and Black Crappie. Spring 2019 gill netting will be conducted to monitor Channel Catfish and White Bass populations. Hydrilla will be surveyed annually. The public will be notified of invasive species spread prevention and existing problematic species in the reservoir. Access and vegetation surveys will be completed in summer 2018.

## INTRODUCTION

This document is a summary of fisheries data collected from Leon Reservoir during 2012-2015. 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 species of fishes was collected, this report deals primarily with major sport fishes and important prey species. Management strategies are included to address existing problems and/or opportunities. Historical data are presented in this report for comparison.

### *Reservoir Description*

Leon Reservoir is a 1,590-acre main-stem reservoir that was constructed in 1954 by the impoundment of the Leon River within the Brazos River Basin. The reservoir is located in Eastland County, roughly seven miles south of the City of Eastland, and it is controlled by the Eastland County Water Supply District. Leon Reservoir provides flood control, municipal and industrial water supply for the City of Eastland, and recreation. Leon Reservoir was eutrophic based on Carlson's Trophic State Index for chlorophyll-a (TSI Chl-a) with a mean TSI Chl-a of 50.8; over the last 10 years the mean TSI Chl-a increased by 11.6 (Texas Commission on Environmental Quality 2011). From 2010-2015, water level in the reservoir fluctuated from about five ft. below conservation pool level to 7.5 ft. below conservation pool level by early spring 2015 (Figure 1); the reservoir reached its lowest point during the period at 14 ft. below in 2011. Heavy rains in May 2015 filled the reservoir over conservation pool level. Other descriptive characteristics for Leon Reservoir are in Table 1.

### *Angler Access*

Boater access consisted of three public boat ramps. Chock-a-Block Ramp was usable during the entire survey period. The primary public boat ramp at the Leon Reservoir Dam was unusable for much of the survey period because the water level was too low to launch. However, a low-water ramp was made available at the dam to allow boater access to the reservoir. Bank fishing and handicapped access were restricted to the areas around boat ramps and the LaMancha Resort. Additional boat ramp characteristics are located in Table 2.

### *Management History*

**Previous management strategies and actions:** Management strategies and actions from the previous survey report (Dumont and Neely 2011) included:

1. Conduct biennial electrofishing surveys to further monitor the relationship between water level and population characteristics of Largemouth Bass and to assess if stunting is also occurring.  
**Action:** Electrofishing surveys were conducted in 2012 and 2014. Age and growth of Largemouth Bass at legal-length were not determined because few 14-in. individuals were caught in the 2012 and 2014 electrofishing surveys.
2. Determine hydrilla coverage and notify the controlling authority.  
**Action:** Hydrilla coverage has been monitored annually since 2011 with random-point surveys and roving observations. Eastland County Water Supply District was notified about hydrilla existing in the reservoir.
3. Make watershed maps for Leon Reservoir and develop management strategies for fisheries management at the watershed scale.  
**Action:** A watershed map was constructed for Leon Reservoir. Fisheries management strategies at the watershed scale are still being evaluated.
4. Educate public about threats of invasive species.  
**Action:** Press releases were distributed to local and statewide media. Signage was

posted at each public ramp to notify users of potential invasive species and threats.

5. Work with controlling authority to improve the public boat ramps.

**Action:** Eastland County Water Supply District was notified about inaccessibility of the Leon Reservoir Dam Ramp during periods of prolonged drought. The district provided a low water ramp during these periods to allow for anglers to access the reservoir.

**Harvest regulation history:** Sport fish in Leon Reservoir have been managed with statewide harvest regulations (Table 3).

**Stocking history:** Leon Reservoir has been stocked with numerous species including; Threadfin Shad, Florida Largemouth Bass, Northern Pike x Muskellunge hybrids, and palmetto bass (i.e., Striped Bass x White Bass hybrids). The most recent stocking of Florida Largemouth Bass occurred in 2012. A complete stocking history is presented in Table 4.

**Vegetation/habitat management history:** Hydrilla was documented in 2010 but was limited to the northeast section of the reservoir near the LaMancha Resort. Hydrilla documented in the 2010 survey was mechanically removed in one cove bordering the resort, but additional areas containing isolated patches of hydrilla were not treated. Hydrilla was documented in 2011, 2012, and 2014 surveys but was confined to the single cove near the resort in sparse coverage. Over the current survey period, hydrilla did not negatively affect boat and angler access.

**Water transfer:** No interbasin transfers are known to exist.

## METHODS

Fishes were collected by electrofishing (1 hour at 12, 5-minute stations), tandem hoop netting (9 tandem hoop net series (3 hoop nets in tandem, two-night sets at 9 stations), trap netting (10 net nights at 10 stations), and gill netting (5 net nights at 5 stations). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing, for tandem hoop netting as the number of fish caught in one tandem series (fish/tandem hoop net series), and for trap and gill nets, as the number of fish caught in one net set overnight (fish/nn). All survey sites were randomly selected and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manuals revised 2011, 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 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 =  $100 \times \text{SE of the estimate/estimate}$ ) was calculated for all CPUE statistics and creel statistics.

Access and vegetation/habitat surveys were conducted in August 2014. The habitat survey was conducted 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 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 ( $\% = [\# \text{ stations present} / \text{total stations sampled}] \times 100$ ) and associated Wald 95% confidence intervals (AusVet Animal Health Services 2015) were calculated for native and exotic plant species and structural habitat types (TPWD, Inland Fisheries Division, unpublished manual revised 2014).

In 2013, a six-month access-point creel survey was conducted at the reservoir from spring to summer (March 1-August 31). Angler interviews were conducted on 5 weekend days and 4 weekdays each quarter to assess angler use and fish catch/harvest statistics in accordance with the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual 2014). Average surface area for each

quarter within a creel period was determined by calculating the acreage of the reservoir at the average depth (i.e., average of the lake level at the 1<sup>st</sup> of each month) of each creel survey period. Derived surface area was used to determine directed effort/acre (TPWD, Inland Fisheries Division, unpublished manual revised 2014).

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 competition of individual fish from 2005-2014 and by electrophoresis for the previous years.

Water level data were collected from the United States Geological Survey National Water Information System (USGS 2015).

## RESULTS AND DISCUSSION

**Habitat:** Structural habitat and substrates were primarily comprised of sand, pebbles, and cobbles (Table 5). Small and large boulders were also present. Shoreline vegetative habitat consisted primarily of water willow, *Chara* sp., dead trees, Illinois pond weed, black willow, *Panicum* spp., and dead vegetation; water willow and *Chara* sp. were the most prevalent aquatic vegetation (Table 6). Hydrilla was found in sparse coverage in the northeast section of the reservoir and was limited to one cove bordering the LaMancha Resort.

**Creel:** The creel conducted from March-August 2013 indicated that anglers spent roughly 11,038 hours fishing at Leon Reservoir. Directed fishing effort by anglers was highest for Largemouth Bass (86.2%), followed by effort directed for crappie (6.5%) and catfishes (5.5%) (Table 7).

**Prey species:** Gizzard Shad relative abundance fluctuated over the survey period with an electrofishing catch rate of 731.0/h in 2010, to 223.0/h in 2012, and to 671.0/h in 2014 (Figure 2). Gizzard shad  $\leq 6$  in. were more abundant in the 2014 survey compared to 2012. Index of vulnerability (IOV) dropped from 77 in 2010 to 56 in 2012. However, IOV greatly increased to 94 in 2014 which indicated that most Gizzard Shad were available as prey for sport fish. Threadfin Shad CPUE in 2014 was 65.0/h, further contributing to the shad forage base (Appendix A). The 2014 electrofishing catch rate for Bluegill (251.0/h) was lower than that reported in the 2012 survey (383.0/h) and 2010 survey (364.0/h) (Figure 3). Size structure for Bluegill was comprised of individuals  $< 6$  in. and most were available as forage for sport fish. CPUE-6 was the same in the 2014 and 2012 surveys (20.0/h) and lower than reported in 2010 (33.0/h). However, relative abundance of Bluegill  $> 6$  inches suggests promise for the population to support a sport fishery. Longear Sunfish were the most relatively abundant sunfish species (265.0/h) in the fall 2014 electrofishing survey and all were  $\leq 5$  in. and available as prey. Green Sunfish, Redear Sunfish, Warmouth, Orange-Spotted Sunfish, Bullhead Minnows, and Inland Silversides were also present. The 2014 electrofishing survey indicated ample prey base existed for sport fish and that availability of prey should not be a limiting factor to the growth and condition of sport fishes in the reservoir.

**Catfishes:** In 2015, gill net catch for Channel Catfish was 8.2/nn, which was similar to 9.0/nn in 2011 and higher than 3.6/nn reported in 2007 (Figure 4). Catch rate of fish  $\geq$ stock-size was 6.0/nn in the 2015 gill net survey which was a slight decrease from 8.0/nn in 2011 and higher than the rate reported in 2007 (3.2/nn). A similar decrease in relative abundance of fish  $\geq 12$  in. was also evident in 2015 when compared to 2011 data. However, reproduction and recruitment in 2015 appear adequate because the catch was represented by mostly smaller individuals (i.e., PSD=13). Greater effort for tandem hoop netting in 2014 yielded a slight increase in catch rate and data precision (5.0/tandem hoop net series; RSE=45) compared to the initial survey conducted in 2010 (2.5/tandem hoop net series; RSE=76) (Figure 5). Tandem hoop netting yielded lower representation of the size distribution structure than gill netting surveys from 2010-2015; only fish  $\leq 15$  in. were caught during the 2014 and 2010 tandem hoop netting surveys. Numbers and sizes of Channel Catfish available to anglers appeared to be adequate. Flathead Catfish were present in low relative abundance (0.2/nn) in the 2015 gill netting survey. Creel data suggested that roughly 6% (609.7 hours) of the directed angler effort was towards catfishes during spring

and summer 2013 (Table 8). During the creel survey, an estimated 281 fish were caught, 46.5 fish were released, and 171.5 were harvested. Approximately, 16.4% of legal-sized fish were released by anglers. Six fish were observed harvested by anglers (Figure 6).

**White Bass:** Gill net CPUE for White Bass was 12.4/nn in 2015, which was higher than in 2011 (5.4/nn) but substantially lower than in 2007 (42.8/nn) (Figure 7). Catch of legal-sized fish (i.e., CPUE-10) increased from 4.8/nn in 2011 to 11.0/nn in 2015, but was lower than in 2007 (36.0/nn). Size structure in 2015 (PSD=90) was similar to the 2011 survey (PSD=89), with most fish being  $\geq 10$  in. Relative abundance of legal-size fish is promising to support a sport fishery for White Bass. However, the 2013 creel survey suggested that anglers spent the least amount of effort (92.4 hours; 0.8% of directed angler effort) targeting White Bass (Table 7).

**Largemouth Bass:** The electrofishing catch rate of Largemouth Bass was 158.0/h in 2014, similar to 171.0/h in 2012 and 166.0/h in 2010 (Figure 8). Catch of bass  $\geq$ stock-size was greater in 2014 (112.0/h) than catches reported in 2012 (91.0/h) and similar to 2010 (110.0/h). In 2014, catch of legal-sized fish declined (7.0/h) from 14.0/h reported in 2012 and 16.0/h in 2010. Since 2010, the PSD has declined from 50 to 21, with most fish being  $\leq 10$  in. Relative weights in 2014 were suboptimal, and they varied (range: 78-91) among inch groups. No clear patterns in body condition were evident based on size. Mean age at 14-in. was not obtained during the sample period because too few fish were obtained during sampling. The 2013 creel survey indicated that Largemouth Bass supported the most popular fishery, which anglers directed 9,516.1 hours targeting the species (Table 9). During the creel survey period, anglers caught roughly 4,321 fish and 100% were released. Prevalence of the Florida Largemouth Bass genetic strain in samples has increased from 9.0% in 1992 to 45.0% in 2014 likely because of Florida Largemouth Bass fingerling stockings that occurred in 2008 and 2012 (Table 10).

**Crappie:** White and Black crappie are both present in Leon Reservoir, and White Crappie were the most relatively abundant. Trap net CPUE for White Crappie was 17.3/nn in 2014, consistent with 13.8/nn in 2012, but slightly less than 24.3/nn in 2010 (Figure 9). A similar trend in CPUE of stock-sized White Crappie was evident from 2008-2014. During 2014, White Crappie CPUE-10 was 1.6/nn, which was consistent with rates from the 2008 and 2012 surveys. Size distribution in 2014 was slightly skewed by larger fish as indicated by a PSD of 69, which was similar to that reported in 2012 (PSD=62), and greater than in 2008 (PSD=35). In 2014, relative weight values were greater compared to those reported in 2008 and were  $\geq 90$  for all size groups, which these values suggest sufficient and improved body condition for White Crappie. Since 2008, CPUE of Black Crappie increased somewhat from 0.4/nn in 2008 to 2.2/nn in 2014; the slight increase was also evident with stock-sized individuals. The creel survey suggested that crappie support the second-most popular fishery at the reservoir, which anglers reported spending about 719.4 hours (6.5% of directed angler effort) targeting them (Table 11). An estimated 497 fish were caught, which about 101 were harvested, and 396 fish were released. Of the fish released, only about 55 (i.e., 13.9%) legal-sized fish were estimated to be released. Two 10-in. White Crappie were observed harvested during the creel period.

## Fisheries management plan for Leon Reservoir, Texas

Prepared - July 2015

**ISSUE 1:** Despite adequate recruitment, the Largemouth Bass population has yielded few fish  $\geq 14$  in. in the monitoring surveys. Further, mean body conditions of fish sampled continue to be low.

### MANAGEMENT STRATEGIES

1. Conduct a bass-only electrofishing to obtain a Category 3 age and growth sample to determine if stunting is occurring.
2. If stunting is ruled out and trophy-size potential is identified, request biennial stockings of Florida Largemouth Bass (FLMB) fingerlings from 2016-2020 at a rate of 1000/shoreline km to increase genetic influence of Florida strain and potential growth.
3. Collect various bass tournament data to identify any trends in weigh-in data.

**ISSUE 2:** Hydrilla was discovered in August 2010 during a habitat survey, and it has continued to be present in the northeastern section of the reservoir near LaMancha Resort.

### MANAGEMENT STRATEGIES

1. Continue to monitor hydrilla coverage annually by circumnavigation of the perimeter and georeferencing locations where it is present.
2. Continue to maintain communication with Eastland County Water Supply District regarding hydrilla coverage in the reservoir.
3. Provide and maintain adequate signage to notify reservoir users of hydrilla presence in the reservoir, as well as signage highlighting TPWD's Clean, Drain, and Dry protocols.

**ISSUE 3:** The White Bass population in the reservoir is introduced, relatively young, and does not currently support a popular fishery. However, fish of legal-size appear to be abundant for anglers.

### MANAGEMENT STRATEGY

1. Promote the underutilized White Bass fishery through press releases and outreach events.

**ISSUE 4:** Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, Giant salvinia (*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. Historically, non-native plants such as water hyacinth and hydrilla have been a problem in the reservoir. These exotic plants restrict recreational use and can negatively impact the quality of fish and wildlife habitat restricting growth and colonization of native vegetation.

### MANAGEMENT STRATEGIES

1. Cooperate with the controlling authority to post appropriate signage at access points around the reservoir.
2. Contact and educate the controlling authority 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. Make a speaking point about invasive species when presenting to constituent and user groups.
4. Keep track of (i.e., map) existing and future inter-basin water transfers to facilitate potential invasive species responses.
5. Monitor hydrilla and for other invasive species through vegetation surveys.
6. Work with Eastland County Water Supply District on collaboration all vegetation control activities.



**SAMPLING SCHEDULE JUSTIFICATION:**

The proposed sampling schedule includes electrofishing in 2016 and 2018 to monitor trends in Largemouth Bass and forage species' relative abundance, size structure, body conditions, as well as to assess genetics, age, and growth of Largemouth Bass (Table 12). Trap netting will be conducted in the fall 2018 to monitor trends in relative abundance, size structure, and body conditions of crappie. Gill netting will be conducted in spring 2019 to assess and monitor trends relative abundance and size structure for Channel Catfish and White Bass. An aquatic vegetation survey will be conducted annually to monitor for presence and possible expansion of nuisance vegetation. Access survey will be conducted in 2018.

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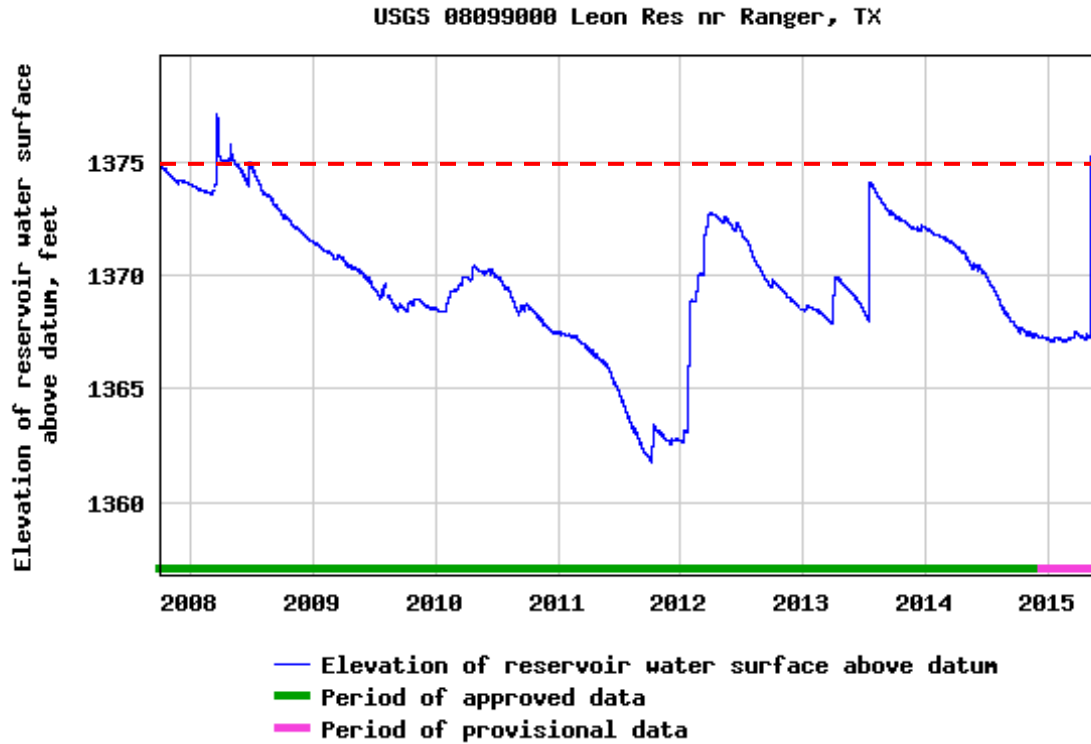


Figure 1. Daily reservoir elevations (ft. above MSL) for Leon Reservoir, Eastland County, Texas, April 2010-April 2015 (USGS 2015). Dashed line represents conservation pool level.

Table 1. Characteristics of Leon Reservoir, Texas.

Characteristic	Description
Year constructed	1954
Controlling authority	Eastland County Water Supply District
County	Eastland
Reservoir type	Mainstream, Leon River
Shoreline Development Index	5.42
Conservation Pool Level (ft. above mean sea level)	1,375
Dead Pool Level (ft. above mean sea level)	1,320
River Basin	Brazos River
USGS 8-Digit HUC Watershed	12070201 (Leon)
Conductivity ( $\mu\text{S}/\text{cm}$ )	526
Carlson's Trophic State Index	50.82

Table 2. Boat ramp characteristics for Leon Reservoir, Texas, June 2015. Reservoir elevation at time of survey was 1,376 ft. above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft.)	Condition
Chock-a-Block	32.363183° -98.723665°	Y	20	1,363	Accessible
Dam Ramp (main)	32.364629° -98.676099°	Y	8	1,368	Accessible
Dam Ramp (low water)	32.366274° -98.677170°	Y	6	Unknown	Inaccessible; currently inundated

Table 3. Harvest regulations for Leon Reservoir, Texas.

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

Table 4. Stocking history of Leon Reservoir, Texas. FRY= &gt;1 in.; FGL = fingerling; ADL = adults.

Species	Year	Number	Size
Shad, Threadfin	1984	1,000	ADL
Bass, Florida Largemouth	1975	40,500	FGL
	1975	40,000	FGL
	1977	80,000	FGL
	1986	75,500	FRY
	1994	79,500	FGL
	2008	152,156	FGL
	2012	175,182	FGL
	Total	642,838	
Bass, Largemouth	1969	146,000	FGL
	1970	50,000	FGL
	Total	196,000	
Northern Pike x Muskellunge	1976	1,500	FGL
Bass, Palmetto (Striped x White Bass Hybrid)	1976	15,763	FGL
	1978	15,875	FGL
	1980	16,000	FGL
	Total	47,638	

Table 5. Percent (%) occurrence and associated 95% confidence intervals (parentheses) for structural habitat types encountered during the summer 2014 habitat survey, Leon Reservoir, Texas, 2014. Water level at time of survey was approximately 6 ft. below conservation pool level.

Habitat type	% of Entire Reservoir	% Shoreline
Rip rap	0.7 ( $\pm 1.3$ )	2.0 ( $\pm 3.9$ )
Bulkhead	0.7 ( $\pm 1.3$ )	2.0 ( $\pm 3.9$ )
Bedrock	2.0 ( $\pm 2.2$ )	6.0 ( $\pm 6.6$ )
Docks	2.0 ( $\pm 2.2$ )	4.0 ( $\pm 5.4$ )
Large boulders (610 mm+; 24+ in)	9.3 ( $\pm 4.7$ )	24.0 ( $\pm 11.8$ )
Silt	16.0 ( $\pm 5.9$ )	24.0 ( $\pm 11.8$ )
Small boulders (64-610 mm; 10-24 in)	17.3 ( $\pm 6.1$ )	44.0 ( $\pm 13.8$ )
Clay	19.3 ( $\pm 6.3$ )	26.0 ( $\pm 12.2$ )
Cobbles (64-256 mm; 2.5-10 in)	24.0 ( $\pm 6.8$ )	58.0 ( $\pm 13.7$ )
Pebbles (2-64 mm; 0.08-2.5 in)	29.3 ( $\pm 7.3$ )	62.0 ( $\pm 13.5$ )
Sand	49.3 ( $\pm 8.0$ )	82.0 ( $\pm 10.7$ )

Table 6. Percent (%) occurrence and associated 95% confidence intervals (parentheses) for vegetative species/ habitat types encountered during the summer 2014 habitat survey, Leon Reservoir, Texas, 2014. Water level at time of survey was approximately 6 ft. below conservation pool level.

Habitat type	% of Entire Reservoir	% Shoreline
Soft rush	0.7 ( $\pm 1.3$ )	2.0 ( $\pm 3.9$ )
Widgeon grass	0.7 ( $\pm 1.3$ )	2.0 ( $\pm 3.9$ )
Bulrush	1.3 ( $\pm 1.8$ )	4.0 ( $\pm 5.4$ )
Woody debris	1.3 ( $\pm 1.8$ )	2.0 ( $\pm 3.9$ )
Unknown grass ( <i>Panicum</i> spp.)	1.3 ( $\pm 1.8$ )	4.0 ( $\pm 5.4$ )
Stumps	1.3 ( $\pm 1.8$ )	4.0 ( $\pm 5.4$ )
Illinois pondweed	6.7 ( $\pm 4.0$ )	16.0 ( $\pm 10.2$ )
Black willow	6.7 ( $\pm 4.0$ )	16.0 ( $\pm 10.2$ )
Dead vegetation	12.7 ( $\pm 5.3$ )	28.0 ( $\pm 12.5$ )
Water willow	13.3 ( $\pm 5.4$ )	36.0 ( $\pm 13.3$ )
<i>Chara</i> sp.	14.0 ( $\pm 5.5$ )	32.0 ( $\pm 12.9$ )
Dead trees	27.3 ( $\pm 7.1$ )	32.0 ( $\pm 12.9$ )
Non-descriptive/featureless	34.0 ( $\pm 7.6$ )	0 ( $\pm 0$ )

Table 7. Total directed effort (hours) and percent (%) directed angler effort by species or species group from March-August 2013, Leon Reservoir, Texas.

Species or Species Group	Directed Effort (hours)	% of Directed Effort
Catfishes	609.7	5.5
Largemouth Bass	9,516.1	86.2
White Bass	92.4	0.8
Crappie	719.4	6.5
Anything	100.7	0.9

## Gizzard Shad

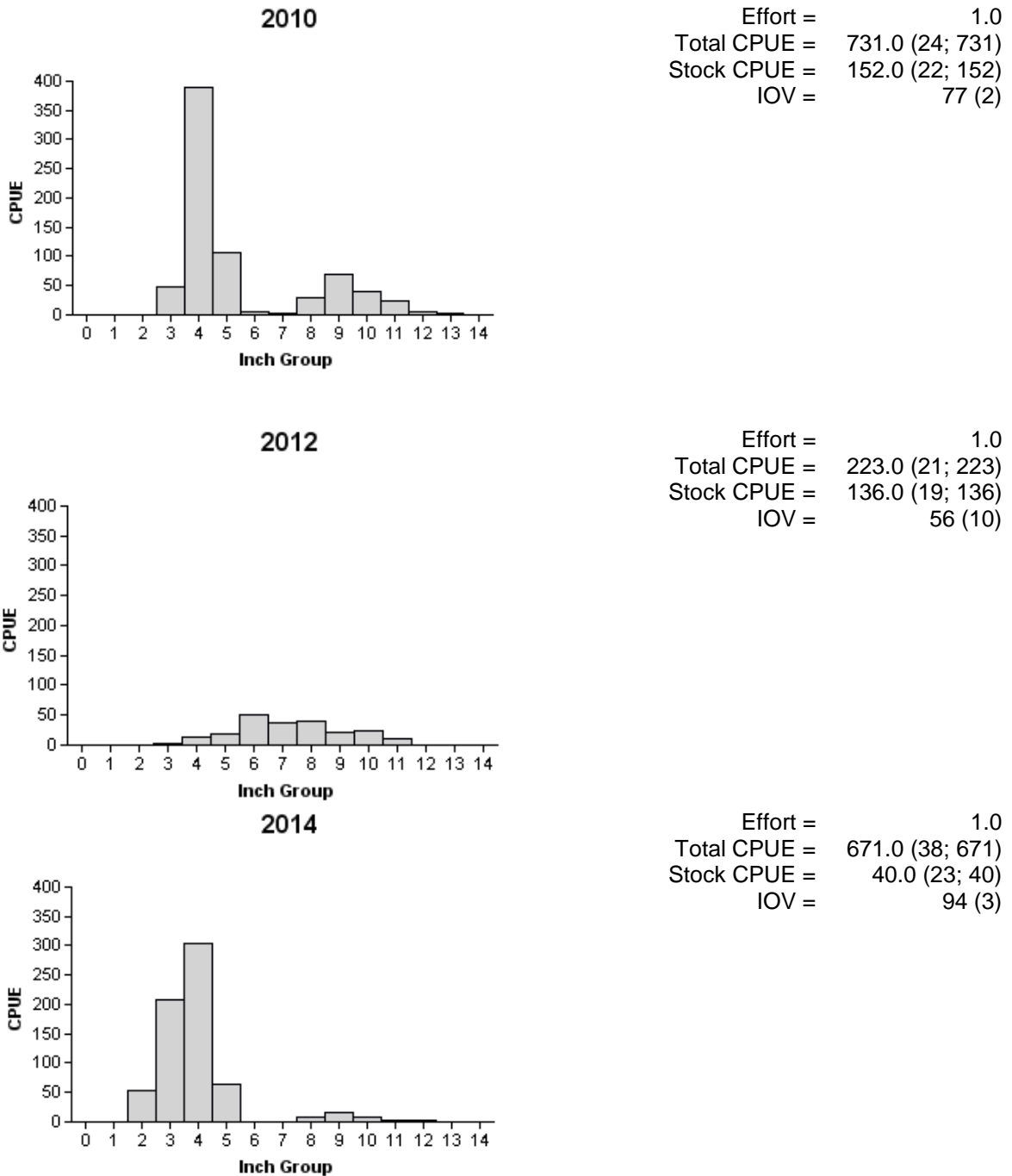


Figure 2. Comparison of the number of Gizzard Shad caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Leon Reservoir, Texas, 2010, 2012, and 2014.

## Bluegill

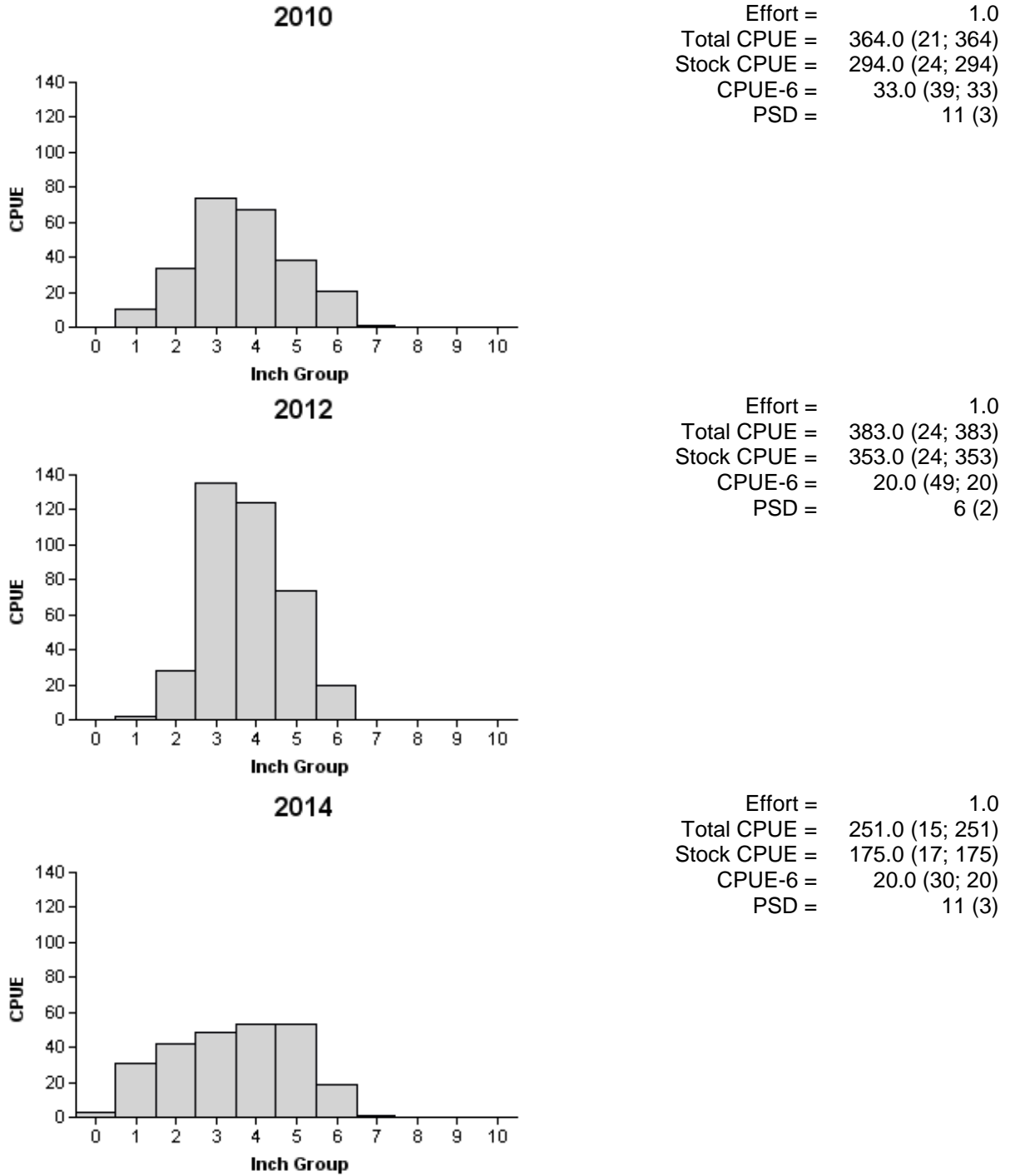


Figure 3. Comparison of the number of Bluegill caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Leon Reservoir, Texas, 2010, 2012, and 2014.



## Channel Catfish

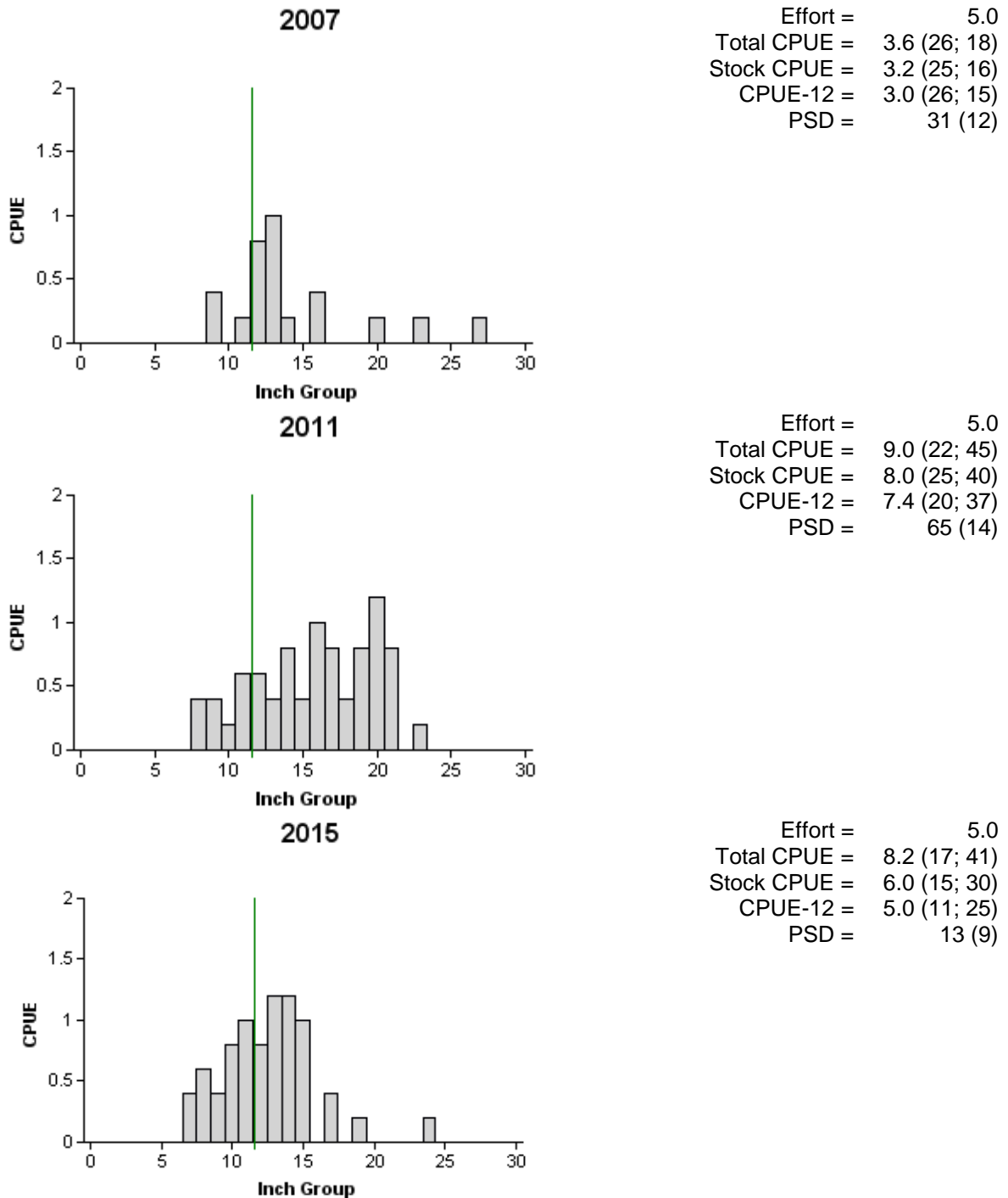


Figure 4. Comparison of the number of Channel Catfish caught per net night (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Leon Reservoir, Texas, 2007, 2011, and 2015. Vertical line denotes 12-in. minimum length limit.

## Channel Catfish

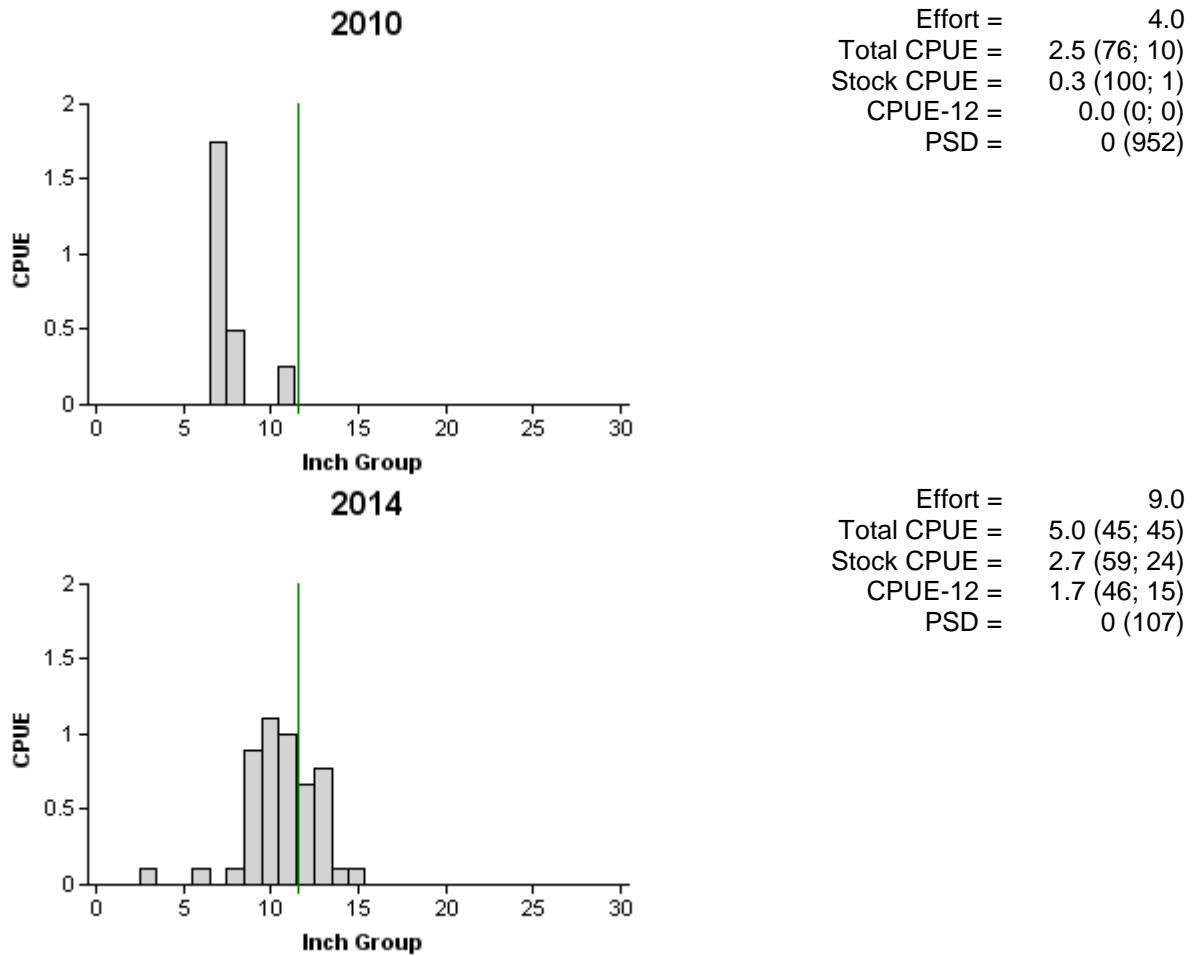


Figure 5. Comparison of the number of Channel Catfish caught per tandem hoop net series (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for summer tandem hoop netting surveys, Leon Reservoir, Texas, 2010 and 2014. Vertical line denotes the 12-in. minimum length limit.

## Catfishes

Table 8. Creel survey statistics for crappie at Leon Reservoir, Texas, from March 1– August 31, 2013. Catch rate is for all anglers targeting catfishes. Harvest is presented as the estimated number of catfish harvested by all anglers. Catfish released is presented as estimated total number of fish released and the percent of legal-sized fish released. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	3/2013-8/2013
Mean surface area (acres)	
Spring 2013	1,219
Summer 2013	1,348
Directed angling effort (h)	609.7 (55)
Angling effort/acre	0.5 (55)
Catch rate (number/h)	0.2 (61)
Harvest	171.5 (82)
Release	46.1 (381)
Percent legal released	16.4

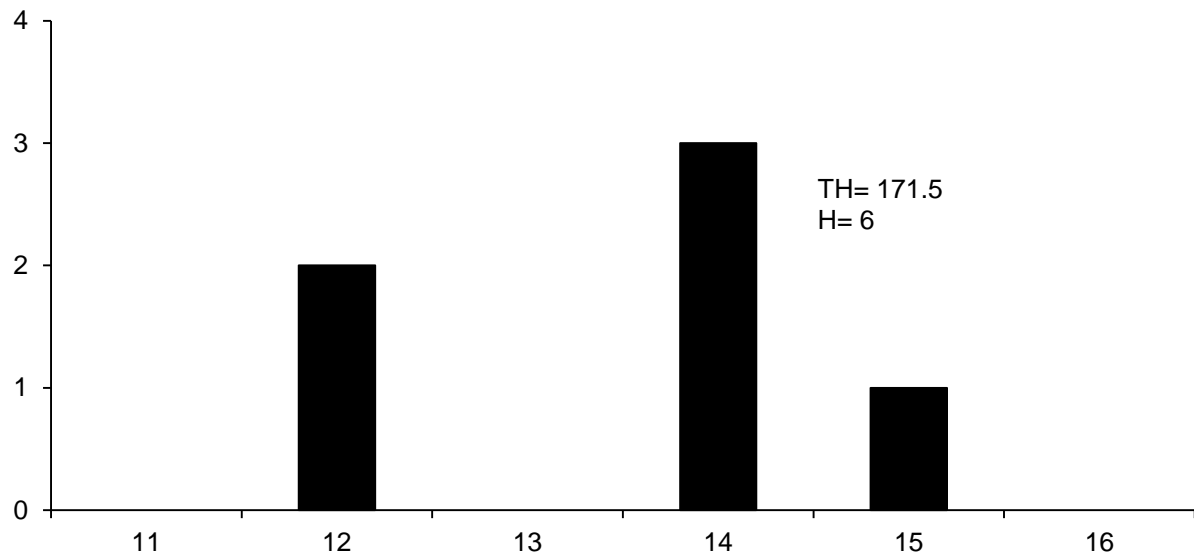


Figure 6. Length frequency distributions of Channel Catfish measured and observed as harvested (H) in the May-August 2013 creel survey, Lake Leon Reservoir, Texas. During the creel, 171.5 fish were estimated harvested (TH) by anglers.

## White Bass

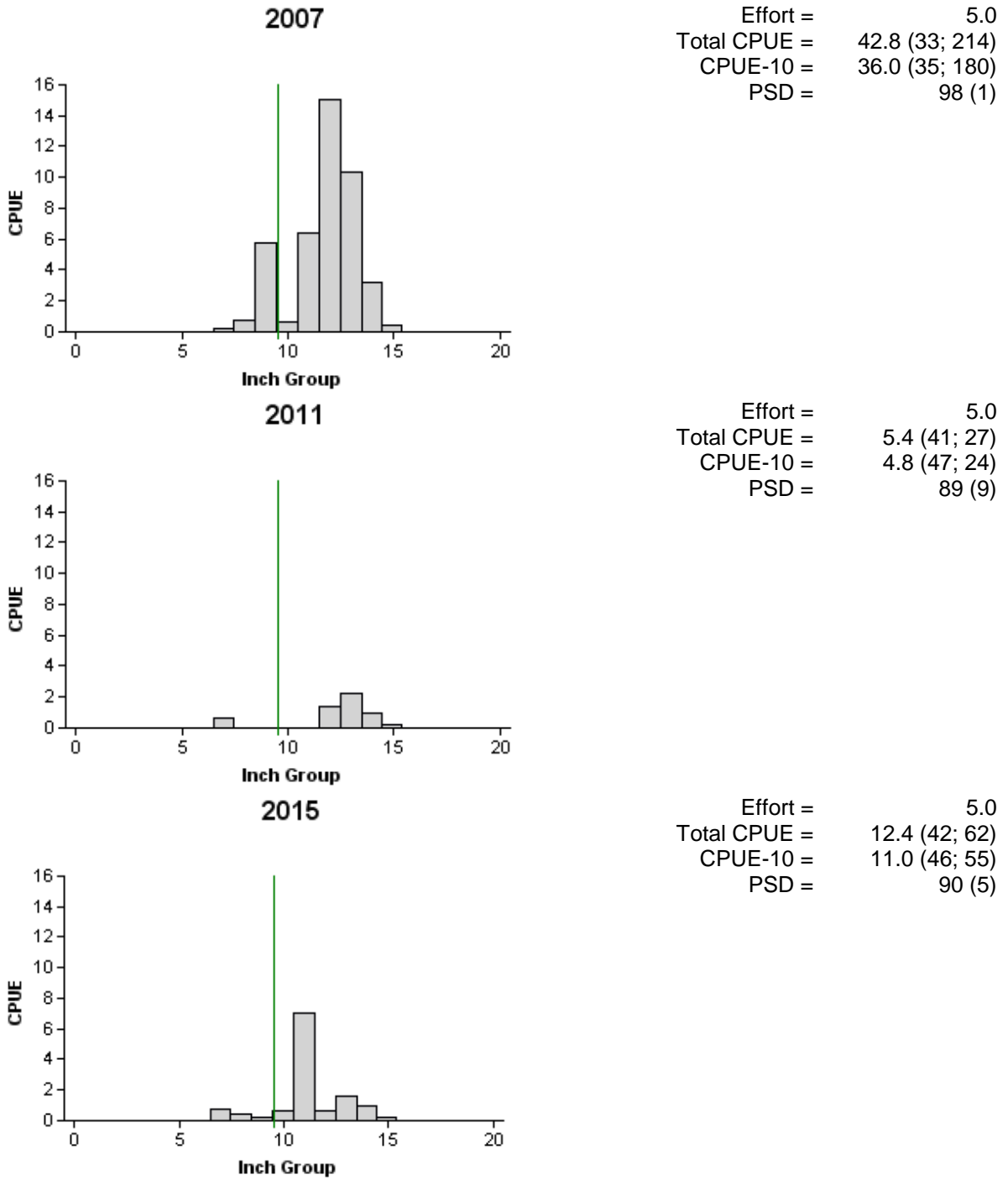


Figure 7. Comparison of the number of White Bass caught per net night (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Leon Reservoir, Texas, 2007, 2011, and 2015. Vertical line denotes 10-in. minimum length limit.

## Largemouth Bass

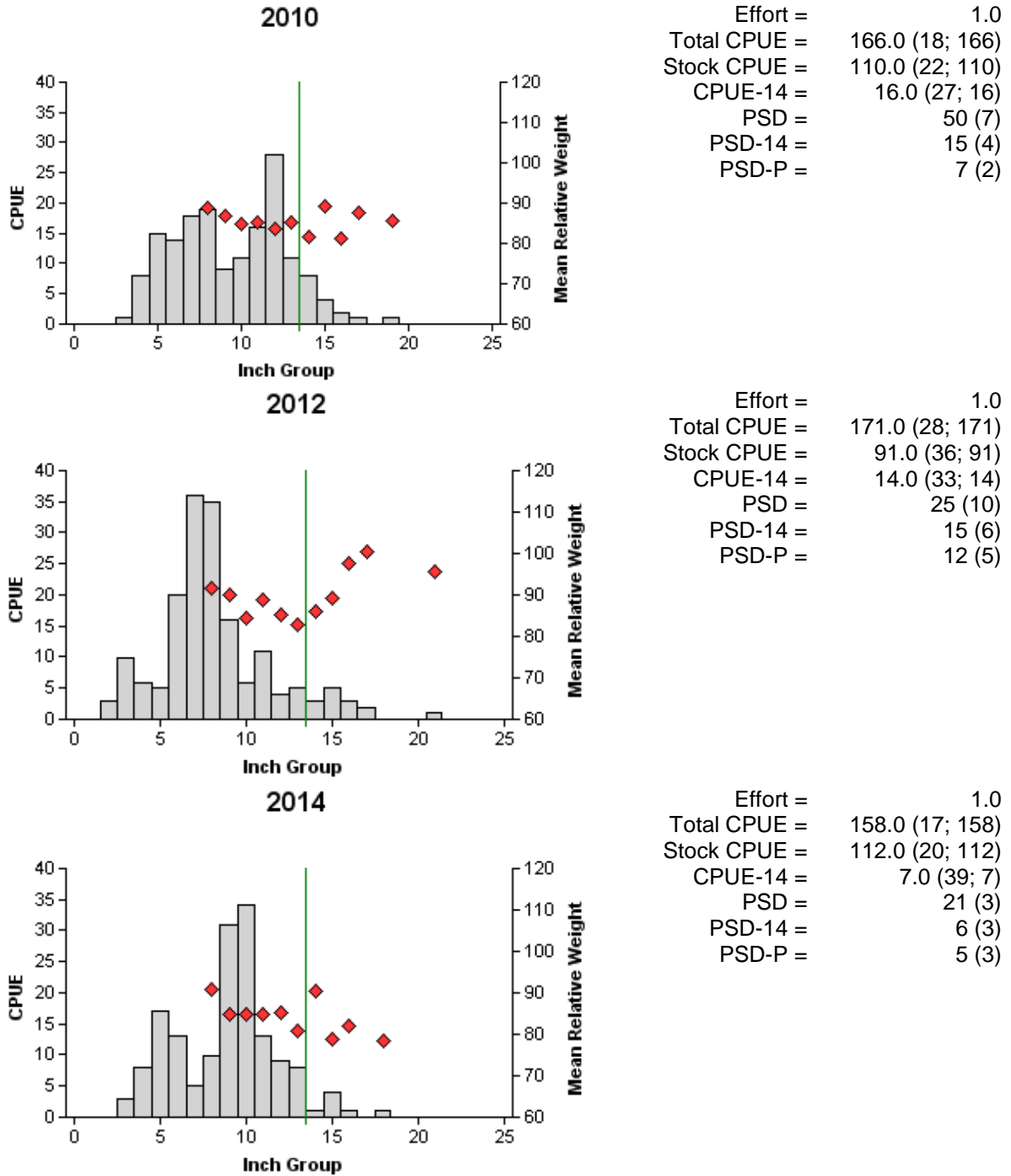


Figure 8. Comparison of the number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure) for fall electrofishing surveys, Leon Reservoir, Texas, 2010, 2012, and 2014. Vertical line denotes 14-in. minimum length limit.

## Largemouth Bass

Table 9. Creel survey statistics for Largemouth Bass at Leon Reservoir, Texas, from March 1-August 31, 2013. Effort is reported as total hours spent by all anglers targeting Largemouth Bass. Harvest is the estimated number of fish kept by anglers, and the number of fish released is reported. Relative standard errors (RSE) are in parentheses. The average surface area during the spring 2013 period was 1,219 acres; the surface area during summer 2013 was 1,348 acres.

Creel survey statistic	3/2013-8/2013
Mean surface area (acres)	
Spring 2013	1,219
Summer 2013	1,348
Directed angling effort (h)	9,516.1 (22)
Total angling effort/acre	7.4 (22)
Catch rate (number/h)	0.5 (26)
Harvest	0.0 (0)
Release	4,321.0 (47)
Legal released	2,048.7 (48)
Released below length-limit	2,272.3 (49)
Percent legal released	100

## Largemouth Bass

Table 10. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Leon Reservoir, Texas, 1992, 1995, 2000, 2002, 2004, 2006, and 2014. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB. Genetic composition was determined by with micro-satellite DNA analysis from 2005 to 2014 and by electrophoresis for previous years.

Year	Sample Size	Number of fish			% FLMB alleles	%FLMB
		FLMB	Intergrade	NLMB		
1992	30	0	12	18	9.0	0.0
1995	30	1	16	13	26.7	3.3
2000	30	1	16	13	20.8	3.3
2002	49	2	36	11	34.7	4.1
2004	32	1	22	9	28.0	3.1
2006	394	0	337	57	29.3	0.0
2014	30	1	29	0	45.0	3.3

## White Crappie

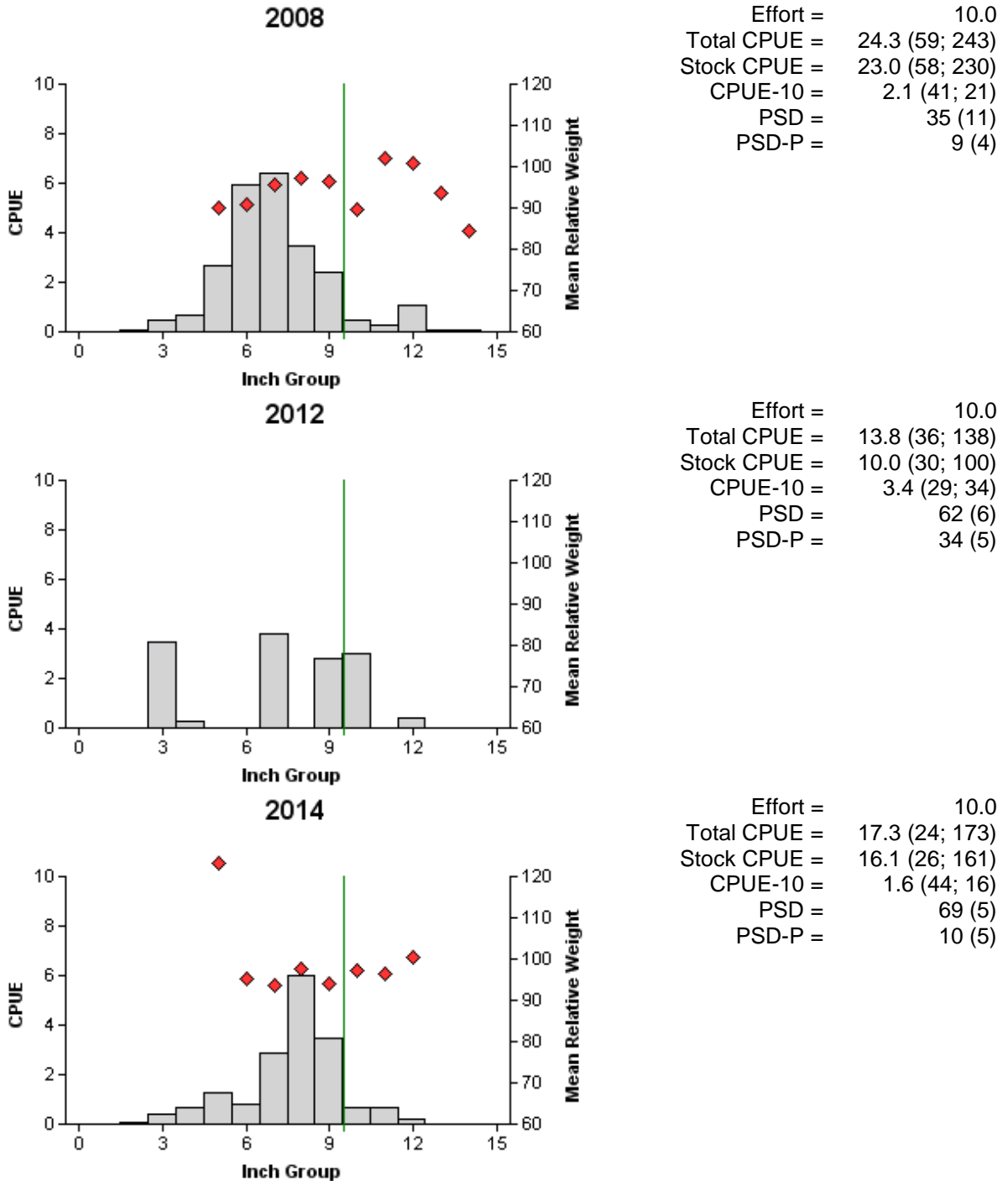


Figure 9. Comparison of the number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Leon Reservoir, Texas, 2008, 2012, and 2014. Vertical line denotes 10-in. minimum length limit. Mean relative weights were not calculated for 2012.



## Black Crappie

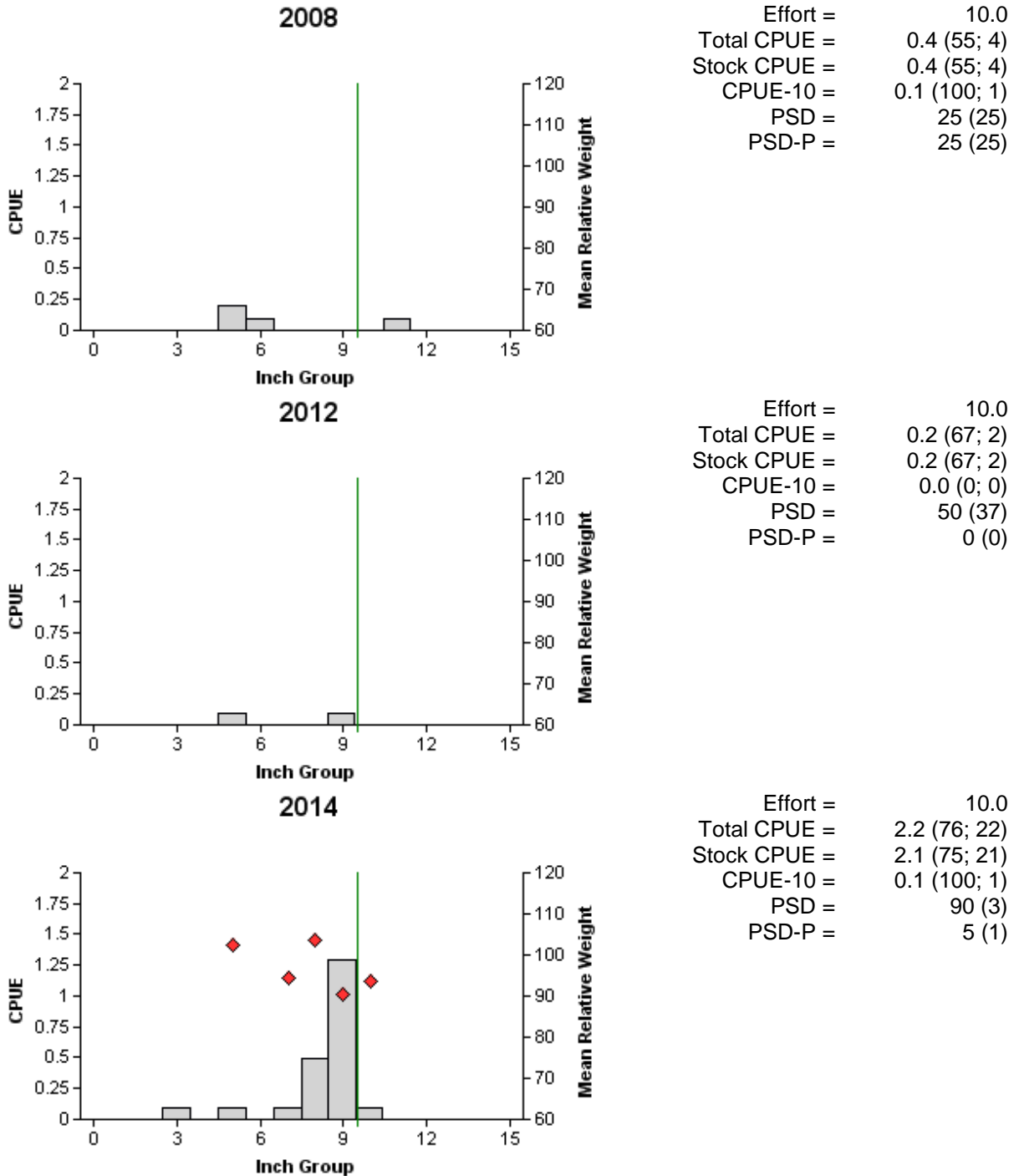


Figure 10. Comparison of the number of Black Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Leon Reservoir, Texas, 2008, 2012, and 2014. Vertical line denotes 10-in. minimum length limit. Mean relative weights not calculated for 2008 and 2012.

## Crappie

Table 11. Creel survey statistics for crappie at Leon Reservoir, Texas, from March 1– August 31, 2013. Catch rate is for all anglers targeting crappie. Harvest is presented as the estimated number of crappie harvested by all anglers. Crappie released is presented as estimated total number of fish released and the percent of legal-sized fish released. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	3/2013-8/2013
Mean surface area (acres)	
Spring 2013	1,219
Summer 2013	1,348
Directed angling effort (h)	719.4 (61)
Angling effort/acre	0.9 (61)
Catch rate (number/h)	0.6 (13)
Harvest	100.9 (140)
Release	395.8 (241)
Percent legal released	13.9

Table 12. Proposed sampling schedule for Leon Reservoir, Texas. Survey period is June through May. Gill netting surveys are conducted in the spring, tandem hoop netting surveys are conducted in the summer, and electrofishing and trap netting surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

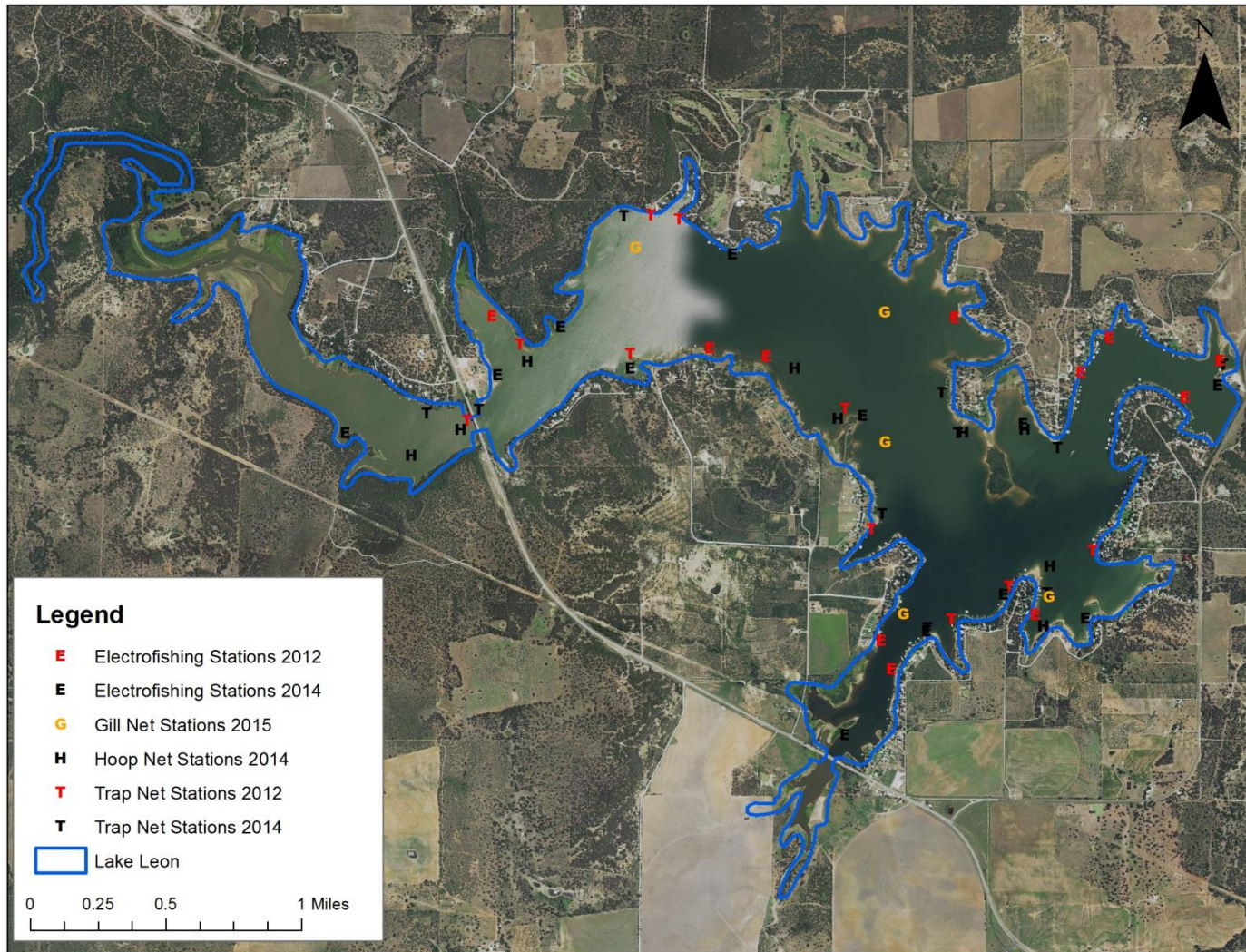
Survey year	Electrofishing	Trap Netting	Gill Netting	Habitat/ Vegetation	Access	Creel survey	Report
2015-2016				/A			
2016-2017	A			/A			
2017-2018				/A			
2018-2019	S	S	S	S/S	S		S

**APPENDIX A**

Number (N) and catch rate (CPUE) of all species collected from all gear types from Leon Reservoir, Texas, 2014-2015. Sampling effort was 1 hour for electrofishing, 5 net nights for gill netting, 10 net nights for trap netting, and 9 tandem hoop netting series.

Species	Electrofishing		Gill Netting		Trap Netting		Hoop Netting	
	N	CPUE	N	CPUE	N	CPUE	N	CPUE
Gizzard Shad	671	671.0						
Threadfin Shad	65	65.0						
Bullhead Minnow	2	2.0						
Channel Catfish			41	8.2			45	5.0
Flathead Catfish			1	0.2				
White Bass			62	12.4				
Green Sunfish	16	16.0						
Warmouth	6	6.0						
Orange-spotted Sunfish	41	41.0						
Bluegill	251	251.0						
Longear Sunfish	265	265.0						
Redear Sunfish	36	36.0						
Largemouth Bass	158	158.0						
White Crappie			5	1.0	173	17.3	18	2.0
Black Crappie			5	1.0	22	2.2	24	2.7

## APPENDIX B



Locations of trap netting (T), gill netting (G), tandem hoop netting (H), and electrofishing (E) stations at Leon Reservoir, Texas, 2012, 2014, and 2015.