

PERFORMANCE REPORT

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INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2015 Fisheries Management Survey Report

**Calaveras Reservoir**

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## SURVEY AND MANAGEMENT SUMMARY

Fish populations were surveyed using electrofishing and gill nets during the 2012-2016 monitoring period. A vegetation survey was conducted during the study period. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir Description:** Calaveras Reservoir is a 3,110-acre power plant cooling reservoir located in Bexar County inside Loop 1604 southeast of San Antonio. A near-constant water level was maintained by pumping from the San Antonio River. Thousand Trails Management Services regulates access to public facilities at the site. Boat angler access was excellent. Aquatic plant coverage in the reservoir was primarily bulrush. Exotic Blue Tilapia and armored catfish populations have become established in the reservoir.
- **Management History:** Important sport fishes included Red Drum, hybrid Striped Bass, and Blue and Channel Catfishes. The Red Drum and Hybrid Striped Bass populations were maintained by frequent fingerling stockings (by TPWD). Sunshine bass (4-6 inch total length), purchased by City Public Service Energy, were stocked in 2014 and 2015. Northern Largemouth Bass (NLMB) were stocked to increase genetic diversity; however stocking success was short-lived. Angler harvest of all sport fishes, except Red Drum, were regulated according to statewide size and daily bag limits. The Largemouth Bass regulation was changed from a minimum size limit of 18 inches to statewide regulations September 1, 2015. Harvest of Red Drum is restricted to a 3-fish daily bag and 20-inch minimum size limit.
- **Fish Community**
  - **Prey species:** Gizzard Shad, Threadfin Shad, and Bluegill were the primary prey species and were present in sufficient numbers and sizes for utilization by predators.
  - **Catfishes:** The reservoir contained abundant populations of Blue and Channel Catfish which supported a popular fishery. Since 2006, Blue Catfish relative abundance has increased and Channel Catfish relative abundance has decreased.
  - **Hybrid Striped Bass:** Relative abundance varied somewhat from year to year during the survey period, but have declined since 2000. However, the stockings have provided a consistently popular fishery for this species.
  - **Largemouth Bass:** Relative abundance remained low and only a negligible fishery exists.
  - **Red Drum:** This introduced species has supported a popular fishery and abundance has increased since 2007.
- **Management Strategies:** Continue to stock hybrid Striped Bass and Red Drum to support these popular fisheries. Assess growth and survival of Red Drum via otoliths collected from angler caught fish. Conduct biennial gill net surveys, a habitat survey and Fall daytime electrofishing survey in 2019, and a 6-month creel survey in 2017.

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INTRODUCTION

This document is a summary of Calaveras Reservoir fisheries data collected from 2012 to 2016. Its purpose is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other species of fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the current data for comparison.

### *Reservoir Description*

Calaveras Reservoir is a 3,110-acre power plant cooling reservoir located on Chupaderas and Calaveras creeks in the San Antonio River Basin in Bexar County inside Loop 1604 southeast of San Antonio. It was constructed in 1969 and is owned and operated by City Public Service Energy (CPSE; Table 1) and a near-constant water level was maintained by pumping from the San Antonio River. Angler access and recreational facilities are managed and maintained by Thousand Trails Management Services and include two boat ramps, a handicapped accessible fishing pier, a fish cleaning station, multiple picnic, camping, and restroom facilities, and a designated kayak and canoe launching area. Aquatic plant coverage in the reservoir was primarily bulrush and comprised 2% of the total surface area. Exotic Blue Tilapia and armored catfish populations have become established in the reservoir.

### *Angler Access*

Calaveras Reservoir has two public boat ramps, an accessible fishing pier, and a designated small kayak launching area. Two multilane ramps were renovated in 2007 using Texas Parks and Wildlife Department (TPWD) Boating Access Grant funds. Shoreline angler access is also excellent and includes an accessible fishing pier (Table 2).

### *Management History*

**Previous management strategies and actions:** Management strategies and actions from the previous survey report (Dennis and Myers 2012) included:

1. Annually stock Red Drum at 200 fingerlings/acre.  
**Action:** Red Drum fingerlings were stocked at or near the recommended rate (200/acre) in 2012, 2013, 2014, and 2015 (Table 4).
2. Annually stock Palmetto Bass at 15 fingerlings/acre. Conduct biennial gill net surveys to monitor trends in palmetto bass population.  
**Action:** Palmetto bass fingerlings were stocked at the recommended rate (15/acre) in 2013 and 2014 and 4-6 inch sunshine bass were stocked at the rate of 4/acre in 2014 and 2015 (Table 4). Gill net surveys were conducted in 2012, 2014, and 2016.
3. Recommend changes to Largemouth Bass regulations from the current 18-inch minimum length limit to a statewide 14-inch minimum length limit (MLL) in 2013.  
**Action:** Minimum length limit of Largemouth Bass changed to 14 inches September 1, 2015.
4. Conduct surveys for invasive aquatic species and inform anglers to take measures to prevent the inadvertent transport of those species to other waterbodies.  
**Action:** No invasive aquatic vegetation observed during routine vegetation and fish population surveys. Installed a "Clean, Drain, Dry" sign at the reservoir entrance.

**Harvest regulation history:** Since impoundment, harvest of all sport fishes except Largemouth Bass and Red Drum were managed according to statewide regulations (Table 3). Largemouth Bass were managed with a 14-18 inch slot limit with a 3-fish daily bag limit from 1981-1987. In 1988, the slot limit was changed to 14-21 inches. The slot limit was replaced in 1990 with an 18-

inch minimum length limit. The bag limit was raised to 5 fish in 1995. In 2015, the minimum length limit was changed to the statewide 14-inch MLL. Freshwater populations of Red Drum, including those in Calaveras Reservoir, are managed with a 20-inch MLL and 3 fish daily bag limit; The maximum size limit utilized for saltwater populations is not used in freshwater populations.

**Stocking history:** Various species, including non-native fishes, have been stocked into the reservoir. Hybrid Black x White Crappie and sub-adult White Crappie were stocked to re-introduce crappie to the reservoir. Crappie stockings were discontinued because of low stocking success. Orangemouth Corvina and Orangemouth Corvina-Speckled Trout hybrids were introduced into the reservoir to provide an additional sport fish. The Orangemouth Corvina and their hybrids stockings were discontinued because of their ability to hybridize with Speckled Trout and the proximity of Calaveras to the Texas Coast. Northern Largemouth Bass (NLMB) were stocked to increase genetic diversity; however stocking success was short-lived. During the last two decades Red Drum and palmetto bass were the primary species stocked. Beginning in 2014, CPSE began purchasing 13,000 4-6 inch sunshine bass from a private supplier for stocking into the reservoir. The complete stocking history is contained in Table 4.

**Vegetation/habitat history:** In 1999 and 2003, various native aquatic species were planted in the reservoir. Only bulrush remains from those plantings.

**Water transfer:** No inter-basin transfers are known to exist.

## METHODS

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

*Electrofishing* – Largemouth Bass, Sunfishes, Gizzard Shad, and Threadfin Shad were collected by daytime electrofishing (1 hour at 12, 5-min stations). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing.

*Gill netting* – Blue Catfish, Channel Catfish, hybrid Striped Bass, and Red Drum were collected by gill netting (10 net nights at 10 stations). CPUE for gill netting was recorded as the number of fish caught per net night (fish/nn). Red Drum otoliths (N=72) were collected from fish sampled by angling by TPWD staff in the restricted hot water discharge and from angler-caught fish at the cleaning station.

*Statistics* – Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD), terminology modified by Guy et al. 2007], and condition indices [relative weight ( $W_r$ )] were calculated for target fishes according to Anderson and Neumann (1996). Proportional size distribution for Palmetto Bass PSD was calculated according to Dumont and Neely (2011) for samples collected in 2012 and 2014 and PSD-12 was calculated for hybrid Striped Bass sampled in 2016. 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.

*Habitat* – A vegetation survey was conducted in accordance with Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015). As no significant shoreline modifications took place since the last shoreline structural survey (2011), it was not updated.

*Creel survey* – Three creel surveys between 1999 and 2010 were conducted (Dennis and Myers 2012) according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual, revision in use at time of sampling). Results of these surveys are included for reference. Voluntary release rates were calculated as:  $(\text{Number of legally harvestable sized fish released}) / [(\text{Number of harvested fish}) + (\text{Legally-harvestable size fish released})] \times 100$  (Myers et al. 2008).

## RESULTS AND DISCUSSION

**Habitat:** As no significant manmade changes were made to the shoreline, the shoreline survey was not updated; the results of the previous survey can be found in the previous report (Dennis and Myers 2012). In 2015, bulrush was the predominant aquatic vegetation species present and covered approximately 2% of the reservoir (Table 6). Cattails were also observed along the shoreline, but their occurrence was sparse and did not occur at any of the random survey sites.

**Creel:** According to the most recent creel survey (2010), catfishes and Red Drum have been the most sought after (38% and 37% of directed fishing effort, respectively), followed by ‘anything’ (19%; Table 7). Anglers targeting both Red Drum and Palmetto Bass were recorded as targeting ‘anything’. Angling effort is considerable at this reservoir; in 2010 fishing effort expended by boat anglers was 48.4h/acre (Table 8). Likewise, direct expenditures by boat anglers were substantial at \$756,654 in 2010 (Table 8).

**Prey species:** Daytime electrofishing catch rate of Gizzard Shad was 12.0 fish/h and IOV was 75; because this sample was collected with daytime electrofishing, these catch rates cannot be compared to previous nighttime samples (Figure 1). Catch rates of Gizzard Shad in the 2009 and 2011 night time samples were 620.0 fish/h and 86.0 fish/h respectively and IOVs were 96 in 2009 and 52 in 2011 (Figure 2). Threadfin Shad were present but since most Threadfin Shad are too small to be collected in 1-inch mesh gill net webbing or ½-inch dip net bags, catch rates were low (see Appendix B). Bluegill CPUE was 26.0 fish/h in the 2015 daytime sample (Figure 3). Catch rates of Bluegill were 181.0 fish/h in 2009 and 399.0 fish/h in 2011 (Figure 4). An ample prey base exists in the reservoir as indicated by excellent body condition and growth of sport fishes.

**Blue Catfish:** Relative abundance of Blue Catfish decreased over the past three surveys from 16.6 fish/nn in 2012 to 12.8 fish/nn in 2014 to 6.0 fish/nn in 2016 and size structure shifted to an increased proportion of larger fish as shown by PSD which increased from 30 to 80 (Figure 5). All of the collected fish in 2014 and 2016 exceeded the 12-inch MLL (Figure 5). In 2016, mean relative weights were above 90 for most inch groups (Figure 5). Blue Catfish relative abundance has shown a general increase since 2006 (Figure 6). The average angler catch rate of all catfishes, combined, by boat anglers in 2010 was 0.85 fish/h and anglers harvested an estimated 1,446 Blue Catfish (Table 9). Blue Catfish up to 27 inches were observed as harvested in the 2010 creel survey (Figure 7). The current Blue Catfish waterbody record is a 36.2 pound fish caught in 2014.

**Channel Catfish:** Relative abundance has decreased steadily over the last three samples with gill net CPUEs of 33.0 fish/nn in 2012, 8.2 fish/nn in 2014, and 3.6 fish/nn in 2016 (Figure 8). This declining trend began in 2008 (Figure 9). Size structure of the population has varied with PSDs ranging between 58 and 98 from 2012-2016; PSD was 69 in the 2016 survey (Figure 8). The majority of the fish collected in all samples since 2012 exceeded the 12-inch MLL (Figure 8). Mean relative weights were variable (Figures 8). Channel Catfish provided a popular fishery at the reservoir: in 2010, boat anglers harvested 47,542 Channel Catfish (Table 10). Channel Catfish up to 24 inches were observed as harvested during the 2010 creel survey (Figure 10). The current waterbody record is 7.9 pounds was caught in 2013.

**Hybrid Striped Bass:** Relative abundance of hybrid Striped Bass varied over the past three samples, from a low of 0.6 fish/nn to a high of 3.6 fish/nn in 2014; 1.3 fish/nn were captured in 2016 (Figure 11). Catch rates have generally declined since 1999 (Figure 12). Estimated angler harvest was 669 palmetto bass (Table 9). Fish up to 22 inches and as short as 14 inches were

harvested (Figure 13). No waterbody record for palmetto bass exists. A sign was posted at the reservoir to address the sub-legal harvest issue (see Appendix C).

**Largemouth Bass:** Only four Largemouth Bass were collected during the latest electrofishing survey indicating they continue to exist in the reservoir (see Appendix B), but only provide a negligible fishery.

**Red Drum:** Gill net catch rate of Red Drum has varied over the past three surveys (5.8 fish/nn in 2012, 0.0/nn in 2014, and 2.7/nn in 2016 (Figure 14), but shows a general increasing trend since 2007 (Figure 15). Size structure was similar in 2012 and 2016 (Figure 14). Red Drum grow to the MLL (20 inches) in two years (Figure 16). Directed fishing effort for Red Drum was greater than 55,000 hours in 2010 (Table 12). Only a small percentage of legally harvestable fish caught were released (Table 12). Fish up to 37 inches were observed as harvested in the 2010 creel survey, and some harvest of under-sized fish was documented (Figure 17). The current waterbody record is a 30-pound fish caught in 2008.

**Fisheries Management Plan for Calaveras Reservoir, Texas**

Prepared-July 2016

**ISSUE 1:** Red Drum are a popular sport fish among anglers and stocking is required to sustain their population because they do not reproduce in the reservoir.

**MANAGEMENT STRATEGIES**

1. Annually stock Red Drum at 200 fingerlings/acre.
2. Assess growth and survival of stocked fish to aid in developing appropriate management strategies.

**ISSUE 2:** Palmetto bass are a popular sport fish among anglers and stocking is required to sustain their population because they do not reproduce in the reservoir. However, the population seems to be declining. This could be from missing year classes from missed stockings, poor stocking success, or from increased water temperatures.

**MANAGEMENT STRATEGIES**

1. Annually stock 13,000 Sunshine Bass provided by CPSE.
2. Monitor population trends with biennial gill netting to determine if stockings should continue.

**ISSUE 3:** Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels (*Dreissena polymorpha*) can multiply rapidly and attach themselves to any available hard structure, restricting water flow in pipes, fouling swimming beaches and plugging engine cooling systems. Giant Salvinia (*Salvinia molesta*) and other invasive vegetation species can form dense mats, interfering with recreational activities like fishing, boating, skiing and swimming. The financial costs of controlling and/or eradicating these types of invasive species are significant. Additionally, the potential for invasive species to spread to other river drainages and reservoirs via watercraft and other means is a serious threat to all public waters of the state.

**MANAGEMENT STRATEGIES**

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



## Objective-Based Sampling Plan and Schedule

Sport fish, forage fish, and other important fishes : Sport fishes in Calaveras Reservoir include Red Drum, Hybrid Striped Bass, Blue Catfish, and Channel Catfish. Known important forage species include Bluegill and Gizzard Shad.

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

**Gizzard Shad and Bluegill:** Gizzard Shad and Bluegill are the primary forage fishes at Calaveras Reservoir. While CPUE of both species is variable, major changes in their relative abundances can be indicated in CPUE trend data. Sampling of these species will be done through day time random electrofishing at 12 5-minute stations. This should provide adequate CPUE precision ( $RSE < 25$ ) of Gizzard Shad and Bluegill to detect major changes in relative abundance. No additional effort will be expended to increase the number of Bluegill or Gizzard Shad collected or reduce RSEs. Sampling will occur once every four years and the next sample will be fall of 2019.

**Blue and Channel catfishes:** Catfishes are consistently the most sought after fish at Calaveras Reservoir. Our objective is to continue to monitor for large-scale population changes of both species. This will be done concurrently with our hybrid striped bass sampling. Data from previous years predicted the effort to achieve an  $RSE$  of  $CPUE$ -Stock  $< 25$  with 95% confidence to be five stations for both species.

**Hybrid Striped Bass:** Both palmetto bass and sunshine bass have been stocked in this reservoir. At least one of these species has been stocked on a near annual basis. Angling effort for this fish has varied throughout the years, likely based on population size as a result of stocking success. Our objective is to monitor for large-scale population changes and determine general stocking success. Sampling to collect  $\geq 50$  8-inch and larger hybrid Striped Bass for size structure analysis will consist of five gill nets set at random sites in the reservoir. If that target is not reached, an additional five nets will be set at randomly selected stations. Sampling will cease after 10 nets. Stocking success will be assessed through otoliths collected from fish collected by gill netting for size structure analysis. Sampling will occur biennially beginning spring 2018.

**Red Drum:** Red Drum are one of the most popular game fishes at Calaveras Reservoir. Unfortunately, we have been ineffective at sampling them consistently. Our objectives are to collect angler utilization data to track the popularity of the fishery and size structure of harvested fish and to collect age and growth data from angler harvested fish to monitor growth rates. The angler utilization and size structure of harvested fish will be collected through a six month creel survey conducted from January through June, 2017. Age and growth structures (otoliths) will be collected from angler harvested fish at the cleaning station during the creel survey. Otoliths from sub-legal ( $< 20$  inches) Red Drum will be collected by TPWD staff in January and February from the hot water cooling basin of the power plant.

### Low Density fisheries:

**Largemouth Bass:** Based on historic electrofishing and angler surveys, Largemouth Bass are not abundant in the reservoir, and only minimal effort is expended by anglers' targeting this species. Their presence/absence will be documented during electrofishing surveys for Gizzard Shad and Bluegill and their popularity as a sportfish will be monitored through our creel survey. Any significant changes observed in those surveys will be addressed by additional sampling, as needed.

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Table 1. Characteristics of Calaveras Reservoir, Texas.

Characteristic	Description
Year constructed	1969
Controlling authorities	City Public Service Energy and Thousand Trails Management Services, Inc.
County	Bexar
Reservoir type	Tributary
Shoreline Development Index	5.96
Conductivity	1,561 $\mu$ mhos/cm

Table 2. Boat ramp, kayak launch, and fishing pier characteristics for Calaveras Reservoir, Texas, August, 2015. Reservoir elevation at time of survey was 485 feet above mean sea level.

<i>Boat ramp</i>	<i>Latitude Longitude (dd)</i>	<i>Public</i>	<i>Parking capacity (N)</i>	<i>Elevation at end of boat ramp (ft)</i>	<i>Condition</i>
North Ramp	29.29180 -98.29946	Y	48	Unknown	Excellent, no access issues
South Ramp	29.28977 -98.29897	Y	41	Unknown	Excellent, no access issues
Kayak launch area	29.28256 -98.29687	Y	20	Not Applicable	Excellent, no access issues
Fishing pier	29.29485 -98.29603	Y	34	Not Applicable	Excellent, no access issues

Table 3. Fish harvest regulations for Calaveras Reservoir, Texas.

Species	Bag Limit	Length limit (inches)
Catfish: Channel and Blue catfish, their hybrids and subspecies	25 (in any combination)	12-inch minimum
Catfish, Flathead	5	18-inch minimum
Bass, Hybrid Striped	5	18-inch minimum
Bass, Largemouth	5	14-inch minimum
Drum, Red	3	20-inch minimum

Table 4. Stocking history of Calaveras Reservoir, Texas. Size categories are: FRY = &lt;1 inch; FGL = 1-3 inches; ADF = 4-6 inches, and ADL = adults.

Year	Number	Size	Year	Number	Size
	<u>Threadfin Shad</u>			<u>Palmetto Bass (continued)</u>	
1969	3,000	ADL	1997	51,789	FGL
	<u>Blue Catfish</u>		1998	51,943	FGL
1969	20,000	FGL	1999	24,452	FGL
1970	4,580	FGL	2000	51,000	FGL
1973	<u>19,596</u>	FGL	2002	26,240	FGL
Total	44,176		2004	46,716	FGL
	<u>Channel Catfish</u>		2005	46,643	FGL
1969	90,000	FGL	2006	569,569	FRY
1970	41,580	FGL	2007	46,997	FGL
1972	30,342	FGL	2008	46,042	FGL
2007	504	FGL	2009	47,000	FGL
2008	641	ADL	2010	621,715	FRY
2009	672	ADL	2011	25,300	FGL
2010	662	ADL	2013	46,701	FGL
2011	612	ADL	2014	<u>47,999</u>	FGL
2012	610	ADL	Total	2,744,996	
2013	672	ADL		<u>Green Sunfish x Redear Sunfish</u>	
2014	610	ADL	1969	13,500	FGL
2015	604	ADL	1970	48,500	FGL
2016	<u>613</u>	ADL	1971	38,575	FGL
Total	168,329		1972	<u>52,000</u>	FGL
	<u>Fathead Minnow</u>		Total	152,575	
1985	10,590	ADL		<u>Largemouth Bass</u>	
	<u>Sunshine Bass</u>		1969	36,500	FGL
2014	13,000	ADF	1973	4,400	FGL
2015	13,000	ADF	1987	10,707	FGL
Total	<u>26,000</u>		2003	32,653	FGL
	<u>Palmetto Bass</u>		2005	<u>34,502</u>	FGL
1975	34,500	FGL	Total	121,762	
1976	50,874	FGL		<u>Florida Largemouth Bass</u>	
1977	70,560	FGL	1974	80,950	FGL
1979	35,995	FGL	1978	79,919	FGL
1980	35,022	FGL	1988	22,636	FGL
1982	35,600	FGL	1989	13,000	FRY
1984	71,300	FGL	1990	22,500	FRY
1985	35,261	FGL	1991	62,754	FRY
1986	68,980	FGL	1992	177,000	FGL
1987	104,500	FGL	1993	172,800	FGL
1988	71,340	FGL	1994	175,120	FGL
1989	76,500	FGL	1995	172,000	FGL
1991	52,170	FGL	1998	175,937	FGL
1992	30,341	FGL	1999*	<u>100,910</u>	FGL
1994	52,550	FGL	Total	1,255,526	
1995	61,400	FGL			
1996	53,330	FGL			

\* Denotes genetically marked

Table 4 (Continued). Stocking history of Calaveras Reservoir, Texas. Size categories are: FRY = <1 inch; FGL = 1-3 inches; ADL = 4-6 inches, ADL = adults, and VAR = various sizes.

Year	Number	Size	Year	Number	Size
<u>White Crappie</u>			<u>Red Drum</u>		
1985	24,150	FGL	1984	207,575	VAR
1986	172,500	FGL	1987	738,000	FGL
1987	9,009	ADL	1989	2,700	FRY
2001	244	ADL	1991	787,255	VAR
2004	850	ADL	1993	385,026	VAR
Total	206,753		1994	318,078	FGL
<u>Black Crappie</u>			1995	349,693	FGL
1969	10,000	FGL	1996	281,253	FGL
<u>White x Black Crappie</u>			1997	305,159	FGL
1993	172,887	FGL	1999	433,350	FGL
1994	174,490	FGL	2000	437,629	FGL
1995	172,830	FGL	2001	455,813	FGL
1997	78,434	FGL	2002	199,694	FGL
Total	598,641		2003	607,487	FGL
<u>Spotted Sea Trout female x Orangemouth</u>			2004	635,302	FGL
<u>Corvina male</u>			2006	109,338	FRY
1984	14,500	FGL	2006	2,309	ADL
1985	24,550	FGL	2006	582,245	FGL
Total	39,050		2007	600,122	FGL
<u>Orangemouth Corvina female x Spotted</u>			2008	773,708	FGL
<u>Sea Trout male</u>			2009	220,542	FGL
1986	36,485	FGL	2010	655,141	FGL
<u>Orangemouth Corvina</u>			2011	621,002	FGL
1986	766,831	FGL	2012	508,881	FGL
1987	13	ADL	2013	651,978	FGL
Total	766,844		2014	688,606	FGL
			2015	627,706	FGL
			Total	12,185,592	

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

Gear/target species	Survey objective	Metrics	Sampling objective
<i>Creel survey</i>			
Red Drum	Angler utilization	Directed effort	6 month creel
	Size structure	Harvested length frequency	6 month creel
	Age and growth	Mean length at age	6 fish per 2-cm group from angler caught fish
<i>Gill netting</i>			
Hybrid Striped Bass <sup>a</sup>	Size structure	PSD, length frequency	N (8-inch) $\geq$ 50
	Age and growth	Mean length at age	N $\geq$ 50
Blue Catfish	Abundance	CPUE – Total	RSE $\leq$ 25
	Size structure	PSD, length frequency	Practical effort
Channel Catfish	Abundance	CPUE – Total	RSE $\leq$ 25
	Size structure	PSD, length frequency	Practical effort
<i>Electrofishing</i>			
Largemouth Bass	Presence	NA	Practical effort
Bluegill <sup>b</sup>	Abundance	CPUE – Total	Practical effort
Gizzard Shad <sup>b</sup>	Abundance	CPUE – Total	Practical effort

<sup>a</sup> No additional effort beyond the 10 gill nets will be expended to collect 50  $\geq$  8-inch hybrid Striped Bass..

<sup>b</sup> No additional effort will be expended to achieve an RSE  $\leq$  25 for CPUE of Bluegill and Gizzard Shad if not reached from designated electrofishing sampling effort. Instead, growth and body condition of other sport fishes can provide information on forage abundance and vulnerability

Table 6. Percent occurrence with lower and upper 95% confidence limits (CL) of aquatic habitat at 107 random sites in Calaveras Reservoir, Texas, August, 2015. Surface area at time of survey was 3,110 acres (full pool).

Structural habitat type	Percent occurrence	Lower CL	Upper CL
Open water	96	91	99
Flooded terrestrial vegetation	2	0	4
Native emergent vegetation <sup>1</sup>	2	0	7

<sup>1</sup> bulrush

Table 7. Percent directed angler effort by species and angler type (BT = boat anglers and BK = bank anglers) for Calaveras Reservoir, Texas. The 2000 creel was conducted from 12/1/1999 to 11/30/2000, the 2002 creel was conducted from 12/1/2001 5/31/2002 (six months), and the 2010 survey was conducted 6/1/2009 to 5/31/2010. Bank anglers were not surveyed in 2009-2010. Anglers indicating they were fishing for both Red Drum and Hybrid Striped Bass were recorded as targeting "Anything."

Species	2000		2002		2010
	BT	BK	BT	BK	BT
Catfishes	45	43	35	30	38
Palmetto bass	13	0	9	26	2
Largemouth Bass	8	2	2	2	4
Red Drum	9	4	21	0	37
Anything	23	50	33	42	19

Table 8. Total fishing effort (h) for all species and total direct angling expenditures by angler type (boat anglers = BT and bank anglers = BK) at Calaveras Reservoir, Texas. The 2000 creel survey was conducted from 12/1/1999 to 11/30/2000, the 2002 creel survey was conducted from 12/1/2001 5/31/2002 (six months), and the 2010 survey was conducted 6/1/2009 to 5/31/2010. Bank anglers were not surveyed in 2009-2010. Relative standard error is in parentheses.

Creel Survey Statistic	2000		2002		2010
	BT	BK	BT	BK	BT
Total fishing effort	63,789 (13)	5,684 (47)	20,570 (28)	8,332 (32)	150,566 (14)
Total directed expenditures	\$202,901 (41)	\$15,663 (58)	\$70,134 (39)	\$17,469 (55)	\$756,654 (25)

# Gizzard Shad

2015

Effort = 1.0

Total CPUE = 12.0 (66; 12)

IOV = 75 (5)

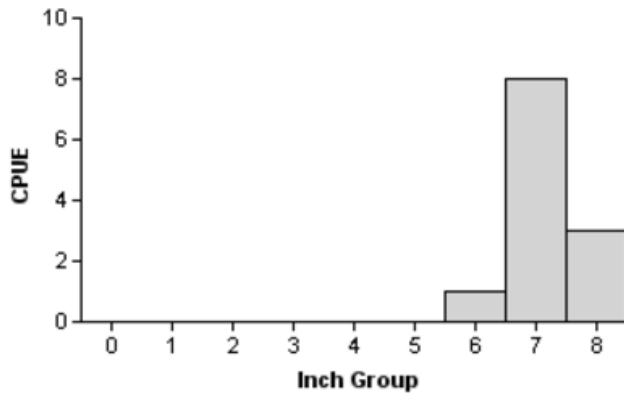


Figure 1. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N are in parentheses) for the fall daytime electrofishing surveys, Calaveras Reservoir, Texas, 2015. RSE is used for CPUE values and SE is used for IOV values.



## Gizzard Shad

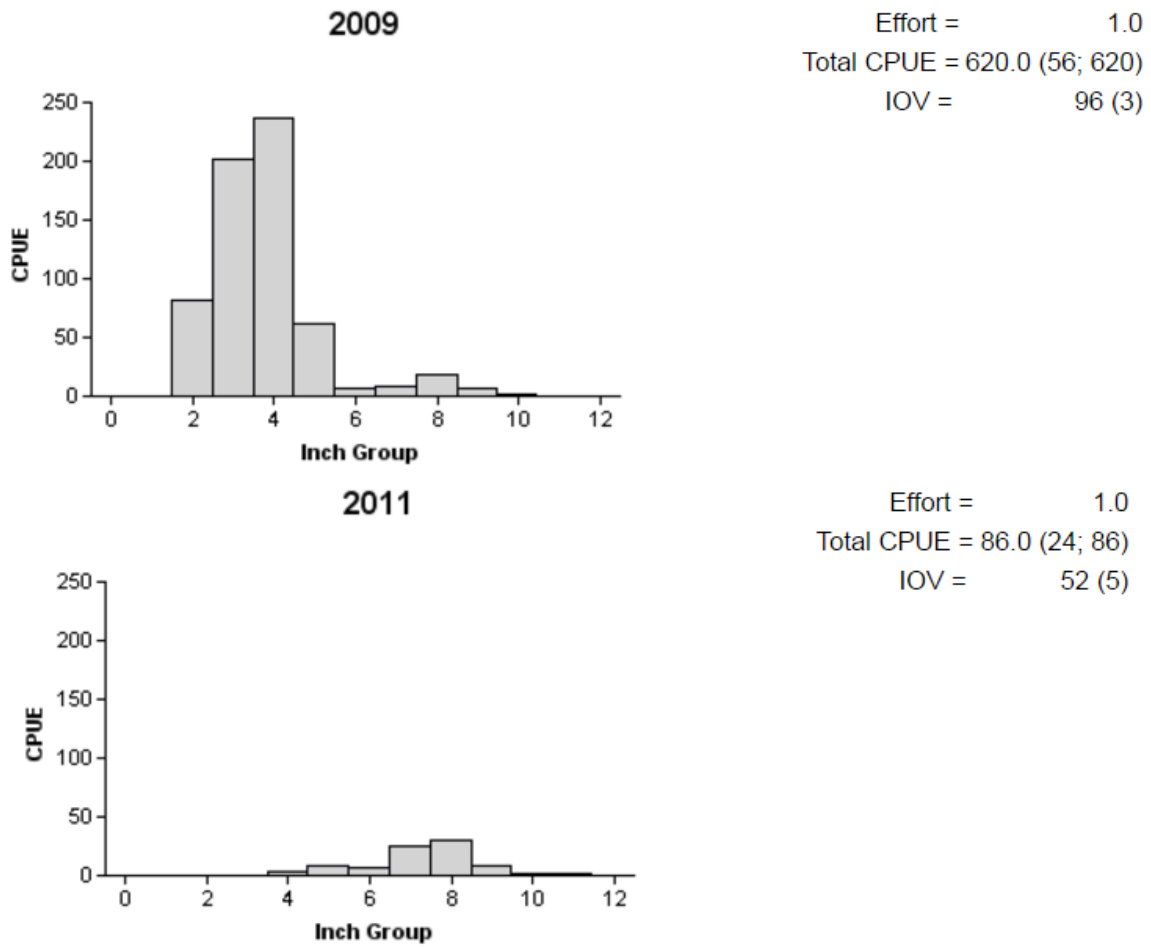


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N are in parentheses) for fall night time electrofishing surveys, Calaveras Reservoir, Texas, 2009 and 2011. RSE is used for CPUE values and SE is used for IOV values.

# Bluegill

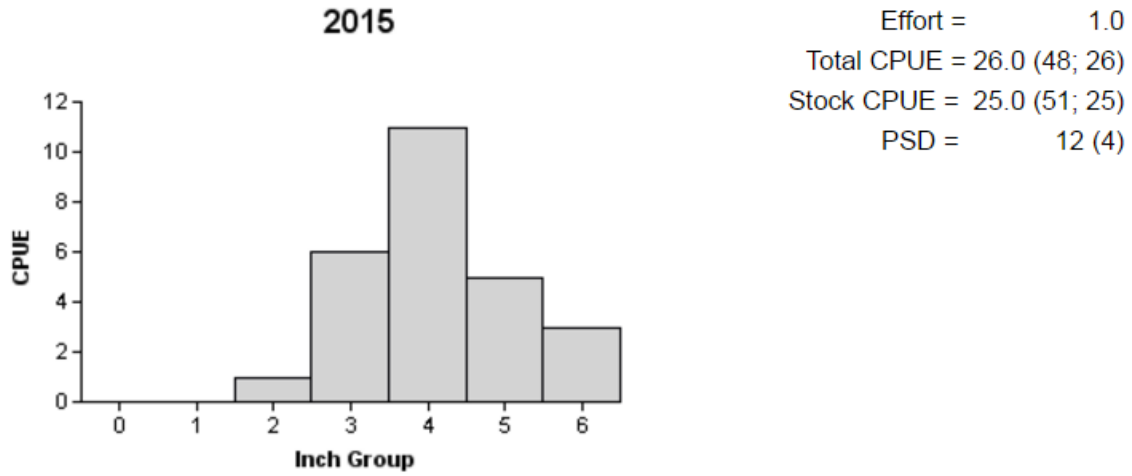


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N are in parentheses) for fall daytime electrofishing surveys, Calaveras Reservoir, Texas, 2015. RSE is used for CPUE values and SE is used for PSD values.

# Bluegill

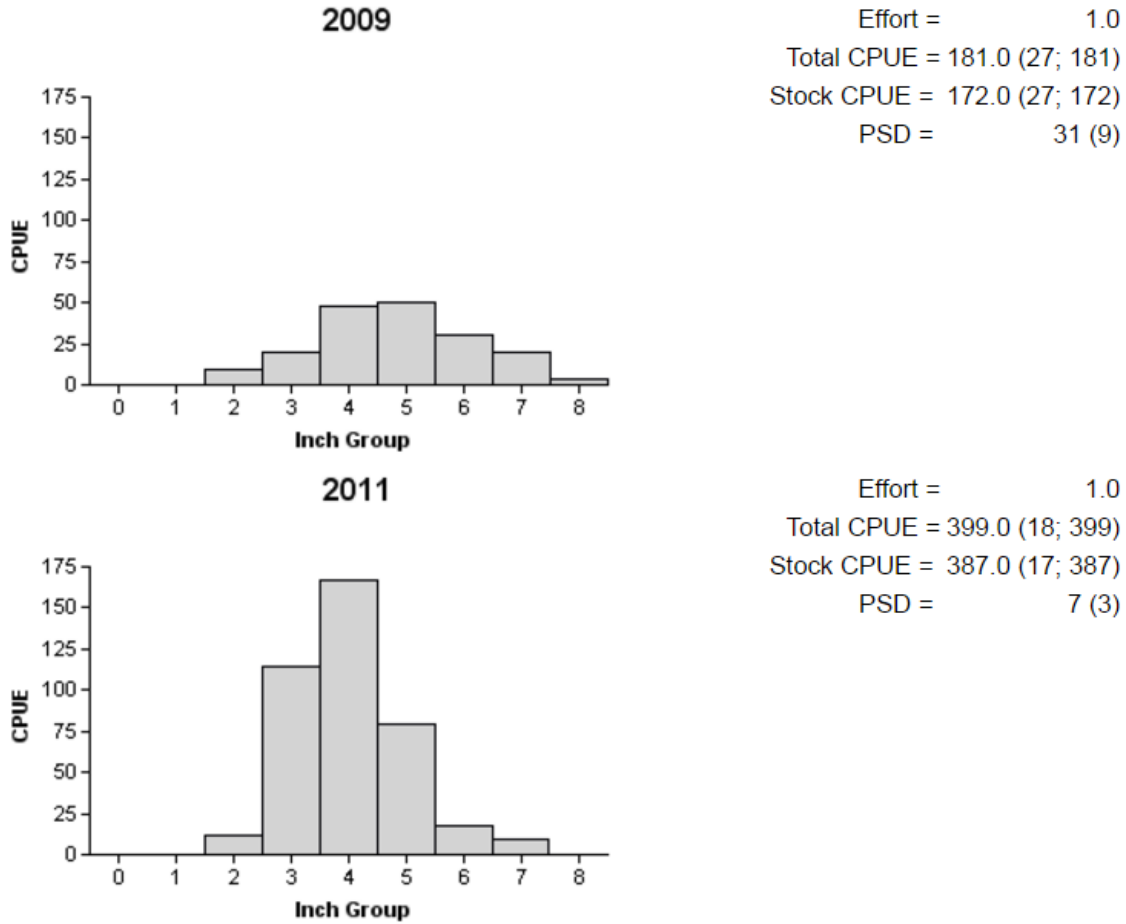


Figure 4. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N are in parentheses) for fall night time electrofishing surveys, Calaveras Reservoir, Texas, 2009 and 2011. RSE is used for CPUE values and SE is used for PSD values.

# Blue Catfish

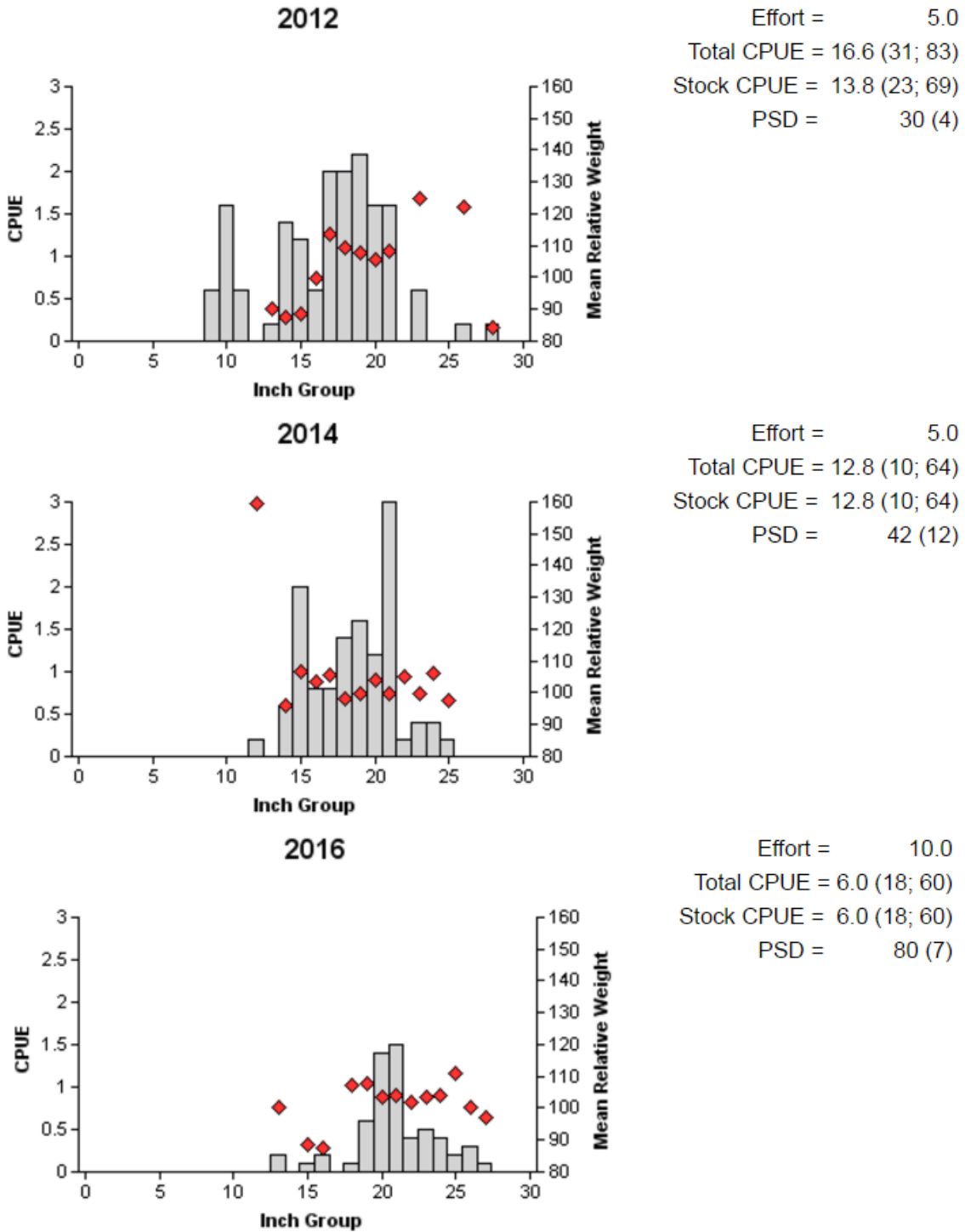


Figure 5. Number of Blue Catfish caught per net night (CPUE, bars) mean relative weight (diamonds) and population indices (RSE and N are in parentheses) for spring gill net surveys, Calaveras Reservoir, Texas, 2012, 2014, and 2016. RSE is used for CPUE values and SE is used for PSD values.

## Blue Catfish

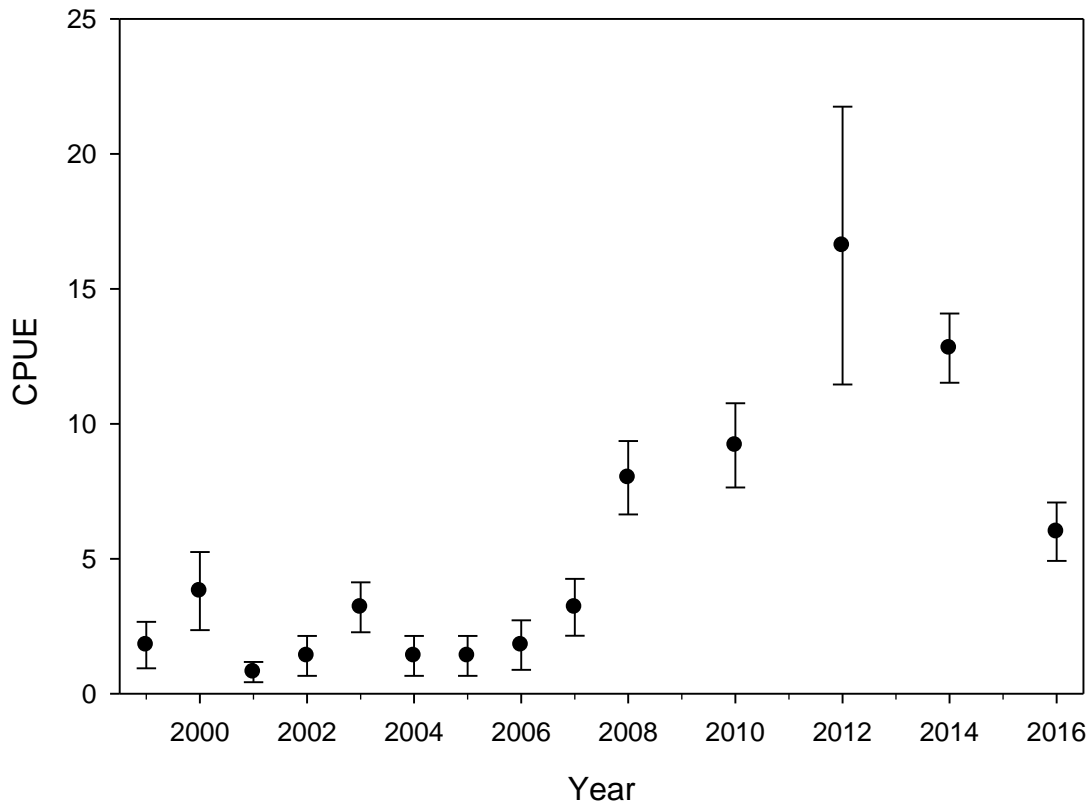


Figure 6. Average number of Blue Catfish collected in gill nets per net-night of sampling effort (CPUE) at Calaveras Reservoir annually from 1999-2016. Error bars represent  $\pm 1$  standard error.

## Blue and Catfishes, combined

Table 9. Creel survey statistics for catfishes at Calaveras Reservoir, Texas. The 2000 creel was conducted from 12/1/1999 to 11/30/2000 (12 months). The 2002 creel was conducted from 12/1/2001 to 5/31/2002 (6 months). The 2010 creel was conducted from 6/1/2009 to 5/31/2010 (12 months). Only data from boat anglers is presented. Estimates for Blue and Channel Catfishes combined unless otherwise indicated. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2000	2002	2010
Surface area (acres)	3,110	3,110	3,110
Directed effort (h)	28,894 (15)	7,182 (31)	56,704 (16)
Directed effort/acre	9.29 (15)	2.31 (31)	18.23 (16)
Average catch per hour	0.50 (25)	0.57 (21)	0.85 (22)
Total harvest			
Blue Catfish	445 (136)	22 (1,200)	1,445 (104)
Channel Catfish	13,810 (19)	4,259 (62)	47,542 (25)
Unidentified Catfishes	0	0	4,637 (43)
Catfishes combined	14,255	4,281	53,624
Harvest per acre:			
Blue Catfish	0.14 (136)	0.01 (1,200)	0.46 (104)
Channel Catfish	4.44 (19)	1.37 (19)	15.29 (25)
Unidentified Catfishes	0	0	1.49 (43)
Catfishes combined	4.58	1.38	17.24
Voluntary release rate	1.9	14.4	0.24

## Blue Catfish

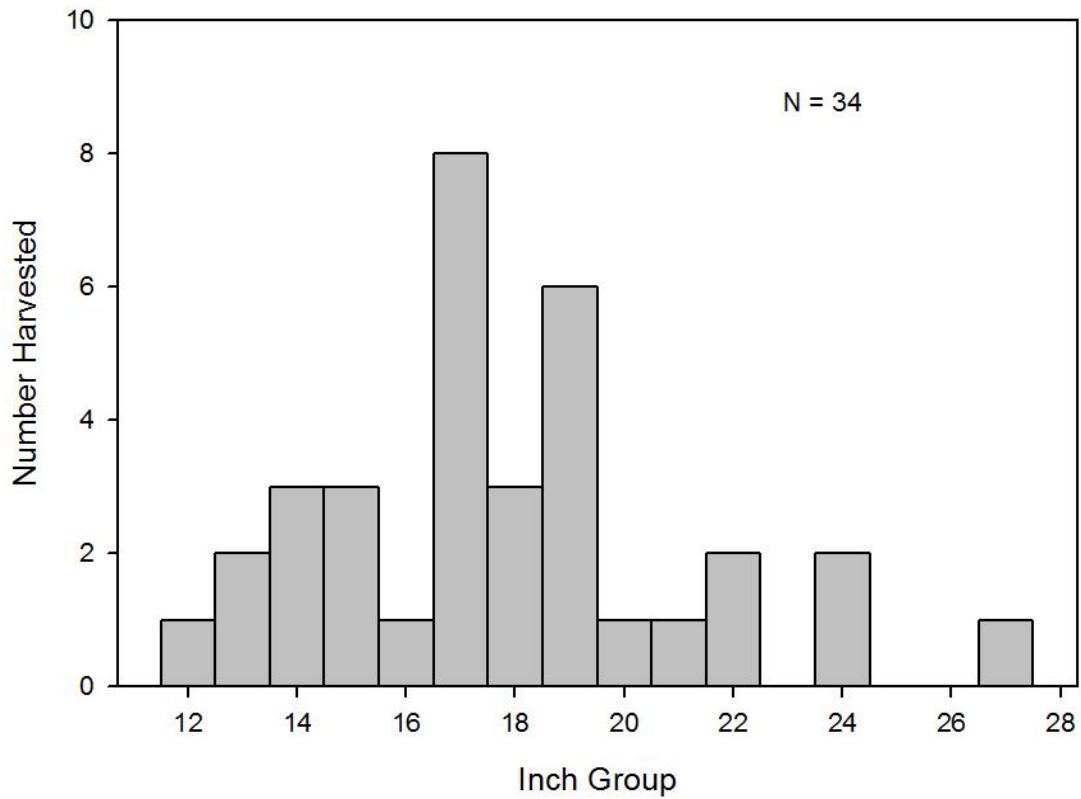


Figure 7. Length frequency of harvested Blue Catfish observed during creel surveys at Calaveras Reservoir, Texas, June 2009 through May 2010, all anglers combined. N is the number of harvested Blue Catfish measured during creel surveys.

# Channel Catfish

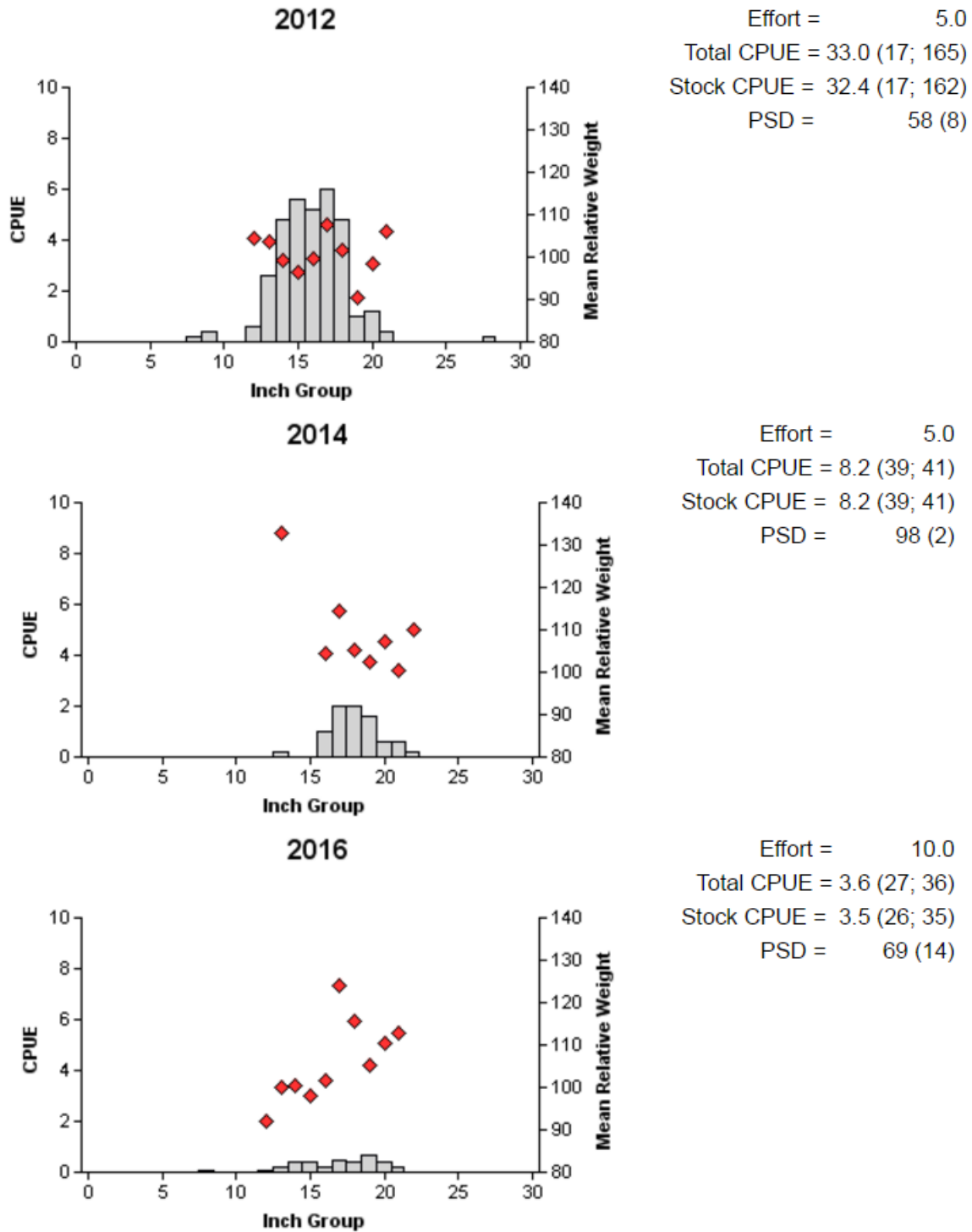


Figure 8. Number of Channel Catfish caught per net night (CPUE, bars) mean relative weight (diamonds) and population indices (RSE and N are in parentheses) for spring gill net surveys, Calaveras Reservoir, Texas, 2012, 2014, and 2016. RSE is used for CPUE values and SE is used for PSD values.



## Channel Catfish

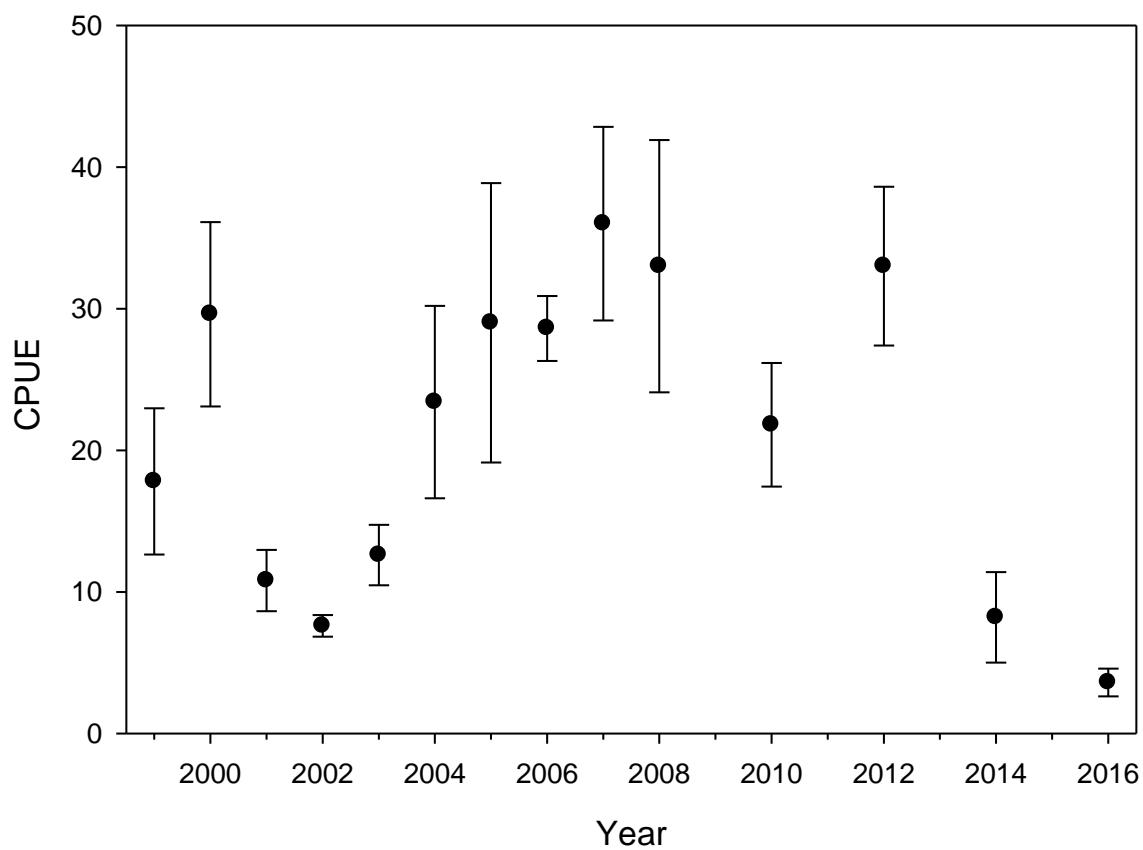


Figure 9. Average number of Channel Catfish collected in gill nets per net-night of sampling effort (CPUE) at Calaveras Reservoir annually from 1999-2016. Error bars represent  $\pm 1$  standard error.

## Channel Catfish

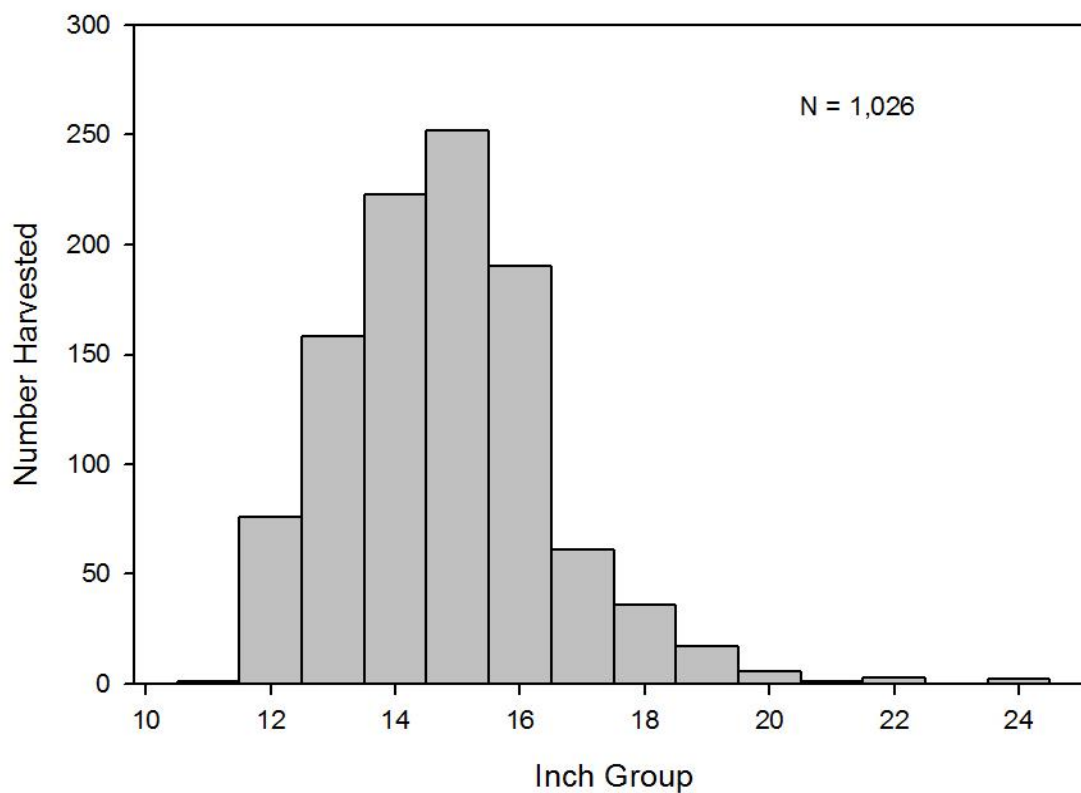


Figure 10. Length frequency of harvested Channel Catfish observed during creel surveys at Calaveras Reservoir, Texas, June 2009 through May 2010, all anglers combined. N is the number of harvested Channel Catfish measured during creel surveys.

# Hybrid Striped Bass

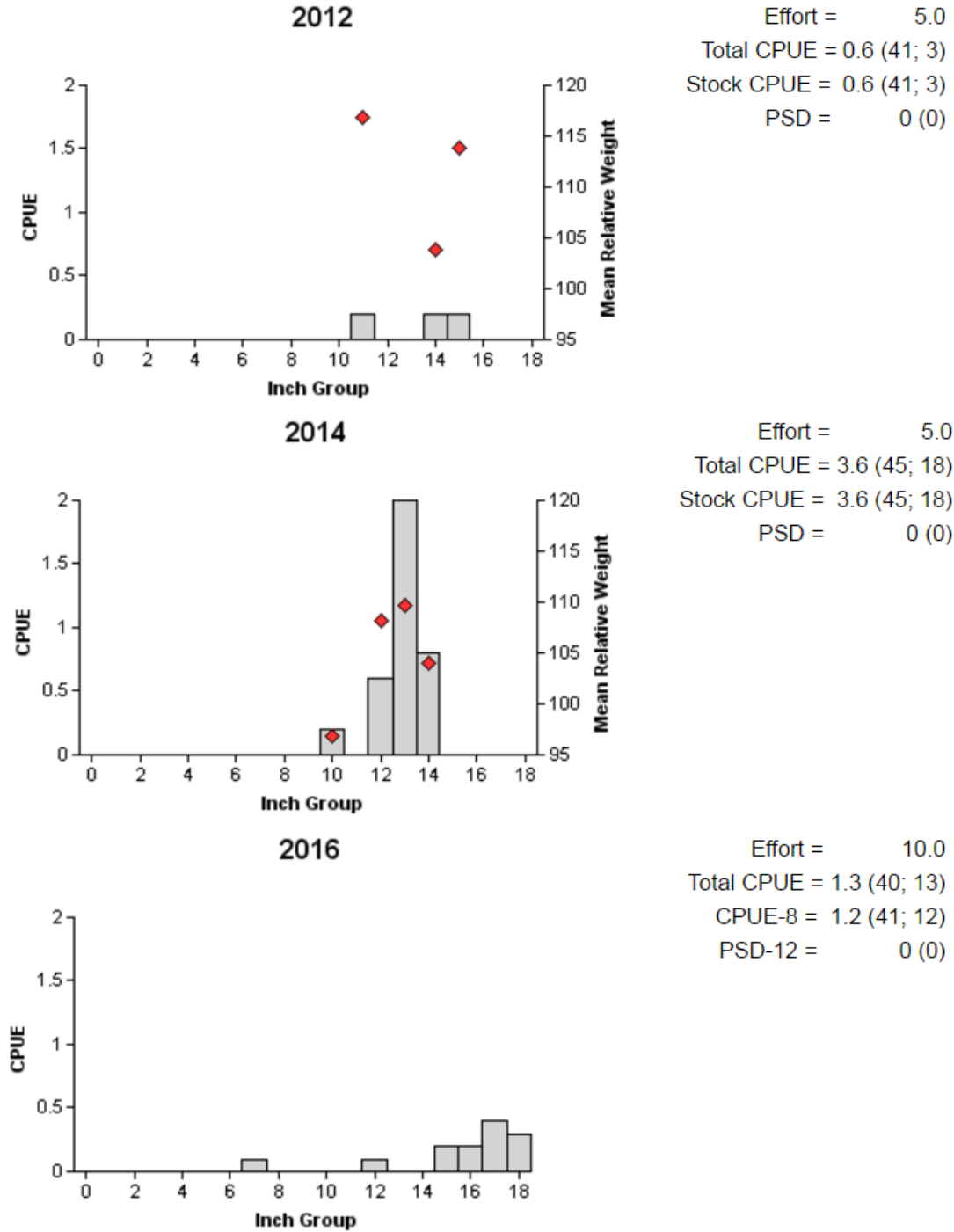


Figure 11. Number of hybrid Striped Bass caught per net night (CPUE, bars) mean relative weight (diamonds) and population indices (RSE and N are in parentheses) for spring gill net surveys, Calaveras Reservoir, Texas, 2012, 2014, and 2016. RSE is used for CPUE values and SE is used for PSD values. Beginning in 2014 both palmetto bass and sunshine bass have been stocked. Only palmetto bass were collected in 2012 and 2014 and both palmetto bass and sunshine bass were collected in 2016, based on fish age data. No relative weight data are presented in 2016 as there is no relative weight equation for both palmetto and sunshine basses.

## Hybrid Striped Bass

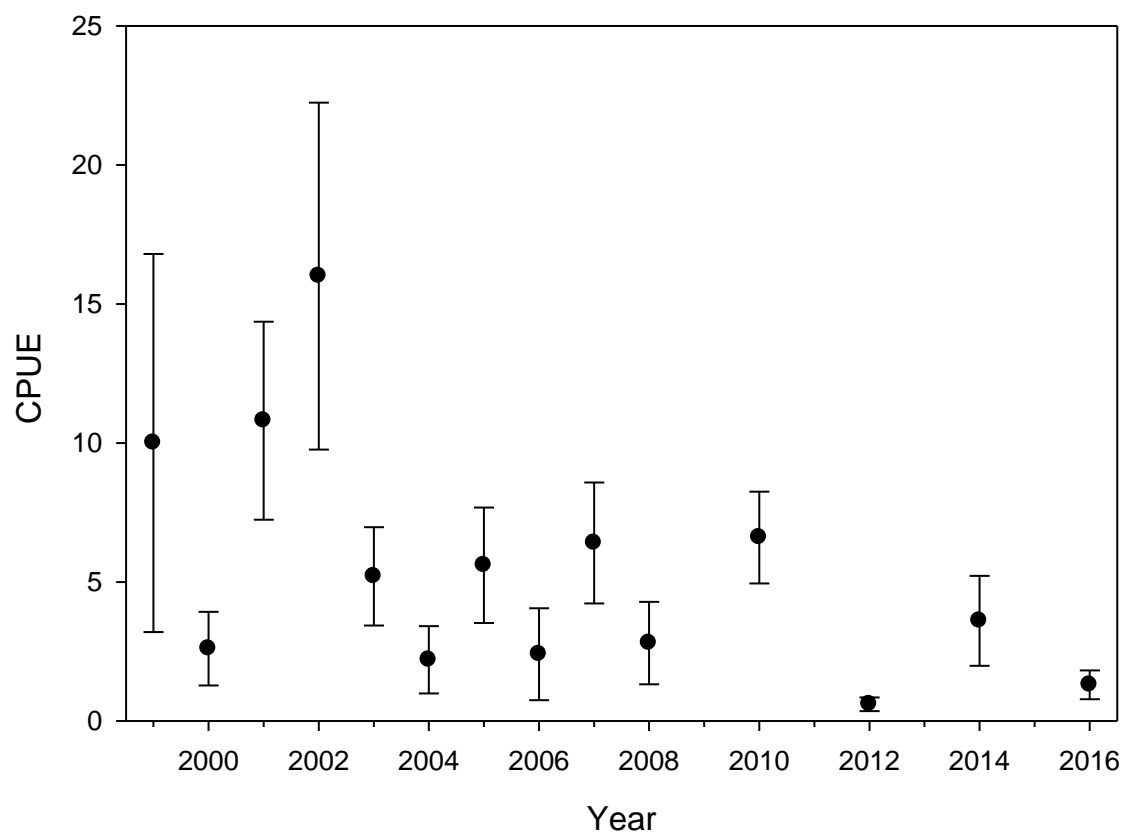


Figure 12. Average number of Hybrid Striped Bass collected in gill nets per net-night of sampling effort (CPUE) at Calaveras Reservoir annually from 1999-2016. Error bars represent  $\pm 1$  standard error. Beginning in 2014 both Palmetto Bass and Sunshine Bass have been stocked.

## Hybrid Striped Bass

Table 10. Creel survey statistics for hybrid Striped Bass at Calaveras Reservoir, Texas. The 2000 creel survey was conducted from 12/1/1999 to 11/30/2000 (12 months). The 2002 creel survey was conducted from 12/1/2001 to 5/31/2002 (6 months). The 2010 creel survey was conducted from 6/1/2009 to 5/31/2010 (12 months). Only data from boat anglers is presented. Relative standard errors (RSE) are in parentheses. Beginning in 2014 both palmetto bass and sunshine bass have been stocked.

Creel survey statistic	Year		
	2000	2002	2010
Surface area (acres)	3,110	3,110	3,110
Directed effort (h)	8,401 (21)	1,813 (38)	3,662 (36)
Directed effort/acre	2.70 (21)	0.58 (38)	1.18 (36)
Average catch per hour	0.32 (41)	0.43 (63)	0.09 (149)
Total harvest	2,548 (37)	897 (70)	669 (173)
Harvest/acre	0.82 (37)	0.29 (70)	0.22 (173)
Voluntary release rate	0	0	6.3

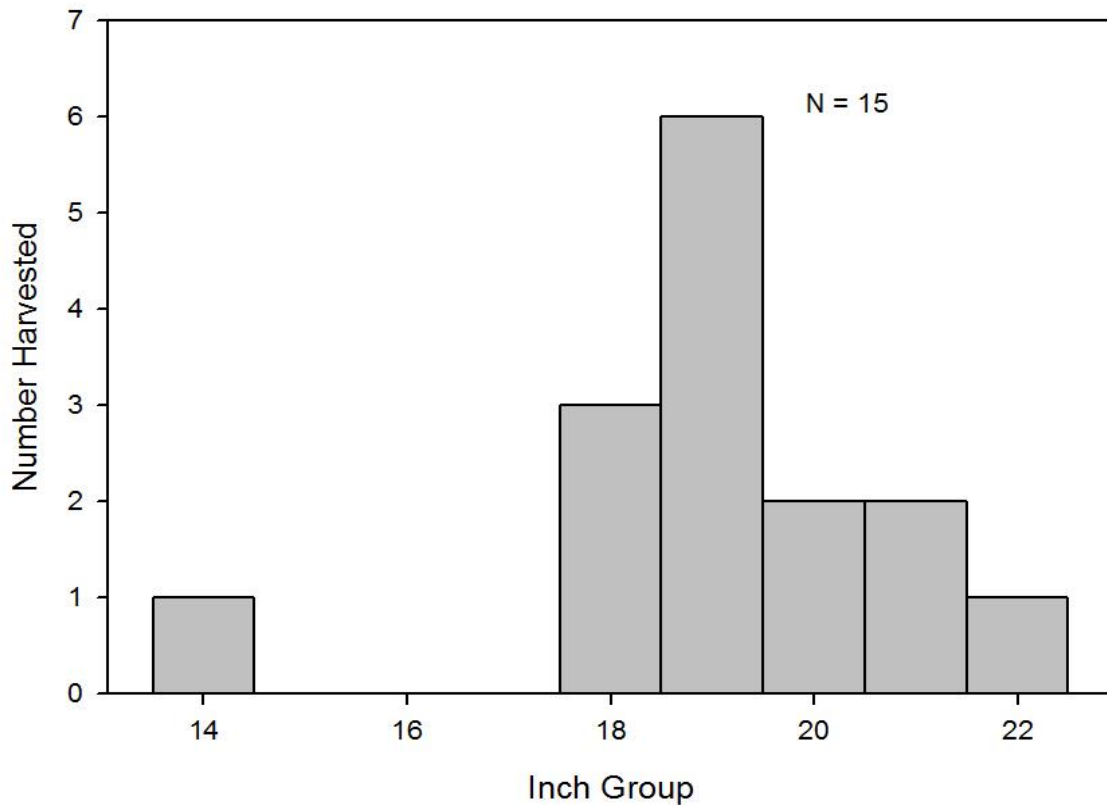


Figure 13. Length frequency of harvested hybrid Striped Bass observed during creel surveys at Calaveras Reservoir, Texas, June 2009 through May 2010, all anglers combined. N is the number of harvested palmetto bass measured during creel surveys. Beginning in 2014 both Palmetto Bass and Sunshine Bass have been stocked.

## Red Drum

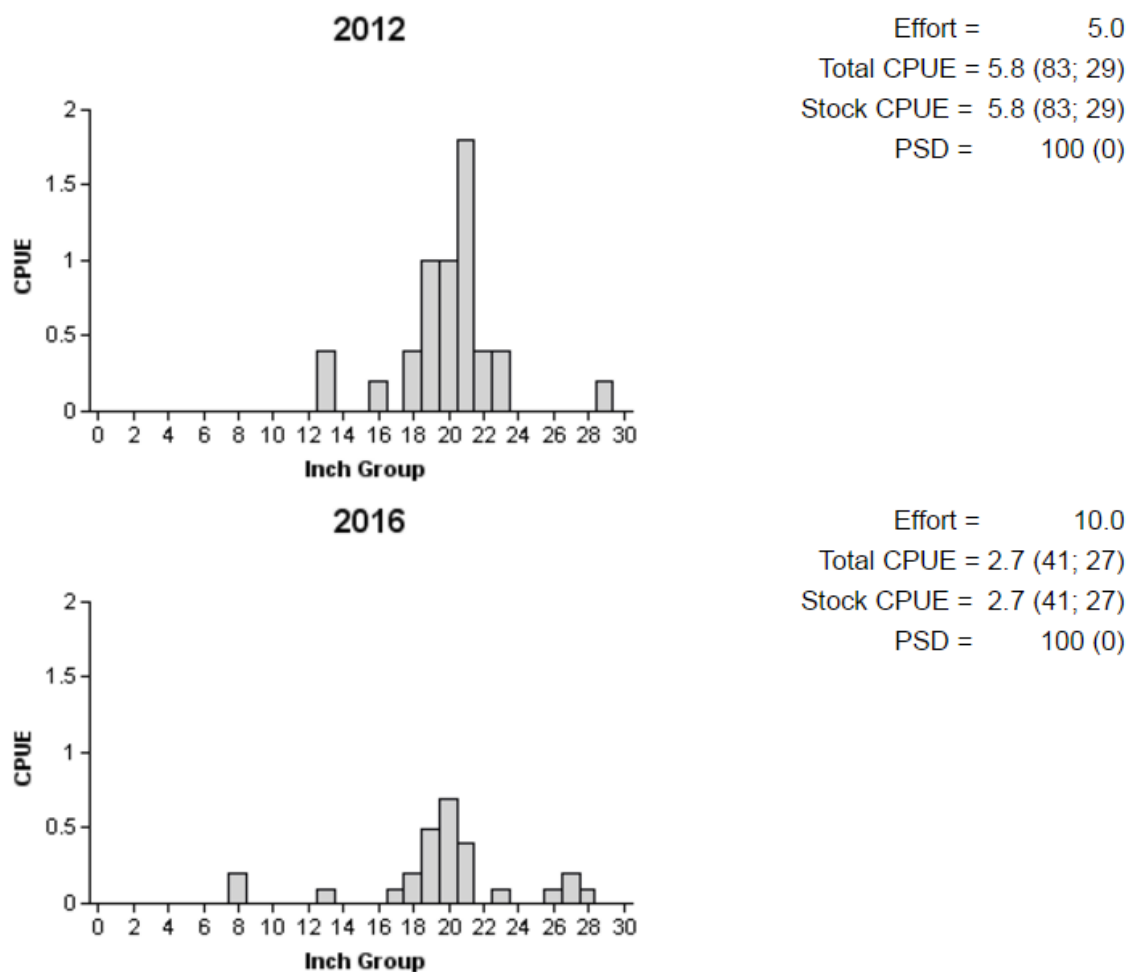


Figure 14. Number of Red Drum caught per net night (CPUE, bars) for spring gill net surveys, Calaveras Reservoir, Texas, 2012 and 2016. No Red Drum were collected in the 2014 gill net survey. RSE and N are in parentheses.

## Red Drum

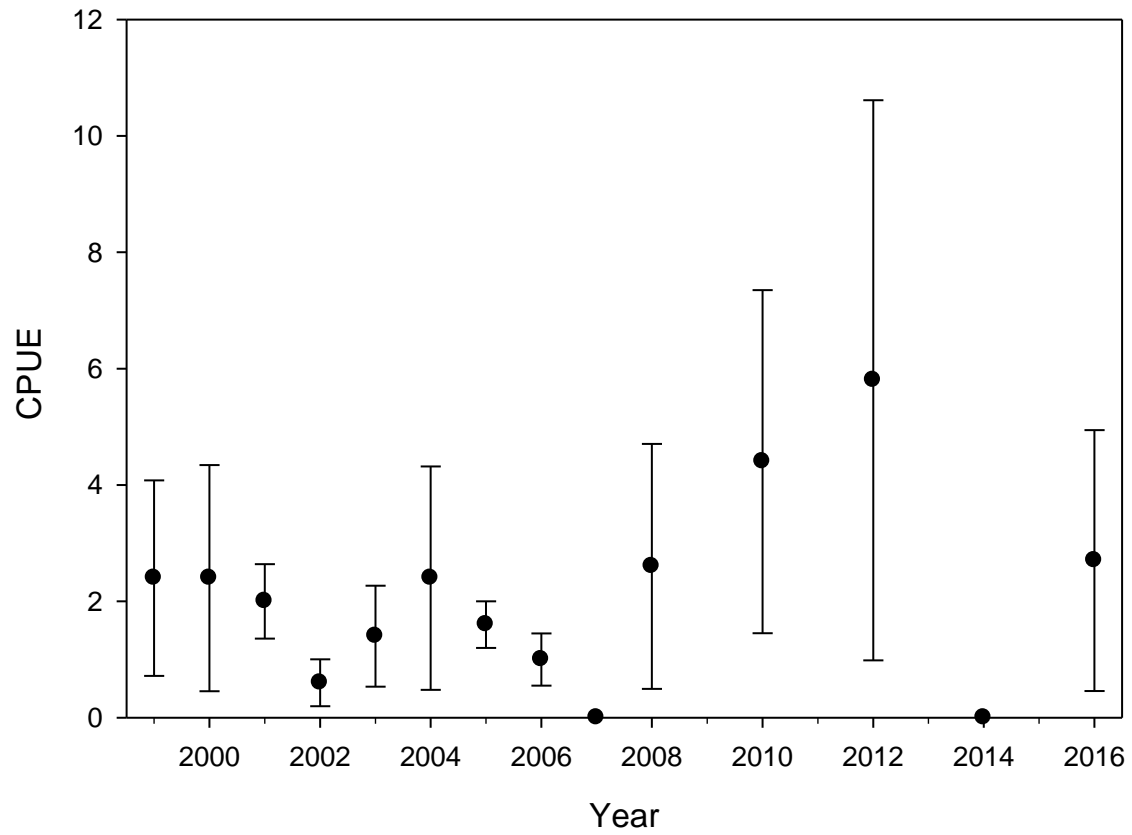


Figure 15. Average number of Red Drum collected in gill nets per net-night of sampling effort (CPUE) at Calaveras Reservoir annually from 1999-2016. Error bars represent  $\pm 1$  standard error.

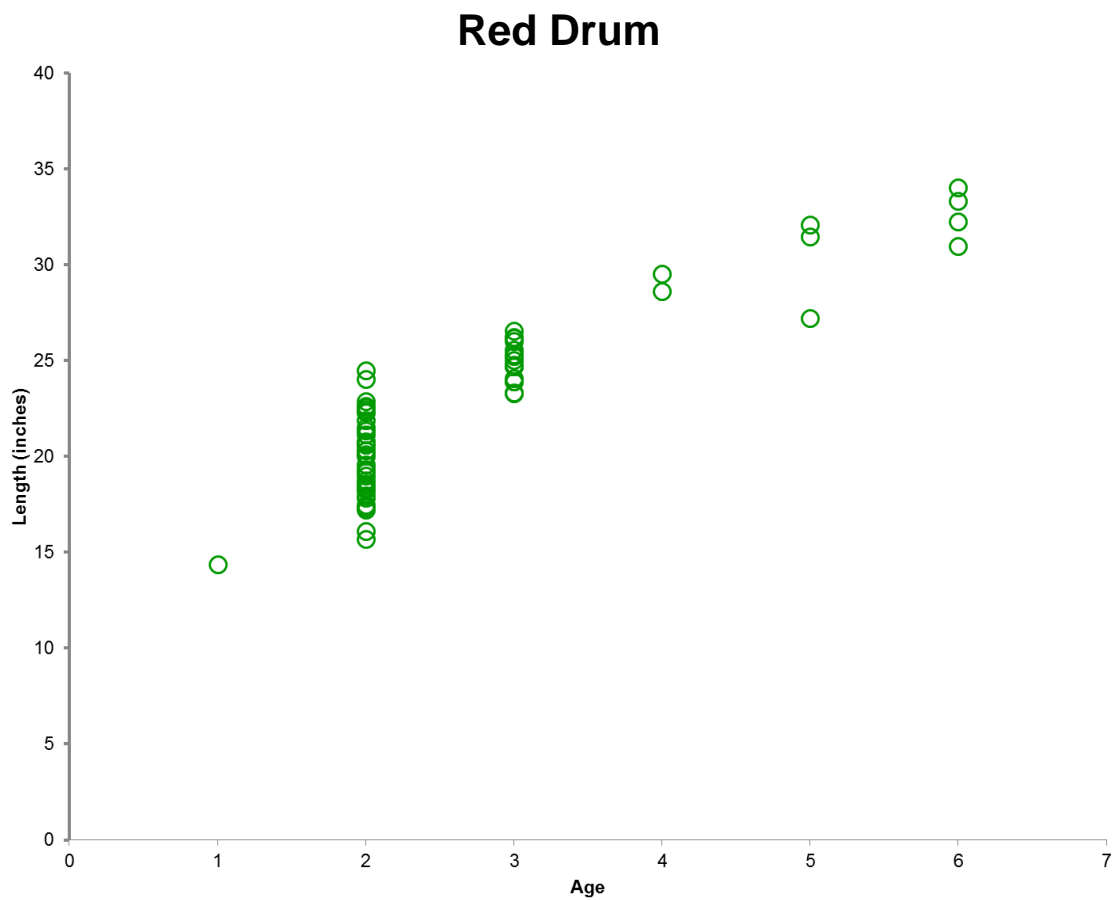


Figure 16. Length at age for Red Drum collected from angling at Calaveras Reservoir, Texas, December 2014 to August 2015.



## Red Drum

Table 11. Creel survey statistics for Red Drum at Calaveras Reservoir, Texas. The 2000 creel survey was conducted from 12/1/1999 to 11/30/2000 (12 months). The 2002 creel survey was conducted from 12/1/2001 to 5/31/2002 (6 months). The 2010 creel survey was conducted from 6/1/2009 to 5/31/2010 (12 months). Only data from boat anglers is presented. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2000	2002	2010
Surface area (acres)	3,110	3,110	3,110
Directed effort (h)	5,577 (25)	4,367 (33)	55,312 (17)
Directed effort/acre	1.79 (25)	1.40 (33)	17.79 (17)
Average catch per hour	0.12 (115)	0.15 (40)	0.19 (27)
Total harvest	377 (127)	436 (79)	6,713 (32)
Harvest/acre	0.12 (127)	0.14 (79)	2.16 (32)
Voluntary release rate	0	0	4.4

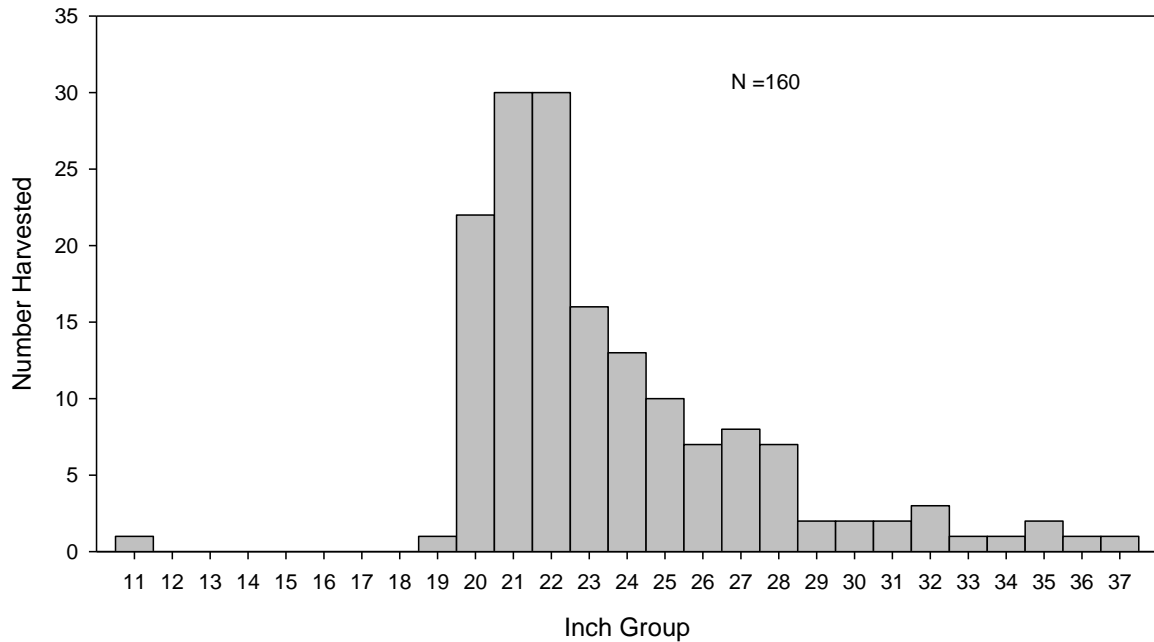
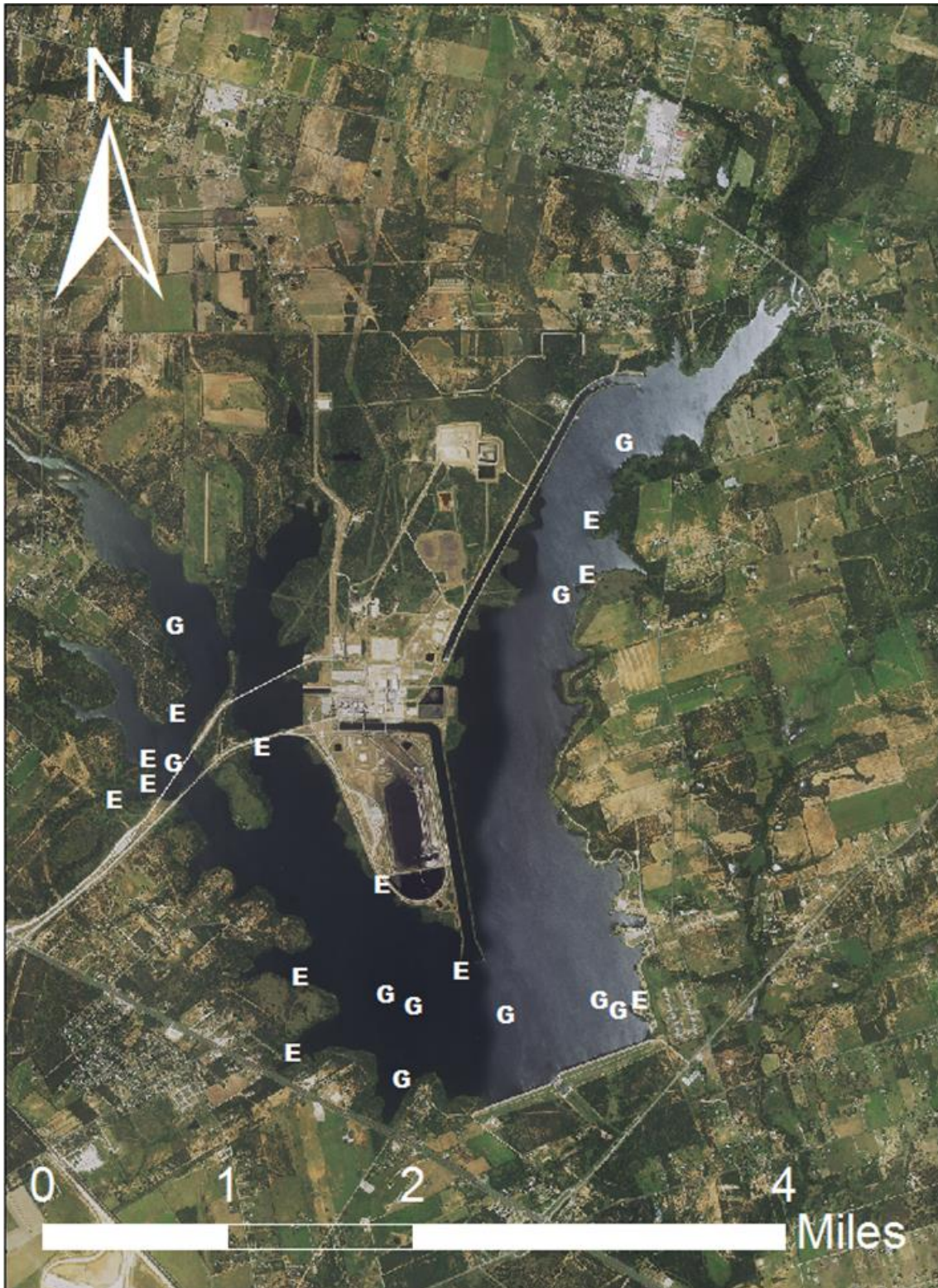


Figure 17. Length frequency of harvested Red Drum observed during creel surveys at Calaveras Reservoir, Texas, June 2009 through May 2010, all anglers combined. N is the number of harvested Red Drum measured during creel surveys.

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

Survey Year	Electrofishing	Gill Net	Creel Survey	Vegetation	Access	Report
Fall 2016-Spring 2017			S			
Fall 2017-Spring 2018		S				
Fall 2018-Spring 2019						
Fall 2019-Spring 2020	S (Day)	S		S	S	S

## Appendix A



Location of gill net (G) and electrofishing (E) sampling sites at Calaveras Reservoir, Texas, 2015-2016. Aerial photography is from 2014 and is available on the Texas Natural Resources Information System (TNRIS) website.

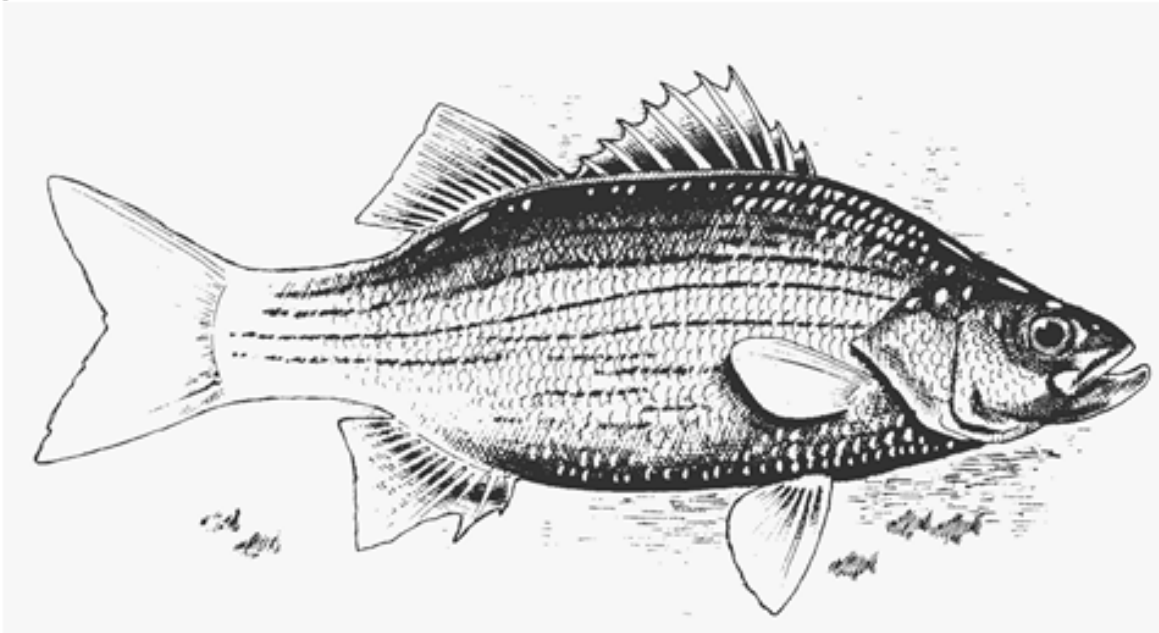
**Appendix B**

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Calaveras Reservoir, Texas, 2015-2016. Relative standard error (RSE) is in parentheses.

Species	Gill Netting		Electrofishing	
	N	CPUE	N	CPUE
Gizzard Shad	805	80.5 (19)	12	12.0 (66)
Threadfin Shad	1	0.1 (100)		
Blue Catfish	60	6.0 (18)		
Channel Catfish	36	3.6 (27)		
Hybrid Striped Bass	13	1.3 (40)		
Green Sunfish			1	1.0 (100)
Bluegill			26	26.0 (48)
Redear Sunfish			13	13.0 (56)
Largemouth Bass			4	4.0 (77)
Blue Tilapia	6	0.6 (37)		
Red Drum	27	2.7 (41)		

## Appendix C

# Hybrid Striped Bass



These are stocked regularly by Texas Parks and Wildlife Department and City Public Service Energy

They are produced in hatcheries by crossing Striped Bass with White Bass. They do not reproduce on their own and require stocking to maintain populations.

The Minimum Length Limit is 18 inches  
and the Daily Bag Limit is 5/day

White Bass and Striped Bass do NOT exist  
in Calaveras or Victor Braunig Reservoirs



Sign posted at entry of Calaveras Reservoir, Texas to educate anglers concerning the harvest regulations for hybrid Striped Bass and the absence of White and Striped basses in the reservoir.