PERFORMANCE REPORT

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INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2016 Fisheries Management Survey Report

Buffalo Springs Reservoir

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Buffalo Springs Reservoir were surveyed in 2016 using electrofishing and in 2017 using gill nets. Historical data are presented with the 2016-2017 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:** Buffalo Springs is a 225-acre reservoir that was impounded in 1960 on Yellowhouse Draw, a tributary of the North Fork of the Double Mountain Fork of the Brazos River, located 5 miles southeast of Lubbock, Texas. It is owned by the Lubbock County Water Control and Improvement District Number 1 and used for recreational purposes. Water level has been stable and nutrient levels in the reservoir are extremely high. A large portion of fish habitat was cattail. Bank and boat access was good and handicap specific facilities were good. The reservoir has experienced *Prymnesium parvum* (golden alga) kills beginning in 2003 which have had a major impact on the fish populations.

- **Management History:** The sport fish populations have been managed with statewide regulations. Intensive Striped Bass stockings have been used to manage an over-abundant Gizzard Shad population with good success.

- **Fish Community**
  - **Prey species:** There was a high number of Gizzard Shad sampled during electrofishing in 2016, and 75% of the shad were small enough to be utilized as prey. Bluegill numbers have increased, and the population was dominated by 5 and 6 inch fish.

  - **Catfishes**: Channel Catfish appear to be the dominate catfish species in the reservoir. No Blue Catfish were observed in the 2017 gill net survey, but Channel Catfish ranging from 9 to 24 inches were observed.

  - **Temperate basses:** Only one White Bass has ever been sampled in gill nets (2001 gill net survey). The gill net catch rate for Striped Bass improved from 0.4/nn in 2015 to 2.2/nn in 2017.

  - **Largemouth Bass:** The electrofishing catch rate for Largemouth Bass has increased from 32.0/h in 2012 to 136.0/h in 2016. Size structure was still dominated by smaller individuals, but there has been an increase in the number of legal-size fish.

  - **White Crappie:** During the 2016 electrofishing survey, White Crappie from 6 inches to 10 inches were observed in the reservoir.

- **Management Strategies:** Based on current information, the reservoir should continue to be managed with existing regulations. Continue stocking Striped Bass to help maintain control of the Gizzard Shad population. Striped Bass should be stocked on an alternating basis at a rate of 15/acre and 40/acre in two consecutive years and then two years of no stocking based on protocols used during research conducted by Schramm et al. (2000). The reservoir should be monitored for *P. parvum* and associated fish kills, and restocking of affected species should be conducted as soon as practical.

INTRODUCTION

This document is a summary of fisheries data collected from Buffalo Springs Reservoir in 2016-2017. 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. Management strategies are included to address existing problems or opportunities. Historical data are presented with the 2016-2017 data for comparison.

Reservoir Description

Buffalo Springs is a 225-acre reservoir impounded in 1960 on Yellowhouse Draw, a tributary of the North Fork of the Double Mountain Fork of the Brazos River, located 5 miles southeast of Lubbock, Texas. It is owned by the Lubbock County Water Control and Improvement District Number 1 and used for recreational purposes. The City of Lubbock, TX discharges its treated effluent into Yellowhouse Draw which allows water level in the lake to remain stable; however, nutrient levels are extremely high. Buffalo Springs is characterized as a hypereutrophic lake with a mean Trophic State Index chl-a of 69.9 (Texas Commission on Environmental Quality 2011). Bank and boat access was good. The reservoir experienced a significant *Prymnesium parvum* (golden algae) kill during 2003 which had a major impact on the fisheries. The reservoir experienced another kill in 2005 and small kills since. Additional reservoir characteristics are presented in Table 1.

Angler Access

Buffalo Springs Reservoir has three public boat ramps. Due to stable water level all boat ramps were available to anglers. Additional boat ramp characteristics are listed in Table 2. Shoreline access is good; fishing is allowed in all open areas of the shoreline on the reservoir, with the exception of the bridge located near the marina. There is also a covered fishing dock located near the marina bridge and several small public fishing docks located around the reservoir. The majority of fishing docks have access ramps or are constructed at ground level making them accessible to people with disabilities.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Clayton and Munger 2013) included:

1. Stock fingerling Striped Bass on an alternating basis where they are stocked at a rate of 15/acre and 40/acre in two consecutive years followed by two years of no stocking.
   Action: Due to *P. parvum* blooms within the state hatchery system during culture of Striped Bass, production has been limited. Buffalo Springs was last stocked with Striped Bass in 2015.
2. Monitor the reservoir for *P. parvum* blooms by collecting quarterly water samples from the reservoir.
   Action: Due to the historical timing of *P. parvum* blooms in the reservoir (early March), it was determined that monthly water samples between November and April would be more informative rather than quarterly water samples. Amarillo District Inland Fisheries staff have collected and evaluated water samples every 4 to 6 weeks during the winter and spring months. Cooperative work with Texas Tech University has also resulted in additional water samples being evaluated throughout the year. Buffalo Springs' employees have also been advised to watch for dead fish and contact the district office in the event a fish kill is observed or suspected.
3. Cooperate with the controlling authority to post appropriate signage at access points around the reservoir; contact and educate marina owners about invasive species, and provide them with posters, literature, etc… so that they can in turn educate their customers; educate the public about invasive species through the use of media and the internet; and make a speaking point about invasive species when presenting to constituents and user groups.

Action: Presentations have been given to the Regional water planning group, the Buffalo Springs Board of Directors, and various area civic groups and school groups. Interviews and new releases concerning invasive species have been done for area newspapers. Stories and posts have been added to the district Facebook page. Invasive species literature has been sent to the Buffalo Springs controlling authority and placement of signage has been advised.

Harvest regulation history: Sport fishes in Buffalo Springs Reservoir have been and continue to be managed with statewide regulations (Table 3).

Stocking history: Buffalo Springs Reservoir has been stocked with Blue Catfish, Channel Catfish, Striped Bass, Bluegill, and Florida Largemouth Bass multiple times since 2003 in an effort to mitigate the effects of fish kills and reestablish populations. The reservoir was experimentally stocked with walleye (1978-1981) Red Drum (1983), and Northern Pike (1975-1976) with limited success. The reservoir was last stocked in 2015 with Striped Bass. The complete stocking history is in Table 4.

Vegetation/habitat management history: Vegetation in Buffalo Springs Reservoir is limited to mainly cattail and a small amount of bulrush. In order to maintain shoreline fishing access, the water authority has periodically removed problematic vegetation with the use of an excavator and herbicides. In May 2016, 131 artificial habitats were installed in 14 public access areas on the West side of the reservoir.

Water transfer: Buffalo Springs Reservoir is primarily used for recreation. No interbasin 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 Buffalo Springs 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).

Electrofishing – Largemouth Bass, Sunfishes, Gizzard Shad, and White Crappie were collected by 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 – Catfish species, White Bass, and Striped Bass were collected by gill netting (6 net nights at 6 stations). CPUE for gill netting was recorded as the number of fish caught per net night (fish/nn). During the gill net survey one gill net was disturbed, and no data was collected from this net. Gill net statistics were calculated based on 5 net nights at 5 stations.

Statistics – Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD), terminology modified by Guy et al. 2007], and condition indices [relative weight (W_r)] were calculated for target fishes according to Anderson and Neumann (1996). Index of vulnerability (IOV) was calculated for Gizzard Shad (DiCenzo et al. 1996). Standard error (SE) was calculated for structural indices and IOV. Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE and creel statistics.

Habitat – A structural habitat survey and a vegetation survey was conducted in August 2016. Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

RESULTS AND DISCUSSION

Habitat: Primary habitat was natural shoreline (75%) followed by bulkhead (18.7%) (Table 6). Aquatic vegetation was limited to cattail and bulrush, primarily along natural shoreline areas (Table 7).

Prey species: Electrofishing catch rates of Gizzard Shad were 519.0/h. Index of vulnerability (IOV) for Gizzard Shad was good, indicating 75% of Gizzard Shad were available to existing predators; this was lower than IOV estimate from 2012 and 2014 (Figure 1). Total CPUE of Gizzard Shad was lower than the 2012 survey (Figure 1). Total CPUE of Bluegill in 2016 (287.0/h) was much higher than the 2012 survey (26.0/h) and 2014 (155.0/h) (Figure 2). OBS objectives for prey species were met.

Channel Catfish: The Channel Catfish population appears to have recovered from previous *P. parvum* blooms. Although the 2017 CPUE (7.8/nn) is slightly lower than the 2013 CPUE (10.4/nn), body condition in larger size classes has improved from mean relative weights of less than 100 to greater than 110 (Figure 3). CPUE-Stock and RSE for Channel Catfish did not reach OBS objectives. A total of 35 stock sized Channel Catfish were collected from 5 of the initial 6 gill net stations. One of the initial stations was disturbed, and no data was collected from this location. It is possible that 1 or 2 additional stations may have collected the necessary fish to meet OBS objectives; however, the size of the reservoir and the extremely high public presence at the reservoir increases the probability that additional gear would also be disturbed. It was also noted that more than half of the stock sized fish (N=19) collected were collected from one gill net, and most likely the additional 15 fish needed to reach the OBS objectives would have required at least 4 more gill net stations. An unfortunate side effect of gill net sampling is mortalities for by-catch species, and the mortalities can be problematic for a small reservoir with an ongoing history of golden algae related fish kills and a high public presence.

Striped Bass: The gill net catch rate of Striped Bass in 2017 (2.2/nn) consisted of 11 fish (Figure 4). The fish ranged from 15 to 19 inches. While the 2017 catch rate was higher than the 2015 catch rate (0.4/nn), catch rates have declined from 2011 (7.2/nn) (Clayton and Munger 2013). The variable catch rates may be attributed to a combination of *P. parvum* blooms and inconsistent stockings since 2008. Sampling statistics based on past surveys indicated that the required effort to meet objectives would have required more than 50 random gill net stations. As this amount of sampling is unreasonable, OBS objectives were not met.

Largemouth Bass: *P. parvum* blooms since 2003 appear to have severely affected the population, but there does appear to be continued improvement. The electrofishing catch rate of Largemouth Bass was 136.0/h in 2016, a large increase from 2012 (32.0/h) (Figure 5). Although the 2016 CPUE is lower than the 2014 CPUE (231.0/h), the majority of fish sampled in 2014 were below stock size. Even though the current population appears to still be dominated by sub-legal size fish, size structure (PSD = 39) has improved over the past four years with more legal-sized fish being sampled. CPUE-S has improved annually from CPUE-S = 6.0 in 2012 to 107.0 in 2016 (Figure 5). OBS objectives for Largemouth Bass were met.

White Crappie: The crappie population appears to fluctuate greatly since *P. parvum* blooms began in 2003. Trap net catch rates are highly variable from year to year. Only one 5-inch fish was sampled during the 2012 trap net survey (Clayton and Munger 2013). Due to the high variability, trap net catch rates for Buffalo Springs Reservoir provide little more than presence/absence data. It was determined that presence/absence data could also be obtained through other survey techniques. During the 2016 electrofishing survey, when White Crappie were observed, they were measured to the nearest inch class. A total of 30 White Crappie, ranging from 6 to 10 inches were measured. Fifty-three White Crappie were also observed during the 2017 gill net survey.

Fisheries management plan for Buffalo Springs Reservoir, Texas

Prepared – July 2017

ISSUE 1 Striped Bass are an important top level predator in Buffalo Springs Reservoir and they provide additional recreation to anglers. Historically, Buffalo Springs was characterized as having an overabundant Gizzard Shad population comprised mostly of adult shad too large to be used as prey. Schramm, et al. (2000) found that the Gizzard Shad population in Buffalo Springs could be restructured to be more conducive to predation by stocking large numbers of Striped Bass. Striped Bass do not reproduce in Buffalo Springs and stocking is required to maintain their abundance. A declining IOV for Gizzard Shad may indicate the population is again shifting to overabundant large fish.

MANAGEMENT STRATEGY

1. Stock fingerling Striped Bass on an alternating basis where they are stocked at a rate of 15/acre and 40/acre in two consecutive years followed by two years of no stocking.

ISSUE 2 The reservoir experienced a severe fish kill in 2003 due to *P. parvum.* There have been repeated smaller kills in the years following the initial kill, but these have been much smaller and primarily restricted to the upper reservoir.

MANAGEMENT STRATEGIES

1. Maintain contacts with reservoir management authority to monitor for fish kills.
2. Conduct monthly *P. parvum* sampling from January through March each year.

ISSUE 3 The reservoir was impounded in 1960, and as a result the majority of fish habitat has degraded and vanished. The reservoir is highly fertile, but there is very limited nursery cover and fish attracting habitat. Vegetation is limited to predominantly common cattails.

MANAGEMENT STRATEGIES

1. Continue to install a variety of artificial habitats to provide nursery cover for juvenile fishes and to attract larger game fish to public access areas.
2. Plant a variety of native aquatic vegetation to provide natural habitat and increase the complexity of the artificial habitat.

ISSUE 4 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. Maintain contact and continually educate lake authorities about the threat of 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.

Objective-Based Sampling Plan and Schedule for Buffalo Springs Reservoir

Sampling Years 2017-2021

Sport fish, forage fish, and other important fishes

Sport fishes in Buffalo Springs Reservoir have historically included Channel Catfish, Striped Bass, Largemouth Bass and White Crappie. The primary forage is Gizzard Shad.

Low-density

Blue Catfish are typically collected in gill nets at a rate of 0.2/nn or lower, and past angler surveys have indicated no directed effort toward this species.

Survey objectives, fisheries metrics, and sampling objectives

Channel Catfish: Channel Catfish populations have been impacted by golden algae since 2003, and trend data on relative abundance and size structure of Channel Catfish has been collected biennially since 2005. Continuation of trend data will allow for general monitoring of large-scale changes in relative abundance and size structure. Catch rates have been highly variable ranging from a low of 0.0/nn in 2009 to 10.4/nn in 2013. Based upon 2013, 2015, and 2017 survey results, gill net sampling effort needed to achieve sampling objectives for relative abundance (CPUE-S; RSE≤25 with 80% confidence) is 10 random stations, and effort for size structure estimation (PSD; 50 fish minimum with 80% confidence) is 8 random gill net stations. Direct angler effort for Channel Catfish post *P. parvum* blooms is unknown. The last creel survey for the reservoir was conducted in 1993, in which Channel Catfish were the most sought after species with 45.8% of angler effort. As this survey was conducted before the reservoir was affected by *P. parvum* blooms in 2003, the current angler effort is unknown. While Channel Catfish are still most likely to be a highly sought after species, a creel survey will be conducted in 2018 to determine direct angler effort. Exploratory sampling will be conducted in summer 2017 and 2020 with baited hoop nets to determine if hoop nets can achieve above objectives with less gear related mortalities. If hoop net results prove to be unsatisfactory (i.e. low CPUE or require effort greater than 9 stations), Channel Catfish will be surveyed in spring 2021 with 5 random gill net stations. If 2020 hoop net data is able to achieve above objectives with reasonable effort (9 stations or less), then the 2021 gill net survey will not be used to target Channel Catfish.

Striped Bass: Striped Bass populations have been impacted by golden algae since 2003, and trend data on relative abundance of Striped Bass has been collected biennially since 2005. Continuation of trend data will allow for general monitoring of any large-scale changes in relative abundance. Catch rates have been highly variable ranging from a low of 0.4/nn (2009, 2013, 2015) to 7.2/nn (2011). Based upon 2013, 2015, and 2017 survey results, achieving a relative abundance precision of RSE≤25 of CPUE-S with 80% confidence could require as many as 55 random gill net stations, and effort for size structure estimation (PSD; 50 fish minimum with 80% confidence) exceeds 60 random stations. As Buffalo Springs Reservoir has a total surface area of 225 acres, this amount of effort would equate to one gill net station per 3.75 acres. Inconsistent stocking will most likely result in a low catch rate regardless of the amount of sampling conducted. Until the stocking schedules is able to be followed more consistently, Striped Bass data will be collected quadrennially using the Channel Catfish gill net sampling strategy of 5 random gill nets in 2021. If Channel Catfish are able to be successfully sampled with hoop nets, then the Striped Bass sampling strategy will consist of general trend data (without precision or sampling size requirement) gathered with 5 random gill net stations in an effort to reduce by-catch mortalities.

Largemouth Bass: Largemouth Bass populations have been impacted by golden algae since 2003; however, trend data on relative abundance and size structure of Largemouth Bass has been collected biennially since 1996 with fall nighttime electrofishing. Continuation of trend data will allow for general monitoring of any large-scale changes in the Largemouth Bass population that may spur further investigation. Analysis of the past two surveys indicated that it would require 19 electrofishing sites to

achieve a relative abundance precision of CPUE-S with RSE≤25. Effort for size structure estimation (PSD: 50 fish minimum with 80% confidence) would require 13 random sites. Since last year's survey objectives were easily obtained with 12 random sites, twelve randomly selected 5-min electrofishing sites will be sampled in 2018 and 2020. If additional effort is required to improve precision, sampling will continue at randomly selected sites until 50 stock-size fish are collected for PSD indices or until a maximum of 18 sites are sampled.

White Crappie: White Crappie populations have been impacted by golden algae since 2003. Trap net catch rates of White Crappie are highly variable. Trend data, using trap nets, has only been able to determine presence/absence of the species; in 2012 only one White Crappie was sampled. Due to potential future golden algae impacts, general monitoring on a quadrennial basis will allow for the evaluation of presence/absence of White Crappie. To determine presence/absence we will document any White Crappie observed in the 2020 electrofishing surveys. If no White Crappie are detected in the electrofishing survey, additional effort will include 5 biologist selected trap net stations. Stations will be selected based upon historic catch rates from previous surveys.

Gizzard Shad: Gizzard Shad are the primary forage at Buffalo Springs Reservoir. Trend data has been collected biennially since 1996. Continuation of sampling, as per Largemouth Bass above, will allow for general monitoring of large-scale changes in relative abundance and size structure. No additional effort will be extended beyond what is used for Largemouth Bass sampling.

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Table 1. Characteristics of Buffalo Springs Reservoir, Texas.

Characteristic	Description
Year constructed	1960
Controlling authority	Lubbock County WC&ID No. 1
County	Lubbock
Reservoir type	Tributary
Shoreline Development Index (SDI)	3.56
Conductivity	1,064 µmhos/cm

Table 2. Boat ramp characteristics for Buffalo Springs Reservoir, Texas, August, 2016.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Marina Ramp	33.53056 -101.70933	Y	30	Unknown	Excellent, no access issues
Water Park Ramp	33.53255 -101.70460	Y	15	Unknown	Excellent, no access issues
Old Gate Ramp	33.53241 -101.72361	Y	30	Unknown	Excellent, no access issues

Table 3. Harvest regulations for Buffalo Springs Reservoir, Texas.

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

Table 4. Stocking history of Buffalo Springs Reservoir, Texas. FRY = fry; FGL = fingerling; ADL = adults; UNK = unknown.

Species	Year	Number	Size
Northern Pike	1975	2,719	UNK
	1976	5,940	UNK
	Total	8,659	
Blue Catfish	1984	13,120	UNK
	2003	5,635	FGL
	2007	25,164	FGL
	2009	24,432	FGL
	Total	68,351	
Channel Catfish	1966	12,500	UNK
	1967	13,000	UNK
	1968	12,000	UNK
	1969	5,500	UNK
	1970	12,540	UNK
	1971	15,000	UNK
	1972	10,500	UNK
	1973	10,000	UNK
	1974	5,000	UNK
	1975	5,000	UNK
	1977	5,000	UNK
	2005	58	ADL
	Total	106,098	
Flathead Catfish	1973	1,500	UNK
Striped Bass	1983	11,450	UNK
	1984	11,000	FGL
	1986	13,500	FGL
	1988	2,416	FGL
	1988	25,000	FRY
	1989	28,400	FRY
	1990	5,110	FGL
	1991	4,500	FGL
	1992	39,566	FGL
	1992	11,055	FRY
	1993	50,450	FGL
	1998	3,486	FGL
	1999	9,487	FGL
	2002	3,428	FGL
	2003	9,752	FGL
	2005	3,686	FGL
	2006	11,619	FGL
	2008	3,988	FGL
	2013	3,705	FGL
	2015	8,351	FGL
	Total	259,949	

Continued next page

Table 4. Continued

Species	Year	Number	Size
Bluegill	2004	64,550	FGL
	2007	24,597	FGL
	Total	89,147	
Largemouth Bass	1966	36,000	FGL
	1967	10,500	FGL
	1968	6,450	FGL
	1969	5,000	FGL
	1970	10,000	FGL
	1971	7,000	FGL
	1991	3,050	FGL
	Total	78,000	
Florida Largemouth Bass	1982	3,000	FGL
	1983	10,500	FGL
	1984	2,400	FRY
	1985	2,000	FGL
	2003	24,316	FGL
	2004	25,019	FGL
	2005	25,105	FGL
	2007	24,361	FGL
	2009	24,008	FGL
	2011	24,141	FGL
	Total	164,850	
Walleye	1978	1,124,775	FRY
	1979	500,000	FRY
	1980	1,102,500	FRY
	1981	2,345,000	FRY
	Total	5,072,275	
Green X Redear Sunfish	1970	5,000	UNK
Red Drum	1983	27,900	UNK

Table 5. Objective-based sampling plan components for Buffalo Springs Reservoir, Texas 2016 – 2017.

Gear/target species	Survey objective	Metrics	Sampling objective
Electrofishing			
Largemouth Bass	Abundance	CPUE - Stock	RSE – Stock ≤ 25
	Size Structure	PSD, length frequency	N ≥ 50 Stock
Bluegill [a]	Abundance	CPUE - Total	RSE ≤ 25
	Size Structure	PSD, length frequency	N ≥ 50
Gizzard Shad [a]	Abundance	CPUE - Total	RSE ≤ 25
	Size Structure	Length frequency	N ≥ 50
	Prey availability	IOV	N ≥ 50
Gill netting			
Channel Catfish	Abundance	CPUE – Stock	RSE – Stock ≤ 25
	Size Structure	PSD, length frequency	N ≥ 50 Stock
Striped Bass	Abundance	CPUE – Stock	RSE – Stock ≤ 25
	Size Structure	PSD, length frequency	N ≥ 50 Stock

[a] No additional effort will be expended to achieve an RSE ≤ 25 for CPUE of Bluegill and Gizzard Shad if not reached from designated Largemouth Bass sampling effort. Instead, Largemouth Bass body condition can provide information on forage abundance, vulnerability, or both relative to predator density.

Table 6. Survey of structural habitat types, Buffalo Springs Reservoir, Texas, 2016. Shoreline habitat type units are in miles.

Habitat type	Estimate	% of total
Natural shoreline	6.0 miles	75.0
Bulkhead	1.5 miles	18.7
Rock shore	0.4 miles	5.0
Bulkhead + piers	0.1 miles	1.3

Table 7. Survey of aquatic vegetation, Buffalo Springs Reservoir, Texas 2008 – 2016. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Vegetation	2008	2012	2016
Native emergent	4.6 (1.9%)	5.6 (2.3%)	6.1 (2.8%)

Gizzard Shad

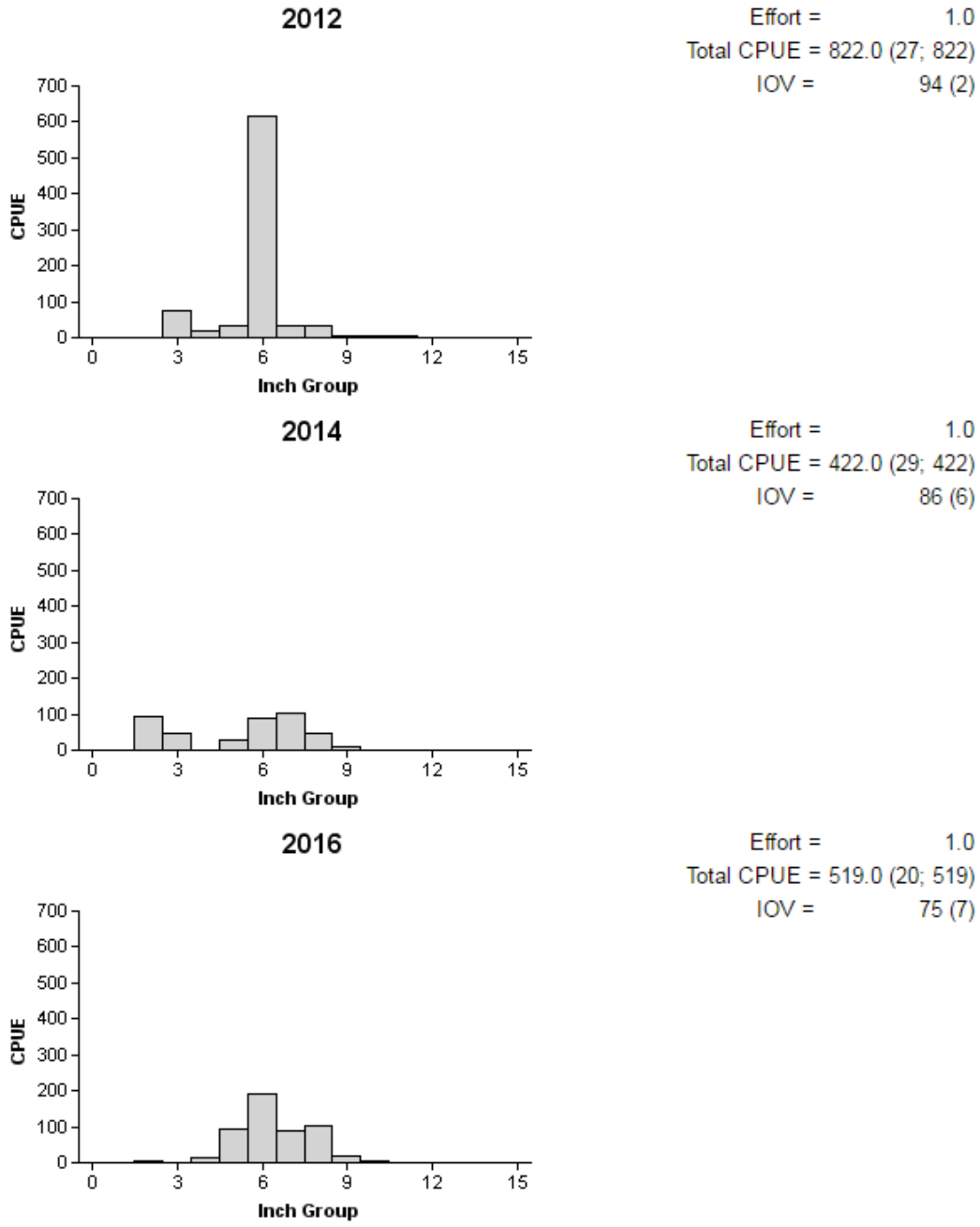


Figure 1. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Buffalo Springs Reservoir, Texas, 2012, 2014, and 2016.

Bluegill

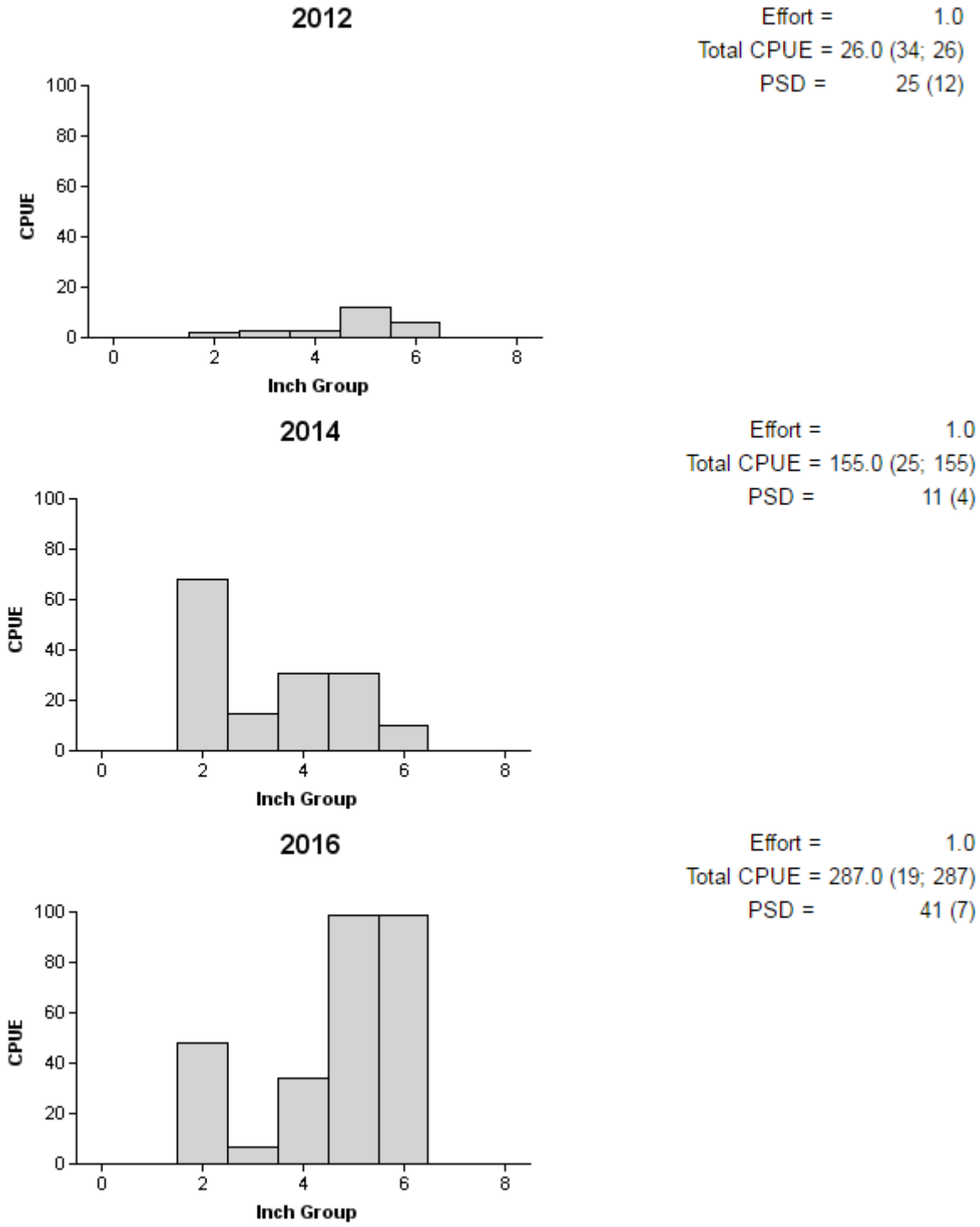


Figure 2. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Buffalo Springs Reservoir, Texas, 2012, 2014, and 2016.

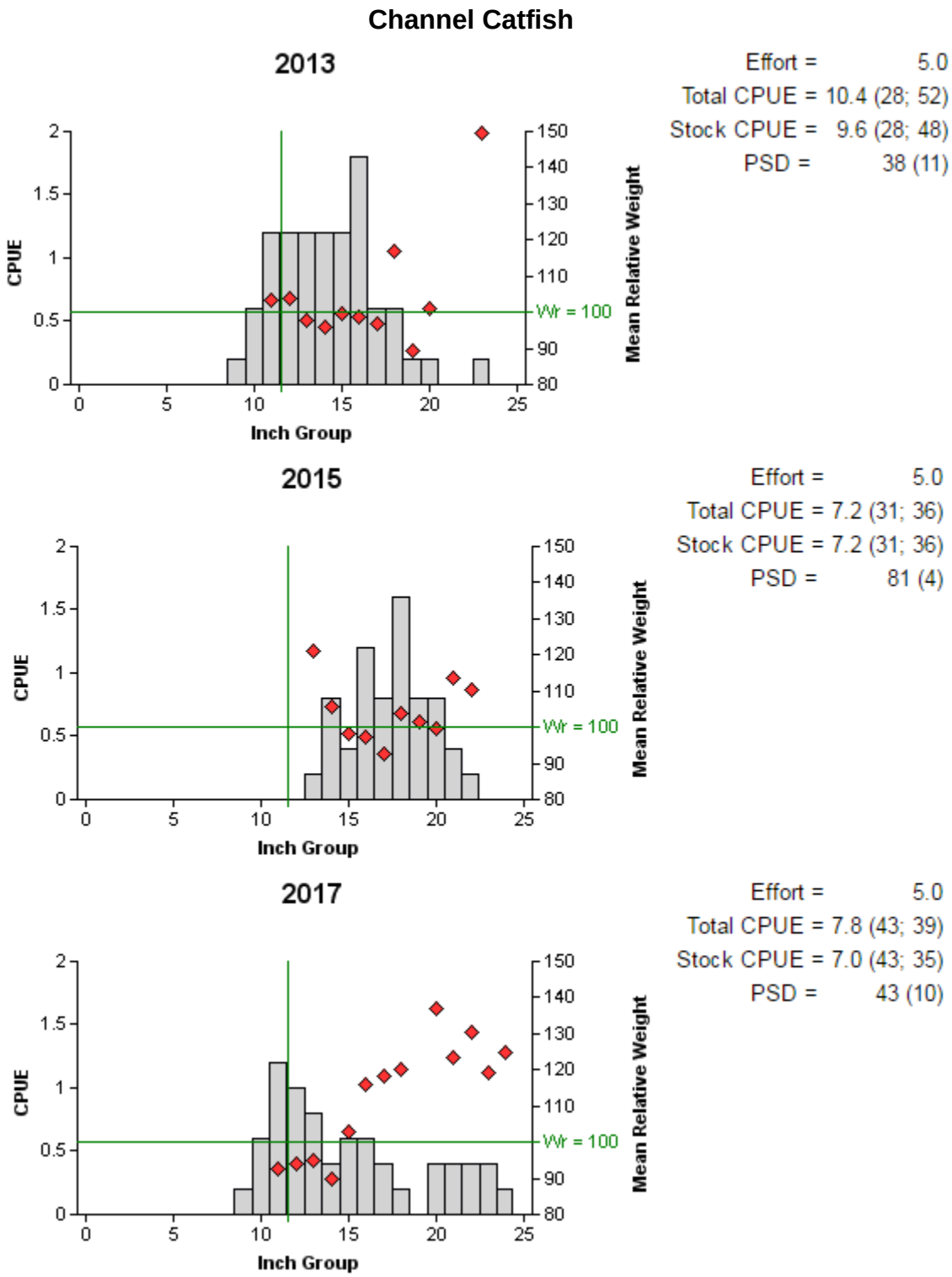


Figure 3. Number of Channel Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Buffalo Springs Reservoir, Texas, 2013, 2015, and 2017. Vertical line represents minimum length limit of 12 inches, and horizontal line represents relative weight of 100.

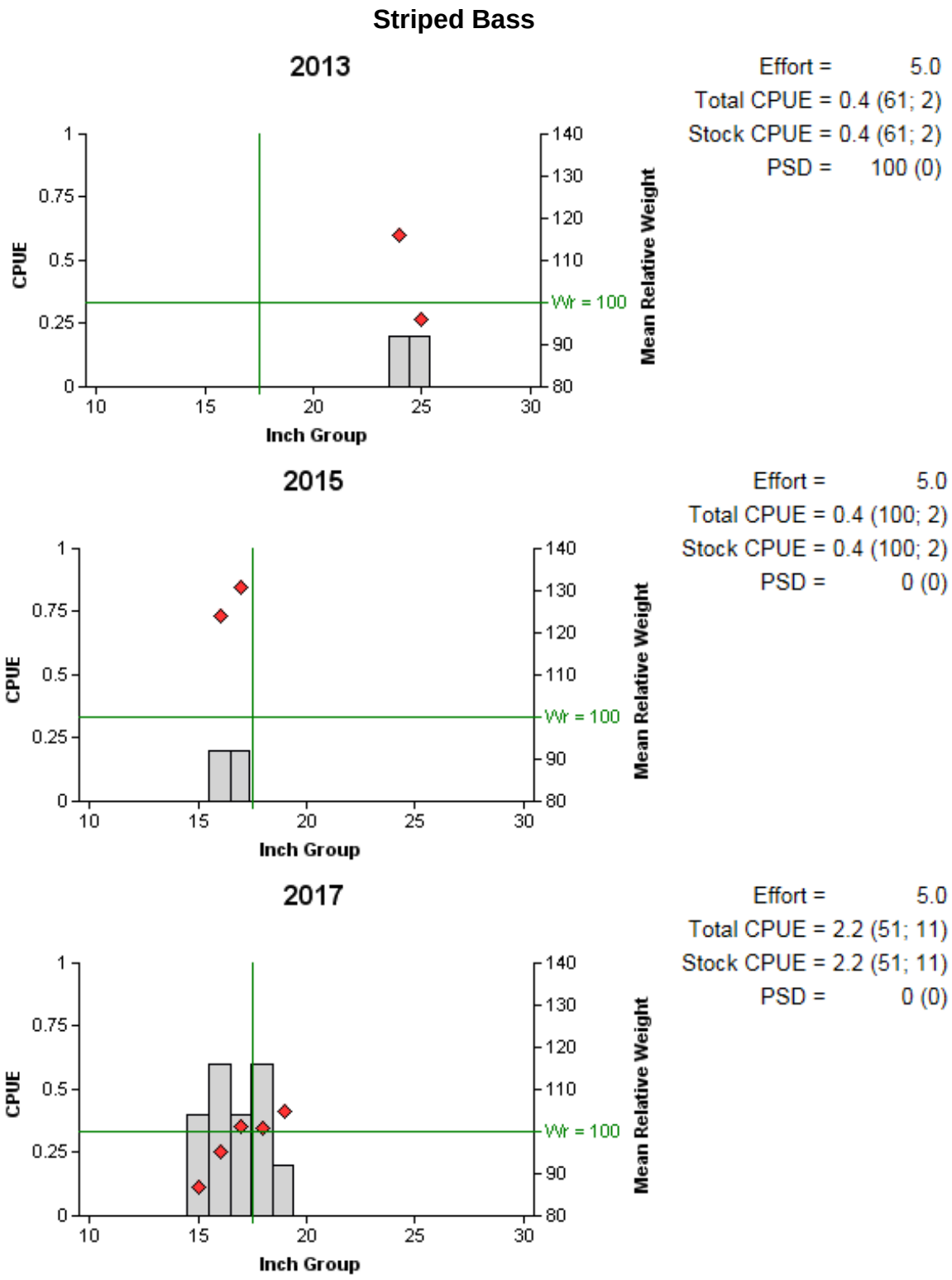


Figure 4. Number of Striped Bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N are in parentheses) for spring gill net surveys, Buffalo Springs Reservoir, Texas, 2013, 2015, and 2017. Vertical line represents minimum length limit of 18 inches, and horizontal line represents relative weight of 100.

Largemouth Bass

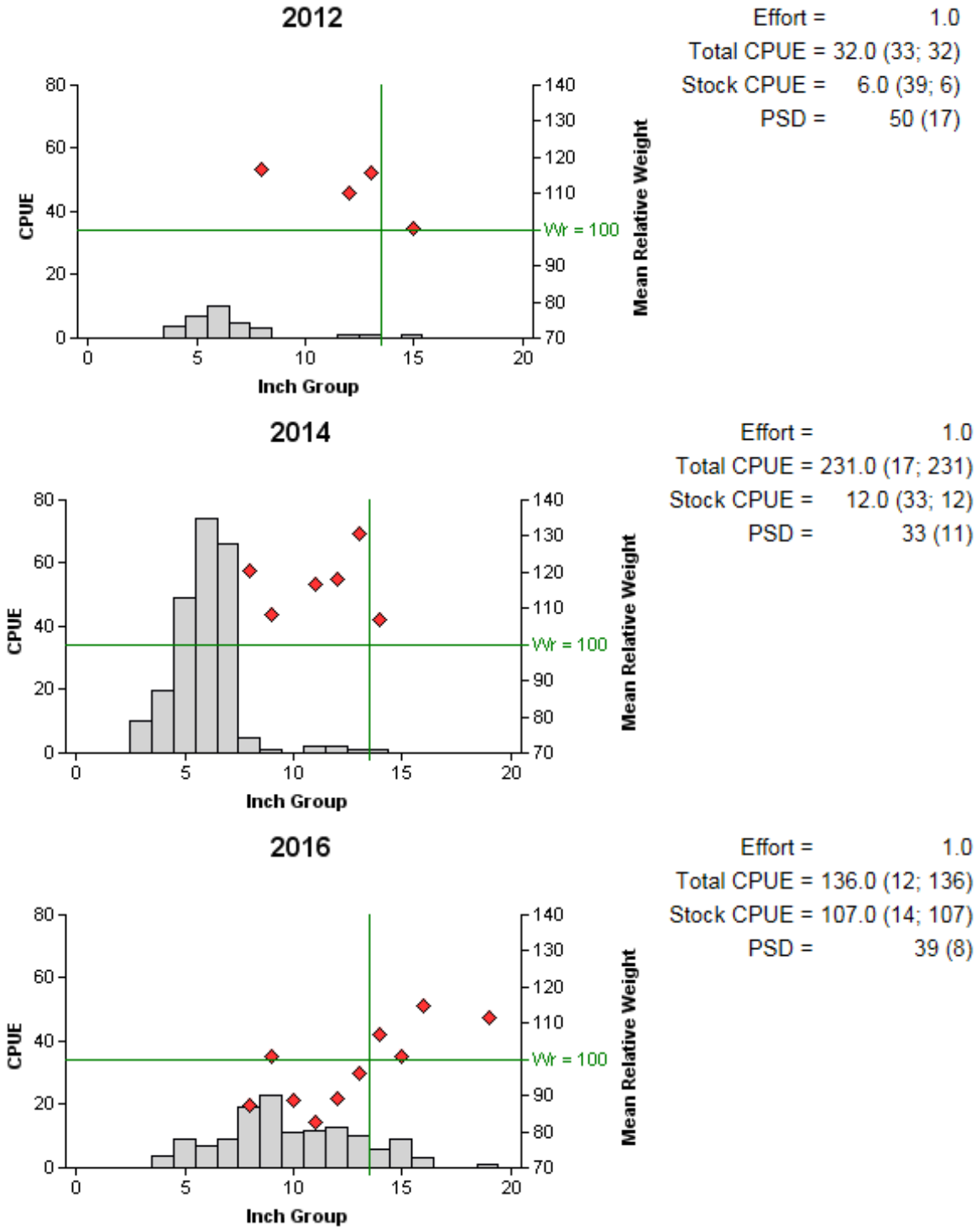


Figure 5. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Buffalo Springs Reservoir, Texas, 2012, 2014, and 2016. Vertical line represents minimum length limit of 14 inches, and horizontal line represents relative weight of 100.

Table 8. Proposed sampling schedule for Buffalo Springs Reservoir. Trap net and electrofishing surveys are conducted in the fall while gill net surveys are conducted in the spring. The letter S indicates standard sampling and additional surveys are denoted by A.

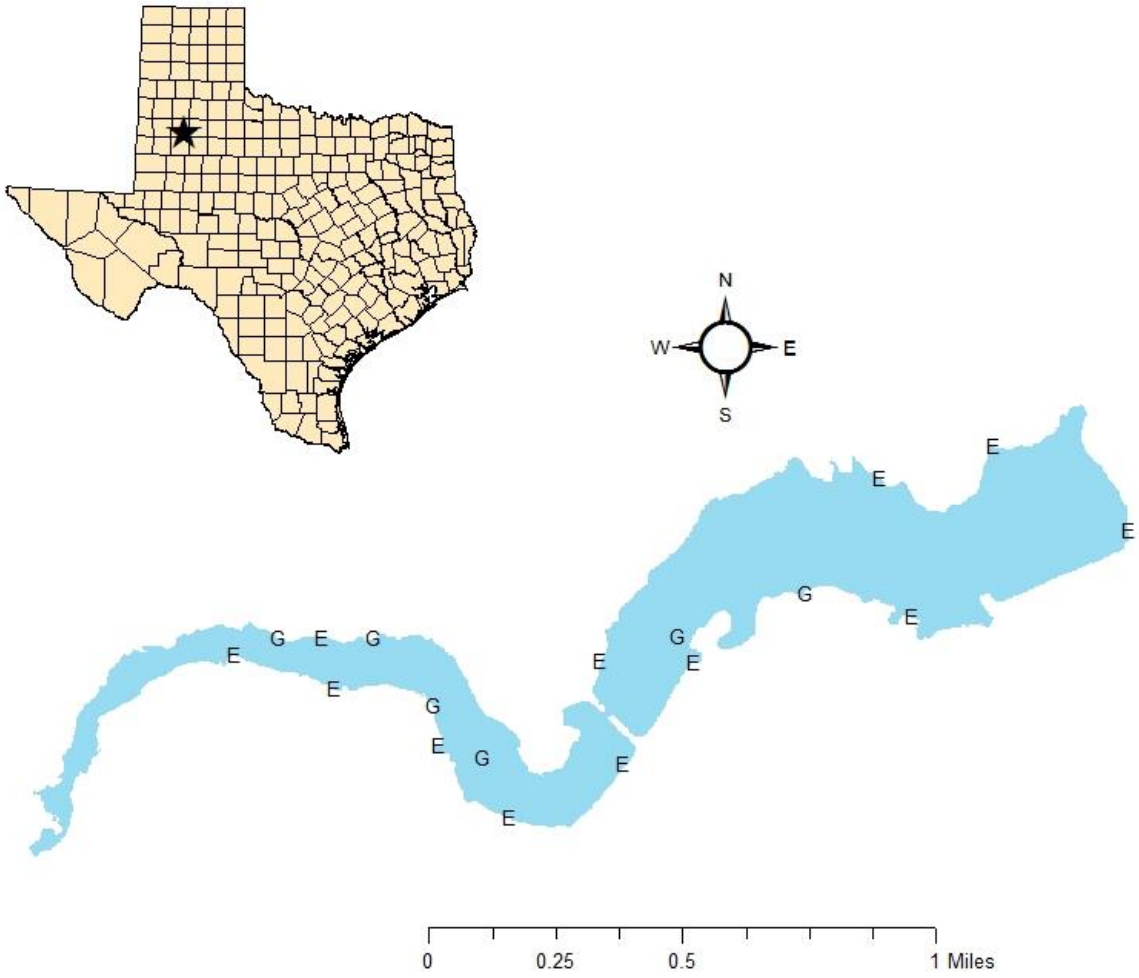
					Habitat				
Survey year	Electrofish Fall (Spring)	Trap net	Hoop net	Gill net	Structural	Vegetation	Access	Creel survey	Report
2017-2018			A						
2018-2019	A							S	
2019-2020			A						
2020-2021	S		A	S	S	S	S		S

APPENDIX A

Number (N) and catch rate (CPUE) of all species collected from all gear types from Buffalo Springs Reservoir, Texas, 2016-2017.

Species	Electrofishing		Gill Netting	
	N	CPUE	N	CPUE
Gizzard Shad	519	519.0	308	61.6
Common Carp	139	139.0	81	16.2
Golden Shiner			1	0.2
Black Bullhead	29	29.0	43	8.6
Channel Catfish	1	1.0	39	7.8
Striped Bass	1	1.0	11	2.2
Green Sunfish	196	196.0		
Bluegill	287	287.0	6	1.2
Longear Sunfish	52	52.0	1	0.2
Redear Sunfish	1	1.0		
Largemouth Bass	136	136.0	7	1.4
White Crappie	30	30.0	53	10.6

APPENDIX B



Location of sampling sites, Buffalo Springs Reservoir, Texas, 2016-2017. Gill net and electrofishing stations are indicated by G and E, respectively. Water level was at full pool at time of sampling.

APPENDIX C

Average cell counts of *P. parvum* collected from Buffalo Springs Reservoir, Texas.

Date	Average Cell count (Cells/ml)
2/19/2003	8,000
3/24/2003	67,000
4/09/2003	218,000
5/05/2003	8,000
2/24/2005	0
2/23/2011	0
3/09/2011	0
3/25/2011	0
4/19/2011	0
5/17/2011	0
6/28/2011	0
7/25/2011	0
8/23/2011	0
9/26/2011	0
10/24/2011	1,000
11/21/2011	1,000
12/15/2011	0
1/23/2012	0
2/27/2012	1,000
3/07/2012	49,000
3/28/2012	1,000
4/23/2012	2,000
4/02/2014	133,000
4/07/2014	124,000
7/15/2014	0
1/27/2015	37,000
4/07/2015	0
3/07/2016	2,000
1/24/2017	0
2/22/2017	0
4/06/2017	0