PERFORMANCE REPORT

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INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2015 Fisheries Management Survey Report

Twin Buttes Reservoir

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Twin Buttes Reservoir were surveyed in 2015 using electrofishing and trap netting and in 2016 using gill netting. Historical data are presented with the 2015-2016 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:** Twin Buttes Reservoir is a 9,080-acre impoundment located 3 miles southwest of San Angelo, Texas in Tom Green County. The reservoir consists of two pools ("North Pool" and "South Pool") connected by an equalization channel. This hypereutrophic reservoir experiences dramatic water level fluctuations, and has extensive fish habitat mostly in the form of flooded terrestrial vegetation. Boating access was poor due to low water levels.

- **Management History:** Important sport fish include White Bass, Largemouth Bass, White Crappie, and Catfishes. Sport fishes have been managed with statewide regulations.

- **Fish Community**
  - **Prey species:** Threadfin Shad were present in the reservoir. Electrofishing catch of Gizzard Shad was adequate, and 87% of Gizzard Shad were available as prey to most sport fish. Electrofishing catch rate of Bluegill was higher than previous surveys.

  - **Catfishes:** Channel Catfish continued to portray a low density population. Flathead Catfish were present in the reservoir. No Blue Catfish were collected, but have been present historically.

  - **Temperate basses:** White Bass catch rates were low and similar to previous surveys with fish ranging from 9 to 14 inches.

  - **Largemouth Bass:** Largemouth Bass are present in the reservoir at low density. Few legal-size fish were available to anglers, but fish up to 21 inches were observed.

  - **White Crappie:** White Crappie were abundant, but few legal-size fish available to anglers.

Management Strategies: Continue to manage under statewide harvest regulations. Conduct additional electrofishing and trap net surveys in 2017 and low-frequency electrofishing surveys in 2018. Conduct additional hoop netting in spring 2018 and 2020. Conduct required monitoring in 2019-2020. Conduct a creel survey in 2019-2020.

INTRODUCTION

This document is a summary of fisheries data collected from Twin Buttes Reservoir in 2015-2016. The purpose of the document is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2015-2016 data for comparison.

Reservoir Description

Twin Buttes Reservoir was constructed in 1963 on the South and Middle Concho Rivers three miles southwest of San Angelo. The 9,080-acre impoundment is used for recreation, municipal water supply and irrigation. The reservoir consists of two pools ("North Pool" and "South Pool") connected by an equalization channel. Twin Buttes is susceptible to significant water level fluctuations and the reservoir was approximately 44 feet below conservation pool during sampling (Figure 1). Twin Buttes Reservoir was hypereutrophic with a mean TSI chl-*a* of 61.76 (Texas Commission on Environmental Quality 2011). Boat access on the North Pool was limited to shoreline-launching in 2011, and was non-existent in spring 2012. Boat access at the South Pool was limited to launching off of a gravel shoreline. Bank fishing access was fair. However, no fishing piers or disabled access facilities were available. Other descriptive characteristics for Twin Buttes Reservoir are presented in Table 1.

Angler Access

Twin Buttes Reservoir has four public boat ramps and no private boat ramps. All ramps were out of the water at the time of the survey and extension is not feasible. Boat launching from unimproved bank areas were available. Additional boat ramp characteristics are in Table 2. Shoreline access is abundant at the public boat ramp areas.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Scott and Farooqi 2012) included:

1. Communicate with the City of San Angelo to voice angler concerns over access to Twin Buttes Reservoir.
   Action: Communicated with the City of San Angelo Parks Department and voiced anglers' concerns to prevent possible blockage of angler access to Twin Buttes.
2. Communicate with the City of San Angelo Water Utilities Department to share information about negative effects on the fishery and the portion of the local economy that is linked to fishing.
   Action: Communicated with the City of San Angelo Water Utilities Department to share information about negative effects on the fishery and the portion of the local economy that is linked to fishing.
3. As soon as water level increases and boat access is possible, conduct additional electrofishing, trap netting, and gill netting.
   Action: Conducted additional electrofishing, trap netting, and gill netting after water levels increased.
4. Work with controlling authorities to post signage, educate the public about invasive species issues through the media and presentations.
   Action: Continued to work with controlling authorities to post signage and to educate the public on invasive species threats through media outlets.

Harvest regulation history: Sport fishes in Twin Buttes Reservoir are currently managed with statewide

regulations (Table 3).

Stocking history: Species stocked have included Threadfin Shad, Blue Catfish, Channel Catfish, Florida and Northern Largemouth Bass, and Striped Bass. Smallmouth Bass and Walleye were stocked in the past, but they failed to establish viable fisheries. The complete stocking history is in Table 4.

Vegetation/habitat management history: Historically, Twin Buttes Reservoir has had severely fluctuating water levels (Figure 1). Flooded terrestrial vegetation has been the primary fish habitat, but native submerged vegetation (e.g., Illinois pondweed, coontail) has been present in recent surveys. The reservoir has no significant habitat management history.

Water transfer: Water from Twin Buttes Reservoir is used by the City of San Angelo to maintain water levels in Nasworthy Reservoir, which is directly downstream and surrounded by parks and residences. No interbasin water transfers are known to occur at this reservoir.

METHODS

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Twin Buttes Reservoir (TPWD unpublished). Primary components of the OBS plan are listed in Table 5. Electrofishing in 2014 was conducted during daylight hours. All survey sites were randomly selected and all other components of the surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Electrofishing – Largemouth Bass, Sunfishes, Gizzard Shad, and Threadfin Shad were collected by electrofishing (1.6 hour at 19, 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.

Trap netting – Crappie were collected using trap nets (10 net nights at 10 stations). CPUE for trap netting was recorded as the number of fish caught per net night (fish/nn).

Gill netting – Channel Catfish and White Bass were collected by gill netting (20 net nights at 20 stations). CPUE for gill netting was recorded as the number of fish caught per net night (fish/nn).

Genetics – Genetic analysis of Largemouth Bass was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015). Micro-satellite DNA analysis was used to determine genetic composition of individual fish from 2005 through 2012 and by electrophoresis for previous years.

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 presence/absence only vegetation survey was conducted in 2015.

Water level – Source for water level data was the United States Geological Survey (USGS 2016).

RESULTS AND DISCUSSION

Habitat: A vegetation survey in 2015 indicated the presence of coontail, sago pondweed, Illinois pondweed, bulrush and cattails. However, abundance of all species was very low. The previous habitat and vegetation surveys were conducted in 2007 (Scott and Farooqi 2008) and had abundant submerged terrestrial vegetation (saltcedar, willow baccharis) that provided most of the littoral fish habitat. Native submerged vegetation (e.g. Illinois pondweed, coontail) and a smaller amount of native emergent plants (cattail, water willow) were also present in 2007 and covered less than 4% of the reservoir.

Prey species: Threadfin Shad were present in 2015, but in low abundance (0.6/h). Electrofishing catch rates of Gizzard Shad was 138.9/h in 2015, which was much lower than 2014 (1,383.0/h) when water levels increased sharply, but similar to 2011 (222.0/h). Index of vulnerability (IOV) for Gizzard Shad was good, indicating that 87% of Gizzard Shad were available to existing predators (Figure 2). Total CPUE of Bluegill in 2015 was higher than total CPUE from surveys in 2014 and 2011, and size structure continued to be low with most fish 4-5 inches in length (Figure 3).

Catfishes: The gill net catch rate of Channel Catfish was low (1.3/nn) in 2016 and was similar to past surveys in 2008 (1.0/nn) and 2004 (0.6/nn). A total of 25 Channel Catfish ranging in size from 4 to 28

inches were collected. Condition was good with all stock-size length groups greater than 90 relative weight. Flathead Catfish were present in the reservoir, with 6 collected ranging from 12 to 32 inches. No Blue catfish were observed, but have been present in past surveys.

White Bass: The gill net catch rate of White Bass was 2.2/nn in 2016, which was very similar to previous surveys in 2008 (2.2/nn) and 2004 (1.7/nn)(Figure 5). White Bass ranged from 9 to 14 inches and were in good condition, relative weights (W_r) were all above 90. Although the population density continues to be low, most fish were legal size and provide harvest opportunities for anglers.

Largemouth Bass: The electrofishing catch rate of stock-length Largemouth Bass was 20.2/h in 2015, which was lower than 63.0/h in 2011. The population continues to recover from severe low water levels in 2012-2013. Daytime electrofishing in 2014 documented that a strong year-class was produced and coincided with a significant increase in water level earlier that year. A total of 32 stock-size fish were collected in 2015, with Largemouth Bass up to 21 inches collected (Figure 6). Body condition in 2015 was good with relative weights over 90 for nearly all stock-size inch-groups (Figure 6). Florida Largemouth Bass influence in the population was denoted by 57% of alleles present in the sample; while 10% of fish in the genetic sub-sample were pure Florida Largemouth Bass (Table 6).

White Crappie: The trap net catch rate of White Crappie was 11.8/nn in 2015, lower than in 2011 (24.0/nn), but similar to 2009 (11.4/nn; Figure 7). The PSD was 44 and was lower than previous surveys, but still at a balanced level (Figure 7). Mean relative weight (W_r) was over 90 for all stock-size inch groups in 2015 and declined with increasing length (Figure 7). Few fish above the minimum length limit were observed and may still be recovering from low water levels in 2012-2013.

Fisheries management plan for Twin Buttes Reservoir, Texas

Prepared – July 2016.

ISSUE 1: Largemouth Bass are a popular sportfish in Twin Buttes Reservoir. Improved water levels in 2014 helped produce a strong year-class. When water levels are up, Twin Buttes is a popular location for local bass club tournaments. Continued sampling is necessary to monitor this important population.

MANAGEMENT STRATEGY

1. Monitor the Largemouth Bass and prey species with electrofishing in fall 2017 and 2019.
2. Continue to request Florida Largemouth Bass at 100 fish/acre, contingent upon stable or improved water levels, to help rebuild the fishery and improve bass genetics.
3. Conduct a creel survey in 2019-2020 to monitor effort and catch rates of Largemouth Bass.
4. Monitor Largemouth Bass genetics. Fin samples will be taken from 30 fish and submitted for genetic analysis in 2019.

ISSUE 2: Based on past sampling data, gill nets have failed to provide adequate catch rates for catfish species in Twin Buttes Reservoir. To be able to evaluate abundance, size structure, and growth, other sampling methods need to be explored to better monitor these potentially important species.

MANAGEMENT STRATEGIES

1. Sample Channel Catfish with baited tandem hoop nets in spring 2020.
2. Conduct exploratory sampling of Flathead Catfish and Blue Catfish with low-frequency electrofishing in spring 2018 with 2 hours sampling (24, 5-minute stations).

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

FY 2017 – FY2020

Sport fish, forage fish, and other important fishes

Sport fish in Twin Buttes Reservoir include Largemouth Bass, White Crappie, White Bass, and Catfish species. Important prey species include Bluegill and Gizzard Shad.

Low-density fisheries

White Bass: White Bass are present in Twin Buttes Reservoir, however historical catch rates in gill nets have been low and has precluded any meaningful analysis of abundance and size structure. Additionally, only 4.0% of anglers targeted White Bass in the 2009-2010 creel survey. Sampling this population is unnecessary in FYs 2017-2020, however some harvest and angling effort data may be collected during a creel survey planned for in 2019-2020, at which time sampling objectives will be re-evaluated.

Survey objectives, fisheries metrics, and sampling objectives

Largemouth Bass: Largemouth Bass are the most sought after fish in Twin Buttes Reservoir. Results from the 2009-2010 creel survey data shows 70% of angler effort is directed towards Largemouth Bass. Anglers spent 25,764 hours fishing for Largemouth Bass during the 2009-2010 creel survey and when water levels are up, attracts local bass club tournaments. The population was negatively affected by low water in 2011-2012, but a sharp rise in May 2014 coincided with a strong year-class that was observed in the fall 2014 electrofishing survey. Continuation of biennial trend data in this reservoir with night electrofishing in the fall will allow for determination of any large-scale changes in the Largemouth Bass population that may spur further investigation. A minimum of 18 randomly selected 5-min electrofishing sites will be sampled in fall 2017 and 2019 (Table 7), but sampling will continue at random sites until 50 stock-size fish are collected and the RSE of CPUE-Stock is < 25 (the anticipated effort to meet both sampling objectives is 18 stations with 80% confidence). Eighteen random stations will be determined. Exclusive of the original 18 random stations, 6 additional random stations will be pre-determined in the event some extra sampling is necessary. A maximum of 24 stations will be sampled. Fin samples will be taken from 30 fish and submitted for genetic analysis in 2019. Otoliths from 13 fish between 13.0 and 14.9 inches will be collected to determine mean age at 14 inches.

White Crappie: The 2009-2010 creel survey indicated White Crappie were the second most popular species among anglers with 10% of the directed effort and a total of 3,544 hours/year fished. Crappie up to 15 inches were observed in the survey. Standard trap net surveys from 2007 to 2015 produced high catch rates (8-24 fish/nn). This reservoir has traditionally supported a popular crappie fishery. Our objectives are to monitor trends in size structure, condition, and growth. Analysis of historical trap net data from 2005-2015 indicates that a CPUE-Stock with an RSE < 25 would rarely be achieved within a reasonable amount of effort and for this reason abundance will not be a sampling objective for White Crappie. A minimum of 10 randomly selected trap net sites will be sampled in 2017 and 2019 (Table 7), but sampling will continue at random sites until 100 stock-size fish are collected and otoliths from 13 fish between 9.0 and 10.9 inches will be collected to determine mean age at 10 inches. The anticipated effort to meet both sampling objectives is 10-15 stations with 80% confidence. Beyond the original 10 random stations, 10 additional random stations will be pre-determined in the event some extra sampling is necessary. A maximum of 20 stations will be sampled.

Channel Catfish: Channel Catfish are present in Twin Buttes Reservoir, however historical catch rates in gill nets have been low and has precluded any meaningful analysis of abundance and size structure. We would like to explore the use of alternative sampling gears to monitor the Channel Catfish population in Twin Buttes Reservoir. We will use baited tandem hoop nets to survey the Channel Catfish population in spring 2018 and 2020 (Table 7). The estimated number of baited hoop net sets to achieve an RSE for CPUE-Stock ≤ 25 is 10 sets using the recommended 2-night soak duration. A target of 100 stock size fish should provide an adequate PSD estimate per the tandem hoop net procedures (PSD within 10% with 80% confidence, 75-140 fish are recommended). If targets are not met after the first 10 nets, we will set nets at an additional 10 randomly set locations. Our maximum sampling effort will be 20 net nights.

Flathead and Blue Catfish: Flathead and Blue Catfish are present in Twin Buttes Reservoir and large individuals have been observed as a lake record 73.35lb Flathead Catfish was caught in 2014. However, traditional gill netting has been ineffective at capturing quality numbers and population data regarding abundance, condition, and size structure is unknown. Low-frequency electrofishing will be utilized to collect exploratory data on abundance, condition, and size structure data on the Flathead Catfish and Blue Catfish populations in spring 2018 (Table 7). For Flathead and Blue Catfish, the minimum number of Low-Frequency Electrofishing (LFE) stations recommended by TPWD Inland Fisheries procedures is 10 stations that produce a catch > 0 with a total sample of 200 fish. It is unlikely 200 fish of each species would be collected in 2 hours of sampling. Because we have no previous LFE sampling for this reservoir to compare to, sampling will be exploratory in nature and based on our findings may spur further investigation. We will conduct 2 hours of LFE (24 randomly-selected 5-min electrofishing stations). Our maximum sampling effort for LFE will be 2 hours total.

Gizzard Shad and Bluegill: Gizzard Shad and Bluegill are the primary forage fish in Twin Buttes Reservoir. Sampling effort based on sampling objectives for Largemouth Bass will be sufficient to determine IOV and CPUE-Total of Gizzard Shad and CPUE-Total and size structure of Bluegill. No additional sampling effort will be expended to achieve an RSE ≤ 25 for CPUE-Total for Gizzard Shad or Bluegill.

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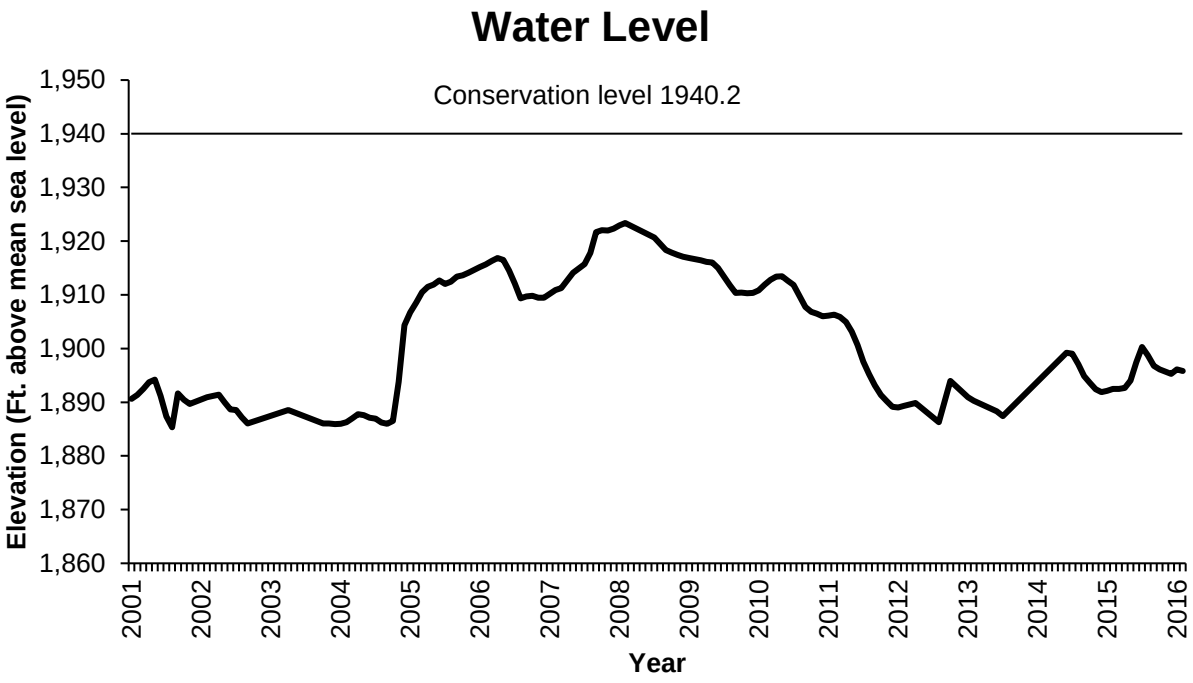


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Twin Buttes Reservoir, Texas.

Table 1. Characteristics of Twin Buttes Reservoir, Texas.

Characteristic	Description
Year constructed	1963
Controlling authority	City of San Angelo, U.S. Bureau of Reclamation
County	Tom Green
Reservoir type	Main-stem
Shoreline Development Index (SDI)	4.0 [north (3.8) and south (4.2) pools, averaged]
Conductivity	1817 μmhos/cm

Table 2. Boat ramp characteristics for Twin Buttes Reservoir, Texas, June, 2016. Reservoir elevation at time of survey was 1903 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Twin Buttes Marina, North Ramp	31.39073 -100.5535	Y	30	1912	Out of water. Extension is not feasible
Twin Buttes Marina, South Ramp	31.37468 -100.5538	Y	30	1905	Out of water. Extension is not feasible
12-Mile Boat Ramp	31.37733 -100.6025	Y	10	1906	Out of water. Extension is not feasible
Equalization Channel	31.34622 -100.5227	Y	10	1923	Out of water. Extension is not feasible

Table 3. Harvest regulations for Twin Buttes Reservoir, Texas.

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

Table 4. Stocking history of Twin Buttes Reservoir, Texas. FGL = fingerling; AFGL = advanced fingerling; ADL = adults.

Species	Year	Number	Size
Threadfin Shad	1982	2,000	UNK
	1984	8,500	UNK
	Total	10,500	
Blue Catfish	1972	1,400	UNK
	1973	11,610	UNK
	1974	4,840	UNK
	1976	28,000	UNK
	1977	39,200	UNK
	1978	24,515	UNK
	1979	83,903	UNK
	1980	57,130	UNK
	Total	250,598	
Channel Catfish	1966	9,550	UNK
	1967	20,000	UNK
	1970	10,500	UNK
	1971	100,549	UNK
	1974	20,000	UNK
	1987	100,300	FGL
	2004	41,950	FGL
	2005	154,733	FGL
	2014	562,773	FRY
	Total	1,020,355	
Striped Bass	1995	51,196	FGL
Palmetto Bass	1979	90,720	UNK
	1982	27,526	UNK
	Total	118,246	
Warmouth	1966	4,000	UNK
Redear Sunfish	1972	3,000	UNK
Smallmouth Bass	1982	105,611	UNK
	1983	80,901	UNK
	1984	168,070	FGL
	1987	30	ADL
	Total	354,612	
Largemouth Bass	1966	100,000	UNK
	1967	10,000	UNK
	1968	416,000	UNK
	1970	33,725	UNK
	1976	6,100	UNK
	Total	510,305	

Table 4. Stocking history continued.

Species	Year	Number	Size
Florida Largemouth Bass	1975	188,500	FGL
	1976	200,500	FGL
	1977	199,900	FRY
	1977	25,750	FGL
	1978	183,776	FGL
	1986	14,981	FGL
	1996	139,304	FGL
	2005	150,017	FGL
	2005	135	ADL
	2008	190,545	FGL
	2016	53,869	FGL
	Total	1,201,734	
White Crappie	1972	53,000	UNK
Walleye	1971	100,000	UNK
	1972	782,325	UNK
	1973	1,400,000	UNK
	1974	105,000	UNK
	Total	2,387,325	
Green X Redear Sunfish	1966	24,500	UNK
	1967	9,000	UNK
	1972	7,200	UNK
	Total	40,700	

Table 5. Objective-based sampling plan components for Twin Buttes Reservoir, Texas 2015 – 2016.

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
	Condition	W_r	10 fish/inch group (max)
	Genetics	% FLMB	N = 30, any age
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
Trap netting			
White Crappie	Abundance	CPUE –Total and Stock	RSE-Stock ≤ 25
	Size structure	PSD, length frequency	N = 50
	Condition	W_r	10 fish/inch group (max)
Gill netting			
Blue Catfish	Abundance	CPUE– Total and stock	RSE-Stock ≤ 25
	Condition	W_r	10 fish/inch group (max)
Channel Catfish	Abundance	CPUE– Total and stock	RSE-Stock ≤ 25
	Condition	W_r	10 fish/inch group (max)
Flathead Catfish	Abundance	CPUE– Total and stock	RSE-Stock ≤ 25
	Condition	W_r	10 fish/inch group (max)
White Bass	Abundance	CPUE– Total and CPUE-10	RSE-Stock ≤ 25
	Size Structure	PSD, length frequency	N = 50
	Condition	W_r	10 fish/inch group (max)

[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.

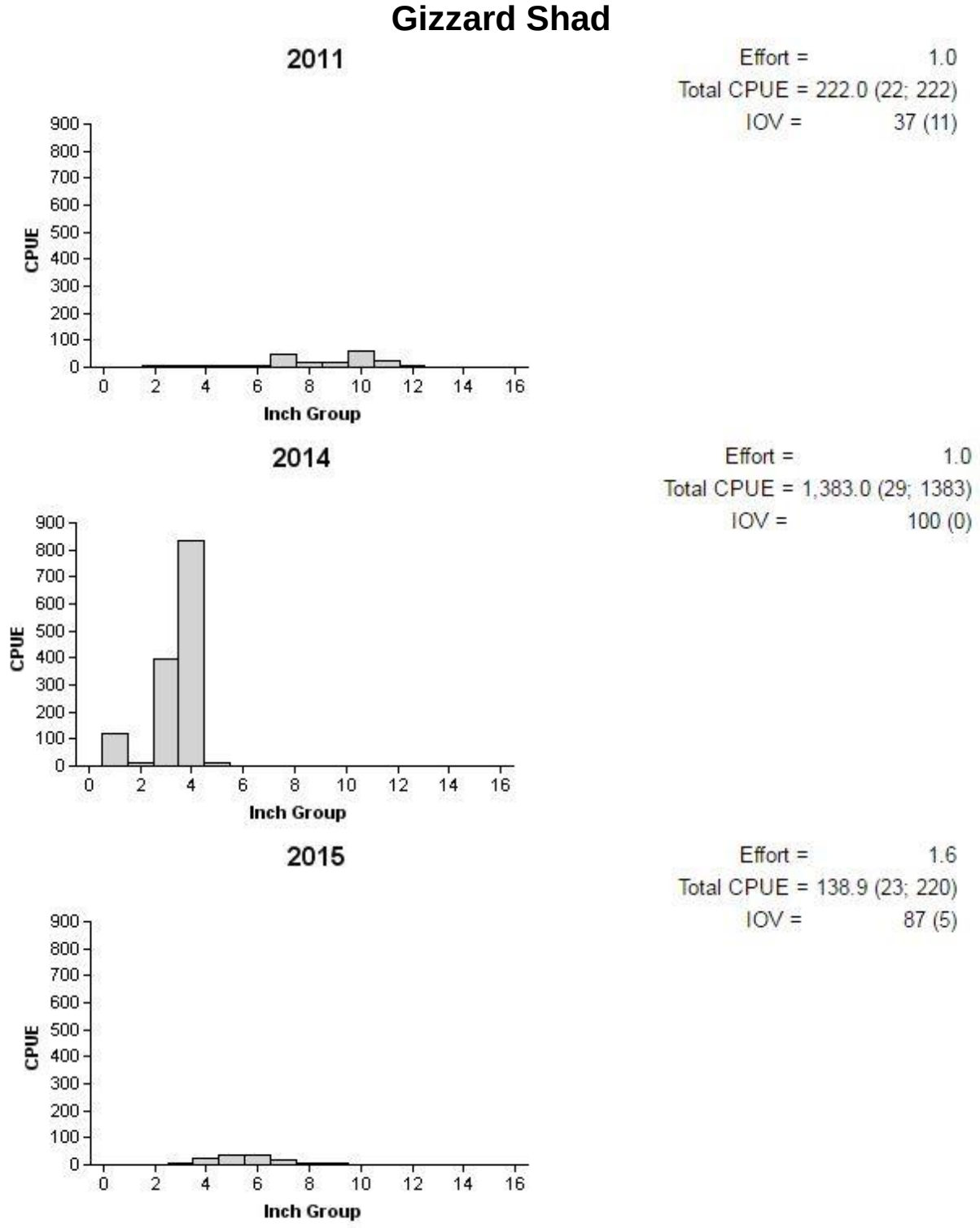


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Twin Buttes Reservoir, Texas, 2011, 2014, and 2015.

Bluegill

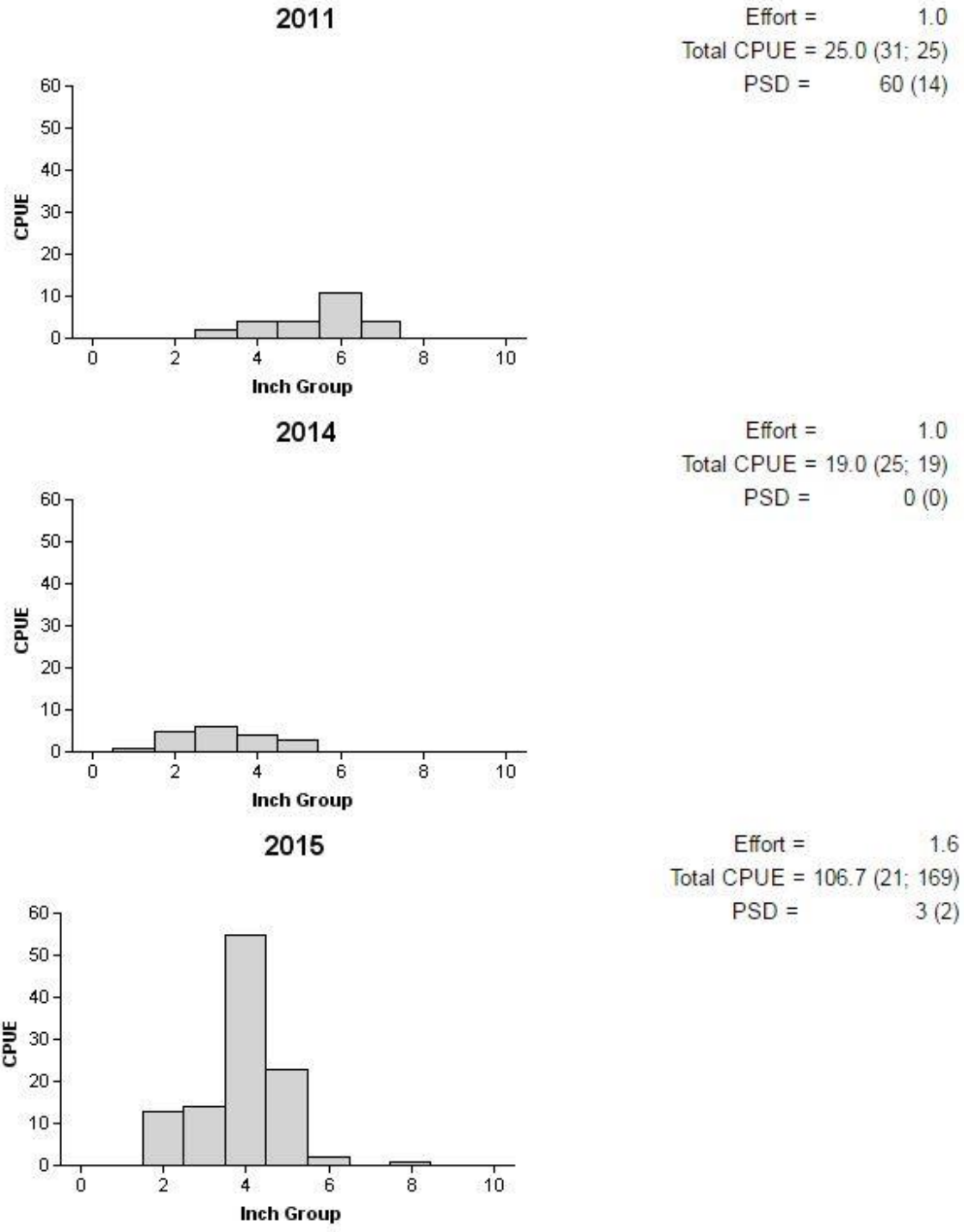


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Twin Buttes Reservoir, Texas, 2011, 2014, and 2015.

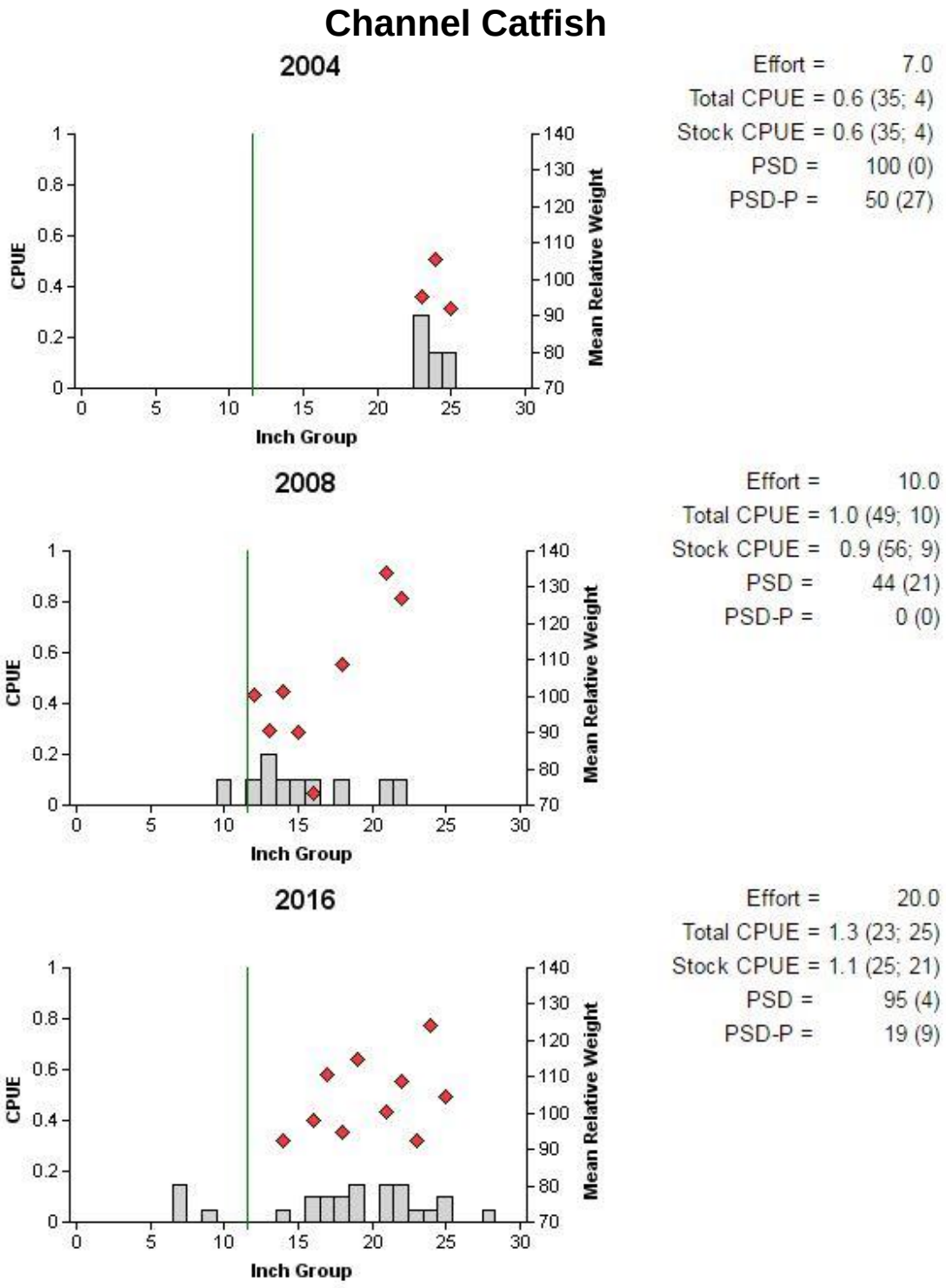


Figure 4. Number of Channel Catfish caught per net night (CPUE), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Twin Buttes Reservoir, Texas, 2004, 2008, and 2016. Vertical line indicates minimum length limit.

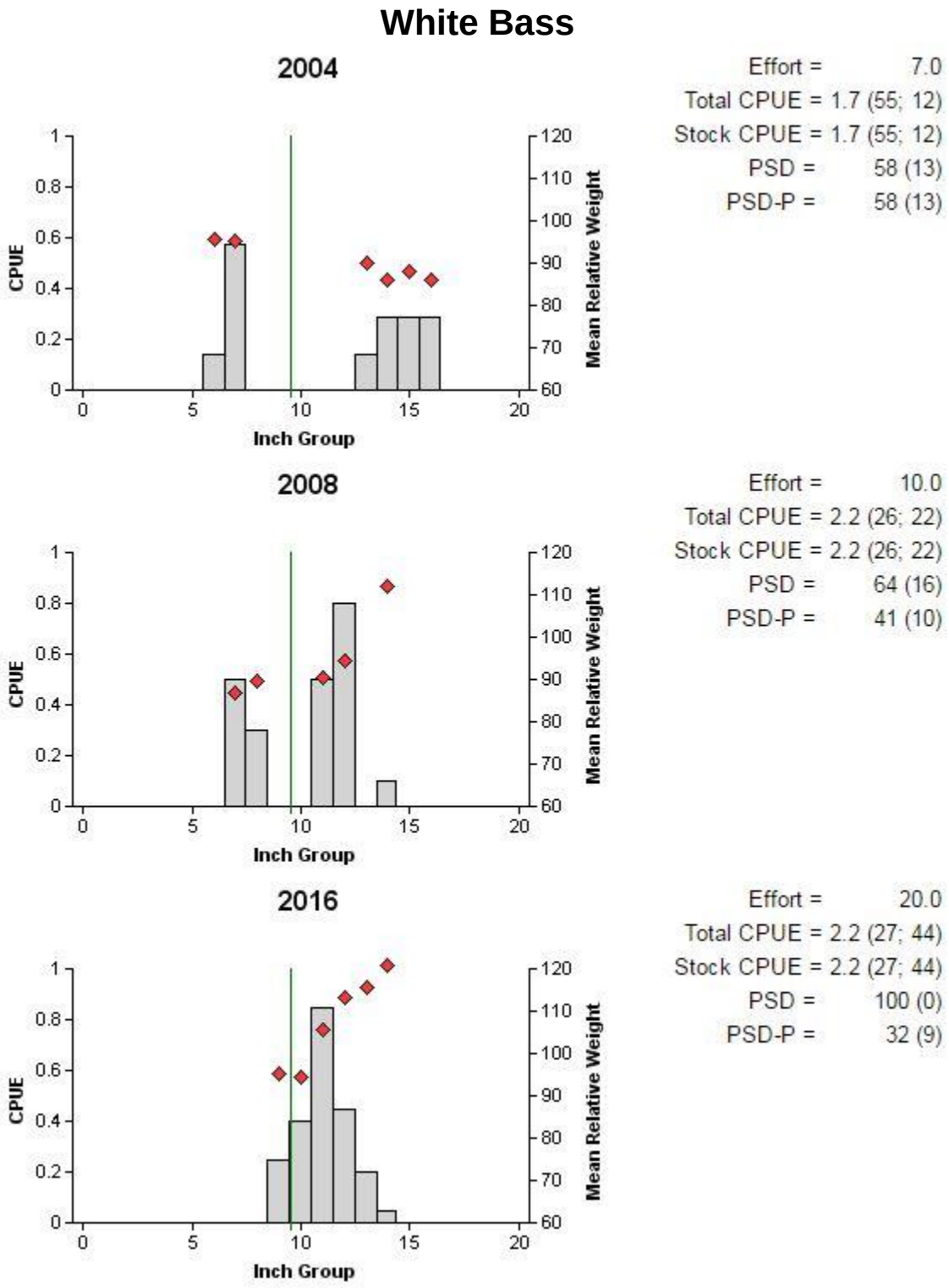


Figure 5. Number of White Bass caught per net night (CPUE), mean relative weight (diamonds), and population indices (RSE and N are in parentheses) for spring gill net surveys, Twin Buttes Reservoir, Texas, 2004, 2008, and 2016. Vertical line indicates minimum length limit.

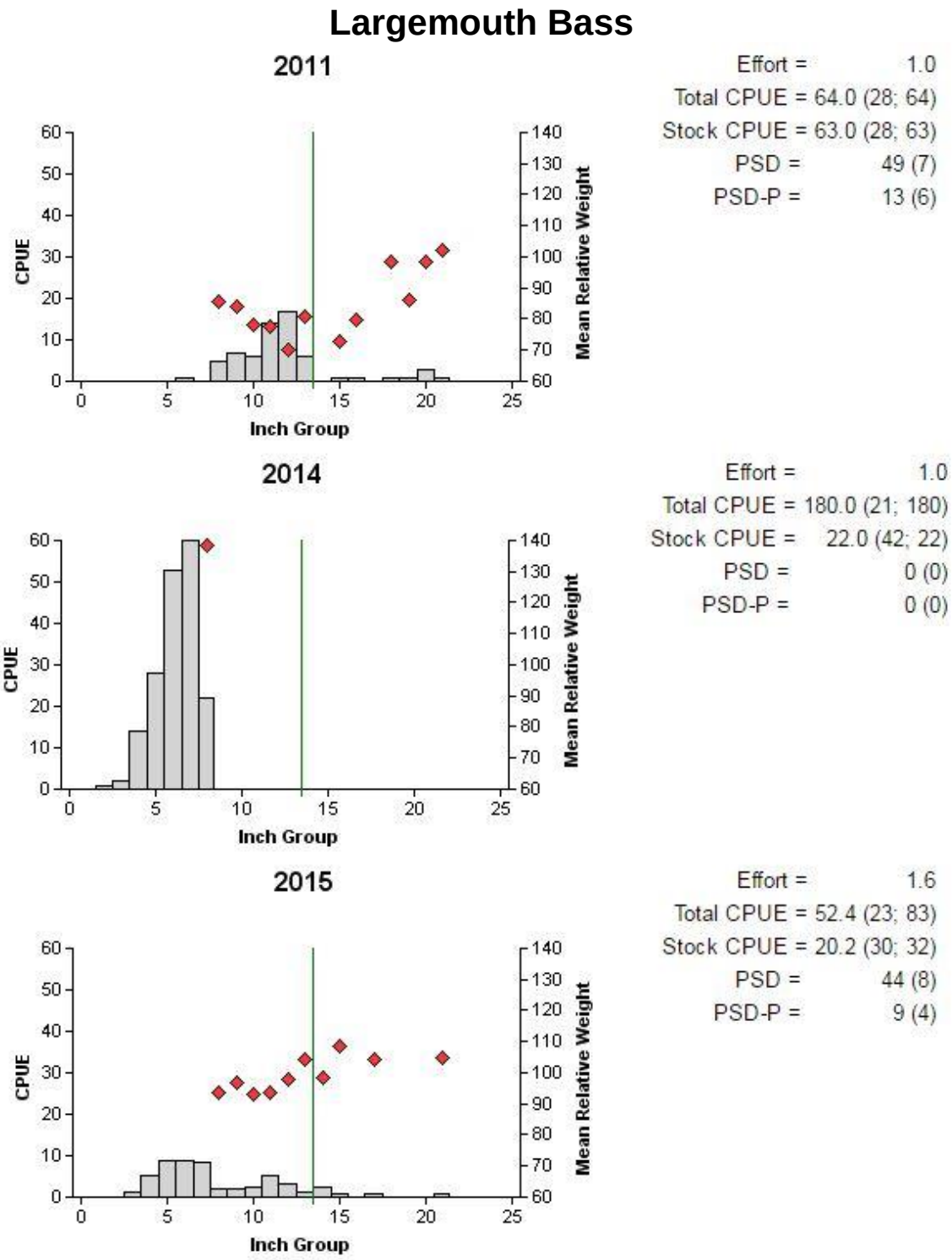


Figure 6. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Twin Buttes Reservoir, Texas, 2011, 2014, and 2015. Vertical line indicates minimum length limit.

Largemouth Bass

Table 6. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Twin Buttes Reservoir, Texas, 2015. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB. Genetic composition was determined by electrophoresis prior to 2005 and with micro-satellite DNA analysis since 2005.

		Number of fish				
Year	Sample size	FLMB	Intergrade	NLMB	% FLMB alleles	% FLMB
2015	30	3	27	0	57.0	10.0

White Crappie

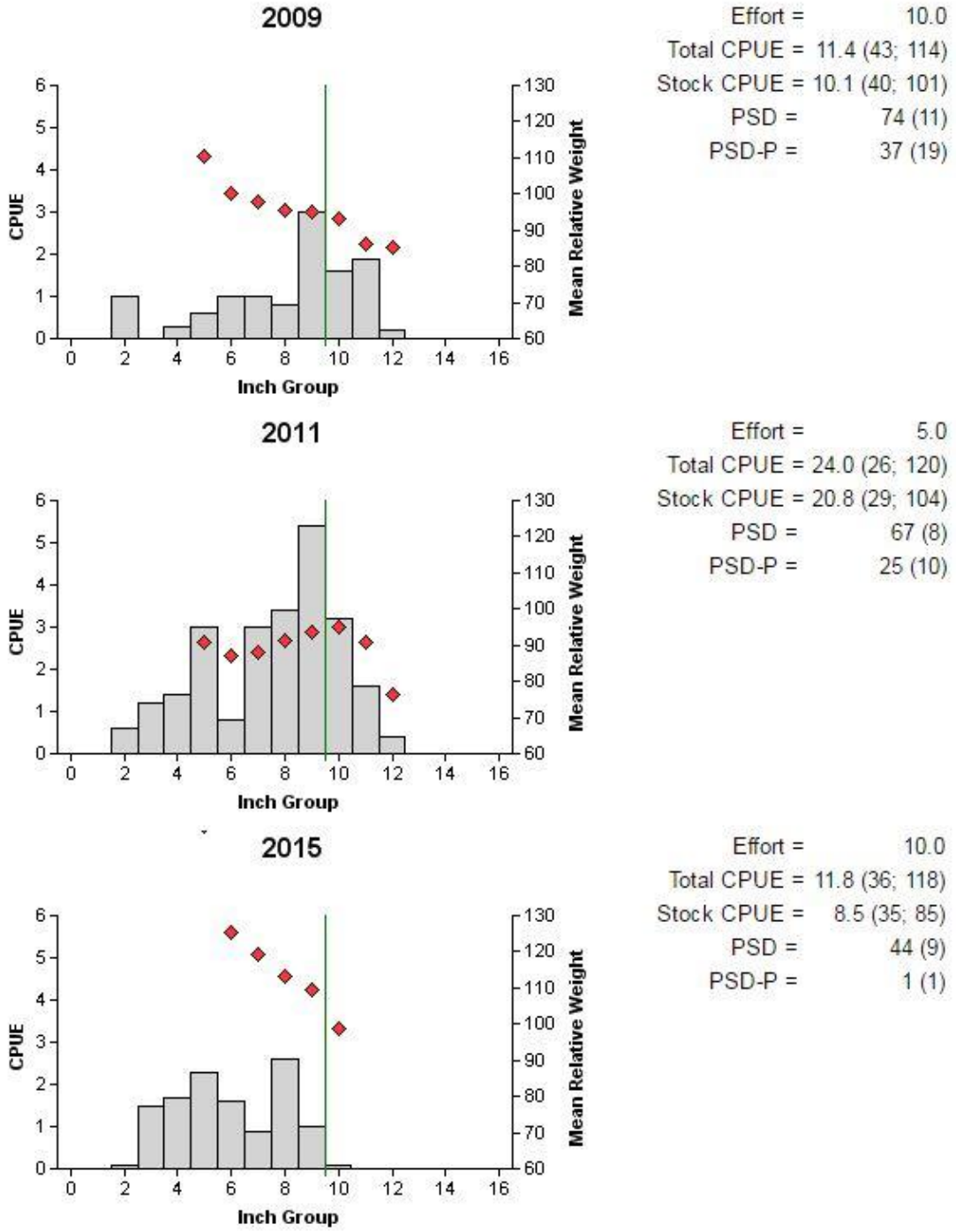


Figure 7. Number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Twin Buttes Reservoir, Texas, 2009, 2011, and 2015. Vertical line indicates minimum length limit.

Table 7. Proposed sampling schedule for Twin Buttes Reservoir, Texas. Survey period is June through May. Gill netting, tandem hoop netting, and low-frequency electrofishing (LFE) surveys are conducted in the late spring, while electrofishing and trap netting surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

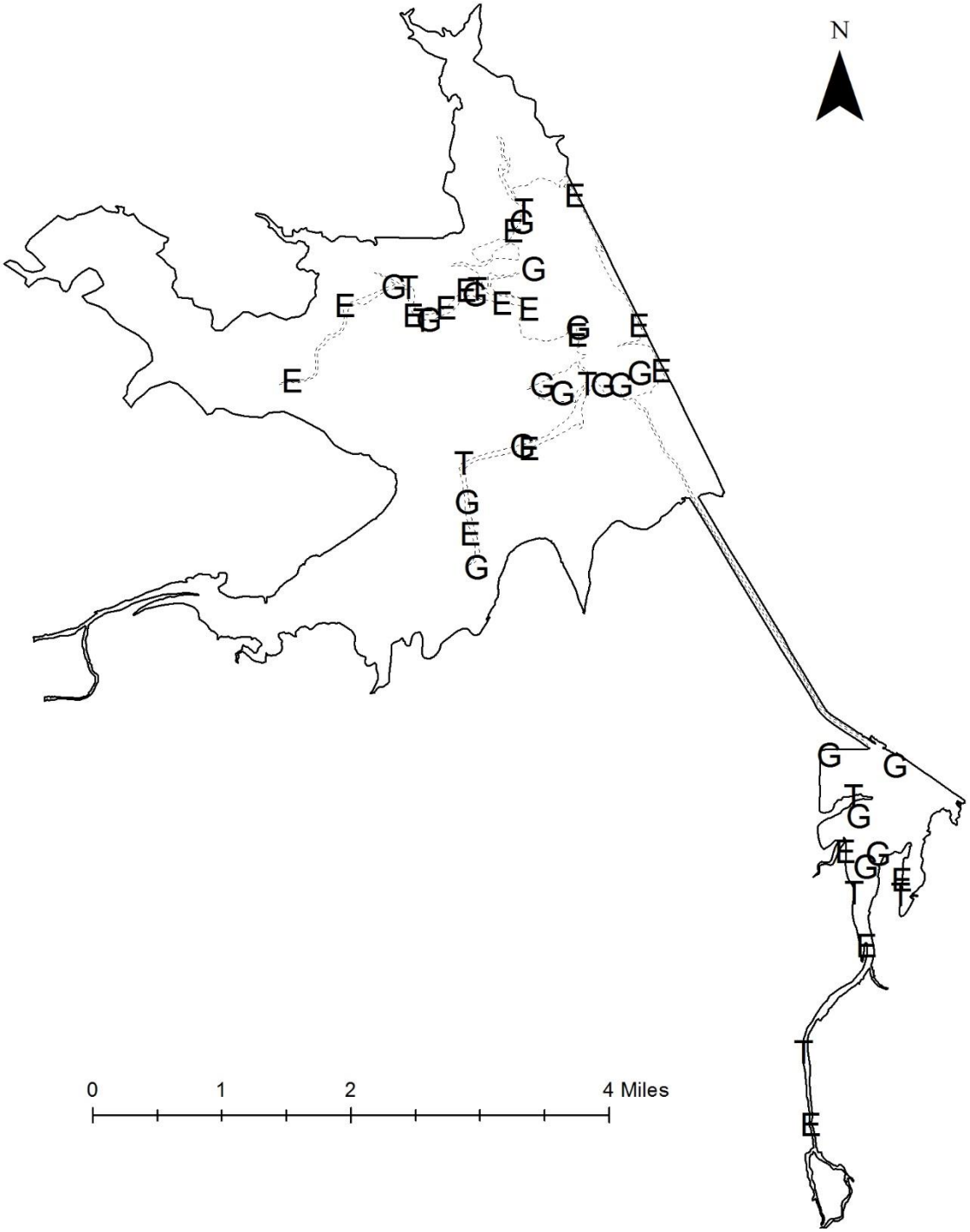
Survey year	Electrofish Fall(Spring)	Trap net	LFE	Tandem hoop net	Vegetation	Access	Creel survey	Report
2016-2017								
2017-2018	A	A	A	A				
2018-2019								
2019-2020	S	S		A	S	S	A	S

APPENDIX A

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Twin Buttes Reservoir, Texas, 2015-2016. Sampling effort was 20 net nights for gill netting, 10 net nights for trap netting, and 1.6 hours for electrofishing.

Species	Gill Netting		Trap Netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Longnose Gar	416	20.8				
Gizzard Shad	276	13.8			220	139.0
Threadfin Shad					1	0.6
Common Carp	61	3.1				
River Carpsucker	144	7.2				
Channel Catfish	25	1.3				
Flathead Catfish	6	0.3				
White Bass	44	2.2				
Green Sunfish					3	1.9
Warmouth			10	1.0	6	3.8
Bluegill	33	1.7	691	69.1	169	106.7
Longear Sunfish			17	1.7	13	8.2
Largemouth Bass	3	0.2	1	0.1	83	52.4
White Crappie	7	0.4	118	11.8		
Freshwater Drum	5	0.3				

APPENDIX B



Location of sampling sites, Twin Buttes Reservoir, Texas, 2015-2016. Trap net, gill net, and electrofishing stations are indicated by T, G, and E, respectively. Water level was approximately 44ft below full pool at time of sampling. Dashed line indicates approximate shoreline at time of sampling.