

Balmorhea Reservoir

2017 Fisheries Management Survey Report

PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-3

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

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Survey and Management Summary

Fish populations in Balmorhea Reservoir were surveyed in 2017 using electrofishing. Historical data are presented with the 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: Balmorhea Reservoir is a 573-acre impoundment located in the Pecos River Basin approximately 5 miles southwest of Balmorhea. Due to heavy irrigation demand, the reservoir water level usually drops severely each summer, reaching a low point in the fall, and then refills from spring inflows during the winter. Balmorhea Reservoir experienced a mild golden alga (*Prymnesium parvum*) bloom and subsequent fish kill in winter 2004. A severe bloom and fish kill occurred in winter 2006, and moderate blooms were observed in 2007, 2008, and 2010. Habitat was mostly nondescript (natural) shoreline or flooded dead terrestrial vegetation, with a small amount of native emergent vegetation.

Management History: Important sport fishes have included Largemouth Bass, Redear Sunfish, White Crappie, and catfish species. Fish populations were mostly eradicated in August 1998 in an effort to eliminate the introduced Sheepshead Minnow and improve the sportfish population that had been overtaken by Common Carp, large Gizzard Shad, and small sportfish. Texas Parks and Wildlife Department re-stocked the reservoir with Channel and Blue Catfish, Northern Largemouth Bass, sunfish species, and White Crappie during 1998-2001. A special research project included the introduction of triploid Florida Largemouth Bass from 1999 through 2003. Genetic analyses demonstrated that some cross-breeding was occurring between Northern and Florida Largemouth Bass, indicating that not all of the stocked Florida Largemouth Bass were sterile. After a golden alga fish kill in 2004, TPWD restocked the reservoir with fingerling Blue and Channel Catfish, Bluegill, Florida and Northern Largemouth Bass, and adult White Crappie. Gill netting and trap netting have been discontinued due to poor catch rates.

Fish Community

- **Prey species:** Electrofishing catch of Gizzard Shad was higher than past surveys with many small fish providing an excellent prey base. Electrofishing catch of Bluegill was also higher than past surveys.
- **Catfishes:** No catfishes were collected during sampling.
- **Largemouth Bass:** The Largemouth Bass population was dominated by small individuals with few legal size fish. Condition was excellent, owing to the improved forage base.
- **White Crappie:** No White Crappie were collected during sampling.

Management Strategies: Conduct additional electrofishing surveys in 2019, and general monitoring survey with electrofishing in 2021 and tandem hoop nets in 2022. Access and vegetation surveys will be conducted in 2021.

Introduction

This document is a summary of fisheries data collected from Balmorhea Reservoir in 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 species of fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2017 data for comparison.

Reservoir Description

Balmorhea Reservoir is a 573-acre impoundment constructed in 1917 on Sandia Creek. It is located in Reeves County approximately 5 miles southwest of Balmorhea and is operated and controlled by the Reeves County Water Improvement District No. 1. Maximum depth when full is 25 ft. Primary water uses include irrigation and recreation. Due to heavy irrigation demand, the reservoir water level usually drops severely each summer (6-8 ft), reaching a low point in the fall, and then refills from spring inflows (San Soloman Spring) during the winter (Figure 1). Water level at time of sampling was near full pool. A habitat survey conducted in 2005 (Scott and Bonds 2006) showed that habitat consisted of nondescript shoreline, flooded terrestrial vegetation (saltcedar), concrete bulkhead, eroded bank, rocky shore, boulder, and some native emergent vegetation (cattail). Balmorhea Reservoir experienced a mild golden alga bloom and subsequent fish kill in winter 2004. A severe bloom and fish kill occurred in winter 2006, and moderate blooms were observed in 2007, 2008, and 2010. Since 2010, no toxic conditions have been observed and no fish kills have been reported. Boat access consisted of one public boat ramp in poor condition. Bank fishing access was excellent, with the majority of the shoreline accessible to anglers. Other descriptive characteristics for Balmorhea Reservoir are in Table 1.

Angler Access

Balmorhea Reservoir has one public boat ramp and no private ramps. The boat ramp was useable in 2017, but was in need of improvements. Additional boat ramp characteristics are in Table 2. Shoreline access is good around most of the reservoir's perimeter.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Scott 2014) included:

1. Continue at least annual testing of water from the reservoir to detect any changes in golden alga densities and toxicity.

Action: Water samples were collected annually until 2015. Conditions were non-toxic from 2013-2015 with low cell counts. After 2015 it was determined to be unnecessary to monitor each year and samples would be taken if a fish kill were reported.

2. Monitor presence/absence of fish species through electrofishing every other year and gill netting every four years.

Action: Electrofishing surveys were conducted in 2015 and 2017. Gill netting was discontinued due to historically poor catch rates.

3. Cooperate with the Reeves County Water Improvement District No. 1 to post signage, educate the public about invasive species, and track existing and future inter-basin water transfers to facilitate potential invasive species responses.

Action: The San Angelo District continued to work with the Reeves County Water Improvement District No. 1 to post signage and to educate the public on invasive species threats through media outlets.

Harvest regulation history: Sportfishes in Balmorhea Reservoir currently are, and have historically been, managed with statewide regulations (Table 3).

Stocking history: Balmorhea Reservoir was partially drained and renovated in 1998; therefore, only stockings since 1998 are discussed here. In 1998, Texas Parks and Wildlife Department reintroduced Blue and Channel Catfish, Redbreast Sunfish, Bluegill, and Green Sunfish x Bluegill hybrids into Balmorhea Reservoir. In 1999, TPWD introduced Largemouth Bass, as well as triploid Florida Largemouth Bass. Annual stockings of triploid Florida Largemouth Bass continued through 2003. In 2000, TPWD reintroduced White Crappie to the reservoir. After a golden alga fish kill in 2004, TPWD restocked the reservoir with Bluegill, Largemouth Bass, Blue and Channel Catfish, and White Crappie. The complete stocking history since 1998 is in Table 4.

Water transfer: Balmorhea Reservoir is primarily used as storage for the irrigation supply district in Reeves County. San Soloman Springs supplies water to the reservoir, and the water is distributed through a network of canals to farmers and residents. No interbasin water transfers are known to occur.

Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Balmorhea 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, and Gizzard Shad 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.

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 2017 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_t)] 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 CPUE.

Habitat – A vegetation survey was conducted in 2017. Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Golden Alga - Golden alga analyses were performed on water samples collected from Balmorhea Reservoir in 2014 and 2015. The samples were shipped overnight to the TPWD Fish Health Laboratory in San Marcos, Texas, where lab staff conducted cell counts and bioassay toxicity assessments using Fathead Minnows.

Results and Discussion

Habitat: Littoral zone habitat consisted primarily of nondescript (natural) shoreline and flooded terrestrial vegetation, with limited stands of cattails. In 2017 there were 14.0 acres of cattails (Table 7), which was a slight increase from the 11.6 acres surveyed in 2013 (Scott 2014) and 12.9 acres surveyed in 2005 (Scott and Bonds 2006). Shoreline habitat has remained relatively unchanged and the most recent survey results can be found in Scott and Bonds (2006).

Golden Alga: Golden Alga was last tested for in 2014 (0 cells/ml) and 2015 (3,000 cells/ml) with no toxicity (Appendix C). No golden alga testing has been done since 2015 and we have had no reports of fish kills during that most recent 4 year reporting period.

Prey species: Electrofishing catch rates of Gizzard Shad greatly improved from past surveys with 378.0/h in 2017, which was higher than 60.0/h in 2015 and 22.0/h in 2013 (Figure 1). Gizzard Shad IOV was good with 88 percent of shad available to most predators (Figure 1). Bluegill abundance also improved from 2.0/h and 11.0/h in 2013 and 2015 to 56.0/h in 2017 (Figure 2). The majority of Bluegills ranged from 3 to 4 inches and provided quality prey for bass.

Channel Catfish: Channel Catfish have historically been present at low abundance, however no direct effort was made to sample catfish and no catfish were observed during fall electrofishing. Local anglers have indicated some catfish are caught while bank fishing.

Largemouth Bass: The electrofishing catch rate of stock-length Largemouth Bass was 58.0/h in 2017, which was similar to the catch rate of 53.0/h in 2015. Size structure was poor with few legal-sized fish, PSD-P was 5 and similar to past surveys (Figure 3). Body condition in 2017 was excellent for nearly all size classes of fish, but did show a declining trend for larger bass (Figure 3). The excellent condition can likely be attributed to the improved abundance of small Gizzard Shad and Bluegill. Florida Largemouth Bass influence increased from 19% in 2004 to 46% in 2017 (Table 6), likely due to a stocking in 2008.

White Crappie: White Crappie have historically been present in low abundance, however no direct effort was made to sample crappie and no crappie were observed during fall electrofishing.

Fisheries Management Plan for Balmorhea Reservoir, Texas

Prepared – July 2018

ISSUE 1: The Largemouth Bass population has shown some improvement over the past two surveys. Additionally, prey species such as Gizzard Shad and Bluegill abundance has increased providing a good prey base. Largemouth Bass and prey species should be monitored for potential improvement.

MANAGEMENT STRATEGY

1. Conduct electrofishing surveys in 2019 and 2021 to monitor Largemouth Bass and prey populations.

ISSUE 2: Channel Catfish and White Crappie populations have been low in past surveys, owing in part to golden alga caused fish kills from 2004 through 2010. No fish kills have occurred in the past eight years and an abundant prey base is currently present. Efforts should be made to restore these sportfish populations.

1. Request 2-inch Channel Catfish stockings for Balmorhea Reservoir in 2019 and 2020.
2. Request FLMB stocking in 2019 to help bolster population recovery and Florida-strain genetics.
3. Conduct a management stocking of White Crappie in fall 2018.
4. Conduct exploratory tandem hoop netting in spring of 2022 to assess the effectiveness of these Channel Catfish stockings.

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 Reeves County Water Improvement District No. 1 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 (2018–2021)

Sport fish, forage fish, and other important fishes

The primary sport fishes in Balmorhea Reservoir is Largemouth Bass. Known important forage species include Bluegill and Gizzard Shad.

Low-density fisheries

White Crappie: White Crappie are present in Lake Balmorhea in low density. White Crappie have not been collected in significant numbers since 2001. From 2003 to 2007 White Crappie total catch rates were < 1.0 fish/nn during fall trap netting. Sampling was discontinued after 2007. Sampling for White Crappie is not necessary during 2018-2021, however, presence/absence data will be collected during fall electrofishing.

Survey objectives, fisheries metrics, and sampling objectives

Largemouth Bass: Largemouth Bass are the primary sportfish in Lake Balmorhea. Trend data on CPUE, size structure, and body condition have been collected biennially since 2001 with fall nighttime electrofishing. 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. Survey data from 2005 to 2017 indicates 12-26 stations would be needed to collect 50 stock size fish during years where golden alga did not affect the reservoir, while 12-20 stations would be needed to achieve an RSE ≤ 25 for CPUE-Stock with 80% confidence. Sampling objectives for Balmorhea Reservoir are to collect 50 stock size fish and achieve a CPUE-Stock RSE ≤ 25 . A minimum of 12 randomly selected 5-min electrofishing sites will be sampled in fall 2019 and 2021. Exclusive of the original 12 random stations, another 3 random stations will be determined in the event some extra sampling is necessary to achieve size structure and CPUE-Stock objectives. A maximum of 15 stations will be sampled. Relative weight of Largemouth Bass > 8 inches will be determined from their length/weight data.

Channel Catfish: Channel Catfish are present in Lake Balmorhea in low density. However, stockings of fingerling Channel Catfish are planned for 2019 and 2020. Exploratory sampling with baited tandem hoop nets will be conducted in spring 2022 to assess the effectiveness of those stockings.

Forage: Sunfish and Gizzard Shad both are important forage fishes in Lake Balmorhea. From 2005 to 2017 catch rates of Bluegill has ranged from 1.0 fish/h to 56.0 fish/h while Gizzard Shad have ranged from 5.0 fish/h to 378.0 fish/h. Sampling effort based on achieving sampling objectives for Largemouth Bass will be sufficient for prey species. Additionally, Largemouth Bass body condition can provide information on forage abundance, vulnerability, or both relative to predator density.

Literature Cited

- Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.
- DiCenzo, V. J., M. J. Maceina, and M. R. Stimpert. 1996. Relations between reservoir trophic state and Gizzard Shad population characteristics in Alabama reservoirs. North American Journal of Fisheries Management 16:888-895.
- Guy, C. S., R. M. Neumann, D. W. Willis, and R. O. Anderson. 2007. Proportional size distribution (PSD): a further refinement of population size structure index terminology. Fisheries 32(7): 348.
- Scott, M. 2014. Statewide freshwater fisheries monitoring and management program survey report for Balmorhea Reservoir, 2013. Texas Parks and Wildlife Department. Federal Aid Report F-221-M-4. Austin.
- Scott, M. and C. Bonds. 2006. Statewide freshwater fisheries monitoring and management program survey report for Balmorhea Reservoir, 2005. Texas Parks and Wildlife Department. Federal Aid Report F-30-R. Austin.

Tables and Figures

Table 1. Characteristics of Balmorhea Reservoir, Texas.

Characteristic	Description
Year constructed	1917
Controlling authority	Reeves County Water Improvement District No. 1
County	Reeves
Reservoir type	Tributary
Shoreline Development Index	2.76
Conductivity	2700 $\mu\text{mhos/cm}$

Table 2. Boat ramp characteristics for Balmorhea Reservoir, Texas, August, 2017. Reservoir elevation at time of survey was 3,187 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Balmorhea Resort	30.96620 -103.7133	Y	5	3180	Poor. Extension is feasible

Table 3. Harvest regulations for Balmorhea 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
Bass: Spotted and Guadalupe	5 ^a	None
Crappie: White and Black crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum

^a Daily bag for Largemouth Bass, Spotted Bass, and Guadalupe Bass = 5 fish in any combination.

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

Species	Year	Number	Size
Blue Catfish	1998	844	ADL
	2005	57,132	FGL
	2006	14,570	FGL
	Species Total	72,546	
Channel Catfish	1998	2,590	ADL
	1998	28,651	FGL
	1999	105	ADL
	1999	29,000	FGL
	2004	56,140	FGL
	2006	58,114	FGL
	2007	57,708	FGL
	2008	57,729	FGL
	2012	4,422	FGL
Species Total	294,459		
Redbreast Sunfish	1998	7	ADL
Bluegill	1998	128	ADL
	1999	210,626	FGL
	2005	28,709	FGL
	2007	58,570	FGL
	2008	56,503	FGL
	2013	20,537	FGL
Species Total	375,073		
Green Sunfish X Bluegill	1998	69	ADL
Florida Largemouth Bass (Triploid)	1999	7,125	FGL
	2000	12,860	FGL
	2001	15,203	FGL
	2002	12,123	FGL
	2003	37,255	FGL
Species Total	84,566		
Largemouth Bass	1999	47,300	FGL
	2005	59,494	FGL
	2007	60,906	FGL
	2013	62,010	FGL
Species Total	229,710		
Florida Largemouth Bass	2008	57,642	FGL
White Crappie	2000	200	ADL
	2004	1,500	ADL
	2005	450	ADL
	2006	650	ADL
	Species Total	2,800	

Table 4. Objective-based sampling plan components for Balmorhea Reservoir, Texas 2017.

Gear/target species	Survey objective	Metrics	Sampling objective
<i>Electrofishing</i>			
Largemouth Bass	Abundance	CPUE–Stock	RSE–Stock ≤ 25
	Size structure	PSD, length frequency	$N \geq 50$ 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	$N \geq 50$
Gizzard Shad ^a	Abundance	CPUE–Total	RSE ≤ 25
	Size structure	Length frequency	$N \geq 50$
	Prey availability	IOV	$N \geq 50$

^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 5. Survey of aquatic vegetation, Balmorhea Reservoir, Texas, 2005, 2013 and 2017. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Vegetation	2005	2013	2017
Native submersed	0 (0)	0 (0)	0 (0)
Native floating-leaved	0 (0)	0 (0)	0 (0)
Native emergent	12.9 (2.3)	11.6 (2.0)	14.0 (2.4)
Non-native	0 (0)	0 (0)	0 (0)

Gizzard Shad

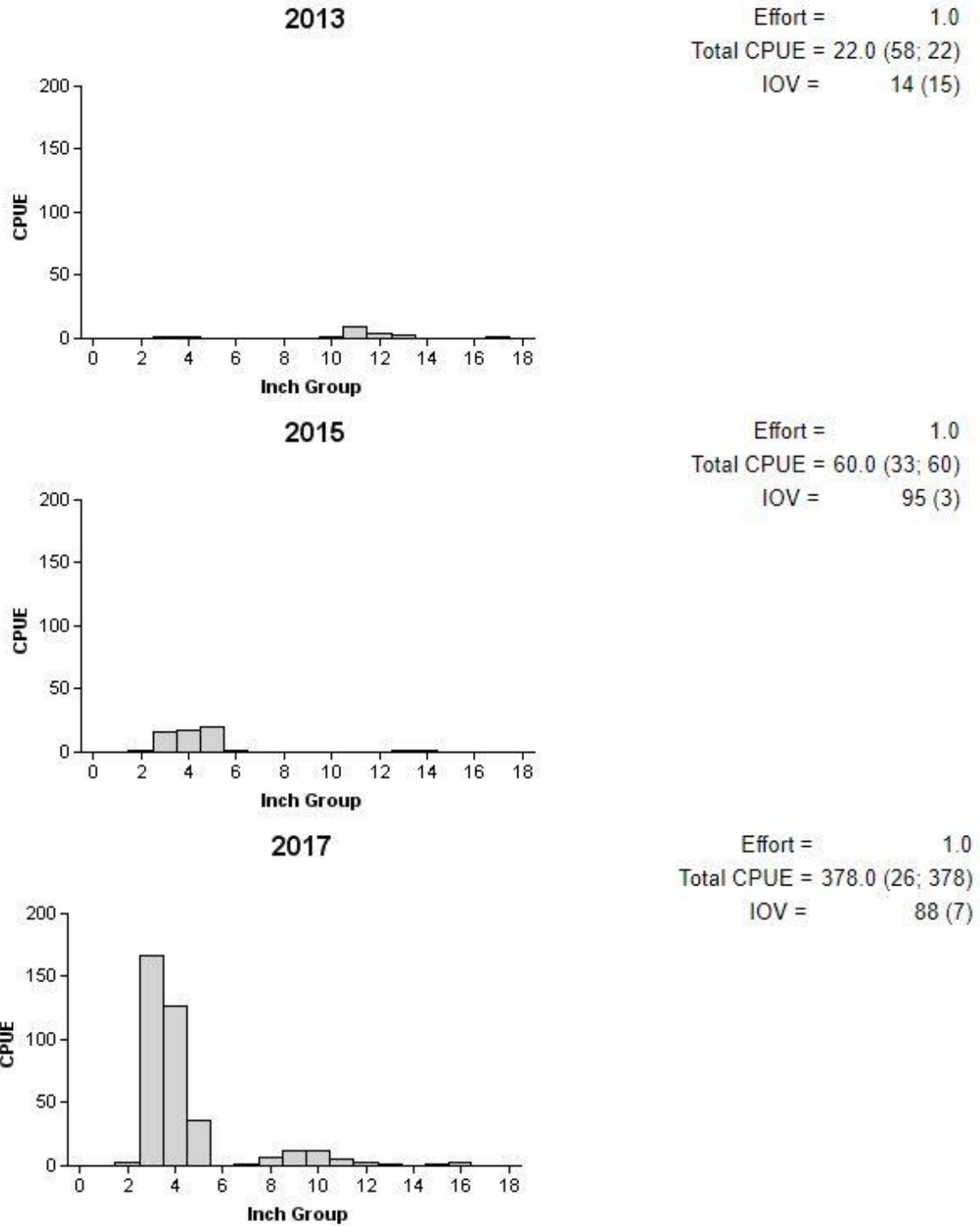


Figure 1. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Balmorhea Reservoir, Texas, 2013, 2015, and 2017.

Bluegill

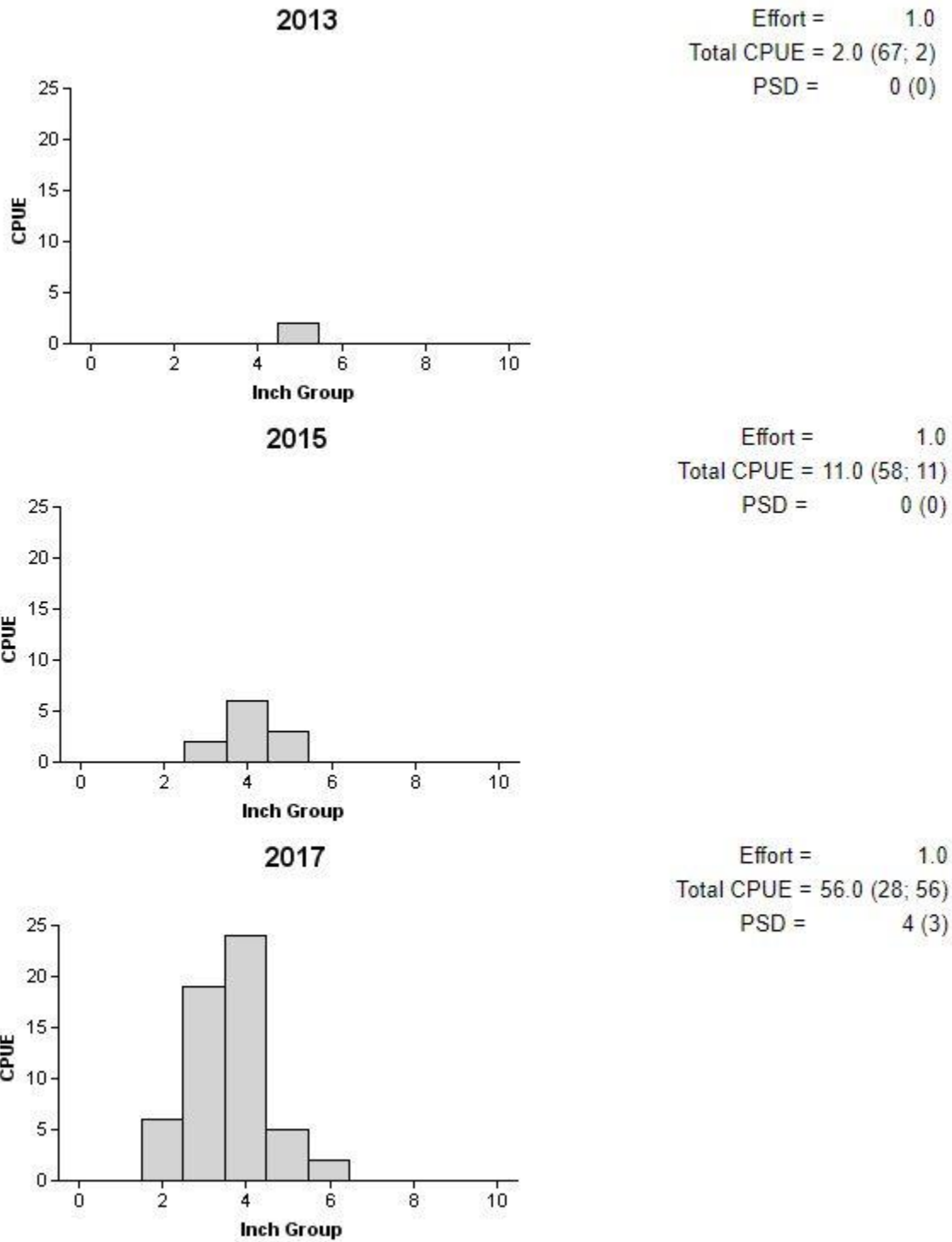


Figure 2. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Balmorhea Reservoir, Texas, 2013, 2015, and 2017.

Largemouth Bass

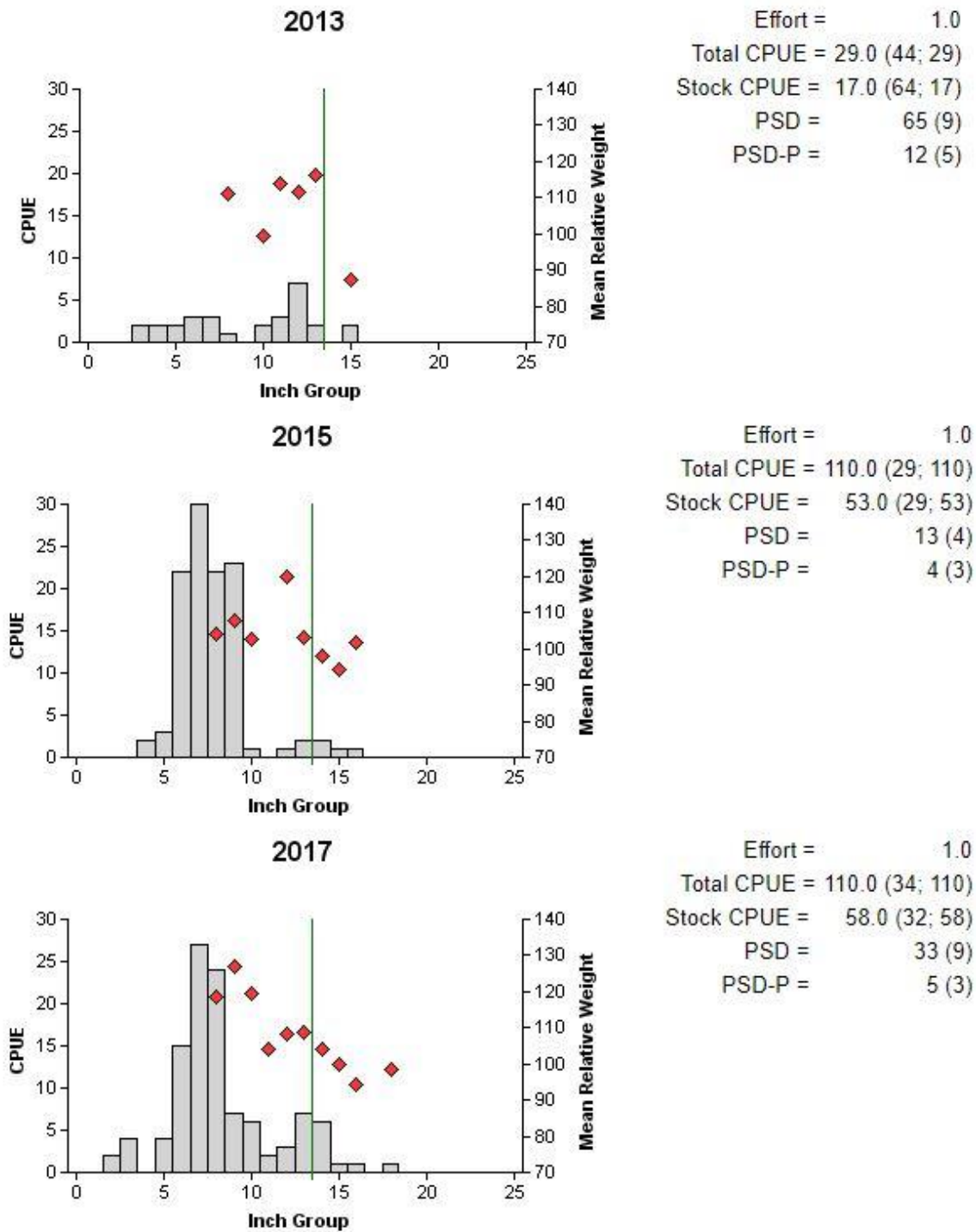


Figure 3. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Balmorhea Reservoir, Texas, 2013, 2015, and 2017. Vertical line indicates minimum length limit.

Table 6. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Balmorhea Reservoir, Texas, 2004 and 2017. 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.

Year	Sample size	Number of fish			% FLMB alleles	% FLMB
		FLMB	Intergrade	NLMB		
2004	120	n/a	n/a	n/a	19%	n/a
2017	30	0	26	4	46%	0%

Proposed Sampling Schedule

Table 7. Proposed sampling schedule for Balmorhea Reservoir, Texas. Survey period is June through May. Gill netting surveys are conducted in the spring, while electrofishing and trap netting surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

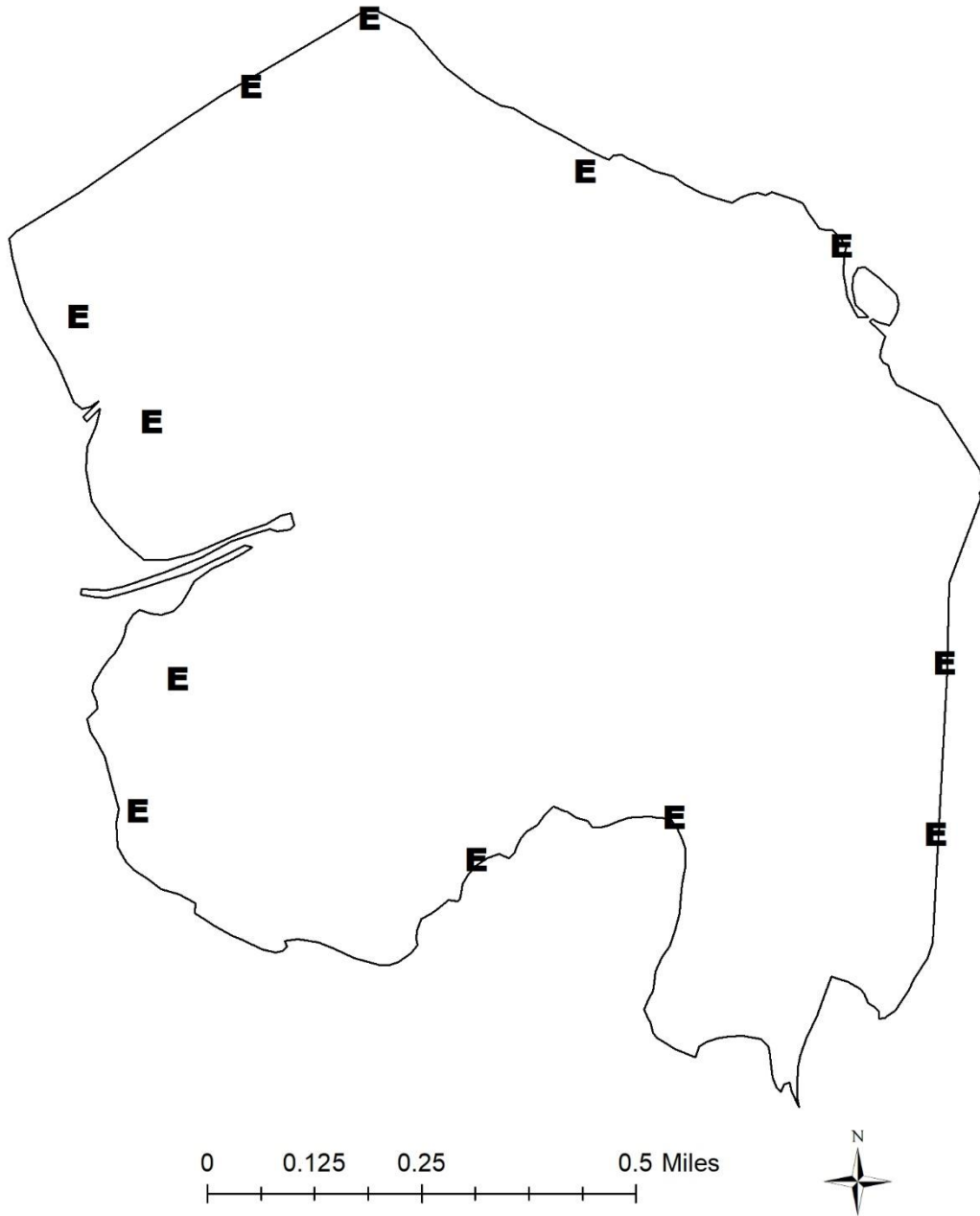
	Survey year			
	2018-2019	2019-2020	2020-2021	2021-2022
Angler Access				S
Structural Habitat				
Vegetation				S
Electrofishing – Fall		A		S
Electrofishing – Spring				
Electrofishing – Low frequency				
Trap netting				
Gill netting				
Baited tandem hoop netting				S
Creel survey				
Report				S

APPENDIX A – Catch rates for all species from all gear types

Number (N) and catch rate (CPUE) (RSE in parentheses) of all target species collected from all gear types from Balmorhea Reservoir, Texas, 2017. Sampling effort was 1 hour for electrofishing.

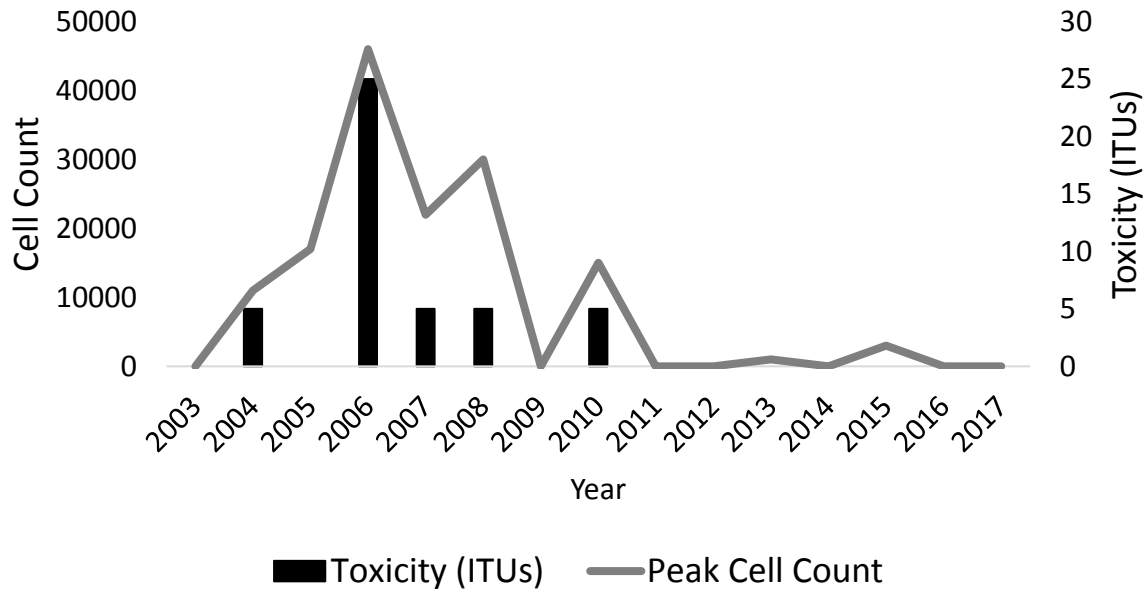
Species	Electrofishing	
	N	CPUE
Gizzard Shad	378	378.0 (26)
Redbreast Sunfish	2	2.0 (100)
Warmouth	1	1.0 (100)
Bluegill	56	56.0 (28)
Largemouth Bass	110	110.0 (34)

APPENDIX B – Map of sampling locations



Location of sampling sites, Balmorhea Reservoir, Texas, 2017. Electrofishing stations are indicated by E. Water level was near full pool at time of sampling.

APPENDIX C – Golden alga monitoring 2003-2017



Golden alga monitoring results for Balmorhea Reservoir, 2003 - 2017. Toxicity rankings based on laboratory bioassays conducted with fathead minnows. Toxicity rankings are: 0=non-toxic, 1.0=slight, 5.0=moderate, and 25.0=high. Cell count units are cells/mL of water. No samples were collected in 2009, 2011, 2012, 2016, or 2017.

APPENDIX D – Historical Catch Rates and Size Structure

Largemouth Bass – Fall Electrofishing

	2001	2003	2004	2005	2007	2009	2013	2015	2017	Average
Total-CPUE	138.0	37.0	31.0	137.0	156.0	104.0	29.0	110.0	110.0	94.7
Stock-CPUE	137.0	27.0	9.0	72.0	79.0	28.0	17.0	53.0	58.8	53.3
PSD	10	37	89	4	1	32	65	13	33	31.6
PSD-P	1	4	44	0	1	7	12	4	5	8.7

Gizzard Shad – Fall Electrofishing

	2001	2003	2004	2005	2007	2009	2013	2015	2017	Average
Total-CPUE	469.0	117.0	294.0	183.0	135.0	12.0	22.0	60.0	378.0	185.6
IOV	55	7	82	68	94	83	14	95	88	65.1

Bluegill – Fall Electrofishing

	2001	2003	2004	2005	2007	2009	2013	2015	2017	Average
Total-CPUE	58.0	63.0	25.0	47.0	20.0	3.0	2.0	11.0	56.0	28.4
PSD	59	23	6	3	0	33	0	0	4	14.2

White Crappie – Fall Trap Netting

	2001	2003	2004	2005	2007	Average
Total-CPUE	18.6	0.4	0.0	0.1	0.0	3.8
Stock-CPUE	4.2	0.4	0.0	0.1	0.0	0.9

Channel Catfish – Spring Gill Netting

	1998	2002	2006	2010	2014	Average
Total-CPUE	3.4	1.6	0.0	0.2	0.6	1.2
Stock-CPUE	1.0	1.6	0.0	0.2	0.6	0.7



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