# **Balmorhea Reservoir**

# 2021 Fisheries Management Survey Report

PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-4

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

<u>Prepared by:</u> Blake Thornton, Assistant District Management Supervisor

and

Lynn Wright, District Management Supervisor

Inland Fisheries Division San Angelo District, San Angelo, Texas

> Carter Smith Executive Director

Craig Bonds Director, Inland Fisheries



July 31, 2022



# Contents

Contents	i
Survey and Management Summary	1
Introduction	2
Reservoir Description	2
Angler Access	2
Management History	2
Methods	4
Results and Discussion	4
Fisheries Management Plan for Balmorhea Reservoir, Texas	6
Objective-Based Sampling Plan and Schedule (2022–2026)	6
Literature Cited	
Tables and Figures	9
Water Level	9
Reservoir Characteristics	9
Harvest Regulations	Error! Bookmark not defined.
Structural Habitat Survey	
Gizzard Shad	
Bluegill	
Channel Catfish	
Largemouth Bass	
APPENDIX A – Map of Sampling Locations	
APPENDIX B – Catch Rates for all Species from all Gear Types	Error! Bookmark not defined.
APPENDIX C – Historical Catch Rates and Size Structure	Error! Bookmark not defined.

## **Survey and Management Summary**

Fish populations in Balmorhea Reservoir were surveyed in 2019 using hoop netting and electrofishing, and in 2021 using hoop netting, electrofishing, and trap netting. Historical data are presented with the 2018-2021 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. However, no fish kills have been documented since 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, 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 (TPWD) 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. TPWD restocked the reservoir with fingerling Blue and Channel Catfish, Bluegill, Florida and Northern Largemouth Bass, and adult White Crappie following golden alga fish kills from 2004-2010. Standard gill netting and trap netting have been discontinued due to poor catch rates.

### **Fish Community**

- **Prey species:** Electrofishing catch of Gizzard Shad was lower than previous years, and less than half were available as prey to most sportfish. Electrofishing catch rate of Bluegill fluctuated over the survey period; however, the most recent survey indicated low abundance and poor population size structure and poor population size structure with few fish over 5 inches.
- **Catfishes:** Channel Catfish were present in the reservoir with hoop-net catch rates higher than other district reservoirs, but the population had poor size structure. Individuals up to 16 inches were observed. Blue Catfish are present but no direct sampling effort was made.
- **Largemouth Bass:** The Largemouth Bass population continued to be dominated by sub-legal sized individuals, resulting in poor size structure. Condition was good for all size classes.
- White Crappie: No White Crappie were collected during sampling.

**Management Strategies**: Conduct additional monitoring survey with electrofishing in fall 2023 and general monitoring electrofishing survey in fall 2025. Conduct spring tandem hoop net and fall trap net surveys in 2025 to monitor Channel Catfish and the presence/absence of White Crappie. Continue habitat enhancement with local partners.

### Introduction

This document is a summary of fisheries data collected from Balmorhea Reservoir from 2019-2021. 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 2019-2021 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. 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. 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 2022 but needed 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 (Wright 2018) included:

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

Action: Electrofishing surveys were conducted as planned in the fall of 2019 and 2021.

2. Request 2-inch Channel Catfish stockings in 2019 and 2020, request Florida Largemouth Bass stocking in 2019, and perform a management stocking of White Crappie in 2018. Assess the effectiveness of the forementioned Channel Catfish stockings with exploratory tandem hoop netting in the spring of 2021.

**Action:** Channel Catfish fingerlings and Florida Largemouth Bass fingerlings were stocked in 2019; management stockings of White Crappie were also performed in 2019 and 2020. A tandem hoop net survey was conducted in 2021 to assess the 2019 Channel Catfish stocking.

3. Cooperate with the Reeves County Water Improvement District No. 1 to post invasive species awareness and fishing regulation 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**: Sport fishes 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, TPWD 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. Following golden alga fish kills from 2004-2010, 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 (Wright 2017). Primary components of the OBS plan are listed in Table 5. All survey sites were randomly selected (Appendix A), and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2017).

**Electrofishing** – Largemouth Bass, sunfishes, Gizzard Shad, and Threadfin 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.

**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).

**Tandem hoop nets** – Channel Catfish were collected using 10 tandem hoop-net series at 10 stations. Nets were baited with soap and deployed for 2-night soak durations. CPUE for tandem hoop netting was recorded as the number of fish caught per tandem hoop net series (fish/series).

**Genetics** – Genetic analysis of Channel Catfish was conducted in 2018 to assess introgression with Headwater Catfish in Balmorhea Reservoir from known populations upstream.

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

### **Results and Discussion**

**Habitat:** Littoral zone habitat consisted primarily of nondescript (natural) shoreline and flooded terrestrial vegetation, with limited stands of cattails. In 2021 there were 2.0 acres of cattails (Table 6), which was down from 14.0 acres in 2017 (Wright 2018) and 11.6 acres in 2013 (Scott 2014). The reservoir controlling authority removed approximately 10 acres of cattails in 2018 and did not consult with TPWD prior to removal. Shoreline habitat has remained relatively unchanged and the most recent survey results can be found in Scott and Bonds (2006).

Artificial habitat was added to the reservoir in 2021 and 2022. Mossback Root Wads and Trophy Tree XL structures were installed in fall 2021. The purchase of the Mossback structures was made possible by Conservation License Plate funds. In spring 2022, pallet structures, each consisting of five wooden pallets and eight cinder blocks, were placed. Materials for the pallet structures were provided by the Balmorhea Lake Improvement Group.

**Prey species:** Electrofishing catch rates of Gizzard Shad decreased from 378.0/h in 2017 to 185.3/h in 2019 and decreased again to 63.0/h in 2021 (Figure 1). Gizzard Shad IOV was high in 2019 with 93 percent of shad available to most predators but decreased to 41 percent in 2021. Bluegill abundance increased from the previous survey, with 147.4/h in 2019, which was higher than 56.0/h in 2017. Catch rates decreased to 7.0/h in 2021 (Figure 2). Bluegill population size structure was inadequate (PSD = 0), with no quality-sized Bluegill caught in 2019 or 2021 (Figure 2). The Bluegill population in 2019 was dominated by 2-4 inch individuals and provided excellent forage for predators; however, the Bluegill population in 2021 was inadequate as a prey source for predators. Green and Longear Sunfish were also present in the 2021 survey (Appendix B) and provided additional prey resources.

**Channel Catfish:** The hoop-net catch rate of Channel Catfish was 6.6/nn in 2019 and increased to 14.0/nn in 2021, both dominated by sub-stock sized individuals (Figure 3). The PSD increased slightly from 0 in 2019 to 8 in 2021 but was still inadequate. The high catch rate of 9-inch Channel Catfish in 2021 was likely the result of the stocking in 2019. Genetic analysis of Channel Catfish collected in 2019 revealed no introgression between the Channel Catfish and Headwater Catfish. Headwater Catfish are present in the San Solomon Springs which flows into Balmorhea Reservoir via a canal system.

**Largemouth Bass:** Largemouth Bass abundance has been variable over the past three surveys. The catch rate of stock-length Largemouth Bass was 78.0/h in 2021, lower than in 2019 (147.4/h), but slightly higher than in 2017 (58.0/h; Figure 4). Size structure has not been adequate over the past three surveys as PSD has ranged from 25-33. PSD-P ranged from 5-11 over the past three surveys indicating few fish over 15 inches were available to anglers. Anecdotal reports from local anglers suggest excessive harvest may be occurring and may in part be responsible for the poor size structure and lack of fish over 15 inches. Overall, size structure indices were similar to long- term averages (Appendix C). Body condition in all three of the most recent surveys was good with nearly all inch classes possessing relative weights above 100.

**White Crappie:** White Crappie have historically been present in low abundance; management stockings in 2019 and 2020 (Table 4) were conducted to bolster the existing population. Trap netting was conducted in the fall of 2021 to assess the efficacy of the 2019 and 2020 stockings; however, no White Crappie were collected. The San Angelo district has not received any angler reports of crappie being caught.

### Fisheries Management Plan for Balmorhea Reservoir, Texas

Prepared – July 2022

**ISSUE 1:** The Largemouth Bass population in Balmorhea Reservoir has had poor size structure and few fish over 15 inches. Anecdotal reports from local anglers suggest excessive harvest is occurring, however, age and growth data in lacking for Balmorhea Reservoir to confirm if slow growth is a factor. Collecting age and growth will help us to determine if slow growth is an issue for Largemouth Bass in Balmorhea Reservoir.

#### MANAGEMENT STRATEGIES

- 1. Conduct electrofishing surveys in 2023 and 2025 to monitor Largemouth Bass and prey species populations.
- 2. Retain 13 individuals between 13.0 and 14.9 inches during 2023 and 2025 fall electrofishing survey for age and growth analysis.
- 3. Request 2-inch Bluegill stocking for Balmorhea Reservoir in 2024 if justified by the results of the fall 2023 electrofishing survey.
- **ISSUE 2:** 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 (2022–2026)**

Sport fish, forage fish, and other important fishes

The primary sportfish in Balmorhea Reservoir are Largemouth Bass and Channel Catfish. 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

6

were < 1.0 fish/nn during fall trap netting. Sampling was discontinued after 2007. In fall 2019 and 2020, management stockings were conducted in efforts to bolster the remnant population; subsequent sampling efforts in 2021 proved unsuccessful. Presence/absence data may be collected during fall electrofishing in 2023 and 2025.

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

Largemouth Bass: Largemouth Bass are the primary sportfish in Balmorhea Reservoir. Trend data on CPUE, size structure, and body condition have been collected biennially since 2015 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 2017 to 2021 indicates 12 stations are sufficient to collect 50 stock size fish, while 48-60 stations would be needed to achieve an RSE ≤25 for CPUE-Stock with 80% confidence. Sampling objectives for Balmorhea Reservoir are to collect a minimum of 50 stock size fish for estimation of size structure indices. A minimum of 12 randomly selected 5-min electrofishing sites will be sampled in fall 2023 and 2025 (Table 7). 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 objectives. A maximum of 15 stations will be sampled. Relative weight of Largemouth Bass > 8 inches will be retained for age and growth analysis in 2023.

**Channel Catfish**: Channel Catfish are present in Balmorhea Reservoir in moderate density. A stocking of fingerling Channel Catfish was conducted in 2019 and tandem hoop-net surveys in 2019 and 2021 indicated stocking success and an abundant population in comparison to other district reservoirs. Trend data on CPUE, size structure, and body condition will be collected with baited tandem hoop-nets in 2025 (Table 7).

**Forage**: Sunfish and Gizzard Shad both are important forage fishes in Balmorhea Reservoir. From 2005 to 2021 catch rates of Bluegill has ranged from 1.0 fish/h to 147.4 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.
- Wright, L. 2018. Statewide freshwater fisheries monitoring and management program survey report for Balmorhea Reservoir, 2017. Texas Parks and Wildlife Department. Federal Aid Report F-221-M-4. 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	3421 μS/cm		

Table 2. Boat ramp characteristics for Balmorhea Reservoir, Texas, April, 2022. Reservoir elevation at time of survey was 3,184 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	3,180	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, only 10 may be > 20 inches)	None
Catfish, Flathead	5	18-inch minimum
Bass, Largemouth	5	14-inch
Crappie: White and Black Crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum

Species	Year	Number	Size
Blue Catfish	1998	844	ADL
	2005	57,132	FGL
	2006	14.570	FGL
	Species Total	72.546	
	oposico rotai	,0 10	
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
	2019	58,138	FGL
	Species Total	130,288	
		_	
Redbreast Sunfish	1998	7	ADL
Blueaill	1998	128	ADL
	1999	210.626	FGL
	2005	28 709	FGL
	2007	58 570	FGI
	2008	56 503	FGI
	2000	20,537	FGL
	Species Total	275 073	FCI
	Species Total	375,075	FGL
Green Sunfish X Bluegill	1998	69	ADL
Largemouth Bass	1000	47 300	FCI
Largemouth Dass	2005	50 404	FGI
	2003	59,494 60,006	FGL
	2007	60,900	
	2013 Onesise Tetel	02,010	FGL
	Species Total	229,710	
Florida LMB (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	
Florido Lorgomouth Door	2008	57 640	
FIGHOR Largemouth Bass	∠UUð 2010	01,04∠ 11,500	
			FGL
	Species I otal	69,142	

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

Species	Year	Number	Size
White Crappie	2000	200	ADL
	2004	1,500	ADL
	2005	450	ADL
	2006	650	ADL
	2019	140	ADL
	2020	600	ADL
	Species Total	3,540	

Table 4. Stocking history. Continued.

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
	Age-and-growth	Age at 14 inches	N = 13, 13.0 – 14.9 inches
	Condition	Wr	10 fish/inch group (max)
Bluegill <sup>a</sup>	Abundance	CPUE-Total	RSE ≤ 25
	Size structure	PSD, length frequency	N ≥ 50
Gizzard Shad <sup>a</sup>	Abundance	CPUE-Total	RSE ≤ 25
	Size structure	Length frequency	N ≥ 50
	Prey availability	IOV	N ≥ 50

Table 5. Objective-based sampling plan components for Balmorhea Reservoir, Texas 2021.

<sup>a</sup> 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 aquatic vegetation, Balmorhea Reservoir, Texas, 2005–2021. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Vegetation	2005	2013	2017	2021
Native submersed	0 (0)	0 (0)	0 (0)	0 (0)
Native floating-leaved	0 (0)	0 (0)	0 (0)	0 (0)
Native emergent	12.9 (2.3)	11.6 (2.0)	14.0 (2.4)	2.0 (0.3)
Non-native	0 (0)	0 (0)	0 (0)	0 (0)



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, 2017, 2019, and 2021.



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, 2017, 2019, and 2021.

Bluegill



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 hoop net surveys, Balmorhea Reservoir, Texas, 2019 and 2021

Effort = 1.0 Total CPUE = 110.0 (34; 110) Stock CPUE = 58.0 (32; 58) PSD = 33 (9) Mean Relative Weight PSD-P = 5 (3) CPUE Ó Inch Group Effort = 1.0 Total CPUE = 330.5 (21; 314) Stock CPUE = 147.4 (34; 140) PSD = 25 (12) 按 Mean Relative Weig PSD-P = 11 (6) CPUE ò ŝ Inch Group Effort = 1.0 Total CPUE = 227.0 (37; 227) -130 Stock CPUE = 78.0 (74; 78) PSD = 31 (3) Weight PSD-P = 6 (2) Mean Relative CPUE Ó Inch Group

Figure 4. 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, 2017, 2019, and 2021. Vertical line indicates the minimum length limit.

	Survey year				
-	2022-2023	2023-2024	2024-2025	2025-2026	
Angler Access				Х	
Vegetation				Х	
Electrofishing – Fall		Х		Х	
Baited tandem hoop netting				Х	
Report				Х	

Table 7. Proposed sampling schedule for Balmorhea Reservoir, Texas. Survey period is June through May. Electrofishing and trap netting surveys are conducted in the fall.

17



Appendix A - Map of sampling locations

Location of sampling sites, Balmorhea Reservoir, Texas, 2021. Trap net, hoop net, and electrofishing stations are indicated by T, H, and E, respectively.

# Appendix B - 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 in 2021. Sampling effort was 10 net nights for hoop netting, 10 net nights for trap netting, and 1 hour for electrofishing.

Species	Hoop Netting		Tra	Trap Netting		Electrofishing	
opeoles	Ν	CPUE	Ν	CPUE	Ν	CPUE	
Gizzard Shad					63	63.0 (43)	
Channel Catfish	140	14.0 (32)					
Green Sunfish					28	28.0 (34)	
Bluegill					7	7.0 (33)	
Longear Sunfish					9	9.0 (37)	
Largemouth Bass					227	227.0 (37)	
White Crappie			0	0.0 (0)			

# Appendix C - Historical Catch Rates and Size Structure

	2001	2003	2004	2005	2007	2009	2013	2015	2017	2019	2021	Average
Total-CPUE	138.0	37.0	31.0	137.0	156.0	104.0	29.0	110.0	110.0	330.5	227.0	128.1
Stock-CPUE	137.0	27.0	9.0	72.0	79.0	28.0	17.0	53.0	58.8	147.4	78.0	64.2
PSD	10	37	89	4	1	32	65	13	33	25	31	30.9
PSD-P	1	4	44	0	1	7	12	4	5	11	6	8.6

#### Gizzard Shad – Fall Electrofishing

	2001	2003	2004	2005	2007	2009	2013	2015	2017	2019	2021	Average
Total-CPUE	469.0	117.0	294.0	183.0	135.0	12.0	22.0	60.0	378.0	185.3	63.0	174.4
IOV	55	7	82	68	94	83	14	95	88	93	41	65.5

#### Bluegill – Fall Electrofishing

	2001	2003	2004	2005	2007	2009	2013	2015	2017	2019	2021	Average
Total-CPUE	58.0	63.0	25.0	47.0	20.0	3.0	2.0	11.0	56.0	147.4	7.0	39.9
PSD	59	23	6	3	0	33	0	0	4	0	0	11.6

#### White Crappie – Fall Trap Netting

	2001	2003	2004	2005	2007	2021	Average
Total-CPUE	18.6	0.4	0.0	0.1	0.0	0.0	3.18
Stock-CPUE	4.2	0.4	0.0	0.1	0.0	0.0	0.9

### Channel Catfish – Spring Gill Netting

		8				
	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

### Channel Catfish – Spring Hoop Netting

	2019	2021	Average
Total-CPUE	6.6	14.0	10.3
Stock-CPUE	1.6	2.4	2



Life's better outside.®

In accordance with Texas State Depository Law, this publication is available at the Texas State Publications Clearinghouse and/or Texas Depository Libraries.

© Texas Parks and Wildlife, PWD RP T3200-1243 (08/21)

TPWD receives funds from the USFWS. TPWD prohibits discrimination on the basis of race, color, religion, national origin, disability, age, and gender, pursuant to state and federal law. To request an accommodation or obtain information in an alternative format, please contact TPWD on a Text Telephone (TTY) at (512) 389-8915 or by Relay Texas at 7-1-1 or (800) 735-2989 or by email at accessibility@tpwd.texas.gov. If you believe you have been discriminated against by TPWD, please contact TPWD, 4200 Smith School Road, Austin, TX 78744, or the U.S. Fish and Wildlife Service, Office for Diversity and Workforce Management, 5275 Leesburg Pike, Falls Church, VA 22041.