PERFORMANCE REPORT

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FEDERAL AID PROJECT F-30-R-31

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2005 Survey Report

Balmorhea Reservoir

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Balmorhea Reservoir were surveyed in 2005 using electrofishing and trap nets, and in 2006 using gill nets and non-standard electrofishing. 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. However, water levels fluctuated less during 2004-2005 due to above-average rainfall. Balmorhea Reservoir experienced a mild golden alga (*Prymnesium parvum*) bloom and subsequent fish kill in winter 2004. A more severe bloom and fish kill occurred in winter 2006. Habitat was mostly nondescript shoreline or flooded dead terrestrial vegetation, with a small amount of native emergent vegetation.

- **Management history:** Important sport fish include largemouth bass, redear sunfish, white crappie, and catfish. The 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 carp, large shad, and small sportfish. TPWD re-stocked the reservoir with channel and blue catfish, Northern largemouth bass, sunfish, 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 the fish kill of 2004, TPWD restocked the reservoir with fingerling blue and channel catfish, bluegill, and Northern largemouth bass, and adult white crappie.

- **Fish community**
  - **Prey species:** Gizzard shad abundance and availability to predators were good. Bluegill abundance was also good, with mostly small individuals. Large redear sunfish were present in good numbers in fall 2005. Additional daytime electrofishing showed that bluegill and redear sunfish abundance may have been negatively impacted by the winter 2006 golden alga bloom.

  - **Catfishes:** The catfish populations appeared to be non-existent.

  - **Largemouth bass:** Largemouth bass were moderately abundant in fall 2005, but size structure was only fair; it is likely that most of the bass were products of recent stockings. Body condition was good. Additional electrofishing indicated that largemouth bass abundance may have been negatively impacted by the winter 2006 golden alga bloom.

  - **White crappie:** Abundance was extremely low despite recent stockings.

- **Management strategies:** Conduct additional gill netting in 2008. Stock bluegill, blue catfish, channel catfish, largemouth bass, and white crappie in 2007 to improve those fisheries. Discuss with controlling authorities the issue of possible overharvest from the inlet canal, and conduct a public meeting if needed. Work with controlling authorities to apply for state boat ramp grant.

INTRODUCTION

This document is a summary of fisheries data collected from Balmorhea Reservoir in 2005-2006. 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 is presented with the 2005-2006 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 during the winter (Figure 1). However, water levels fluctuated less during 2004-2006 due to above-average rainfall. Water level at time of sampling was near full pool. Habitat at time of sampling consisted of nondescript shoreline, flooded dead terrestrial vegetation (saltcedar), concrete bulkhead, eroded bank, rocky shore, boulder, and some native emergent vegetation (cattail). Balmorhea Reservoir experienced a mild golden alga (*Prymnesium parvum*) bloom and subsequent fish kill in winter 2004. A more severe bloom and fish kill occurred in winter 2006. Boat access consisted of one public boat ramp in poor-fair 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.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Dennis 2002) included:

1. Continue evaluation of triploid Florida largemouth bass with annual spring sampling using electrofishing and angling and annual stockings of triploid Florida largemouth bass.
   Action: Annual stockings of triploid Florida strain and Northern strain largemouth bass were made from 1999-2003, and annual spring electrofishing and angling surveys were conducted from 2002-2004. Genetic analyses showed that Northern-Florida intergrades were present, indicating that some of the stocked Florida bass were not sterile triploids. A final report on the triploid Florida bass evaluation was prepared and submitted for publication.
2. Continue to monitor aquatic vegetation.
   Action: An aquatic vegetation survey was conducted in fall 2005 in conjunction with a physical habitat survey.

Harvest regulation history: Sportfishes in Balmorhea Reservoir currently are, and have historically been, managed with statewide regulations (Table 2).

Stocking history: Balmorhea Reservoir was drained and renovated in 1998; therefore, only stockings since 1998 are discussed here. In 1998, Texas Parks and Wildlife Department (TPWD) reintroduced blue and channel catfish, redbreast sunfish, bluegill, and green sunfish x bluegill hybrids into Balmorhea Reservoir. In 1999, TPWD introduced pure Northern strain, as well as triploid Florida strain, 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 3.

Vegetation/habitat history: Before renovation in 1998, the reservoir was devoid of aquatic vegetation, probably because of high turbidity (Dennis 2002). Water clarity increased after renovation (Dennis 2002),

and Balmorhea reservoir supported a small amount of native emergent vegetation (cattail) in fall 2005 (Table 4). In 2005, most fish habitat in the reservoir consisted of flooded dead saltcedar.

METHODS

Fishes were collected by electrofishing (1 hour at 12 5-min stations), gill netting (5 net nights at 5 stations), and trap netting (7 net nights at 7 stations). Also, a supplemental daytime electrofishing sample (0.58 hour total) was performed in May 2006 at biologist-chosen stations to allow evaluation of the fish population after the reservoir experienced golden alga toxicity in winter 2005-2006. Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing and, for gill and trap nets, as the number of fish per net night (fish/nn). All survey sites, excluding spring 2006 electrofishing sites, were randomly selected. All surveys, including a habitat survey in fall 2005, were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2005), with the exception of the addition of two trap net stations and the non-standard springtime electrofishing.

Golden alga analyses were performed on water samples collected from Balmorhea Reservoir. Samples were taken from near the dam in November 2005, March 2006, and May 2006. Another sample was taken from the inlet canal in May 2006. 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.

Sampling statistics (CPUE for various length categories), structural indices [Proportional Stock Density (PSD), Relative Stock Density (RSD)], 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). Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE statistics and for creel statistics and SE was calculated for structural indices and IOV. Source for water level data was the Reeves County Water Improvement District No. 1.

RESULTS AND DISCUSSION

Habitat: Littoral zone habitat consisted primarily of nondescript shoreline and flooded dead terrestrial vegetation (Table 4). Limited off-shore habitat was provided by 12.89 acres of cattails.

Prey species: Electrofishing catch rates of bluegill and gizzard shad were 47.0/h and 183.0/h, respectively. The IOV for gizzard shad was fair at 68.3%, indicating that a little over two-thirds of gizzard shad were available to existing predators. The IOV and total catch rate of gizzard shad in 2005 were lower than in 2004, but higher than in 2003 (Figure 2). Bluegill catch rate in 2005 was higher than in 2004, but slightly lower than in 2003 (Figure 3). The bluegill population was dominated by small individuals, providing additional forage for predators.

Electrofishing catch rate of redear sunfish in 2005 was 26.0/h, compared to 9.0/h in 2004 and 5.0/h in 2003 (Figure 4). Large individuals contributed a significant proportion of the population in the last two sampling years, providing good angling opportunity. The RSD of preferred-size (9-inch) redear sunfish increased from 0.0 in 2003 to 38.0 in 2004, and dropped slightly to 27.0 in 2005.

Supplemental spring electrofishing in 2006 confirmed that redear sunfish were still present throughout the reservoir after the wintertime golden alga toxicity, albeit in lower relative abundance (see Appendix A). This additional sampling showed that gizzard shad were still present in adequate numbers; however, only one bluegill was collected.

Channel catfish: No channel catfish were collected in 5 gill net-nights in 2006. In previous surveys, channel catfish were present in low numbers (Figure 5). The most recent survey where channel catfish were collected showed no fish less than 15 inches, therefore it is likely that recruitment has been severely limited in recent years.

Largemouth bass: According to electrofishing catch rates, largemouth bass appeared to be more abundant in 2005 (137.0/h) than in either 2004 (31.0/h) or 2003 (27.0/h; Figure 6). Condition was good, with relative weights ranging from 91-108. During the fall electrofishing sample we did not collect any legal-sized (14-inch minimum) largemouth bass. The 2005 sample, where CPUE of stock-sized (8-inch) bass was high (72.0/h) and PSD was low (4.0), was probably influenced strongly by the spring 2005 stocking of Northern strain largemouth bass fingerlings. In our May 2006 supplemental electrofishing sample, the largemouth bass catch rate was very low (12.0/h), and 71% (N=5) of those bass were collected from the spring inlet canal, where golden alga was suppressed (see Appendix C).

White crappie: One 10-inch white crappie was collected in seven trap net-nights in fall 2005, for a catch rate of 0.1/nn. The 2003 trap net sample was similar, with a catch rate of only 0.4/nn. However, white crappie were once abundant in the reservoir, as can be seen by the catch rate of 18.6/nn in 2001. Despite stockings of adult crappie in 2003, 2004, and 2005, efforts to re-establish this species have been unsuccessful thus far.

Fisheries management plan for Balmorhea Reservoir, Texas

Prepared – July 2006.

ISSUE 1: There is evidence that toxic golden alga blooms have reduced sport fish populations to low numbers.

MANAGEMENT STRATEGY

1. Blue catfish have been requested for 2006 at 100/acre. Stock bluegill, Northern largemouth bass, channel catfish, and white crappie (100/acre) in 2007. If any surpluses of these species become available in 2006, request them for Balmorhea.

ISSUE 2: During periods of toxicity, some fish have been able to find refuge in the spring inlet canal. The canal has excellent bank access for anglers, and seems to be the most popular fishing location on the reservoir. Concerns have been raised by some local anglers that fish in the canal are being overharvested, especially during golden alga toxicity periods.

MANAGEMENT STRATEGY

1. Discuss with Balmorhea controlling authorities the issue of possible overharvest from the canal and potential solutions. If needed, coordinate a public meeting with Balmorhea locals to discuss the problem and options to correct it.

ISSUE 3: Reeves County Water Improvement District currently operates the only boat ramp on the reservoir. It is a single-lane concrete ramp in poor-fair condition.

MANAGEMENT STRATEGY

1. We provided information about the TPWD boat ramp grant program to Lee Renz of Reeves County Water Improvement District in 2005. Continue to work with the authorities and encourage application for a grant.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule includes standard electrofishing and trap netting in fall 2007, additional gill netting in spring 2008, and mandatory monitoring in 2009/2010 (Table 5). Standard electrofishing and trap net samples in 2007, along with an additional gill net sample in 2008, are needed to evaluate the impacts of 2006-2007 stockings and possible future golden alga blooms.

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DiCenzo, V. J., M. J. Maceina, and M. R. Stimert. 1996. Relations between reservoir trophic state and gizzard shad population characteristics in Alabama reservoirs. North American Journal of Fisheries Management 16:888-895.

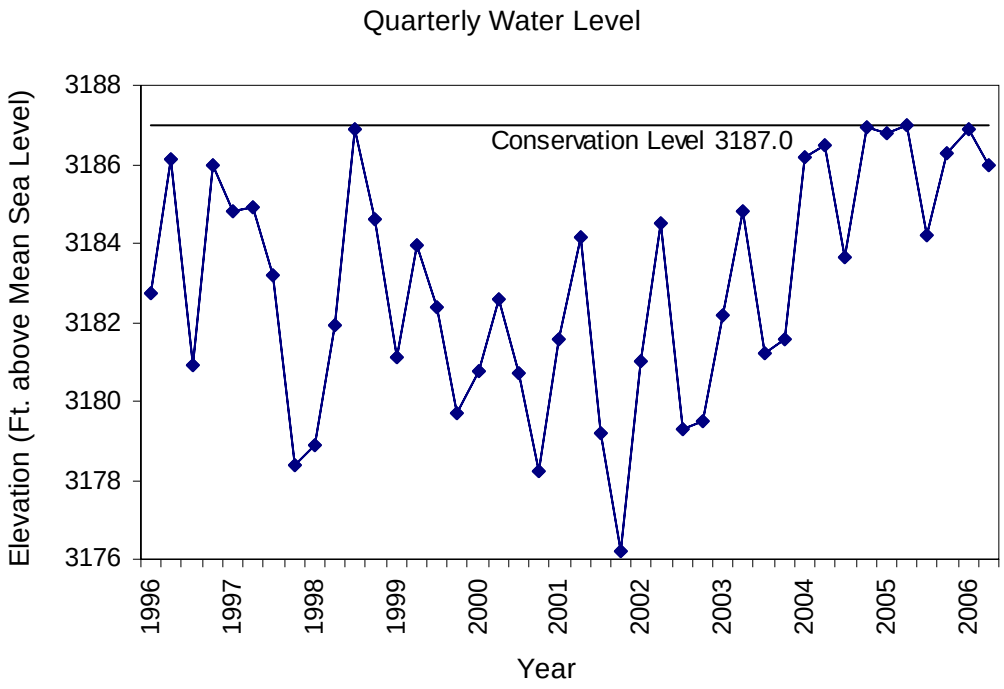


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Balmorhea Reservoir, Texas.

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 (SDI)	2.76
Conductivity	2500 µmhos/cm

Table 2. Harvest regulations for Balmorhea Reservoir, Texas.

Species	Bag Limit	Minimum-Maximum Length (inches)
Catfish: channel and blue catfish, their hybrids and subspecies	25 (in any combination)	12 - No Limit
Catfish, flathead	5	18 - No Limit
Bass, white	25	10 - No Limit
Bass, largemouth	5	14 - No Limit
Crappie: white and black crappie, their hybrids and subspecies	25 (in any combination)	10 - No Limit

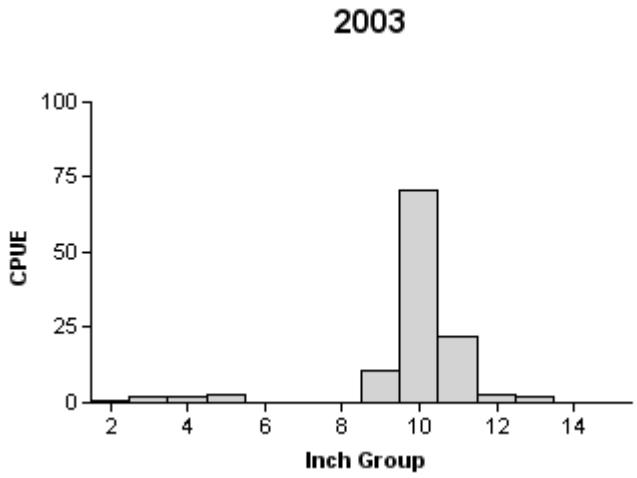
Table 3. Stocking history of Balmorhea Reservoir, Texas since renovation in 1998. Size Categories are: FGL = 1-3 inches; and ADL = adults.

Year	Number	Size
	Blue catfish	
1998	844	ADL
2005	57,132	FGL
Species Total	57,976	
	Channel catfish	
1998	2,590	ADL
1998	28,651	FGL
1999	105	ADL
1999	29,000	FGL
2004	56,140	FGL
Species Total	116,486	
	Redbreast sunfish	
1998	7	ADL
Species Total	7	
	Bluegill	
1998	128	ADL
1999	210,626	FGL
2005	28,709	FGL
Species Total	239,463	
	Northern largemouth bass	
1999	47,300	FGL
2005	59,494	FGL
Species Total	106,794	
	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	
	White crappie	
2000	200	ADL
2004	1,500	ADL
2005	450	ADL
2006	650	ADL
Species Total	2,800	
	Green sunfish X Bluegill	
1998	69	ADL
Species Total	69	

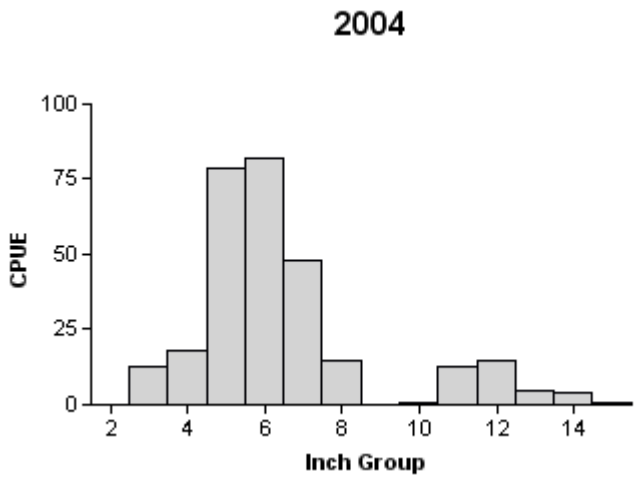
Table 4. Survey of littoral zone and physical habitat types, Balmorhea Reservoir, Texas, 2005. A linear shoreline distance (miles) was recorded for each habitat type found. Surface area (acres) and percent of reservoir surface area was determined for each type of aquatic vegetation found.

Littoral habitat type	Shoreline Distance		Surface Area	
	Miles	Percent of total	Acres	Percent of reservoir surface area
Eroded bank	0.44	7.1		
Nondescript	2.83	46.1		
Boulder	0.47	7.6		
Bulkhead/boat docks	0.14	2.4		
Bulkhead	0.42	6.9		
Rocky shore	0.19	3.1		
Flooded dead terrestrial	1.64	26.8		
Cattail			12.89	2.44

Gizzard Shad



Effort = 1.0
Total CPUE = 117.0 (33; 117)
IOV = 7 (0.03)



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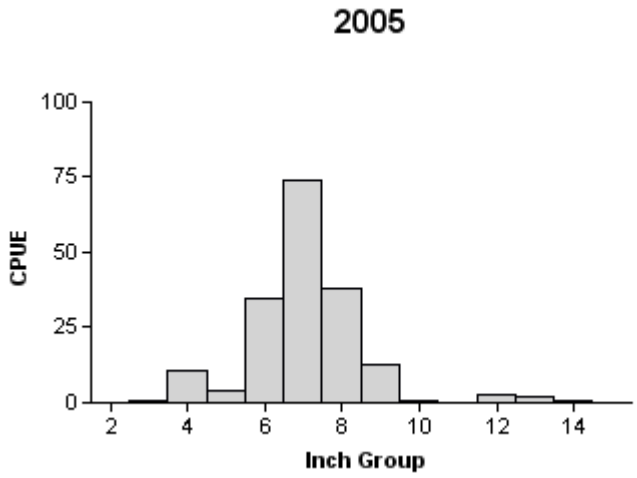
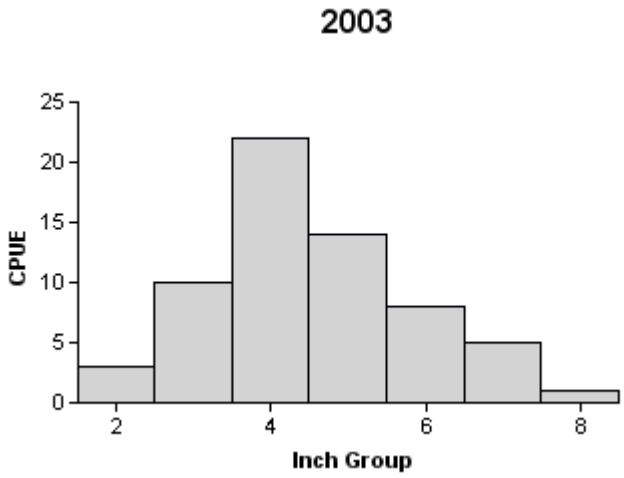
IOV = 82 (0.03)



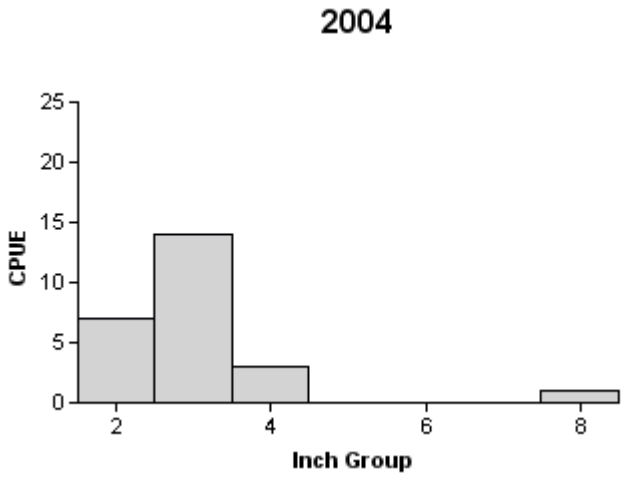
Effort = 1.0
Total CPUE = 183.0 (20; 183)
IOV = 68 (0.05)

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, Balmorhea Reservoir, Texas, 2003, 2004, and 2005.

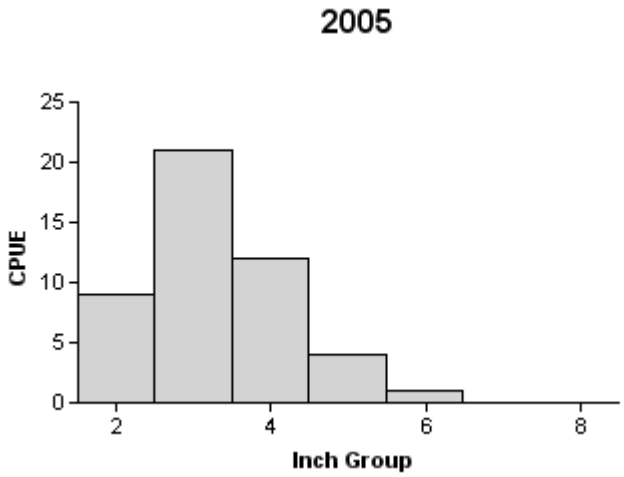
Bluegill



Effort = 1.0
Total CPUE = 63.0 (22; 63)
PSD = 23.0 (0.06)



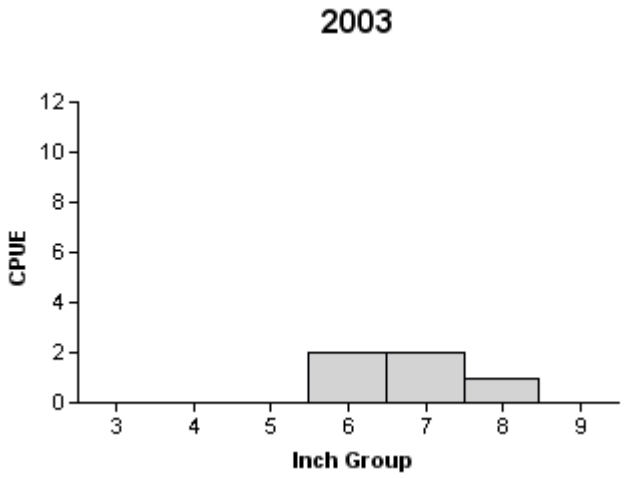
Effort = 1.0
Total CPUE = 25.0 (42; 25)
PSD = 6.0 (0.05)



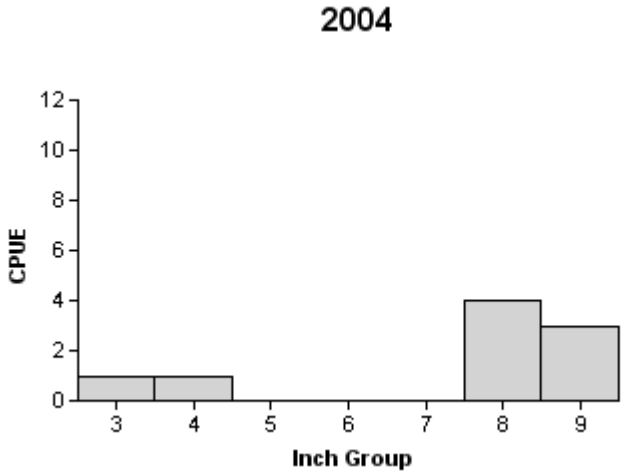
Effort = 1.0
Total CPUE = 47.0 (17; 47)
PSD = 3.0 (0.02)

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, Balmorhea Reservoir, Texas, 2003, 2004, and 2005.

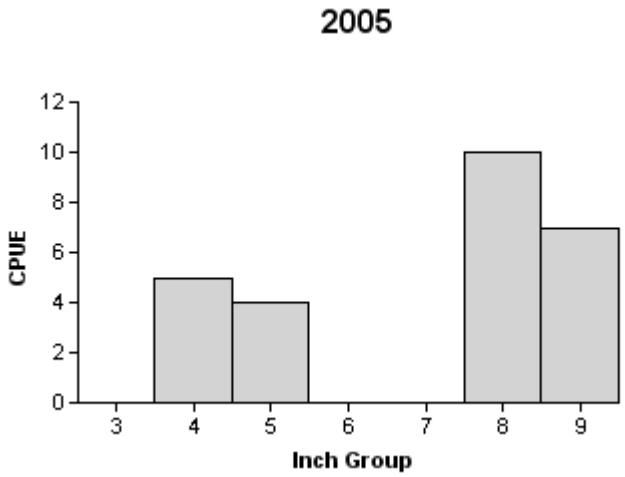
Redear Sunfish



Effort = 1.0
Total CPUE = 5.0 (20; 5)
PSD = 60.0 (0.32)
RSD-P = 0.0 (0)



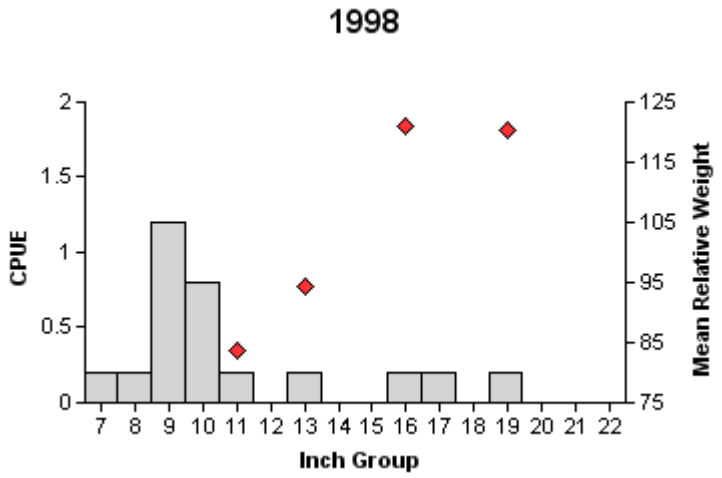
Effort = 1.0
Total CPUE = 9.0 (42; 9)
PSD = 88.0 (0.09)
RSD-P = 38.0 (0.26)



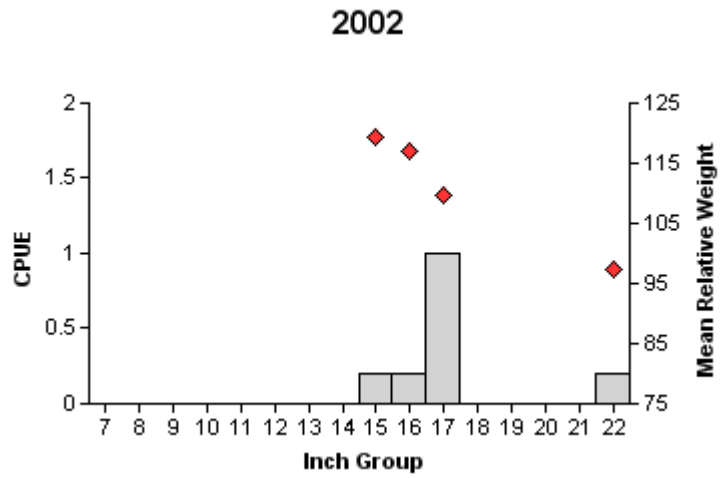
Effort = 1.0
Total CPUE = 26.0 (29; 26)
PSD = 65.0 (0.1)
RSD-P = 27.0 (0.09)

Figure 4. Number of redear sunfish caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Balmorhea Reservoir, Texas, 2003, 2004, and 2005.

Channel Catfish



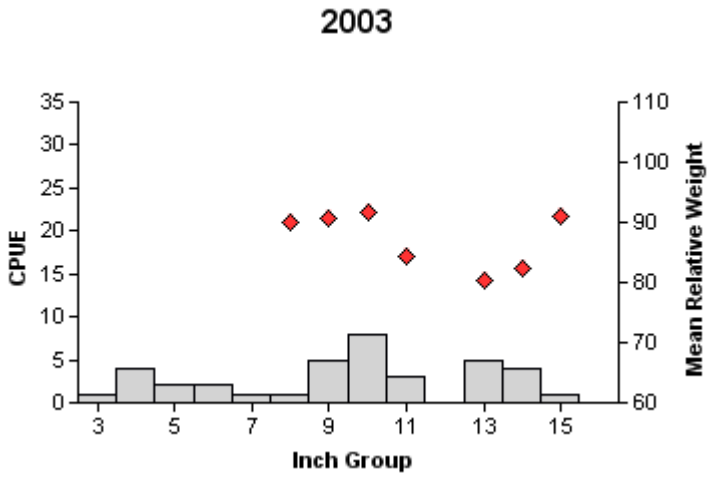
Effort = 5.0
Total CPUE = 3.4 (24; 17)
PSD = 60.0 (0.19)



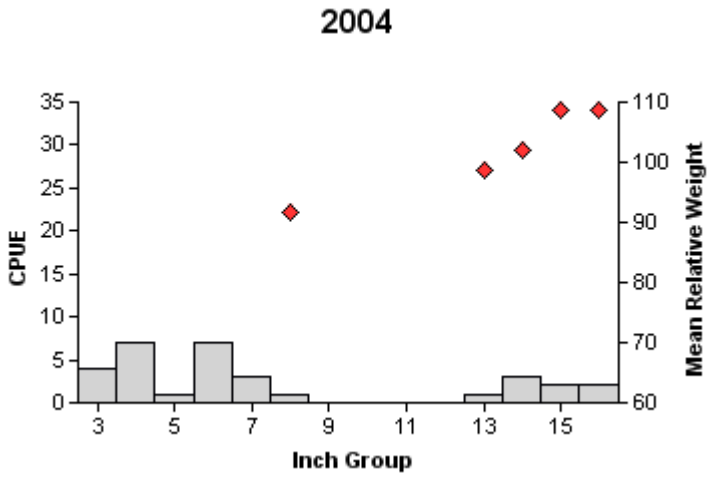
Effort = 5.0
Total CPUE = 1.6 (29; 8)
PSD = 88.0 (0.15)

Figure 5. Number of channel catfish caught per net night (CPUE), mean relative weights (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Balmorhea Reservoir, Texas, 1998 and 2002. No channel catfish were caught in 5 net nights in spring 2006.

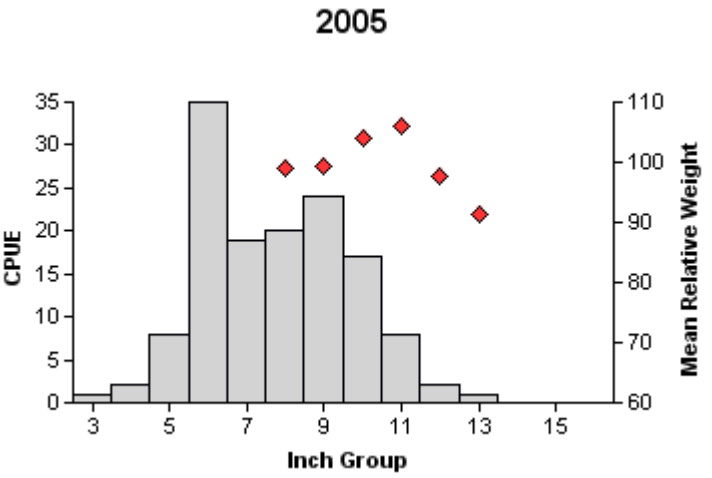
Largemouth Bass



Effort = 1.0
Total CPUE = 37.0 (40; 37)
Stock CPUE = 27.0 (51; 27)
PSD = 37.0 (0.15)



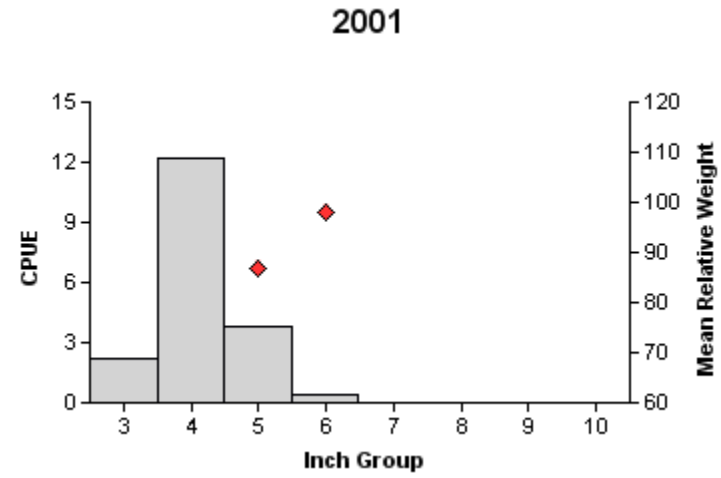
Effort = 1.0
Total CPUE = 31.0 (32; 31)
Stock CPUE = 9.0 (65; 9)
PSD = 89.0 (0.13)



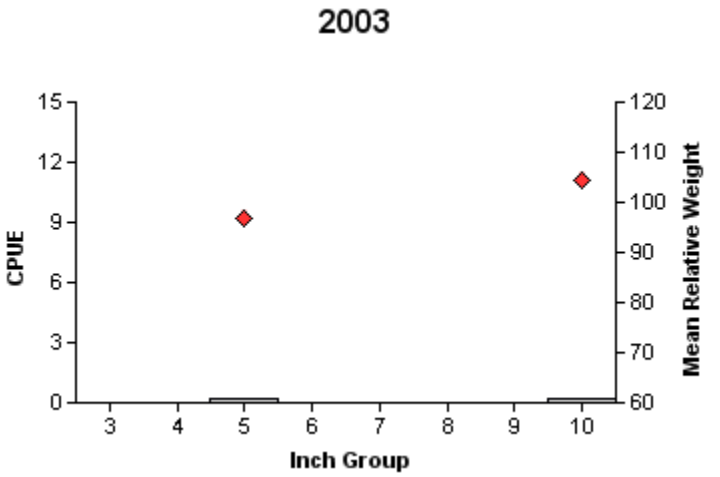
Effort = 1.0
Total CPUE = 137.0 (28; 137)
Stock CPUE = 72.0 (20; 72)
PSD = 4.0 (0.03)

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, Balmorhea Reservoir, Texas, 2003, 2004, and 2005.

White Crappie



Effort = 5.0
Total CPUE = 18.6 (27; 93)
PSD = 0 (2.53)



Effort = 5.0
Total CPUE = .4 (100; 2)
PSD = 50.0 (0)

Effort = 7.0
Total CPUE = .1 (100; 1)
PSD = 100.0 (0)

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 net surveys, Balmorhea Reservoir, Texas, 2001, 2003, and 2005.

Table 5. Proposed sampling schedule for Balmorhea Reservoir, Texas. 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.

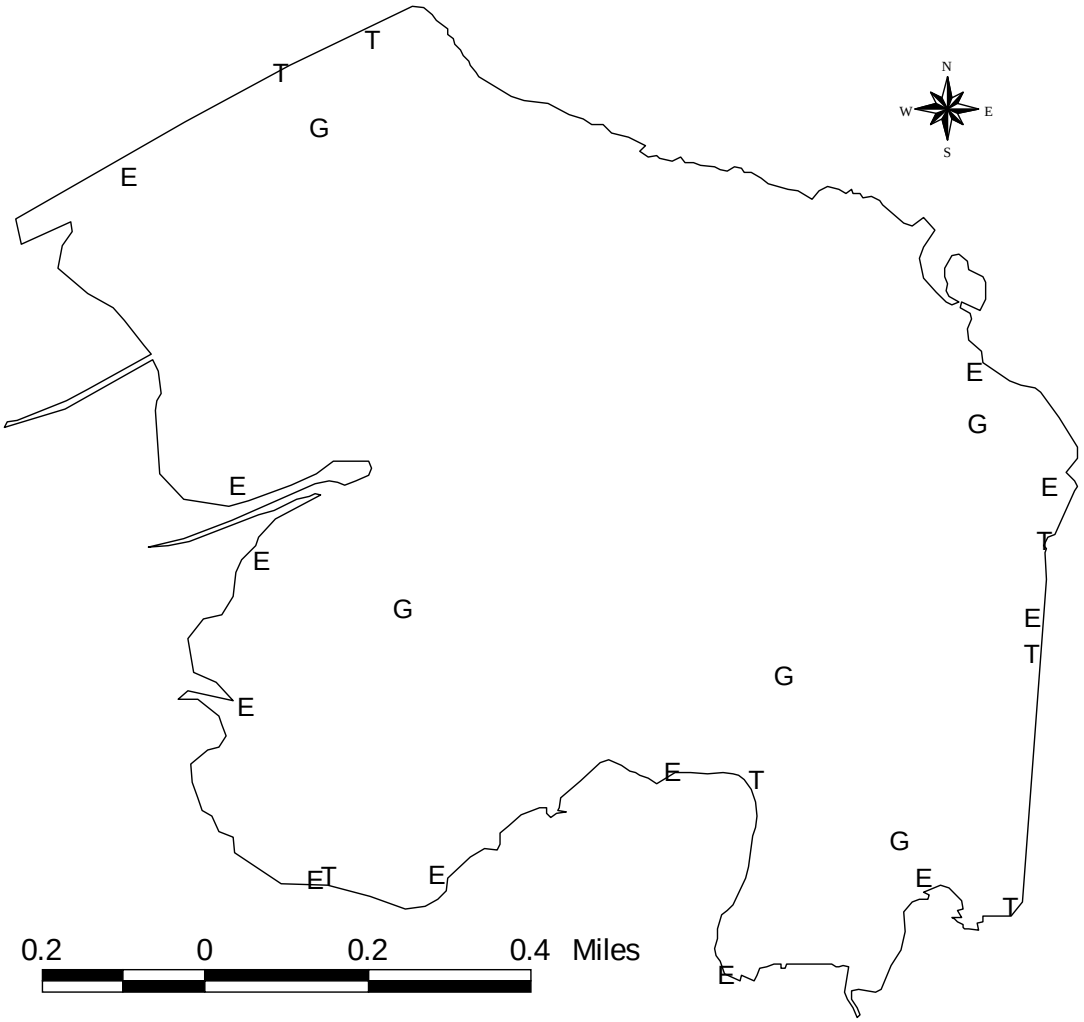
Survey Year	Electrofisher	Trap Net	Gill Net	Creel Survey	Report
Fall 2006-Spring 2007					
Fall 2007-Spring 2008	S	A	A		
Fall 2008-Spring 2009					
Fall 2009-Spring 2010	S	A	S		S

APPENDIX A

Number (N) and catch rate (CPUE) of all species collected from all gear types from Balmorhea Reservoir, Texas, 2005-2006.

Species	Gill Netting		Trap Netting		Electrofishing (standard)		Electrofishing (daytime, non-standard)	
	N	CPUE	N	CPUE	N	CPUE	N	CPUE
Gizzard shad	34	6.8			183	183.0	72	123.4
Common carp	28	5.6					97	168.0
Redbreast sunfish					2	2.0	1	1.7
Green sunfish					5	5.0		
Bluegill					47	47.0	1	1.7
Redear sunfish					26	26.0	5	8.6
Largemouth bass					137	137.0	7	12.0
White crappie			1	0.1				

APPENDIX B



Location of sampling sites, Balmorhea Reservoir, Texas, 2005-2006. Trap net, gill net, and electrofishing stations are indicated by T, G, and E, respectively. Water level was near full pool at time of sampling.

APPENDIX C

Results of golden alga cell counts and bioassay toxicity tests performed on water samples from Balmorhea Reservoir, Texas, 2005-2006. ITU=ichthyotoxin unit; measures degree of toxicity.

Date (sampling)	Date (lab)	Site	Density (cells/mL)	Bioassay	ITUs	Comments
11/3/2005	11/4/2005	near dam	17,000	non-toxic	0	mixed algal community
3/2/2006	3/3/2006	near dam	46,000	highly toxic	$\geq$ 25	*P. parvum* dominant
5/18/2006	5/19/2006	near dam	3,000	non-toxic	0	low algal densities
5/18/2006	5/19/2006	canal	0	non-toxic	0	very low algal densities