

PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

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FEDERAL AID PROJECT F-30-R-34

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2008-09 Survey Report

**Diversion Reservoir**

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## TABLE OF CONTENTS

|   |      |
|---|------|
| Survey and management summary .....                   | 2    |
| Introduction.....                                     | 3    |
| Reservoir description.....                            | 3    |
| Management history .....                              | 3    |
| Methods.....  | 4    |
| Results and discussion.....                           | 4    |
| Fisheries management plan.....                        | 6    |
| Literature cited.....                                 | 7    |
| Figures and tables.....                               | 8-19 |
| Reservoir elevations (Figure 1) .....                 | 8    |
| Reservoir characteristics (Table 1) .....             | 8    |
| Harvest regulations (Table 2).....                    | 8    |
| Stocking history (Table 3).....                       | 9    |
| Habitat survey (Table 4) .....                        | 10   |
| Gizzard shad (Figure 2).....                          | 11   |
| Bluegill (Figure 3) .....                             | 12   |
| Blue catfish (Figure 4) .....                         | 13   |
| Channel catfish (Figure 5).....                       | 14   |
| White bass (Figure 6).....                            | 15   |
| Largemouth bass (Figure 7; Table 5).....              | 16   |
| White crappie (Figure 8).....                         | 18   |
| Proposed sampling schedule (Table 6) .....            | 19   |
| Appendix A  |      |
| Catch rates for all species from all gear types ..... | 20   |
| Appendix B  |      |
| Map of 2008-2009 sampling locations .....             | 21   |

## SURVEY AND MANAGEMENT SUMMARY

Fish populations in Diversion Reservoir were surveyed in 2008 using trap netting and electrofishing and in 2009 using gill nets. This report summarizes the results of those surveys and contains a reservoir management plan based on the findings.

**Reservoir Description:** Diversion Reservoir is a 3,491-acre impoundment located in Archer (dam) and Baylor counties on the Wichita River, a tributary of the Red River, approximately 30 miles west of Wichita Falls. It was impounded in 1924 and is jointly owned by the City of Wichita Falls and Wichita County Water Improvement District No. 2 and is operated primarily for irrigation. In February 2009 Diversion and Kemp Reservoir above it, began service as a secondary municipal water source for the city of Wichita Falls. The Waggoner Ranch based in Vernon, Texas privately owns the land surrounding the reservoir. Vehicle and boat trailer access is through a single tollgate on the northeast side. On January 1, 2009, a \$15 per person fee for three-day passes was instituted. One or two day passes are no longer offered. Also on January 1, 2009 annual permit fees were raised from \$200 to \$500. The reservoir elevation is consistent, varying not more than three feet a year. Diversion is relatively shallow, with moderately clear water. Protective cover in littoral areas includes standing timber and submersed vegetation as observed during the 2008 habitat survey. During the winter/spring months of 2001-2009 the fishery was adversely affected by toxic golden alga blooms resulting in significant losses of game fish and a reduction in angling opportunity.

- **Management history:** Historically important sport fish included channel catfish, white bass, largemouth bass and white crappie. Fingerling Florida largemouth bass and channel catfish were stocked in 2005 in response to golden alga fish kills.
- **Fish Community**
  - **Prey species:** The 2008 gizzard shad catch rate was below average. The electrofishing survey catch rate for sunfishes was low with no bluegill and only a few green and longear sunfish sampled. Bluegill were present in the reservoir as evidenced by their later presence in the 2008 trap net survey. Inland silversides and small carp appeared to be important prey judging by the numbers present and examining the stomach contents of largemouth bass and catfish.
  - **Catfishes:** Blue catfish abundance continued the decline that began in 2001 with the first occurrence of toxic golden alga. However, the fish sampled were in excellent condition and abundant in the lower end of the reservoir. Channel catfish abundance has remained constant since the 2005 gill net survey. A length range of 17-23 inches was sampled in 2009.
  - **White bass:** No white bass were sampled during the year with any sampling gear. It is uncertain what the population status actually is at present.
  - **Largemouth bass:** Largemouth bass abundance as measured by catch rate had increased compared to the 2004 survey. Lengths ranged from 5 -10 inches with all bass sampled being of the 2008 year class. This is encouraging news since this means that in 2008 largemouth bass naturally spawned in the reservoir.
  - **White crappie:** The catch rate for this species more than doubled from the 2006 trap net survey. However, crappie abundance was still down from historical numbers and no legal size fish were sampled. Body condition was excellent.
- **Management Strategies:** Continue monitoring the reservoir for golden alga. Survey the reservoir every four years.

## INTRODUCTION

This document is a summary of fisheries data collected from Diversion Reservoir in 2008-2009. The document purpose is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other species of fish was collected, this report deals primarily with major sport fishes and important prey species. Historical data is presented with the 2008-2009 data for comparison.

### *Reservoir Description*

Diversion is a 3,491-acre reservoir located in Archer (dam) and Baylor counties, and was impounded in 1924. Diversion is an impoundment of the Wichita River approximately 20 miles below Kemp Reservoir. Controlled releases from Kemp are used to maintain nearly constant water levels at Diversion. This results in reservoir fluctuations of not more than three feet a year (Figure 1). The reservoir has a 234 square-mile drainage area which flows through rolling plains and grasslands. Erosion of Permian outcroppings and salt springs in the watershed result in high concentrations of dissolved salts in the reservoir. Diversion is relatively shallow, with moderately clear water and a basic pH. It has a shoreline length of 28 miles, mean depth of 12 feet, and a maximum depth of 35 feet. The reservoir is jointly owned by the City of Wichita Falls and Wichita County Water Improvement District No. 2 and has been operated primarily for irrigation purposes. However, in February 2009 Diversion, and Kemp Reservoir above it, began service as secondary municipal water sources for the city of Wichita Falls. The Waggoner Ranch based in Vernon, Texas privately owns the land surrounding the reservoir charging a fee to access their property. On January 1, 2009, a \$15 per person fee for three-day passes was instituted. One or two day passes are no longer offered. Also on January 1, 2009 annual permit fees were raised from \$200 to \$500. During the 2008 habitat survey, littoral areas standing timber and over 300 acres of submersed vegetation were observed.

Diversion serves as the water supply for the Dundee State Fish Hatchery. On March 16, 2001 a heavy bloom of the toxic golden alga *Prymnesium parvum* was first confirmed in the reservoir. Fish hatchery operations were impacted and significant mortalities occurred. During the winter and spring months of 2003-2009 the Diversion fishery has been impacted by toxic golden alga blooms which combined with the increase in gate fees, has led to sharp reduction in angling activity.

### *Management History*

**Previous management issues and actions:** Management issues and actions from the previous survey report (Mauk and Howell 2005):

1. Golden alga fish kills have occurred nearly every year at Diversion since 2001. The fish populations have been adversely affected and angler use has declined.

**Actions:** Monitored reservoir for golden alga blooms utilizing Dundee fish hatchery incoming water cell counts as an early indicator of problems. Performed an additional trap net survey during November 2006 to monitor the white crappie population. Stocked the reservoir with Florida largemouth bass fingerlings during 2005 at the rate of 50 per acre and channel catfish fingerlings at the rate of 20 per acre. The public was provided with information about fishery status and management plans through a public meeting in 2005. Walleye fingerling stockings were discontinued.

**Harvest regulation history:** Sport fish species continued to be managed with standard statewide regulations (Table 2).

**Stocking history:** In response to largemouth bass and channel catfish population decreases caused by golden alga fish kills, both species were supplementally stocked in 2005. Future stockings of walleye which had occurred from 1998-2000 were stopped. The complete stocking history is shown in Table 3.

## METHODS

Fishes were collected by electrofishing (one hour at 12 five-minute stations), gill netting (10 net nights at 10 stations), and trap netting (10 net nights at 10 stations). Catch per unit effort 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 caught per net night (fish/nn). All survey sites were randomly selected and the surveys were conducted according to standardized Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2008).

Sampling statistics (CPUE for 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 was calculated for gizzard shad (DiCenzo et al. 1996). Relative standard error ( $RSE = 100 \times SE$  of the estimate/estimate) was calculated for all CPUE statistics and SE was calculated for structural indices and IOV.

## RESULTS AND DISCUSSION

**Habitat:** A physical habitat survey was conducted August 25, 2008 and indicated that the littoral zone habitat consisted primarily of rocky and featureless shoreline with some emergent and submergent aquatic vegetation. Open water habitat consists of submerged aquatic vegetation and flooded dead trees (Table 4). The acreage of submerged aquatic vegetation has declined by 67% since the previous physical habitat survey conducted in 2004 (Mauk and Howell 2005). There were few if any observed manmade changes to the physical habitat during the four year period.

**Prey species:** Electrofishing catch rates of bluegill and gizzard shad were 0.0/h and 30.0/h, respectively. Index of vulnerability for gizzard shad was high (100) indicating the entire sampled gizzard shad population was available as prey. Total CPUE of gizzard shad in 2008 was lower than the previous two surveys of 2004 (94.0/hr) and 2000 (64.0/hr) (Figure 2). Total CPUE of bluegill in 2008 was similar to the catch rate during the 2004 survey (1.0/hr) but well below the 2000 catch rate of 88.0/hr which was the last survey before golden alga adversely affected fish populations (Figure 3). Bluegill were still present in the reservoir since the 2008 trap net survey resulted in a catch rate of 2.1/nn (Appendix A). It was observed that there were some other species serving as prey for predators such as inland silversides and age-0 common carp. Both were observed in the stomach contents of largemouth bass and catfish.

**Blue Catfish:** Blue catfish 2009 gill net catch rate was 0.6/nn, a decline from 2005 when the catch rate was 1.6/nn (Figure 4). Blue catfish gill net catch rates have been steadily declining since golden alga fish kills first occurred in 2001. The blue catfish that were sampled were in excellent body condition with  $W_r$ 's over 100.

**Channel Catfish:** Channel catfish abundance remained the same as the 2005 gill net catch rate of 0.7/nn (Figure 5). This is close to the historical reservoir average of 0.9/nn and an increase from the 2003 catch rate of 0.1/nn. Channel catfish body condition as measured by relative weights was good ranging from 91-106. A length range of only adult fish from 17 to 23 inches was sampled. Channel catfish populations do not appear to be negatively impacted by golden alga to the extent that blue catfish populations are. This is a trend we observe for many of our golden alga impacted reservoirs.

**White bass:** No white bass were gill netted in 2009 (Figure 6). During the 2005 gill net survey, the catch rate was only 1.0/nn which was below the historical average of 3.9/nn. It is uncertain what the population status actually is at present since there are many possibilities that would explain the lack of white bass during the survey period. Golden alga avoidance, spawning run up the river, extirpation from reservoir caused by multiple golden alga fish kill events, lack of suitable spawning habitat over multiple years, or a combination would explain the survey results.

**Largemouth bass:** The 2008 electrofishing CPUE of largemouth bass of 52.0/h (Figure 7) was a great

improvement over the 2004 survey when the catch rate was 10.0/hr, but still below the 2000 CPUE of 82.0 hr. All bass surveyed in 2008 were age-0 which is encouraging since they were naturally reproduced, indicating that mature bass are surviving despite the toxic golden alga events. Body condition, as measured by relative weight was excellent ranging from 120-135. The percentage of Florida largemouth bass alleles was 36% and no pure Florida largemouth bass were sampled (Table 5). This is an indication that the Florida largemouth bass stocking in 2005 was successful.

**White crappie:** The trap net catch rate of white crappie was 1.7/nn in 2008 which was a large increase from 2004 (0.3/nn) and 2006 (0.7/nn) but well below the historical average of 8.4/nn (Figure 8). All sampled crappie were between seven to nine inches in length. Body condition was excellent with Wr's all above 120.

## **Fisheries management plan for Diversion Reservoir, Texas**

Prepared – July 2009

**ISSUE 1:** Golden alga fish kills have been documented nearly every year at Diversion since 2001. Fish populations have been adversely affected. Combined with a large increase in access fees angler use has declined sharply.

### **MANAGEMENT STRATEGIES**

1. Continue to help document toxic golden algal bloom events.
2. Confine monitoring efforts on an every fourth year cycle.
3. Only supplementally stock 2-inch channel catfish on a conservative basis if surplus hatchery fish are available.

**ISSUE 2:** Reservoir and boat ramp access is limited to a single toll gate controlled by the Waggoner ranch. This is a factor anglers consider when considering where to fish.

### **MANAGEMENT STRATEGIES**

1. Continue to monitor the fees the ranch charges for entry.
2. Make public aware that there is a small area of public land near the spillway with access to the reservoir that can be used for shoreline angling.

### **SAMPLING SCHEDULE JUSTIFICATION:**

Standard sampling will be conducted in 2012-2013 to continue monitoring species population trends.

## 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, 2<sup>nd</sup> edition. American Fisheries Society, Bethesda, Maryland.
- 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.
- Mauk, R., and M. Howell. 2005. Statewide freshwater fisheries monitoring and management program survey report for Diversion Reservoir, 2004. Texas Parks and Wildlife Department, Federal Aid Report F-30-R-30, Austin, Texas.



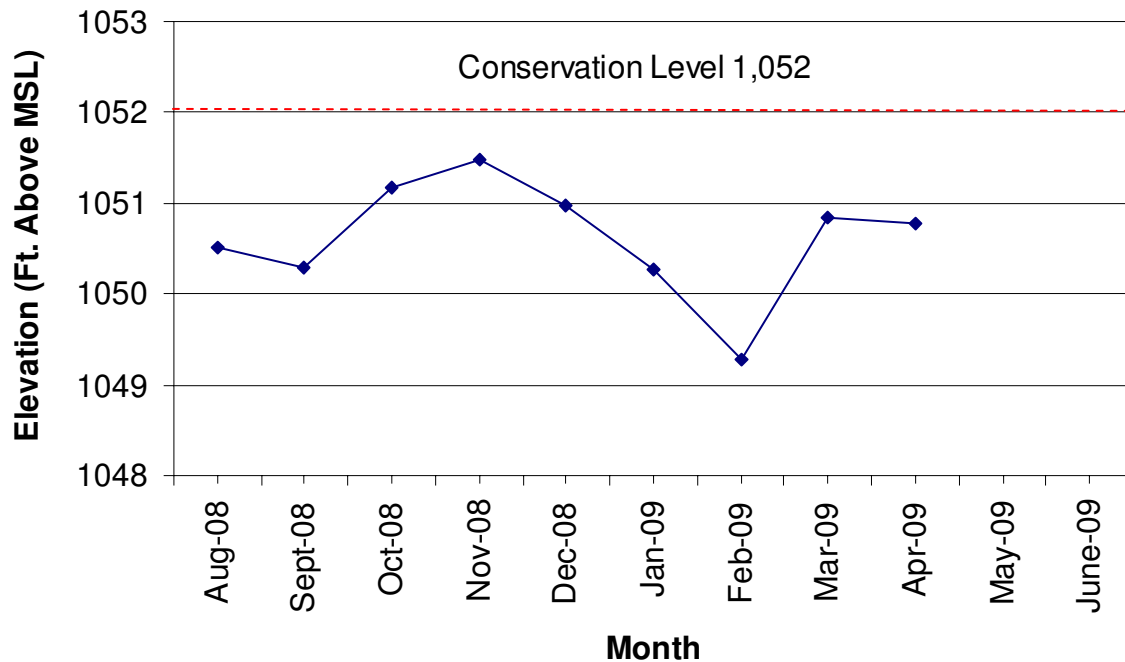


Figure 1. Monthly water level elevation averages in feet above mean sea level (MSL) recorded for Diversion Reservoir, Texas.

Table 1. Characteristics of Diversion Reservoir, Texas.

| Characteristic                    | Description                              |
|-----------------------------------|--|
| Year impounded                    | 1924                                     |
| Controlling authority             | City of Wichita Falls-Wichita Co. WID #2 |
| County                            | Archer                                   |
| Reservoir type                    | Tributary                                |
| Shoreline development index (SDI) | 3.4                                      |
| Conductivity                      | 4,186 $\mu$ mhos/cm                      |
| Secchi disc reading               | 86 cm                                    |

Table 2. Harvest regulations for Diversion Reservoir, Texas.

| Species   | Bag Limit                  | Length Limit (inches) |
|---|----------------------------|-----------------------|
| Catfish: Channel and blue catfish, their hybrids and subspecies | 25<br>(in any combination) | 12 minimum            |
| Flathead catfish  | 5                          | 18 minimum            |
| White bass  | 25                         | 10 minimum            |
| Largemouth bass   | 5                          | 14 minimum            |
| White crappie   | 25                         | 10 minimum            |

Table 3. Stocking history of Diversion (Baylor County), Texas. Life stages are fry (FRY), fingerlings (FGL), advanced fingerlings (AFGL), adults (ADL) and unknown (UNK). Life stages for each species are defined as having a mean length that falls within the given length range. For each year and life stage the species mean total length (Mean TL; in) is given. For years where there were multiple stocking events for a particular species and life stage the mean TL is an average for all stocking events combined.

| Species                                     | Year  | Numbe     | Life Stage | Mean TL (in) |
|---|-------|-----------|------------|--------------|
| Blue catfish                                | 1989  | 34,31     | FGL        | 2.5          |
|   | 1990  | 34,62     | FGL        | 2.0          |
|   | 1991  | 33,09     | FGL        | 2.1          |
|   | Total | 102,03    |            |              |
| Channel catfish                             | 1969  | 10,00     | AFGL       | 7.9          |
|   | 1970  | 14,00     | AFGL       | 7.9          |
|   | 1981  | 53,52     | AFGL       | 7.9          |
|   | 2005  | 71,94     | FGL        | 2.9          |
|   | Total | 149,47    |            |              |
| Florida largemouth bass                     | 1993  | 177,71    | FGL        | 1.7          |
|   | 2005  | 177,15    | FGL        | 1.5          |
|   | Total | 354,86    |            |              |
| Palmetto bass (striped X white bass hybrid) | 1979  | 350,00    | FRY        | 0.4          |
|   | 1981  | 400,00    | FRY        | 0.4          |
|   | Total | 750,00    |            |              |
| Walleye                                     | 1969  | 4,700,03  | FRY        | 0.2          |
|   | 1970  | 400,00    | FRY        | 0.2          |
|   | 1971  | 1,450,00  | FRY        | 0.2          |
|   | 1972  | 435,67    | FRY        | 0.2          |
|   | 1973  | 1,230,47  | FRY        | 0.2          |
|   | 1974  | 70,00     | FRY        | 0.2          |
|   | 1989  | 445,00    | FRY        | 0.2          |
|   | 1993  | 3,367,36  | FRY        | 0.2          |
|   | 1994  | 6,847,10  | FRY        | 0.2          |
|   | 1998  | 75,30     | FGL        | 1.7          |
|   | 1999  | 38,94     | FGL        | 1.4          |
|   | 2000  | 171,71    | FGL        | 1.6          |
|   | Total | 19,231,60 |            |              |

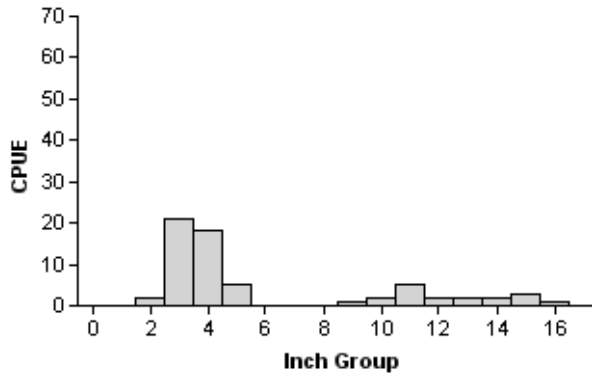
Table 4. Survey of littoral zone and physical habitat types for Diversion Reservoir on August 25, 2008. A linear shoreline distance (miles) was recorded for each habitat type found. Surface area (acres) and percent of reservoir surface area was determined for each type of aquatic vegetation found.

| Shoreline habitat type                    | Shoreline Distance |                  | Surface Area |                                   |
|---|--------------------|------------------|--------------|-----------------------------------|
|   | Miles              | Percent of total | Acres        | Percent of reservoir surface area |
| Rocky shore                               | 13.8               | 49.1             |              |                                   |
| Riprap                                    | 0.8                | 2.8              |              |                                   |
| Bulkhead                                  | 0.1                | 0.3              |              |                                   |
| Overhanging brush                         | 0.1                | 0.3              |              |                                   |
| Featureless                               | 10.1               | 35.9             |              |                                   |
| Native emergent vegetation                | 3.2                | 11.4             |              |                                   |
| Total shoreline length                    | 28.1               |                  |              |                                   |
| <b>Vegetation type</b>                    |                    |                  |              |                                   |
| Native emerged vegetation                 |                    |                  | 10.9         | 0.3                               |
| Native submerged vegetation               |                    |                  | 318.8        | 9.1                               |
| <b>Habitat type adjacent to shoreline</b> |                    |                  |              |                                   |
| Boat docks                                |                    |                  | 3.0          | <0.1                              |
| Dead trees                                |                    |                  | 209.4        | 6.0                               |

## Gizzard Shad

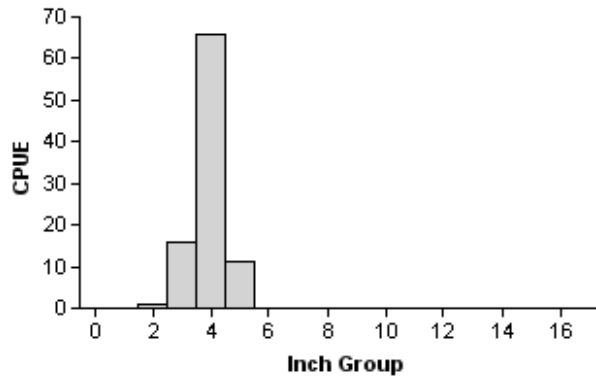
**2000**

Effort : 1.0  
Total CPUE : 64.0 (43; 64)  
IOV : 71 (10.1)



**2004**

Effort : 1.0  
Total CPUE : 94.0 (44; 94)  
IOV : 100 (0.0)



**2008**

Effort : 1.0  
Total CPUE : 30.0 (35; 30)  
IOV : 100 (0.0)

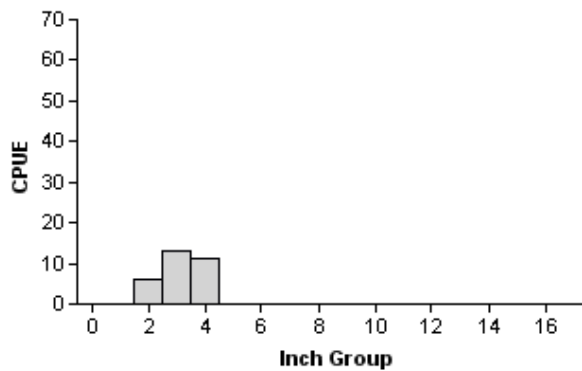


Figure 2. Number of gizzard shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Diversion Reservoir, Texas, 2000, 2004, and 2008.

## Bluegill

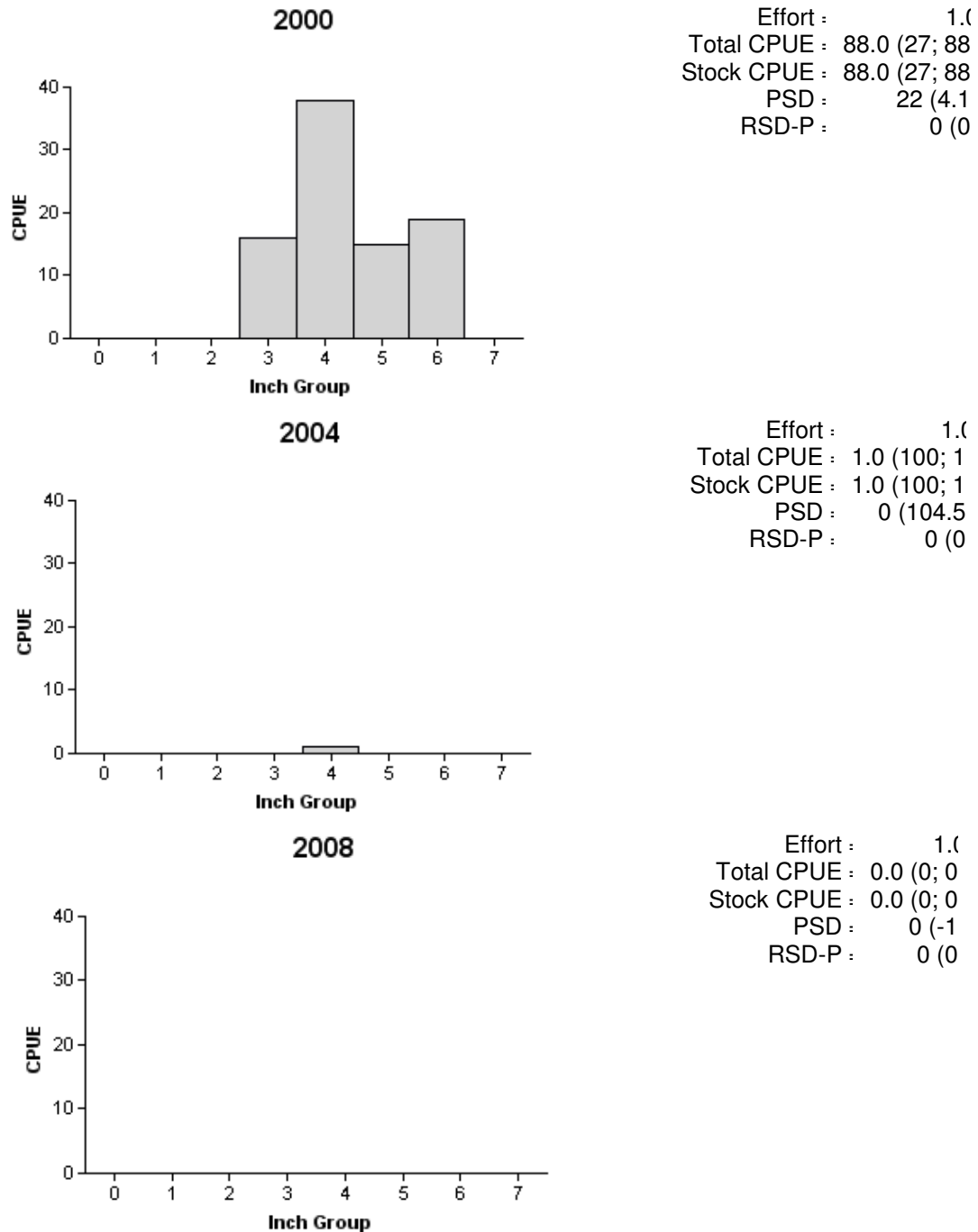
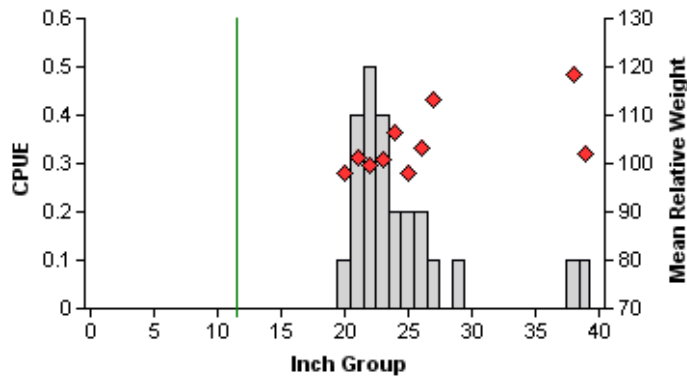


Figure 3. Number of bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Diversion Reservoir, Texas, 2000, 2004 and 2008.

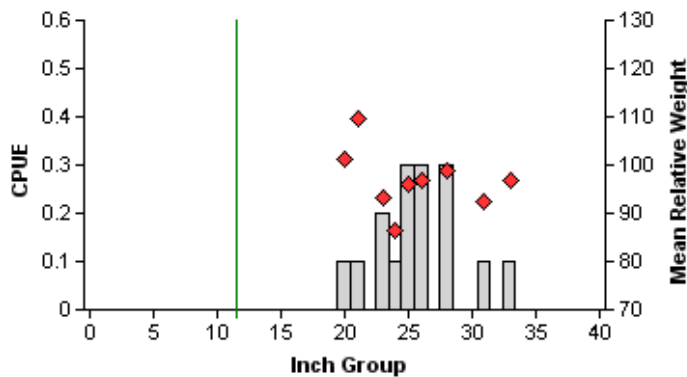
## Blue Catfish

2003



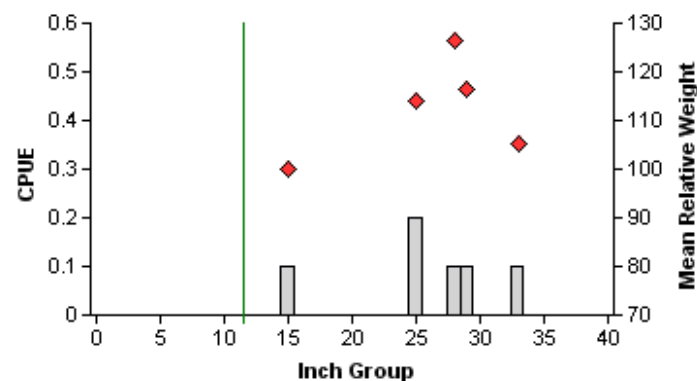
Effort : 10.0  
 Total CPUE : 2.4 (20; 24  
 Stock CPUE : 2.4 (20; 24  
 PSD : 100 (0  
 RSD-P : 8 (8.3

2005



Effort : 10.0  
 Total CPUE : 1.6 (41; 16  
 Stock CPUE : 1.6 (41; 16  
 PSD : 100 (0.0  
 RSD-P : 12 (8.6

2009



Effort : 10.0  
 Total CPUE : 0.6 (51; 6  
 Stock CPUE : 0.6 (51; 6  
 PSD : 83 (17.6  
 RSD-P : 17 (10

Figure 4. Number of blue catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill netting surveys, Diversion Reservoir, Texas, 2003, 2005, and 2009. Line indicates minimum length limit at time of sampling.

## Channel Catfish

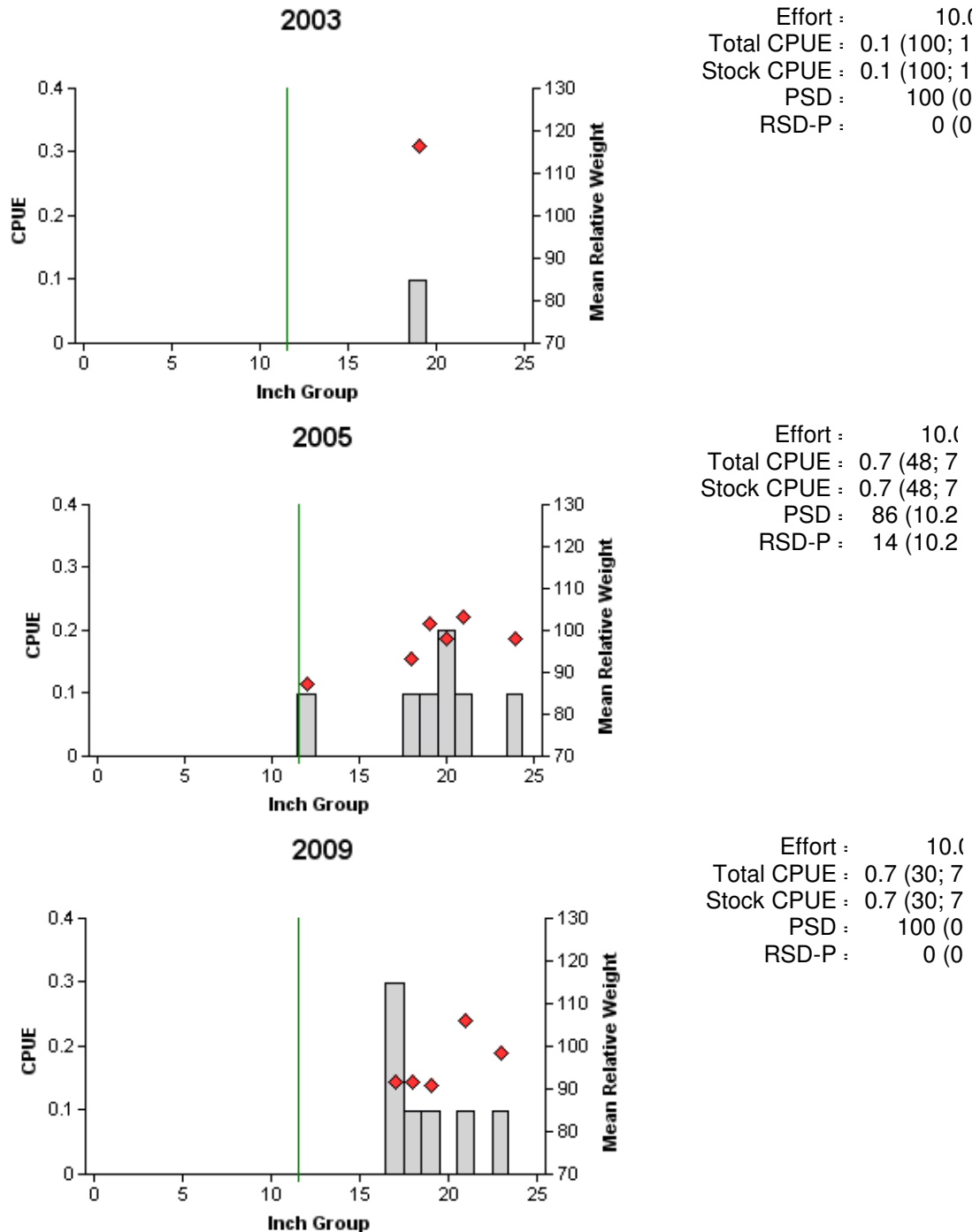


Figure 5. Number of channel catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill netting surveys, Diversion Reservoir, Texas, 2003, 2005, and 2009. Line indicates minimum size limit at time of sampling.

## White Bass

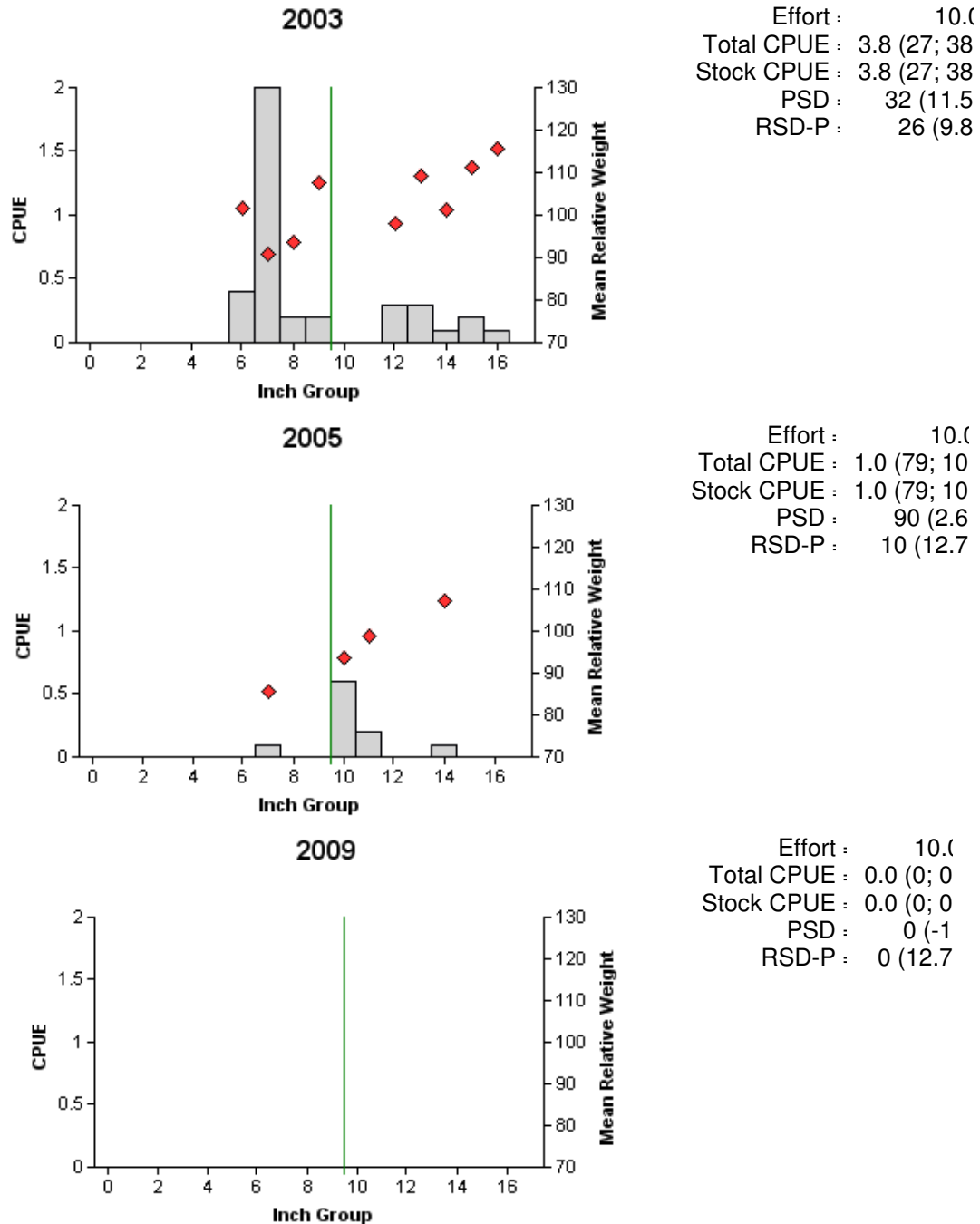


Figure 6. Number of white bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill netting surveys, Diversion Reservoir, Texas, 2003, 2005, and 2009. Line indicates minimum size limit at time of sampling.



## Largemouth Bass

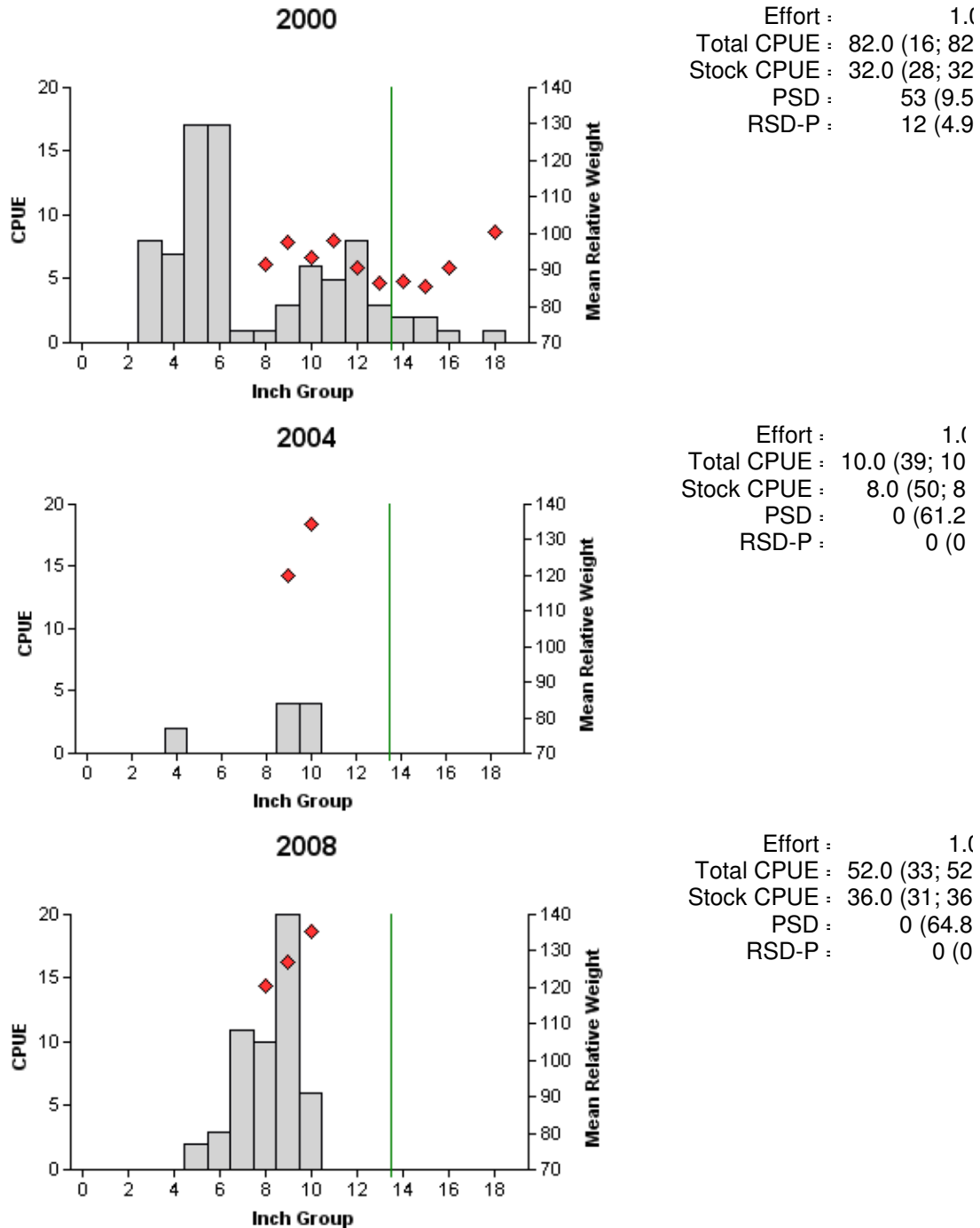


Figure 7. Number of largemouth bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Diversion Reservoir, Texas, 2000, 2004, and 2008. Line indicates minimum size limit at time of sampling.

## Largemouth Bass

Table 5. Results of genetic analysis of largemouth bass collected by fall electrofishing at Diversion Reservoir, Texas. FLMB = Florida largemouth bass, NLMB = Northern largemouth bass, F1 = first generation hybrid between a FLMB and a NLMB, Fx = second or higher generation hybrid between a FLMB and a NLMB.

| Year | Sample size | Genotype |          |      | % FLMB alleles | % pure FLMB |
|------|-------------|----------|----------|------|----------------|-------------|
|      |             | FLMB     | F1 or Fx | NLMB |                |             |
| 1997 | 28          | 2        | 25       | 1    | 51.8           | 7.1         |
| 2000 | 30          | 0        | 24       | 6    | 30.0           | 0.0         |
| 2004 | 2           | 0        | 1        | 1    | 50.0           | 0.0         |
| 2008 | 30          | 0        | 28       | 2    | 36.0           | 0.0         |

## White Crappie

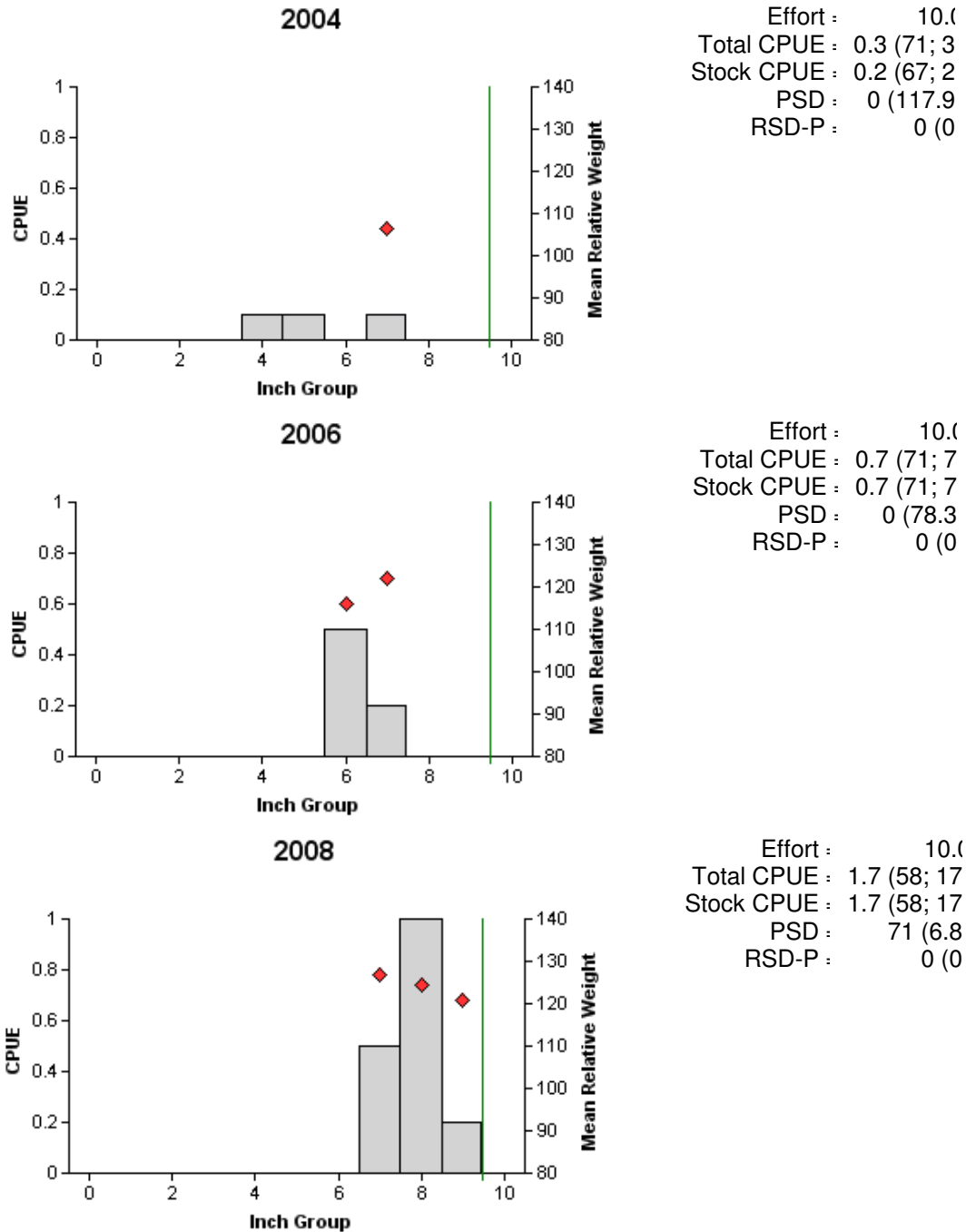


Figure 8. Number of white crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Diversion Reservoir, Texas, 2004, 2006, and 2008. Line indicates minimum size limit at time of sampling.

Table 6. Proposed sampling schedule for Diversion Reservoir, Texas. Gill net surveys are conducted in the spring, while electrofishing and trap net surveys are conducted in the fall. S denotes standard survey, A denotes an additional survey.

| Survey Year           | Electrofishing | Trap Net | Gill Net | Creel | Report |
|-----------------------|----------------|----------|----------|-------|--------|
| Fall 2009-Spring 2010 |                |          |          |       |        |
| Fall 2010-Spring 2011 |                |          |          |       |        |
| Fall 2011-Spring 2012 |                |          |          |       |        |
| Fall 2012-Spring 2013 | S              | S        | S        |       | S      |

**APPENDIX A**

Number (N) and catch rate (CPUE) for species collected from gill nets (2009), trap nets (2008) and electrofishing (2008) from Diversion Reservoir, Texas.

| Species               | Gill Nets |      | Trap Nets |      | Electrofishing |      |
|-----------------------|-----------|------|-----------|------|----------------|------|
|                       | N         | CPUE | N         | CPUE | N              | CPUE |
| Longnose gar          | 1         | 0.1  |           |      |                |      |
| Gizzard shad          | 1         | 0.1  | 36        | 3.6  | 30             | 30.0 |
| Common carp           | 18        | 1.8  | 1         | 0.1  |                |      |
| Smallmouth buffalo    | 4         | 0.4  |           |      |                |      |
| Blue catfish          | 6         | 0.6  |           |      |                |      |
| Channel catfish       | 7         | 0.7  | 1         | 0.1  |                |      |
| Green sunfish         |           |      | 7         | 0.7  | 6              | 6.0  |
| Warmouth              |           |      | 5         | 0.5  |                |      |
| Orangespotted sunfish |           |      | 1         | 0.1  |                |      |
| Bluegill              |           |      | 21        | 2.1  |                |      |
| Longear sunfish       |           |      | 2         | 0.2  | 1              | 1.0  |
| Largemouth bass       |           |      |           |      | 52             | 52.0 |
| White crappie         |           |      | 17        | 1.7  |                |      |

## APPENDIX B



Location of sampling sites, Diversion Reservoir, Texas, 2008-2009. Trap net, gill net, and electrofishing stations are indicated by T, G, and E, respectively.