PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-30-R-34

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2008 Survey Report

Texoma Reservoir

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Texoma Reservoir were surveyed in 2008 using an electrofisher and trap nets and in 2009 using gill nets. Habitat was surveyed in 2004. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir description:** Texoma Reservoir is a 74,686-acre impoundment on the Red River between Texas and Oklahoma. Water level closely paralleled conservation elevation (617 feet-mean sea level) June 2005 to May 2009 except for a flood event July 2007. Texoma Reservoir has moderate productivity. Habitat features consisted mainly of rocky shoreline, submerged boulders, boat docks, and native emergent vegetation.

- **Management history:** Important sport fish included blue and channel catfish; white bass; striped bass; smallmouth, spotted, and largemouth bass; and black and white crappie. The management plan from the 2004 survey report included: continue gill net monitoring the striped bass population annually and continue monitoring golden alga/toxin by collecting water samples from established sites; supplemental electrofishing for smallmouth and largemouth bass in response to apparent declines in both populations. Finally, we recommended updating the Texoma Reservoir web page as required.

- **Fish community**

  - **Prey species:** Threadfin shad continued to maintain their presence in the reservoir at adequate numbers. Electrofishing catch rate of gizzard shad declined from previous surveys, however, over one-half the population was ideal prey for a variety of sizes of sportfish. Electrofishing catch of prey-size bluegills was the highest on record.

  - **Catfishes:** Gill net catch of blue catfish increased over previous surveys. Most of the population was legal-size and larger, in fair condition, and recruitment was evident. Gill net catch of channel catfish remained similar to previous catches. About one-half the population was legal size and larger and in good condition. Recruitment was excellent, but growth was slow.

  - **Temperate basses:** Gill net catch of white bass was good and over one-half were legal-size. Gill net catch of striped bass has changed very little over the past four years, body condition was good, and recruitment was excellent. Growth in both species was good.

  - **Black basses:** Largemouth bass were the most abundant, followed by spotted bass and smallmouth bass. Size structure and body condition was adequate for all three species. Growth was good for largemouth and smallmouth bass. Florida largemouth bass alleles continue to be present.

  - **Crappie:** Abundance and body condition of white crappie continued to be good. No legal-size black crappie were caught.

  - **Golden alga:** Golden alga showed up in the Lebanon Pool in record concentrations, 198,000 cells/cc producing fish kills. Other sites near Lebanon Pool had moderate concentrations.

  - **Mussels:** Live adult zebra mussels, *Dreissena polymorpha,* were found at three locations in Texoma Reservoir.

- **Management strategies:** Based on current information, only one blue catfish 30 inches or longer should be included in the daily bag limit of catfish and limit alligator gar harvest to only one per angler per day. Close Hagerman National Wildlife Refuge and Texoma Reservoir west of US377 to alligator gar fishing in May. Continue annual gill net monitoring of striped bass. Continue monitoring golden alga and zebra mussels. Conduct routine fish stock assessment in 2012/2013.

INTRODUCTION

This document is a summary of fisheries data collected from Texoma Reservoir in 2008-2009. 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 2008-2009 data for comparison.

Reservoir Description

Texoma Reservoir is a 74,686-acre impoundment constructed in 1944 on the Red River between Texas and Oklahoma. Denison Dam impounds waters of the upper Red River basin and the entire Washita River basin for a total watershed of 40,000 square miles in west Texas and central and western Oklahoma. The shoreline is 580 miles long and approximately 40% of the reservoir is $\leq$ 15 feet deep. Texoma Reservoir is operated and controlled by the U.S. Army Corps of Engineers (USACOE). Water level closely paralleled conservation elevation (617 ft-MSL) June 2005 to May 2009 except for a flood event July 2007 (Figure 1). In 1992 the USACOE implemented a seasonal pool elevation management plan that bore the consensus of the USACOE and other members of the "Texoma Reservoir Advisory Committee". This committee is comprised of, in addition to USACOE personnel, various conservation/recreation agency personnel, area businesses, and chambers of commerce. The plan varies from the conventional reservoir conservation elevation (617 ft-MSL; Figure 2) in that water level is allowed to drop to a level below conservation elevation during the spring and early fall. Reservoir level is then maintained above the conservation elevation during summer, late fall, and early winter. This unique plan serves to minimize negative impacts of extreme high and low water conditions. Reservoir purposes include: flood control; hydropower; municipal, industrial, and agricultural water supply; and recreation. Boat access is adequate with some 39 public boat ramps with bank access available at these sites. However, the trend is to control access to these public facilities by "out-granting" facilities to private operators who disallow or charge a fee for access. Free access to most of the public facilities on the reservoir does not exist. Access to facilities for the physically challenged are provided. Fish habitat consisted primarily of rock rip-rap, flooded boulders/rocks/stumps, boat docks, boat ramps, and standing timber. Texoma Reservoir was mesotrophic with a mean Trophic State Index based on Secchi Disc (TSI SD) of 40.00 (Texas Commission on Environmental Quality 2008); hence, moderately productive. Other descriptive characteristics for Texoma Reservoir are in Table 1.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Hysmith and Moczygemba 2005) included:

1. Recommended continuing annual monitoring of the premier striped bass fishery.
   Action: Continued annual gill net sampling of striped bass each February at 30 selected sites (15 by TPWD and 15 by ODWC) around the reservoir. Shared, analyzed, and presented these data at TPWD/ODWC strategy meetings. No striped bass management changes required during this reporting period (2005 – 2008).
2. Recommended continuing monitoring golden alga and toxins from water samples.
   Action: Monitored golden alga/toxin through water samples collected from October through March annually through 2008. A protocol was established with ODWC for collecting and transporting water samples to TPWD laboratories in Waco and San Marcos, TX. Investigated reported fish kills suspected to be linked to golden alga. Attended golden alga related work shops to exchange information with other biologists.
3. Recommended supplemental electrofishing targeting smallmouth and largemouth bass.
   Action: Conducted supplemental electrofishing for smallmouth bass and largemouth bass during the fall of 2005 in selected habitat (Figures 9 & 11).
4. Recommended updating Texoma Reservoir web page with current fisheries information.
   Action: Updating Texoma Reservoir web page is ongoing as needed.

Harvest regulation history: Only smallmouth, spotted, and largemouth bass in Texoma Reservoir are currently managed with statewide regulations. All other sportfishes are managed with exceptions to statewide regulations (Table 2).

Stocking history: Texoma's first stocking occurred in 1944 with 67,000 channel catfish fingerlings; 2,400 coppernose bluegill fingerlings; 225,000 largemouth bass fingerlings; and 18,000 redear sunfish fingerlings (Table 3). The reservoir was last stocked in 2007 with 2,029 sub-adult paddlefish by the U.S. Fish and Wildlife Service.

Vegetation/habitat history: Texoma Reservoir supported limited aquatic vegetation (Table 4). Most of this was buttonbush. Fishery habitat consisted mostly of rocky shoreline and was augmented by boulders found at infrequent intervals around the reservoir.

METHODS

Fishes were collected by electrofishing (2 hours at 24 5-min stations), gill netting [30 net nights (nn) at 30 stations, 15 stations by ODWC], and trap netting (15 nn at 15 stations). 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 caught per net night (fish/nn). Survey sites for electrofishing and trap netting were randomly selected. Gill netting survey sites were subjectively selected for 15 stations (ODWC) and 15 stations were randomly selected (TPWD). All surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2008).

Sampling statistics (CPUE for various length categories), structural indices [Proportional Stock Density (PSD), Relative Stock Density (RSD)], and condition index [relative weight (Wr)] 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. Otoliths, for aging channel catfish, striped and white bass, smallmouth and largemouth bass, white and black crappie, were extracted from the auditory capsules in the neurocranium, washed to remove all adhering tissues, dried, and stored for further analysis. Ages for all species were determined using Category 2 protocol according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2008). The manual specifies largemouth bass, but we adapted the protocol to include channel catfish, white bass, striped bass, smallmouth bass, and white and black crappie.

RESULTS AND DISCUSSION

Habitat: Littoral zone habitat consisted primarily of rock rip-rap, flooded boulders/rocks/stumps, boat docks, boat ramps, and standing timber (Table 4).

Prey species: Electrofishing CPUE of gizzard shad and bluegill were 149.5/h and 327.5/h, respectively (Figures 3 and 4). The IOV for gizzard shad was fair, 64% of gizzard shad were available to existing predators, which was similar to 2004, but below 88% recorded in 2000. Total CPUE of bluegill was a record for Texoma Reservoir (Appendix C) and size structure continued to be dominated by small individuals (Figure 4). Electrofishing CPUE for threadfin shad was 56.0/h (Appendix A).

Catfish: Gill net CPUE of blue catfish was 0.9/nn, an increase from previous years (Figure 5). Relative weight was good to excellent and increased with size. There was evidence of recruitment. Based on a 2003 study (Mauck and Boxrucker 2004), blue catfish grew to 12 inches in 3-4 years (N = 333; Appendix D).

Gill net CPUE of channel catfish (2.4/nn; Figure 6) was the second highest on record (Appendix C). Relative weights were good generally increasing with size (Figure 6). Recruitment was excellent and based on a sample of 2 fish growth was good.

Temperate basses: Gill net CPUE of white bass (5.3/nn) has remained fairly consistent since 2007 (Figure 7). Relative weight was good and there was good recruitment (Figure 7). Based on a sample size of 3 growth was

good. Over one-half the sample population was legal to harvest.

Gill net CPUE of striped bass (23.4/nn) was similar to the CPUE over the previous fifteen years (Figure 8 and Appendix C). Relative weights were good, indicating healthy fish. Growth was good; 20 inches in 3-5 years (N = 13). Good growth was substantiated by ODWC biologists who reported growth to 20 inches in 3-5 years (N = 812; unpublished data ODWC; Appendix E)

Black basses: Electrofishing total CPUE of smallmouth bass was 9.5/h (Figure 9) similar to the historic average (Appendix C). Relative weight was good, recruitment was evident, and based on a sample of 3, growth was good. Following low CPUE in 2004, a supplemental daytime/nighttime survey was conducted at subjective selective sites in the fall of 2005. Total CPUE as well as stock CPUE in the supplemental sample increased (Figure 9), indicating random sampling in 2004 failed to include smallmouth bass habitat.

Electrofishing total CPUE of spotted bass (17.0/h), was the lowest on record (Figure 10 and Appendix C). Relative weight was good for small spotted bass, but was average for larger fish. Recruitment was evident.

Electrofishing CPUE of largemouth bass (51.0/h) was the highest since 2004 (Figure 11). Relative weights showed good body condition, recruitment was excellent, and legal-size was attained in 2-5 years (N = 11). Genetic analysis showed 20% Florida largemouth bass alleles (Table 5).

Crappie: Trap net CPUE of white crappie (21.5/nn) was the second highest on record (Figure 12 and Appendix C). Excellent recruitment of sub-stock white crappie in 2007 probably accounted for the excellent recruitment of stock length white crappie in 2008. Relative weights indicated white crappie are in good condition. White crappie reach legal size in one year (N = 13; all one year old), and about 20% of the sample population was legal.

Trap net CPUE of black crappie (1.7/nn) was a record catch, although there were no legal-size fish (Figure 13). Records show there were legal-size black crappie in the past and there probably will be again based on the number and body condition of small recruits in 2008.

Golden alga: Golden alga, *Prymnesium parvum*, was discovered in Texoma Reservoir in 2004 with a resulting fish kill (Hysmith and Moczygemba 2005). Since 2004 only the Lebanon Pool in the upper Red River arm has recorded fish kills related to golden alga. During this reporting period, however, moderate concentrations of cells showed up in samples from Wilson, Briar, Keeton, and Buncombe Creeks near the Lebanon Pool on the west end of the Red River arm (Appendix F). Low concentrations were found in Johnson Creek, located north on the Washita River arm, north of US Hwy 70.

Mussels: On October 10, 2006, a 27-foot boat from MN was found to have zebra mussels *Dreissena polymorpha* on it and it was sanitized prior to being launched on Texoma. This was the first documented occurrence of zebra mussels at Texoma Reservoir. Since then there have been five cases where zebra mussel were found to be on vessels trying to launch in Texoma Reservoir but in each case the boat was quarantined and cleaned prior to launching. On April 3, 2009, the first live adult zebra mussel was found attached to a communication line underneath a boathouse in Texoma Reservoir. The event was covered by a myriad of media and Larry Hodge prepared and distributed a news release (Appendix G). The most recent observations included June 12, 2009 when two live zebra mussels on a hydro-hoist at Grandpappy Marina and three live zebra mussels on an outdrive from a boat in Eisenhower Yacht Club Marina and June 30, 2009, when one was found on a fire extinguisher recovered from Catfish Bay Marina in the Washita River Arm.

Fisheries management plan for Texoma Reservoir, Texas

Prepared – July 2009.

ISSUE 1: Gill net sampling historically produces low blue catfish CPUE's; hence, not an accurate representation of catfish populations in Texoma Reservoir.

MANAGEMENT STRATEGY

1. Conduct low pulse and low amp electrofishing (Mauck and Boxrucker, 2004) in the upper Red River arm during August of 2009, 2010, 2011, and 2012.

ISSUE 2: Texoma Reservoir supports a popular and valuable striped bass fishery that contributes over $22 million annually to the local economy (Schoor et al. 1995). Fisheries managers in Texas and Oklahoma need to monitor this important fishery annually.

MANAGEMENT STRATEGIES

1. Conduct annual gill net surveys at 30 established sites. Oklahoma Department of Wildlife Conservation (ODWC) personnel will conduct 15 site surveys on the Oklahoma side and Texas Parks and Wildlife Department (TPWD) personnel will conduct 15 site surveys on the Texas side of the reservoir.

2. Resulting data will be shared, analyzed, and presented at a scheduled Texoma Reservoir management meeting.

ISSUE 3: Golden alga, *Prymnesium parvum*, was discovered in Texoma Reservoir in 2004 with a resulting fish kill (Hysmith and Moczygemba 2005). Since 2004 only the Lebanon Pool in the upper Red River arm has recorded fish kills related to golden alga. Monitoring, resource review meetings, and training sessions have been ongoing.

MANAGEMENT STRATEGY

1. Continue our agency role along with personnel from ODWC and the University of Oklahoma in monitoring golden alga in Texoma Reservoir, participating in resource review meetings, public awareness communications, and attendance and participation in training sessions.

ISSUE 4: One live adult zebra mussel, *Dreissena polymorpha,* was found attached to a communication line underneath a boathouse in Texoma Reservoir. Since 2006 there have been four cases of boats carrying zebra mussels attempting to launch into Texoma Reservoir. They were quarantined and treated with a 10% bleach solution, 140 degree F high pressure water, and dry storage for a minimum of 15 days (guidelines from USGS, Oklahoma Water Resources Board, California Department of Water Resources, Iowa Department of Natural Resources, New Jersey Sea Grant Marine Advisory Service and the Virginia Department of Game & Inland Fisheries) prior to being released. This was the first time a live adult zebra mussel was found attached to an object in Texoma Reservoir.

MANAGEMENT STRATEGY

1. Continue our intra-agency role along with personnel from ODWC, USACOE, and the U.S. Fish and Wildlife Service in monitoring zebra mussels in Texoma Reservoir, participating in resource review meetings, public awareness communications, and attendance and participation in training sessions.

2. Continue monitoring zebra mussel infestation in Texoma Reservoir by making periodic observations of Portland Zebra Mussel Samplers (Portland University, School of Lakes and Rivers) located at three strategic points on the south shore of Texoma Reservoir.

3. Work with North Texas Municipal Water District to try and limit the spread of zebra mussels to other reservoirs and river systems.

4. Communicate to constituents.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule (Table 6) includes a modified (low pulse/low amp) electrofishing to assess the blue catfish population to include abundance and age and growth. Assessment utilizes 4 15-minute electrofishing samples with the catch recorded as n/h. Length, weight, and otoliths will be collected. Also included is annual gill netting at selected historical sites to monitor temperate basses. General monitoring surveys in 2012 – 2013 require electrofishing and trap netting, at randomly selected sites.

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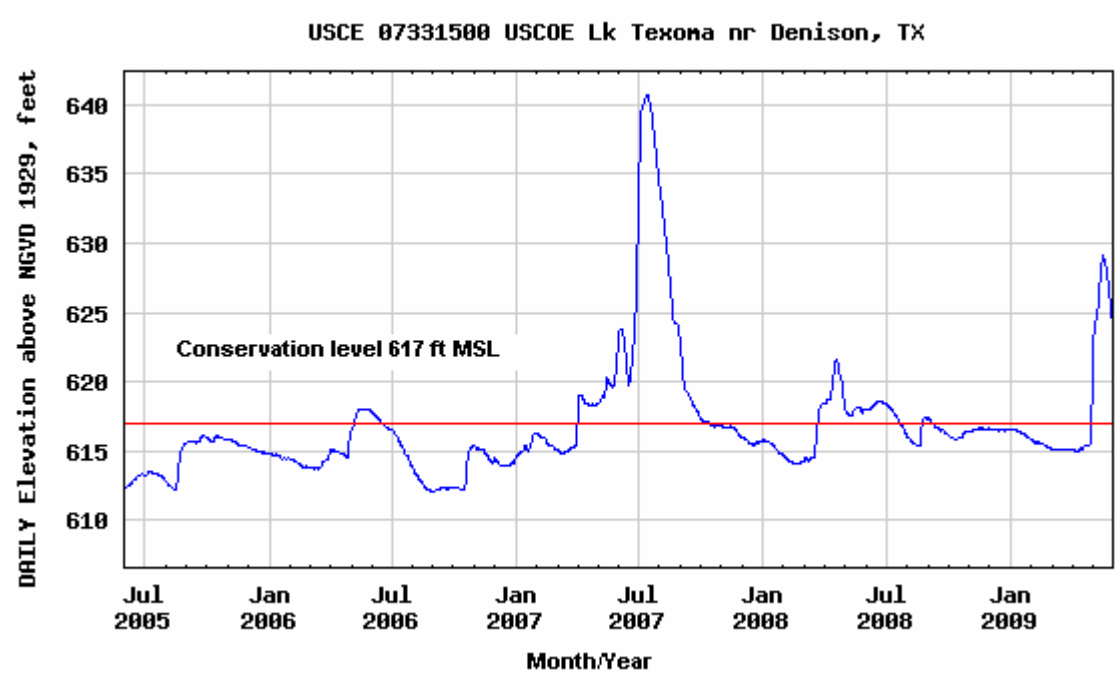

Figure 1. Daily water level elevations in feet above mean sea level (msl) recorded for Texoma Reservoir, Texas-Oklahoma, June 2005-May 2009.

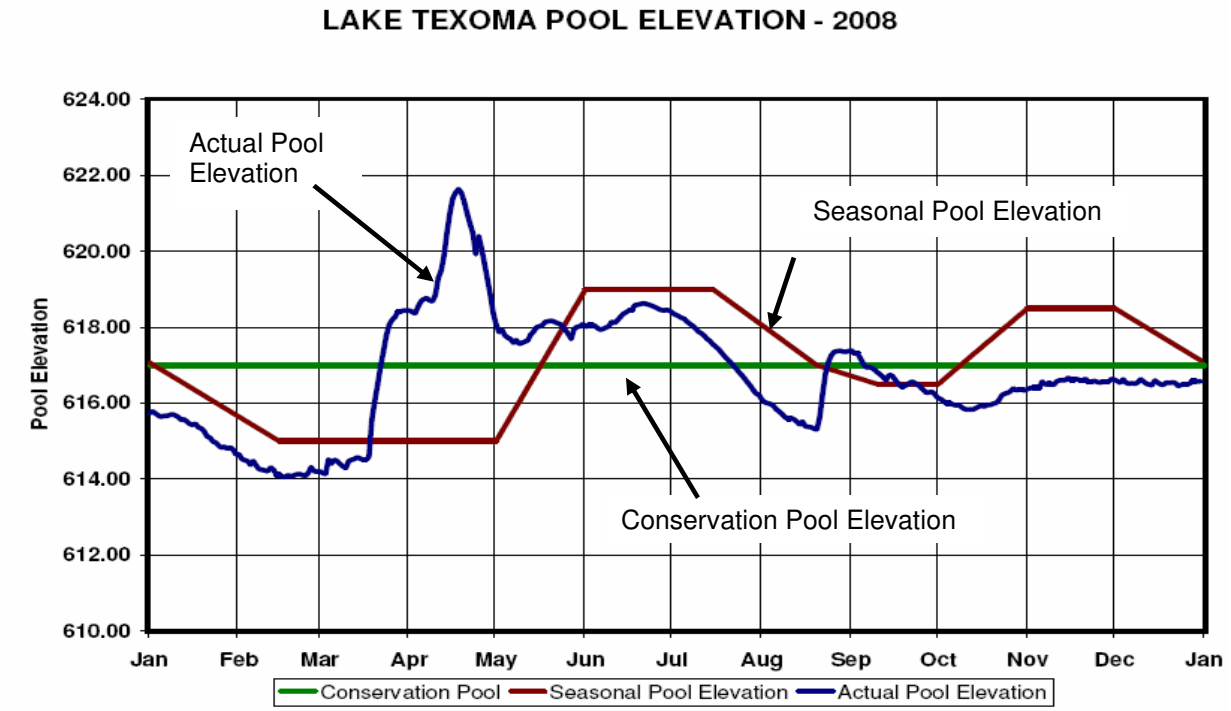

Figure 2. Example of the seasonal pool elevation management plan for Texoma Reservoir, Texas-Oklahoma, 2008.

Table 1. Characteristics of Texoma Reservoir, Texas-Oklahoma.

Characteristic	Description
Year constructed	1944
Controlling authority	U.S. Army Corps of Engineers
Counties	Grayson and Cooke, Texas; Bryan, Marshall, and Love, Oklahoma
Reservoir type	Mainstream
Shoreline development index	13.9
Conductivity	1890 µmhos/cm

Table 2. Harvest regulations for Texoma Reservoir, Texas-Oklahoma.

Species	Bag Limit	Length Limit (inches)
Catfish: channel and blue catfish, their hybrids and subspecies	15 (in any combination)	12 minimum
Catfish, flathead	5	20 minimum
Bass, white	25	No limit
Bass, striped: its hybrids and subspecies	10 (in any combination)	No limit, only two fish 20 inches or greater may be retained each day
Bass, spotted	5 (in any combination)	No limit
Bass, largemouth and smallmouth		14 minimum
Crappie: white and black crappie, their hybrids and subspecies	37 (in any combination)	10 minimum
Walleye	5	18 minimum

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Table 3. Stocking history of Texoma Reservoir, Texas. Life stages are fry (FRY), fingerlings (FGL), advanced fingerlings (AFGL), sub-adults (SADL), and adults (ADL). 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	Number	Life Stage	Mean TL (in)
Bluegill	1945	22,400	AFGL	2.0
	1948	15,500	AFGL	2.0
	1949	18,000	AFGL	2.0
	1951	4,000	AFGL	2.0
	1979	20,400	AFGL	2.0
	Total	80,300		
Channel catfish	1944	67,000	FGL	2.0
	1945	104,500	FGL	2.0
	1946	43,000	FGL	2.0
	1947	18,000	FGL	2.0
	1948	6,000	FGL	2.0
	1949	9,000	FGL	2.0
	1974	30,000	FGL	2.0
	1979	12,200	FGL	2.0
	2002	67,000	FGL	2.0
	Total	356,700		
Coppernose bluegill	1944	2,400	AFGL	2.0
	Total	2,400		
Florida Largemouth bass	1975	200,000	FGL	2.0
	1975	112,000	FRY	1.0
	1976	25,000	FGL	2.0
	1977	23,748	FGL	2.0
	1977	200,000	FRY	1.0
	1986	231,850	FGL	2.0
	1997	109,950	FGL	1.3
	1998	110,500	FGL	1.2
	1999	327,191	FGL	1.4
	2000	324,444	FGL	1.2
	Total	1,664,683		
Kemp's Largemouth bass	1975	80,000	FGL	2.0
	Total	80,000		
Largemouth bass	1944	225,000	FGL	2.0
	1945	61,000	FGL	2.0
	1946	7,000	FGL	2.0
	1947	14,500	FGL	2.0
	1948	28,000	FGL	2.0

Species	Year	Number	Life Stage	Mean TL (in)
	1949	34,000	FGL	2.0
	1949	425,000	FRY	0.7
	1951	34,000	FGL	2.0
	1953	142,000	FGL	2.0
	1954	8,000	FGL	2.0
	1980	30,976	FGL	2.0
	Total	1,009,476		
Other sunfishes	1945	14,000	FGL	2.0
	Total	14,000		
Paddlefish	1999	5,757	SADL	14.3
	2000	20,846	SADL	12.2
	2001	770	SADL	12.0
	2002	16,792	SADL	12.0
	2003	4,421	SADL	12.0
	2004	26,330	SADL	12.0
	2005	30,478	SADL	12.0
	2006	10,920	SADL	12.0
	2007	2,029	SADL	18.0
	Total	118,343		
Redear sunfish	1944	18,000	FGL	2.0
	1945	220,500	FGL	2.0
	1946	116,000	FGL	2.0
	1947	16,000	FGL	2.0
	1948	82,500	FGL	2.0
	1949	87,000	FGL	2.0
	1951	4,000	FGL	2.0
	Total	544,000		
Rock bass	1945	21,000	FGL	2.0
	1947	4,000	FGL	2.0
	Total	25,000		
Smallmouth bass	1981	576,655	FGL	1.5
	1982	452,372	FGL	1.3
	1983	48,104	FGL	2.0
	1987	6,800	FGL	2.0
	Total	1,083,931		
Striped bass	1965	138	FGL	2.0
	1967	200,000	FRY	0.8
	1968	5,000	FGL	2.0
	1969	284,614	FGL	2.0
	1970	77,640	FGL	2.0
	1971	96,839	FGL	2.0
	1972	208,340	FGL	2.0

Species	Year	Number	Life Stage	Mean TL (in)
	1973	141,612	FGL	2.0
	1974	548,898	FGL	2.0
	1977	1,600	FGL	2.0
	1984	490	FGL	2.0
	1985	500	FGL	2.0
	Total	1,565,671		
Threadfin shad	1979	31,181	AFGL	2.0
	1982	1,500	AFGL	2.0
	1984	19,176	AFGL	2.5
	1985	271,959	AFGL	2.0
	Total	323,816		
Walleye	1968	50,400	FGL	2.0
	1968	400	FRY	0.2
	1969	500,000	FGL	2.0
	1970	3,219,891	FRY	0.2
	1975	8,398,000	FRY	0.2
	1976	98,000	FGL	2.0
	1976	180,000	FRY	0.2
	1977	2,261,000	FRY	0.2
	Total	14,707,691		
Warmouth	1947	4,000	FGL	2.0
	Total	4,000		
White crappie	1945	3,000	FGL	2.0
	1946	28,000	FGL	2.0
	1948	11,100	FGL	2.0
	1953	12,000	FGL	2.0
	Total	54,100		

Table 4. Survey of littoral zone and physical habitat types, Texoma Reservoir, Texas, 2004. 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
Riprap	12.2	2.1		
Rocky shore	131.5	22.7		
Boulders	37.5	6.4		
Bulkhead	0.4	<0.1		
Native emergent	30.5	<0.1	80	<0.1
Boat docks	27	<0.1	490	<0.1
Dead trees	6.2	<0.1	15	<0.1

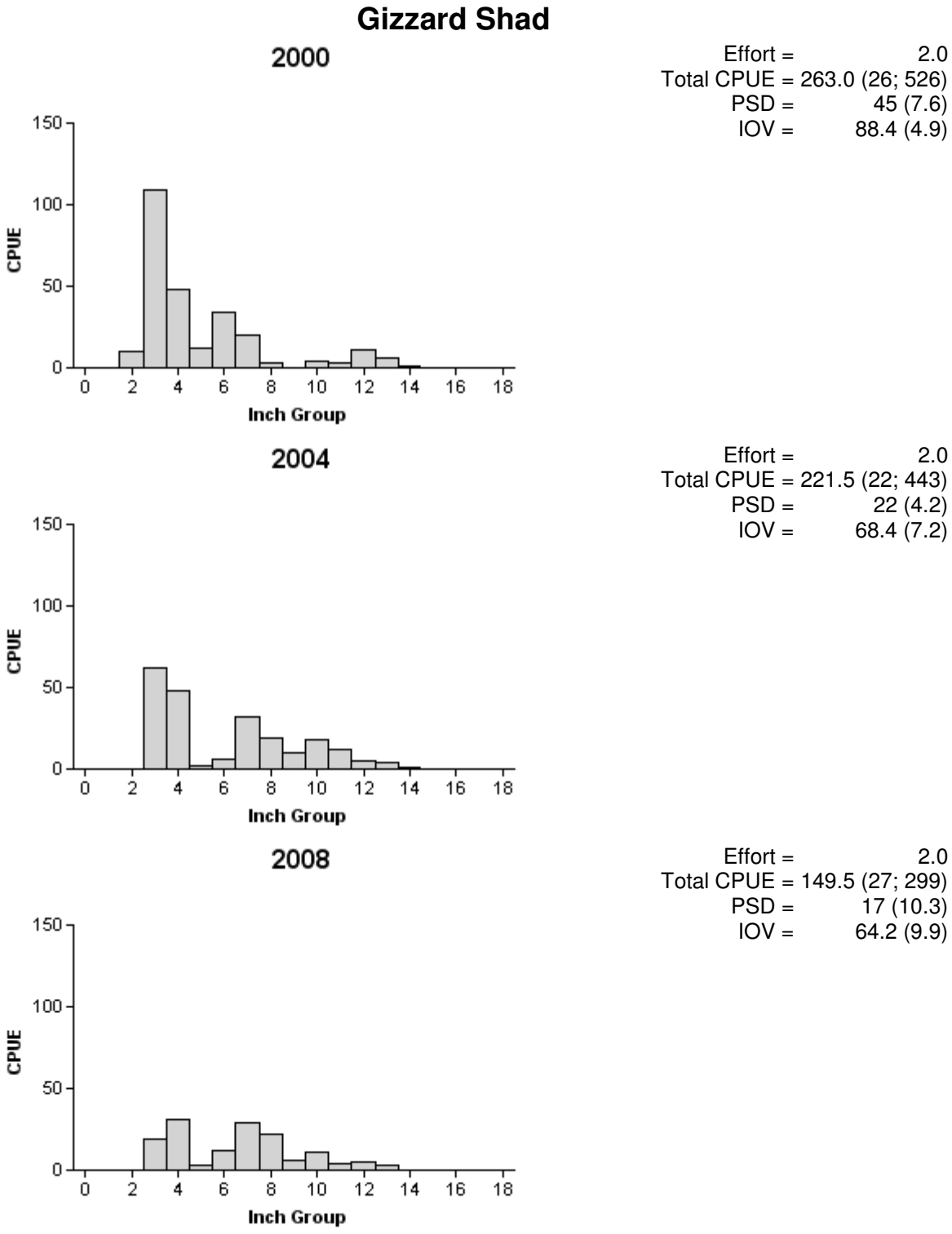


Figure 3. Number of gizzard shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Texoma Reservoir, Texas-Oklahoma, 2000, 2004, and 2008.

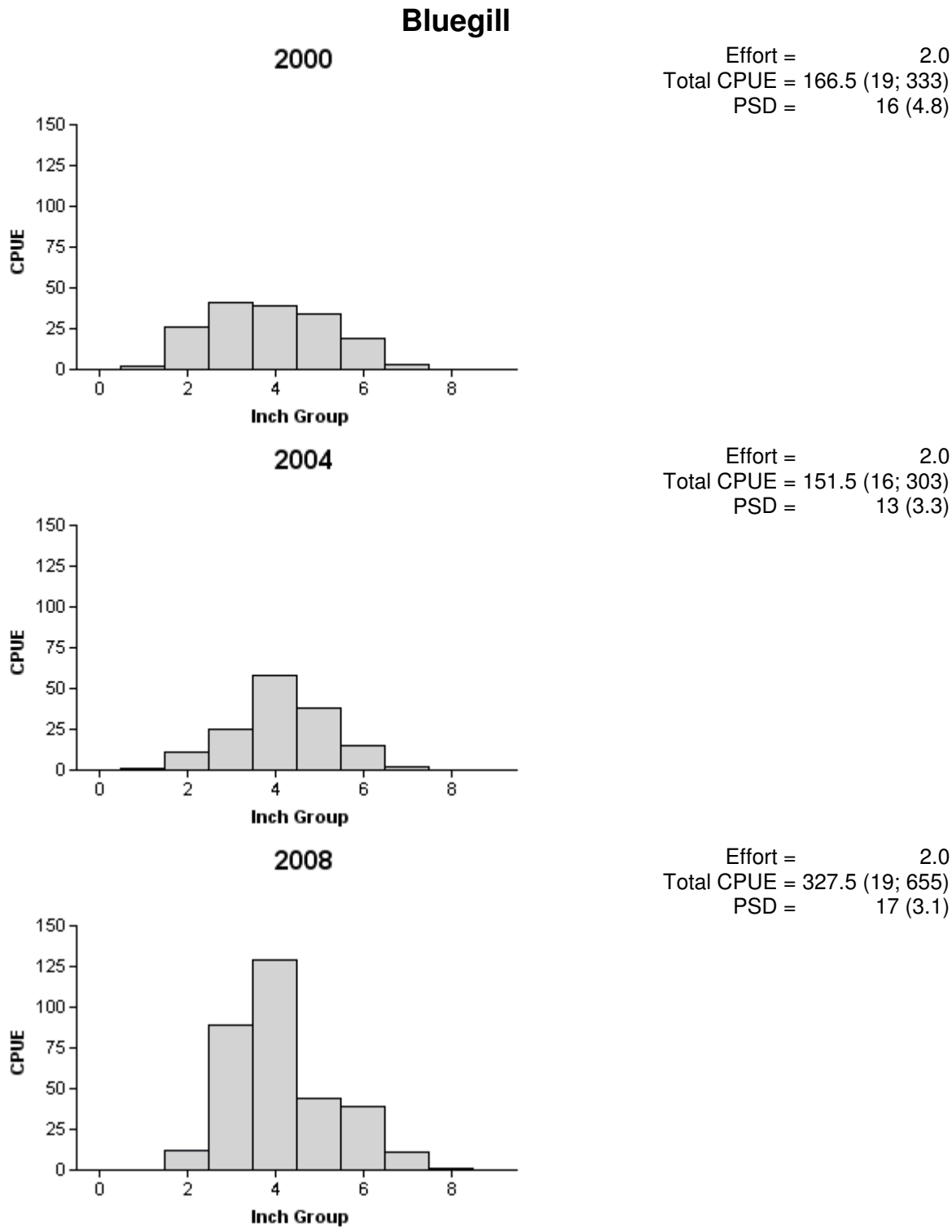


Figure 4. Number of bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Texoma Reservoir, Texas-Oklahoma, 2000, 2004, and 2008.

Blue Catfish

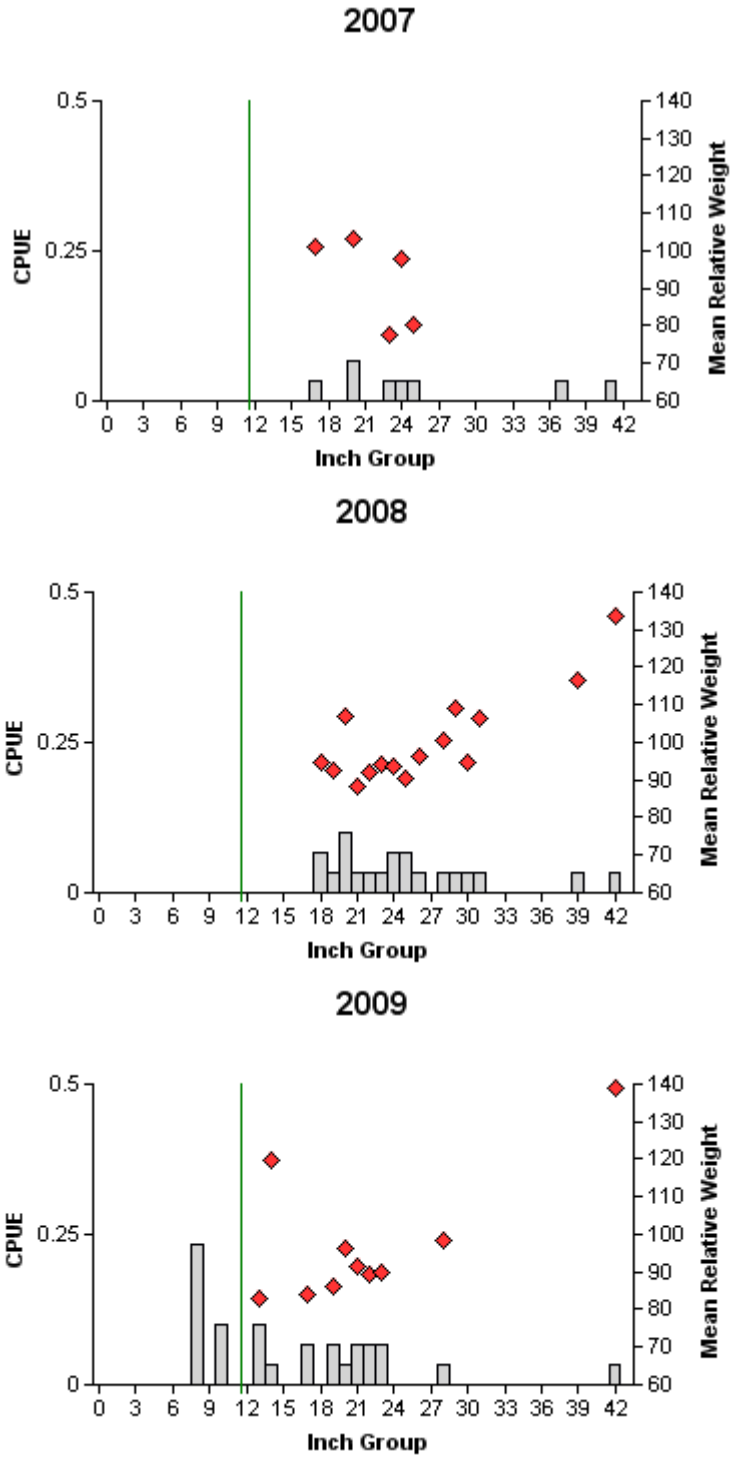


Figure 5. Number of blue catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Texoma Reservoir, Texas-Oklahoma, 2007, 2008, and 2009. Vertical lines represent length limit at time of collection.

Channel Catfish

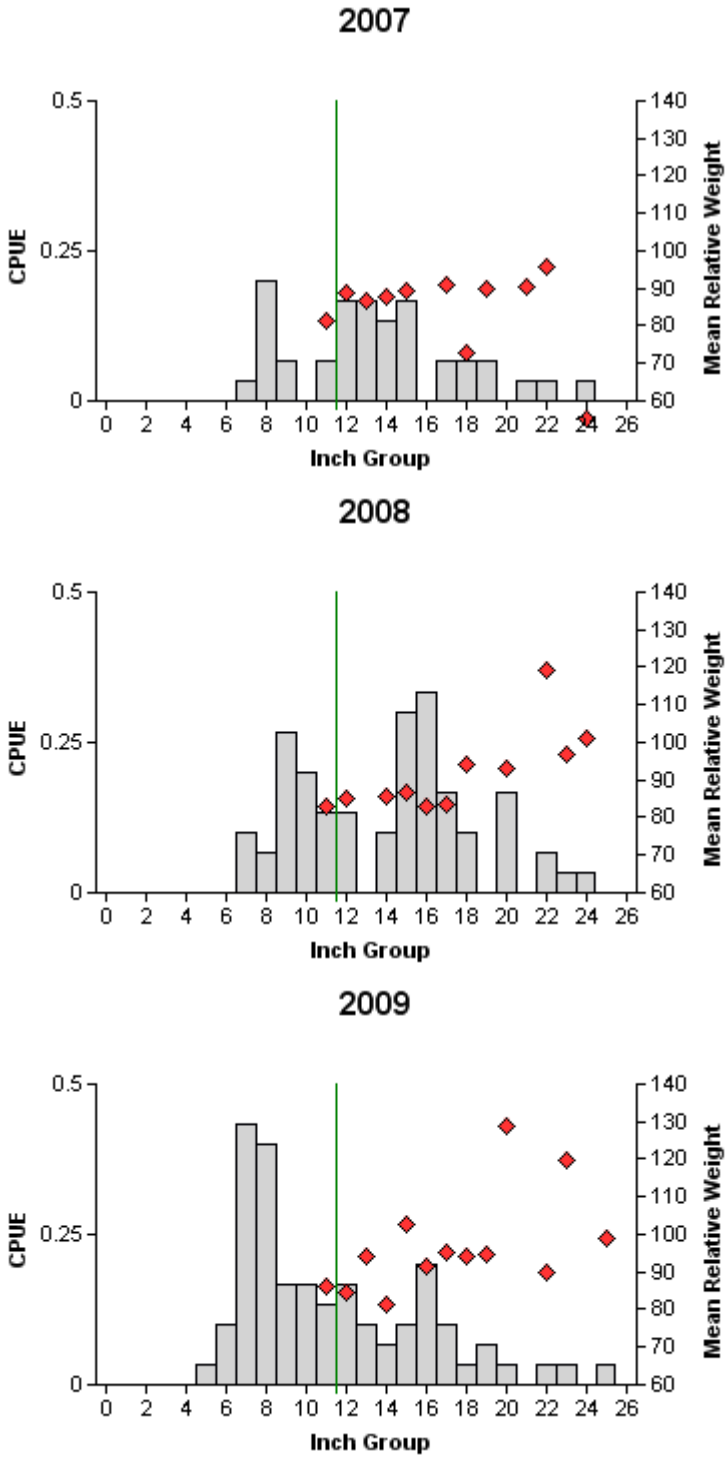
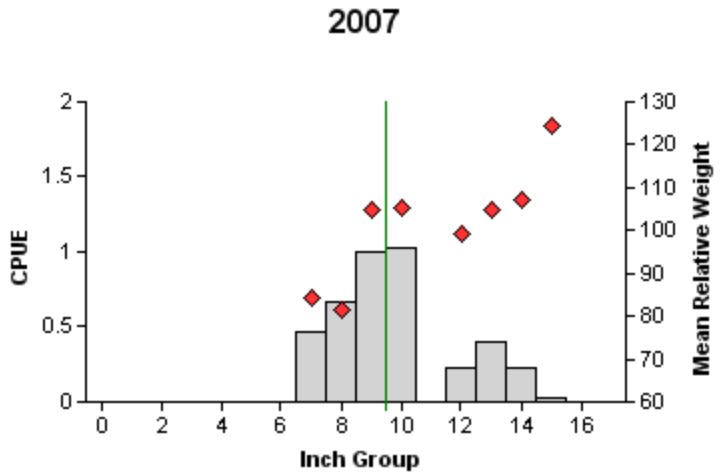
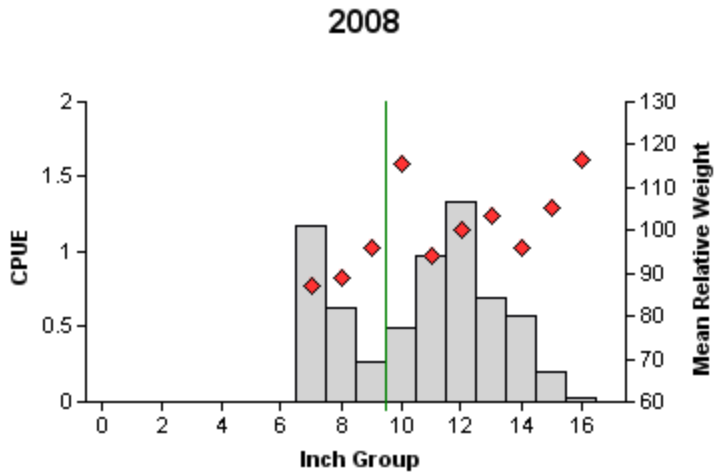


Figure 6. Number of channel catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Texoma Reservoir, Texas-Oklahoma, 2007, 2008, and 2009. Vertical lines represent length limit at time of collection.

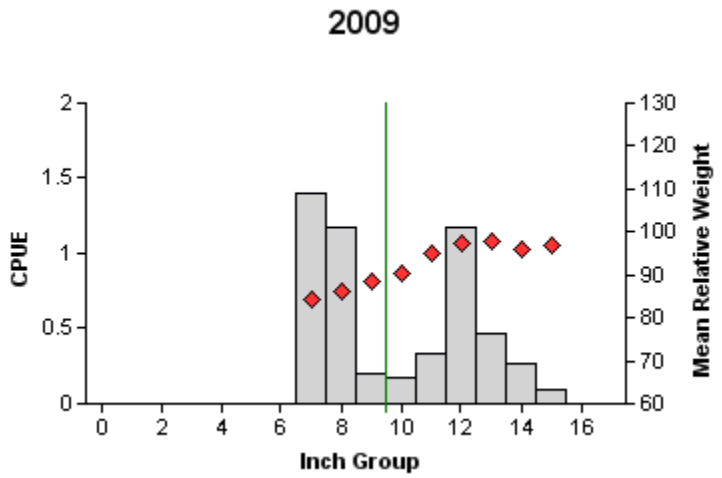
White Bass



Effort = 30.0
Total CPUE = 4.1 (21; 122)
Stock CPUE = 4.1 (21; 122)
PSD = 72 (4.4)



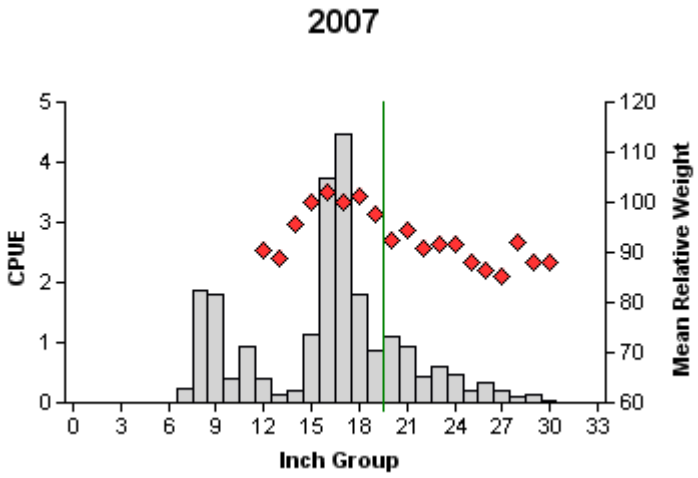
Effort = 30.0
Total CPUE = 6.4 (29; 191)
Stock CPUE = 6.4 (29; 191)
PSD = 72 (3.7)



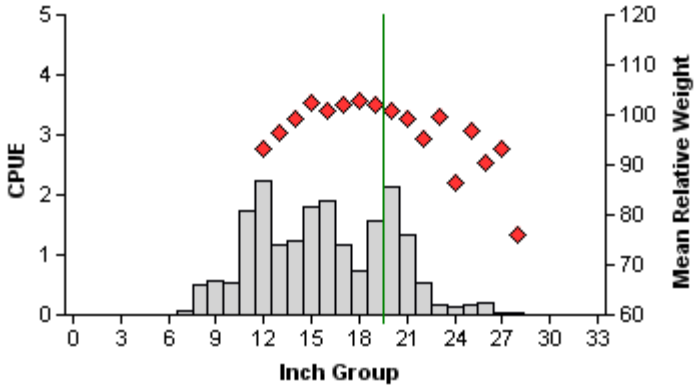
Effort = 30.0
Total CPUE = 5.3 (21; 158)
Stock CPUE = 5.3 (21; 158)
PSD = 51 (6)

Figure 7. 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 net surveys, Texoma Reservoir, Texas-Oklahoma, 2007, 2008, and 2009. Vertical lines represent length limit at time of collection.

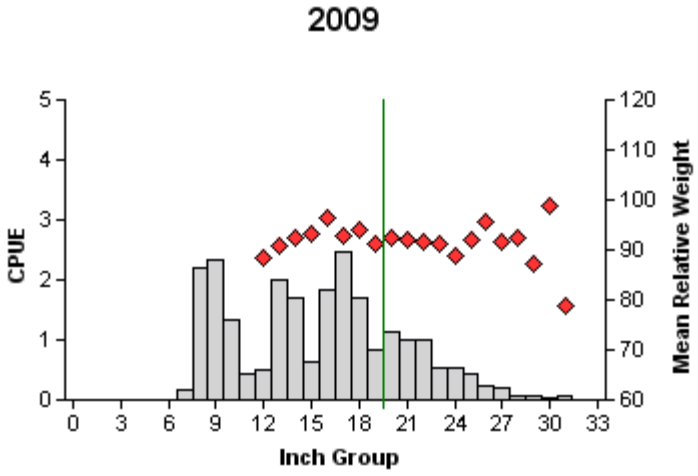
Striped Bass



Effort = 30.0
Total CPUE = 22.5 (10; 675)
Stock CPUE = 17.3 (10; 518)
PSD = 26 (3.4)



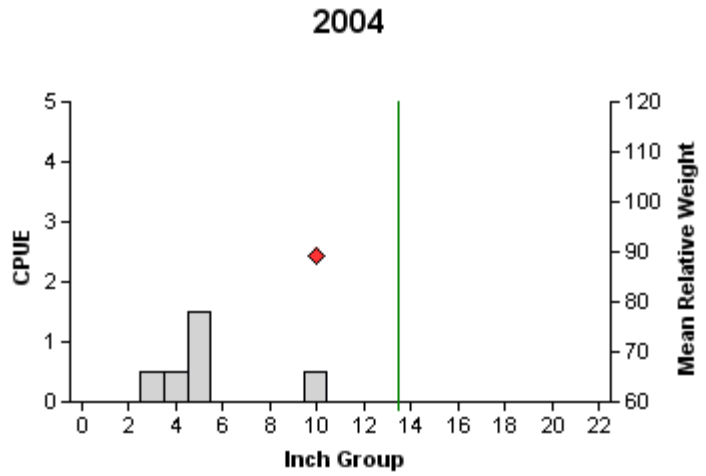
Effort = 30.0
Total CPUE = 19.9 (15; 598)
Stock CPUE = 16.5 (13; 496)
PSD = 29 (3.5)



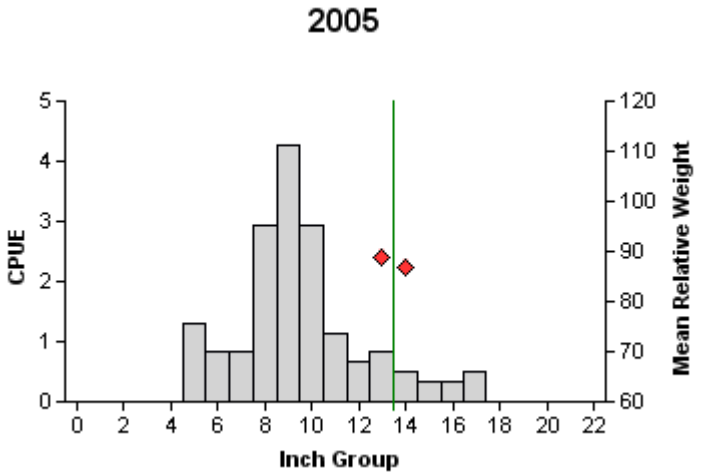
Effort = 30.0
Total CPUE = 23.4 (11; 703)
Stock CPUE = 17.0 (11; 509)
PSD = 31 (3)

Figure 8. Number of striped 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 net surveys, Texoma Reservoir, Texas-Oklahoma, 2007, 2008, and 2009. Vertical lines represent length above which only 2 fish can be retained in the daily bag of 10 fish.

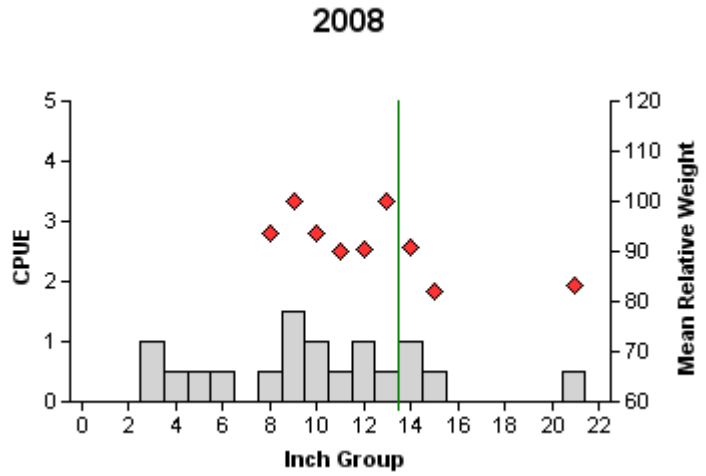
Smallmouth Bass



Effort = 2.0
Total CPUE = 3.0 (50; 6)
Stock CPUE = 0.5 (100; 1)
PSD = 0 (323)



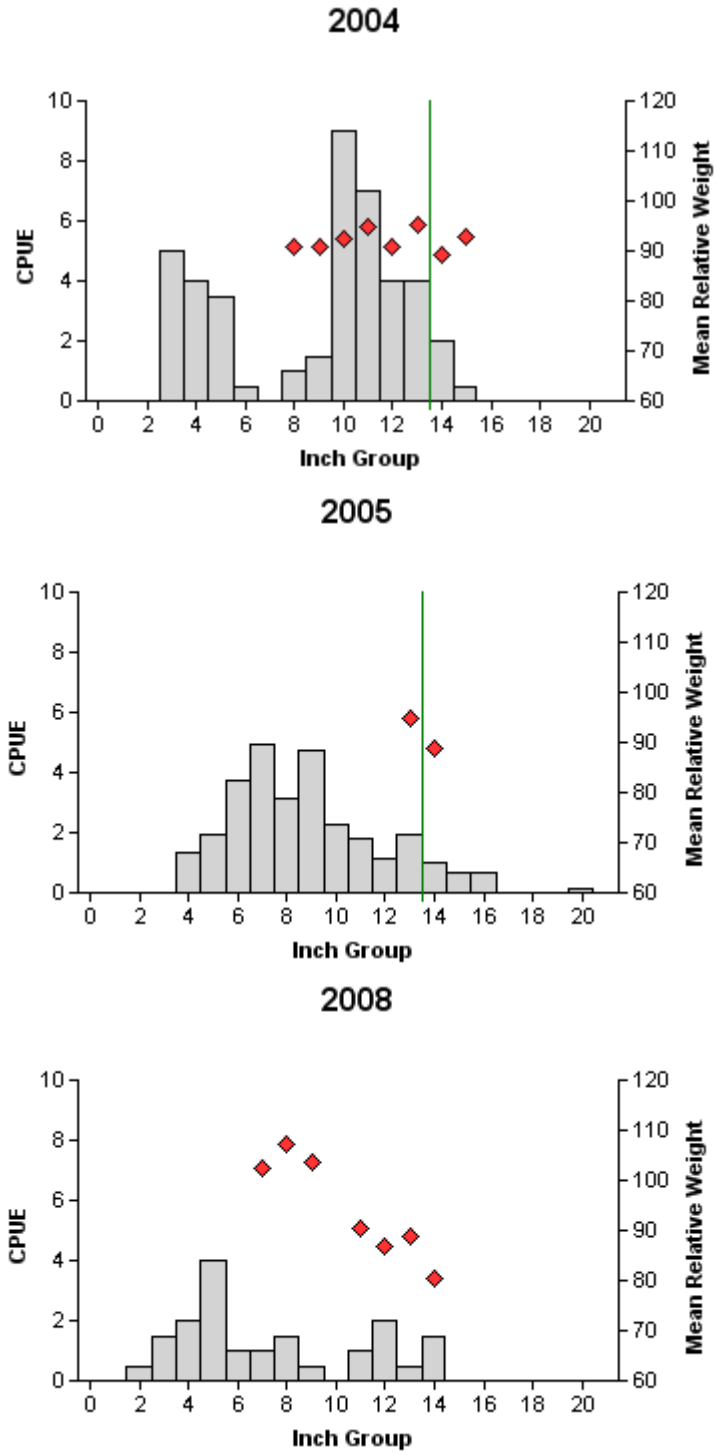
Effort = 6.1
Total CPUE = 17.3 (31; 106)
Stock CPUE = 15.2 (30; 93)
PSD = 28 (5.9)



Effort = 2.0
Total CPUE = 9.5 (40; 19)
Stock CPUE = 7.0 (42; 14)
PSD = 57 (11.7)

Figure 9. Number of smallmouth 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, Texoma Reservoir, Texas-Oklahoma, 2004, 2005, and 2008. Sampling in 2005 was combined daytime/nighttime at subjective stations. Vertical lines represent length limit at time of collection.

Spotted Bass



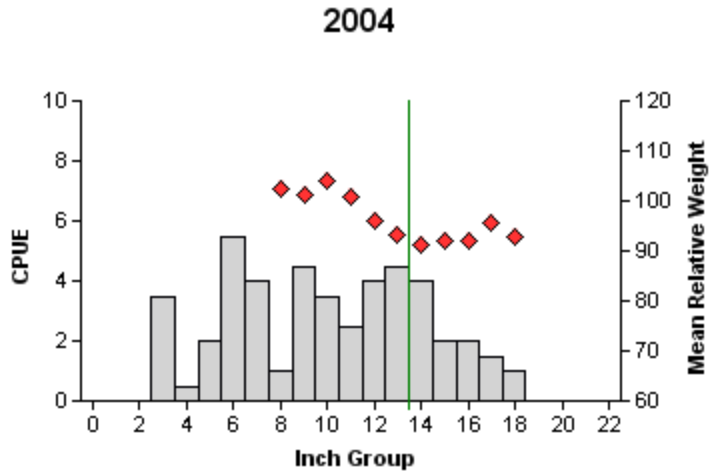
2004
Effort = 2.0
Total CPUE = 42.0 (22; 84)
Stock CPUE = 29.0 (31; 58)
PSD = 60 (7.2)

2005
Effort = 6.1
Total CPUE = 29.4 (22; 180)
Stock CPUE = 22.4 (24; 137)
PSD = 33 (5.0)

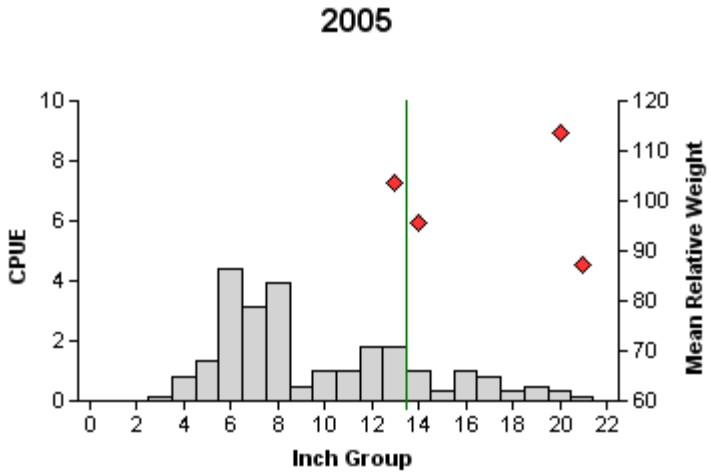
2008
Effort = 2.0
Total CPUE = 17.0 (28; 34)
Stock CPUE = 8.0 (39; 16)
PSD = 62 (13.1)

Figure 10. Number of spotted 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, Texoma Reservoir, Texas-Oklahoma, 2004, 2005, and 2006. Sampling in 2005 was combined daytime/nighttime at subjective stations. Vertical lines represent length limit at time of collection.

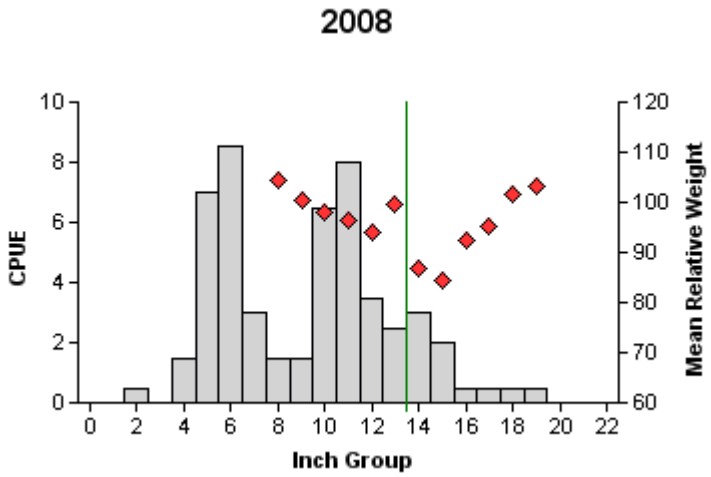
Largemouth Bass



Effort = 2.0
Total CPUE = 46.0 (22; 92)
Stock CPUE = 30.5 (27; 61)
PSD = 62 (7.2)



Effort = 6.1
Total CPUE = 24.2 (27; 148)
Stock CPUE = 14.4 (24; 88)
PSD = 56 (3.5)



Effort = 2.0
Total CPUE = 51.0 (27; 102)
Stock CPUE = 30.5 (25; 61)
PSD = 43 (7.2)

Figure 11. 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, Texoma Reservoir, Texas-Oklahoma, 2004, 2005, and 2008. Sampling in 2005 was combined daytime/nighttime at subjective stations. Vertical lines represent length limit at time of collection

Table 5. Results of allozyme analysis of largemouth bass collected by fall electrofishing, Texoma Reservoir, Texas-Oklahoma, 1988, 1995, 1998, 1999, 2000, 2002, 2003, and 2004. Results of genetic analysis of largemouth bass collected by fall electrofishing, 2008. FLMB = Florida largemouth bass, NLMB = Northern largemouth bass, Hybrids = cross between a FLMB and a NLMB.

		Genotype				
Year	Sample size	FLMB	Hybrids	NLMB	% FLMB alleles	% pure FLMB
1988	70	0	12	58	5.0	0.0
1995	40	0	1	39	1.2	0.0
1998	30	3	9	18	20.0	10.0
1999	22 (age 1)	4	4	14	26.1	18.2
1999	32	3	8	21	20.0	9.4
2000	74	11	25	38	30.3	14.9
2002	61	0	12	49	7.7	0.0
2003	89	4	39	46	20.7	4.5
2004	89	0	41	48	17.6	0.0
2008	30	0	26	4	20.0	0.0

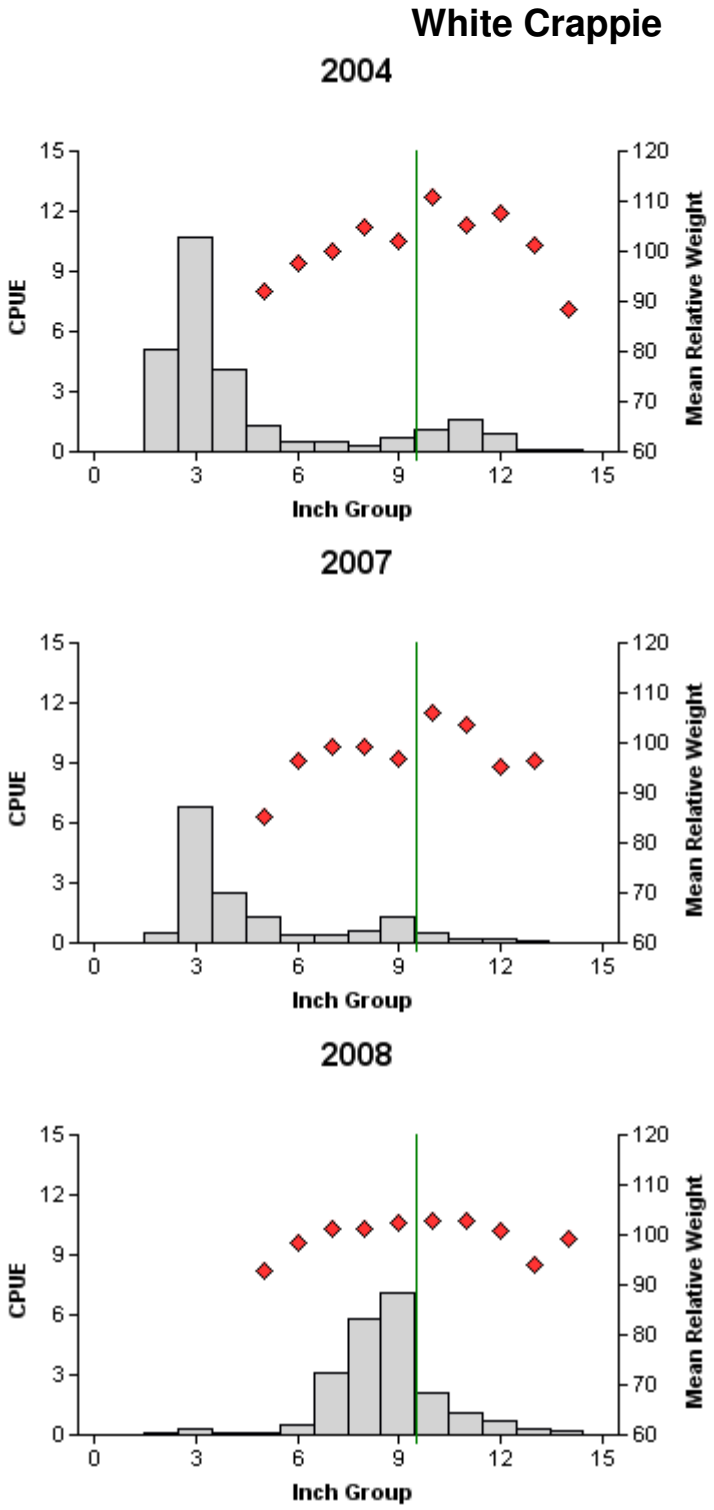


Figure 12. Number of white crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Texoma Reservoir, Texas-Oklahoma, 2004, 2007, and 2008. Vertical lines represent length limit at time of collection.

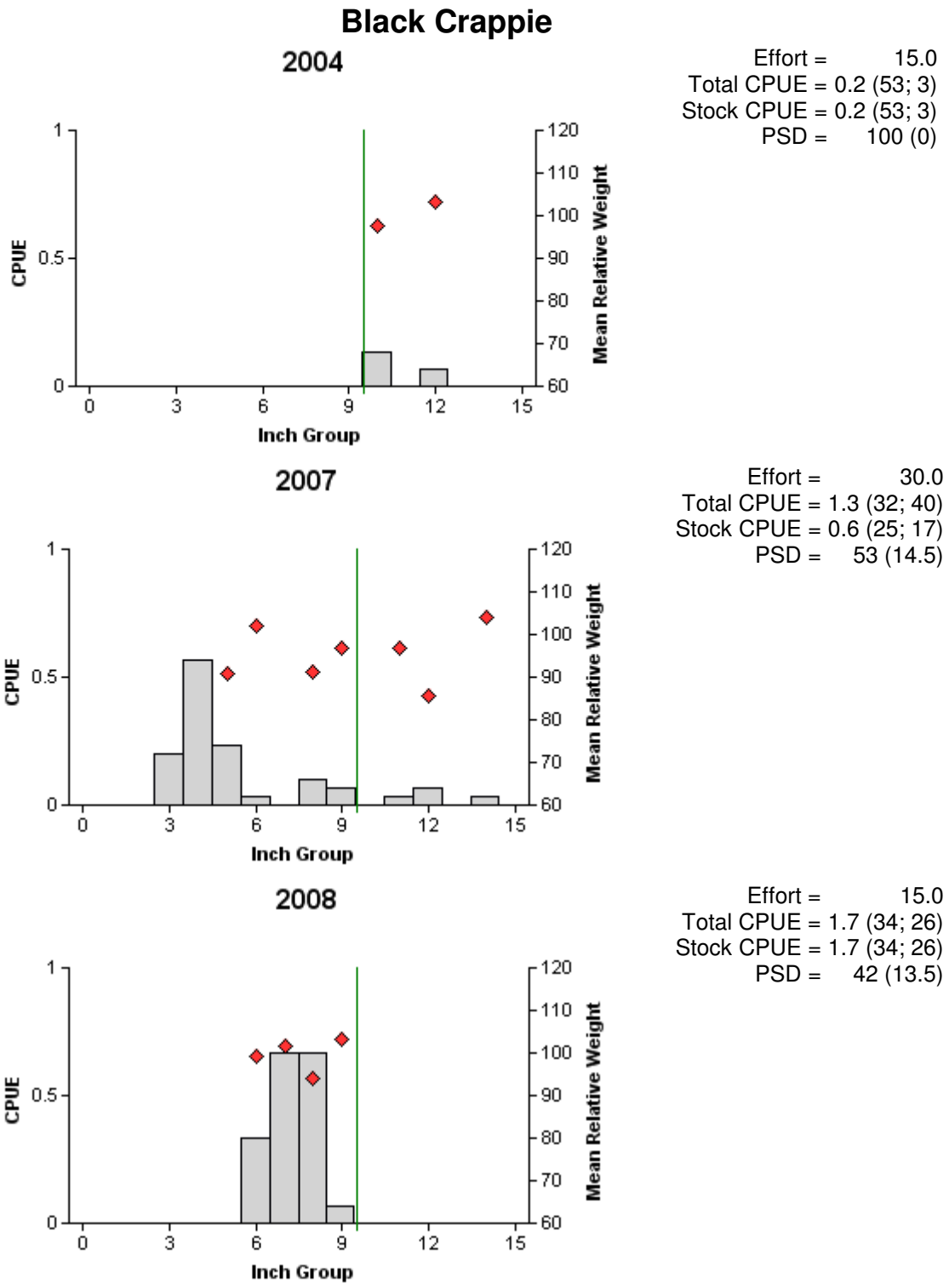


Figure 13. Number of black crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Texoma Reservoir, Texas-Oklahoma, 2004, 2007, and 2008. Vertical lines represent length limit at time of collection.

Table 6. Proposed sampling schedule for Texoma Reservoir, Texas-Oklahoma. 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.

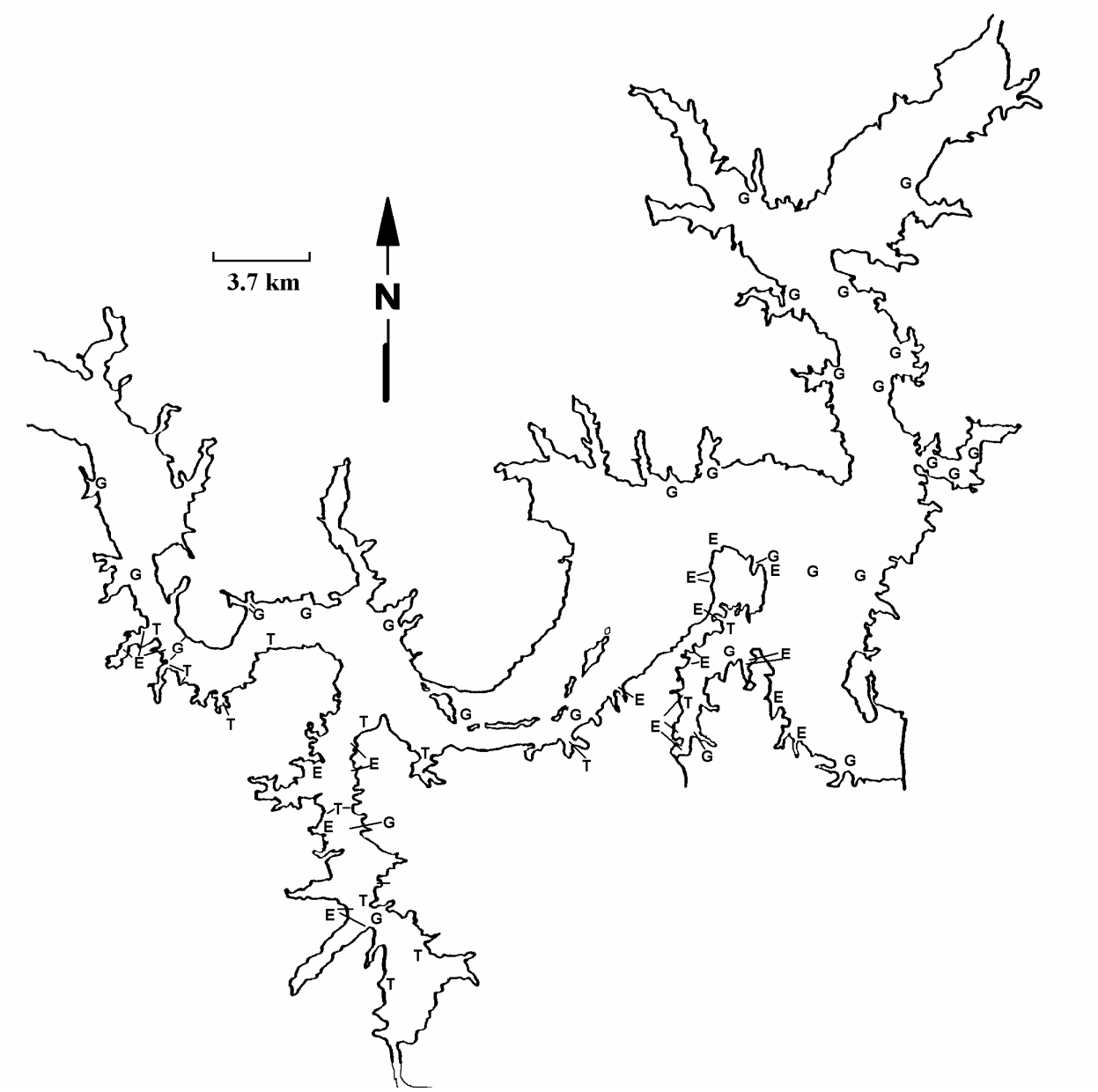
Survey Year	Electrofisher	Trap Net	Gill Net	Creel Survey	Report
Fall 2009-Spring 2010	A		A		
Fall 2010-Spring 2011	A		A		
Fall 2011-Spring 2012	A		A		
Fall 2012-Spring 2013	S	S	S		S

Appendix A

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Texoma Reservoir, Texas-Oklahoma, 2008-2009.

	Gill Netting		Trap Netting		Electrofishing	
Species	N	CPUE	N	CPUE	N	CPUE
Gizzard shad					299	149.5
Threadfin shad					112	56.0
Blue catfish	27	0.9				
Channel catfish	72	2.4				
Flathead catfish	1	0.1				
White bass	158	5.3				
Striped bass	703	23.4				
Green sunfish					49	24.5
Warmouth					11	5.5
Orangespotted sunfish					1	0.5
Bluegill					655	327.5
Longear sunfish					114	57.0
Redear sunfish					24	12.0
Smallmouth bass					19	9.5
Spotted bass					34	17.0
Largemouth bass					102	51.0
White crappie			322	21.5		
Black crappie			26	1.7		

Appendix B



Location of sampling sites, Texoma Reservoir, Texas-Oklahoma, 2008-2009. Electrofishing, gill netting, and trap netting stations are indicated by E, G, and T, respectively. Water level was at seasonal pool level for electrofishing, 0.5 feet above seasonal pool level during gill netting, and 1.5 feet below seasonal pool level for trap netting.

Appendix C

Catch rates (CPUE) of targeted species by gear type for Texoma Reservoir, Texas, 1993-1999

Gear	Species	Year						
		1993[a]	1994[a]	1995[b]	1996[b]	1997[b]	1998[b]	1999[b]
Gill Netting[c]	Blue catfish	1.3	0.3	1.0	1.3	0.1	0.3; 1.1	0.6; 1.6
Winter; Spring	Channel catfish	1.6	1.2	2.1	1.1	0.7	1.1; 1.3	1.8; 3.5
	Flathead catfish	<0.1	0.3	<0.1	0.0	<0.1	0.2; 0.3	<0.1; 0.1
	White bass	8.7	6.1	3.2	11.1	2.6	10.3; 1.3	2.2; 0.9
	Striped bass	16.1	19.0	11.0	12.5	17.7	19.3; 3.3	18.2; 3.1
	Palmetto bass	0.0	<0.1	0.0	0.0	0.0	0.0; 0.0	0.0; 0.0
Electrofishing[d]	Gizzard shad	215.5; 193.5	211.5; 152.0	134.0	161.5	191.0	204.0	228.0
Spring; Fall	Threadfin shad	103.0; 20.5	22.5; 6.0	121.0	3.5	5.5	11.0	28.0
	Green sunfish	10.0; 11.5	48.5; 21.5	13.5	4.0	0.0	17.5	23.0
	Warmouth	1.5; 10.5	10.5; 6.0	3.0	1.0	0.5	1.0	2.5
	Bluegill sunfish	181.5; 259.0	261.0; 295.5	315.0	110.0	127.5	92.5	209.0
	Longear sunfish	17.0; 38.5	26.5; 44.0	28.5	24.5	35.5	8.5	57.0
	Redear sunfish	7.5; 12.5	4.0; 8.0	5.5	7.5	9.0	0.5	1.0
	Smallmouth bass	22.0; 31.5	27.0; 33.5	27.0	9.0	2.5	9.5	8.0
	Spotted bass	21.0; 41.0	25.5; 53.0	42.5	21.5	19.5	21.0	23.0
	Largemouth bass	72.5; 116.0	76.5; 96.5	155.5	40.5	65.0	37.5	65.5
Trap Netting	White crappie	7.3	5.8	10.1	1.6	1.0	1.3	2.7
	Black crappie	0.2	0.0	0.2	0.0	0.3	0.0	0.1

[a]Electrofishing, gill netting, and trap netting sampling sites were subjectively selected.
[b]Electrofishing and trap netting sampling sites were randomly selected, and gill netting sampling sites were subjectively selected.
[c]Gill netting in 1998 and 1999 was conducted in winter and spring. Gill netting in all other years was conducted in winter.
[d]Electrofishing in 1993 and 1994 was conducted in spring and fall. Electrofishing in all other years was conducted in fall.

Appendix C (continued)

Catch rates (CPUE) of targeted species by gear type for Texoma Reservoir, Texas, 2000-2009.

		Year									
Gear	Species	2000	2001	2002	2003	2004	2005[f]	2006	2007	2008	2009
Gill Netting[e]	Blue catfish	0.3	0.8; 0.1	0.4	0.2	0.3	0.2; 0.8	0.5	0.3	0.7	0.9
Winter; Spring	Channel catfish	0.8	2.2;1.7	1.6	2.0	1.8	1.6; 1.1	1.9	1.3	2.2	2.4
	Flathead catfish		0.2		0.1	0.1	0.0; 0.2			0.1	0.1
	White bass	6.7	2.4;0.9	1.9	5.0	0.9	4.5; 0.1	2.6	4.1	6.4	5.3
	Striped bass	18.9	24.9;10.7	19.3	21.7	24.4	22.3; 9.3	25.2	22.5	19.9	23.4
	Palmetto bass		0.1								
Electrofishing	Gizzard shad	245.5				221.5				149.5	
	Threadfin shad	57.5				37.0				56.0	
	Green sunfish	25.0				17.5				24.5	
	Warmouth	5.0				2.5				5.5	
	Bluegill sunfish	166.5				151.5				327.5	
	Longear sunfish	57.5				41.5				57.0	
	Redear sunfish	2.0				7.5				12.0	
	Smallmouth bass	4.5				3.0	17.3			9.5	
	Spotted bass	36.5				42.0	29.4			17.0	
	Largemouth bass	38.5				46.0	24.2			51.0	
Trap Netting	White crappie	1.8	3.9	5.5	5.5	27.1			14.7	21.5	
	Black crappie	0.2	0.0	0.0	0.2	0.2			1.3	1.7	

[e]Gill netting in 2001 and 2005 was conducted in winter and spring. Gill netting in all other years was conducted in winter.
[f]Combined daytime and nighttime electrofishing at subjectively selected sites.

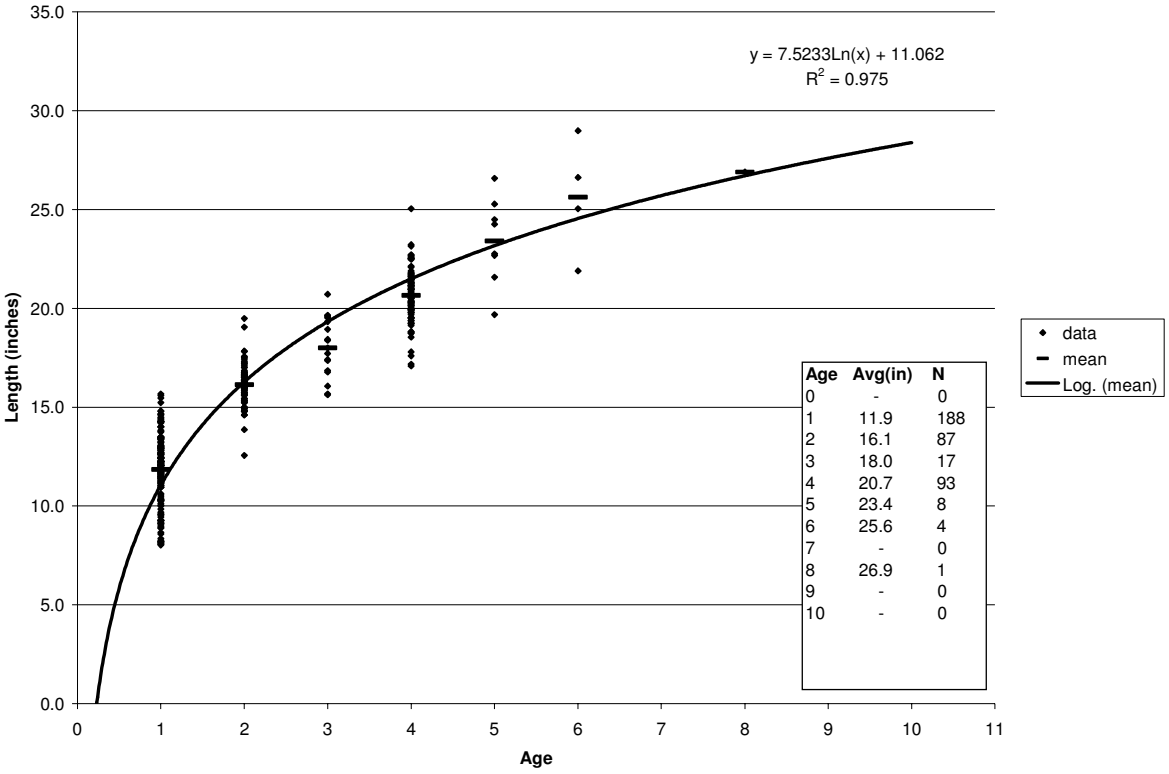
Appendix D

Age and average length at capture for blue catfish (sexes combined) collected by low –pulse electrofishing, Texoma Reservoir, Texas-Oklahoma, 2003. Otoliths were used for aging. Sample sizes are in parentheses (Mauck and Boxrucker 2004).

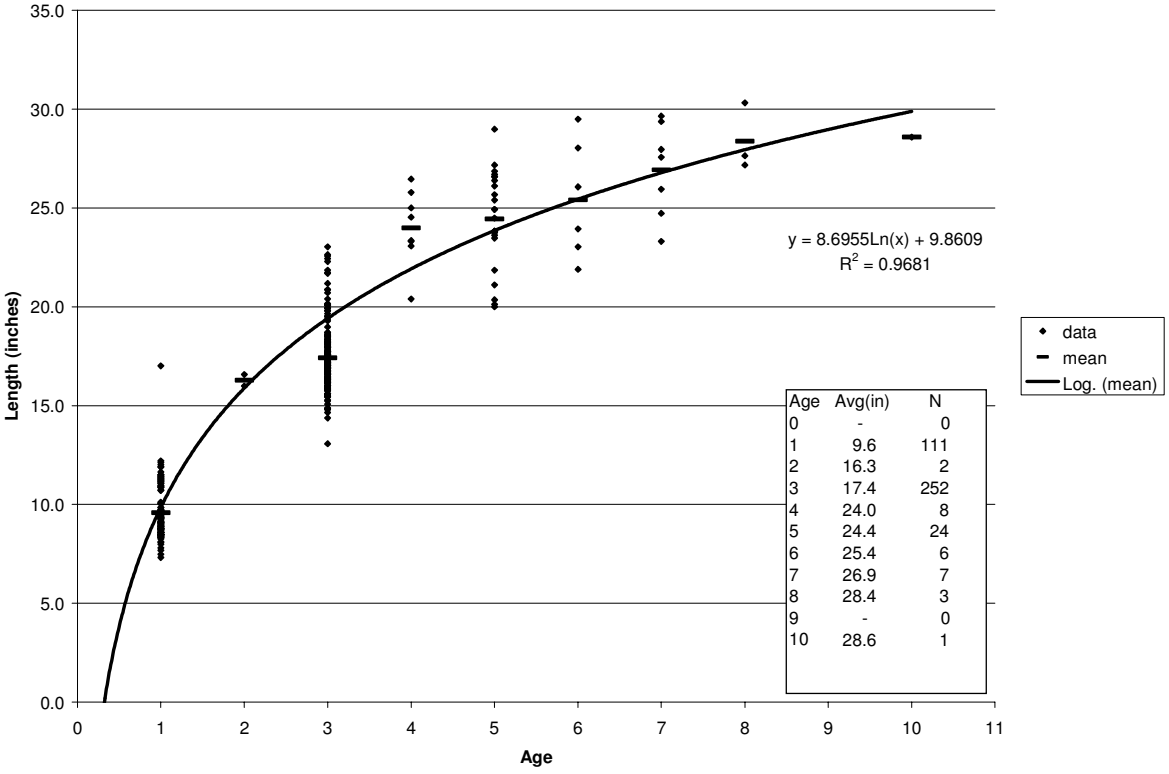
	Length (inches) at capture for age															
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2003	6.8	10.0	12.4	14.6	15.8	17.3	18.1	19.5	21.1	23.0	22.6	26.7			31.7	36.7
	(30)	(21)	(23)	(42)	(32)	(35)	(19)	(47)	(26)	(17)	(18)	(11)			(3)	(4)

Appendix E

Length-at-age for striped bass collected from gill netting at Texoma Reservoir, Texas-Oklahoma, February 2008. Collected by Oklahoma Department of Wildlife Conservation, unpublished data.



Length-at-age for striped bass collected from gill netting at Texoma Reservoir, Texas-Oklahoma, February 2007. Collected by Oklahoma Department of Wildlife Conservation, unpublished data.



Appendix F

Cell counts (cells/ml) for golden alga samples collected from Texoma reservoir, Texas-Oklahoma, 2008 and 2009. Counting method is by hemocytometer with a minimum of 6 independent samples. Samples were collected and analyzed by the University of Oklahoma Biological Station.

	Littoral Stations								Pelagic stations				
Date	Wilson Creek	Lebanon Pool	Brier Creek	Keeton Creek	Buncombe Creek	Soldier Creek	Catfish Bay	Johnson Creek	Red River	Buncombe Creek	Islands	Denison Dam	Washita-RR bridge
30-Sep-08	0	333	333	0	0	0	0	0					
29-Oct-08	8,667	2,333	667	333	333	0	0	0					
17-Nov-08	0	3,000	2,333	333	0	0	0	0					
18-Nov-08									1,333	2,865	0	0	0
8-Dec-08		3,333											
15-Dec-08	333	7,333	2,333	333	333	0	0	0					
18-Dec-08									0	0	0	0	0
22-Dec-08		22,000											
2-Jan-09	3,000	41,667	20,333	0	1,000	0	0	0					
8-Jan-09		60,000											
12-Jan-09									6,000	3,000	666	0	0
13-Jan-09	2,333	74,250	9,000	1,667	333	0	0	0					
19-Jan-09		82,500											
26-Jan-09	5,333	93,000	28,667	4,667	667	0	0	333					
2-Feb-09		120,667											
4-Feb-09		115,000											
6-Feb-09		123,666											
10-Feb-09	2,333	137,667	19,667	2,000	1,000	0	0	0					
13-Feb-09		158,000											
16-Feb-09		169,000											
19-Feb-09		149,333											
23-Feb-09	4,000	161,667	33,000	667	0	0	0	0					
25-Feb-09									5000	667	0	0	0
2-Mar-09		141,885											
3-Mar-09		148,667											
6-Mar-09		163,000											
9-Mar-09	1,333	155,000	24,000	2,333	2,000	0	0	0					
11-Mar-09		155,000											
16-Mar-09		127,333											

Appendix F (continued)

Cell counts (cells/ml) for golden alga samples collected from Texoma reservoir, Texas-Oklahoma, 2008 and 2009. Counting method is by hemocytometer with a minimum of 6 independent samples. Samples were collected and analyzed by the University of Oklahoma Biological Station.

	Littoral Stations								Pelagic stations				
Date	Wilson Creek	Lebanon Pool	Brier Creek	Keeton Creek	Buncombe Creek	Soldier Creek	Catfish Bay	Johnson Creek	Red River	Buncombe Creek	Islands	Denison Dam	Washita-RR bridge
19-Mar-09		146,667											
24-Mar-09									5,333	0	667	0	0
25-Mar-09	333	198,000	22,000	1,000	667	0	0	0					
30-Mar-09		180,667											
6-Apr-09	5,667	135,333	36,333	3,667	333	0	0	0					
13-Apr-09		52,333											
16-Apr-09		65,000											
20-Apr-09	2,333	33,000	21,333	3,000	333	0	0	0					
21-Apr-09									9,000	0	0	0	0
27-Apr-09		13,000											

Appendix G

Zebra mussels Texoma Reservoir

Lone Zebra Mussel Found in Lake Texoma

AUSTIN—For the fifth time in four years, an alert citizen has assisted Texas Parks and Wildlife Department (TPWD) and the Oklahoma Department of Wildlife Conservation (ODWC) in their efforts to keep zebra mussels from invading Lake Texoma.

On April 3 Brent Taylor, an employee of a private landowner on the south shore of Lake Texoma, reported to TPWD Inland Fisheries biologist Bruce Hysmith that he had found a suspected zebra mussel on a boathouse communication line.

TPWD personnel confirmed the identification and inspected the boathouse but found no additional specimens.

In 2006 Tim Ray, an employee of a marina in Pottsboro, found zebra mussels on a boat that had been brought from Minnesota. In 2007 Tim Ray again found zebra mussels on a boat from the Ohio River. Both boats were decontaminated before being put into the water. In 2008 Marty Ulmer, an employee of a Denison marina found zebra mussels on a boat arriving from Sturgeon Bay Wisconsin. In 2009 Bobby Vaughn, an employee of another Denison marina fund zebra mussels on yet another boat from Wisconsin. Both boats were decontaminated prior to launching into Lake Texoma. These individuals stated that they were previously aware of the threat from zebra mussels and made a practice of watching out for them.

Hysmith immediately notified the local U.S. Army Corps of Engineers; the U.S. Fish and Wildlife Service at Tishomingo, Oklahoma; local game wardens and area marinas to be on the alert.

Zebra mussels are native to Asia and were first found in the United States in 1988. They have since spread to 24 states from Michigan to West Virginia to Oklahoma to California.

The aquatic invaders are about 5/8-inch long and usually have striped shells. They can live for several days out of water and can be dispersed overland by trailered boats, though their main method of spread is by free-floating larvae. Zebra mussels can multiply rapidly to the point of clogging water treatment plant intake pipes, fouling boat bottoms and possibly depleting food sources that fish and other aquatic species depend on.

The U.S. Geological Survey (USGS) nonindigeous aquatic species web site calls zebra mussels “one of the most important biological invasions into North America.” That site contains photographs and information that can be used to identify the organisms.

Only through the vigilance of people like Taylor and Ray and the thousands of anglers and boaters on the water daily can the threat from invasive aquatic species be stymied.

“Biologists and game wardens can’t be everywhere,” said Phil Durocher, director of TPWD’s Inland Fisheries Division. “We need all anglers, boaters and other recreational users of our lakes to watch for zebra mussels and contact their local biologist, game warden or lake controlling authority if they think they’ve found one.”

“Texas and Oklahoma are working jointly on this issue because of the danger these invaders could spread to other water bodies,” said Barry Bolton, Chief of Fisheries for ODWC. “We are asking our recreational users to be vigilant not just on Lake Texoma but on other lakes in Texas and Oklahoma as well.”