

PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

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FEDERAL AID PROJECT F-30-R-32

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2006 Survey Report

Sam Rayburn 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.....	5
Fisheries management plan	7
Literature cited.....	9
Figures and tables.....	10-32
Water level (Figure 1)	10
Reservoir characteristics (Table 1).....	10
Harvest regulations (Table 2)	11
Stocking history (Table 3).....	12
Vegetation survey (Table 4)	15
Percent directed angler effort per species (Table 5)	16
Total fishing effort and fishing expenditures (Table 6)	16
Gizzard shad (Figure 2).....	17
Bluegill (Figures 3, 4; Table 7)	18
Blue catfish (Figures 5, 7; Table 8)	20
Channel catfish (Figures 6, 8; Table 8)	21
White bass (Figures 9, 11; Table 9)	23
Palmetto bass (Figures 10, 12; Table 9)	24
Spotted bass (Figures 13, 15; Table 10)	26
Largemouth bass (Figures 14, 16; Tables 10, 11)	27
Crappie (Table 12)	30
Proposed Sampling Schedule (Table 13).....	31
Appendix A	
Catch rates for all species from all gear types	32
Appendix B	
Map of 2006-2007 sampling locations.....	33
Appendix C	
Results of tournament-monitoring program.....	35

SURVEY AND MANAGEMENT SUMMARY

Fish populations in Sam Rayburn Reservoir were surveyed in 2006 using electrofishing and trap nets and in 2007 using gill nets. Anglers were surveyed from June 2006 - May 2007 with a creel. This report summarizes the results of the surveys and contains a management plan for the reservoir.

- **Reservoir description:** Sam Rayburn Reservoir is an 111,422-acre impoundment of the Angelina River in Jasper, Tyler, Angelina, Nacogdoches, San Augustine, and Sabine counties in southeast Texas. Water level fluctuations average 6.7 feet annually. Aquatic habitat consisted of aquatic vegetation (primarily hydrilla and American lotus) and standing timber.
- **Management history:** Historically, the black bass fishery is the most popular at Sam Rayburn Reservoir. Typically, 65 - 75% of annual angling effort is directed at black bass, which includes over 300 bass tournaments per year. Approximately 15 - 20% of anglers target crappie and 4 - 8% target catfish. Angler interest in more restrictive length limits for largemouth bass and potential impacts of bass tournaments prompted research in 2004 - 2007. Results indicated that the proportion of the largemouth bass population harvested was relatively low (9%) and more restrictive length limits would provide little benefit. In addition, the research found that impacts of tournaments on the largemouth bass population were low (only 5% of population retained by tournament anglers). Florida largemouth bass (FLMB) have been stocked annually since 1994 to attain $\geq 20\%$ pure FLMB in the population. Palmetto bass were stocked annually from 1995 - 2000 but discontinued due to low angler directed effort and harvest. Introduction of giant salvinia via transport from Toledo Bend Reservoir has been a major concern but has not been documented.
- **Fish community**
 - **Prey species:** Gizzard shad, threadfin shad, and bluegill were the most abundant prey species and provided ample forage for sport fish.
 - **Catfishes:** Abundances of blue and channel catfish were stable compared to previous years. Angler catch rates averaged 2.6/hour. Blue and flathead catfish provided a trophy opportunity for anglers.
 - **Temperate basses:** White bass were present in the reservoir but numbers were low. Palmetto bass stockings were discontinued after 2000 and few fish remain. Few anglers target temperate bass.
 - **Black basses:** Spotted bass were present in low numbers. Largemouth bass abundance was high and stable compared to previous years, and size structure and fish condition was good. The black bass fishery was most popular (70.5% of anglers targeted bass). Angler catch rates were high (0.78/hour).
 - **Crappie:** White and black crappie were present in the reservoir. Angler catch (2.4/hour) and total annual harvest (226,160 fish) reflected an abundant crappie population.
- **Management strategies:** Stock FLMB annually to maintain and improve trophy fish abundance. Monitor largemouth bass population annually with electrofishing and creel surveys. Continue tournament-monitoring program to more effectively monitor larger fish abundance. Maintain educational signs and conduct annual vegetation surveys to minimize potential impacts of giant salvinia. Monitor the crappie fishery via annual creel surveys. Conduct research to estimate total economic value of tournament and recreational angling. Monitor the catfish populations with gill net surveys every two years. Publish monthly articles in the Lakecaster highlighting TPWD activities.

INTRODUCTION

This document is a summary of fisheries data collected from Sam Rayburn Reservoir in 2006-2007. The purpose of the document is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other species of fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2006-2007 data for comparison.

Reservoir Description

Sam Rayburn Reservoir is an impoundment of Angelina River in Jasper, Tyler, Angelina, Nacogdoches, San Augustine, and Sabine counties in southeast Texas. The U.S. Army Corps of Engineers (USACE) constructed the reservoir in 1965 for flood control, generation of hydroelectric power, and for municipal, industrial, agricultural, and recreational uses. At conservation pool, Sam Rayburn Reservoir is 111,422 surface acres, has a shoreline length of 750 miles, and a mean depth of 20 feet. Water level fluctuations average 6.7 feet annually (Figure 1). The reservoir was mesotrophic with a mean Trophic State Index chl-*a* of 55.9 (Angelina and Neches River Authority, unpublished data). Angler and boat access was excellent with 24 boat ramps present. Habitat at time of sampling consisted of aquatic vegetation (primarily hydrilla and American lotus) and standing timber. Most of the land around the reservoir is used for timber production and agriculture. Other descriptive characteristics for Sam Rayburn Reservoir are in Table 1.

Management History

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

1. Publish results and conclusions of largemouth bass exploitation study in local media outlets and scientific journals.
Action: Numerous popular articles were published in the Lakecaster newsletter. A manuscript was published summarizing tournament-related impacts on the largemouth bass population (Driscoll et al. 2007).
2. Stock Florida largemouth bass (FLMB) annually (100 fingerlings/acre) in 5,000-acre embayment until pure FLMB constitute > 20% of the population within embayment.
Action: From 2000 - 2002, FLMB were stocked annually in the Caney Creek embayment. The FLMB genotype in Caney Creek was 33% in 2002 (Table 10). Annual FLMB stockings were conducted in the Ayish Bayou embayment from 2003 - 2007. Ayish Bayou FLMB genotypes were below the target of 20% (Table 10).
3. Conduct annual electrofishing and creel surveys to monitor status of largemouth bass population and examine growth every four years.
Action: Surveys were conducted from 2005 - 2007 and indicated relatively stable population abundance and angling success. Growth was examined in 2006.
4. Continue black bass tournament-monitoring program to increase information on relative abundance of large fish (> 20 inches).
Action: Data from 28 tournaments were entered and summarized in Appendix C.
5. Conduct annual vegetation surveys to monitor hydrilla abundance and prevent establishment of giant salvinia.
Action: Surveys were conducted in 2005 and 2006. Hydrilla coverage increased to 9,112 surface acres (8% of reservoir surface area). Giant salvinia was not found in the reservoir.
6. Conduct gillnetting surveys every two years to monitor the status of catfish populations and examine growth every four years to ensure the 12-inch minimum length limit is appropriate.
Action: Surveys were conducted in 2005 and 2007. Growth was examined in 2007.
7. Publish monthly popular articles in the Lakecaster, a newsletter distributed to 30 counties in

Texas and Louisiana.

Action: Articles highlighting TPWD activities at Sam Rayburn Reservoir have been published monthly since 2000.

Harvest regulation history: Historically, all sport fishes in Sam Rayburn Reservoir have been managed with statewide regulations (Table 2).

Stocking history: Since 1994, Sam Rayburn Reservoir has received annual stockings of FLMB (Table 3). Since 2000, FLMB have been stocked in 5,000-acre embayments (Caney Creek or Ayish Bayou) at a rate of 100 fingerlings/acre to maximize stocking influence. The Caney Creek embayment was stocked from 2000 - 2002. Embayment sampling during the fall of 2002 indicated that the observed FLMB genotype was 33%, which exceeded the embayment goal of 20% (Table 11). The Ayish Bayou embayment was selected for stocking in 2003 - 2007. FLMB genotypes were below the embayment goal of 20% (Table 11). From 1991 - 2000, palmetto bass were stocked annually. Stockings were discontinued after 2000 due to low directed angler effort and harvest. The complete stocking history is in Table 3.

Vegetation/habitat history: Historically, aquatic vegetation coverage at Sam Rayburn Reservoir (primarily hydrilla) has approached 20,000 surface acres and included over 25 plant species. Since 2000, aquatic vegetation coverage has ranged from 5,415 (2004) - 14,695 surface acres (2000). Since 2004, hydrilla coverage has increased from 2,944 - 9,112 surface acres (Table 4). Although hydrilla is an exotic, invasive species and is listed on the TPWD list of prohibitive plants, hydrilla is considered beneficial at Sam Rayburn Reservoir, as coverage has never been problematic or caused access problems. Nuisance exotic species include common salvinia and water hyacinth. Although there is potential for plant expansion, both have persisted in shallow backwaters of creeks and embayments and caused few problems.

METHODS

Fishes were collected by electrofishing (2 hours at 24 5-min stations during October), gill netting (15 net nights at 15 stations during February), and trap netting (6 net nights at 6 stations in December). 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 were randomly selected and, with the exception of trap net effort, all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2005). Standard trap netting was conducted in conjunction with experimental tandem net procedures (24 net nights at 6 stations). Only results from standard trap nets are reported.

Sampling statistics (CPUE for various length categories), structural indices [Proportional Stock Density (PSD), Relative Stock Density (RSD)], and condition indices [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. Average ages for 12-inch blue and channel catfish and 14-inch largemouth bass were determined from otoliths. Water level data were obtained from the USACE website.

A roving creel survey (36 days; 9 days per quarter) was conducted from June 2006 - May 2007 to assess angler use and catch in accordance with the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2005).

An aquatic vegetation survey was conducted in 2006 via an aerial flight. Coverages were calculated for all prevalent species.

Results of largemouth bass tournaments collected as part of an approved special project to supplement population information collected from electrofishing and creel surveys are included in the appendix.

RESULTS AND DISCUSSION

Habitat: A habitat survey conducted in 2002 indicated that the littoral zone included primarily indescrpt bank, overhanging brush, and dead timber (Driscoll and Parks 2003). Approximately 24,000 acres of standing timber were present. In 2006, beneficial aquatic vegetation (primarily hydrilla and American lotus) increased considerably (Table 4). Nuisance plants (common salvinia and water hyacinth) also increased in coverage.

Creel: Similar to previous survey years, fishing effort at Sam Rayburn Reservoir was primarily directed at black basses (70.5%) and crappies (15.9%) (Table 5). Total fishing effort for all species was 731,901 h and declined from previous years (Table 6). Total directed expenditures (\$7,334,508) were similar to the previous survey year.

Prey species: Primary prey species included gizzard shad, threadfin shad, and bluegill. Gizzard shad catch rate was high in 2004 (136.3/h) with a relatively high proportion available as prey (IOV = 65; Figure 2). However, catch rates declined in 2005 (37.0/h) and 2006 (33.5/h) and were similar to the historical reservoir average (45.2/h). Historically, threadfin shad catch rates have been highly variable (76.8/h; SD = 133.1) and are probably not reflective of population status. The catch rate in 2006 was 24.0/h (Appendix A). Bluegill catch rates have decreased during the last three survey years (2004 – 455.3/h; 2005 – 323.5/h; 2006 – 160.5/h) (Figure 3). Prey species abundance was adequate, as relative weights of sport fish were within desired ranges. Few anglers target sunfish (< 1% of total fishing effort) (Table 7), but they are frequently harvested by anglers seeking other species (Figure 4).

Catfish: Since 2004, blue catfish recruitment has been relatively steady. Catch rates ranged from 4.4 - 6.0/n (Figure 5) and exceeded the historical average of 2.7/n. Although few blue catfish > 25 inches were collected, anecdotal information indicates passive gear anglers frequently catch fish > 30 pounds. The catch rate of channel catfish was 6.4/n in 2007, a slight increase from rates in 2004 (4.5/n) and 2005 (2.5/n; Figure 6). Population size structure and relative weights were similar across years. In 2007, average age of 12-inch (11.5 - 12.5 inches) blue catfish and channel catfish was 2.9 years (N = 12; range = 2 – 3 years) and 3.7 years (N = 19; range = 2 – 5 years), respectively.

Directed rod and reel angler effort, catch, and harvest rates of catfishes were similar in 2004 – 2007 (Table 8). Catfish anglers accounted for 4 - 8% of the total fishing effort during the three survey years. Total estimated harvest was 111,931 fish in 2006/2007; 97% of harvested fish were channel catfish (Figure 8).

White and palmetto bass: Gill net data indicated that the population density of white bass in the reservoir was relatively low. During the last three survey years, catch rates ranged from 0.3 - 0.4/n (Figure 9). Historical catch rates average 2.5/n. From 1995 - 2000, palmetto bass fingerlings were stocked annually at low rates (~ 5/acre), but no fish have been stocked since 2000. As expected, catch rates were low during the last three survey years (\leq 1.2/n; Figure 10). Little fishing effort was directed at temperate basses (Table 9), with most attributed to bank anglers at the reservoir powerhouse.

Black bass: Electrofishing catch rates of spotted bass have been historically low, averaging 5.7/h. Catch rates were < 9.0/h during 2004 - 2006 (Figure 13). Few spotted bass > 10 inches were collected. Estimated angler harvest was 8,613 fish in 2006 - 2007 (Figure 15).

Fall electrofishing catch rates during 2004 – 2006 reflected relatively high and stable largemouth bass recruitment rates (range = 170.0 - 213.0/h; Figure 14). The historical reservoir average is 152.0/h.

Population size structure was remarkably similar across years (PSD range = 41 - 51; RSD-14 range = 18 - 26). Relative weights ranged from 89 - 110, indicating largemouth bass were in good condition. Growth of largemouth bass was good; average age at 14 inches (13.5 - 14.5 inches) was 2.3 years (N = 13; range = 1 - 4 years).

Although the reservoir has been stocked with FLMB annually since 1994 (Table 3), overall FLMB influence has remained low and relatively stable. Since 2000, FLMB have been successfully stocked at rates of 100 fish/acre in selected embayments (Caney Creek and Ayish Bayou) to increase stocking influence (i.e., achieve $\geq 20\%$ pure FLMB). Caney Creek received annual FLMB stockings during 2000 - 2002 and genetic analysis in 2002 revealed 32.5% pure FLMB, compared to 5.8% in the reservoir (Table 10). In 2003 and 2004, Caney Creek maintained levels of pure FLMB without stockings (25.0% and 34.0%, respectively). However, in 2005 and 2006 pure FLMB declined to 17.0% and 7.0%, respectively. The Ayish Bayou embayment received stockings in 2003 - 2007. Genetic analysis in 2005 and 2006 revealed 9.0% and 7.0% pure FLMB, respectively.

The black bass fishery accounted for the majority of annual fishing effort (70.5%; Table 5). Creel surveys indicated that directed effort, catch, and harvest rates were similar in 2004 - 2007 (Table 10). Total harvested numbers of largemouth bass decreased by 43% in 2006-2007, with the majority of fish ranging from 14 - 18 inches in length (Figure 16).

A tournament-monitoring program was implemented in June 2003 to increase information on fish ≥ 14 inches and provide greater insight regarding large (> 20 inches) fish abundance (Appendix C). Although average weights of 1st - 3rd places were similar across years, the percentages of participants with weights > 15 pounds and with bag limits declined in 2006. Results of Sealy Outdoors McDonald's Big Bass Splash tournaments reflect an initial decline in large fish catch following the 1998 fish kill attributed to Largemouth Bass Virus (1999 - 2001). From 2002 - 2007, average fish weights increased to levels observed prior to the fish kill.

Crappie: Historically, trap net catch rates of crappie (both white and black) have been low and variable (4.5/nn, SD = 5.0). In 2006, no crappie were collected with trap nets.

Creel data reflected a relatively stable and productive crappie fishery that was second only to the black bass fishery in terms of total fishing effort (15.9%; Table 5). During 2004 - 2007, angler catch rates were high and stable, ranging from 2.4 - 3.1/h (Table 12). Similarly, harvest rates were also high and stable (range = 2.0 - 2.7/acre). In 2006 - 2007, estimated annual harvest was 226,160 fish (Figure 18).

Fisheries management plan for Sam Rayburn Reservoir, Texas

Prepared – July 2007

ISSUE 1: Creel surveys indicate most sportfishing effort at Sam Rayburn Reservoir is for largemouth bass. The reservoir also hosts a substantial number of annual bass tournaments. The economic contribution of the largemouth bass fishery to the local area is likely high, as the total economic value of the recreational fishery was estimated at \$15,100,401 (Anderson et al. 2002). The reservoir has also demonstrated the potential for producing trophy fish.

MANAGEMENT STRATEGIES

1. Continue annual embayment stocking of FLMB (100/acre stocked in a 5,000-acre area) to maintain and improve the trophy largemouth bass population. Select different 5,000-acre embayment if pure FLMB represent > 20% of a subsample of age-0 fish within the current embayment.
2. Continue the tournament-monitoring program to increase information on fish ≥ 14 inches.
3. Conduct annual electrofishing and creel surveys to monitor status of largemouth bass population.
4. Examine largemouth bass growth every four years.
5. Continue to promote fish handling procedures that minimize tournament-related mortality to minimize impacts on largemouth bass population and reduce conflicts with non-tournament anglers.

ISSUE 2: Giant salvinia is present in nearby Toledo Bend Reservoir. Transport to Sam Rayburn Reservoir is likely.

MANAGEMENT STRATEGIES

1. Maintain all educational signs posted at Sam Rayburn and Toledo Bend reservoirs to minimize transport potential and increase likelihood of quick discovery.
2. Conduct annual vegetation survey to monitor for giant salvinia introduction.

ISSUE 3: The crappie fishery at Sam Rayburn Reservoir is significant, accounting for 16% of the total annual fishing effort. During 2006 – 2007, estimated harvest was 226,160 fish.

MANAGEMENT STRATEGY

1. Conduct annual creel surveys to monitor the crappie fishery, as trap netting at Sam Rayburn Reservoir is not effective.

ISSUE 4: Discussions regarding interbasin transfer of East Texas water are increasing due to rising demands for water. A current economic value estimate of recreational fishing at Sam Rayburn Reservoir is needed to ensure that responsible decisions are made regarding water allocation. Although the economic value of recreational fishing at Sam Rayburn Reservoir was estimated at \$15.1 million in 2001, the actual overall value is likely much higher, as the study design did not represent all black bass *Micropterus spp.* tournaments and participants. In 2004, over 300 bass tournaments were conducted at the reservoir with tournament angling comprising 19% of total angling effort. The significance of economic impacts associated with tournaments is widely discussed at Sam Rayburn Reservoir but is unknown.

MANAGEMENT STRATEGY

1. Conduct economic research at Sam Rayburn Reservoir estimating the annual number of black bass tournaments and associated participants, and the annual direct expenditures, recreational

value, and economic impact of both black bass tournaments and recreational angling.

ISSUE 5: A considerable catfish fishery also exists. Although the rod and reel catfish fishery is negligible, the majority of the actual directed catfish effort is likely due to passive gear anglers.

MANAGEMENT STRATEGY

1. Conduct gillnetting surveys every two years to monitor catfish populations and examine growth every four years.

ISSUE 6: Area constituents are interested in TPWD activities and management actions related to Sam Rayburn Reservoir and need to be informed.

MANAGEMENT STRATEGY

1. Continue to publish monthly popular articles on TPWD activities in the Lakecaster, a newsletter distributed to approximately 30 counties in Texas and Louisiana.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule includes annual electrofishing and creel surveys to closely monitor the popular largemouth bass fishery (Table 13). Annual creels are also needed to monitor the crappie fishery due to ineffectiveness of trap nets. Gill net surveys will be conducted every two years to adequately monitor catfish populations. Growth of largemouth bass and catfish will be examined every four years.

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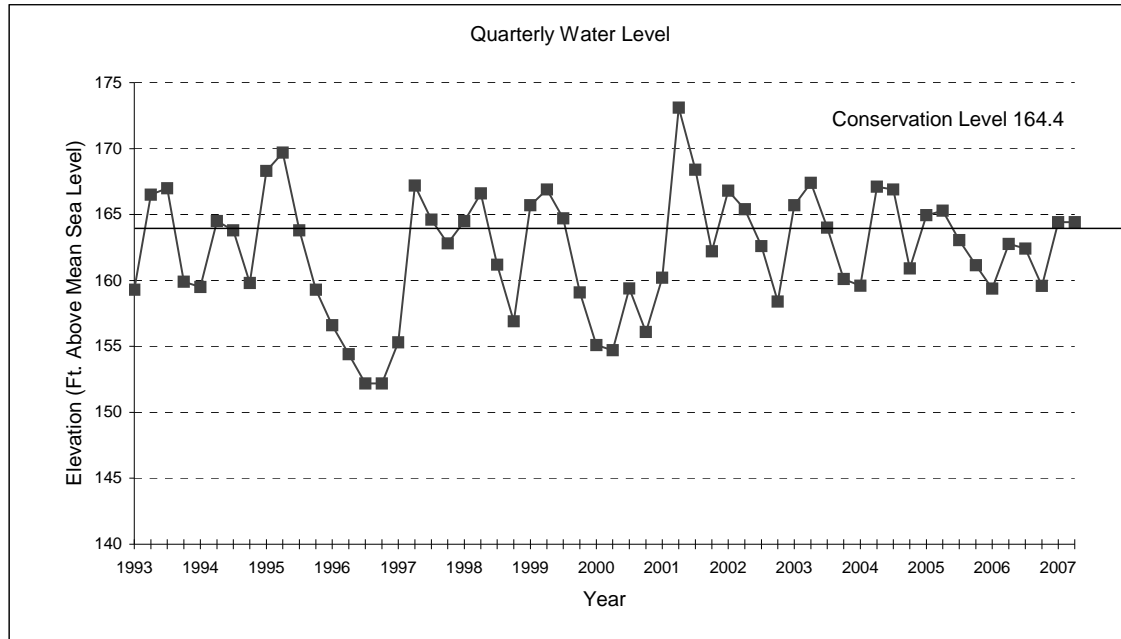


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Sam Rayburn Reservoir, Texas.

Table 1. Characteristics of Sam Rayburn Reservoir, Texas.

Characteristic	Description
Year constructed	1966
Controlling authority	U.S. Army Corps of Engineers
Counties	Jasper, Tyler, Angelina, Nacogdoches, San Augustine, and Sabine
Reservoir type	Mainstream
Shoreline Development Index (SDI)	16.25
Conductivity	120 umhos/cm

Table 2. Harvest regulations for Sam Rayburn Reservoir.

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

^aBag limit for largemouth and spotted bass is 5 in the aggregate.

Table 3. Stocking history of Sam Rayburn Reservoir, Texas. Size categories are fry (FRY = < 1 inch), fingerlings (FGL = 1-4 inches), advanced fingerlings (AFGL = 4-8 inches), adults (ADL), and unknown (UNK).

Species	Year	Number	Size
Blue catfish	1966	105,100	UNK
	1987	199,870	FGL
	Total	304,970	
Channel catfish	1966	74,600	AFGL
	1966	6,100	FGL
	1973	110,000	AFGL
	Total	190,700	
Florida largemouth bass	1975	25,000	FRY
	1976	60,000	FRY
	1977	60,000	FRY
	1978	165,000	FGL
	1978	47,000	FRY
	1980	361,840	FGL
	1983	1,200	AFGL
	1983	37,700	FGL
	1987	249,660	FRY
	1990	1,000	AFGL
	1994	159,360	FGL
	1994	782,966	FRY
	1995	232,392	FGL
	1996	948,017	FGL
	1996	276,051	FRY
	1997	317,729	FRY
	1998	229,200	FGL
	1999	1,329,160	FGL
	2000	510,735	FGL
	2001	500,783	FGL
	2001	273,407	FRY
	2002	42	ADL
	2002	1,066,781	FGL
	2003	1,033,318	FGL
	2003	291,008	FRY
	2004	523,648	FGL
	2005	1,026,943	FGL
	2006	499,858	FGL
	2007	500,033	FGL
	Total	11,509,831	

Table 3. Stocking history continued.

Species	Year	Number	Size
Largemouth bass	1965	364,000	FGL
	1966	97,000	FGL
	1988	21	ADL
	Total	461,021	
Longear sunfish	1965	40,000	
	Total	40,000	
Paddlefish	1990	3,581	
	1991	16,741	
	1992	43,584	
	1995	46,529	
	Total	110,435	
Palmetto bass (striped X white bass hybrid)	1979	571,400	FRY
	1981	447,528	FRY
	1982	1,000,000	FRY
	1985	1,000,000	FRY
	1987	1,500,000	FRY
	1988	1,100,000	FRY
	1989	279,748	FGL
	1989	1,130,036	FRY
	1991	1,111,683	FRY
	1992	1,347,961	FRY
	1993	1,140,000	FRY
	1994	1,175,000	FRY
	1995	943,903	FGL
	1995	1,469,882	FRY
	1996	116,000	FGL
	1997	186,577	FGL
	1998	406,229	FGL
	1998	168,428	FRY
	1999	289,974	FGL
	2000	290,990	FGL
	Total	15,675,339	
Redear sunfish	1966	1,400	
	1967	530,000	
	Total	531,400	

Table 3. Stocking history continued.

Species	Year	Number	Size
Striped bass	1976	115,108	UNK
	1977	843,161	UNK
	1978	182,800	UNK
	1979	215,490	UNK
	1983	1,000,000	UNK
	Total	2,356,559	
Walleye	1973	426,000	FRY
	1974	349,400	FRY
	1975	378,376	FRY
	1976	220,000	FRY
	Total	1,373,776	
Warmouth	1965	80,000	
	1966	800	
	Total	80,800	
White crappie	1965	7,000	FGL
	Total	7,000	

Table 4. Survey of prevalent aquatic vegetation species, Sam Rayburn Reservoir, Texas, September 2002 - 2006. Acreage of each species and percent of total surface area coverage (in parentheses) are presented. Surveys from 2002 - 2005 were conducted by boat and the 2006 survey was conducted via an aerial flight.

Species	2002	2003	2004	2005	2006
American lotus	643 (<1)	1,259 (1)	1,418 (1)	1,346 (1)	3,573 (3)
Common salvinia	trace	180 (<1)	365 (<1)	trace	680 (1)
Hydrilla	6,582 (6)	8,026 (7)	2,944 (3)	4,876 (4)	9,112 (8)
<i>Potamogeton</i> spp.	225 (<1)	548 (<1)	376 (<1)	87 (<1)	89 (<1)
Water hyacinth	15 (<1)	88 (<1)	trace	14 (<1)	132 (<1)

Table 5. Percent directed angler effort by species for Sam Rayburn Reservoir, Texas, 2004 – 2007.

Species	Year		
	2004/2005	2005/2006	2006/2007
Gars		0.3	
Catfishes	6.6	4.4	7.9
Temperate basses	1.4		0.3
Sunfishes	0.2	0.6	0.2
Black basses	66.0	78.1	70.5
Crappies	19.5	14.7	15.9
Anything	6.3	1.9	5.2

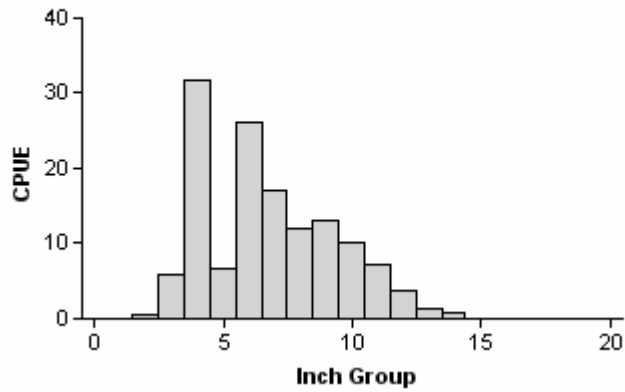
Table 6. Total fishing effort (h) for all species and total directed expenditures at Sam Rayburn Reservoir, Texas, 2004- 2007.

Creel Statistic	Year		
	2004/2005	2005/2006	2006/2007
Total fishing effort	844,152	771,763	731,901
Total directed expenditures	\$6,040,735	\$7,737,888	\$7,334,508

Gizzard shad

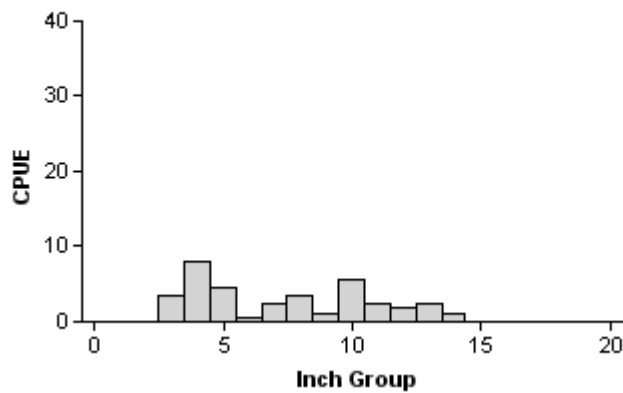
2004

Effort = 4.0
Total CPUE = 136.3 (19; 545)
IOV = 64.59 (4.5)



2005

Effort = 2.0
Total CPUE = 37.0 (27; 74)
IOV = 51.35 (12.2)



2006

Effort = 2.0
Total CPUE = 33.5 (31; 67)
IOV = 35.82 (18.5)

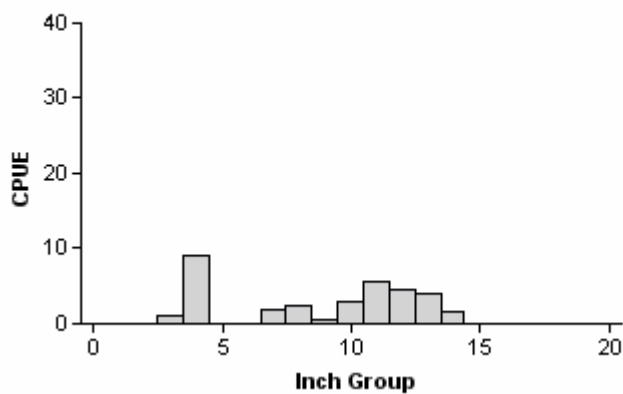
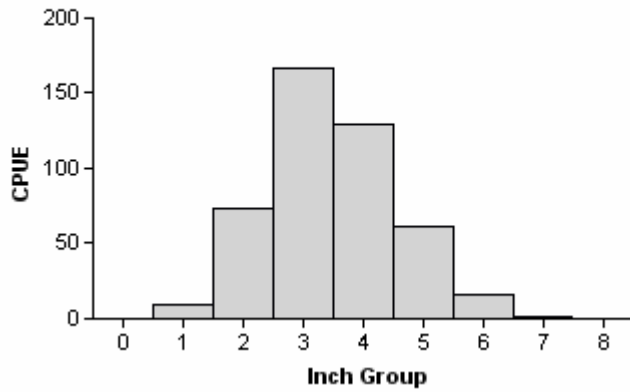


Figure 2. Number of gizzard shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Sam Rayburn Reservoir, Texas, 2004, 2005, and 2006.

Bluegill

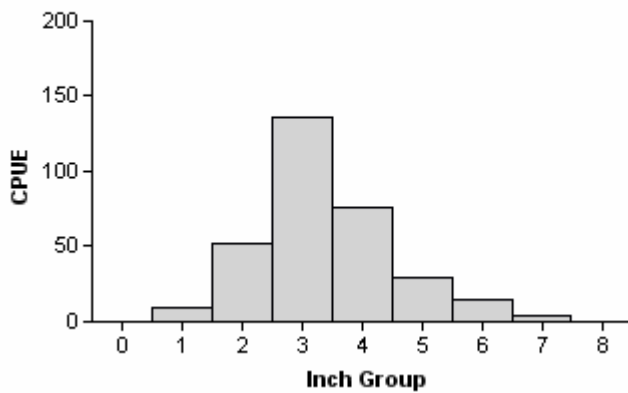
2004

Effort = 4.0
Total CPUE = 455.3 (13; 1821)
PSD = 4 (1.1)



2005

Effort = 2.0
Total CPUE = 323.5 (14; 647)
PSD = 7 (2.2)



2006

Effort = 2.0
Total CPUE = 160.5 (16; 321)
PSD = 12 (4.8)

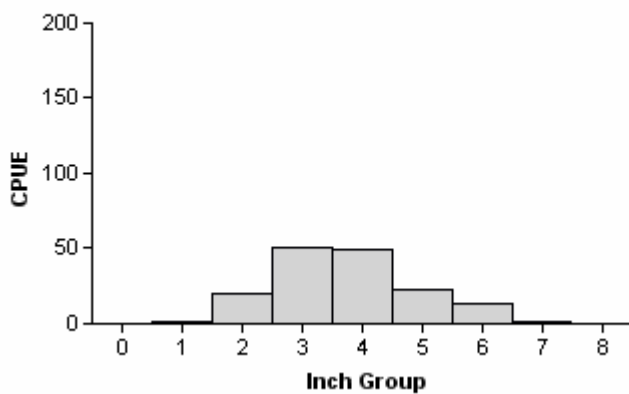


Figure 3. Number of bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Sam Rayburn Reservoir, Texas, 2004, 2005, and 2006.

Sunfishes

Table 7. Creel survey statistics for sunfishes at Sam Rayburn Reservoir from June 2004 through May 2005, June 2005 through May 2006, and June 2006 through May 2007, where total catch per hour is for anglers targeting sunfishes and total harvest is the estimated number of sunfishes harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year		
	2004-2005	2005-2006	2006-2007
Directed effort (h)	1,916.40 (56)	4,544.93 (48)	1,128.06 (81)
Directed effort/acre	0.02 (56)	0.04 (48)	0.01 (81)
Total catch per hour	1.99 (21)	5.75 (68)	7.75 (83)
Total harvest	16,102 (67)	34,661.00 (98)	3,292.00 (323)
Harvest/acre	0.14 (67)	0.31 (98)	0.03 (323)
Percent legal released	52	14	61

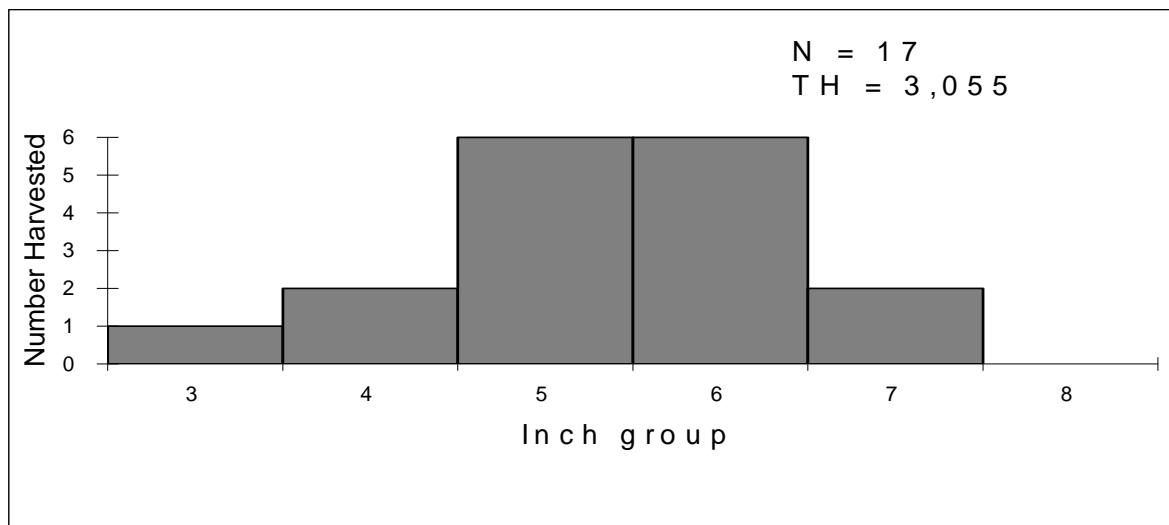
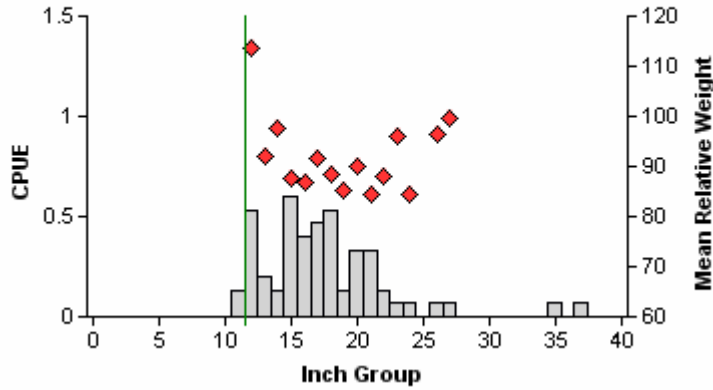


Figure 4. Length frequency of harvested bluegill observed during creel surveys at Sam Rayburn Reservoir, Texas, June 2006 through May 2007, all anglers combined. N is the number of harvested bluegill observed during creel surveys, and TH is the total estimated harvest for the creel period.

Blue catfish

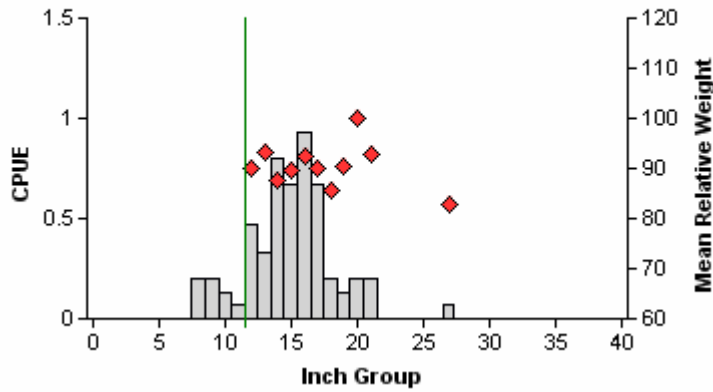
2004

Effort = 15.0
Total CPUE = 4.4 (33; 66)
PSD = 30 (10.7)



2005

Effort = 15.0
Total CPUE = 5.3 (21; 79)
PSD = 10 (4.4)



2007

Effort = 15.0
Total CPUE = 6.0 (35; 90)
PSD = 13 (3.6)

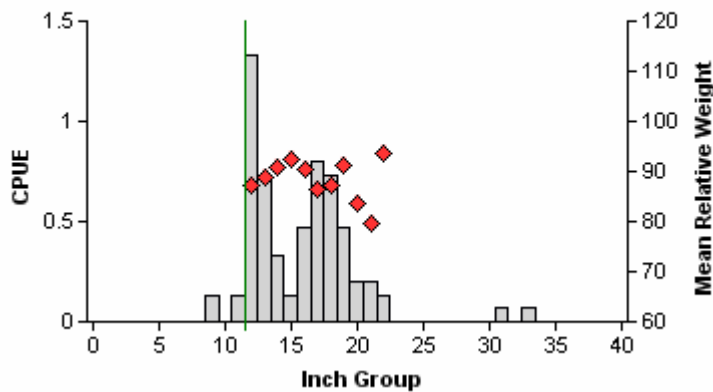
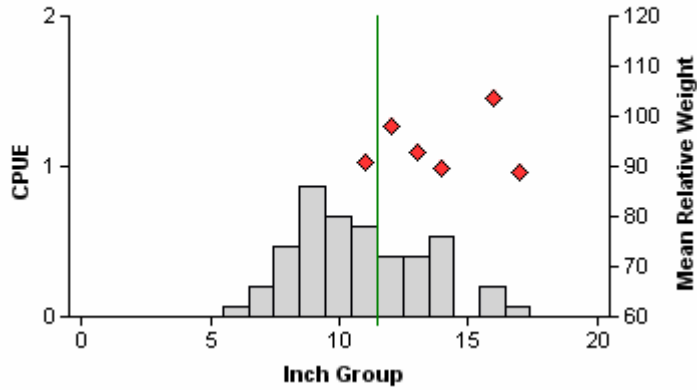


Figure 5. Number of blue catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Sam Rayburn Reservoir, Texas, 2004, 2005, and 2007. Vertical lines indicate minimum length limit.

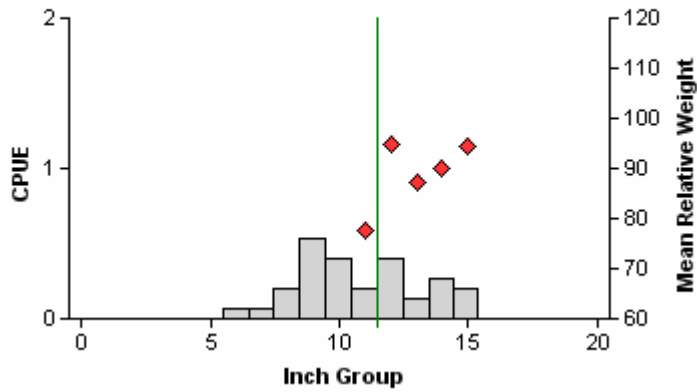
Channel catfish

2004



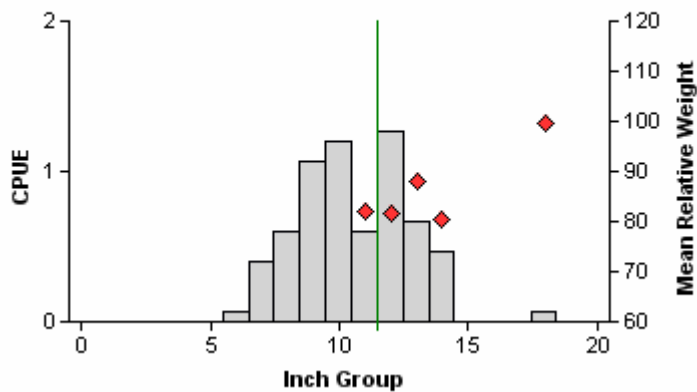
Effort = 15.0
Total CPUE = 4.5 (18; 67)
PSD = 12 (6.6)

2005



Effort = 15.0
Total CPUE = 2.5 (20; 37)
PSD = 0 (68.8)

2007



Effort = 15.0
Total CPUE = 6.4 (31; 96)
PSD = 2 (2.4)

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, Sam Rayburn Reservoir, Texas, 2004, 2005, and 2007. Vertical lines indicate minimum length limit.

Catfishes

Table 8. Creel survey statistics for catfishes at Sam Rayburn Reservoir from June 2004 through May 2005, June 2005 through May 2006, and June 2006 through May 2007, where total catch per hour is for anglers targeting catfishes and total harvest is the estimated number of catfishes harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year		
	2004-2005	2005-2006	2006-2007
Directed effort (h)	56,012.31 (11)	34,237.62 (21)	58,097.36 (16)
Directed effort/acre	0.50 (11)	0.31 (21)	0.52 (16)
Total catch per hour	3.07 (18)	1.92 (24)	2.58 (26)
Total harvest	88,628.00 (28)	97,677.00 (52)	111,931.00 (37)
Harvest/acre	0.80 (28)	0.88 (52)	1.00 (37)
Percent legal released	5	1	10

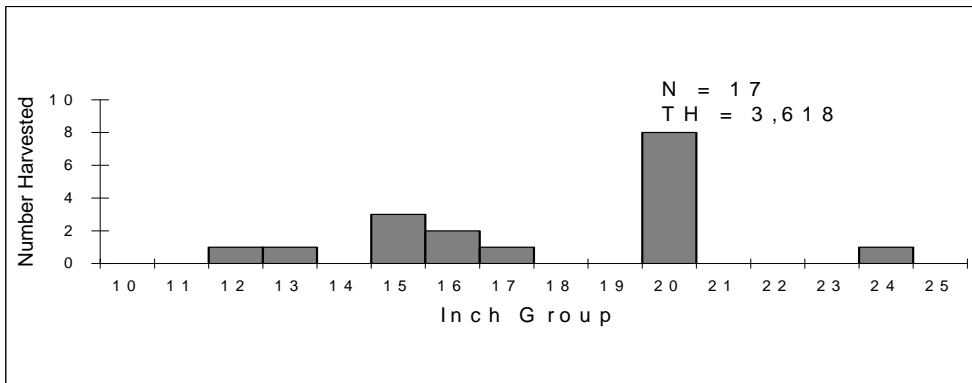
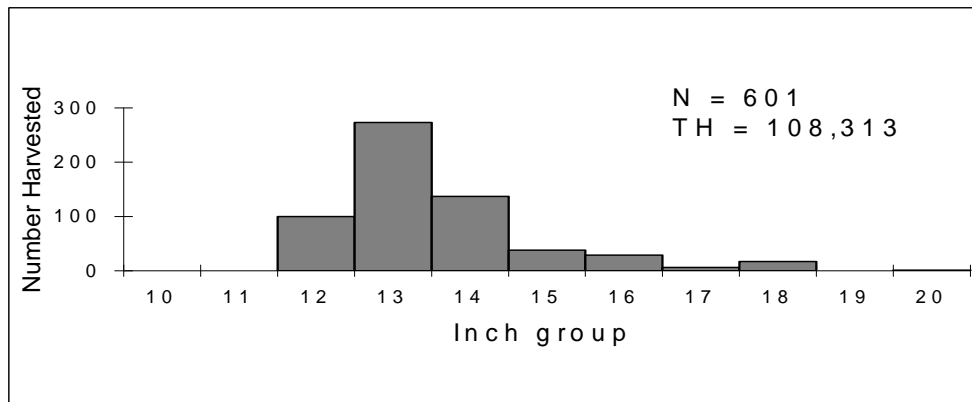


Figure 7. Length frequency of harvested blue catfish observed during creel surveys at Sam Rayburn Reservoir, Texas, June 2006 through May 2007, all anglers combined. N is the number of harvested blue



catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

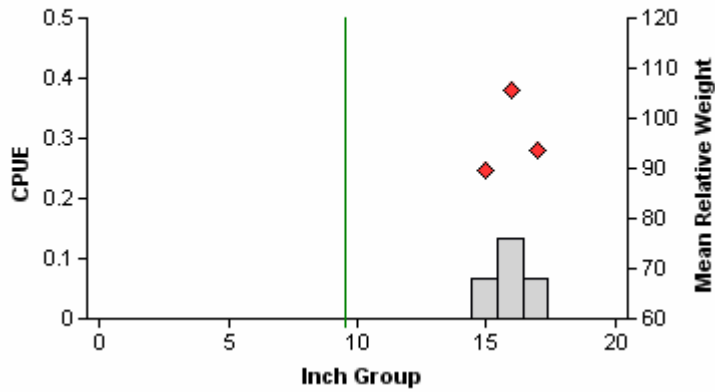
Figure 8. Length frequency of harvested channel catfish observed during creel surveys at Sam Rayburn Reservoir, Texas, June 2006 through May 2007, all anglers combined. N is the number of harvested blue

catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

White bass

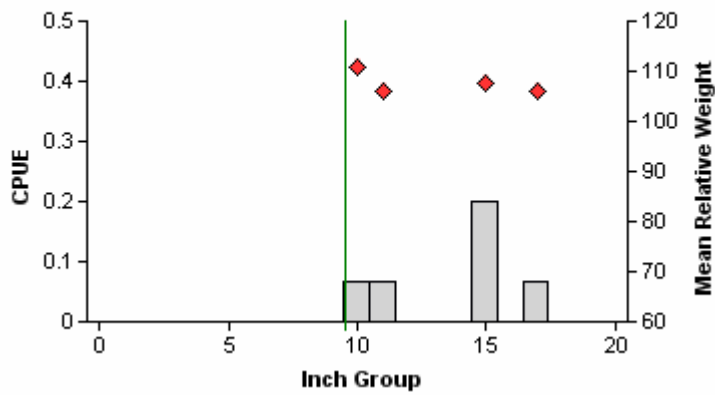
2004

Effort = 15.0
Total CPUE = 0.3 (57; 4)



2005

Effort = 15.0
Total CPUE = 0.4 (84; 6)



2007

Effort = 15.0
Total CPUE = 0.3 (100; 4)

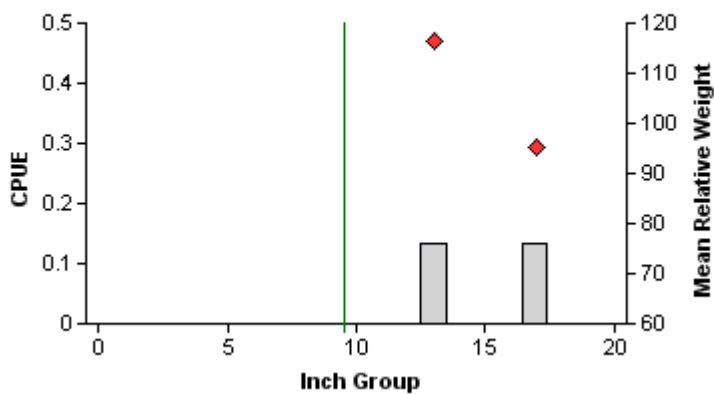
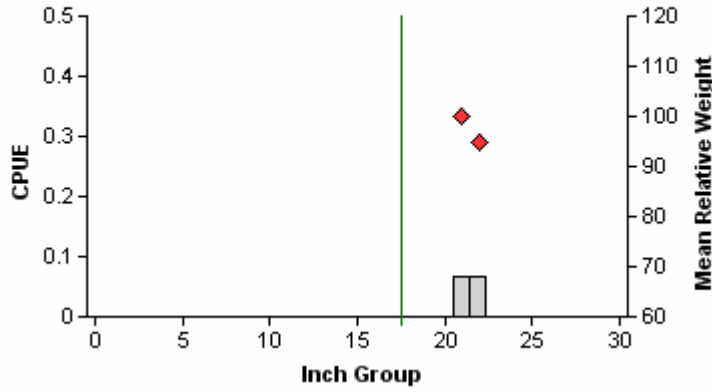


Figure 9. Number of white bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N are in parentheses) for spring gill net surveys, Sam Rayburn Reservoir, Texas, 2004, 2005, and 2007. Vertical lines indicate minimum length limit.

Palmetto bass

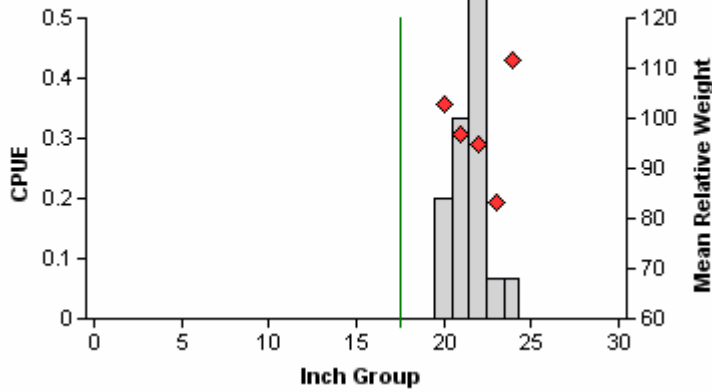
2004

Effort = 15.0
Total CPUE = 0.1 (68; 2)



2005

Effort = 15.0
Total CPUE = 1.2 (83; 18)



2007

Effort = 15.0
Total CPUE = 1.1 (63; 17)

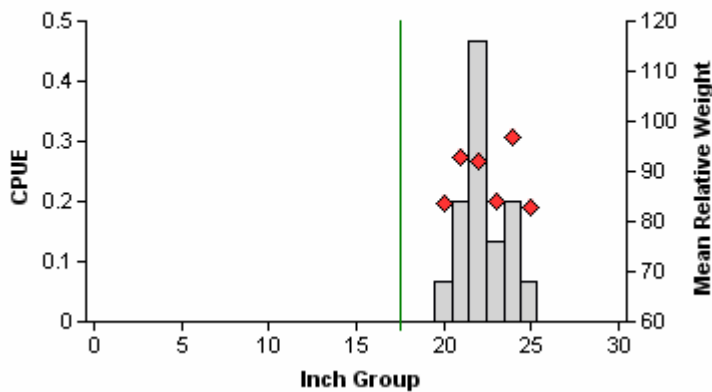


Figure 10. Number of palmetto bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N are in parentheses) for spring gill net surveys, Sam Rayburn Reservoir, Texas, 2004, 2005, and 2007. Vertical lines indicate minimum length limit.

Temperate basses

Table 9. Creel survey statistics for temperate basses at Sam Rayburn Reservoir from June 2004 through May 2005, June 2005 through May 2006, and June 2006 through May 2007, where total catch per hour is for anglers targeting temperate basses and total harvest is the estimated number of temperate basses harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year		
	2004-2005	2005-2006	2006-2007
Directed effort (h)	12,360.90 (55)		2,553.74 (101)
Directed effort/acre	0.11 (55)		0.02 (101)
Total catch per hour	1.99 (21)		0.00
Total harvest	2,216.00 (551)	1,782.00 (607)	734.00 (1,262)
Harvest/acre	0.02 (551)	0.02 (607)	0.01 (1,262)
Percent legal released	74	61	33

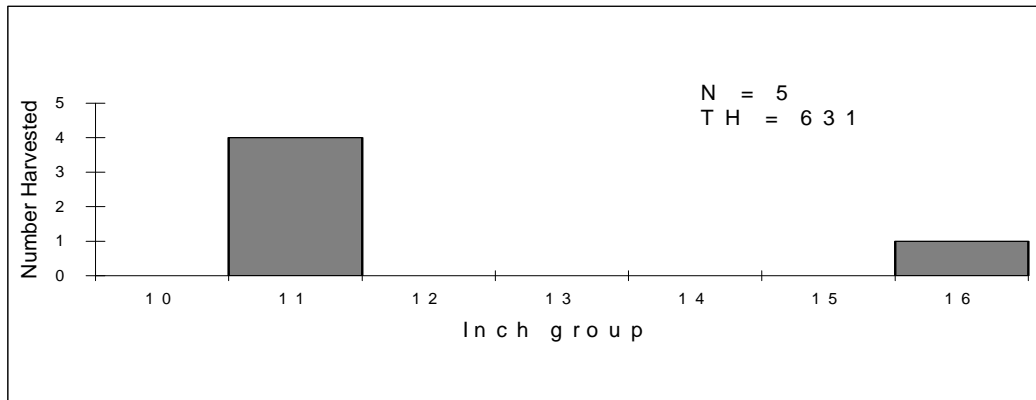


Figure 11. Length frequency of harvested white bass observed during creel surveys at Sam Rayburn Reservoir, Texas, June 2006 through May 2007, all anglers combined. N is the number of harvested white bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

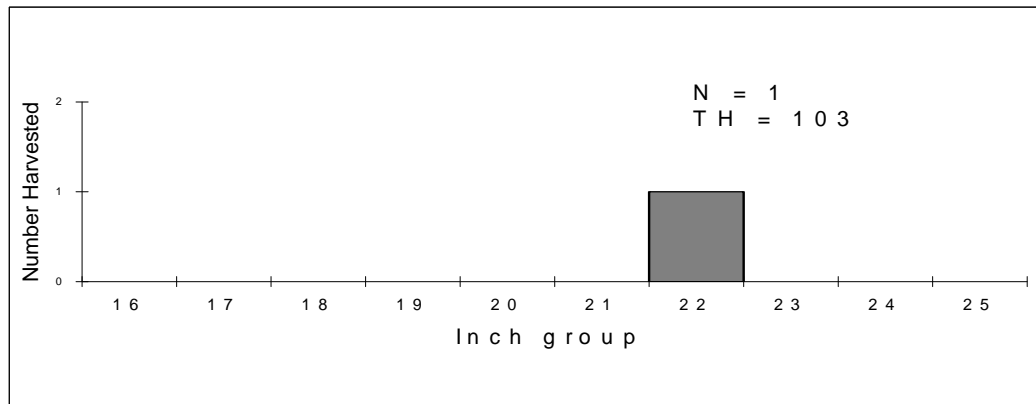
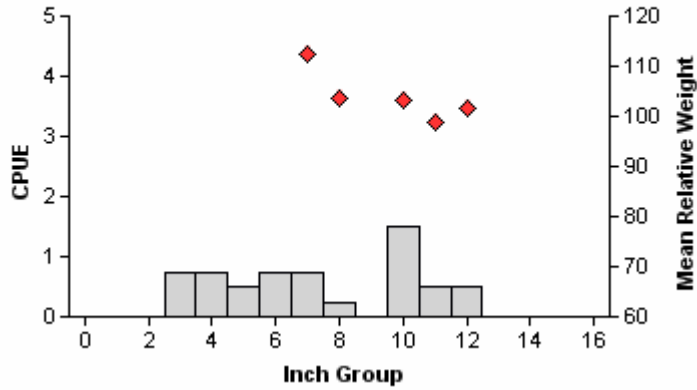


Figure 12. Length frequency of harvested palmetto bass observed during creel surveys at Sam Rayburn Reservoir, Texas, June 2006 through May 2007, all anglers combined. N is the number of harvested palmetto bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Spotted bass

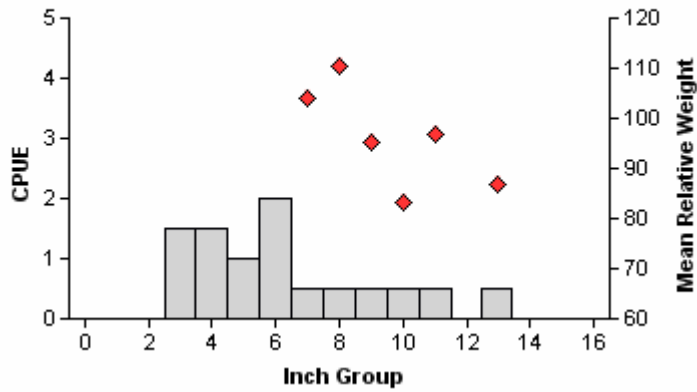
2004

Effort = 4.0
Total CPUE = 6.3 (36; 25)



2005

Effort = 2.0
Total CPUE = 9.0 (35; 18)



2006

Effort = 2.0
Total CPUE = 8.5 (45; 17)

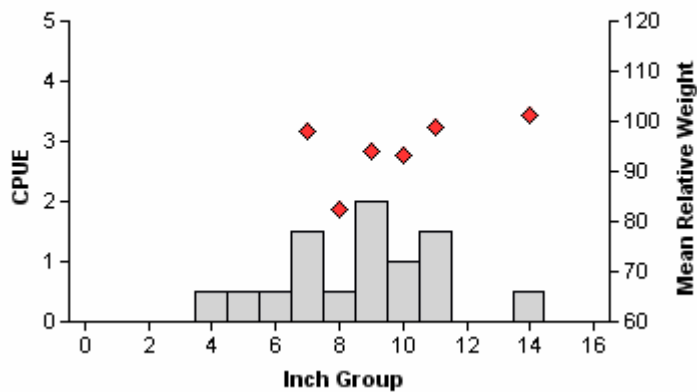
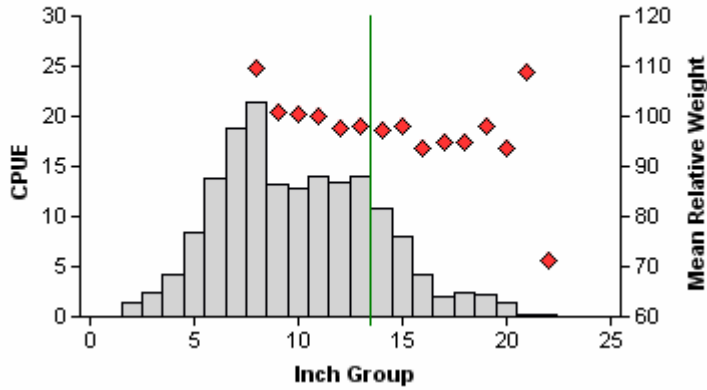


Figure 13. Number of spotted bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE) for fall electrofishing surveys, Sam Rayburn Reservoir, Texas, 2004, 2005, and 2006.

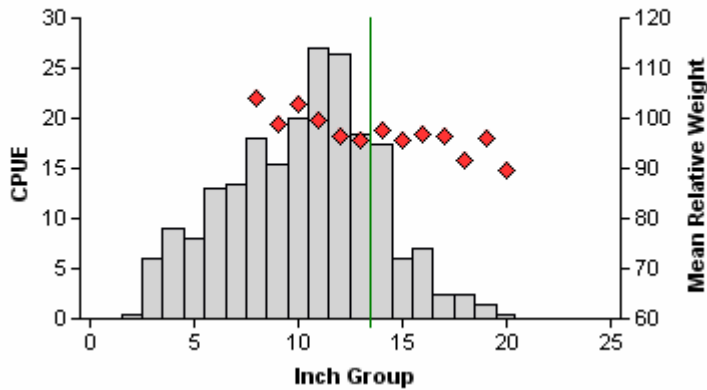
Largemouth bass

2004



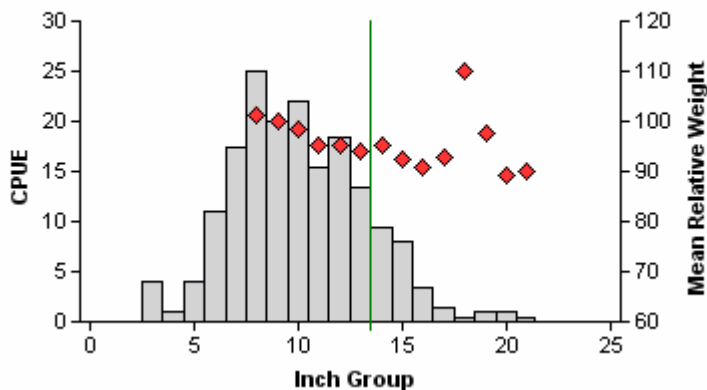
Effort = 4.0
 Total CPUE = 170.0 (11; 680)
 Stock CPUE = 120.8 (10; 483)
 PSD = 49 (3.1)
 RSD-14 = 26 (2.7)

2005



Effort = 2.0
 Total CPUE = 213.0 (15; 426)
 Stock CPUE = 163.0 (15; 326)
 PSD = 51 (3.1)
 RSD-14 = 23 (2.7)

2006



Effort = 2.0
 Total CPUE = 177.5 (13; 355)
 Stock CPUE = 140.0 (14; 280)
 PSD = 41 (4.4)
 RSD-14 = 18 (2.8)

Figure 14. 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, Sam Rayburn Reservoir, Texas, 2004, 2005, and 2006. Vertical lines indicate minimum length limit.

Black basses

Table 10. Creel survey statistics for black basses at Sam Rayburn Reservoir from June 2004 through May 2005, June 2005 through May 2006, and June 2006 through May 2007, where total catch per hour is for anglers targeting black basses and total harvest is the estimated number of black basses harvested by all anglers. Relative standard errors (RSE) are in parentheses

Creel Survey Statistic	Year		
	2004-2005	2005-2006	2006-2007
Directed effort (h)	556,159.91 (9)	602,555.90 (23)	516,136.17 (13)
Directed effort/acre	5.0 (9)	5.4 (23)	4.60 (13)
Total catch per hour	0.76 (9)	0.73 (6)	0.78 (13)
Total harvest	144,820.00 (25)	199,333.00 (36)	113,001.00 (37)
Harvest/acre	1.30 (25)	1.79 (36)	1.01 (37)
Percent legal released	64	49	37

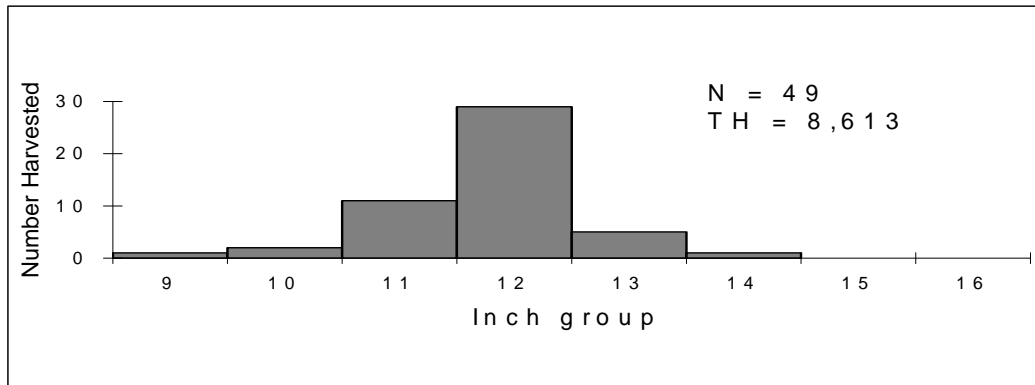


Figure 15. Length frequency of harvested spotted bass observed during creel surveys at Sam Rayburn Reservoir, Texas, June 2006 through May 2007, all anglers combined. N is the number of harvested spotted bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

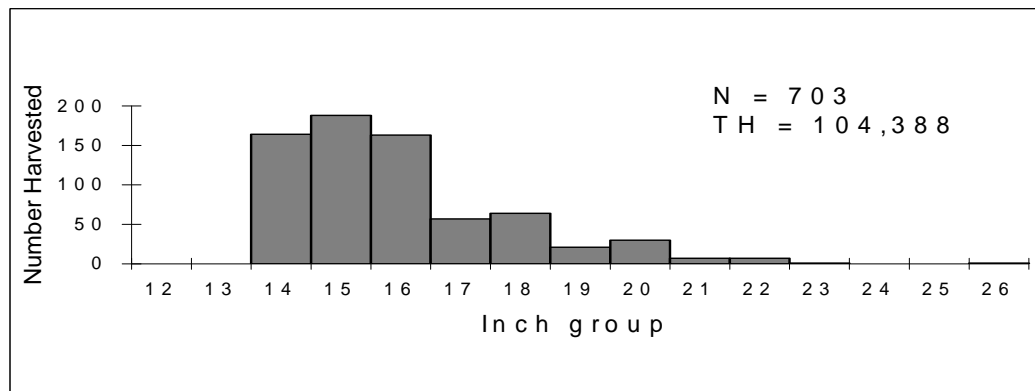


Figure 16. Length frequency of harvested largemouth bass observed during creel surveys at Sam Rayburn Reservoir, Texas, June 2006 through May 2007, all anglers combined. N is the number of harvested largemouth bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Table 11. Results of genetic analysis of largemouth bass collected by fall electrofishing, Sam Rayburn Reservoir, Texas, 2002 - 2006. 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	Fx	NLMB		
2002	69	4	14	44	7	44.5	5.8
2002 ^a	50	16	9	25	0	57.1	32.5
2003	89	9	21	46	13	44.2	10.1
2003 ^a	40	8	10	20	2	62.4	25.0
2004	91	9	18	46	18	40.0	9.8
2004 ^a	50	17	10	22	1	70.5	34.0
2005	62	3		56 ^c	3	47.6	2.0
2005 ^a	58	10		48 ^c	0	63.5	17.0
2005 ^b	58	5		53 ^c	0	64.5	9.0
2006	50	2		48 ^c	0	51.0	3.0
2006 ^a	50	4		46 ^c	0	69.0	7.0
2006 ^b	50	4		46 ^c	0	72.0	7.0

^aCaney Creek stocking embayment

^bAyish Bayou stocking embayment

^cDetermination of hybrid status not conducted

Crappie

Table 12. Creel survey statistics for crappies at Sam Rayburn Reservoir from June 2004 through May 2005, June 2005 through May 2006, and June 2006 through May 2007, where total catch per hour is for anglers targeting crappies and total harvest is the estimated number of crappies harvested by all anglers. Relative standard errors (RSE) are in parentheses

Creel Survey Statistic	Year		
	2004/2005	2005/2006	2006/2007
Directed effort (h)	164,677.36 (11)	113,136.71 (19)	116,046.07 (14)
Directed effort/acre	1.48 (11)	1.02 (19)	1.04 (14)
Total catch per hour	2.68 (11)	3.08 (18)	2.37 (17)
Total harvest	246,450.00 (18)	295,331.00 (42)	226,160.00 (30)
Harvest/acre	2.21 (18)	2.65 (42)	2.02 (30)
Percent legal released	<1	2	<1

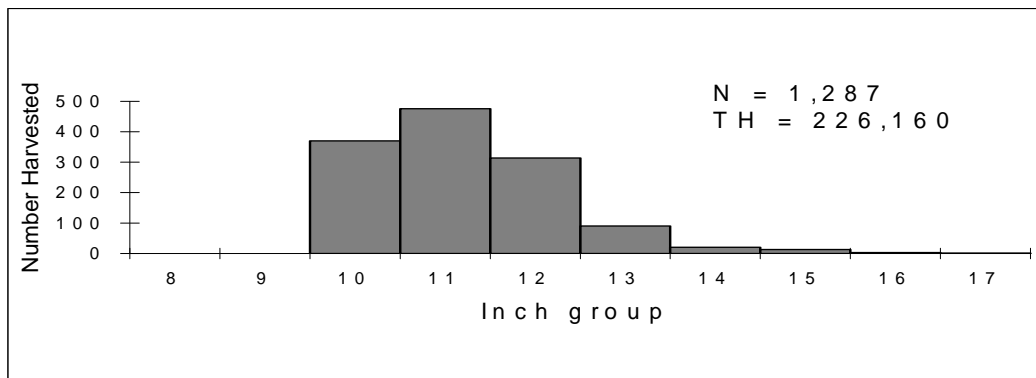


Figure 18. Length frequency of harvested crappie observed during creel surveys at Sam Rayburn Reservoir, Texas, June 2006 through May 2007, all anglers combined. N is the number of harvested crappies observed during creel surveys, and TH is the total estimated harvest for the creel period.

Table 13. Proposed sampling schedule for Sam Rayburn Reservoir, Texas. Gill netting surveys are conducted in the winter, while electrofishing surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

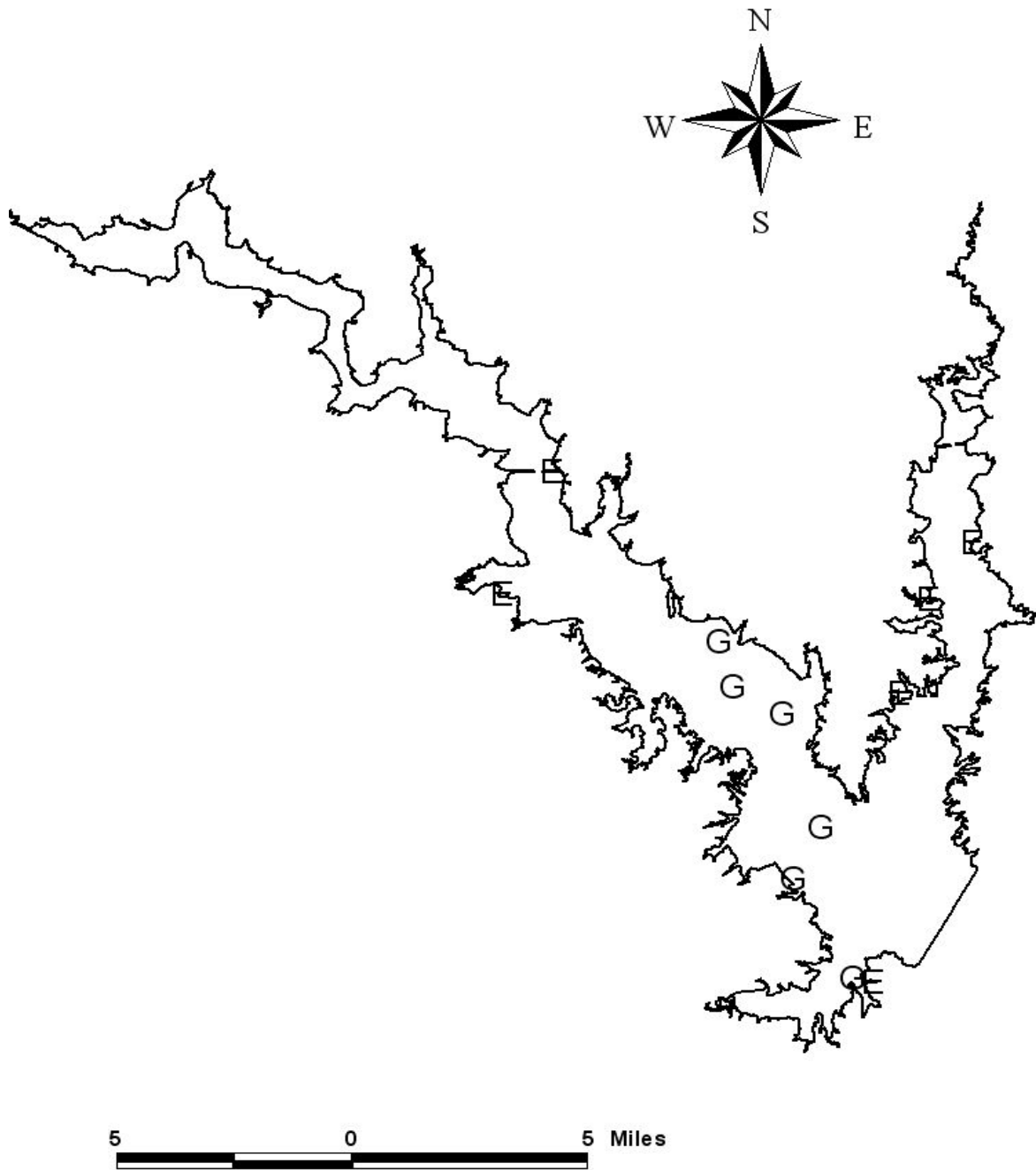
Survey Year	Electrofisher	Gill Net	Creel Survey	Vegetation	Report
2007-2008	A		A	A	
2008-2009	A	A	A	A	A
2009-2010	A		A	A	
2010-2011	S	S	A	S	S

APPENDIX A

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Sam Rayburn Reservoir, Texas, 2006-2007.

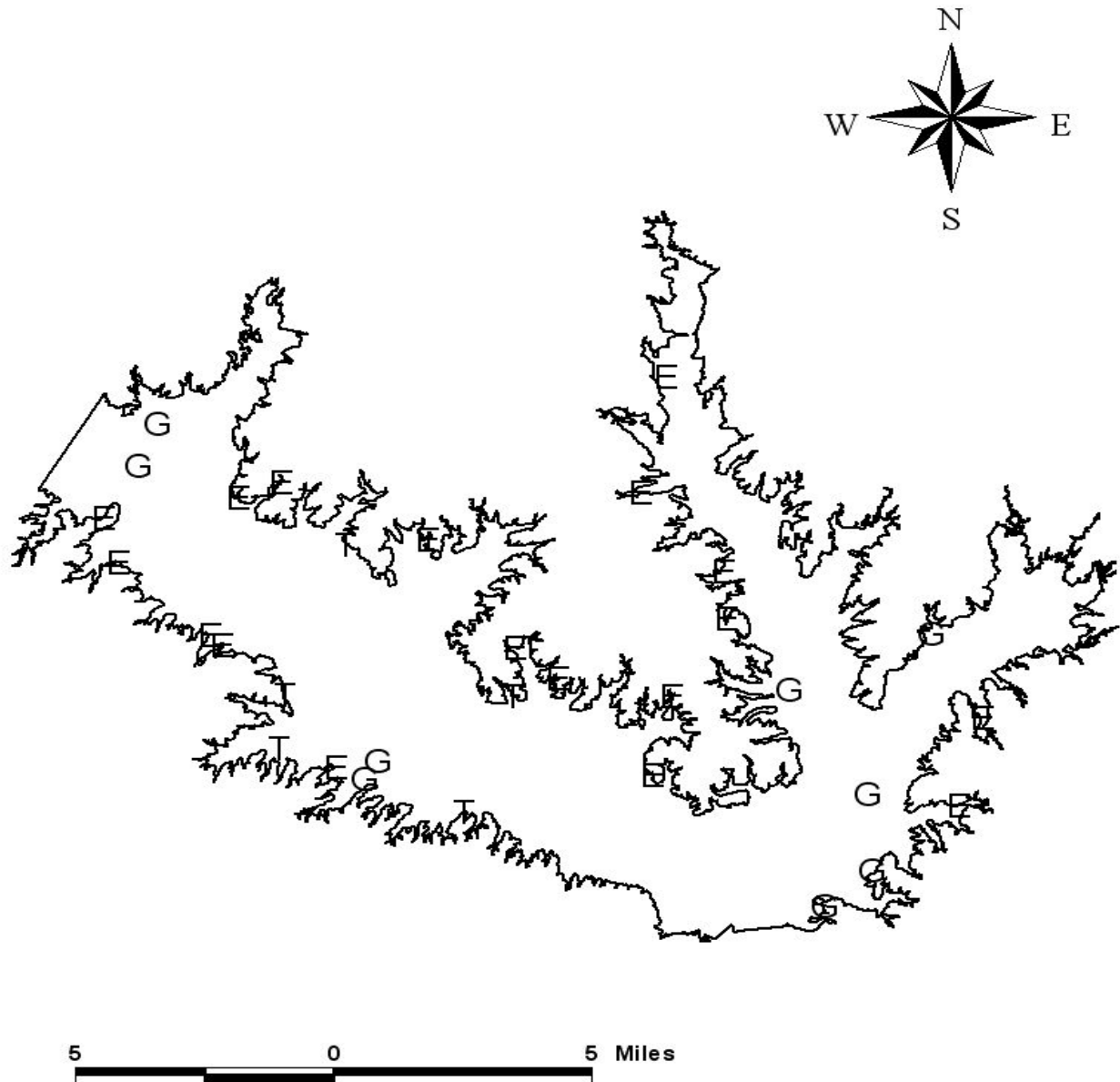
Species	Gill Netting		Trap Netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Gizzard shad	124	8.3			804	33.5
Threadfin shad					576	24.0
Blue catfish	91	6.1				
Channel catfish	96	6.4				
White bass	4	0.3				
Yellow bass	24	1.6				
Palmetto bass	17	1.1				
Redbreast sunfish					300	12.5
Warmouth					180	7.5
Bluegill					3,852	160.5
Longear sunfish					648	27.0
Redear sunfish					1,740	72.5
Spotted sunfish					48	2.0
Spotted bass	10	0.7			204	8.5
Largemouth bass	12	0.8			4,260	177.5
White crappie	3	0.2				
Black crappie	13	0.9	59	2.5		

APPENDIX B



Location of sampling sites, north Sam Rayburn Reservoir, Texas, 2006-2007. Gill net and electrofishing stations are indicated by G and E, respectively. Water level was near full pool at time of sampling.

APPENDIX B



Location of sampling sites, south Sam Rayburn Reservoir, Texas, 2006-2007. Gill net, electrofishing, and trap net stations are indicated by G, E, and T, respectively. Water level was near full pool at time of sampling.

APPENDIX C

Results from individual and team format bass tournaments at Sam Rayburn Reservoir, 2003 - 2004. Only tournaments with 5-fish bag limits and > 50 participants or teams were included. Weights are expressed in pounds.

Year	N	1 st place weight	2 nd place weight	3 rd place weight	% total weights > 15 lbs.	% catching limit	Big bass weight
Individual							
2003	9	20.6	19.0	17.5	5.5	29.3	8.2
2004	13	21.0	19.2	18.0	7.8	37.7	8.3
2005	14	22.0	20.9	19.5	16.3	57.5	7.7
2006	11	20.2	17.4	16.4	4.2	27.1	8.5
Team							
2003	14	21.9	20.3	18.7	11.0	44.5	9.5
2004	20	22.6	20.6	19.0	10.8	39.0	8.5
2005	17	23.1	20.8	20.1	14.8	51.2	9.1
2006	16	23.4	20.7	19.6	7.7	37.7	8.4

Results of Sealy Outdoors McDonald's Big Bass Splash tournaments, Sam Rayburn Reservoir, 1997 – 2007.

Year	Top 10 Fish/Hour Average Weight	Top 10 Fish Each Day Average Weight	Overall Top 10 Fish Average Weight	Weight of Overall Big Fish
1997	6.42 (240)	8.35 (30)	9.07 (10)	10.58
1998	5.99 (239)	9.33 (30)	10.57 (10)	12.10
1999	4.92 (240)	7.21 (30)	8.16 (10)	8.84
2000	5.71 (240)	8.06 (30)	9.08 (10)	10.02
2001	4.80 (240)	6.99 (30)	7.99 (10)	9.64
2002	5.95 (240)	8.21 (30)	9.28 (10)	10.52
2003	6.07 (240)	8.52 (30)	9.32 (10)	10.18
2004	6.80 (240)	8.95 (30)	9.98 (10)	11.83
2005	6.45 (240)	8.81 (30)	9.93 (10)	11.57
2006	5.85 (240)	7.79 (30)	8.91 (10)	9.51
2007	6.32 (240)	8.33 (30)	9.06 (10)	11.08

1997 and 1998 were pre-LMBV fish kill