

PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

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FEDERAL AID PROJECT F-30-R-33

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2007 Survey Report

Amistad Reservoir

Prepared by:

Randy Myers and John Dennis
Inland Fisheries Division
District 1-D Office, San Antonio, Texas



Carter Smith
Executive Director

Phil Durocher
Director, Inland Fisheries

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SURVEY AND MANAGEMENT SUMMARY

Fish populations were surveyed using electrofishing (2001, 2003 and 2007), bass-only electrofishing (2005-2007), and gill nets (2004, 2006 and 2008). Creel surveys were conducted in 2002-2003 and 2007. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir Description:** Amistad Reservoir is a 63,680 acre impoundment on the Rio Grande River. It was constructed in 1969 by the International Boundary and Water Commission and Mexico to provide water for irrigation and hydro-electric power generation. Water level in the reservoir dramatically increased in 2003-2004 resulting in substantially improved fisheries habitat. In 2007, submersed aquatic vegetation occupied 39% of the reservoir bottom (Texas side). Boat and angler access was controlled by the National Park Service (NPS) and was adequate with 11 public boat ramps. A socio-economic survey revealed direct expenditures of Amistad anglers totaled \$20.7 million in 2007.
- **Management History:** Important sport fishes include largemouth bass, catfishes, striped bass, and white bass. Striped bass were stocked in most years since 1974. Stockings of Florida largemouth bass (FLMB) fingerlings were conducted in 2004 to take advantage improved fisheries habitat resulting from a dramatic water level increase. Angler harvest of all sport fishes has been regulated according to statewide size and bag limits. Since 2004, the NPS has regulated largemouth bass tournaments on the reservoir via a tournament permitting program.
- **Fish Community**
 - **Prey species:** Gizzard shad and sunfishes (primarily bluegill) formed the reservoir's forage base. However, most of the gizzard shad sampled were too large to be considered potential forage for largemouth bass. Abundance of both prey species has declined in recent years, but remains sufficient to support the existing predator fish populations.
 - **Catfishes:** The catfish community is dominated by channel catfish. Blue and flathead catfish are present, but in low numbers. Channel catfish abundance increased slightly during the study period. Angling effort directed at catfishes was substantially lower in 2007 compared to in 2002-2003.
 - **White bass:** Abundance of white bass was greater in 2008 than in previous years, with most fish in the population exceeding the 10-inch minimum length limit. However, angling effort directed at this species was substantially lower in 2007 than in 2002-2003.
 - **Striped bass:** Abundance of striped bass was slightly greater in 2008 than in previous years, with most fish in the population exceeding the 18-inch minimum length limit. Angling effort directed at this species was slightly lower in 2007 than in 2002-2003.
 - **Largemouth bass:** Strong year classes of largemouth were produced in 2003 and 2004 coincident with the 2003-2004 dramatic water level increase. This yielded an improved population which supported a popular fishery. Angling effort in 2007 was nearly double compared to 2002-2003.

Management Strategies: Continue to provide a striped bass fishery supported by annual stockings. Examine possible management activities to maintain the high quality largemouth bass fishery including evaluating the potential impacts of reducing the largemouth bass bag limit from 5 to 3 fish. Conduct approved special research project to determine optimum treatment techniques for alleviating decompression illness common to tournament caught fish at the reservoir.

INTRODUCTION

This document is a summary of Amistad Reservoir fisheries data collected from 2001 to 2007. Its purpose 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 2007-2008 survey period data for comparison.

Reservoir Description

Amistad Reservoir is a 63,680 acre impoundment on the Rio Grande River, of which 34,312 acres (54%) are within Texas jurisdiction. It was constructed in 1969 by the International Boundary and Water Commission and Mexico to provide water for irrigation and hydro-electric power generation. Most of the Texas shoreline is federally owned and managed by the NPS as a National Recreation Area. The NPS controls angler access and maintains 11 boat ramps at the reservoir, with most having courtesy docks. They also provide two fish cleaning stations and operate a tournament permitting and scheduling program primarily to avoid over crowded situations at boat ramps and to obtain tournament catch statistics which are provided to TPWD-Inland Fisheries annually. Water level has remained below conservation pool elevation, 1,117 feet above mean sea level, since 1993 (Figure 1). However, water level increased nearly 50 feet in 2003-2004 and since has remained within 15 feet of conservation pool elevation. In 2007, habitat primarily consisted of submersed aquatic vegetation. Other descriptive characteristics for Amistad Reservoir are contained in Table 1.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Dean 2003) included:

1. Continue management and monitoring of the fishery population under current regulations.
Action: Fish populations, sport fishery, and habitat conditions were assessed using standard survey techniques.
2. Stock FLMB at 50 fish/acre based on current lake level to take advantage of improving habitat.
Action: Fingerling FLMB were stocked at a rate of 8.7 fish/acre in 2004 and northern largemouth bass (NLMB) were stocked at a rate of 0.7 and 4.5 fish/acre in 2004 and 2005, respectively. Additionally, 4,519 ShareLunker bass were stocked in 2006.
3. Stock striped bass at 10/acre to provide an additional sport fish.
Action: Striped bass were stocked at rates between 1.9-5.0 fish/acre from 2004 to 2008. This reduced stocking rate was used to minimize conflict among opposing angling groups.

Harvest regulation history: Since impoundment, harvest of all sport fishes has been managed according to statewide regulations (Table 2).

Stocking history: Largemouth bass (both FLMB and NLMB), blue and channel catfish, smallmouth bass, striped bass, palmetto bass, walleye, northern pike, and muskellunge have been stocked. The most recent large-scale largemouth bass stockings occurred in 2004 and were conducted to take advantage of the improved habitat resulting from the substantial water level increase. Smallmouth

bass stockings were conducted in the late 1970s and early 1980s, but were later discontinued. A high quality smallmouth bass fishery developed in the Devils River above the reservoir, and incidental catches of smallmouth bass occur in the Devils River arm of the reservoir. Channel and blue catfish were last stocked in 1973 and 1967, respectively, and populations for these species are self sustaining. Experimental stockings of northern pike, walleye, and muskellunge were conducted in the 1970s, however these stockings were unsuccessful, and thus discontinued. The complete stocking history is contained in Table 3.

Vegetation/habitat history: In July 1999, hydrilla occupied 880 acres and native submersed vegetation species 162 acres (Zerr 1999, Dean 2003).

METHODS

All standard surveys, except for vegetation and habitat, were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2005). Fishes were collected by electrofishing (2 hours at 24 5-minute stations) and gill netting (15 net-nights at 15 stations). Standard electrofishing surveys were conducted during night time and sample station selection was random for all gear types (Appendix A). Additional daytime electrofishing was conducted at random 5-minute random and biologist selected stations with varying effort in 2006 and 2007 to collect a 400-fish sample for age and growth analysis. 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 nets as the number of fish per net night (fish/nn).

Sampling statistics (CPUE for various length categories), structural indices [Proportional Stock Density (PSD), Relative Stock Density (RSD)], and condition indices [relative weight (W_r)] were calculated for target fishes according to Anderson and Neumann (1996). Index of vulnerability (IOV) was calculated for gizzard shad (DiCenzo et al. 1996). Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE statistics and SE was calculated for structural indices and IOV. Ages of largemouth were determined using otoliths.

Genetic analysis of the 401 largemouth bass collected in 2006 was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2006) and micro-satellite analysis was used to determine genotype of individual fish.

A littoral zone/physical habitat survey was conducted in 1999 in accordance with the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2005). There were no significant man-made changes to the shoreline in 2007-2008, thus the survey was not updated. Because of the size of the reservoir and the complexity of the vegetative habitat, alternative methods were used to survey and quantify the aquatic vegetation in the reservoir in 2007. For detailed methodology see the unpublished report titled "Submersed Aquatic Vegetation Survey at Amistad Reservoir: Evaluation of Alternative Survey Methods" prepared by Randall A. Myers and John A. Dennis, 2007.

Creel survey sampling was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2005) from 12/1/2002 to 11/30/2003 and again from 1/1/2007 to 12/31/2007. For 2007 surveys additional information was obtained from interviewed anglers including largemouth bass angler type and the weights of largemouth bass that were caught and released.

In conjunction with the 2007 creel survey, a socio-economic study was conducted to provide an understanding of the social and demographic characteristics, expenditures, experiences, preferences, and attitudes of the various angler segments. Surveys were mailed to 775 anglers interviewed in 2007. Names and addresses were collected, and surveys mailed on a bi-monthly basis to minimize recall bias.

RESULTS AND DISCUSSION

Habitat: In 2007, 13,347 acres of the 34,312 acres (39%) of Amistad Reservoir on the Texas side contained submerged aquatic vegetation (Table 4). This represented a substantial increase in coverage compared to in 1999 when hydrilla occupied only 880 acres and other submersed species 182 acres (Dean 2003). In 2007, hydrilla coverage was estimated 7,995 acres, chara 4,049 acres, and pondweed spp. 5,353 acres. Hydrilla and chara were found growing in water up to 30 feet deep and water star grass as deep as 22 feet in 2007, however pondweed spp. predominated at water depths <12 feet (Appendix B).

Prey species: Gizzard shad abundance declined and population structure shifted to larger sizes during the survey period with electrofishing CPUE decreasing from 75 fish/h in 2001 to 37 fish/h in 2007 (Figure 2). Gizzard shad IOV decreased from 22.4 in 2001 to 0.0 in 2007, suggesting few individuals were of a small enough size to be forage for predator fishes. Bluegill abundance increased from 340 fish/h in 2001 to 518 in 2003, then plummeted to 90 fish/h in 2007 (Figure 3). Nearly all bluegill were a sufficient size to be available to predators (< 6 inches total length, TL). Other sunfish species were collected, and contribute to the forage base (Appendix C). Decreased forage abundance in the reservoir may be a result of increased predator abundance. Although, overall prey abundance was sufficient to support existing populations of predator fishes.

Blue catfish: Abundance of blue catfish remained low throughout the survey period (gill net CPUEs of 0.0-0.3 fish/nn). All of the fish collected were >17 inches TL (Figure 4).

Channel catfish: Abundance increased from 2004 to 2008 as gill net CPUE was greater in 2008 (1.5 fish/nn) than in 2004 (0.5 fish/nn) and 2006 (0.7 fish/nn). Size structure remained similar throughout the study period as PSD ranged from 81-100 (Figure 5). Anglers most frequently harvested 18-19 inch channel catfish (Figure 6). Total catfish harvest was estimated to be 5,175 in 2007 (Appendix D), a decrease compared to 17,118 fish in 2002-2003 (Appendix E).

Flathead catfish: Relative abundance of this species has remained low during the survey period (0.5-0.8 fish/nn; Figure 7).

White bass: Gillnet CPUE of white bass increased from 1.2/nn in 2004 and 1.4/nn in 2006 to 3.3/nn in 2008 (Figure 8). The population and catch of white bass (Figure 9) was dominated with larger fish, as PSDs ranged from 78-100 across years in the survey period and fish as large as 15 inches were harvested. Angling effort for white bass decreased substantially from 13,968 hours in 2002-2003 (Appendix D) to 2007 when only 4,539 hours were expended for this species (Appendix E).

Striped bass: Trends for the striped bass population were similar to that for white bass with increasing abundance and size structure dominated by larger individuals (Figure 10). Striped bass harvest was similar in 2002-2003 and 2007 (Appendices D and E). Likewise, angler success (in terms of catch rate) was similar between 2002-2003 and 2007.

Largemouth bass: Standard electrofishing survey data suggested fluctuating abundance (Figure 12), whereas bass-only electrofishing data indicate a slight increase in largemouth bass abundance in 2007 due to a higher number of sub-stock size fish (Figure 13). However, both survey methods indicate an excellent population size structure, with PSD values ranging from 38-69. Relative weights of collected largemouth bass averaged about 90 which indicated average and sufficient fish condition thereby suggesting forage is not critically limiting growth. Total annual mortality for the population was considered moderate ranging from 0.48 to 0.58 in 2006-2007 (Appendix F) and the population was dominated by fish from the 2003 and 2004 year classes (Appendix G) which were produced coincident and immediately following the dramatic water level increase. Growth was considered acceptable with most age-3 fish exceeding 14 inches TL (Figure 14). Introgression of FLMB genetics in the population remained high, with FLMB alleles averaging 76% in 2006 (Table 5). Angling effort directed for largemouth bass more than doubled from 265,273 hours in 2002-2003 to 601,855 hours in 2007 (Appendices D and E). Angling catch rate of largemouth bass was similarly high in 2002-2003 and 2007 ranging from 0.74 to 0.80 fish/hour of fishing. Estimated number of largemouth bass

harvested by non-tournament anglers was 22,426 fish and the number of fish tournament anglers weighed-in then later released was 29,559 fish. Size distributions of fish harvested and weighed-in were similar (Figures 15-16). In 2007, anglers caught and immediately released 18,963 largemouth bass weighing over 4 lbs., of which 1,364 weighed between 7-10 lbs and 136 over 10 lbs (Table 6). Economic value of the reservoir's fishery increased substantially. In 2002-2003, direct expenditures in Texas totaled 5.4 million dollars (Bradle et al. 2003), whereas in 2007 direct expenditures were 20.7 million dollars. See Appendix H for additional results from the socio-economic survey.

Fisheries Management Plan for Amistad Reservoir

Prepared July 2008.

ISSUE 1: Striped bass are a popular sport fish at Amistad Reservoir. Annual stockings are required to maintain the population because this species does not successfully reproduce in Amistad Reservoir.

MANAGEMENT STRATEGY

1. Stock striped bass annually at 3-5 fish/ acre.

ISSUE 2: In recent years, the reservoir has been recognized as one of the nation's best largemouth bass fisheries; however, largemouth bass harvest has increased substantially. In 2007, non-tournament anglers removed 22,426 fish and tournament anglers subjected an additional 29,559 fish to weigh-in prior to release.

MANAGEMENT STRATEGY

1. Determine the potential effects of reducing the largemouth bass bag limit to 3-fish using yield-per-recruit-analysis in FAST software.

ISSUE 3: During some seasons, over half of the largemouth bass weighed-in at Amistad Reservoir largemouth bass tournaments experience decompression illness (DI) which necessitates treatment before release back into the reservoir. Tournament anglers and organizers use various techniques to alleviate DI in fish, but post-release survival rate of treated fish has not been quantified.

MANAGEMENT STRATEGY

1. Conduct special research project to quantify post-release survival of fish treated for DI and compare effectiveness of the various DI treatment techniques.

SAMPLING SCHEDULE JUSTIFICATION:

Biennial electrofishing surveys are necessary to monitor the largemouth bass population. Conduct largemouth bass only electrofishing in 2009 in addition to the required electrofishing survey in 2011. Continue biennial gill net sampling to evaluate striped bass stockings. In addition to the required gill net survey in 2012, conduct a gill net survey in 2010 (Table 7).

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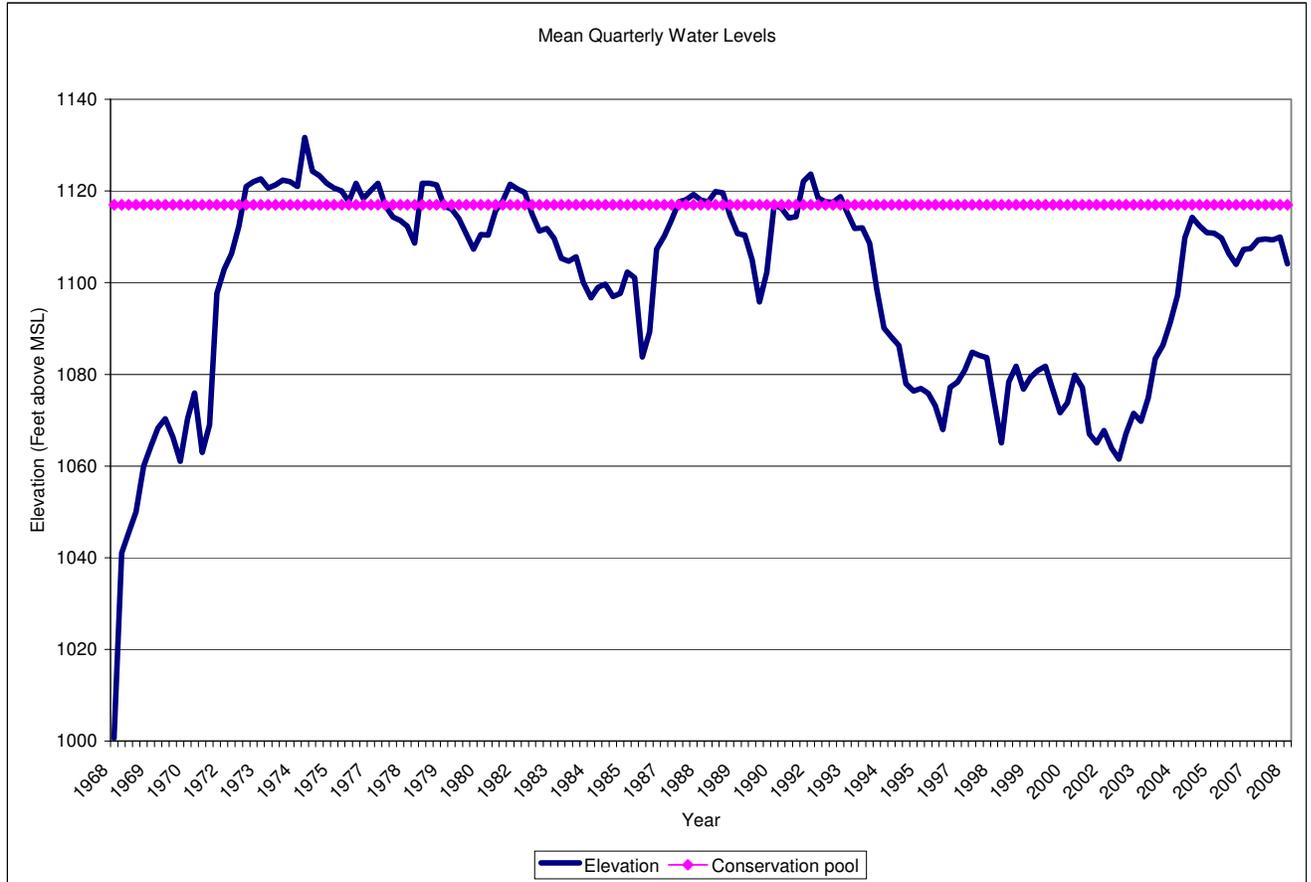


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Amistad Reservoir, Texas. Conservation pool elevation is 1,117 feet MSL.

Table 1. Characteristics of Amistad Reservoir, Texas.

Characteristic	Description
Year constructed	1969
Controlling authority	International Boundary and Water Commission and Mexico
County	Val Verde
Reservoir type	Mainstream
Shoreline Development Index	23.47
Conductivity	871 umhos/cm

Table 2. Fish harvest regulations for Amistad Reservoir.

Species	Bag Limit	Minimum length limit (inches)
Catfish: channel and blue catfish, their hybrids and subspecies	25 (in any combination)	12
Catfish, flathead	5	18
Bass, striped	5	18
Bass, largemouth and smallmouth	5 (in any combination)	14
Bass, white	25	10
Crappie: white and black crappie, their hybrids and subspecies	25 (in any combination)	10

Table 3. Stocking history of Amistad Reservoir, Texas. Size categories are: FRY = <1 inch; FGL = 1-3 inches; and ADL = adults.

Species	Year	Number	Size
Northern pike	1976	1,030,305	FRY
Muskellunge	1976	700	FGL
Blue catfish	1967	5,445	FGL
Channel catfish	1967	22,650	FGL
	1968	317,695	FGL
	1969	77,025	FGL
	1971	8,000	FGL
	1972	10,100	FGL
	1973	50,550	FGL
	Total	486,020	
Striped bass	1974	13,198	FGL
	1976	62,992	FGL
	1977	693,107	FGL
	1978	204,891	FGL
	1979	255,000	FGL
	1980	12,000	FGL
	1982	101,000	FGL
	1984	649,289	FGL
	1986	180,770	FGL
	1988	850,000	FGL
	1991	252,371	FGL
	1992	339,369	FGL
	1993	657,937	FGL
	1994	1,316,638	FGL
	1995	100,259	FGL
	1997	67,463	FGL
	1998	67,885	FGL
	1999	67,800	FGL
	2000	184,113	FGL
	2002	133,800	FGL
2004	233,111	FGL	
2005	318,908	FGL	
2006	120,085	FGL	
2007	127,685	FGL	
2008	140,348	FGL	
	Total	7,150,019	
Palmetto bass	1975	171,300	FGL
	1976	173,662	FGL
	1982	1,270,000	FGL
	Total	1,614,962	
Smallmouth bass	1975	100,000	FGL
	1976	200,000	FGL
	1978	164,750	FGL
	1983	200,500	FGL
	Total	665,250	

Table 3 continued. Stocking history of Amistad Reservoir, Texas. Size categories are: FRY \leq 1 inch; FGL = 1-3 inches, and ADL = adults.

Species	Year	Number	Size
Largemouth bass	1967	1,053,750	FGL
	1968	928,425	FGL
	1969	810,700	FGL
	1971	446,600	FGL
	1972	100	ADL
	1973	1,050	ADL
	2004	42,077	FGL
	2005	289,666	FGL
	Total	3,530,351	
Florida largemouth bass	1975	50,000	FGL
	1976	88,000	FGL
	1977	70,000	FGL
	1978	158,000	FGL
	1979	300,000	FGL
	980	214,700	FGL
	1992	507,075	FGL
	1996	130,768	FGL
	1997	272,262	FGL
	2004	552,648	FGL
	2006*	4,519	FGL
	Total	2,347,972	
	White crappie	1968	17,393,000
Walleye	1975	5,250,000	FRY
	1976	5,100,000	FRY
	1977	2,033,000	FRY
	1978	5,000,000	FRY
	Total	17,383,000	FRY

* ShareLunker largemouth bass

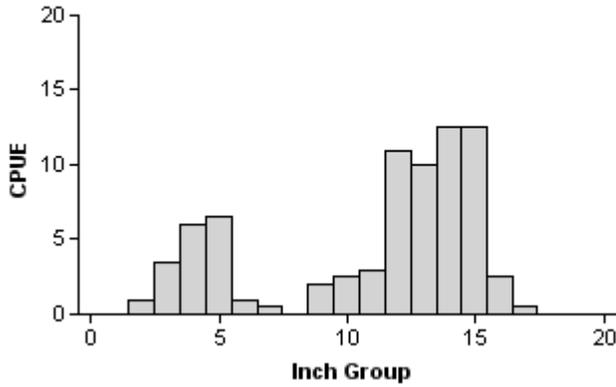
Table 4. Summary results for aquatic vegetation survey conducted at Amistad Reservoir August 2007. Minimum and maximum depth (feet), frequency of occurrence (percent) with lower and upper 95% confidence limits (CL), and bottom coverage (acres) are shown by species or aquatic habitat type. Sampling occurred at 365 random stations on the Texas side of the reservoir which encompassed 34,312 acres. Water level at the time of survey (1,110.5 feet) was 6.5 feet below conservation pool elevation (1,117 feet).

Species/aquatic habitat	Minimum depth	Maximum depth	Frequency of occurrence	Occurrence lower 95 CL	Occurrence upper 95 CL	Bottom coverage
Chara	1	30	11.8	8.5	15.1	4,049
Hydrilla	2	32	23.3	19.0	27.6	7,995
American pondweed	2	8	1.6	0.3	3.0	549
Curly-leaf pondweed	1	15	10.7	7.5	13.9	3,671
Sago pondweed	1	15	6.3	3.8	8.8	2,162
Combined pondweed spp.	1	15	15.6	11.9	19.3	5,353
Water star grass	2	22	2.2	0.7	3.7	755
Naiad spp.	2	11	2.5	0.9	4.1	858
Bladderwort spp.	4	16	1.1	0.1	2.2	377
Combined Vegetation	1	32	38.9	33.9	43.9	13,347
Submerged brush	2	30	12.1	8.7	15.4	4,152

Gizzard Shad

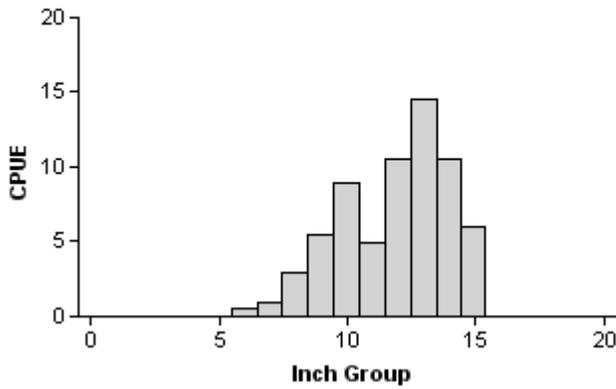
2001

Effort = 2.0
 Total CPUE = 75.0 (32;150)
 IOV = 22.4 (8.1)



2003

Effort = 2.0
 Total CPUE = 65.5 (29; 131)
 IOV = 2.3 (1.0)



2007

Effort = 2.0
 Total CPUE = 37.0 (31;74)
 IOV = 0.0

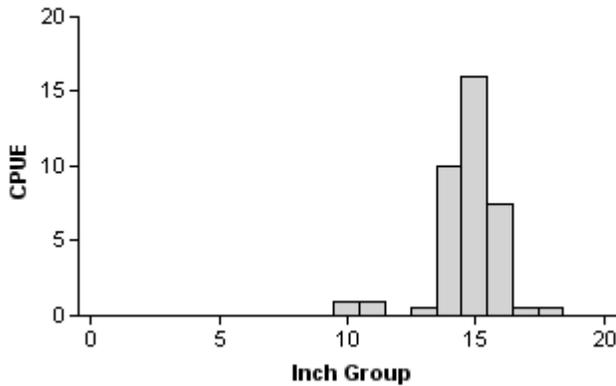
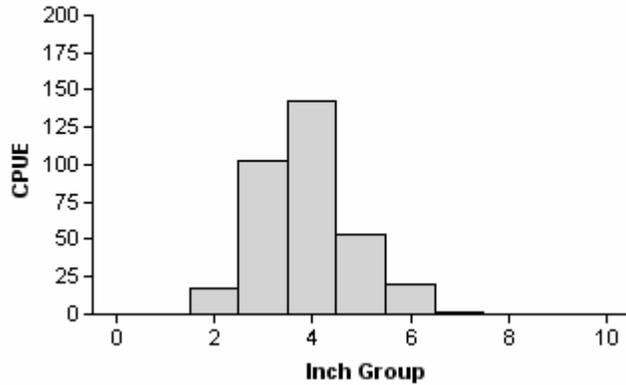


Figure 2. Number of gizzard shad caught per hour (CPUE) and population indices (RSE and N are in parentheses) for fall electrofishing surveys, Amistad Reservoir, Texas, 2001, 2003, and 2007. RSE is used for CPUE values and SE is used for IOV values.

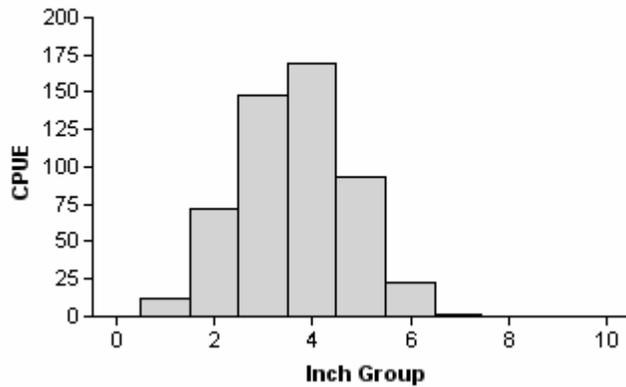
Bluegill

2001



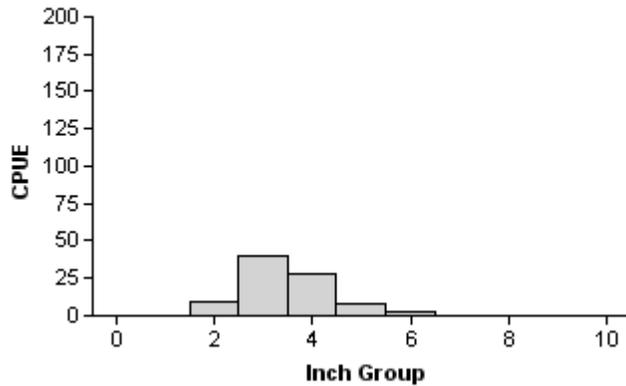
Effort = 2.0
 Total CPUE = 340.0 (15; 680)
 Stock CPUE = 321.5 (16; 643)
 PSD = 7 (1.5)

2003



Effort = 2.0
 Total CPUE = 518.0 (16; 1036)
 Stock CPUE = 246.0 (28; 246)
 PSD = 5 (2.2)

2007



Effort = 2.0
 Total CPUE = 90.0 (19; 180)
 Stock CPUE = 80.5 (18; 161)
 PSD = 4 (2.5)

Figure 3. Number of bluegill caught per hour (CPUE) and population indices (RSE and N are in parentheses) for fall electrofishing surveys, Amistad Reservoir, Texas, 2001, 2003, and 2007. RSE is used for CPUE values and SE is used for PSD values.

Blue Catfish

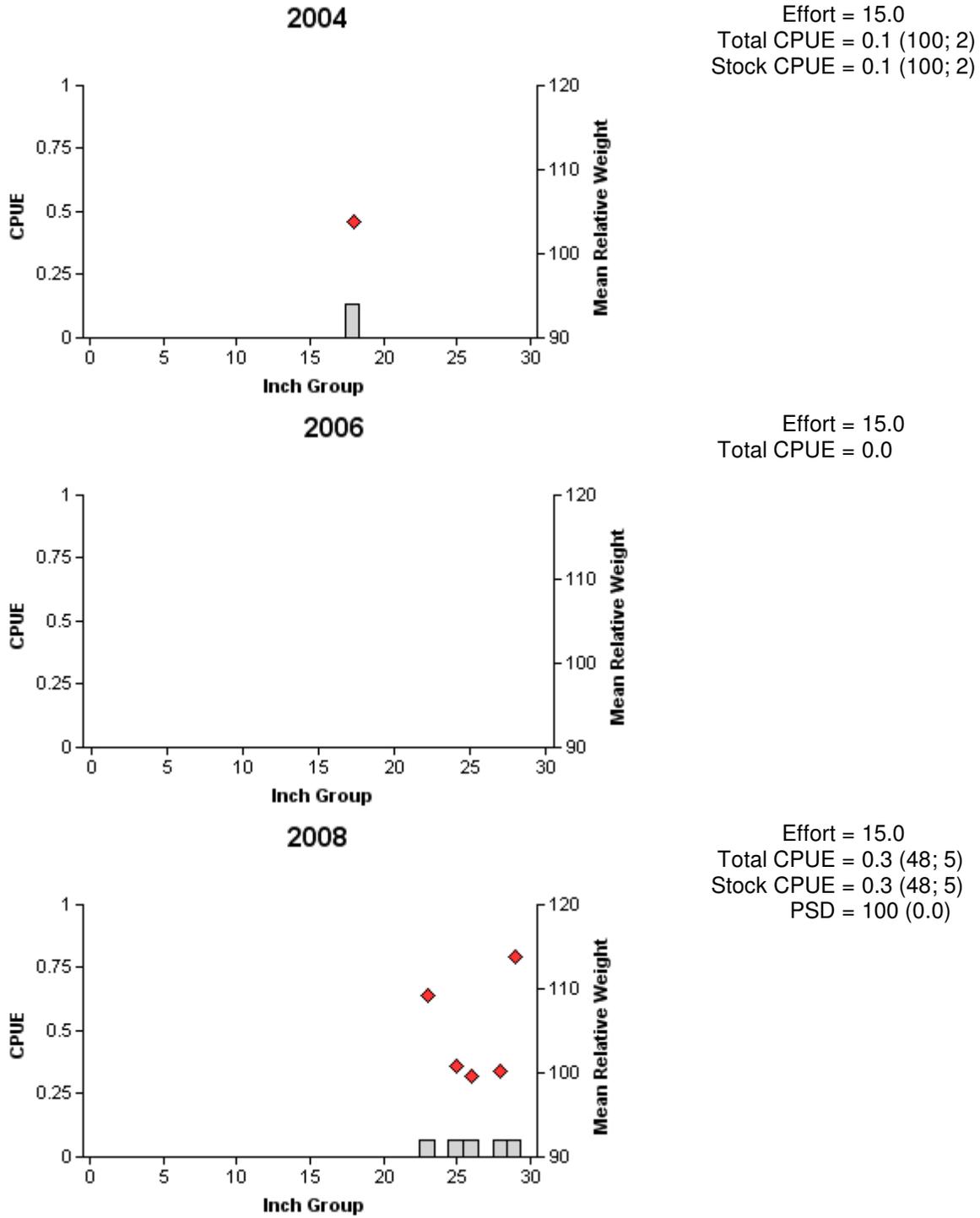


Figure 4. Number of blue catfish caught per net night (CPUE) and population indices (RSE and N are in parentheses) for spring gill net surveys, Amistad Reservoir, Texas, 2004, 2006, and 2008. RSE is used for CPUE values and SE is used for PSD values.

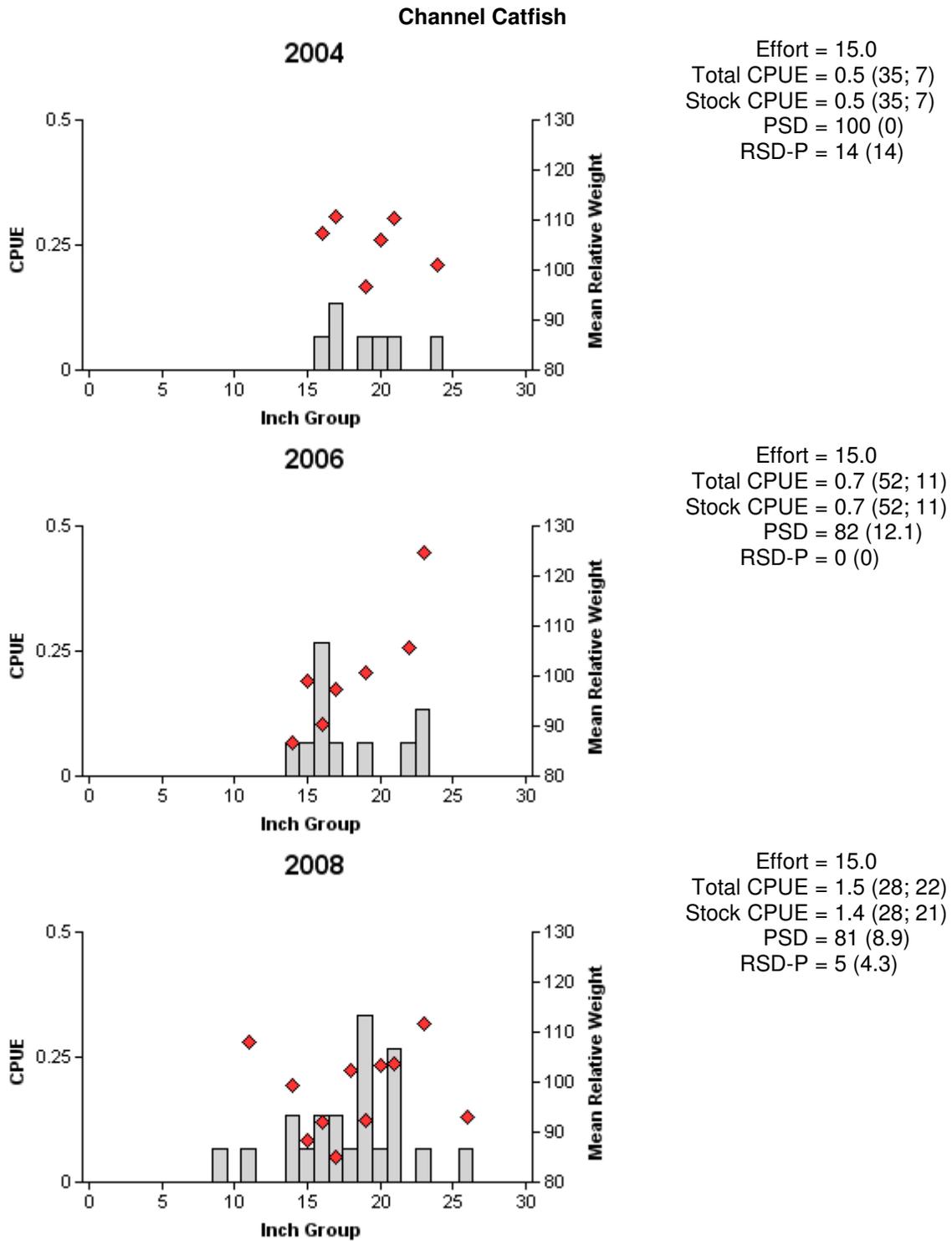


Figure 5. Number of channel catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N are in parentheses) for spring gill net surveys, Amistad Reservoir, Texas, 2004, 2006, and 2008. RSE is used for CPUE values and SE is used for RSD and PSD values.

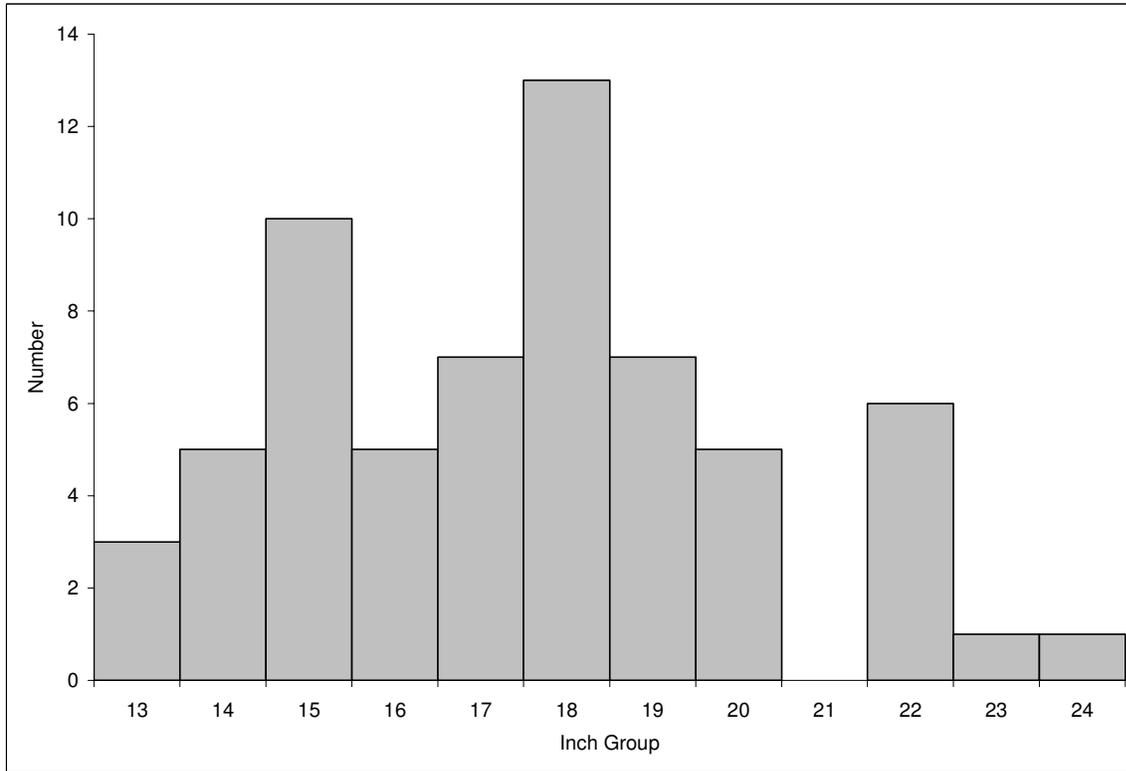
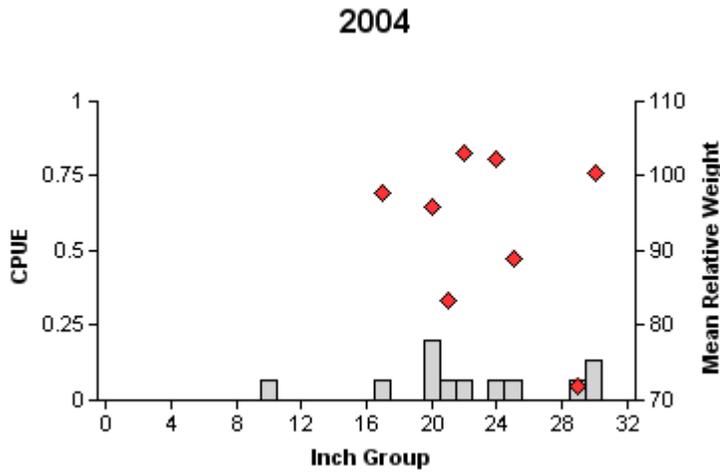
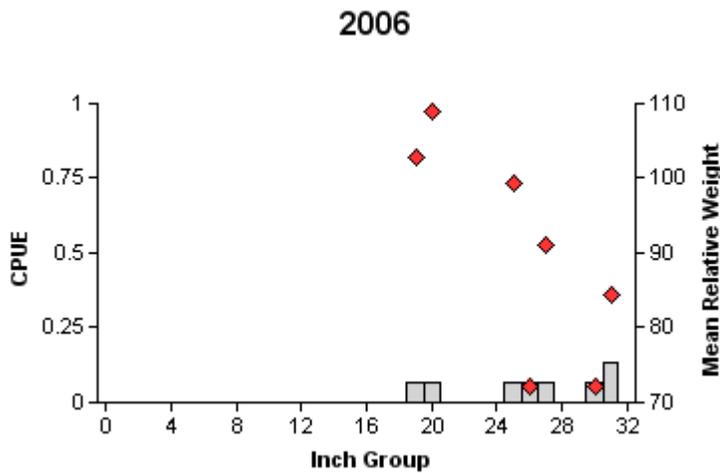
Channel Catfish

Figure 6. Length frequency distribution of angler-harvested channel catfish from Amistad Reservoir in 2007. Sample size was 50 fish.

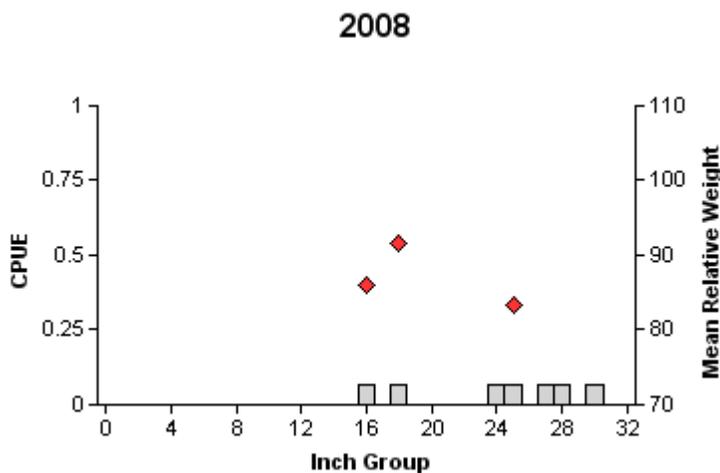
Flathead Catfish



Effort = 15.0
 Total CPUE = 0.8 (30; 12)
 Stock CPUE = 0.7 (34; 11)
 PSD = 91 (8.5)
 RSD-P = 27 (16.1)



Effort = 15.0
 Total CPUE = 0.5 (36; 8)
 Stock CPUE = 0.5 (36; 8)
 PSD = 88 (12.5)
 RSD-P = 38 (16.8)



Effort = 15.0
 Total CPUE = 0.5 (44; 8)
 Stock CPUE = 0.5 (44; 8)
 PSD = 75 (22.4)
 RSD-P = 38 (18.3)

Figure 7. Number of flathead catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N are in parentheses) for spring gill net surveys, Amistad Reservoir, Texas, 2004, 2006, and 2008. RSE is used for CPUE values and SE is used for RSD and PSD values.

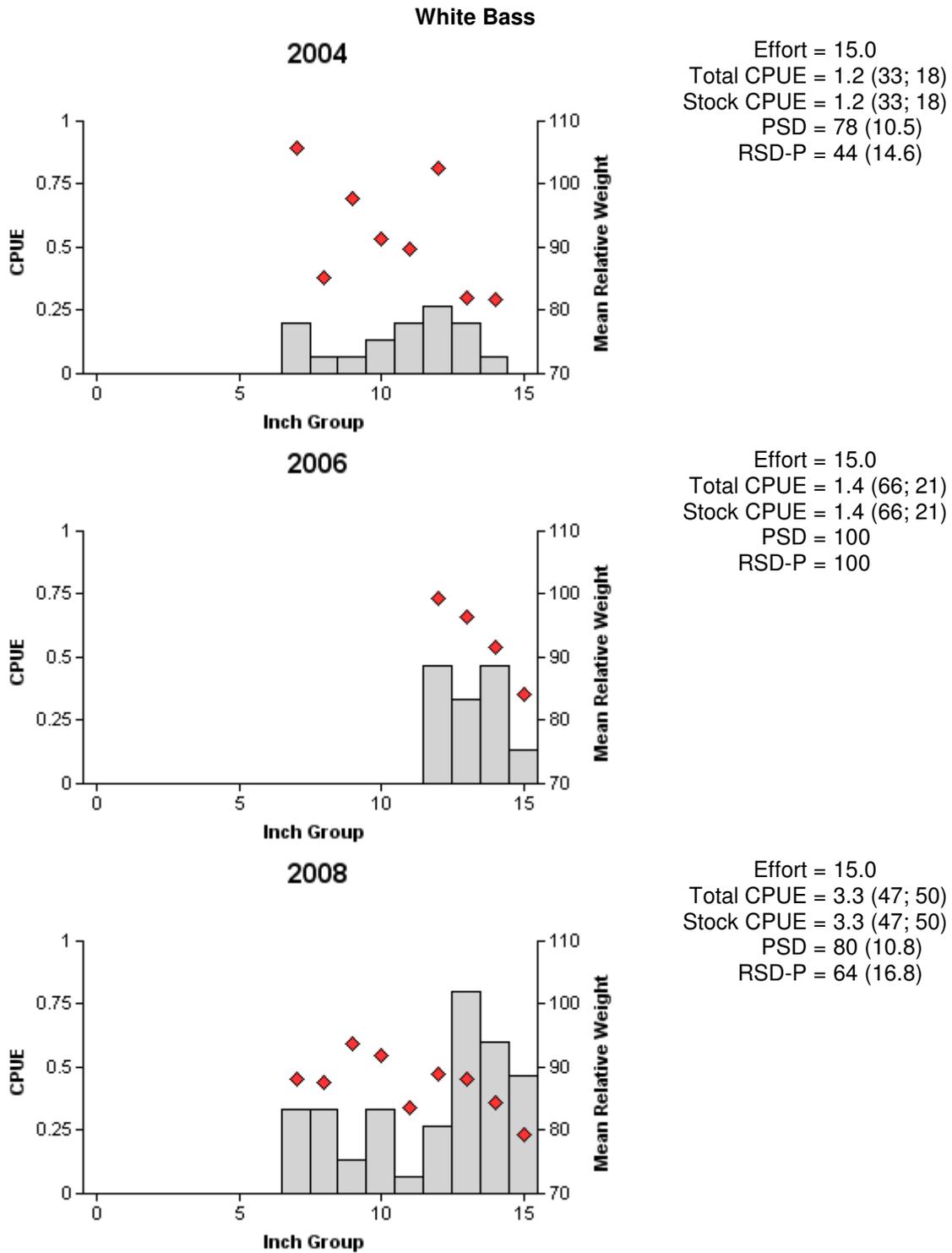


Figure 8. Number of white bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N are in parentheses) for spring gill net surveys, Amistad Reservoir, Texas, 2004, 2006, and 2008. RSE is used for CPUE values and SE is used for RSD and PSD values.

White Bass

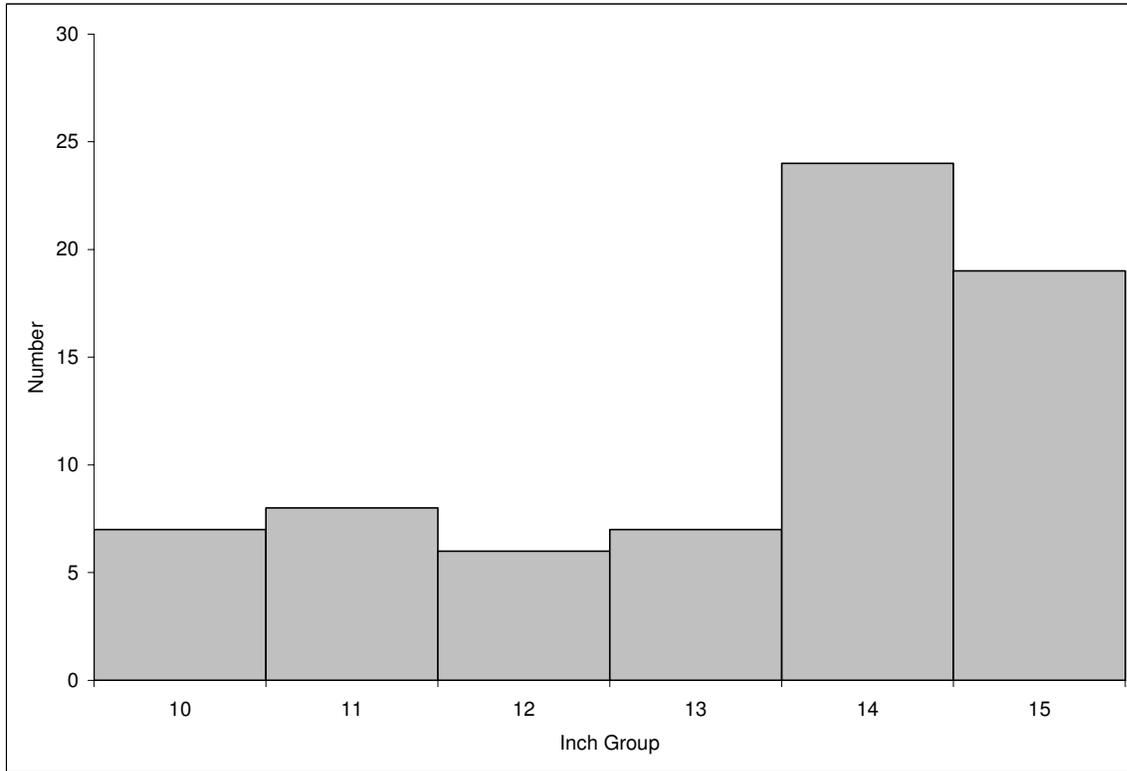


Figure 9. Length frequency distribution of angler-harvested white bass from Amistad Reservoir in 2007. Sample size was 71 fish.

Striped Bass

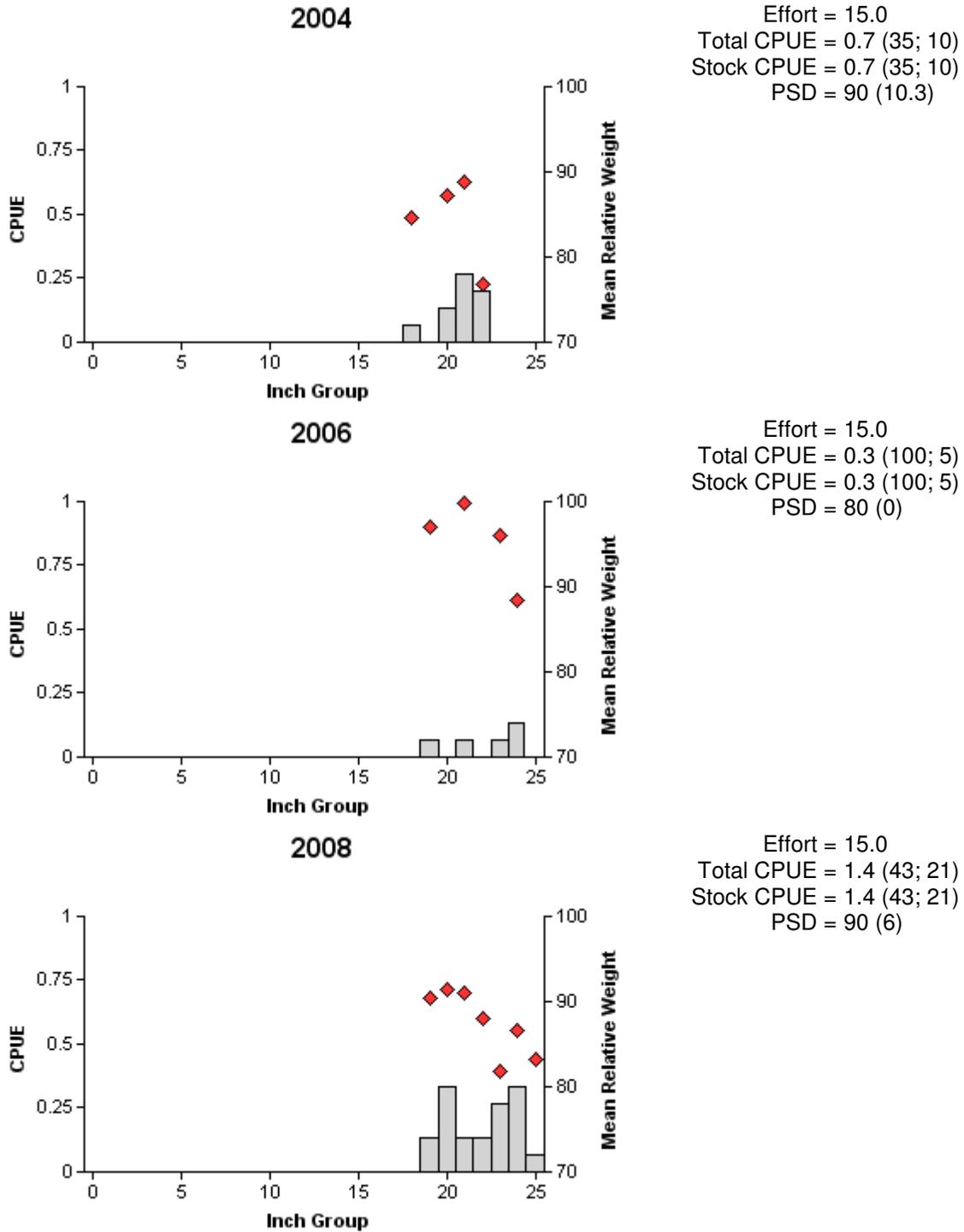


Figure 10. Number of striped bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N are in parentheses) for spring gill net surveys, Amistad Reservoir, Texas, 2004, 2006, and 2008. RSE is used for CPUE values and SE is used for PSD values.

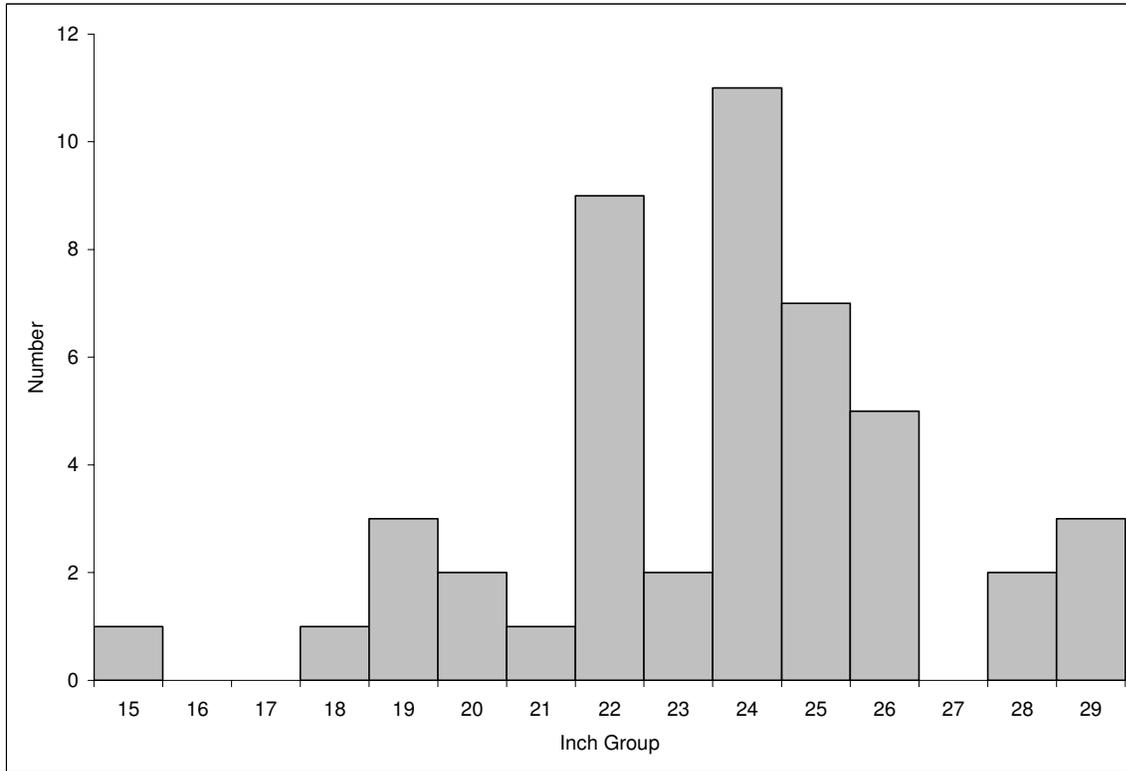
Striped Bass

Figure 11 Length frequency distribution angler-harvested striped bass from Amistad Reservoir in 2007. Sample size was 46 fish.

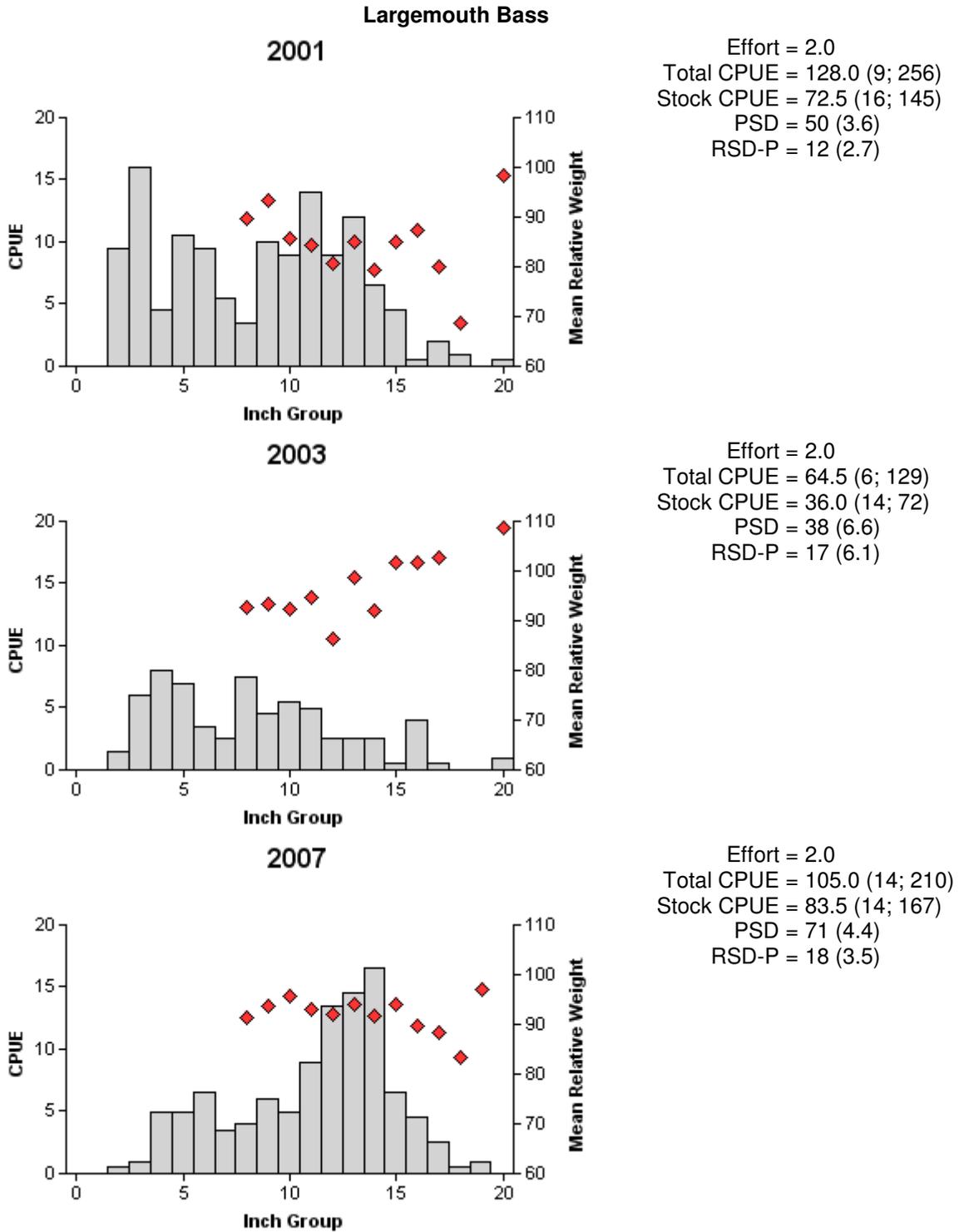


Figure 12. Number of largemouth bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N are in parentheses) for fall electrofishing surveys, Amistad Reservoir, Texas, 2001, 2003, and 2007. RSE is used for CPUE values and SE is used for RSD and PSD values

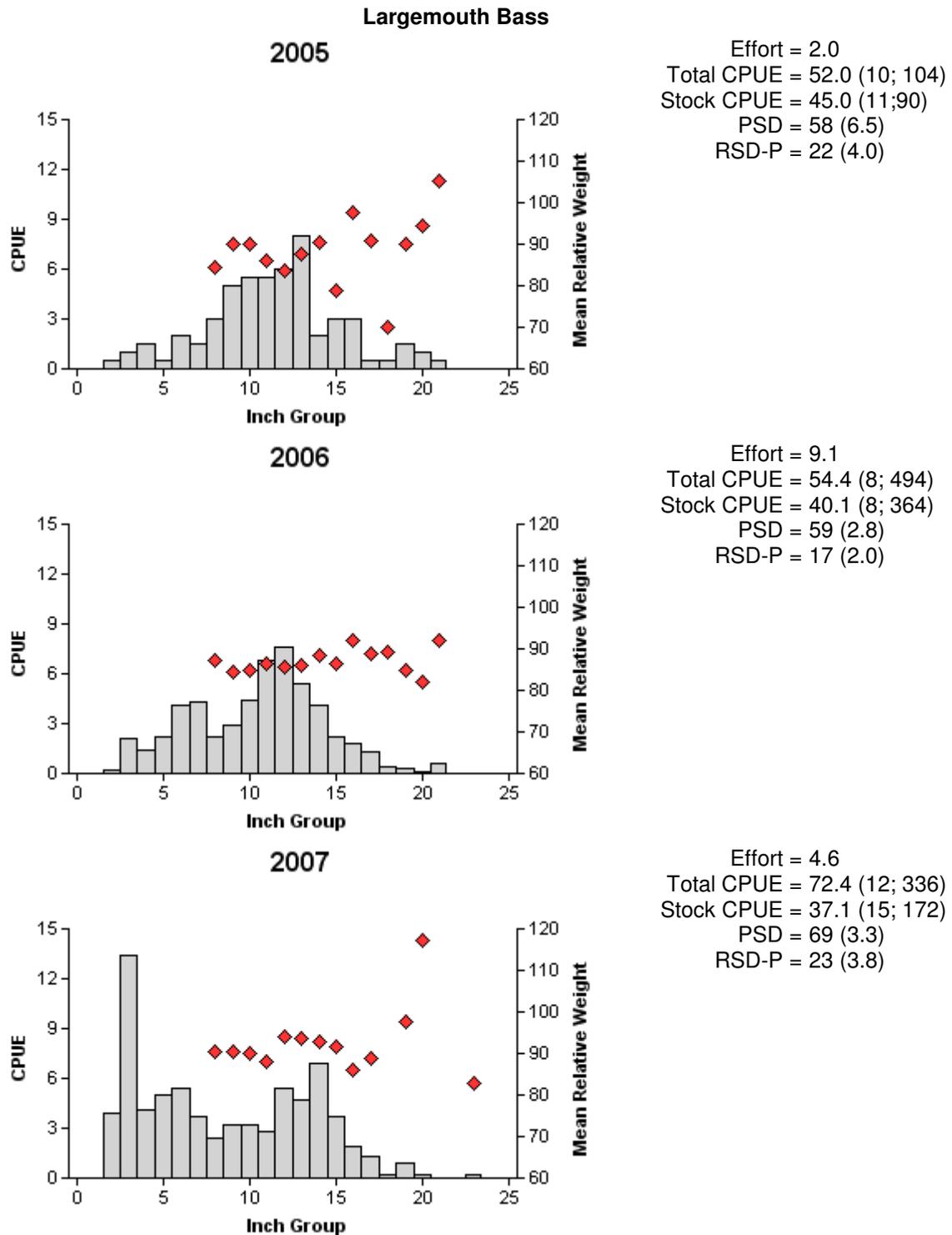
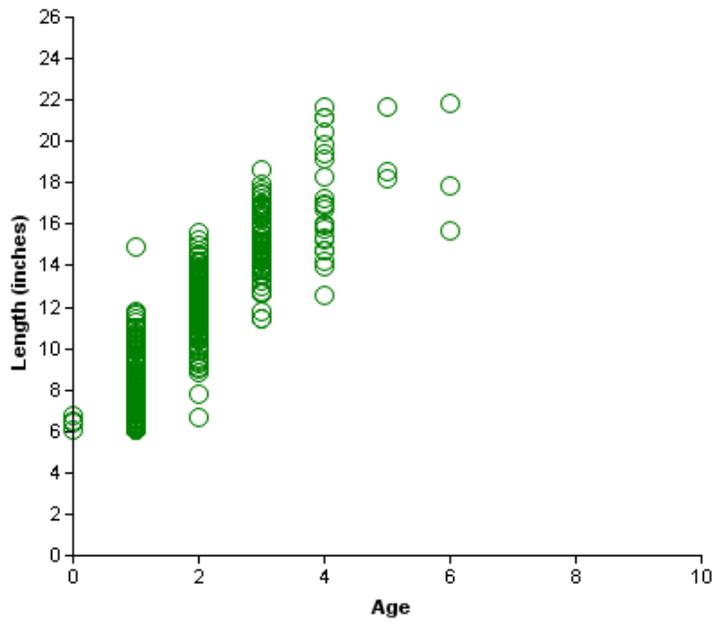


Figure 13. Number of largemouth bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N are in parentheses) for fall bass only electrofishing surveys, Amistad Reservoir, Texas, 2005, 2006, and 2007. RSE is used for CPUE values and SE is used for RSD and PSD values. The 2005 sample was conducted at random night time stations. The 2006 and 2007 samples were conducted during day and night, with random and biologist selected stations.

2006



2007

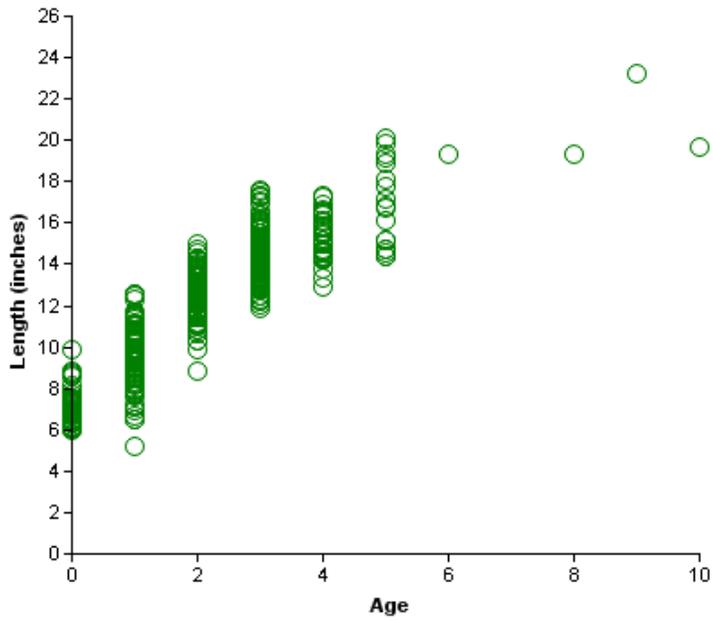


Figure 14. Length of capture by age for largemouth bass collected by electrofishing from Amistad Reservoir, Texas, November 2006 and 2007. Sample sizes were 414 fish in 2006 and 401 fish in 2007.

Harvested Largemouth Bass

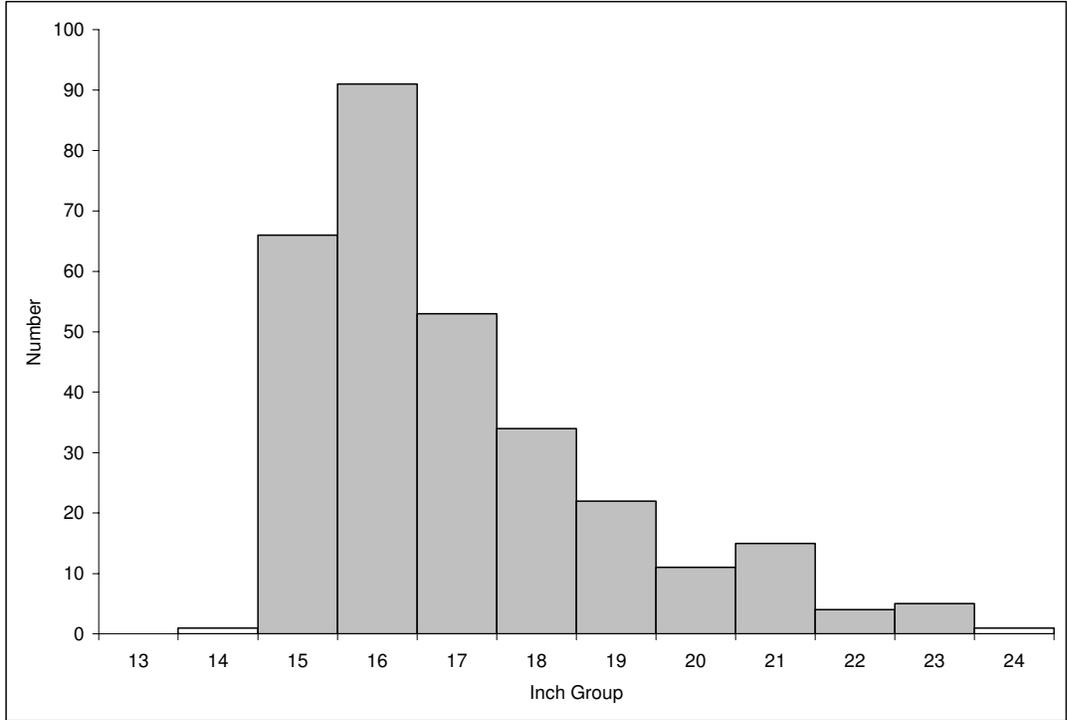


Figure 15. Length frequency distribution of angler-harvested largemouth bass from Amistad Reservoir in 2007. Sample size was 303 fish.

Tournament Weighed-In Largemouth Bass

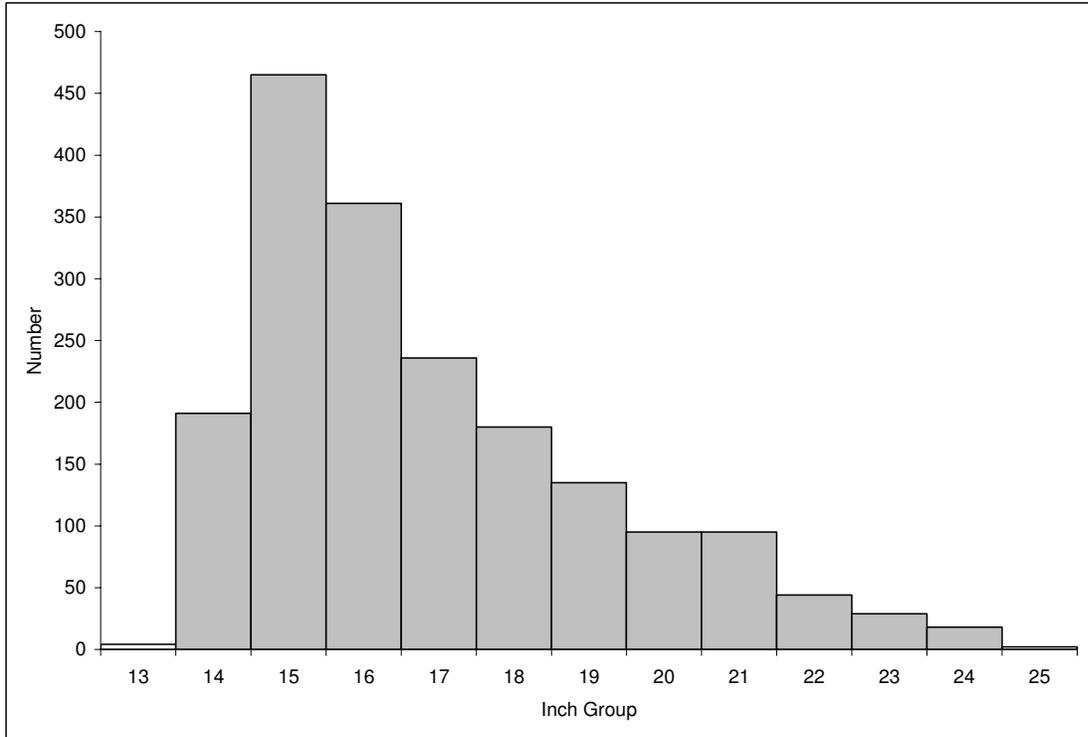


Figure 16. Length frequency distribution of largemouth bass brought to tournament weigh-ins for live release tournaments at Amistad Reservoir in 2007. Sample size was 1,855 fish.

Table 5. Results of genetic analysis of largemouth bass collected by electrofishing during fall from Amistad Reservoir, Texas. Intergrade fish are those with both Florida largemouth bass (FLMB) and northern largemouth bass (NLMB) genes. Genetic analysis procedures changed from electrophoresis to micro satellite DNA in 2006. Thus, the 2006 % FLMB genotype estimate can not be validly compared with previous estimates. Comparisons across year of % FLMB alleles values are valid.

Year	Sample size	Number of fish by genotype			% FLMB alleles	% FLMB genotype
		FLMB	Intergrade	NLMB		
1991	29	2	27	0	74.6	6.9
1993	35	4	29	2	49.3	11.4
1996	19	4	15	0	72.4	21.1
1999	32	10	21	1	68.0	31.3
2001	99	19	79	1	71.5	19.2
2003	50	23	27	0	80.5	46
2006	413	55	357	1	76	13

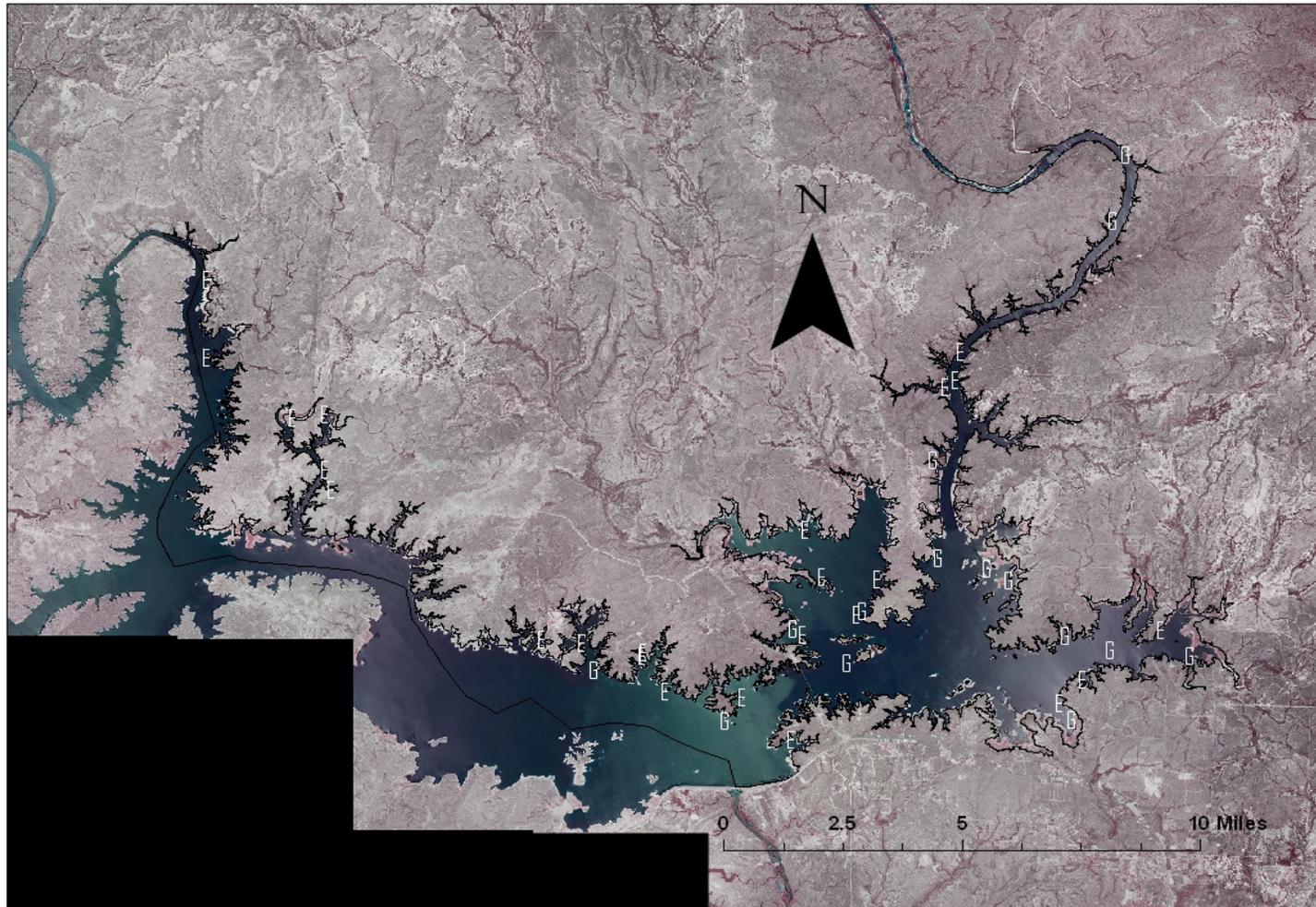
Table 6. Number by weight category of angler-caught largemouth bass >14 inches immediately released at Amistad Reservoir in 2007. During creel interviews, anglers provided estimated weights of legal-size fish which they caught and immediately released. Below values are reservoir wide annual estimates.

Weight category (lbs)	Number
<4	119,381
4 -7	17,463
7-10	1,364
>10	136
Total >4	18,963
Total >7	1,500

Table 7. Proposed sampling schedule for Amistad Reservoir, Texas. Gill netting surveys are conducted in the spring, while electrofishing and trap netting surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

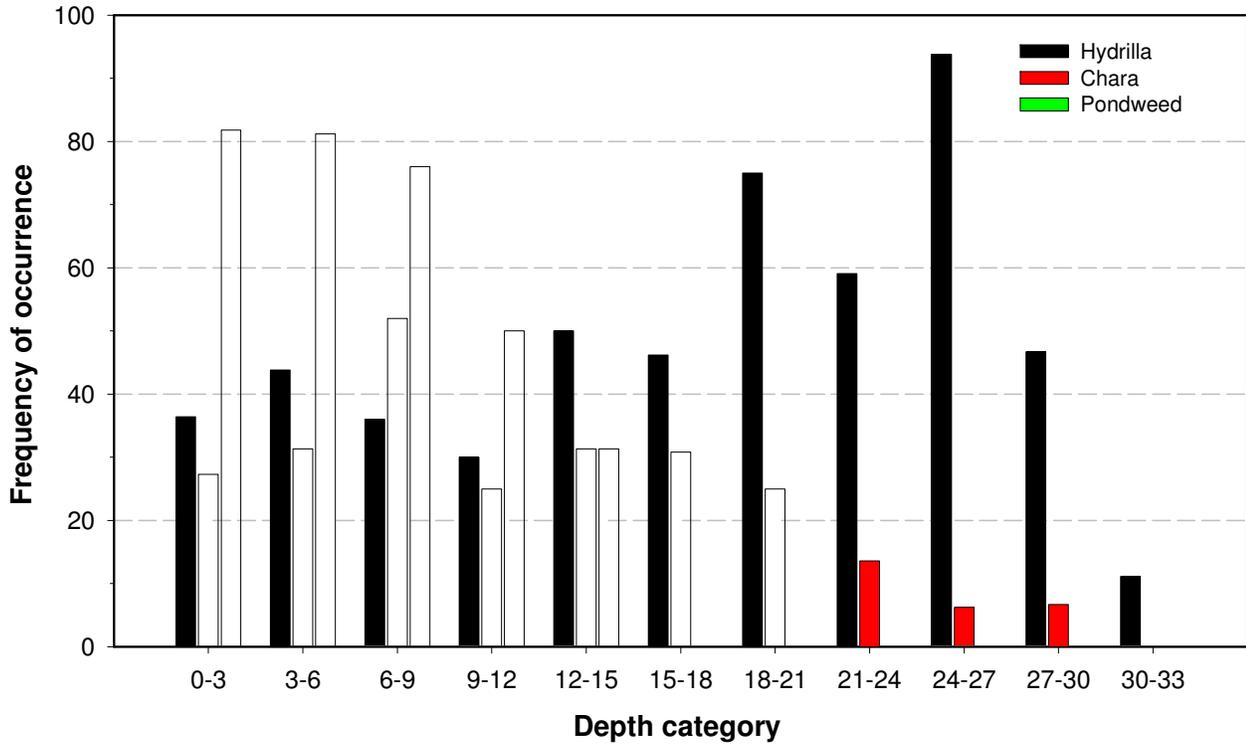
Survey Year	Electrofishing	Trap Net	Gill Net	Creel Survey	Report
Fall 2008-Spring 2009					
Fall 2009-Spring 2010	A		A		
Fall 2010-Spring 2011					
Fall 2011-Spring 2012	S		S		S

Appendix A



Location of gill net (G) and electrofishing (E) sampling sites, Amistad Reservoir, Texas, 2006-2007. Aerial photography is from the 2006 survey by the Water Development Board available from the Texas Natural Resources Information System (TNRIS) website.

Appendix B



Frequency of occurrence (percent) of the three most abundant submersed vegetation species/types by 3-foot depth category for the Texas side of Amistad Reservoir in August 2007. Sample size by depth category ranged from 9 to 25 random points

Appendix C

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Amistad Reservoir, Texas, 2007-2008.

Species	Gill Netting		Electrofishing	
	N	CPUE	N	CPUE
Gizzard shad			74	37.00
Blue catfish	5	0.33		
Channel catfish	22	1.47		
Flathead catfish	8	0.53		
White bass	50	3.33		
Striped bass	21	1.4		
Redbreast sunfish			134	67.00
Green sunfish			3	1.50
Warmouth			24	12.00
Bluegill			180	90.00
Longear sunfish			2	1.00
Redear sunfish			32	16.00
Largemouth bass			210	105.00

Appendix D

Creel estimates for Amistad Reservoir boat anglers for the annual period 03/1/2002-2/28/2003. Species represents angler-targeted species or species group. Angling effort is in hours with percent of total angling hours shown in parentheses. Harvest and catch is actual number of fish and HPUE and CPUE represent mean number of fish caught and harvested, respectively, per angling hour.

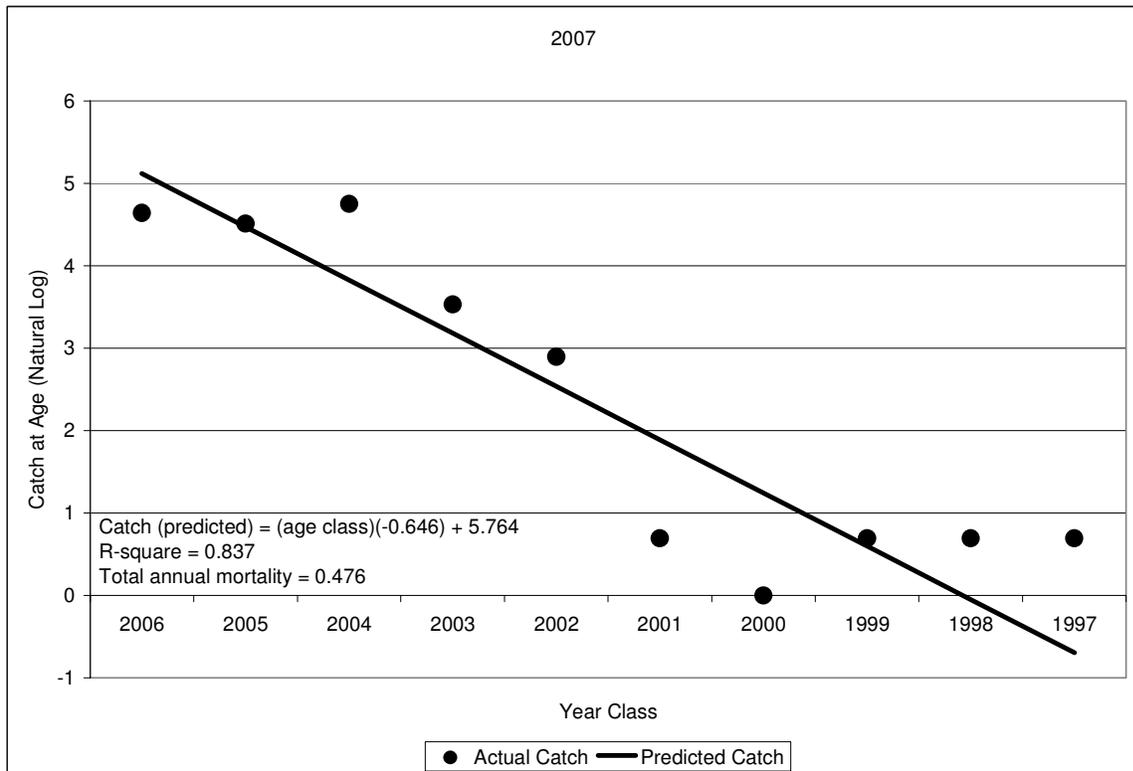
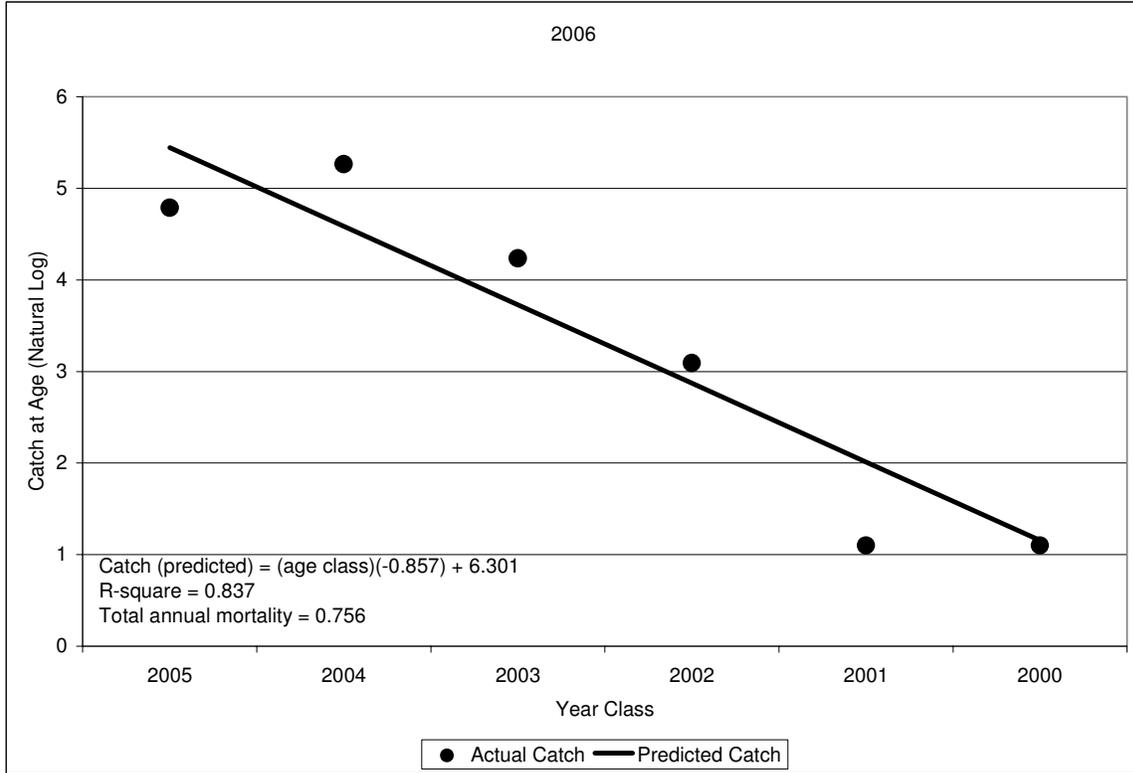
Species	Angling hours	Harvest	Catch	HPUE	CPUE
Catfish spp.	7,229
Channel catfish	23,549	15,220	24,746	0.65	1.05
Other catfish spp.	2,046	1,898	2,668	0.92	1.30
Catfishes total	32,824 (10)	17,118	27,414	.	.
White bass	13,968	34,566	45,459	2.47	3.25
Striped bass	3,824	2,991	5,156	0.78	1.3
Hybrid striped bass	586	72	87	0.12	0.15
Temperate basses total	18,378 (6)	37,629	50,702	.	.
Largemouth bass	265,273	15,822	196,593	0.06	0.74
Spotted bass	.	28	633	.	.
Smallmouth bass	.	48	65	.	.
Black basses total	265,273 (83)	15,898	197,291	.	.
Sunfish spp.	2,230 (<1)	7,513	8,080	3.40	3.60
Crappies	664 (<1)	952	1,241	1.43	1.87
Other species/anything	104 (<1)	214	368	.	.
All species total	319,473	79,324	285,096	.	.

Appendix E

Creel estimates for Amistad Reservoir boat anglers for the annual period 01/01/2007-12/31/2007. Species represents angler-targeted species or species group. Angling effort is in hours with percent of total angling hours (by species group) shown in parentheses. Harvest and catch is actual number of fish and HPUE and CPUE represent mean number of fish caught and harvested, respectively, per angling hour. Angling effort and harvest estimates were computed by largemouth bass angler type (tournament and non-tournament); tournament angler types were live release of weighed-in fish (LR), harvest of weighed-in fish (NR), and practicing for tournament scheduled to occur within 30 days (P).

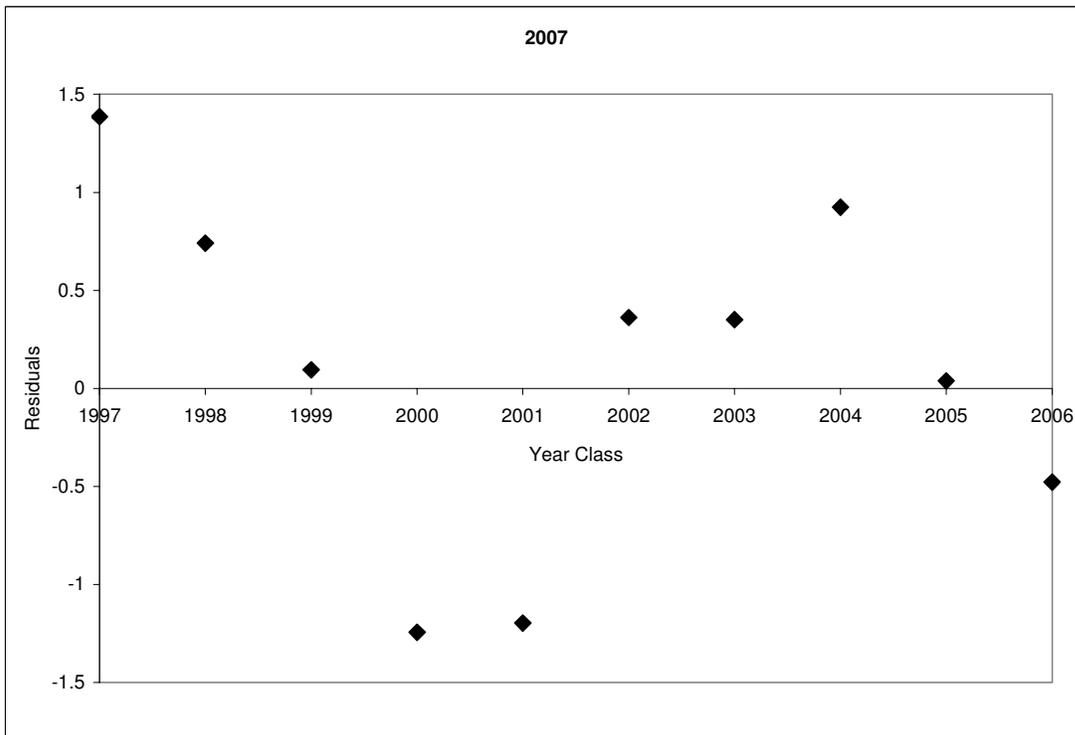
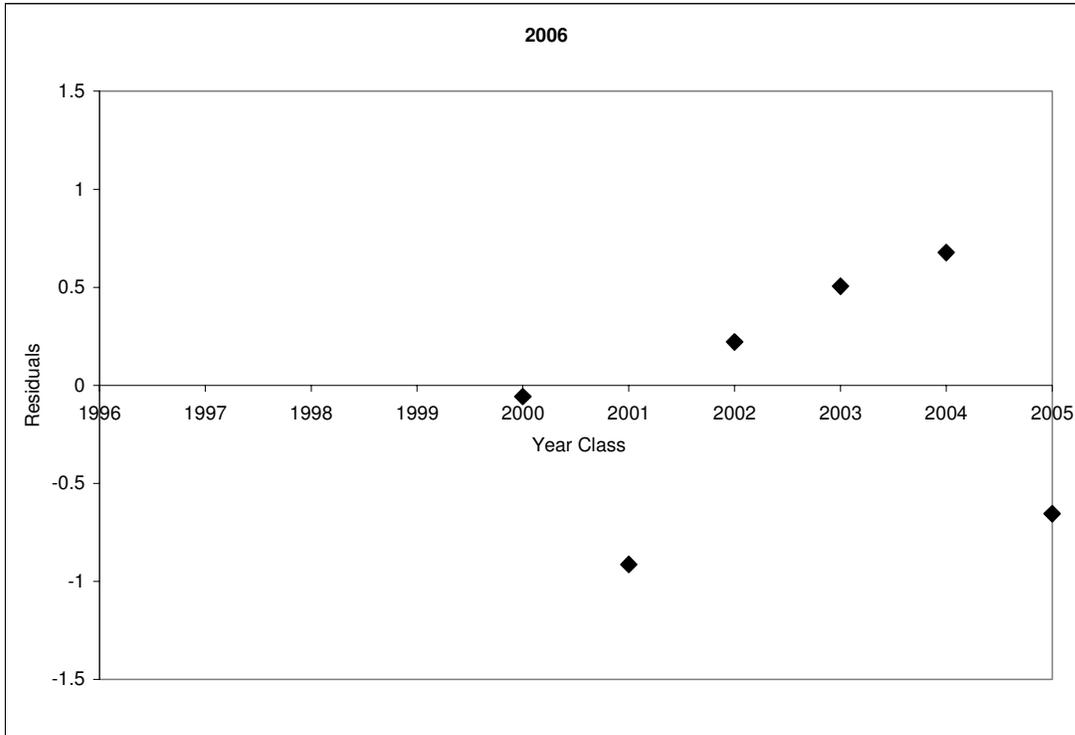
Species	Angling hours	Harvest	Catch	HPUE	CPUE
Catfish spp.	20,067		740		0.31
Channel catfish		5,077	5,077		
Flathead catfish		98	98		
Catfishes total	20,067 (3)	5,175	5,915		
Temperate bass spp.	2,297				0.66
White bass	4,539	5,881	6,872	0.60	0.63
Striped bass	2,490	3,183	5,780	0.60	1.13
Temperate basses total	9,326 (1)	9,064	12,652		
Largemouth bass	601,855	55,123	415,985	0.10	0.80
Tournament -LR	130,069	29,559			
Tournament-NR	3,093	1,712			
Tournament-P	119,342	1,426			
Non-tournament	349,351	22,426			
Smallmouth bass			246		
Black basses total	601,855 (93)	55,123			
Sunfish spp.	653 (<1)	754	1,240	0.27	0.27
Crappies			30		
Anything	11,713 (2)				
All species total	643,515	70,116	436,068		

Appendix F



Plot of largemouth bass catch curves to illustrate total annual mortality.

Appendix G



Plot of residuals from largemouth bass catch curves shown in Appendix F to illustrate varying year class strength. Points below the line represent relatively weak year classes and points above the line represent strong year classes.

Appendix H

Results of socio-economic survey of Amistad Reservoir anglers conducted in 2007.

General Fishing Activity

- The majority of Amistad anglers primarily fished lakes or reservoirs, averaging 44 days in the past 12 months. These same anglers averaged 7 days fishing in farm ponds or stock tanks, 5 days fishing in rivers and streams, and 2.5 days fishing in saltwater.
- Slightly over half of all Amistad anglers (57%) participated in fishing tournaments, averaging 11 tournaments in the past year.

Specific Trip Information

- Only 13% indicated that this was their first trip to the Amistad Reservoir area
- Anglers averaged 8 days on their trip, with an average of 7 days fishing.
- 93% made this trip with the primary purpose of fishing.
- More than half of all anglers (61%) stayed in Val Verde county for the majority of their trip, 37% stayed in the city of Del Rio. Only 2% stayed outside Val Verde County.
- 95% of anglers indicated the opportunity to fish at Amistad was “important” (14%) or “very important” (81%) for their decision to stay in the Amistad area.
- Slightly less than 10% of all anglers participated in other recreational activities during their trip.
- More than three-fourths (76%) of anglers indicated they were “very satisfied” or “extremely satisfied” with their trip to the Amistad Reservoir area.

Overall Fishing Activity, Attitudes, and Management Preferences

- The majority of anglers (71%) indicated they fish at Amistad Reservoir because of the “reputation of the fishery”. More than half of all anglers (58%) indicated they fish Amistad because of the “beauty of the reservoir”. Approximately one-third of anglers indicated “fishing tournaments” (39%) “close to home” (33%), and “facilities” (32%). Only 16% indicated “accommodations”, while 7% indicated “close to a National Park”.
- Anglers averaged 29 days fishing at Amistad in the previous 12 months.
- Anglers primarily targeted largemouth (or black) bass as their primary species of fish sought on Amistad Reservoir.
- The majority of anglers had never used a guide or charter fishing service on Amistad Reservoir.
- Anglers, on average, have spent 14 years fishing at Amistad Reservoir.
- 81% had previously fished at Amistad Reservoir while a fishing tournament was in progress and were not a participant. 70% of those anglers did not think the tournament affected their quality of fishing, 26% said it negatively affected, only 4% said it positively affected their fishing.

- More than half of all anglers (60%) had previously participated in a fishing tournament on Amistad Reservoir. During the past 12 months, anglers averaged participation in 4 tournaments on Amistad.
- Slightly more than half (55%) of anglers reported never targeting striped bass while fishing at Amistad, 20% indicated “occasionally,” 14% indicated “frequently, and ” 4% indicated “very frequently.”
- 81% of anglers were “very satisfied” (48%) or “extremely satisfied” (33%) with their fishing experiences at Amistad Reservoir.

Demographics

- 97% of anglers were male.
- Amistad anglers averaged 51 years of age.
- Approximately one-fourth (24%) of anglers have a temporary residence in the Del Rio area. Of those, the majority indicated a trailer or cabin.
- More than one-third (37%) of Amistad anglers reported annual household incomes, before taxes, of \$100,000 or more. More than half (52%) of anglers reported incomes greater \$80,000.