

PERFORMANCE REPORT

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INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2014 Fisheries Management Survey Report

**Amistad Reservoir**

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## SURVEY AND MANAGEMENT SUMMARY

Fish populations in Amistad Reservoir were surveyed in 2014-2015 using electrofishing and gill netting. Anglers were surveyed from January to June 2015 with a creel survey. Historical data are presented with the 2014-2015 data for comparison. 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 Texas-Mexico border impoundment on the Rio Grande River. It was constructed in 1969 and managed by the International Boundary and Water Commission to provide water for irrigation and hydro-electric power generation. Boat and angler access is excellent; the National Park Service (NPS) maintains 11 public boat ramps. Water level declined from full pool in 2011 to a record 61 feet low in 2013. Water level has increased since 2013 and has remained at 28-30 feet low since December 2014. Aquatic vegetation coverage was lower in 2011-2014 than in previous years, and hydrilla is the predominant species.
- **Management History:** Important sport fishes include Largemouth Bass, catfishes, Striped Bass, and White Bass. Striped Bass were stocked in most years since 1974. Florida Largemouth Bass (FLMB) were stocked periodically from 1975 to 2006 and annually since 2010 to improve FLMB introgression and trophy Largemouth Bass potential. 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 via a tournament permitting program.
- **Fish Community**
  - **Prey species:** Shad and sunfish spp. comprise the primary prey in the reservoir. Relative abundance of aforementioned prey was low in recent years.
  - **Catfishes:** Channel Catfish is the predominant catfish species present in the reservoir. Relative abundance of Channel Catfish has been consistently low since 2011. Catfish angling annually accounted for 1.1-7.3% of total angling effort at the reservoir.
  - **Temperate basses:** White Bass and Striped Bass relative abundance has been consistently low since 2011. White Bass attain legal harvestable size between age 1 and 2. Temperate Basses angling annually accounted for 1.4-6.5% of total angling effort at the reservoir.
  - **Black Basses:** Largemouth Bass relative abundance has declined in recent years due to extreme water level fluctuation and an associated decrease in aquatic vegetation coverage. Largemouth Bass angling annually accounted for 84-95% of total angling effort at the reservoir. Catch of Smallmouth Bass increased considerably in recent years. Black bass tournament angling comprises a substantial portion of the fishery.
- **Management Strategies:** Continue to provide a Striped Bass fishery supported by annual stockings. Continue stocking FLMB annually to maintain high FLMB introgression and trophy potential. Work cooperatively with Amistad Reservoir stakeholders to address issues that arise. Conduct electrofishing, gill net, and vegetation surveys every other year and a creel survey every four years.

## INTRODUCTION

This document is a summary of fisheries data collected from Amistad Reservoir in 2014-2015. 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 fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2014-2015 data for comparison.

### *Reservoir Description*

Amistad Reservoir is a 63,680 acre impoundment on the Rio Grande River, of which 34,312 acres (54%) lie within Texas (Appendix A). It was constructed in 1969 by the International Boundary and Water Commission to provide water for irrigation and hydro-electric power generation. Most of the Texas shoreline is federally owned and managed by the National Park Service (NPS) as a National Recreation Area. On average, there were 153 tournament events and 31,472 black bass weighed-in per year (Amistad Reservoir Black Bass Tournaments, 2008 Annual Report). The total economic value of the fishery was estimated to be \$22.7 million in 2007 (Schuett et al. 2012). Other descriptive characteristics for the reservoir are contained in Table 1. Local anglers speculated poor fishing in 2013 and 2014 was due to copper toxicity caused by heavy inflows from a portion of the Mexico watershed containing copper mines. The Texas Commission on Environmental Quality (TCEQ) analyzed water, sediment, and fish tissue for excessive copper and found non-toxic levels in 2014 (personal communication, Elsa Hull TCEQ). A fish kill involving multiple species occurred in April 2015 at the upper end of the reservoir. Testing by TPWD staff confirmed presence of golden alga at a moderate toxicity level; this was the first documented golden alga related fish kill in the reservoir.

### *Angler Access*

The NPS maintains 11 public boat ramps at the reservoir, with most having courtesy docks. Two ramps (Diablo East and Rough Canyon) remained open when water level reached record low level in 2013. The NPS also provides two fish cleaning stations and operates a tournament permitting and scheduling program to avoid over-crowding at boat ramps and to obtain tournament catch statistics. Shoreline angling access is limited and fishing is not allowed at boat ramp locations. Boat ramp characteristics are in Table 2.

### *Management History*

**Previous management strategies and actions:** Management strategies and actions from the previous survey report (Myers and Dennis 2012) included:

1. Stock Striped Bass annually at 3-5 fish/acre to maintain fishery.  
**Action:** Striped Bass fingerlings were stocked in 2014 (153,371 fish) and 2015 (325,606 fish). Stockings were not conducted in 2011-2013 due to unavailability.
2. Stock FLMB fingerlings to maintain Largemouth Bass trophy potential.  
**Action:** A total of 1.72 million FLMB were stocked since 2012.
3. Monitor for the presence of invasive species.  
**Action:** Golden alga related fish kills have been documented to occur in the Pecos River which is a tributary of the River Grande located about 20 miles upstream of Amistad Reservoir. A fish kill involving multiple species occurred in April 2015 in Amistad Reservoir at the confluence of the Rio Grande River. Testing by TPWD staff confirmed presence of golden alga at a moderate toxicity level, representing the first documented golden algae related fish kill in the reservoir.

**Harvest regulation history:** Harvest of all sport fishes has been managed according to statewide regulations since reservoir impoundment (Table 3).

**Stocking history:** Florida and northern strain Largemouth Bass, Blue and Channel catfishes, Smallmouth Bass, Striped Bass, Palmetto Bass, Walleye, Northern Pike, and Muskellunge have been stocked. All fishes except FLMB and Striped Bass are no longer stocked. Annual stockings of FLMB have been conducted since 2010 to maintain high FLMB introgression and trophy potential. Striped Bass were stocked in most years since 1974 to support a fishery. The complete stocking history is in Table 4.

**Vegetation/habitat management history:** Management actions for aquatic vegetation have consisted of routine monitoring of relative abundance. A few dozen left over Christmas trees donated by Home Depot in Del Rio were secured to large cement blocks and deployed in an area near a shoreline access area to serve as a fish attractor.

**Water transfer:** Amistad Reservoir is used to store, conserve, and distribute water for downstream irrigation needs in both Mexico and the U.S. Rio Grande River water is allocated per terms of a treaty formed in 1944 between the two countries. Each country has separate operational control of the dam and release water in response to downstream irrigation needs. No inter-basin transfer of water is known to exist.

## METHODS

Fishes were collected by electrofishing (2 hours at 24 5-minute stations) during spring 2014 and 2015. The 2014 survey was for bass only and conducted during daytime and the 2015 survey was for all species and conducted during night time. Fishes were collected by gill netting (15 net nights at 15 stations) in spring 2015. 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). All sampling stations were randomly selected on the Texas portion of the reservoir (Appendix A) and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2014).

An access-point creel survey was conducted from January to June in 2015. Angler interviews were conducted on 12 weekend days and 18 weekdays to estimate angler use and fish catch/harvest in accordance with the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2014)

Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD), terminology modified by Guy et al. 2007], 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). Standard error (SE) was calculated for structural indices and IOV. Relative standard error ( $RSE = 100 \times SE$  of the estimate/estimate) was calculated for all CPUE and creel statistics. Ages were determined for selected species using otoliths.

A vegetation survey was conducted during fall 2014 using the random point method to quantify coverage of aquatic vegetation (TPWD, Inland Fisheries Division, unpublished manual revised 2014). A shoreline structural habitat survey was last conducted in 2010 (Myers and Dennis 2012).

Source for water level data was the International Boundary and Water Commission United States Rio Grande Watermaster Report emailed directly to our office weekly.

## RESULTS AND DISCUSSION

**Habitat:** The reservoir experiences extreme water level fluctuations (Figure 1). During the study period, water level declined about 60 feet to a record low level, and then increased about 25 feet, remaining relatively stable in 2014-2015. Aquatic vegetation coverage was lower during the study period than in previous years due to extreme water level fluctuations (Figure 2). Percent occurrence of combined vegetation was estimated at 16.9% in 2014 (Table 5). Hydrilla remained the predominant species. Aquatic vegetation was nearly non-existent in the reservoir in 2013 when water level dropped to a record low-level (author's personal observations). In 2010 when water level was two feet below conservation elevation, the predominant substrate at the land-water interface was rock, with flooded terrestrial vegetation occurring at 68% of the sampling locations (Myers and Dennis 2012).

**Creel:** Largemouth Bass continue to be the most sought after fish at Amistad (between 83.6 and 95.2% of directed effort in the past three surveys), followed by catfishes and *Marone* species (Table 7). Directed effort declined over the past three surveys from 369,605 h in 2007 to 295,314 h in 2012 to 237,397 h in 2015 (Table 7). While the recreational fishery at the reservoir continues to have a high economic value in 2015 (\$3.3 million in direct expenditures), it dropped from 2012 (\$4.3 million; Table 7).

**Prey species:** Shad and sunfish spp. comprised the primary prey in the reservoir. Electrofishing CPUE of Gizzard Shad and Threadfin Shad were low in recent years. Electrofishing CPUE of Gizzard Shad was 37.0 fish/h in fall 2007 and 16.5 fish/h in fall 2011 and IOVs were 0 and 3, respectively (Figure 3). In the spring of 2015, 11.5 fish/h were collected by electrofishing (Appendix B). Electrofishing CPUE of Threadfin Shad was 0.5 fish/h in spring 2015 (Appendix B). Similarly, CPUE of Bluegill, Redear Sunfish, and Redbreast Sunfish was 173 to 122 fish/h (combined) with fall electrofishing (Figures 4-6) and was also low in 2015 with spring electrofishing ( $\leq 13$  fish/h; Appendix B). Extreme fluctuation in water level which included a record low water level during the study period led to a reduction in aquatic plant coverage, and in turn, decreased abundance of prey species, reduced vulnerability to electrofishing, or a combination of both. Sunfishes comprise a small fraction of the fishery (Table 6).

**Catfishes:** Channel, Blue, and Flathead catfishes were present in the reservoir and Channel Catfish were the predominant species. Gill net CPUE of channel catfish was similar in 2011, 2012, and 2015, ranging from 0.9 to 1.7 fish/nn (Figure 7). The majority of fish collected in 2015 were available for angler harvest with individuals up to 21 inches collected. From January-June 2015 (6 months), catfishes angler effort was 18,512 h and harvest was 2,963 fish, whereas from January-June 2012 (6 months), catfishes angler effort and harvest was 3,191 h and 3,165 fish, respectively (Table 8). Most of the Channel Catfish harvested ranged in size from 14-18 inches in 2015 (Figure 8).

**White Bass:** Relative abundance of White Bass remained consistent from 2011 to 2015, with gill net CPUE ranging from 2 to 4.5 fish/nn (Figure 9). Stock size fish continue to account for the majority of the fish sampled, with PSD ranging from 70-96 across years. Four year classes were represented in the 43 fish collected in gill nets in 2015 (Figure 10) that were aged. White Bass attained legal-harvestable size between age 1 and 2. White bass angler effort, catch and harvest have increased since 2007 (Table 9). From January-June 2015 (6 months), White Bass angler effort was 11,504 h and harvest was 6,512 fish, whereas from January-June 2012 (6 months) angler effort and harvest was 3,852 h and 5,544 fish, respectively. The most common size White Bass harvested was 11 inches in 2015 (Figure 12).

**Striped Bass:** Striped Bass gill net CPUE was low, ranging from 0.1 to 0.9 fish/nn from 2011 to 2015 (Figure 12). Lack of fingerling stockings from 2011 to 2013 contributed to the low relative abundance. The 14 fish collected in 2015 were identified through ageing to belong to the 2014 (N = 12 fish) and 2009 (N = 2 fish) stocked year classes. Mean length of 2014 year class fish at time of collection (about 9 months after stocking) was 11.6 inches. From January-June 2015 (6 months), Striped Bass angler effort was 895 h and catch was 384 fish, whereas from January-June 2012 (6 months) angler effort and catch was 480 h and 137 fish, respectively (Table 10). The most common size Striped Bass harvested was 24

inches in 2015 and some illegal harvest was documented (Figure 12).

**Smallmouth Bass:** Anecdotally, anglers and tournament directors reported increased catches of Smallmouth Bass in 2015 compared to previous years. Hatchery staff (TPW) collected adult Smallmouth Bass from a March 2015 tournament to be used as brood fish. Electrofishing CPUE of Smallmouth Bass was 1.0 fish/h in spring 2015. From January-June 2015 (6 months), there was no directed effort for Smallmouth Bass, but incidental catch by Largemouth Bass anglers was 3,712 fish, which is a slight increase over the 3,411 fish caught in the 2012 creel survey (Table 11).

**Largemouth Bass:** Relative abundance of Largemouth Bass was variable between 2007 and 2012, ranging from high of 126 fish/h in 2009 to a low of 64 fish/h in 2011 from fall night all species and bass-only electrofishing surveys (Figures 14-15). Spring surveys in 2014 (day time bass only) and 2015 (day time all species) exhibited much lower CPUEs (30 and 56 fish/hr, respectively; Appendix B). The lower CPUEs in 2014 and 2015 follow extreme fluctuations in water level, including a record low water level set in 2013, and attendant decrease in aquatic vegetation and likely reflect a decrease in relative abundance. The creel survey results, discussed below, give further evidence of a decrease in abundance. Despite the decline in overall relative abundance, stock size fish continued to represent a substantial portion (>50%) of largemouth bass collected, and PSD remains above 50 for all samples since 2007. Average relative weights were adequate (>80) for most size classes from all surveys (including the latest 2015 spring daytime collection) with the exception of some of the 18-20 inch fish collected in 2011 and 2012. Six year classes (2008-2013) were identified from a sample 12 aged fish ranging in size from 13 to 15 inches TL collected in spring 2015. This suggests slow growth in recent years. Introgression of FLMB into the population has not been assessed since 2011, however from 2003 to 2011, FLMB alleles were consistently high ranging from 73 to 80% (Myers and Dennis 2012). Annual stockings of FLMB were initiated in 2010 to maintain a high FLMB introgression, and in turn, trophy potential. Angler effort directed at largemouth bass in 2015 (198,559 h in 6 months) was lower than in 2012 (281,150 h in 6 months) and in 2007 (343,226 h in 6 months; Table 12). Tournament angler effort represented approximately 33-40% of all effort for the last three creel surveys. Angler catch rates in 2015 was 0.47 fish/h which is much lower than the 0.80 fish/h and 0.73 fish/h in 2007 and 2012, respectively. Additionally, tournament weigh-in and released fish dropped by an order of magnitude from 2012 to 2015 (35,954 and 3,249, respectively). No Largemouth Bass  $\geq$ 10 pounds were reported caught and released in 2015. The most common size largemouth bass harvested was 14-16 inches (Figure 16).

## Fisheries Management Plan for Amistad Reservoir, Texas

Prepared – July 2015.

**ISSUE 1:** Striped Bass are a popular sport fish at Amistad Reservoir. Annual stocking is 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:** Amistad is well known for its high quality largemouth bass fishery and for catches of trophy- size fish. The reservoir was ranked as the 6th best largemouth bass fishing destination in 2012 by ESPN-Bassmaster. It has produced 12 ShareLunkers (Largemouth Bass that weigh more than 13 pounds and are donated to TPW for brood fish), five of which were caught between 2008 and 2012. While numerous largemouth bass weighing over 10 lbs. have been caught according to the 2012 creel survey, none were reported in 2015. This is likely an effect of the record low water levels in 2013.

### MANAGEMENT STRATEGY

1. Annually stock FLMB fingerlings at the rate of 1,000/ km of shoreline to maintain a high level Florida bass introgression and maximize production of trophy fish.

**ISSUE 3:** Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels (*Dreissena polymorpha*) can multiply rapidly and attach themselves to any available hard structure, restricting water flow in pipes, fouling swimming beaches and plugging engine cooling systems. Giant salvinia (*Salvinia molesta*) and other invasive vegetation species can form dense mats, interfering with recreational activities like fishing, boating, skiing and swimming. The financial costs of controlling and/or eradicating these types of invasive species are significant. Additionally, the potential for invasive species to spread to other river drainages and reservoirs via watercraft and other means is a serious threat to all public waters of the state.

### MANAGEMENT STRATEGIES

1. Cooperate with the controlling authority to post appropriate signage at access points around the reservoir.
2. Contact and educate marina owners about invasive species, and provide them with posters, literature, etc... so that they can in turn educate their customers.
3. Educate the public about invasive species through the use of media and the internet.
4. Make a speaking point about invasive species when presenting to constituent and user groups.
5. Keep track of (i.e., map) existing and future inter-basin water transfers to facilitate potential invasive species responses.

**ISSUE 4:** Multiple government agencies are charged with monitoring and management of the reservoir. These include International Boundary and Water Commission, National Park Service, Texas Commission on Environmental Quality, and TPWD. Although agency responsibilities differ, issues arise such as renovation of the fish release tube, Largemouth Bass barotrauma, copper toxicity concern, and golden algae monitoring that are best addressed through coordinated efforts.

#### MANAGEMENT STRATEGY

1. Work cooperatively with government agencies responsible for monitoring and managing the reservoir.

**Objective-Based Sampling Plan for Amistad Reservoir**  
**2016-2019**

Sport fish, forage fish, and other important fishes

The primary sport fish in Amistad Reservoir is Largemouth Bass; 85-95% of the fishing effort was directed at Largemouth Bass in the past three creel surveys. Other sport fish include Channel Catfish, White Bass, Striped Bass, and Smallmouth Bass. Known important forage species include Bluegill, Redbreast Sunfish, and Gizzard Shad.

Survey objectives, fisheries metrics, and sampling objectives

**Largemouth bass:** Largemouth Bass are the most highly sought after sport fish in the Reservoir. This fishery is a popular destination for anglers from all across the nation having been ranked in the top 10 (including #1) of the 100 top bass fishing lakes in the nation, by ESPN-Bassmasters. This reservoir experiences extreme water level fluctuations and changes in habitat which leads to fluctuations in Largemouth Bass abundance, size structure, and fishing quality. Since 2001, the Largemouth Bass population has been sampled on a biennial basis to track trends in abundance, size structure, growth, and Florida Bass gene introgression. As one of the premier Largemouth Bass fisheries in the nation, continued biennial sampling will be needed to track changes in the relative abundance and size structure, and trigger further investigations into issues and conditions as they arise. Fall night time electrofishing will occur every other fall (2016 and 2018) and spring night time bass only electrofishing will occur every other spring (2017 and 2019). The fall surveys will consist of 18 randomly selected 5-minute stations. Based on our evaluation of existing electrofishing data,  $RSE \leq 20$  for CPUE-(S), the collection of 50+ stock-sized and larger bass for size structure determination, 30 fish for genetic analysis, and 13 fish between 13.0 and 14.9 inches for age and growth analysis with approximately 12 stations. However, we chose to set the total effort at 18 stations because of the distance from the office to the reservoir requiring an overnight stay. Spring surveys will consist of 24 randomly selected stations to collect 50+ fish for size structure determination and should allow for an  $RSE \leq 25$  for CPUE-(S). No further sampling effort will be expended in the spring. Fishing quality (as determined by directed effort and angler catch rates) will be measured with a 6-month creel survey conducted January through June, 2018. Sixteen creel survey days per quarter will be sampled. Effort will be split approximately 50:50 between weekend and weekday creels. Sample sites (boat ramps) will be stratified among the six most used boat ramps using vehicle counts supplied by the National Park Service.

**Smallmouth Bass:** Electrofishing surveys do not sample Smallmouth Bass effectively in Amistad Reservoir; however, anglers do report catches of these fish. Large scale changes in angler use will be monitored by determining angler catch, harvest, and directed effort of Smallmouth Bass during the 2018 creel survey described in the Largemouth Bass section.

**Channel Catfish:** Our survey objective is to monitor for large-scale changes in angler use. The sampling objective is to determine angler catch, harvest, and angler effort from the creel survey in 2018 (described in the Largemouth Bass section).

**White Bass:** The objective for White Bass is to determine large-scale changes in size structure. From personal observations during previous creel surveys, most anglers targeting White Bass at Amistad Reservoir fish for them in the Castle Canyon and Devil's River areas of the reservoir from January through March. Sampling, therefore, will be accomplished using gill nets at biologist selected stations in each of those areas. A minimum of eight nets will be set for one night in each area to collect a minimum of 50 total stock sized and larger White Bass. If the objective is not met, an additional four nets will be set in each of those areas on a subsequent trip for a maximum effort of 24 gill net nights. Sampling will occur in 2019.

**Striped Bass:** Currently, gill net surveys have not collected sufficient Striped Bass to make meaningful analyses. Striped Bass will be sampled in conjunction with White Bass to determine if biologist selected stations in 'popular' fishing areas will lead to increased catches.

**Bluegill Redbreast Sunfish, and Gizzard Shad:** Bluegill, Redbreast Sunfish, and Gizzard Shad are the primary forage fishes at Amistad Reservoir. Major changes in the relative abundances of Bluegill and Redbreast can be indicated in CPUE (T) trend data for these sunfishes. Sampling of the sunfishes concurrently with the Largemouth Bass in the fall should provide adequate precision ( $RSE \leq 20$ ) for CPUE (T) to detect major changes in relative abundance. Gizzard Shad CPUEs are so variable that trends in abundance cannot be detected with a reasonable amount of sampling effort (see table below). They will be collected concurrently with the Largemouth Bass sampling, but due to the variability, the data will be of minimal use. No additional sampling effort will be expended to increase the precision of Bluegill, Redbreast Sunfish, and Gizzard Shad.

Negligible fisheries

Negligible fisheries in Amistad Reservoir include Blue Catfish, Flathead Catfish, and White Crappie. The presence or absence of these species will be determined from incidental gill net catches.

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Table 1. Characteristics of Amistad Reservoir, Texas.

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

Table 2. Characteristics of the six primary boat ramps at Amistad Reservoir, Texas, August 2014. Reservoir elevation at time of survey was 1,075 feet above mean sea level.

Boat ramp	Latitude and longitude	Public	N parking spaces	Elevation at end of ramp (feet above MSL)	Condition
Diablo East	29.477313 -101.016495	Y	250	unknown	Excellent
Black Brush	29.474045 -100.986480	Y	50	1,077 <sup>a</sup>	Excellent
Air Force	29.473237 -101.037822	Y	50	1,077 <sup>a</sup>	Excellent
Rough Canyon	29.576928 -100.978195	Y	50	unknown	Excellent
Box Canyon	29.524826 -101.173759	Y	50	1,077 <sup>a</sup>	Excellent

<sup>a</sup>estimated

Table 3. Harvest regulations for Amistad Reservoir, Texas.

Species	Bag limit	Length limit
Catfish: Channel and Blue, their hybrids and subspecies	25 (in any combination)	12-inch minimum
Catfish, Flathead	5	18-inch minimum
Bass, White	25	10-inch minimum
Bass, Largemouth and Smallmouth	5 (in any combination)	14-inch minimum
Bass: Striped	5	18-inch minimum
Gar, Alligator	1	none
Crappie: White and Black, their hybrids and subspecies	25 (in any combination)	10-inch minimum

Table 4. Stocking history of Amistad Reservoir, Texas.

Species	Year	Number Stocked	Size
Bass, Florida Largemouth	2014	500,217	Fingerling
	2013	504,890	Fingerling
	2012	269,075	Fingerling
	2011	252,283	Fingerling
	2010	252,550	Fingerling
	2008	501,874	Fingerling
	2004	552,648	Fingerling
	1997	500,943	Fingerling
	1996	130,768	Fingerling
	1992	507,075	Fingerling
	1980	214,700	Fingerling
	1979	450,000	Fingerling
	1978	288,000	Fingerling
	1978	308,000	Fry
	1977	429,420	Fingerling
	1977	244,800	Fry
	1976	260,000	Fingerling
	1975	52,000	Fingerling
	Total	6,219,243	
Bass, Largemouth	2005	289,666	Fingerling
	2004	42,077	Fingerling
	1973	1,050	Unknown
	1972	100	Unknown
	1971	446,660	Unknown
	1969	810,700	Unknown
	1968	928,425	Unknown
	1967	1,053,750	Unknown
	Total	3,572,428	
Bass, ShareLunker largemouth	2010	2,081	Fingerling
	2008	2,614	Fingerling
	2006	4,519	Fingerling
	Total	9,214	
Bass, Smallmouth	1983	200,500	Unknown
	1978	164,750	Unknown
	1976	200,000	Unknown
	1975	100,000	Unknown
	Total	665,250	

Table 4. Continued.

Species	Year	Number Stocked	Size
Bass, Palmetto	1982	1,270,000	Unknown
	1976	173,662	Unknown
	1975	171,300	Unknown
	Total	1,614,962	
Bass, Striped	2015	325,606	Fingerling
	2014	153,371	Fingerling
	2010	152,998	Fingerling
	2009	184,494	Fingerling
	2008	140,348	Fingerling
	2007	127,685	Fingerling
	2006	120,085	Fingerling
	2005	318,908	Fingerling
	2004	99,311	Fingerling
	2002	133,800	Fingerling
	2000	436,717	Fingerling
	1999	67,800	Fingerling
	1998	67,885	Fingerling
	1997	67,463	Fingerling
	1995	100,259	Fingerling
	1994	1,316,638	Fingerling
	1993	255,094	Fingerling
	1993	402,843	Fry
	1992	339,369	Fingerling
	1991	252,371	Fingerling
	1991	80,000	Fry
	1988	850,000	Fry
	1986	180,770	Fingerling
	1984	649,289	Fingerling
	1982	101,000	Unknown
	1980	12,000	Unknown
	1979	255,000	Unknown
	1978	204,891	Unknown
	1977	693,107	Unknown
	1976	62,992	Unknown
	1974	82,616	Fingerling
	Total	8,234,710	

Table 4. Continued.

Species	Year	Number Stocked	Size
Catfish, Blue	1971	5,445	Unknown
Catfish, Channel	1973	50,550	Unknown
	1972	10,100	Unknown
	1971	8,000	Unknown
	1969	77,025	Unknown
	1968	317,695	Unknown
	1967	22,650	Unknown
	Total	486,020	
Crappie, White	1989	144,491	Fry
	1968	100	Unknown
	Total	144,591	
Muskellunge	1976	700	Unknown
Pike, Northern	1976	1,030,305	Unknown
Walleye	1978	5,000,000	Unknown
	1977	2,033,000	Unknown
	1976	5,100,000	Unknown
	1975	5,250,000	Unknown
	1954	10,000	Unknown
	Total	17,393,000	

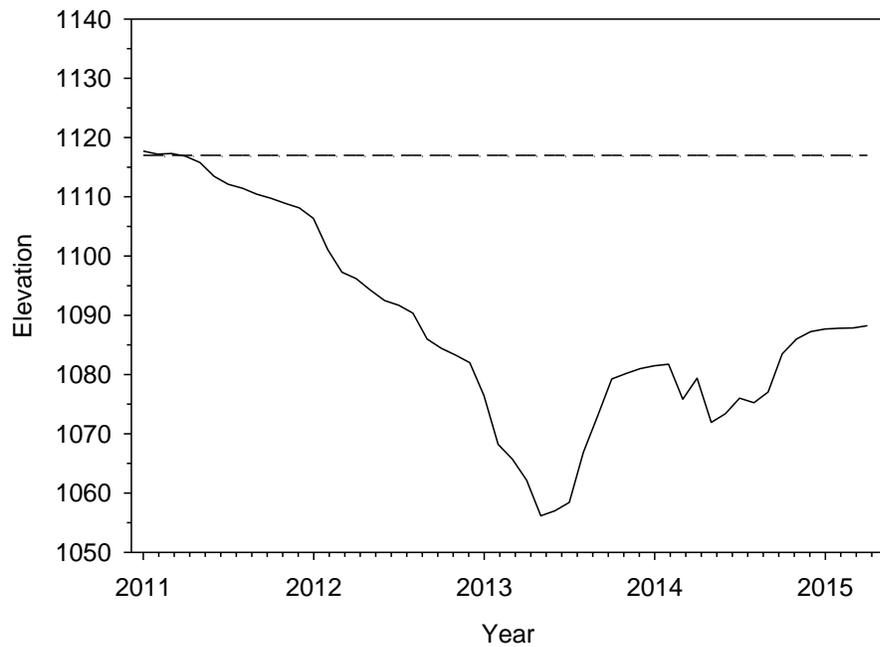
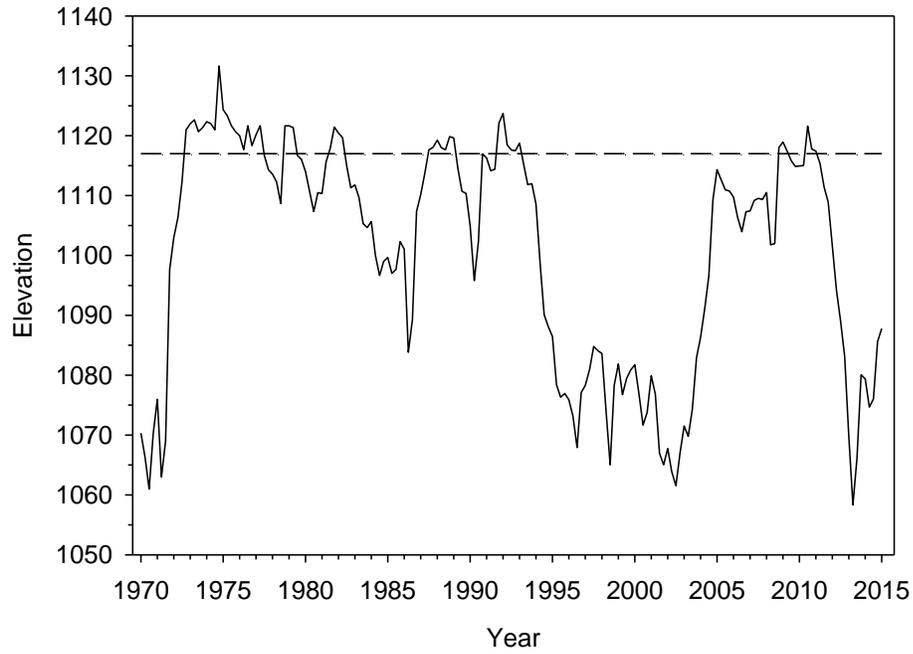


Figure 1. Average water level elevation in feet above mean sea level (MSL) by quarter since 1970 (top panel) and by month since 2011 (bottom panel) for Amistad Reservoir, Texas. Conservation pool elevation is 1,117 feet above MSL and is represented by the horizontal dashed line.

Table 5. Results of vegetation survey conducted at Amistad Reservoir in August 2014. Percent occurrence with lower and upper 95% confidence limits (CL) is shown by vegetation species/type. Sampling occurred at 195 random sites on the Texas side of the reservoir. Water level at time of survey was 1,075 feet (42 feet low).

Species/vegetation type	Percent occurrence	Lower CL	Upper CL
Chara	1.5	0.0	3.3
Hydrilla (Tier III)	8.7	4.8	12.7
Naiad spp.	7.7	4.0	11.4
Pondweed spp.	2.6	0.0	4.8
Native submersed	10.8	6.4	15.1
Combined vegetation	16.9	11.7	22.2

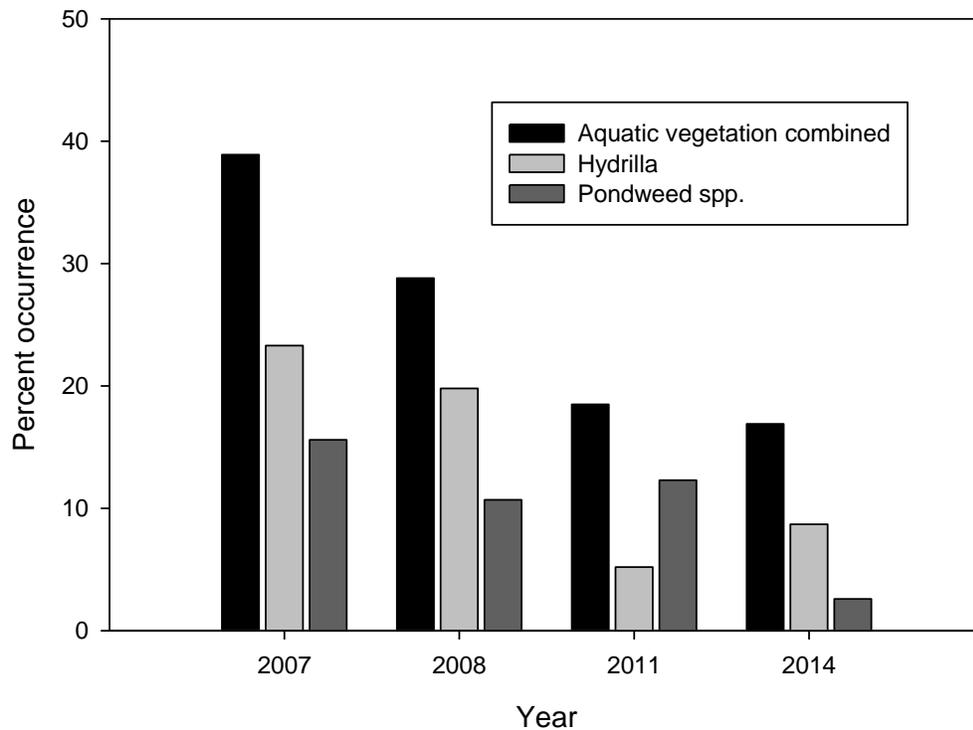


Figure 2. Percent occurrence of aquatic vegetation combined, hydrilla, and pondweed spp. at Amistad Reservoir (Texas side) in 2007-2008, 2011, and 2014.

Table 6. Percent directed angler effort by species for Amistad Reservoir, Texas, 2007, 2012, and 2015. Survey periods were from January 1 to June 30 each year.

Species	2007	2012	2015
Catfishes	3.1	1.1	7.3
Temperate Basses	0	0	1.3
White Bass	1.0	1.3	4.8
Striped Bass	0.4	0.2	0.4
Sunfishes	0.4	0	<0.1
Largemouth Bass	92.9	95.2	83.6
Other and anything	2.3	2.2	2.0

Table 7. Total fishing effort (hours) for all species and total directed expenditures (\$ millions) at Amistad Reservoir, Texas, 2007, 2012, and 2015. Survey periods were from January to June in each year.

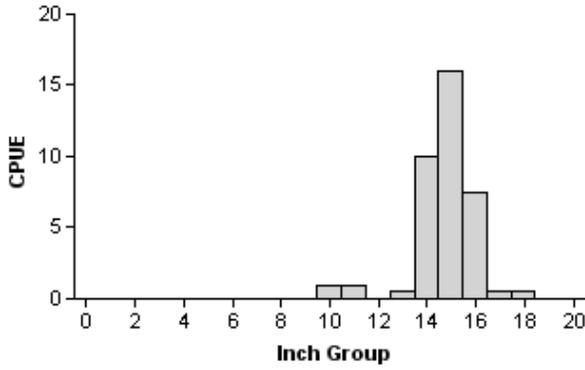
Creel Statistic	2007	2012	2015
Total fishing effort	369,605	295,314	237,397 (27)
Total direct expenditures	14.6 <sup>a</sup>	4.3 <sup>b</sup>	3.3 <sup>b</sup>

<sup>a</sup>annual estimate per Shuett et al. 2012; <sup>b</sup> per TPWD creel survey studies

**Gizzard Shad**

**2007**

Effort = 2.0  
 Total CPUE = 37.0 (31;74)  
 IOV = 0(0)



**2011**

Effort = 2.0  
 Total CPUE = 16.5 (32; 33)  
 IOV = 3 (3)

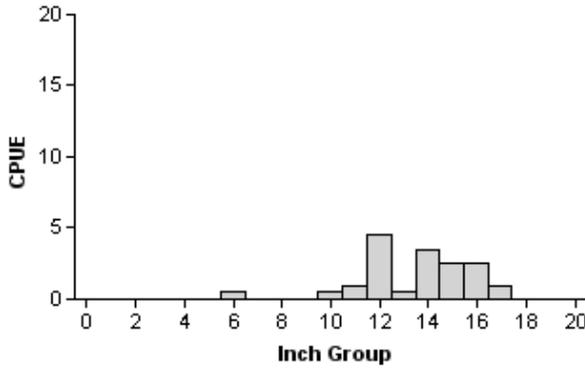


Figure 3. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for 2007 and 2011 fall electrofishing surveys, Amistad Reservoir, Texas.

**Bluegill**

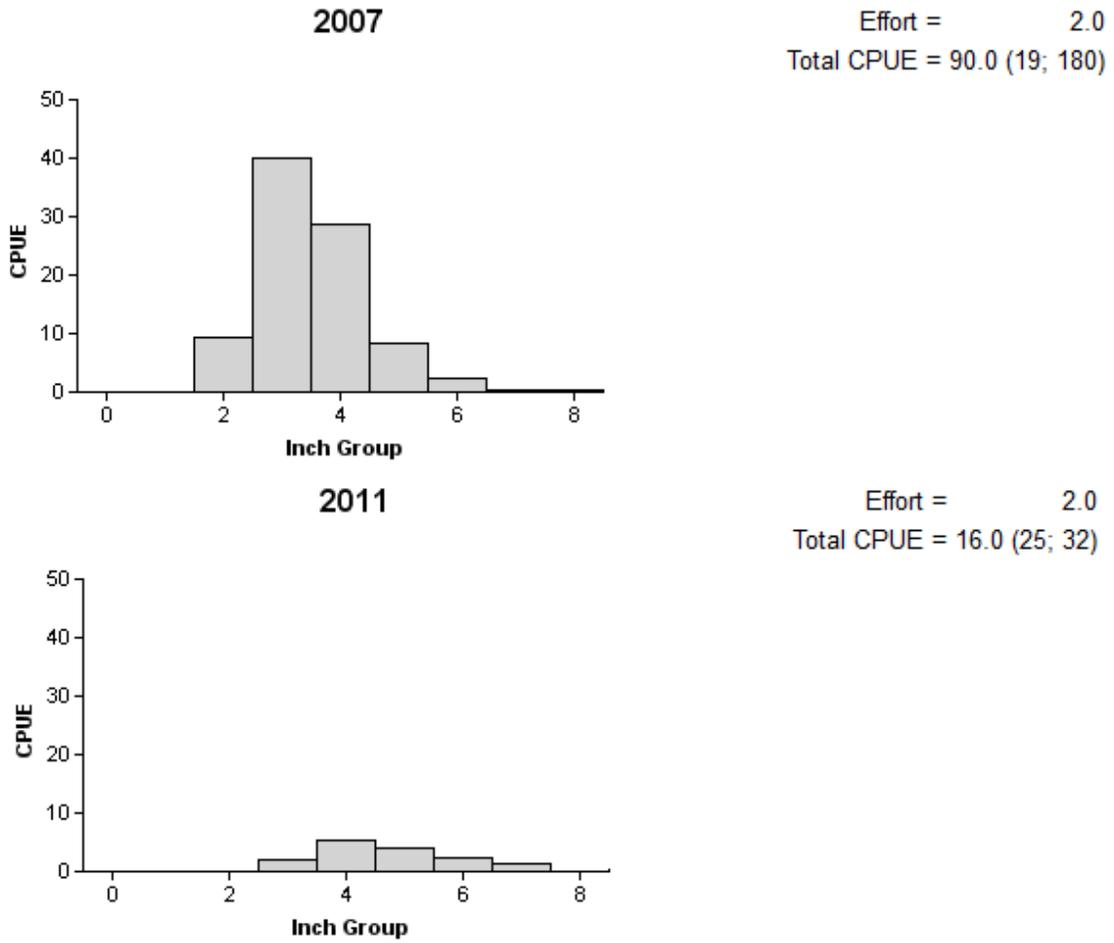
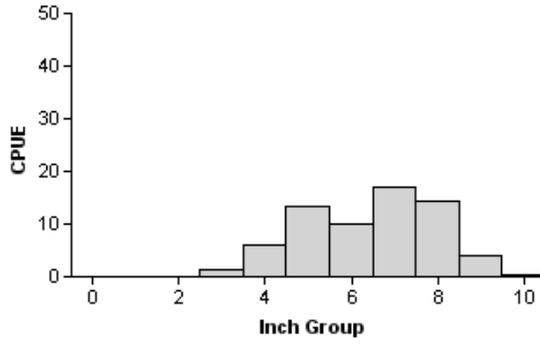


Figure 4. Number of Bluegill caught per hour (CPUE) for 2007 and 2011 fall electrofishing surveys, Amistad Reservoir, Texas. RSE and N are in parentheses.

**Redbreast Sunfish**

**2007**

Effort = 2.0  
Total CPUE = 67.0 (23; 134)



**2011**

Effort = 2.0  
Total CPUE = 103.0 (24; 206)

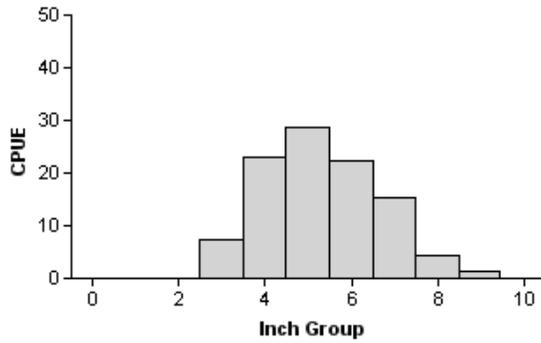
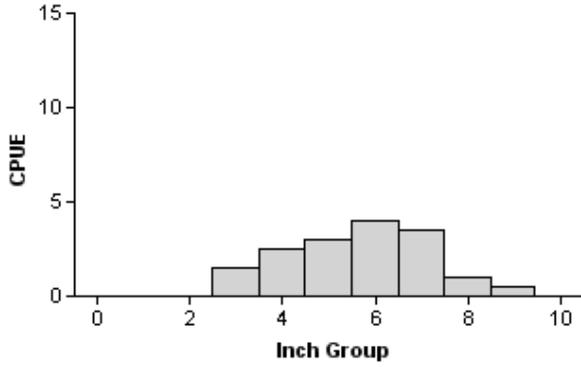


Figure 5. Number of Redbreast Sunfish caught per hour (CPUE) for 2007 and 2011 fall electrofishing surveys, Amistad Reservoir, Texas. RSE and N are in parentheses.

**Redear Sunfish**

**2007**

Effort = 2.0  
Total CPUE = 16.0 (26; 32)



**2011**

Effort = 2.0  
Total CPUE = 2.5 (50; 5)

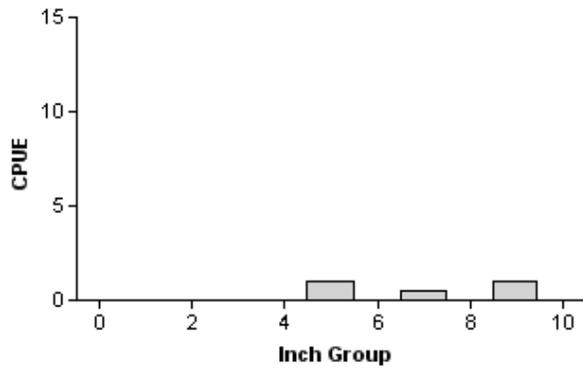


Figure 6. Number of Redear Sunfish caught per hour (CPUE) for 2007 and 2011 fall electrofishing surveys, Amistad Reservoir, Texas. RSE and N are in parentheses.

## Channel Catfish

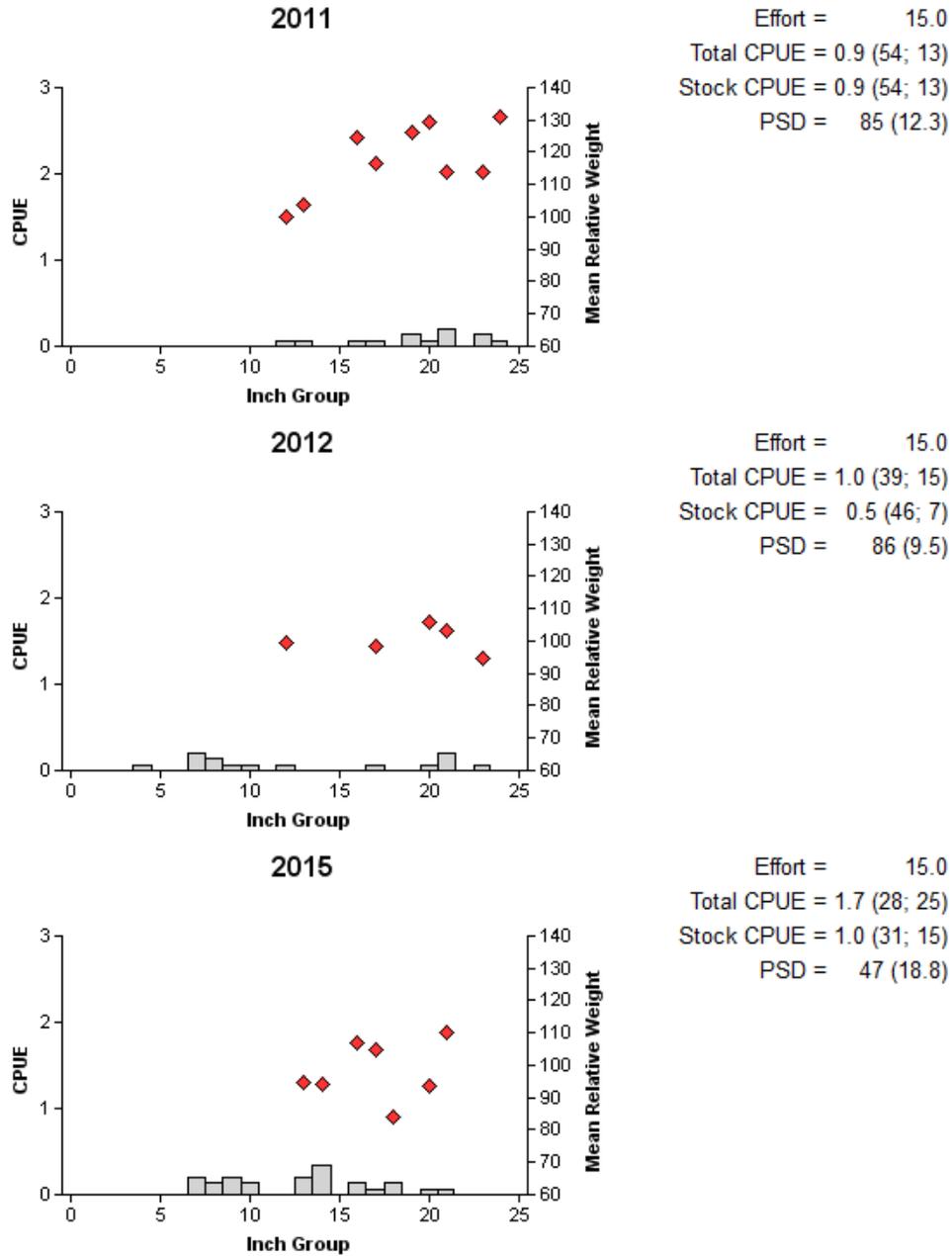


Figure 7. Number of Channel Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Amistad Reservoir, Texas, 2011, 2012, and 2015.

**Catfishes**

Table 8. Creel survey statistics for Catfishes at Amistad Reservoir, Texas, Surveys were conducted from January to June in 2007, 2012, and 2015. Angling effort was estimated for anglers specifically targeting these species. Total harvest and total catch estimates include catfishes caught by anglers targeting these species and by anglers targeting other species. HPUE and CPUE is the average number of fish harvested and caught, respectively, per one-hour angling effort by anglers targeting catfishes. Voluntary release rate is the percentage of legal-size fish (>12 inches for Channel and Blue catfishes and >18 inches for Flathead Catfish) caught and released. Relative standard errors (RSE) are in parentheses.

Creel statistic	2007	2012	2015
Reservoir water level (feet above MSL)	1,108	1,098	1,088
Reservoir surface area (acres)	57,903	49,724	41,940
Angling effort (h):			
Catfishes combined	11,291 (32)	3,191(60)	18,512 (38)
Angling effort/acre (h):			
Catfishes combined	0.19 (32)	0.06 (60)	0.44 (38)
Harvest (number of fish):			
Channel Catfish	1,585 (>100)	2,696 (>100)	2,666 (50)
Blue Catfish	0	469 (>100)	101 (>100)
Flathead Catfish			196 (>100)
Harvest/acre (number of fish):			
Catfishes combined	0.03 (>100)	0.06 (>100)	0.07 (98)
Catch (number of fish):			
Channel Catfish	1,585 (>100)	2,696 (>100)	2,854 (49)
Blue Catfish	0	469 (>100)	101 (>100)
Flathead Catfish			196 (>100)
Voluntary release rate			
Catfishes combined	0	0	9
HPUE:			
Catfishes combined	0.20 (64)	0.73 (73)	0.24 (49)
CPUE:			
Catfishes combined	0.27 (57)	0.73 (73)	0.30 (54)

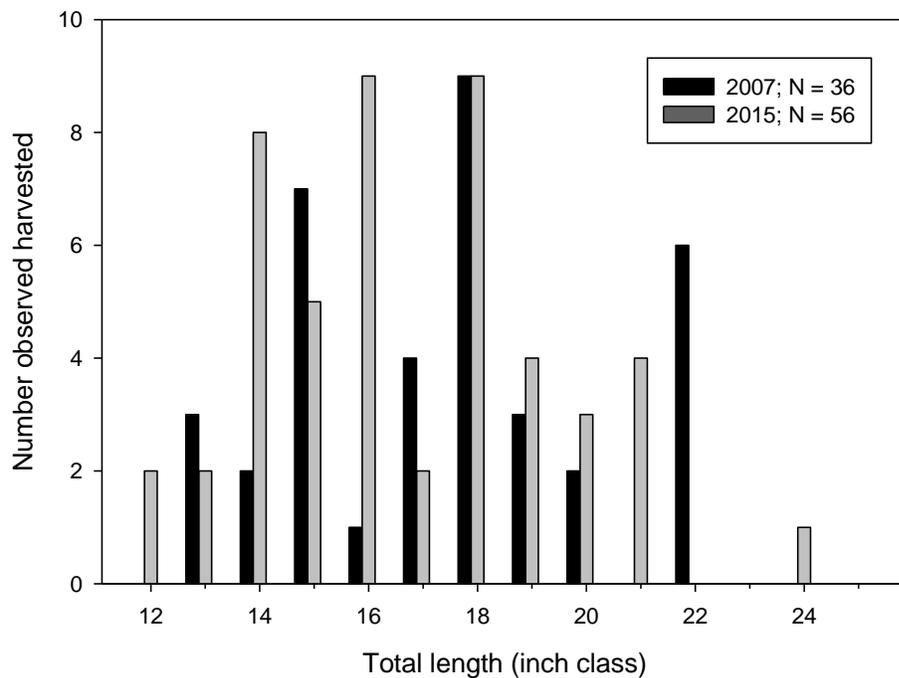


Figure 8. Length frequency of harvested Channel Catfish observed during creel surveys at Amistad Reservoir, Texas, January to June, 2007 and 2015. N is the number of harvested Channel Catfish observed during creel surveys. Insufficient numbers of Channel Catfish in 2012 and Blue and Flathead catfishes in all years were observed harvested to plot length frequencies.

**White Bass**

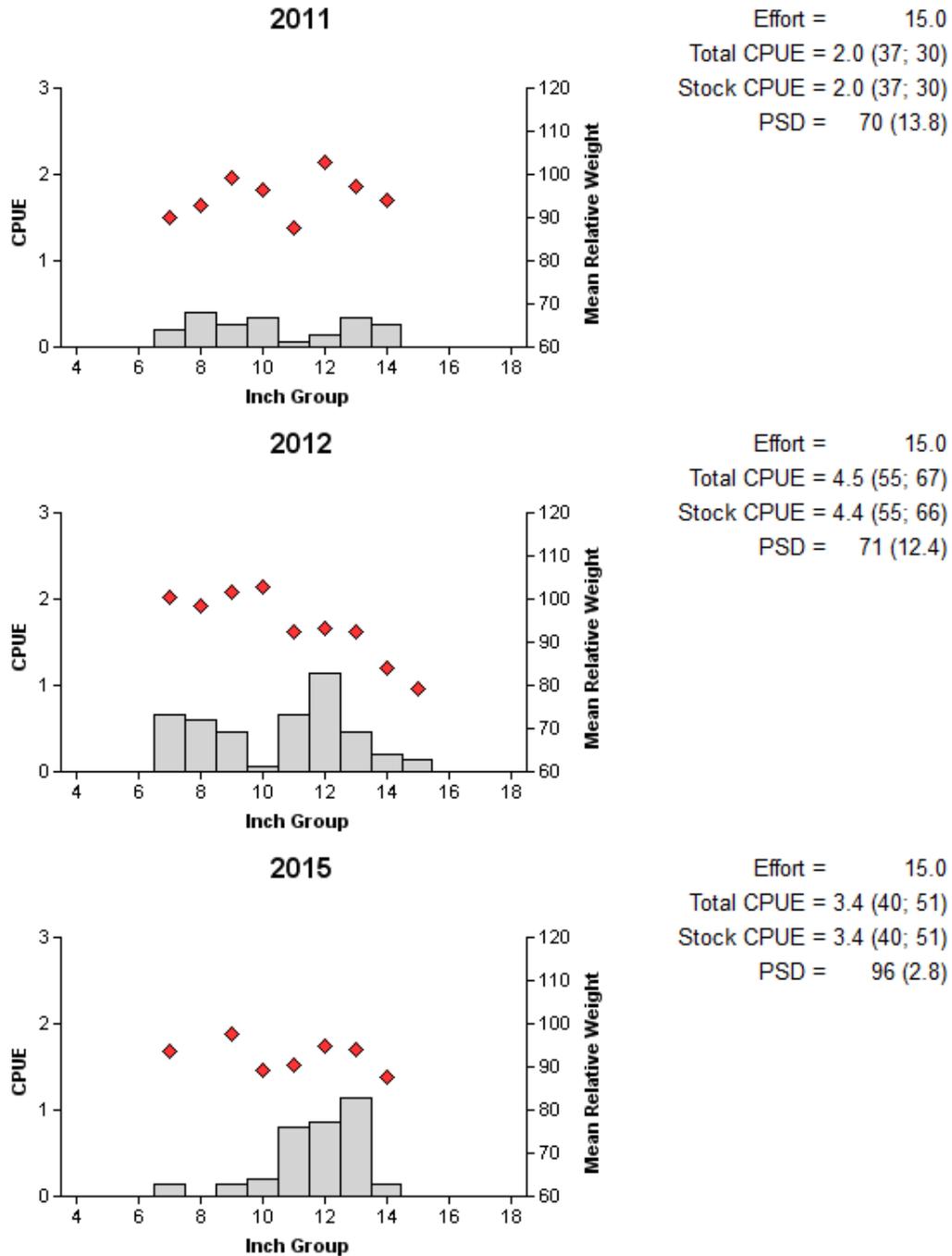


Figure 9. Number of White Bass caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Amistad Reservoir, Texas, 2011, 2012, and 2015.

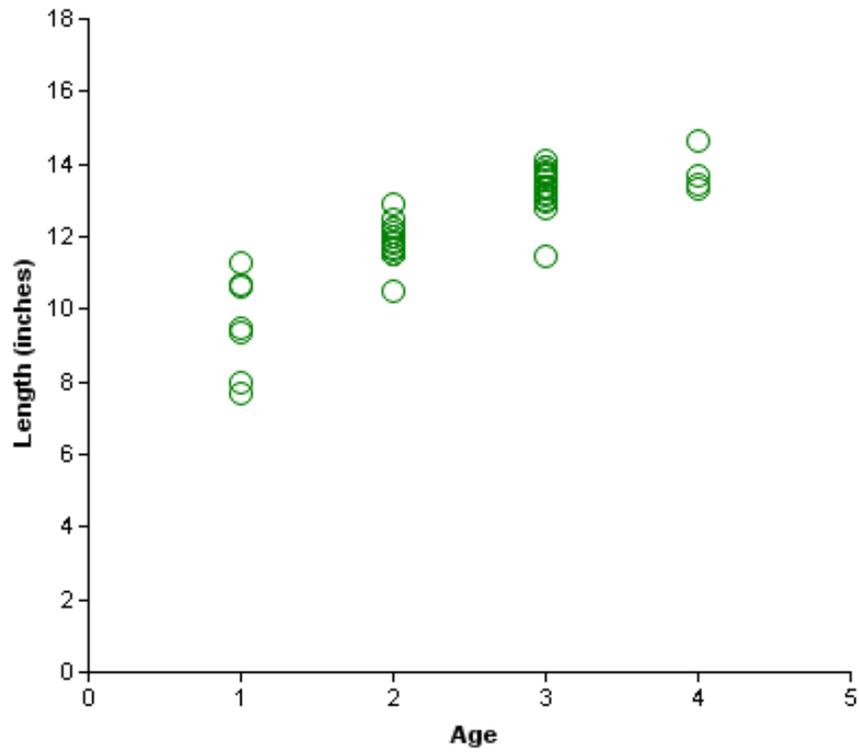


Figure 10. Length at age of 43 White Bass collected by gill netting from Amistad Reservoir in spring 2015.

### White Bass

Table 9. Creel survey statistics for White Bass at Amistad Reservoir, Texas. Surveys were conducted from January to June in 2007, 2012, and 2015. Angling effort was estimated for anglers specifically targeting this species. Total harvest and total catch estimates include White Bass caught by anglers targeting this species and by anglers targeting other species. HPUE and CPUE is the average number of White Bass harvested and caught, respectively, per one-hour angling effort by anglers targeting this species. Voluntary release rate is the percentage of legal-size fish (>10 inches) caught and released. Relative standard errors (RSE) are in parentheses.

Creel statistic	2007	2012	2015
Reservoir water level (feet above MSL)	1,108	1,098	1,088
Reservoir surface area (acres)	57,903	49,724	41,940
Angling effort (h)	3,772 (48)	3,852 (56)	11,504(48)
Angling effort/acre (h)	0.07 (48)	0.08 (56)	0.27 (48)
Total harvest (number of fish)	2,891 (87)	5,544 (98)	6,512 (49)
Harvest/acre (number of fish)	0.05 (87)	0.11 (98)	0.16 (49)
Total catch (number of fish)	3,806 (>100)	6,424 (98)	13,391 (41)
Voluntary release rate	12	14	45
HPUE	0.38 (90)	1.03 (73)	0.61 (37)
CPUE			0.84 (34)

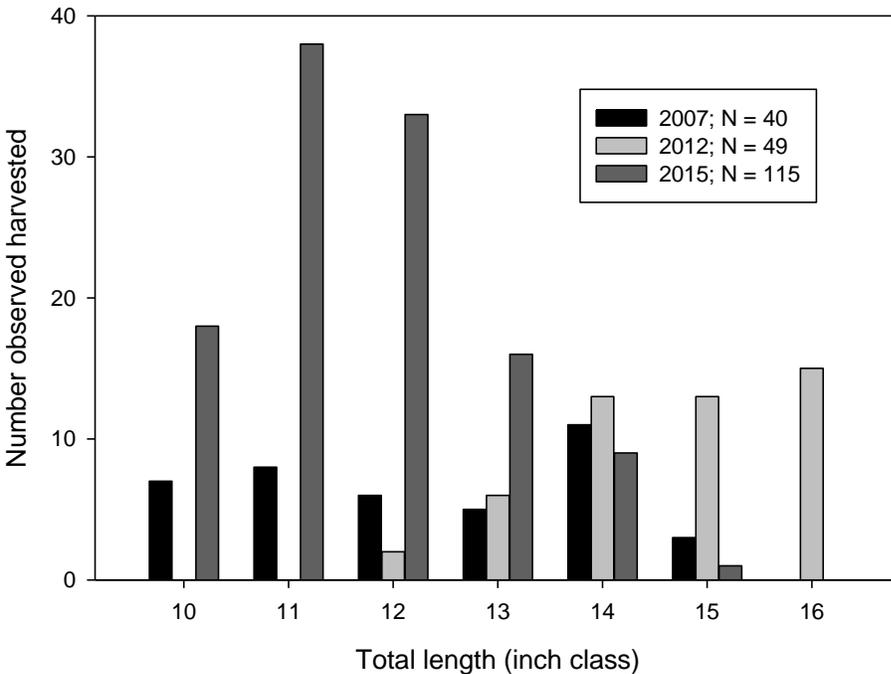


Figure 11. Length frequency of harvested White Bass observed during creel surveys at Amistad Reservoir, Texas, 2007, 2012, and 2015. Surveys were conducted January to June in each year.

28  
**Striped Bass**

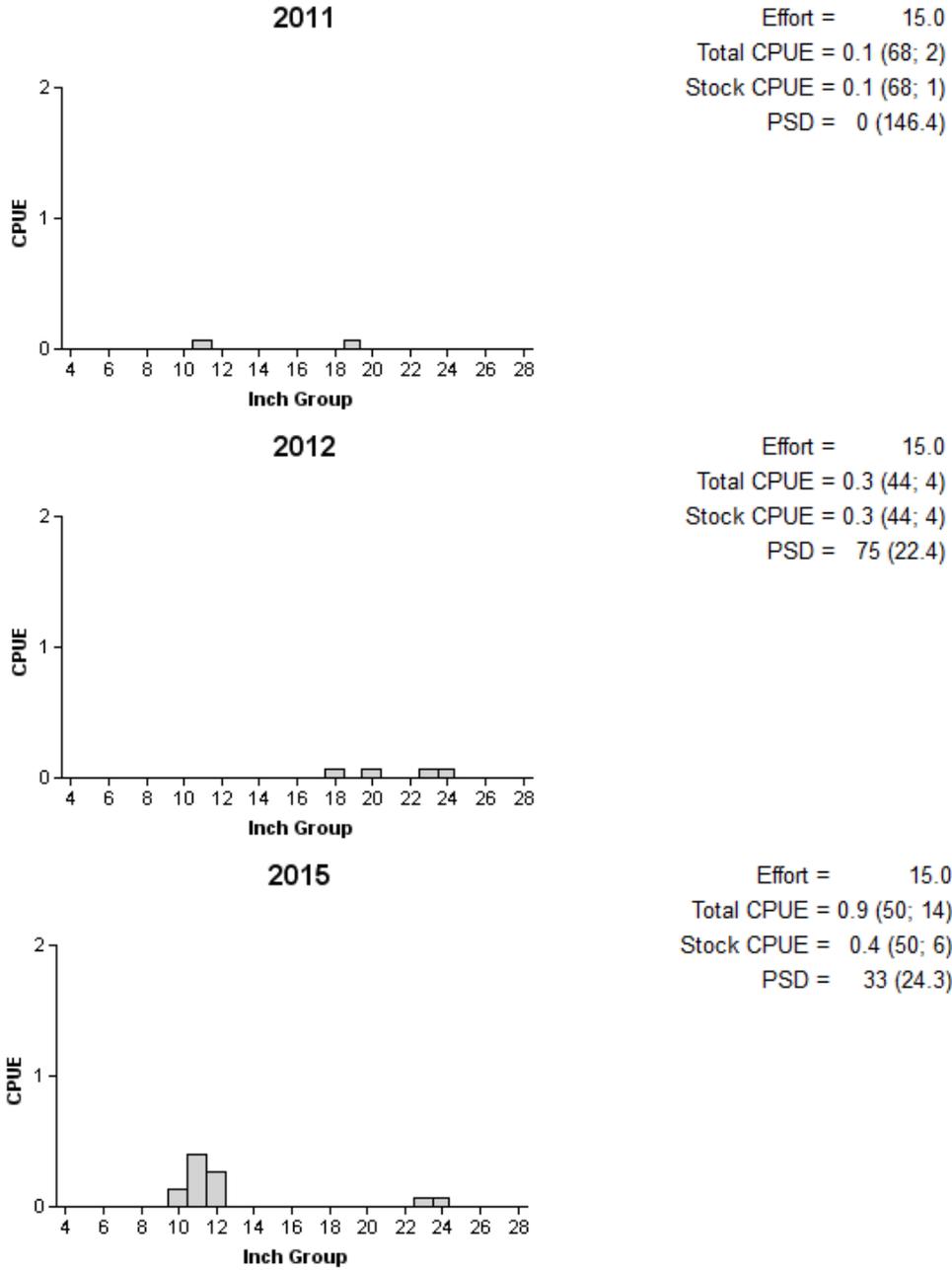


Figure 12. Number of Striped Bass caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Amistad Reservoir, Texas, 2011, 2012, and 2015.

### Striped Bass

Table 10. Creel survey statistics for Striped Bass at Amistad Reservoir, Texas. Surveys were conducted from January to June in 2007, 2012, and 2015. Angling effort was estimated for anglers specifically targeting Striped Bass. Total harvest and total catch estimates include Striped Bass caught by anglers targeting this species and by anglers targeting other species. HPUE and CPUE is the average number of fish harvested and caught, respectively, per one-hour angling effort by anglers targeting this species. Voluntary release rate is the percentage of legal-size fish (>18 inches) caught and released. Relative standard errors (RSE) are in parentheses

Creel statistic	2007	2012	2015
Reservoir water level (feet above MSL)	1,108	1,098	1,088
Reservoir surface area (acres)	57,903	49,724	41,940
Angling effort (h)	1,382 (>100)	480 (>100)	895 (>100)
Angling effort/acre (h)	0.02 (>100)	<0.01 (>100)	0.02 (>100)
Harvest (number of fish)	1,317 (>100)	0	0
Harvest/acre (number of fish)	0.02 (>100)	0	0
Catch (number of fish)	3,683 (>100)	137 (>100)	384 (>100)
Voluntary release rate	63	100	100
HPUE	1.0 (4)	0	0
CPUE	2.1 (27)	0.10 <sup>a</sup>	0

<sup>a</sup>RSE not available due to insufficient sample size

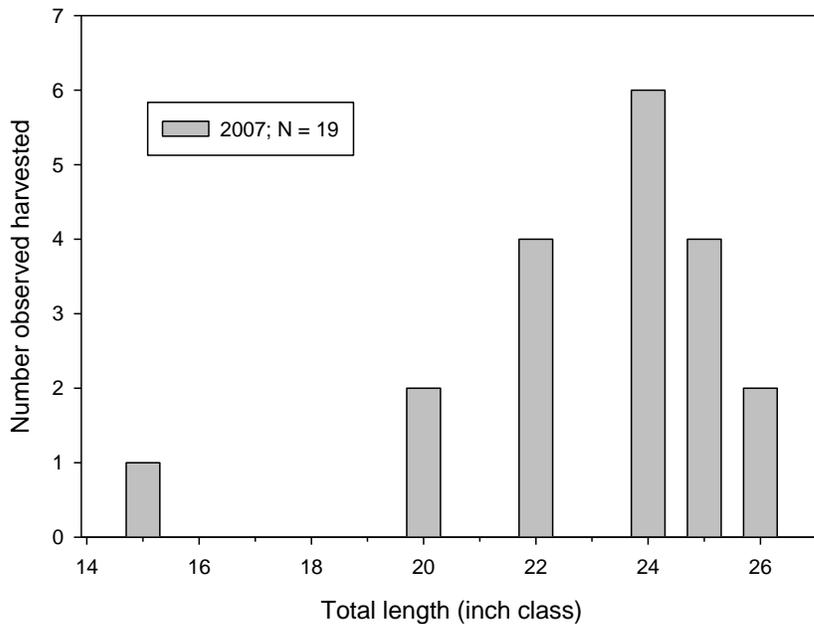


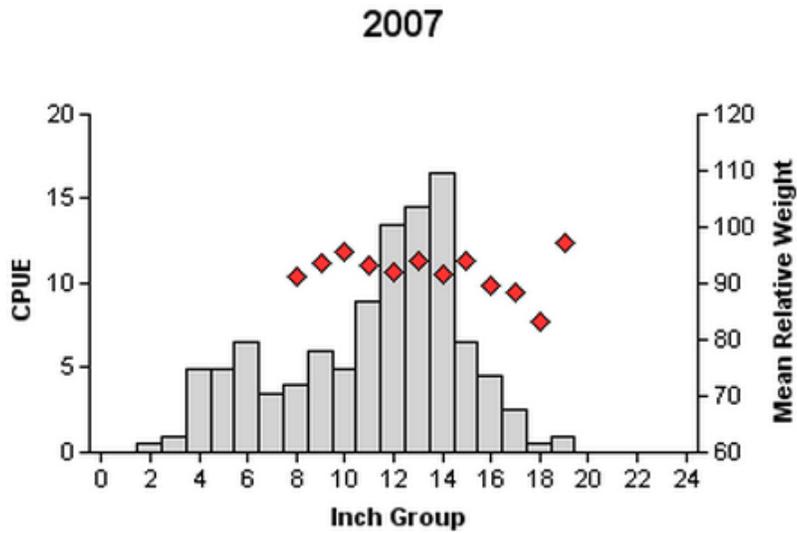
Figure 13. Length frequency of harvested Striped Bass observed during creel surveys at Amistad Reservoir, Texas, in 2007. Insufficient Striped Bass were observed harvested in 2012 and 2015 to plot on the length frequency.

**Smallmouth Bass**

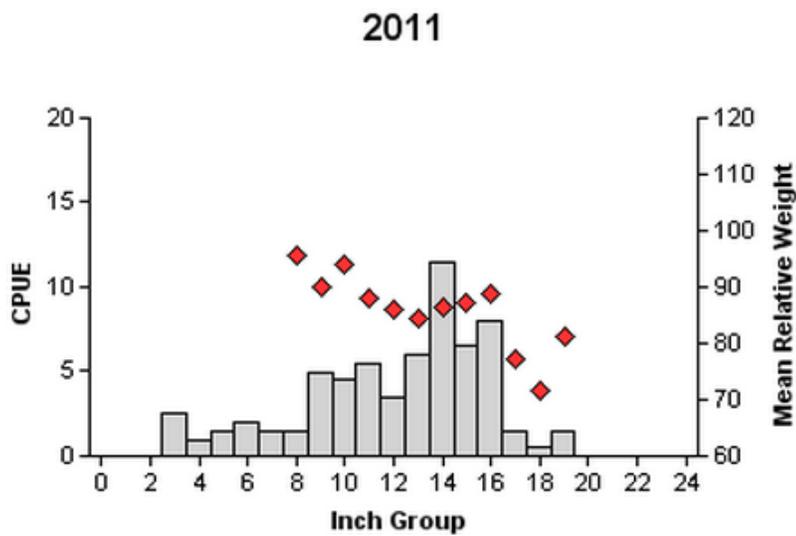
Table 11. Creel survey statistics for Smallmouth Bass at Amistad Reservoir, Texas. Surveys were conducted from January to June in 2007, 2012, and 2015. Angling effort was estimated for anglers specifically targeting Smallmouth Bass. Total harvest and total catch estimates include Smallmouth Bass caught by anglers targeting this species and by anglers targeting other species. HPUE and CPUE is the average number of fish harvested and caught, respectively, per one-hour angling effort by anglers targeting this species. Voluntary release rate is the percentage of legal-size fish (>14 inches) caught and released. Relative standard errors (RSE) are in parentheses

Creel statistic	2007	2012	2015
Reservoir water level (feet above MSL)	1,108	1,098	1,088
Reservoir surface area (acres)	57,903	49,724	41,940
Angling effort (h)	0	0	0
Angling effort/acre (h)	0	0	0
Harvest (number of fish)	0	0	0
Harvest/acre (number of fish)	0	0	0
Catch (number of fish)	108 (>100)	3,411 (>100)	3,712 (>100)
Voluntary release rate	100	100	100
HPUE	0	0	0
CPUE	0	0	0

## Largemouth Bass



Effort = 2.0  
 Total CPUE = 105.0 (14; 210)  
 Stock CPUE = 83.5 (14; 167)  
 PSD = 71 (4)



Effort = 2.0  
 Total CPUE = 64.0 (15; 128)  
 Stock CPUE = 55.5 (15; 111)  
 PSD = 70 (6)

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 PSD are in parentheses) for fall 2007 and all-species electrofishing surveys, Amistad Reservoir, Texas.

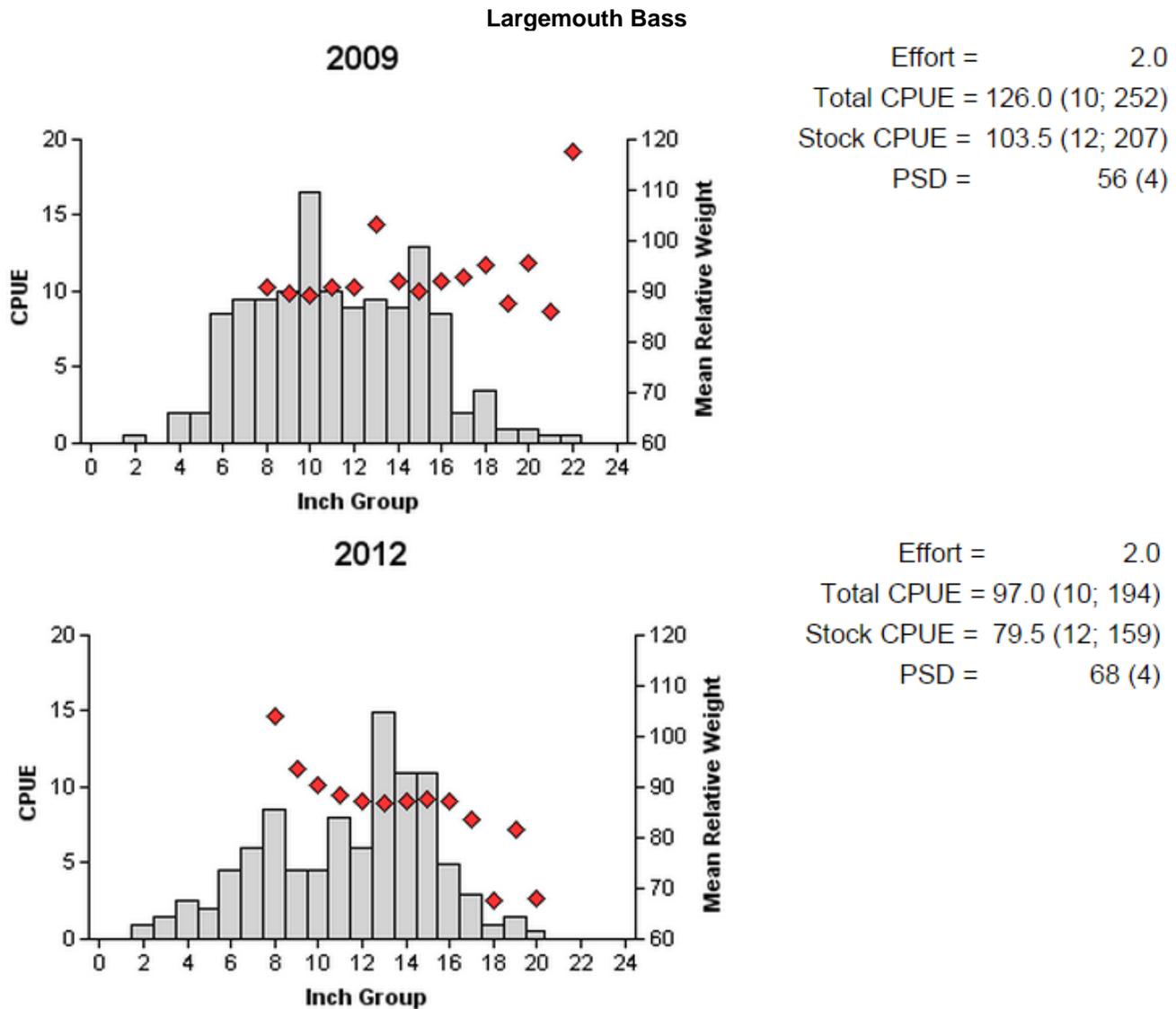


Figure 15. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for PSD are in parentheses) for fall 2009 and 2012 from bass-only electrofishing surveys, Amistad Reservoir, Texas.

**Largemouth Bass**

Table 12. Creel survey statistics for Largemouth Bass at Amistad Reservoir, Texas. Surveys were conducted from January to June in 2007, 2012, and 2015. Catch rate is for all anglers targeting Largemouth Bass. Harvest is partitioned by the estimated number of fish harvested by non-tournament anglers and the number of fish retained by tournament anglers for weigh-in and release. Voluntary release rate is the percentage of legal-size fish (>14 inches) caught and released. Relative standard errors (RSE) are in parentheses.

Statistic	2007	2012	2015
Reservoir water level (feet above MSL)	1,108	1,098	1,088
Reservoir surface area (acres)	57,903	49,724	41,940
Directed angling effort (h)			
Tournament	135,878 (27)	92,543 (27)	72,234 (29)
Non-tournament	207,348 (18)	188,607 (21)	126,325 (28)
All black bass anglers combined	343,226 (20)	281,150 (22)	198,559 (27)
Angling effort/acre	5.93 (20)	5.65 (22)	4.7 (27)
Catch (number of fish)	234,483 (17)	315,320 (39)	81,975 (33)
Catch rate (number/h)	0.80 (8)	0.73 (7)	0.47 (12)
Harvest (number of fish)			
Non-tournament harvest	16,773 (25)	23,342 (30)	1,574 (40)
Harvest/acre	0.29 (25)	0.47 (30)	0.04 (40)
Tournament weigh-in and release	16,571 (27)	35,954 (60)	3,249 (48)
Release by weight (number of fish) <sup>1</sup>			
<4.0 lbs		241,730 (55)	75,386 (45)
4.0-6.9 lbs		13,404 (57)	1,700 (72)
7.0-9.9 lbs		693 (>100)	66 (>100)
≥10.0 lbs		197 (>100)	0
Percent legal released (non-tournament)	77	82	90

<sup>1</sup>Release by weight estimates for 2007 were not available.

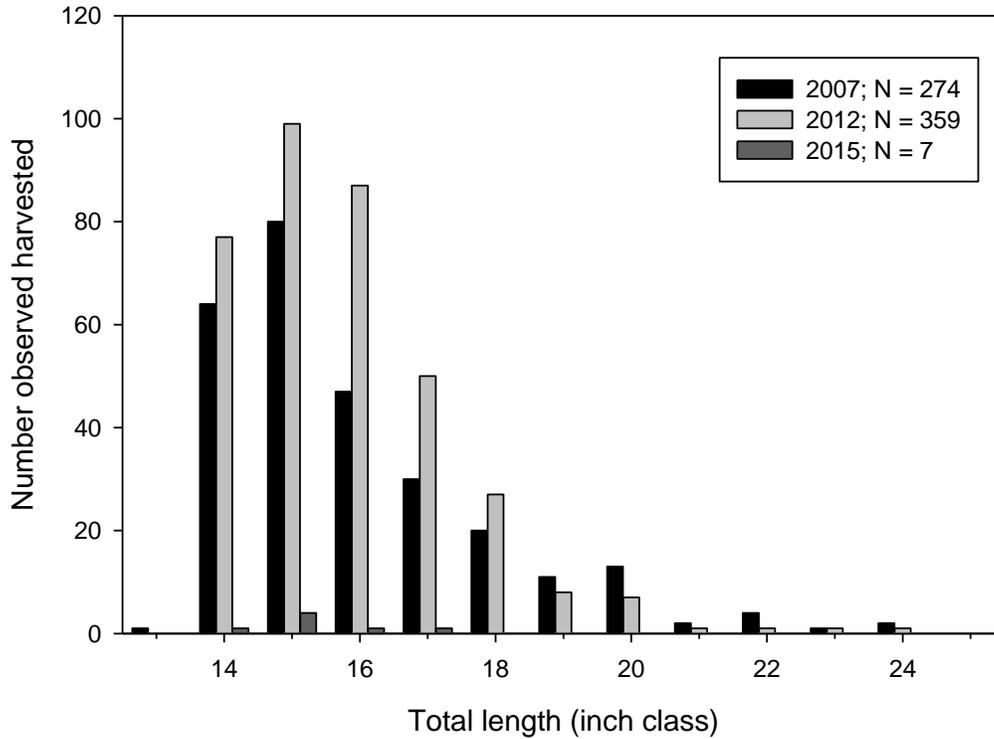
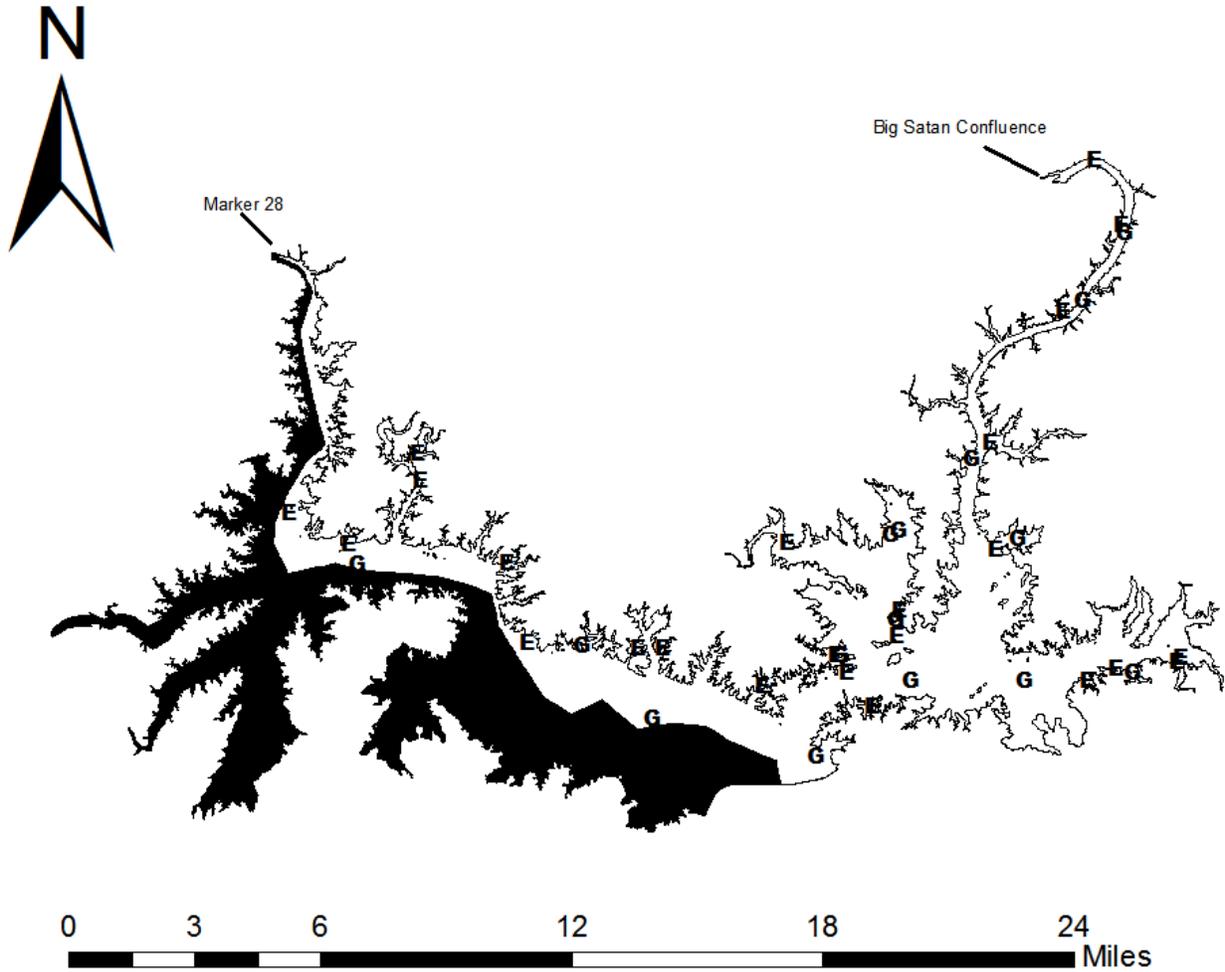


Figure 16. Length frequency of non-tournament harvested Largemouth Bass observed during creel surveys at Amistad Reservoir, Texas, in 2007, 2012, and 2015. Surveys were conducted January to June in each year.

Table 13. Proposed sampling schedule for Amistad Reservoir, Texas. Survey period is June through May. Gill net surveys are conducted in the spring. Both all-species fall and spring bass-only electrofishing surveys will be conducted. Vegetation and access surveys will be conducted in August-September. Creel surveys will be conducted January-June. Standard survey denoted by S and additional survey denoted by A.

Survey Year	Electrofishing	Gill Net	Creel	Vegetation	Access	Report
Fall 2015-Spring 2016						
Fall 2016-Spring 2017	S	S		S		S
Fall 2017-Spring 2018						
Fall 2018-Spring 2019	A	A	A	A	S	A

APPENDIX A



Location of sampling sites, Amistad Reservoir, Texas, 2015. Gill net and electrofishing stations are indicated by G and E, respectively. The portion of the reservoir owned by Mexico is in black. Water level was about 30 feet below full pool at time of sampling.

**APPENDIX B**

Number (N) and catch rate (CPUE) of all species collected from all gear types from Amistad Reservoir, Texas, 2015. Sampling effort was 15 net nights for gill netting, and 2 hours for spring day time electrofishing.

Species	Gill Netting		Electrofishing	
	N	CPUE	N	CPUE
Spotted Gar	7	0.47		
Longnose Gar	3	0.20		
Gizzard Shad	122	8.13	23	11.50
Threadfin Shad			1	0.50
Common Carp	19	1.27		
River Carpsucker	12	0.80		
Blue Catfish	4	0.27		
Channel Catfish	25	1.67		
Flathead Catfish	6	0.40		
White Bass	51	3.40		
Striped Bass	14	0.93		
Redbreast Sunfish			26	13.00
Green Sunfish			11	5.50
Warmouth			1	0.50
Bluegill	2	0.13	5	2.50
Redear Sunfish	3	0.20	20	10.00
Smallmouth Bass			2	1.00
Largemouth Bass	13	0.87	112	56.00
White Crappie	4	0.27		
Freshwater Drum	37	2.47		