PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-4

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2013 Fisheries Management Survey Report

Alvarado Park Reservoir

Prepared by:
John Tibbs, District Management Supervisor
and
Michael S. Baird, Assistant District Management Supervisor

Inland Fisheries Division
District 2B, Waco, Texas

Carter Smith
Executive Director

Gary Saul
Director, Inland Fisheries

July 31, 2014

TABLE OF CONTENTS

SURVEY AND MANAGEMENT SUMMARY

Fish populations in Alvarado Park Reservoir were surveyed in 2013 using electrofishing and trap netting and in 2014 using gill netting. Historical data are presented with the 2013-2014 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:** Alvarado Park Reservoir is a 507-acre impoundment located near the city of Alvarado, Johnson County, Texas. We were unable to obtain the conservation pool elevation from the city of Alvarado as there is no elevation monitoring system in place. The reservoir was at or near conservation pool during the sampling period but reportedly did experience low water levels in prior years. Primary water use is recreation. Alvarado Park Reservoir is eutrophic with stable productivity. Habitat features included natural shoreline, bulk heading, and boat docks/piers. Aquatic vegetation is limited to shoreline stands of cattail (Typha spp.) and bulrush (Scirpus spp.).

- **Management History:** Sport fishes in Alvarado Park Reservoir have always been managed with statewide regulations. Important sport fishes include White Bass, Largemouth Bass, and catfish. Since the last report (2010), the City of Alvarado was contacted and informed about the possibility to use funds from selling water to well drilling companies to match federal funds for a boating access program. The City of Alvarado matched funding by sale of water to well drilling companies, and the grant application is pending. Invasive species signage was posted at the access in 2013.

- **Fish Community**
  - **Prey species:** Forage species included Gizzard Shad, Threadfin Shad, Bluegill, Longear Sunfish and Redear Sunfish. Gizzard Shad and Bluegill were collected in numbers above historical averages.

  - **Catfishes:** Channel and Blue Catfish catch rates were above historical averages, and body condition was good. Flathead Catfish were not observed.

  - **White Bass:** White Bass catch rates were the lowest on record, yet body condition remained excellent.

  - **Largemouth Bass:** Largemouth Bass catch rates were below the historical average, yet the population remains stable. Body condition was good.

  - **White Crappie:** White Crappie were present in the reservoir in low numbers.

- **Management Strategies:** Continue managing Alvarado Park Reservoir with existing regulations. Conduct general monitoring with electrofishing and gill netting in 2017-2018. Conduct an aquatic vegetation and access survey during summer 2017. Continue efforts to educate the public about zebra mussel issues, and protect the reservoir from zebra mussel introductions. Investigate the possibility of the city of Alvarado privately stocking Sunshine Bass.

INTRODUCTION

This document is a summary of fisheries data collected from Alvarado Park Reservoir in 2013-2014. 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 2013-2014 data for comparison.

Reservoir Description

Alvarado Park Reservoir is a 507-acre impoundment constructed in 1966. It is located in Johnson County near the City of Alvarado and is operated and controlled by the City of Alvarado. The primary water use was recreation although the City of Alvarado has sold water rights to gas drilling companies in recent years. Alvarado Park Reservoir is eutrophic with Secchi readings generally less than two feet. Habitat consisted of natural shoreline, bulk heading, and boat docks and piers. Mean and maximum depths were six and 20 feet respectively. Water elevation data is currently not collected by the City of Alvarado (see Table 1 for other descriptive characteristics for Alvarado Park Reservoir).

Angler Access

Alvarado Park Reservoir's boat access consists of a single public boat ramp, and bank fishing access is limited to the public boat ramp area and park. There is no public handicap access. The boat ramp has been available to anglers since 2010 despite drought conditions during the summers of 2011, 2012 and 2013. Although usable, the ramp requires renovation (see previous management strategies and actions below; see Table 2 for additional boat ramp characteristics).

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Baird and Tibbs 2009) included:

1. Monitor fish populations during standard surveys, including trap netting in 2013 and 2014.
   Action: All standard surveys were conducted as scheduled.
2. Contact city officials and suggest that proceeds from future water contracts be used as funds to match Federal grant money for a boat ramp project.
   Action: The City of Alvarado was contacted in spring 2010 about the possible use of water contract funds to expand and improve the single boat ramp. In October 2013, the City of Alvarado submitted an application for assistance under the Texas State Boating Access Program, to renovate the nearly 50 year old boat ramp. Inland Fisheries staff reviewed the City of Alvarado's application, and made it a priority boating access project in the district. Final approval is pending.
3. Cooperate with the City of Alvarado to post appropriate invasive species signage at the single access point. Make a speaking point about exotic species when presenting to constituents and user groups. Keep track of (i.e., map) all existing and future inter-basin water transfer routes to facilitate potential exotic species responses.
   Action: Invasive species signage was posted at the Alvarado Park Reservoir boat ramp during summer 2013. District biologists have made a speaking point about invasive species, how to prevent their spread, and potential effects on Alvarado Park Reservoir, while speaking to constituent user groups such as the Central Texas Flyrodders, Legacy Outfitters, and Brazos River Sportsman's Club over the past several years. Inter-basin water transfers are a permanent fixture in this report now, and will be updated appropriately.

Harvest regulation history: Sport fishes in Alvarado Park Reservoir have always been managed with

statewide regulations (Table 3).

Stocking history: Only a few stockings were conducted prior to 2000. Florida Largemouth Bass were stocked at 100/acre in both 1997 and 1998. Channel Catfish were stocked at nearly 50/acre in 1990, and Bluegill were stocked at 50/acre in 1983. Blue Catfish were stocked in 2000 (85,700), 2001 (50,600), 2008 (21,868), and 2009 (21,870) (see Table 4 for the complete stocking history).

Vegetation/habitat management history: No vegetation/habitat management actions have been performed on Alvarado Park Reservoir, and no problematic species of aquatic vegetation exist in the reservoir.

Water Transfer: Alvarado Park Reservoir is used primarily for recreation. There are currently no permanent pumping stations on the reservoir other than domestic irrigation systems, and none are planned for the near future. In 2010 the City of Alvarado sold short-term water rights to a gas company for 70,000 barrels to be collected during May and June. This one-time operation was completed in May of that year. More recently, the City sold 113,580 barrels of water from the reservoir to a gas company in February of 2014. Similar opportunities will no doubt present themselves to the City of Alvarado in the future.

METHODS

Fishes were collected by electrofishing (1 hour at 12, 5-min stations) and gill netting (5 net nights at 5 stations), and trap netting (5 net nights at 5 stations). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing and, for gill and trap nets, as the number of fish per net night (fish/nn). All survey sites were randomly selected and all surveys were conducted according to the Fishery Assessment Procedures [TPWD, Inland Fisheries Division, (unpublished manual revised 2011)].

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 X SE of the estimate/estimate) was calculated for all CPUE statistics. Fish aging became optional in 2004, and no new age and growth data were collected from the 2013/2014 survey. The most recent age and growth information for Alvarado Park Reservoir can be found in Baird and Tibbs (2002).

Genetic analysis of Largemouth Bass was conducted according to the Fishery Assessment Procedures [TPWD, Inland Fisheries Division, (unpublished manual revised 2011)]. Micro-satellite DNA analysis was used to determine genetic composition of individual fish from 2005 through 2012 and by electrophoresis for previous years.

RESULTS AND DISCUSSION

Habitat: Littoral zone habitat consisted primarily of emergent vegetation, natural shoreline, bulk heading, and private docks and piers. Structural habitat and vegetation were surveyed in summer 2008 and 2013 respectively (Tables 5 and 6). Additionally, a side scan sonar habitat survey using side scan sonar was completed in summer 2013 (results not yet available).

Creel: The most recent creel survey was conducted during the spring quarter of 2007 to determine angler effort and catch rates of popular sport fish species (Tibbs and Baird 2010).

Prey species: Gizzard Shad were collected by electrofishing at 569.0/h in 2013 and is the highest catch on record (Figure 1). The IOV for Gizzard Shad was average, and 78% of Gizzard Shad were available to existing predators as forage. Other important forage species collected were Threadfin Shad (1,575.0/h), Bluegill (544.0/h; Figure 2), Longear Sunfish (65.0/h) and Redear Sunfish (8.0/h). Panfish seldom reach preferred size classes in Alvarado Park Reservoir.

Catfishes: Blue Catfish were collected with gill nets at 1.2/nn in 2014 (Figure 3). This catch rate equates to 6 collected individuals. All of the Blue Catfish sampled were legal size, and body condition was generally good.

Channel Catfish were collected with gill nets at 8.8/nn in 2014 (Figure 4). This catch rate equates to 44 collected individuals, and was slightly higher than the historical average of 7.0/nn (Appendix B). Proportional size distribution was good, indicating balanced recruitment, growth, and mortality rates. Most Channel Catfish sampled were legal size, and few approached the preferred size category of 24 inches. Body condition was fair (Figure 4).

No Flathead catfish were observed during 2014 sampling.

White Bass: White Bass were collected with gill nets at 1.0/nn in 2014 (Figure 5). This catch rate equates to 5 collected individuals, and represents the poorest catch for this species on record. This is not surprising considering the continuing drought and this population's dependency on gravel substrate for spawning since there are no tributaries to migrate into. The PSD for White Bass has remained at 100 for the past three surveys, indicating a skewed population of larger individuals and possibly poor recruitment. It might also suggest a lack of spawning opportunity since before the current drought began (Baird and Tibbs, 2006). Body condition was good (Figure 5).

Largemouth Bass: Largemouth Bass were collected by electrofishing at 144.0/h in 2013. This catch rate equates to 144 collected individuals and was below the historical average of 192.0/h (Appendix B). Proportional size distribution was good, illustrating a balanced population (Figure 6). The proportion of individuals 14-inches and larger was 14, indicating fair numbers of harvestable bass for anglers. Body condition was variable across size classes, but improved with length (Figure 6). Largemouth Bass genetics were analyzed in 2013 and showed good Florida influence (59%; Table 7).

White Crappie: White Crappie were collected from trap nets at 1.40/nn in 2013 (Figure 7). This catch rate equates to 7 collected individuals. White Crappie were also collected from spring gill netting at 6.4/nn (Figure 8). Proportional size distribution from both samples was 100, indicative of a population skewed towards larger individuals and possible poor recruitment. Body condition was excellent for all size classes sampled, and gill netting yielded a much broader sample of size classes (Figures 7 and 8). Additional White Crappie data will be obtained during standard gill netting in the future.

Fisheries management plan for Alvarado Park Reservoir, Texas

Prepared – July 2014.

ISSUE 1: Alvarado Park Reservoir currently has a single one-lane boat ramp that is nearly 50 years old and is in poor repair. Additionally, this access has no restrooms or boat dock facilities. The City of Alvarado submitted an application for assistance under the Texas State Boating Access Program for renovation efforts, and the application is pending.

MANAGEMENT STRATEGIES

1. Monitor progress of application and subsequent renovation and provide input if needed.

ISSUE 2: 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 City of Alvarado to maintain appropriate invasive species signage at the single access point.
2. Educate the public about invasive species through the use of media and the internet.
3. Make a speaking point about invasive species when presenting to constituent and user groups.
4. Keep track of (i.e., map) existing and future inter-basin water transfers to facilitate potential invasive species management responses.

ISSUE 3: Prey in the form of Gizzard and Threadfin Shad are extremely abundant and condition of all predator fish species is very good. Efforts to utilize excess prey by stocking Blue Catfish have had limited success. The White Bass population has been very good in the past, with many large individuals, indicating that *Morone spp.* can do very well in this system. An angler survey in spring 2010 showed that White Bass was the third most sought species (20.5% directed effort) after Catfish spp. (33.6%) and Largemouth Bass (22.2%) Hybrid Striped Bass would likely do as well or better and attain much larger sizes. The relatively small size of the reservoir would limit the number of Hybrid Striped Bass needed for stocking. However, the fact that the reservoir has never been stocked with Hybrid Striped Bass prevents us from adding it to the already extensive hatchery requests.

MANAGEMENT STRATEGY

1. Investigate the possibility of a private purchase of Sunshine Bass by the City of Alvarado. Ongoing sale of water to natural gas companies could serve as a source of funding.
2. If funding is secured, recommend a stocking rate of 10/acre and issue a stocking permit.
3. Evaluate stocking success during regularly scheduled gill netting.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule includes general monitoring with electrofishing, trap netting, and gill netting in 2017 and 2018 and an aquatic vegetation and access survey in summer 2017 (Table 8).

LITERATURE CITED

Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Baird, M. S. and J. Tibbs. 2002. Statewide freshwater fisheries monitoring and management program survey report for Alvarado Park Reservoir, 2001. Texas Parks and Wildlife Department, Federal Aid Report F-30-R-27, Austin.

Baird, M. S. and J. Tibbs. 2006. Statewide freshwater fisheries monitoring and management program survey report for Alvarado Park Reservoir, 2005. Texas Parks and Wildlife Department, Federal Aid Report F-30-R-31, Austin.

Baird, M. S. and J. Tibbs. 2010. Statewide freshwater fisheries monitoring and management program survey report for Alvarado Park Reservoir, 2009. Texas Parks and Wildlife Department, Federal Aid Report F-30-R-35, Austin.

DiCenzo, V. J., M. J. Maceina, and M. R. Stimert. 1996. Relations between reservoir trophic state and gizzard shad population characteristics in Alabama reservoirs. North American Journal of Fisheries Management 16:888-895.

Guy, C. S., R. M. Neumann, D. W. Willis, and R. O. Anderson. 2007. Proportional Size Distribution (PSD): A Further Refinement of Population Size Structure Index Terminology. Fisheries volume 32, number 7: 348

Table 1. Characteristics of Alvarado Park Reservoir, Texas.

Characteristic	Description
Year Constructed	1966
Controlling authority	City of Alvarado
Counties	Johnson
Reservoir type	Tributary
Shoreline Development Index (SDI)	1.5
Conductivity	363 umhos/cm

Table 2. Boat ramp characteristics for Alvarado Park Reservoir, Texas, 2013. Latitude and longitude are in decimal degrees.

Boat ramp	Latitude; Longitude	Public?	Parking capacity	Condition
Alvarado	32.3828ºN; -97.2518ºW	Y	12 trailers	Renovation needed

Table 3. Harvest regulations for Alvarado Park Reservoir, Texas, 2013.

Species	Bag Limit	Length limit
Catfish: Channel and Blue Catfish, their hybrids and subspecies	25 (in any combination)	12” minimum
Catfish, Flathead	5	18” minimum
Bass, White	25	10” minimum
Bass: Largemouth and Spotted[a]	5[a]	14” minimum
Crappie: White and Black Crappie, their hybrids and subspecies	25 (any combination)	10” minimum

[a]Daily bag for Largemouth Bass and Spotted Bass = 5 fish in any combination; no minimum for Spotted Bass.

Table 4. Stocking history of Alvarado Park Reservoir, Texas. Life stages are fry (FRY), fingerlings (FGL), advanced fingerlings (AFGL), adults (ADL) and unknown (UNK). Life stages for each species are defined as having a mean length that falls within the given length range. For each year and life stage the species mean total length (Mean TL; in) is given. For years where there were multiple stocking events for a particular species and life stage the mean TL is an average for all stocking events combined.

Species	Year	Number	Life Stage	Mean TL (in)
Blue Catfish	2000	85,700	FGL	2.2
	2001	50,600	FGL	2.4
	2008	21,868	FGL	2.0
	2009	21,870	FGL	2.0
	Total	180,038		
Channel Catfish	1990	26,039	FGL	2.5
	Total	26,039		
Coppernose Bluegill	1983	27,000	UNK	UNK
	Total	27,000		
Florida Largemouth Bass	1997	50,857	FGL	1.3
	1998	51,495	FGL	1.5
	Total	102,352		

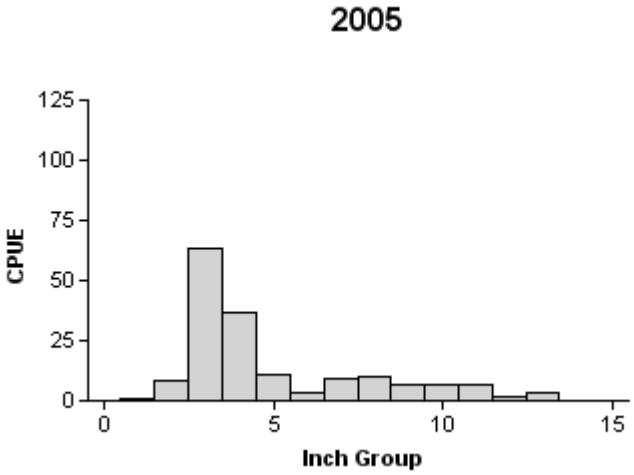
Table 5. Survey of structural habitat types, Alvarado Park Reservoir, Texas, 2008. Shoreline habitat type units are in miles.

Habitat type	Estimate	% of total
Bulkhead	1.0 miles	11.31
Boat docks/piers	0.27 miles	3.05
Natural	7.12 miles	80.54
Rocky shoreline (rocks > 4”)	0.42 miles	4.75
Gravel shoreline (rocks < 4”)	0.03 miles	0.34

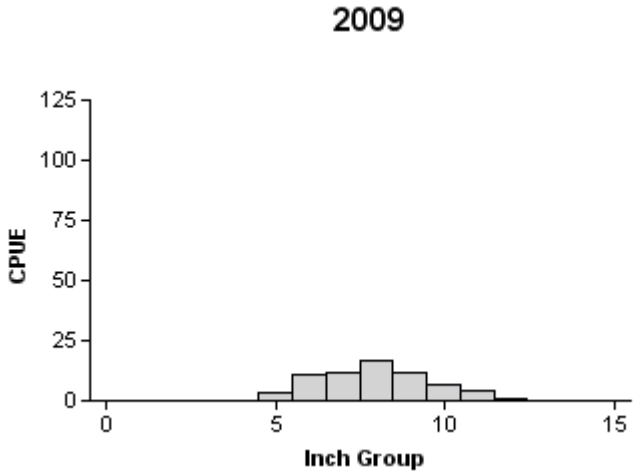
Table 6. Survey of aquatic vegetation, Alvarado Park Reservoir, Texas, 2010 and 2013. Surface area (acres) is listed with percent of total reservoir surface area in parentheses. In 2013, the value for individual species represents the percentage of randomly selected points with that species present during a habitat and access survey on August 15, 2013.

Vegetation	2010	2013
Native submersed	--	--
Native floating-leaved	--	--
Native emergent	19.9 (3.9)	9.0 (1.8)
Water willow		28.0% (7 of 25)
Bullrush		64.0% (16 of 25)
Cattail		12.0% (3 of 25)

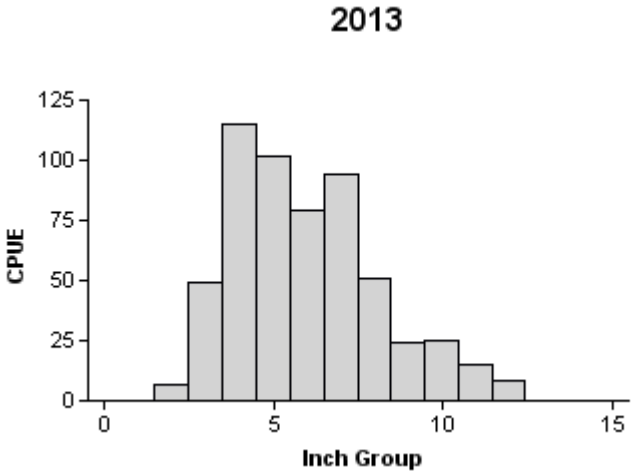
Gizzard Shad



Effort = 1.0
Total CPUE = 168.0 (17; 168)
Stock CPUE = 45.0 (35; 45)
IOV = 79 (6.2)



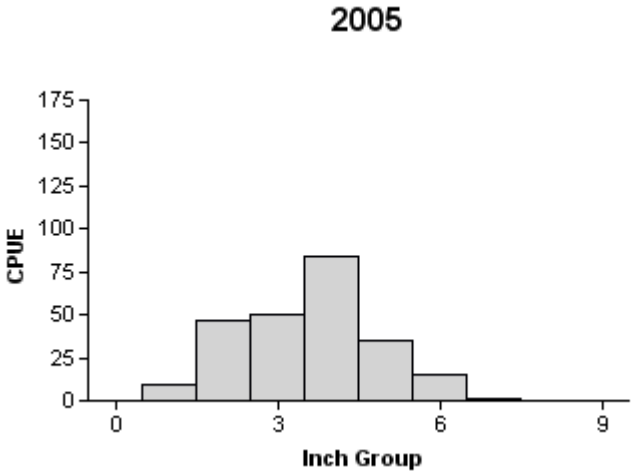
Effort = 1.0
Total CPUE = 67.0 (22; 67)
Stock CPUE = 53.0 (22; 53)
IOV = 39 (8.5)



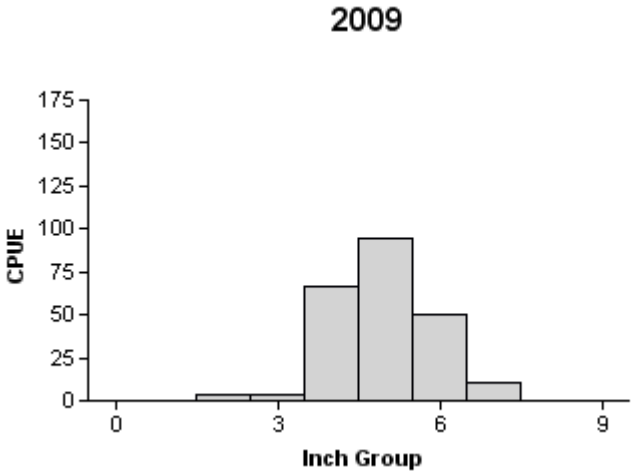
Effort = 1.0
Total CPUE = 569.0 (15; 569)
Stock CPUE = 217.0 (19; 217)
IOV = 78 (4.9)

Figure 1. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Alvarado Park Reservoir, Texas, 2005, 2009 and 2013.

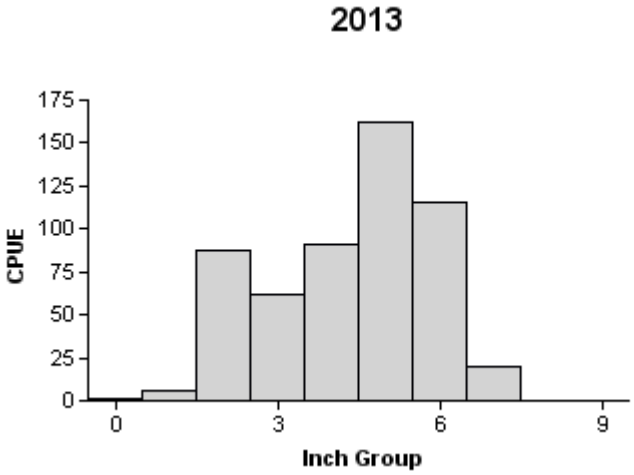
Bluegill



Effort = 1.0
Total CPUE = 241.0 (33; 241)
Stock CPUE = 185.0 (44; 185)
PSD = 9 (2.2)



Effort = 1.0
Total CPUE = 228.0 (19; 228)
Stock CPUE = 225.0 (18; 225)
PSD = 27 (4.2)



Effort = 1.0
Total CPUE = 544.0 (22; 544)
Stock CPUE = 450.0 (24; 450)
PSD = 30 (8.8)

Figure 2. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Alvarado Park Reservoir, Texas, 2005, 2009, and 2013.

Blue Catfish

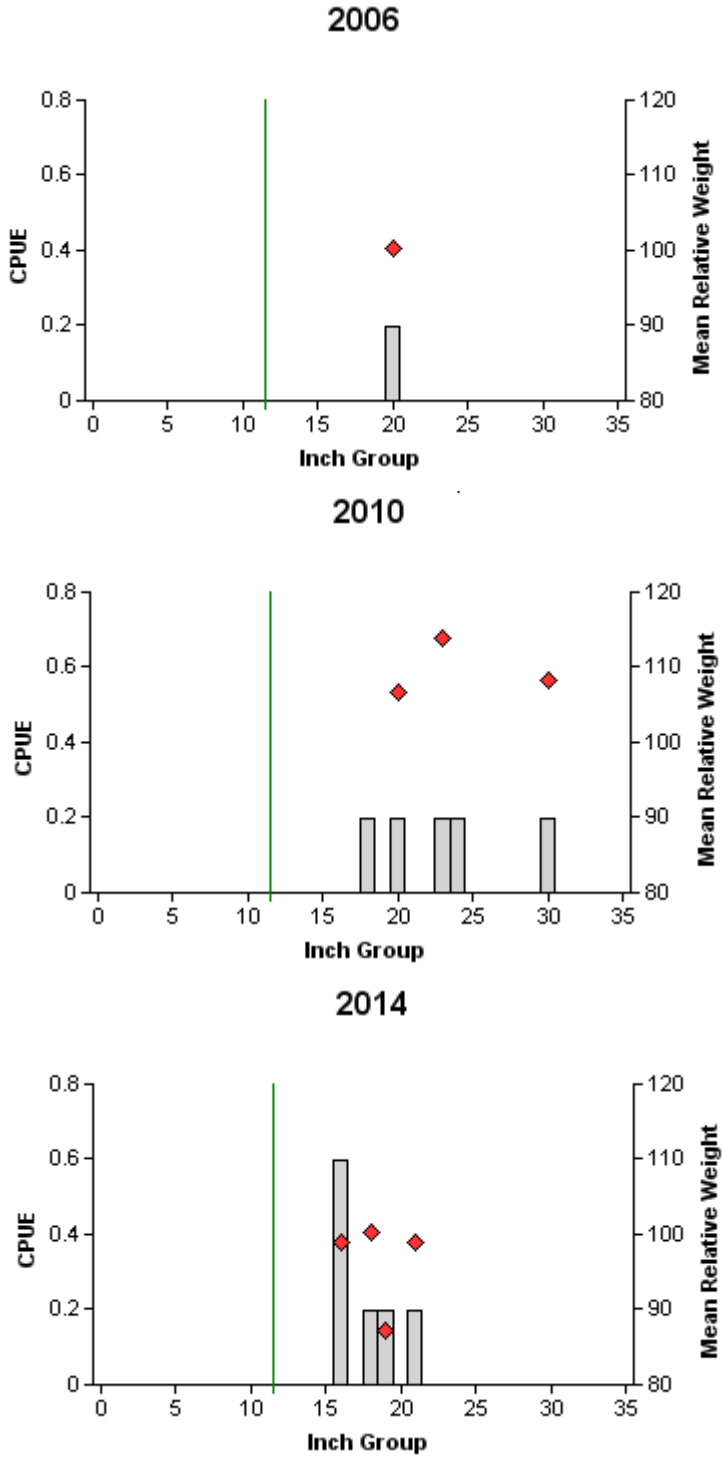
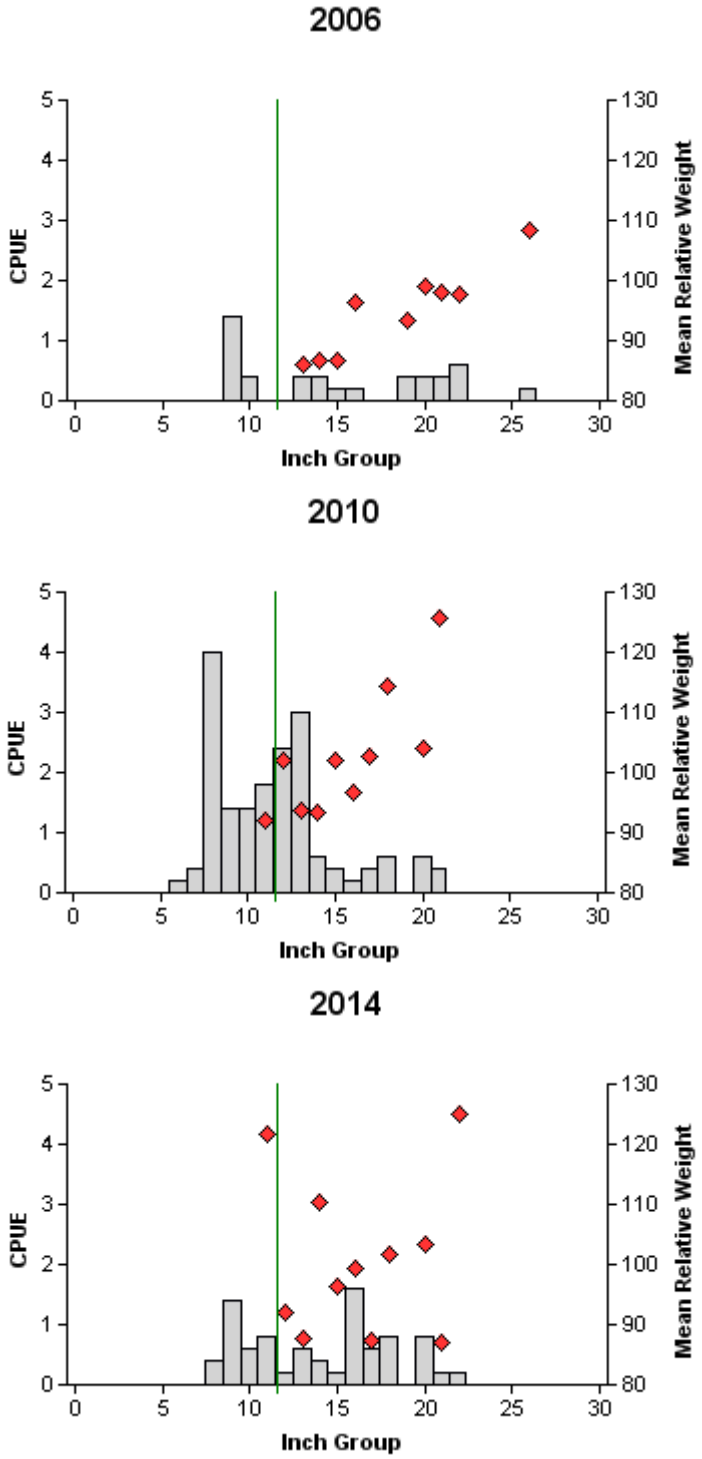


Figure 3. Number of Blue Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Alvarado Park Reservoir, Texas, 2006, 2010, and 2014. Minimum length limit represented by vertical line.

Channel Catfish



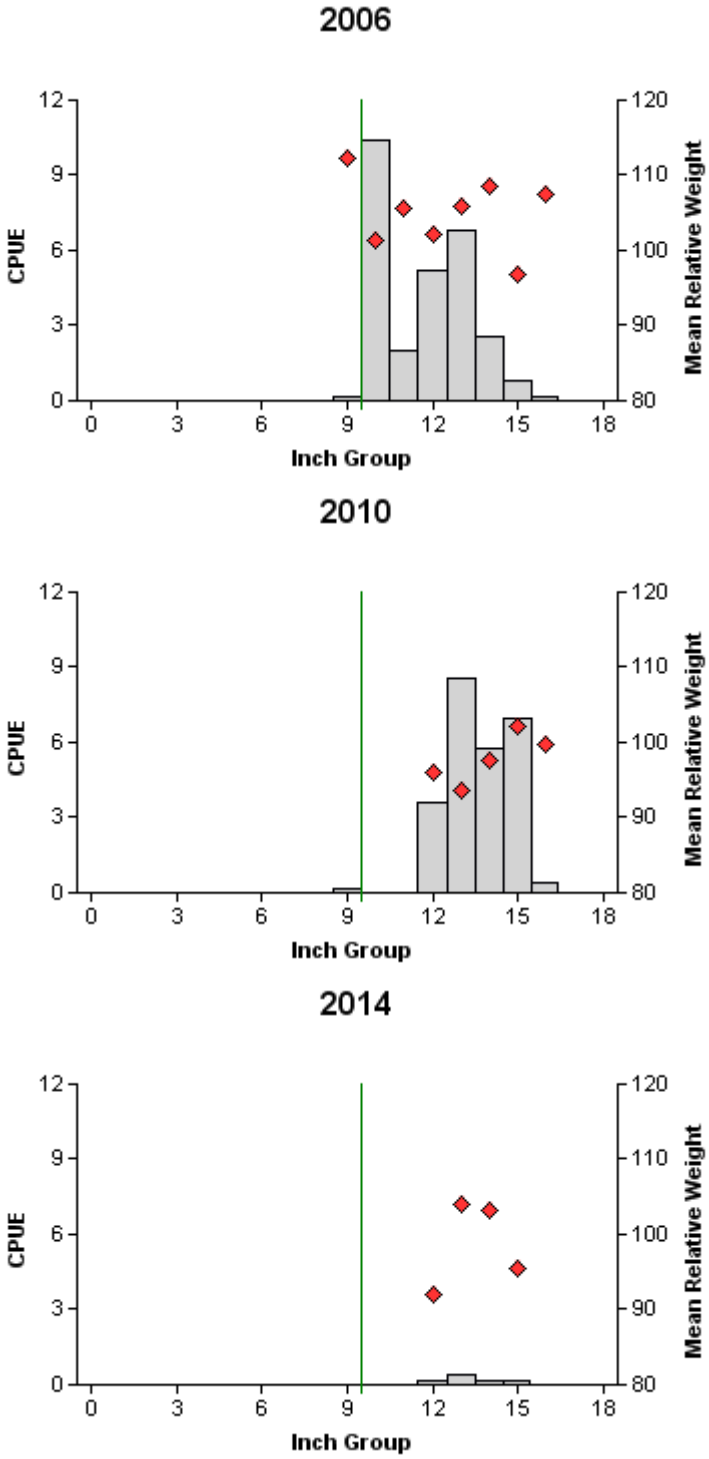
Effort =	5.0
Total CPUE =	5.0 (62; 25)
Stock CPUE =	3.2 (69; 16)
PSD =	69 (10.4)
PSD-12 =	100 (0)

Effort =	5.0
Total CPUE =	17.8 (32; 89)
Stock CPUE =	10.4 (31; 52)
PSD =	21 (5.7)
PSD-12 =	83 (4.8)

Effort =	5.0
Total CPUE =	8.8 (20; 44)
Stock CPUE =	6.4 (21; 32)
PSD =	66 (9.8)
PSD-12 =	88 (9.7)

Figure 4. 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, Alvarado Park Reservoir, Texas, 2006, 2010, and 2014. Minimum length limit represented by vertical line.

White Bass



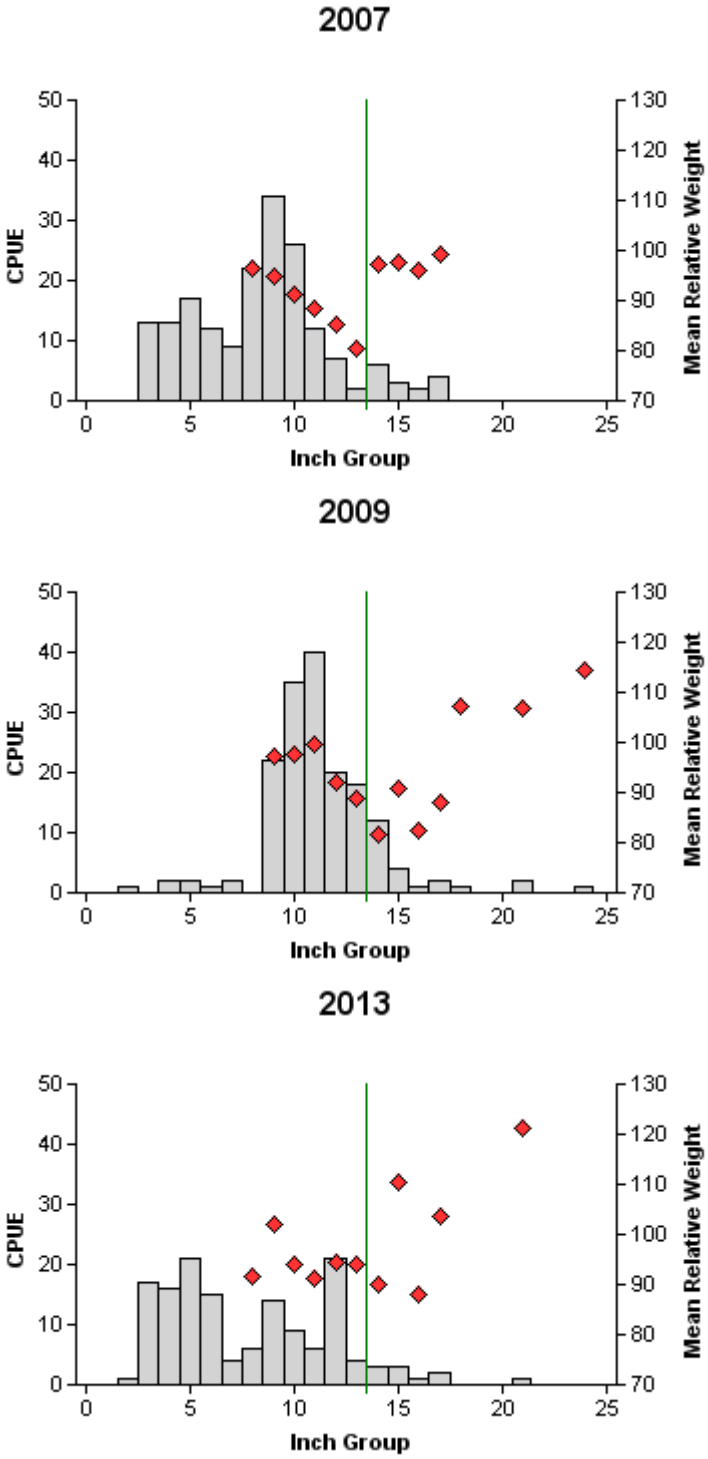
Effort =	5.0
Total CPUE =	28.2 (21; 141)
Stock CPUE =	28.2 (21; 141)
PSD =	100 (0)
PSD-10 =	99 (0.6)

Effort =	5.0
Total CPUE =	25.6 (34; 128)
Stock CPUE =	25.6 (34; 128)
PSD =	100 (0)
PSD-10 =	99 (0.9)

Effort =	5.0
Total CPUE =	1.0 (45; 5)
Stock CPUE =	1.0 (45; 5)
PSD =	100 (0)
PSD-10 =	100 (0)

Figure 5. 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, Alvarado Park Reservoir, Texas, 2006, 2010, and 2014. Minimum length limit represented by vertical line.

Largemouth Bass



Effort =	1.0
Total CPUE =	182.0 (11; 182)
Stock CPUE =	118.0 (12; 118)
PSD =	20 (3.2)
PSD-14 =	13 (3.8)

Effort =	1.0
Total CPUE =	166.0 (17; 166)
Stock CPUE =	158.0 (17; 158)
PSD =	39 (5.5)
PSD-14 =	15 (1.9)

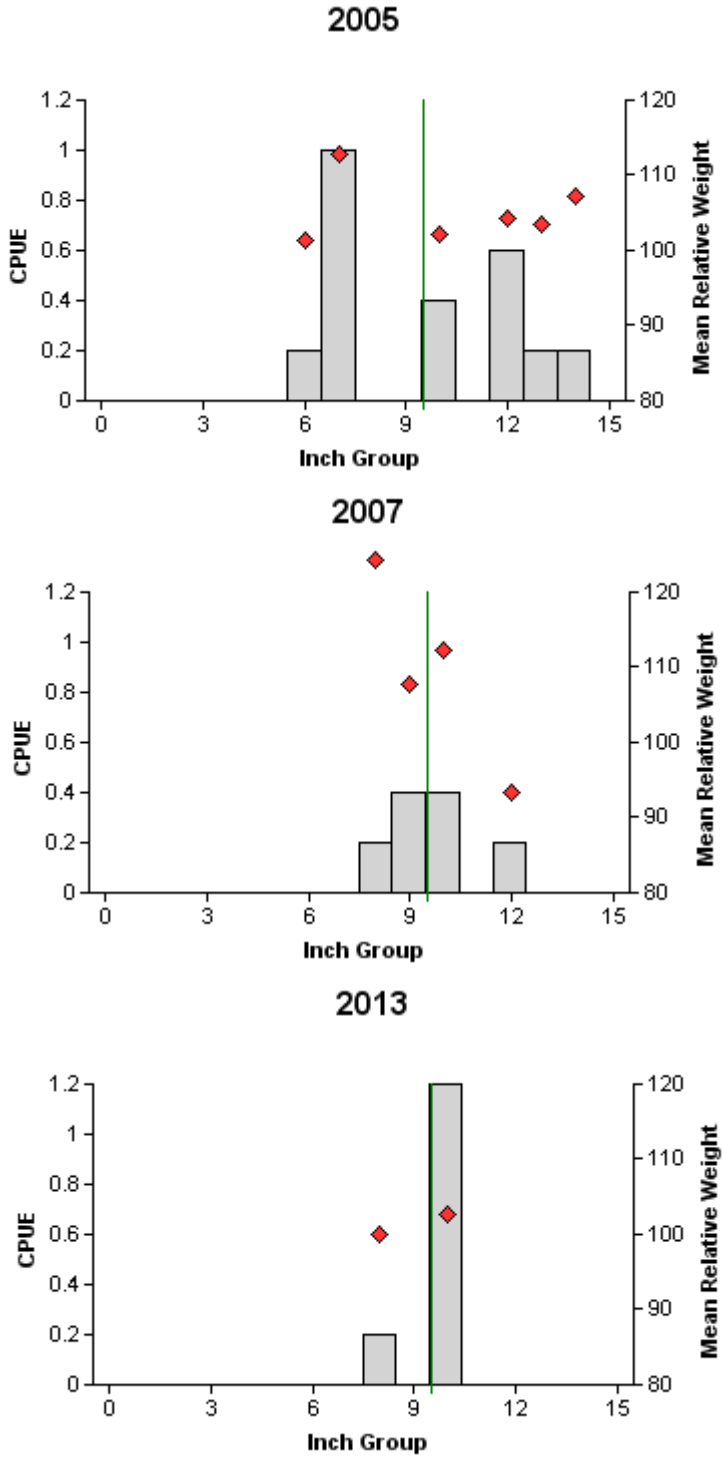
Effort =	1.0
Total CPUE =	144.0 (17; 144)
Stock CPUE =	70.0 (21; 70)
PSD =	50 (6.2)
PSD-14 =	14 (5.2)

Figure 6. Number of Largemouth Bass caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Alvarado Park Reservoir, Texas, 2007, 2009, and 2013. Minimum length limit represented by vertical line.

Table 7. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Alvarado Park Reservoir, Texas, 1998, 2001, 2005, and 2013. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB. Genetic composition was determined by electrophoresis prior to 2005 and with micro-satellite DNA analysis since 2005.

		Number of fish				
Year	Sample size	FLMB	Intergrade	NLMB	% FLMB alleles	% FLMB
1998	30	4	21	5	41.7	13.3
2001	30	3	22	5	35.8	10
2005	30	2	26	2	49.5	7
2013	30	0	30	0	59.0	0

White Crappie



Effort =	5.0
Total CPUE =	2.6 (75; 13)
Stock CPUE =	2.6 (75; 13)
PSD =	54 (7.4)
PSD-10 =	54 (7.4)

Effort =	5.0
Total CPUE =	1.2 (33; 6)
Stock CPUE =	1.2 (33; 6)
PSD =	100 (0)
PSD-10 =	50 (0)

Effort =	5.0
Total CPUE =	1.4 (29; 7)
Stock CPUE =	1.4 (29; 7)
PSD =	100 (0)
PSD-10 =	86 (15.8)

Figure 7. Number of White Crappie caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Alvarado Park Reservoir, Texas, 2005, 2007, and 2013. Minimum length limit represented by vertical line.

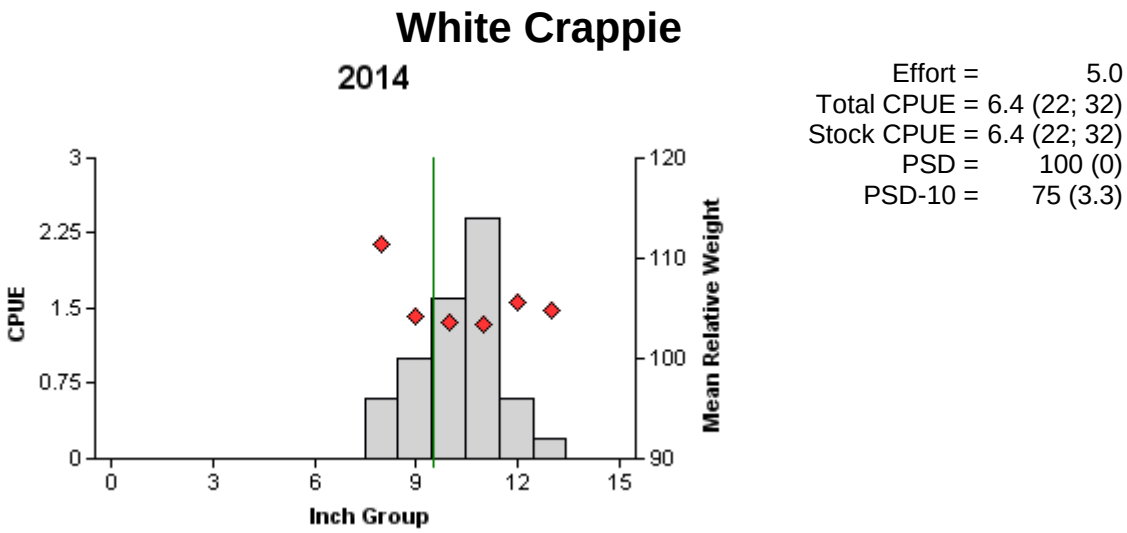


Figure 8. Number of White Crappie caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill netting surveys, Alvarado Park Reservoir, Texas, 2014. Minimum length limit represented by vertical line.

Table 8. Proposed sampling schedule for Alvarado Park Reservoir, Texas. Survey period is June through May. 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	Electrofish Fall(Spring)	Trap net	Gill net	Habitat		Access	Creel survey	Report
				Structural	Vegetation			
2014-2015								
2015-2016								
2016-2017								
2017-2018	S	S	S		S	S		S

APPENDIX A

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Alvarado Park Reservoir, Texas, 2013-2014. Sampling effort was 5 net nights for gill netting, 5 net nights for trap netting, and 1 hour for electrofishing.

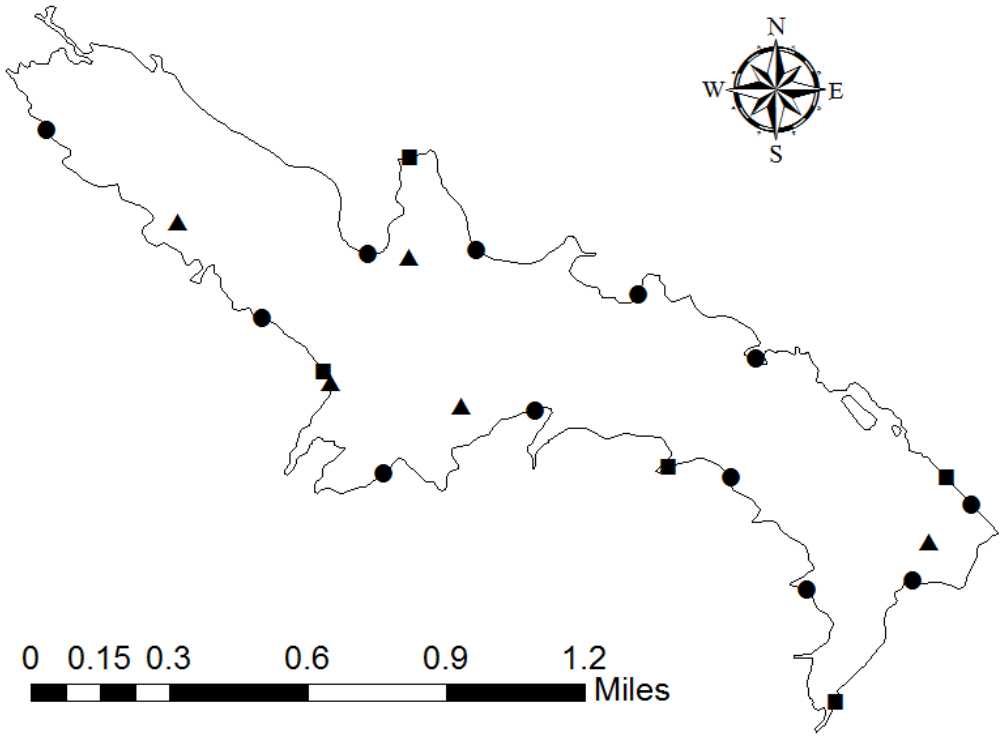
Species	Gill Netting		Trap Netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Gizzard Shad					569	569.0
Threadfin Shad					1,575	1,575.0
Channel Catfish	44	8.80				
Blue Catfish	6	1.20				
White Bass	5	1.00				
Bluegill					544	544.0
Longear Sunfish					65	65.0
Redear Sunfish					8	8.0
Largemouth Bass					144	144.0
White Crappie	32	6.40	7	1.40		

APPENDIX B

Historical catch rates (CPUE) of targeted species by gear type for standard surveys on Alvarado Park Reservoir, Texas, 1998 to present. All stations were randomly selected. Electrofishing stations were shocked with a 5.0 Smith-Root GPP (Gas Powered Pulsator) until 2010, after which a 7.5 Smith-Root GPP was used. Species averages are in bold. Gill net catches of White Crappie are marked with an (*), and do not contribute to historical averages for crappie.

Gear	Species	1998	2001	2002	2004	2005	2006	2007	2009	2010	2013	2014	Avg.
Electrofisher													
	Largemouth Bass	223	305			124			166		144		**192**
	Gizzard Shad	134	510			168			67		569		**290**
	Threadfin Shad	3468	582			2801			225		1575		**1730**
	Bluegill Sunfish	369	518			241			228		544		**380**
	Redear Sunfish	8	20			14			16		8		**13**
	Longear Sunfish	74	98			84			36		65		**71**
	Green Sunfish	16	6			8			0		0		**6**
	Warmouth	1	3			7			1		0		**2**
Gill nets													
	Blue Catfish	0		0	0.4		0.6			1.0		1.2	**0.5**
	Channel Catfish	5.6		4.0	3.4		5.0			17.8		8.8	**7.4**
	Flathead Catfish	0		0	0		0.4			0.4		0	**0.1**
	White Bass	22.6		29.4	26.8		28.2			25.6		1.0	**22.3**
	White Crappie											6.4	**6.4**
	Black Crappie											0	**0**
Trap nets													
	White Crappie	51.6	0.6			2.6		1.2			1.4		**12**
	Black Crappie												

APPENDIX C



Location of sampling sites, Alvarado Park Reservoir, Texas, 2013-2014. Electrofishing, gill netting and trap netting stations are indicated by circles, triangles and squares respectively. Water level was near full pool at time of sampling.