PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-3

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2012 Fisheries Management Survey Report

Austin Reservoir

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TABLE OF CONTENTS

SURVEY AND MANAGEMENT SUMMARY

Fish populations in Austin Reservoir were surveyed in 2012 using electrofishing and in 2013 using gill netting. Historical data are presented with the 2012-2013 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:** Austin Reservoir is a stable-level 1,599-acre riverine type impoundment of the Colorado River located in the heart of the City of Austin (COA). It was constructed in 1893 for purposes of hydro-electric power, municipal water supply, water conservation and recreation. The reservoir is used to pass water from Travis Reservoir downstream. The reservoir is operated by the Lower Colorado River Authority (LCRA) and COA. The reservoir lies within the Edwards Plateau and has a drainage area of approximately 38,240 square miles. Land surrounding the reservoir is highly developed with commercial and residential property bordering most of the shoreline. Natural habitat features consisted of boulders, native and non-native submerged aquatic plants, including hydrilla (*Hydrilla verticillata*).

- **Management History:** Important sport fish include Largemouth Bass and catfish. The management plan from the 2008 survey report included stocking Florida Largemouth Bass to maintain high genetic influence and managing invasive levels of hydrilla. Largemouth Bass have been managed under statewide regulations.

- **Fish Community**
  - **Prey species:** Bluegill, Redbreast Sunfish, Gizzard Shad and Threadfin Shad were the dominant prey species available.
  - **Catfishes:** Channel, Blue and Flathead Catfish were present in low density.
  - **Largemouth Bass:** Largemouth Bass were abundant. Almost all angling effort on the reservoir is directed towards Largemouth Bass. Lake Austin is considered one of Texas' best trophy Largemouth Bass fisheries. Since 1994, nineteen Largemouth Bass weighing 13 pounds or greater caught by anglers have been entered into the Texas Parks and Wildlife Department (TPWD) ShareLunker Program. The most recent entry was in March 2013.

Management Strategies: The reservoir should continue to be managed with existing harvest regulations. Aquatic vegetation coverage, including hydrilla, typically varies each year and will be monitored every year on a quarterly basis or as required. Conduct additional electrofishing surveys in 2013, 2014, 2015 to measure Largemouth Bass abundance as it relates to aquatic vegetation coverage, and general monitoring surveys with gill nets, and electrofishing surveys in 2016-2017. An access survey will be conducted in 2016. Continue Florida Largemouth Bass stockings to maintain optimal genetic influence and trophy potential of this population. Promote the trophy Smallmouth Buffalo opportunities to meet increasing angler interests. Inform the public about the negative impacts of aquatic invasive species.

INTRODUCTION

This document is a summary of fisheries data collected from Austin Reservoir in 2012-2013. 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 2012-2013 data for comparison.

Reservoir Description

Austin Reservoir is a stable-level 1,599-acre riverine type impoundment of the Colorado River located in the City of Austin (COA). It was constructed in 1893 for purposes of hydro-electric power, municipal water supply, water conservation and recreation. The reservoir is used to pass water from Travis Reservoir downstream. The reservoir is operated by the Lower Colorado River Authority (LCRA) and COA. The reservoir lies within the Edwards Plateau and has a drainage area of approximately 38,240 square miles. Austin Reservoir was mesotrophic with a mean TSI chl-*a* of 42.92 (Texas Commission on Environmental Quality 2011). Land surrounding the reservoir is highly developed with commercial and residential property bordering most of the shoreline. Shoreline habitat at time of sampling consisted of bulkhead, natural shoreline, rocky bluffs, boulders, and native and non-native submerged vegetation. The most common shoreline habitat feature was bulkhead (43%). Hydrilla and Eurasian watermilfoil, non-natives, account for the vast majority of the aquatic vegetation habitat in the reservoir. Other descriptive characteristics for Austin Reservoir are listed in Table 1.

Angler Access

Austin Reservoir has four public boat ramps. All ramps remained open under stable water level conditions maintained at this reservoir. Additional boat ramp characteristics are in Table 2. Public shoreline access was available in seven public parks.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Magnelia and De Jesus 2009) included:

1. Continue annual aquatic vegetation and fall electrofishing surveys.
   Action: Multiple aquatic vegetation surveys were conducted annually to monitor hydrilla and other aquatic vegetation. Annual fall electrofishing surveys were conducted to monitor the Largemouth Bass population.
2. Continue to use hydrilla coverage, as documented by TPWD aquatic vegetation surveys, to determine the need for additional triploid Grass Carp (*Ctenopharyngodon idella*) stockings.
   Action: Data from aquatic vegetation surveys were used to determine triploid Grass Carp stocking rates in Austin Reservoir. The stockings were coordinated by a user-group committee formed to manage aquatic vegetation in the reservoir.
3. Continue Florida Largemouth Bass sub-species stockings when applicable.
   Action: Florida Largemouth Bass were stocked in 2009, 2010 and 2011 into Austin Reservoir.

Harvest regulation history: Sport fish in Austin Reservoir have been managed with statewide regulations. Current regulations are found in Table 3.

Stocking history: Since 1996 Austin Reservoir has been stocked regularly with Florida Largemouth Bass. With the current increase in ShareLunker entries from this reservoir, ShareLunker offspring have

been stocked since 2008. Triploid Grass Carp have been stocked to control expanding hydrilla since 2003. The complete stocking history is in Table 4.

Vegetation/habitat management history: Aquatic vegetation management has been a part of the Austin Reservoir overall management scheme for over fifty years. A history of aquatic vegetation management efforts through 2000 are found in Tennant and Magnelia (2001). Since 2003 48,359 triploid Grass Carp have been stocked by the COA, TPWD, LCRA and Friends of Lake Austin (FOLA) to control the aquatic plant hydrilla. A history of those efforts and effects on the Largemouth Bass population through 2006 is found in Chilton and Magnelia (2009). In addition to triploid Grass Carp stockings the reservoir has been periodically drawn down 12 feet during the winter months in an attempt to manage aquatic vegetation. Waterfront homeowners have also used bottom barriers and harvesters to control aquatic vegetation along their shoreline. Angler attitudes and opinions concerning aquatic vegetation management practices on the reservoir are found in Smith et al. (2002).

Water transfer: Austin Reservoir is primarily used for municipal water supply, recreation, and to a lesser extent, flood control. No interbasin transfers are known to exist.

METHODS

Fishes were collected by electrofishing (1.5 hours at 18, 5-min stations) and gill 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 and creel statistics. Ages were determined for Largemouth Bass in fall 2012 using otoliths from 13 individuals between 330 and 381mm (category 2 age analysis; TPWD, Inland Fisheries Division, unpublished manual revised 2011).

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 structural habitat consisted primarily of bulkhead and natural shoreline (Table 5). Aquatic vegetation coverage expanded to over 600 acres (39.5%) of the reservoir's surface area (Table 6) compared to 159 acres (10%)% coverage reported by Magnelia and De Jesus in 2009. Hydrilla was first documented in the reservoir in July 1999. In 2000, 2001 and 2002, winter (January and February) reservoir drawdowns were used by the controlling authorities in an attempt to control this potentially invasive aquatic plant. In February 2003, the first triploid Grass Carp stocking was initiated by COA. As of spring 2013, over 48,000 triploid Grass Carp have been stocked into Austin Reservoir by COA, TPWD, LCRA and FOLA. Stocking rates were based on the results of TPWD aquatic vegetation surveys, and Grass Carp were incrementally stocked over a four year period. The premise of incrementally stocking was to rely upon the fact that hydrilla would be a preferred food item (Fowler and Robson 1978). The

strategy was to increase the number of Grass Carp slowly until there were just enough in the reservoir to control hydrilla, but not so many as to eliminate less preferred species (Chilton and Magnelia 2009). The decision to incrementally stock, rather than using high initial stocking rates, was made with the understanding that aquatic vegetation was good for erosion control, fish habitat and water clarity (Carpenter and Lodge 1986). The number of triploid Grass Carp in the reservoir per acre of hydrilla, taking into account monthly mortality, ranged from 11.8 to 3,482.4 (Chilton and Magnelia 2009). Historic trends show responses in hydrilla coverage since the introduction of triploid Grass Carp in 2003 without affecting the Eurasian watermilfoil (*Myriophyllum spicatum*), not preferred by the triploid Grass Carp (Magnelia and De Jesus 2009). Since 2008 the hydrilla mixed with other aquatic plants has remained concentrated in the very upper end of the reservoir, above Emma Long Park (Appendix C). Eurasian watermilfoil competes with hydrilla and coverage for these species has fluctuated in past years, possibly related to ecological conditions alternately favoring both species. The milfoil species typically grows in a depth of 15 feet or less and is adapted to grow at cooler temperatures (Smith and Barko 1990), while hydrilla can grow to over 20 feet of depth in the reservoir's clear water and require warmer temperatures to flourish. Extreme drought conditions in central Texas since 2011 have led to the reduction of hypolimnetic discharges from Travis Reservoir upstream, which creates a water temperature gradient in Austin Reservoir. Cooler water will reach approximately mid reservoir under regular releases from Travis Reservoir, warming further downstream. Low discharge flows and reduced cool water stretches have created favorable conditions for hydrilla in the upper stretches of Austin Reservoir. In September 2012, hydrilla accounted for almost 90% of the aquatic vegetation coverage surveyed. This aquatic plant coverage in the upper third of the reservoir has provided good cover for Largemouth Bass (Appendix C), but the remainder of the reservoir lacked significant stands of aquatic vegetation. Overall lake coverage has remained within the ideal percentages (20 – 40%) optimal for fish production (Durocher et al. 1984, Dibble et al. 1996); however it's all concentrated in the upper end, causing unfavorable conditions for boaters and swimmers, while habitat is sparse in the lower portion of the lake. Cooler water temperatures in the uppermost stretches of the reservoir may be a factor affecting Grass Carp feeding rates in this section (Chilton and Magnelia 2009). This may explain why aquatic vegetation remains in this area, while aquatic vegetation in the middle and lower reaches of the reservoir has mostly disappeared. Eurasian watermilfoil is also one of the least preferred submerged plant species for Grass Carp (Fowler and Robson 1978), which may explain the few consistent patches of milfoil growing in the lower portion of the lake.

Prey species: Electrofishing catch rates of Gizzard Shad declined to 47.3/h in 2012 from 77.3/h, in 2008. Index of vulnerability (IOV) for Gizzard Shad was poor, indicating that only 3% of Gizzard Shad were available to existing predators; this was lower than IOV estimates in previous years (Figure 1). Total CPUE of Redbreast Sunfish, Bluegill and Redear Sunfish in 2012 were 355.3/h, 73.3/h and 24.0/h, respectively. These were noticeable increases from the 126.0/h, 44.7/h and 10.7/h, respectively in 2008 (Figures 2, 3 and 4). Size structures continued to be dominated by small individuals; however large Redbreast and Redear Sunfish individuals were present and provided quality sunfish fishing opportunities (Figures 2, 3 and 4). Other common prey species present included Golden Shiners and Blacktail Shiners (Appendix A). It is probable that the increased biomass of aquatic vegetation since 2011 has favored the centrarchid forage species while reducing the abundance of the pelagic clupeids, also possibly affected by the increasing Largemouth Bass abundance.

Catfishes: The gill net catch rate of Channel Catfish was 2.4/nn in 2013, increasing from 1.0/nn in 2009 (Figure 5). The Channel Catfish population continued to have low relative abundance with an apparent increase in the number of larger fish (≥20 inches). Channel Catfish condition was good as most mean relative weights (W_r) remained above 100% for most inch groups. Blue Catfish and Flathead Catfish were present in low densities.

White Bass: White Bass were present in low densities. Only 3 individuals were collected in gill nets, accounting for a catch rate of 0.6/nn; similar to previous surveys.

Largemouth Bass: Austin Reservoir contained a high quality, moderate density Largemouth Bass population. Historic creel surveys revealed almost all angling effort (91%) on the reservoir was directed towards Largemouth Bass (Smith et al. 2002). Many large bass have been caught in this reservoir since the early 1990's, including nineteen bass over 13 pounds, which were entered into the TPWD ShareLunker Program. Based on these catches, it is regarded as one of the state's best trophy Largemouth Bass fisheries. The electrofishing catch rate of stock-length Largemouth Bass was 97.3/h in 2012, higher than the 57.3/h in 2008. Size structure was adequate as PSD varied from 39 to 62 since 2004; with memorable- and trophy-size individuals present (Figure 6). Growth of Largemouth Bass in Austin Reservoir was average for the Edwards Plateau eco-region (Figure 7); as, on average, fish reached legal harvest size of 14 inches by age 3 (N = 13; range = 1 – 3 years). Body condition in 2012 was good (relative weight ≥85) for nearly all size classes of fish and was more consistent than body condition in previous surveys (Figure 6). Florida Largemouth Bass influence has remained relatively constant as Florida alleles have ranged from 71 to 80% and Florida genotype has ranged from 7 to 17% (Table 7).

The increase in total vegetation coverage since 2011 has had a positive effect on Largemouth Bass abundance, reversing the declining electrofishing catch rate trend reported by Magnelia and De Jesus in 2009. Continuing annual fall electrofishing surveys along with aquatic vegetation monitoring will help us further evaluate this relationship in coming years. The biggest challenge currently faced is mediating vegetation control needs between the boaters, homeowners and anglers. The established aquatic vegetation control scheme is not a popular option among bass anglers due to historical outcomes at other reservoirs managed with Grass Carp. The perception among anglers is that Grass Carp will eliminate all available vegetation habitats, potentially decimating the popular trophy fishery. TPWD understands this premise and has advocated for conservative triploid Grass Carp stocking rate increments to avoid such outcome; however navigation and flood effect concerns cannot be neglected in this multi-use reservoir. Magnelia and De Jesus (2009) determined that the current triploid Grass Carp stocking regime did not affect Largemouth Bass electrofishing catch rates; furthermore, mean electrofishing CPUE(21) significantly increased (P<0.05) after triploid Grass Carp introduction. The goal is to manage aquatic vegetation by reducing hydrilla coverage while allowing native plant species to fill in the required habitat to help sustain this popular trophy fishery.

Fisheries management plan for Austin Reservoir, Texas

Prepared – July 2013.

ISSUE 1: Aquatic vegetation management continues to be an issue of concern in Austin Reservoir. If hydrilla coverage increases, further stocking of triploid Grass Carp may be requested by the City of Austin or other partners. Aquatic vegetation provides the only significant habitat for Largemouth Bass in the reservoir. Reductions in this habitat over the long-term (years) could decrease abundance of this species and the quality of the fishery.

MANAGEMENT STRATEGIES

1. Continue annual aquatic vegetation and fall electrofishing surveys to document vegetation coverage and Largemouth Bass population trends.
2. Continue to use hydrilla coverage, as documented by TPWD aquatic vegetation surveys, to determine the need for additional triploid Grass Carp stockings.

ISSUE 2: Nineteen Largemouth Bass over 13 pounds (i.e., trophy bass) have been documented caught from this reservoir since the early 1990's. Many 8- to 12-pound fish are regularly reported caught in tournaments and by recreational anglers as well. Based on these catches the reservoir has the potential for producing trophy Largemouth Bass. Maintaining genetic influence from the Florida sub-species of Largemouth Bass will increase the potential for future trophy bass catches.

MANAGEMENT STRATEGY

1. Continue requesting annual Florida Largemouth Bass sub-species stockings at 10/acre.

ISSUE 3: In recent years there has been increasing interest in trophy Smallmouth Buffalo fishing in Texas, especially Austin-area reservoirs. The species is attracting anglers from other states and overseas, where Smallmouth Buffalo rarely reach large sizes or are not available. The rod and reel record for Austin Reservoir is 70.5 pounds. The anglers employ European-style bank fishing techniques and are limited to those reservoirs offering good bank access. Historically, the species has not been recognized as a sport fish.

MANAGEMENT STRATEGIES

1 Promote the availability of the Smallmouth Buffalo fishery in Austin Reservoir to recruit more anglers.
2 Investigate opportunities to increase bank access for these angler types.

ISSUE 4: 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.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule includes additional electrofishing in 2013, 2014 and 2015 and mandatory monitoring in 2016/2017 (Table 8). Additional electrofishing surveys are necessary to maintain consistent data for trend information on this heavily used Largemouth Bass fishery. Gill net survey is only necessary every four years at this point to monitor Channel Catfish, Flathead Catfish, Smallmouth Buffalo, and White Bass populations. Annual vegetation surveys are necessary to monitor hydrilla and Eurasian watermilfoil.

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.

Carpenter, S. R., and D. M. Lodge. 1986. Effects of submersed macrophytes on ecosystem processes. Aquatic Botany 26:341-370.

Chilton, E. W., and S. J. Magnelia. 2009. Use of an incremental triploid Grass Carp stocking strategy for maintaining vegetation coverage in a riverine Texas reservoir. Pages 543-555 In: M.S. Allen, S. Sammons and M.J. Maceina, editors. Balancing Fisheries Management and Water Uses for Impounded River Systems. American Fisheries Society, Bethesda, Maryland.

Dibble, E. D., K. J. Killgore and S. H. Harrel. 1996. Assessment of fish-plant interactions. American Fisheries Society Symposium 16:357-372

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.

Durocher, P. P., W. C. Provine, and J. E. Kraai. 1984. Relationship between abundance of largemouth bass and submerged vegetation in Texas reservoirs. North American Journal of Fisheries Management 4: 84-88.

Fowler, M. C. and T. O. Robson. 1978. The effects of the food preferences and stocking rates of Grass Carp *Ctenopharyngodon idella* Val. on mixed plant communities. Aquatic Botany 5:261-76.

Guy, C. S., R. M. Neuman, D. W. Willis, and R. O. Anderson. 2007. Proportional size distribution (PSD): a further refinement of population size structure index terminology. Fisheries 32(7): 348.

Magnelia, S. J., and M. J. De Jesus. 2009. Statewide freshwater fisheries monitoring and management program survey report for Austin Reservoir, 2008. Texas Parks and Wildlife Department, Federal Aid Report F-30-R-34, Austin. 25 pp.

Smith, C. S., and J. W. Barko. 1990. Ecology of Eurasian Watermilfoil. Journal of Aquatic Plant Management 28: 55-64.

Smith, T. O., S. J. Magnelia and F. Janssen. 2002. Lake Austin angler attitude and opinion and economic impact study: Final Report. Texas Parks and Wildlife Department, Austin, Texas. 15 pp.

Tennant, M. A. and S. J. Magnelia. 2001. Statewide freshwater fisheries monitoring and management program survey report for Austin Reservoir, 2000. Texas Parks and Wildlife Department, Federal Aid Report F-30-R, Austin. 31 pp.

Texas Commission on Environmental Quality. 2011. Trophic classification of Texas reservoirs. 2010 Texas Water Quality Inventory and 303 (d) List, Austin. 18 pp.

Table 1. Characteristics of Austin Reservoir, Texas.

Characteristic	Description
Year constructed	1893
Controlling authority	LCRA and COA
County	Travis
Reservoir type	Mainstem water supply
Shoreline Development Index (SDI)	8.5
Conductivity	400 - 700 µS/cm

Table 2. Boat ramp characteristics for Austin Reservoir, Texas, September, 2012. Reservoir elevation at time of survey was 493 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Walsh Boat Landing	30.29721 -97.78380	Y	12	NA	Excellent, no access issues
Loop 360 Bridge	30.34975 -97.79940	Y	20	NA	Excellent, no access issues
Emma Long Park	30.32930 -97.84285	Y	20	NA	Excellent, no access issues
Mary Quinlan Park	30.32624 -97.92852	Y	10	NA	Excellent, no access issues

Table 3. Harvest regulations for Austin Reservoir, Texas.

Species	Bag limit	Length limit
Catfish: Channel and Blue Catfish, 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	5[a] (only 1 > 24 inches)	14-inch minimum
Bass: Spotted and Guadalupe	5[a]	None
Crappie: White and Black Crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum

[a] Daily bag for Largemouth Bass, Spotted Bass, and Guadalupe Bass = 5 fish in any combination.

Table 4. Stocking history of Austin 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)
Channel Catfish	2007	204	ADL	14.6
	Total	204		
Florida Largemouth Bass	1996	1,103,215	FRY	0.6
	1997	196,074	FRY	0.7
	1998	184,554	FGL	1.4
	1998	685,311	FRY	0.7
	1999	4,980	AFGL	5.4
	1999	184,016	FGL	1.7
	2003	262,750	FGL	1.7
	2003	881,925	FRY	0.6
	2004	318	ADL	10.2
	2004	162,149	FGL	1.6
	2004	431,007	FRY	0.4
	2005	12,000	FGL	1.9
	2007	171,291	FGL	2.1
	2007	89,897	FRY	0.3
	2009	174,246	FRY	0.3
	2010	182,277	FGL	1.7
	2011	436,843	FRY	0.3
	Total	5,162,853		
Grass Carp	2003	13	ADL	24.1
	Total	13		
Northern Pike	1980	88,500		UNK
	1981	34,514		UNK
	Total	123,014		
Palmetto Bass (Striped X White Bass hybrid)	1975	20,000	UNK	UNK
	1977	20,035	UNK	UNK
	1981	5,000	UNK	UNK
	1983	10,089	UNK	UNK
	Total	55,124		
Rainbow Trout	2001	3,008	ADL	9.3
	Total	3,008		
ShareLunker Largemouth Bass	2008	12,612	AFGL	6.2
	2010	2,220	FGL	2.5

Species	Year	Number	Life Stage	Mean TL (in)
	2011	3,913	FGL	2.4
	2012	11,025	FGL	2.0
	Total	29,770		
Triploid Grass Carp	2003	3,825	ADL	UNK
	2004	4,300	ADL	UNK
	2006	1,600	ADL	UNK
	2007	3,075	ADL	UNK
	2009	4,400	ADL	12.0
	2011	10,800	ADL	13.0
	2012	11,369	ADL	12.0
	2013	9,000	ADL	12.0
	Total	48,369		
Walleye	1976	20,200	FRY	0.2
	Total	20,200		

Table 5. Survey of structural habitat types, Austin Reservoir, Texas, 2012. Shoreline habitat type units are in miles.

Habitat type	Estimate	% of total
Bulkhead	3.6	6.0
Bulkhead with boat docks	22.7	37.7
Natural	13.9	23.1
Natural with boat docks	3.0	4.9
Rocky bluff	4.7	7.8
Rocky bluff with boat docks	2.2	3.7
Rocky	8.3	13.7
Rocky with boat docks	2.0	3.2

Table 6. Survey of aquatic vegetation, Austin Reservoir, Texas, early fall 2009 – 2012. Surface area (acres) is listed with percent of total reservoir surface area in parentheses. All surveys were conducted in September except for 2010 when the survey was conducted in August.

Vegetation	2009	2010	2011	2012
Native submersed	49 (3.1)	272 (17.0)	2 (<1.0)	-
Native emergent	-	-	-	-
Non-native				
Hydrilla	339 (21.2)	66 (4.1)	536 (33.5)	554 (34.6)
Eurasian watermilfoil	158 (10.0)	225 (14.1)	80 (5.0)	78 (4.9)

Gizzard Shad

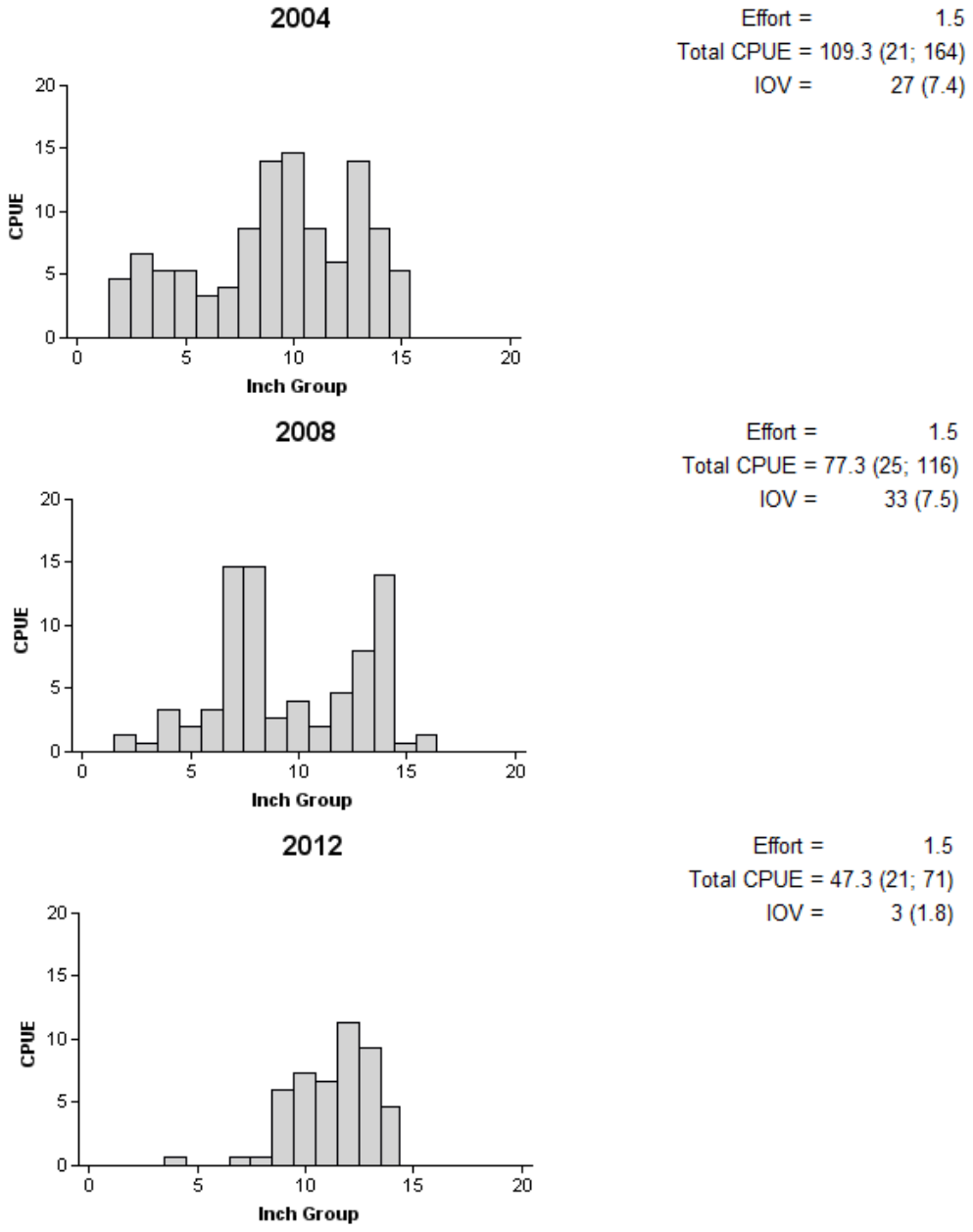


Figure 1. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Austin Reservoir, Texas, 2004, 2008, and 2012.

Redbreast Sunfish

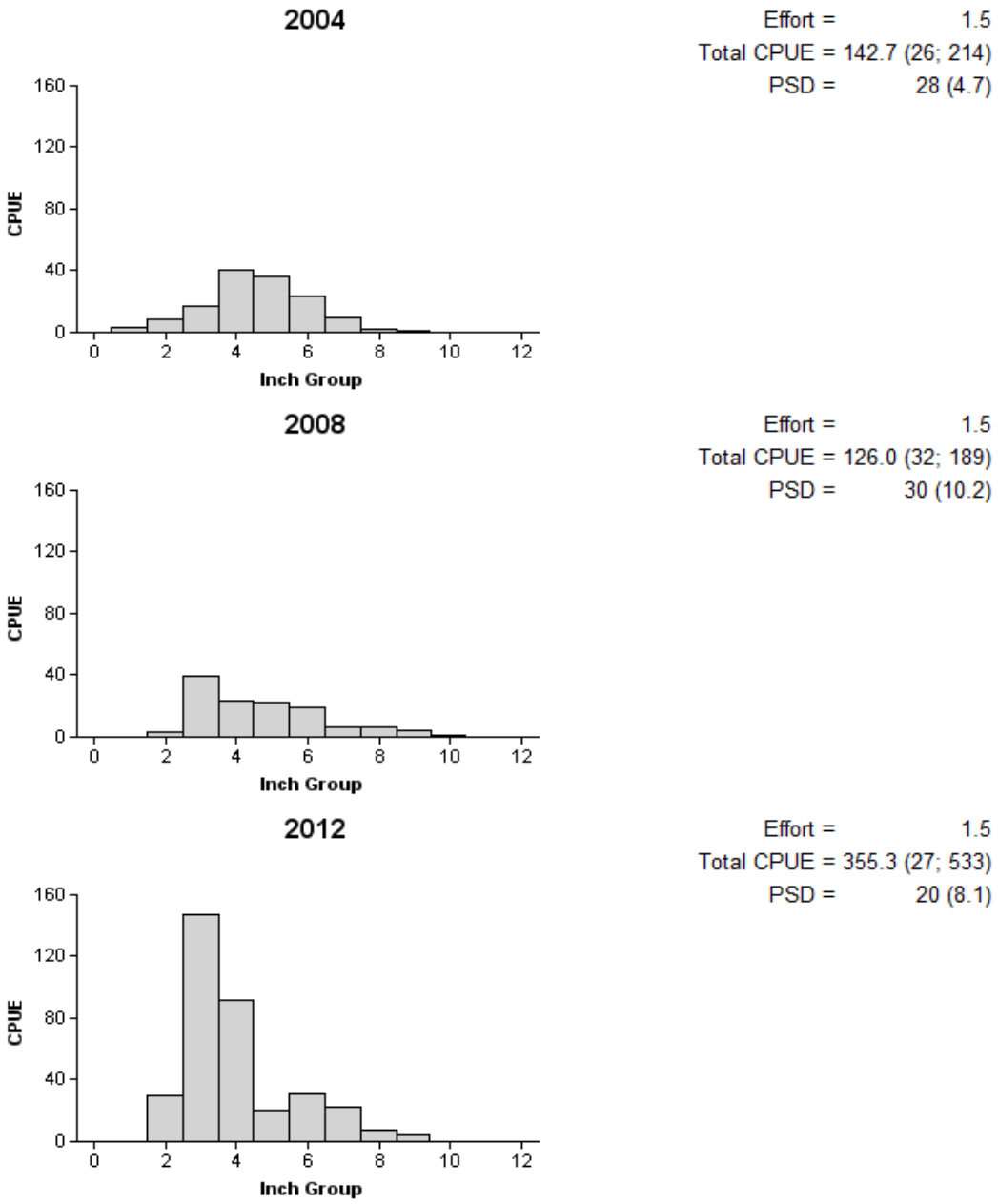


Figure 2. Number of Redbreast Sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Austin Reservoir, Texas, 2004, 2008, and 2012.

Bluegill

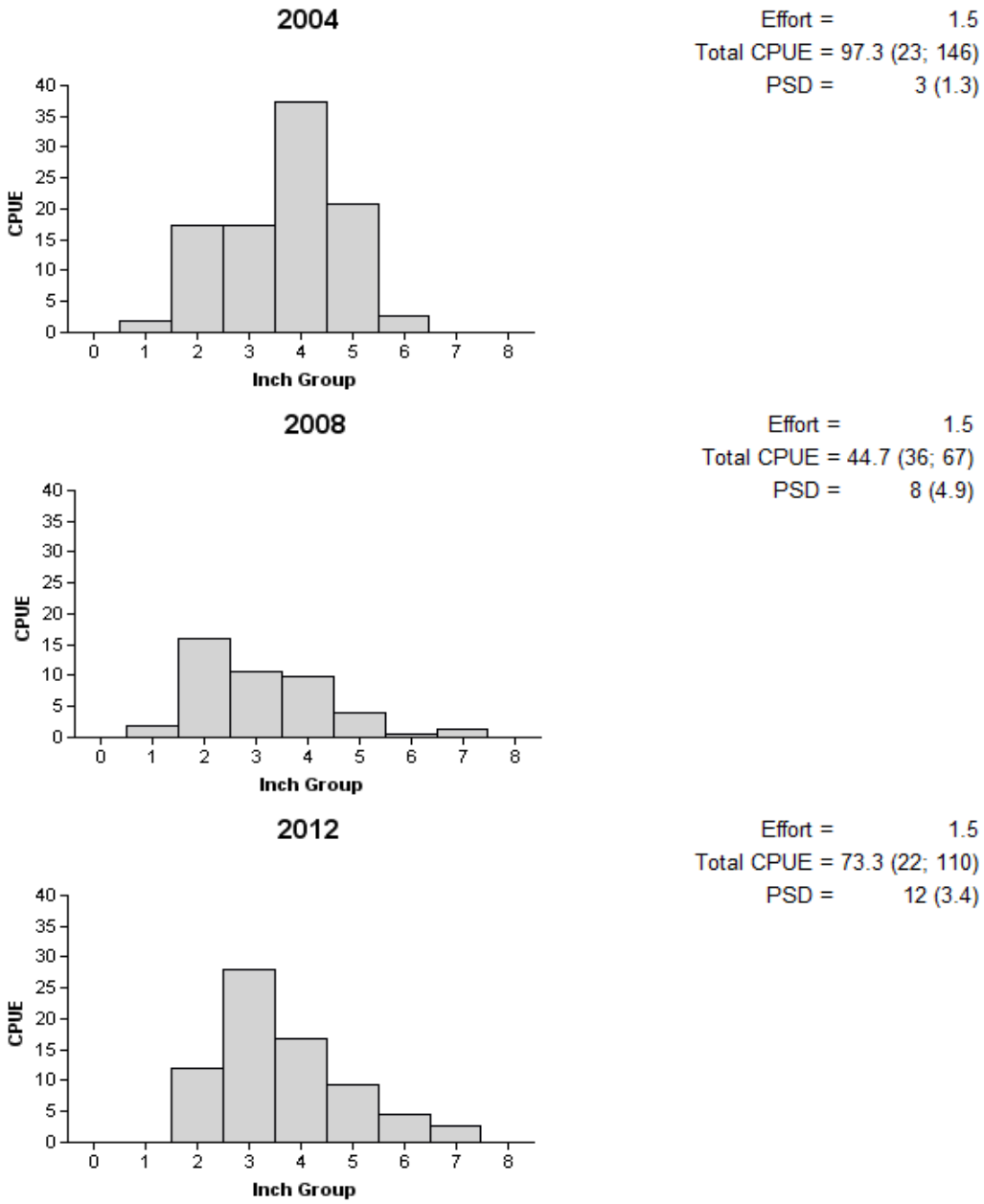


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Austin Reservoir, Texas, 2004, 2008, and 2012.

Redear Sunfish

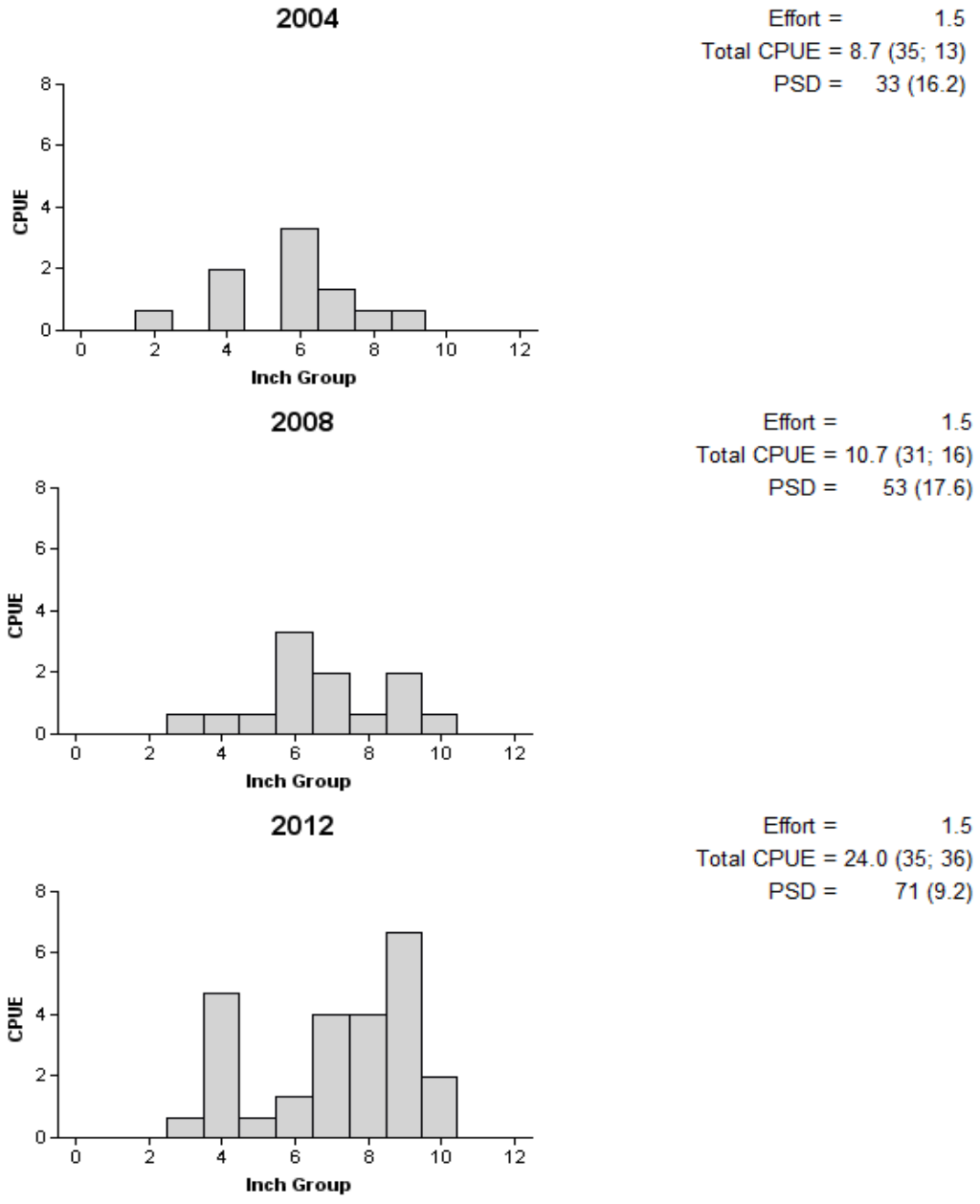


Figure 4. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Austin Reservoir, Texas, 2004, 2008, and 2012.

Channel Catfish

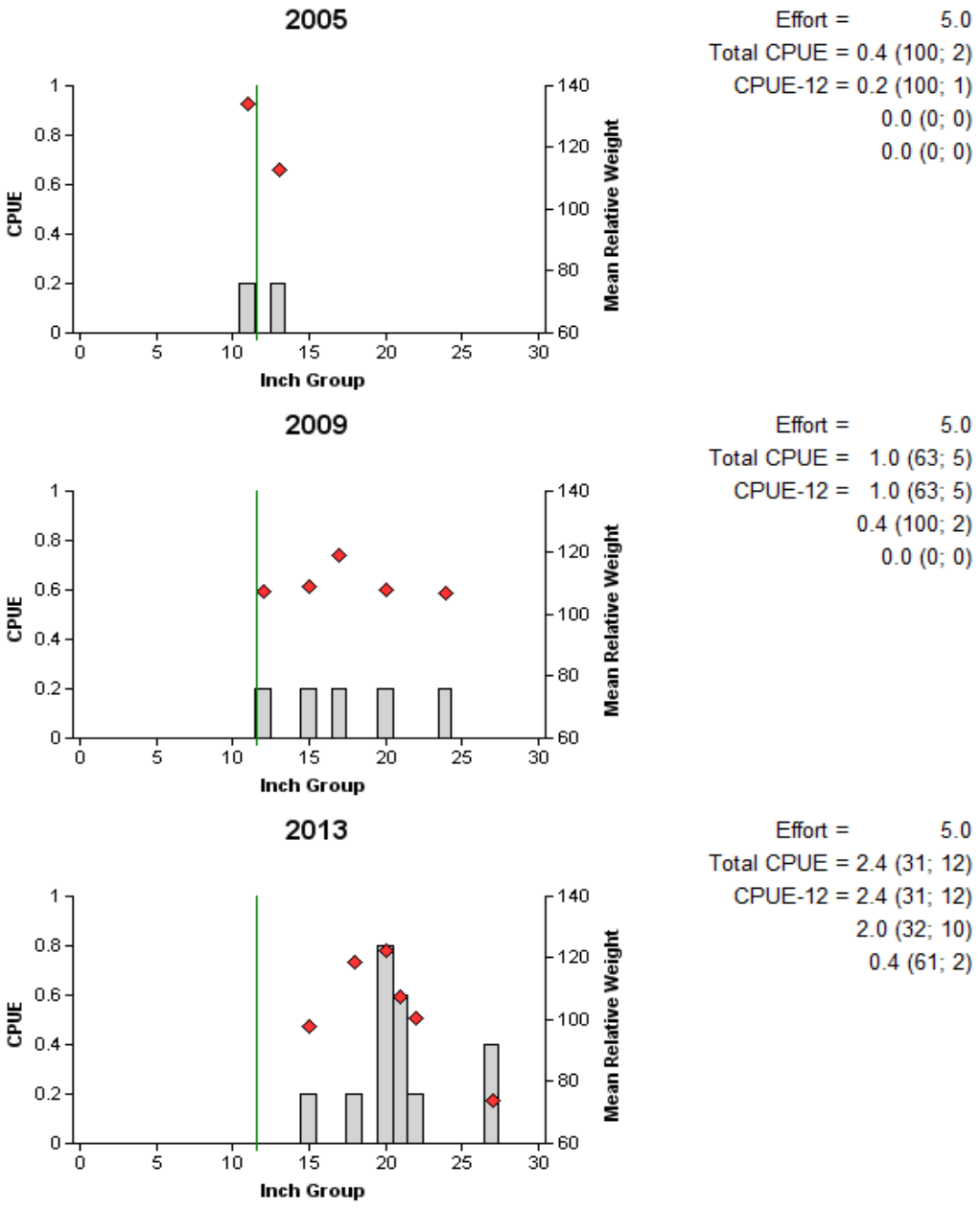
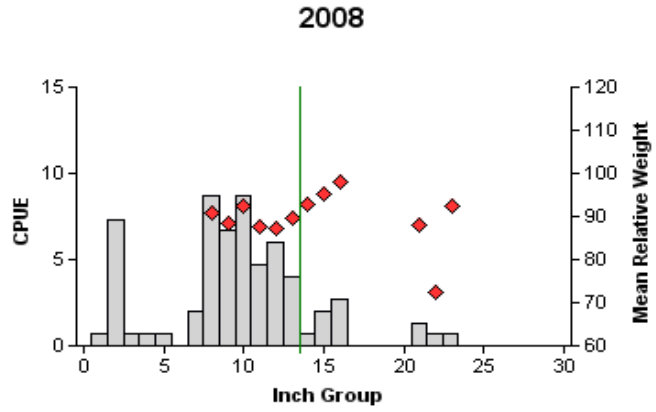
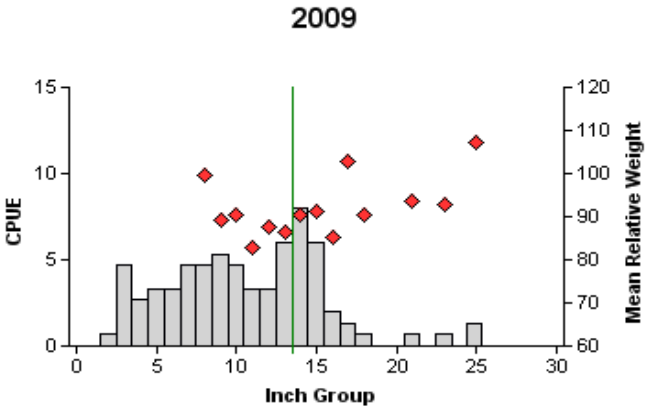


Figure 5. Number of Channel Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Austin Reservoir, Texas, 2005, 2009, and 2013. Vertical line represents minimum length limit at time of survey.

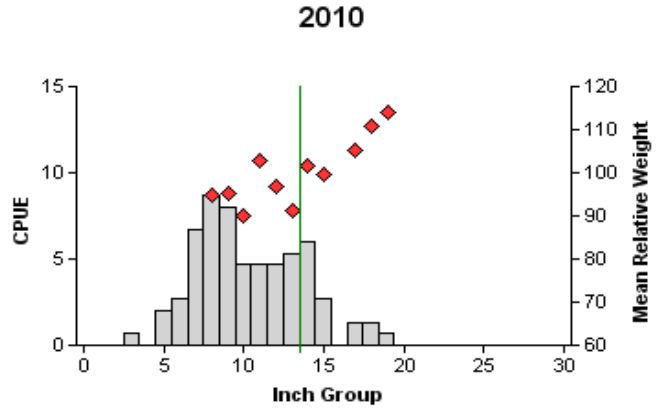
Largemouth Bass



Effort =	1.5
Total CPUE =	58.7 (18; 88)
Stock CPUE =	46.7 (19; 70)
CPUE-14 =	8.0 (24; 12)
CPUE-20 =	2.7 (45; 4)
CPUE-25 =	0.0 (0; 0)
PSD =	39 (7.2)
PSD-M =	6 (2.6)
PSD-T =	0 (0)



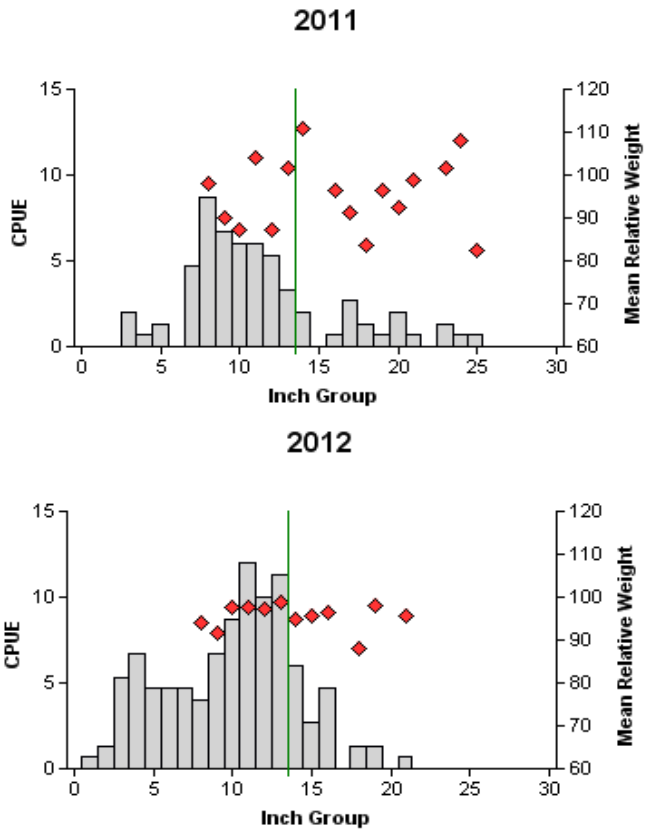
Effort =	1.5
Total CPUE =	67.3 (17; 101)
Stock CPUE =	48.0 (15; 72)
CPUE-14 =	20.7 (21; 31)
CPUE-20 =	2.7 (45; 4)
CPUE-25 =	1.3 (69; 2)
PSD =	62 (7.2)
PSD-M =	6 (2.4)
PSD-T =	3 (1.8)



Effort =	1.5
Total CPUE =	60.0 (16; 90)
Stock CPUE =	48.0 (18; 72)
CPUE-14 =	12.0 (20; 18)
CPUE-20 =	0.0 (0; 0)
CPUE-25 =	0.0 (0; 0)
PSD =	46 (5.5)
PSD-M =	0 (0)
PSD-T =	0 (0)

Figure 6. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Austin Reservoir, Texas, 2008, 2009, and 2010. Vertical line represents minimum length limit at time of survey.

Largemouth Bass



Effort =	1.5
Total CPUE =	57.3 (16; 86)
Stock CPUE =	48.7 (18; 73)
CPUE-14 =	12.7 (25; 19)
CPUE-20 =	5.3 (37; 8)
CPUE-25 =	0.7 (100; 1)
PSD =	44 (5.8)
PSD-M =	11 (3.5)
PSD-T =	1 (1.3)

Effort =	1.5
Total CPUE =	97.3 (15; 146)
Stock CPUE =	69.3 (16; 104)
CPUE-14 =	16.7 (21; 25)
CPUE-20 =	0.7 (100; 1)
CPUE-25 =	0.0 (0; 0)
PSD =	55 (7.9)
PSD-M =	1 (1)
PSD-T =	0 (0)

Figure 6 (cont.). Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Austin Reservoir, Texas, 2011 and 2012. Vertical line represents minimum length limit at time of survey.

Largemouth Bass

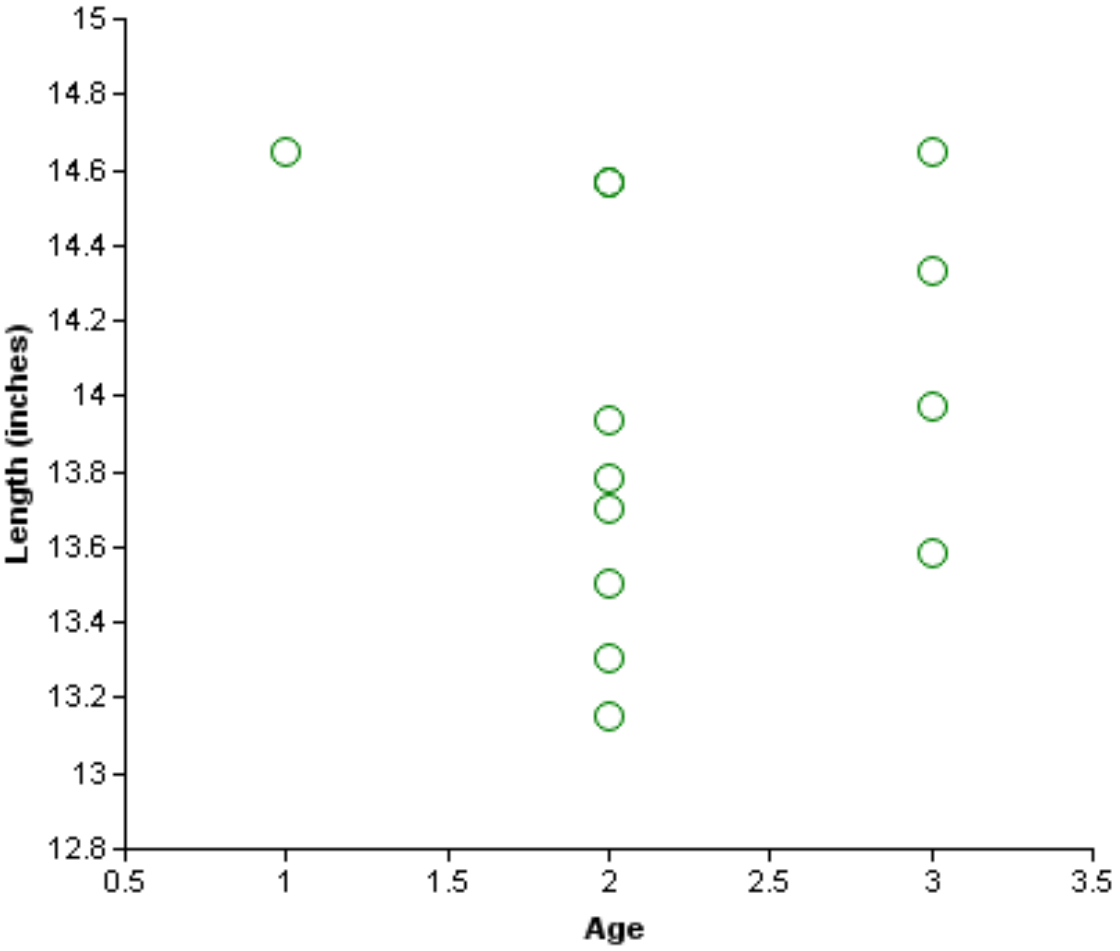


Figure 7. Length at age for Largemouth Bass collected by electrofishing at Austin Reservoir, Texas, November 2012 (N = 13).

Largemouth Bass

Table 7. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Austin Reservoir, Texas, 2006, 2008, and 2012. 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
2006	30	2	28	0	71.0	7.0
2008	30	4	26	0	76.0	13.0
2012	30	5	25	0	80.0	17.0

Table 8. Proposed sampling schedule for Austin 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			
2013-2014	A				A			
2014-2015	A				A			
2015-2016	A				A			
2016-2017	S		S		S	S		S

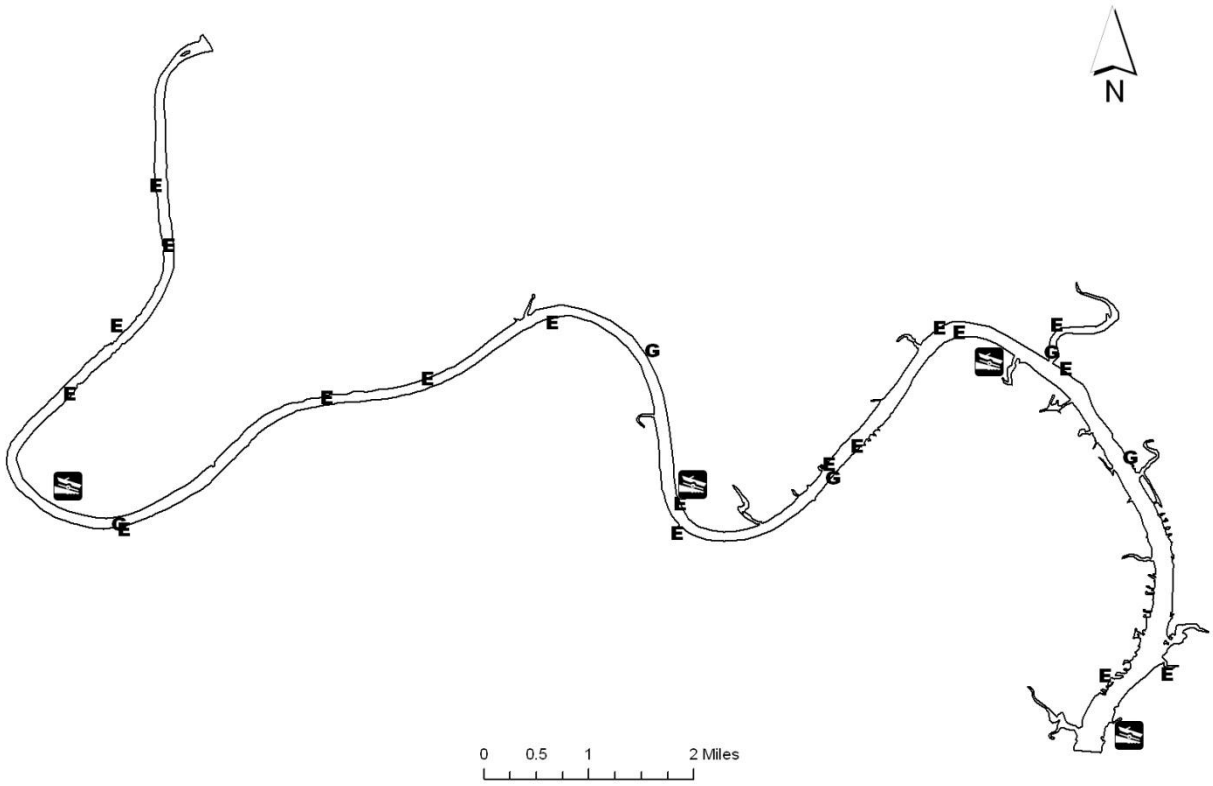
APPENDIX A

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Austin Reservoir, Texas, 2012-2013. Sampling effort was 5 net nights for gill netting and 1.5 hour for electrofishing.

Species	Gill Netting		Electrofishing	
	N	CPUE	N	CPUE
Gizzard Shad			71	47.3
Golden Shiner			44	29.3
Blacktail Shiner			4	2.7
Blue Catfish	1	0.2		
Channel Catfish	12	2.4		
Flathead Catfish	8	1.6		
White Bass	3	0.6		
Redbreast Sunfish			533	355.3
Warmouth			1	0.7
Bluegill			110	73.3
Longear Sunfish			1	0.7
Redear Sunfish			36	24.0
Redspotted Sunfish			53	35.3
Largemouth Bass			146	97.3
Guadalupe bass			1	0.7

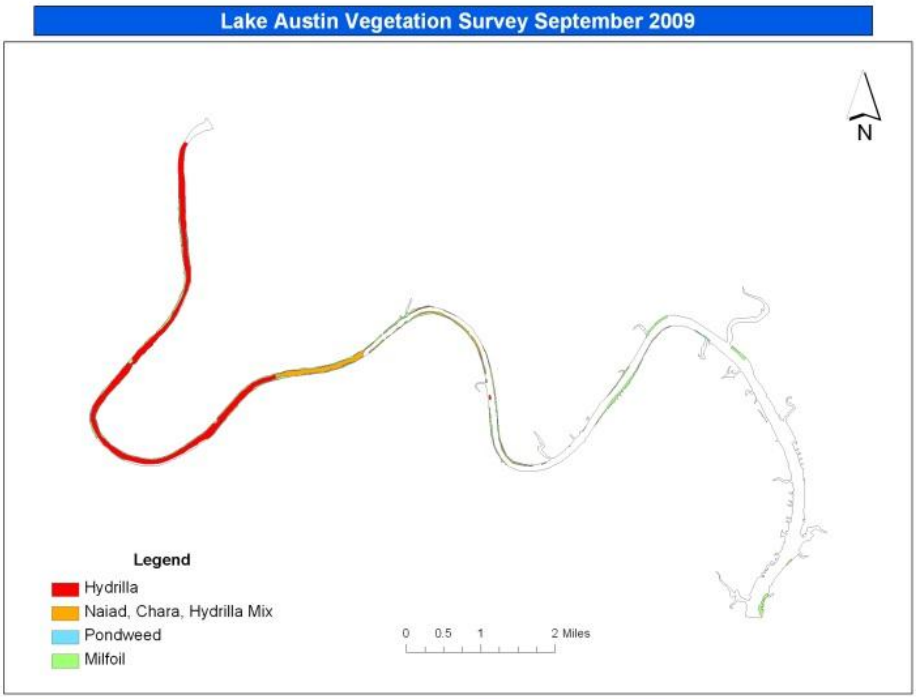
APPENDIX B

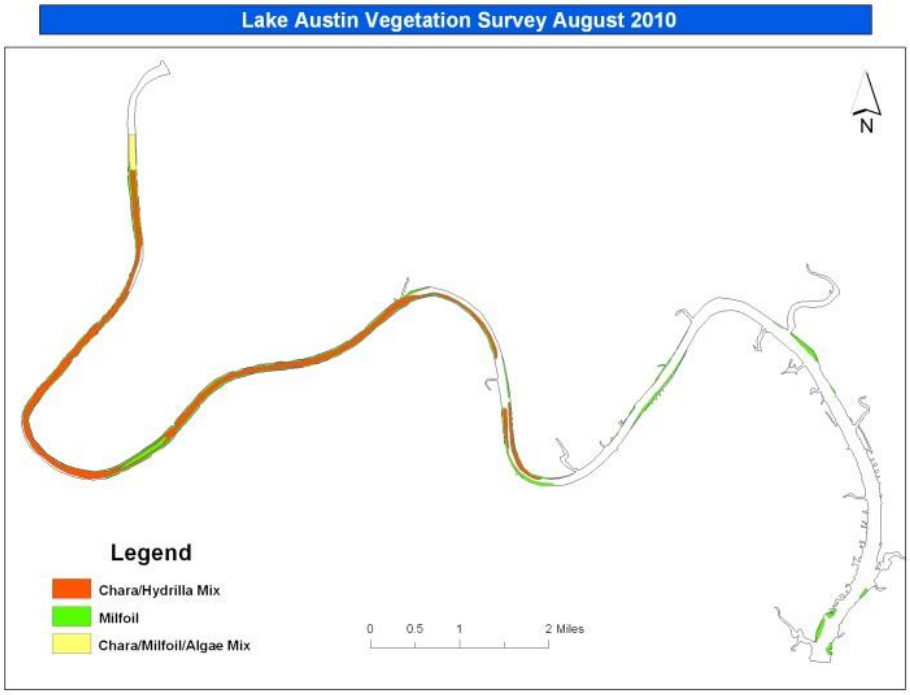
Location of sampling sites, Austin Reservoir, Texas, 2012-2013. Gill net and electrofishing stations are indicated by G and E, respectively. Water level was near full pool at time of sampling.



APPENDIX C

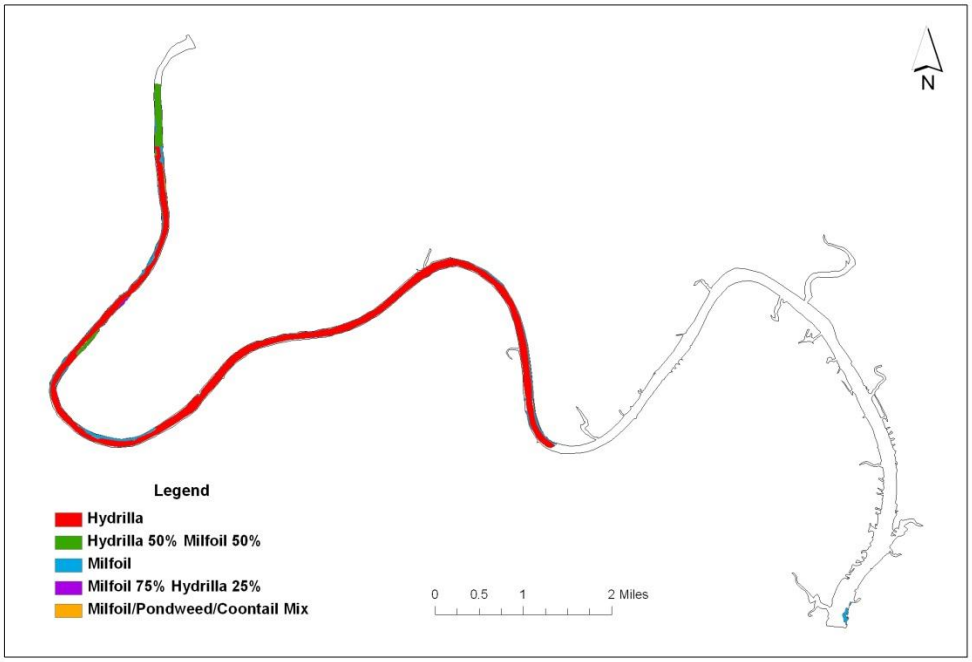
Location, species, acres and percent (%) coverage of aquatic vegetation coverage, Austin Reservoir, Texas, 2009, 2010, 2011 and 2012. July through September is considered the peak of the growing season for aquatic vegetation.





APPENDIX C (Cont.)

Lake Austin Vegetation Survey September 2011



Lake Austin Vegetation Survey September 2012