

PERFORMANCE REPORT

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FEDERAL AID PROJECT F-221-M-3

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2012 Fisheries Management Survey Report

Lake Brazos Reservoir

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July 31, 2013

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Lake Brazos were surveyed in 2012 using electrofishing and trap netting 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:** Lake Brazos is a 523-acre impoundment of the Brazos River located in downtown Waco, McLennan County, Texas. Bank and boat access on the reservoir are good, and include handicap-friendly facilities such as walkways, picnic shelters, and fishing piers. Habitat features consisted mainly of emergent aquatic vegetation and overhanging riparian brush and trees.
- **Management History:** Important sport fish include Blue and Channel Catfish, White and Striped Bass, Largemouth Bass, and White Crappie. The management plan from the 2008 survey report included annual monitoring of giant cane, placement of new fishing habitat, publicizing new angling opportunities, requesting Florida Largemouth Bass stockings, and collecting base line age and growth data during 2012/2013 surveys. Nearly 50 Crappie condos have been placed into the reservoir since 2009, giant reed is monitored annually, news releases concerning fish populations and newly added fish habitat were released via newspaper articles and YouTube videos, and Florida Largemouth Bass were stocked at 100 fingerlings per acre in 2010. Age and growth data were also collected on Largemouth Bass, White Crappie, Catfish, and temperate bass species, and are included in this report.
- **Fish Community**
 - **Prey species:** Forage species present included Longear Sunfish, Bluegill, Gizzard Shad, Threadfin Shad, Redear Sunfish, and Warmouth in order of decreasing abundance. Catch rates were low for all collected forage species, with the exception of Longear Sunfish and Bluegill.
 - **Catfishes:** Blue Catfish were present in record numbers and Channel Catfish were present in fair numbers; all were in good to excellent condition. No Flathead Catfish were sampled.
 - **Temperate basses:** White Bass, Striped Bass, and Palmetto (Hybrid Striped) Bass were collected during the 2013 survey. Catch rates were low, but catchable populations exist.
 - **Black basses:** Three species of black basses were collected in fall 2012. Largemouth Bass were collected at above average rates, Spotted Bass were collected near historical average rates, and Smallmouth Bass were collected for the first time.
 - **White Crappie:** White Crappies were collected in fair numbers and condition during winter 2012.
- **Management Strategies:** Continue managing Lake Brazos with statewide regulations as this fishery becomes established. Conduct standard monitoring with electrofisher and trap netting in 2016 and gill netting in 2017. Future management strategies should include further habitat enhancement throughout the reservoir, and eradication of exotic giant reed if monitoring data show further increases in coverage.

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INTRODUCTION

This document is a summary of fisheries data collected from Lake Brazos 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

Lake Brazos is a 523-acre impoundment of the Brazos River located in downtown Waco, McLennan County, Texas. The reservoir was constructed by the City of Waco in 1965 to serve as a municipal water source and to stimulate economic development in the downtown area. Other water uses include recreation. The reservoir is eutrophic with an average reservoir depth of 12.3 feet, and water transparencies typically ranging from 1 to 3 feet. Habitat at time of sampling consisted mainly of natural and rocky shoreline, bulkhead, emergent aquatic vegetation (e.g., water willow *Justicia Americana*, bulrush *Scirpus sp.*, and cattail *Typha sp.*) and over-hanging riparian brush and trees. Giant reed, a non native, currently covers 7.5 acres of shoreline, and is slowly expanding. There are currently no sources for water level data for Lake Brazos. Other descriptive characteristics for Lake Brazos are in Table 1.

Angler Access

Bank and boat access on Lake Brazos is excellent. Boat access consists of two two-lane ramps and a kayak launch located at Brazos Park East, a single lane ramp at the McLennan Community College (MCC) campus, and a single lane ramp at Baylor University. All four boat ramps were useable during the recent 2011/2012 drought years, and there are currently no access issues. Shoreline access is excellent throughout the lower two-thirds of the reservoir. Additional boat ramp characteristics are in Table 2.

Management History

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

1. Monitor the reservoir for Giant reed annually through 2012.
Action: Giant reed has been monitored annually with summer surveys since the last report. The collected data show no significant changes in coverage.
2. Work with the City of Waco to control Giant reed with appropriate means.
Action: The need to control the spread of Giant reed has been shared with the City of Waco, but given the limited changes in its coverage, no control measures have been taken to date.
3. Work with the City of Waco to organize placement of new fish habitat near fishing piers.
Action: Inland Fisheries staff worked with the City of Waco, the Cameron Park Zoo, and local Boy Scout groups to deploy 20 Crappie condos in spring 2011 and 15 Crappie condos in spring 2012. The condos are manufactured by placing bamboo stems into buckets all directions, then filling the buckets with concrete to hold the stems in place. The condos were placed near all major fishing piers along the middle reservoir proper, and the structures were mapped so that locations could be provided to interested anglers and constituents.
4. Request stockings of Florida Largemouth Bass in 2010 at a rate of 100/acre.
Action: Florida Largemouth Bass were stocked at 100 fish/acre in spring 2010.
5. Work with City of Waco to maintain current access points and enhance fishing opportunities by increasing the number and type of access points available.
Action: Inland Fisheries staff worked with the City of Waco, Baylor University, and other partners on access projects since the 2008 report. For example, staff contributed to the multi vision integration committee by providing input for the development of Lake Brazos's

green areas. Additionally, staff has worked to add and maintain fish attractors (i.e., crappie condos) on an annual basis.

6. Collect appropriate base line growth data on important sport fish species for the 2013 report.
Action: Baseline A&G data were collected on Largemouth Bass, White Crappie, White Bass, Palmetto Bass, and Striped Bass collected from 2012/2013 surveys.
7. Publicize new angling opportunities via written news releases and local interviews.
Action: Several news releases were published regarding Lake Brazos, its fish populations, and angling opportunities, including a YouTube video demonstrating the placement and purpose of the crappie condos.

Harvest regulation history: Sportfishes in Lake Brazos are currently managed with statewide regulations (Table 3).

Stocking history: Lake Brazos was stocked with 47,025 Florida Largemouth Bass in 2010 and 47,491 Blue Catfish in 2009. The complete stocking history is in Table 4.

Vegetation/habitat management history: Vegetation/habitat management actions have been limited to the addition of fish habitat (crappie condos) near fishing piers, and annual monitoring of Giant reed shoreline coverage.

Water transfer: No interbasin transfers are known to exist within Lake Brazos.

Reservoir capacity: No volumetric surveys have been performed on Lake Brazos.

METHODS

Fishes were collected by electrofishing (1 hour at 12, 5-min stations), trap netting (5 net nights at 5 stations), and gill netting (5 net nights at 5 stations). An additional 5 net nights of trap netting was conducted in an attempt to collect additional age and growth data for crappie species. 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 shad (DiCenzo et al. 1996). Standard error (SE) was calculated for structural indices and IOV. Relative standard error ($RSE = 100 \times SE \text{ of the estimate/estimate}$) was calculated for all CPUE and creel statistics. Ages were determined using otoliths from 5 to 10 fish per inch group, unless large numbers could not be obtained.

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.

There is currently no source for water level data for Lake Brazos; however its water levels are fairly stable.

RESULTS AND DISCUSSION

Habitat: A habitat survey was last conducted in 2008 (Tibbs and Baird 2009).

Creel: No angler creel surveys have been conducted on Lake Brazos to date.

Prey species: Threadfin Shad and Gizzard Shad were collected by electrofisher at 17.0/h and 96.0/h respectively in 2012. The Gizzard Shad catch rate is well below the historical average, whereas the Threadfin Shad catch rate is similar to the historical average. The index of vulnerability (IOV) for Gizzard Shad was poor as only 58% of the population was available to existing predators as forage. Other important forage species collected were Bluegill (119.0/h), Longear Sunfish (133.0/h), and Redear Sunfish (5.0/h). Panfish seldom reach preferred size classes in Lake Brazos (Figures 1 and 2; Appendices A and B).

Catfishes: Blue Catfish were collected with gill nets at 11.0/nn in 2013; this catch rate equates to 55 collected individuals, and is the highest catch rate on record. Proportional size distribution values have varied over the past three surveys indicating unstable recruitment, growth, or mortality. Many individuals approached or exceeded the preferred size category of 30 inches. Body condition was good and improved with increasing length (Figure 3; Appendices A and B).

Channel Catfish were collected with gill nets at 2.6/nn in 2013; this catch rate equates to 13 collected individuals, and is below the historical average. Proportional size distribution values have remained stable over the past three surveys indicating steady recruitment, growth, and mortality. Few Channel Catfish approached the preferred size category of 24 inches. Body condition was good, and improved with increasing length (Figure 4; Appendices A and B).

Flathead Catfish are present in the reservoir in low densities, but none were collected (Appendix B).

Temperate basses: White Bass were collected with gill nets at 1.80/nn in 2013; this catch rate equates to 9 collected individuals, and is the highest catch rate on record. Proportional size distribution values have remained high over the past three surveys. Body condition was average (Figure 5; Appendices A and B). Growth of White Bass in Lake Brazos was good. White Bass reached the minimum legal size of 10 inches by age 2 (N = 4; average length = 11.3 inches) (Figure 6).

Palmetto and Striped Bass were collected with gill nets at 0.40/nn and 0.60/nn in 2013; these catch rates equate to 2 and 3 individuals respectively. This is the first survey in which Palmetto Bass have been sampled, having emigrated from Lake Waco. Two age 4 Palmetto Bass were collected, and their average length was 19.1 inches. Striped Bass are immigrants from Lake Whitney, and continue to be present in low density. Striped Bass reached the minimum legal size of 18 inches by age 3 (N = 2; average length = 18.7 inches). Both species are relatively new to the fishery and will likely increase in number in the future due to escapement from Waco and Whitney reservoirs and more stable water levels in Lake Brazos (Appendices A and B).

Black basses: Largemouth Bass were collected by electrofisher at 63.0/h in 2012; this catch rate equates to 63 collected individuals, and is the highest catch rate on record. Proportional size distribution was good (38), and reflects improvement to the population structure since the 2010 survey. The proportion of stock-size individuals 14-inches and larger was 21, indicating excellent numbers of harvestable bass for anglers - and one individual at 22 inches. Body condition was fair, with Wrs averaging between 80 and 90 for most size classes. Florida Largemouth Bass influence, determined during fall 2008 surveys, was also fair as Florida alleles were estimated at 37% (Figures 7; Table 7; Appendices A and B). Growth of Largemouth Bass in Lake Brazos was slow. Largemouth Bass reached the minimum legal size of 14 inches by age 4 (N = 2; average length = 14.2 inches) (Figure 8).

Spotted Bass were collected by electrofisher in Lake Brazos at 13.0/h, similar to the historical catch rate. Smallmouth Bass were also collected at 2.0/h, representing the first occurrence of the species in Lake Brazos (Appendices A and B).

White Crappie: White Crappie were collected from trap nets at 2.60/nn in 2012; this catch rate equates to 13 collected individuals, and was similar to the historical average. Proportional size distribution was good (69), and reflects improvement to the population structure since the 2008 survey. Body condition was fair for all size classes sampled (range 80 to 85) however few legal-sized individuals were collected (Figure 9; Appendices A and B). Growth of White Crappie in Lake Brazos was good. White Crappie reached the minimum legal size of 10 inches by age 3 (N = 3; average length = 10.8 inches) (Figure 10).

Fisheries management plan for Lake Brazos, Texas

Prepared – July 2013.

ISSUE 1: Giant reed *Arundo donax*, is an exotic species of vegetation still present in Lake Brazos, and impedes long stretches of shoreline on the lower end of the reservoir. Four years of monitoring data show coverage of this species is slowly increasing. There is a good chance it will continue to spread, causing further access problems and competition for preferred native emergent species of vegetation in the future. The City of Waco has expressed concerns about the spread of this species as well.

MANAGEMENT STRATEGIES

1. Continue monitoring the reservoir for Giant reed annually through 2016.
2. Work with the City of Waco to control this species with appropriate means.

ISSUE 2: Lake Brazos has lot of potential as an urban fishery and further development is needed. Several fishing piers have been built by the City of Waco to accommodate bank anglers and other user groups. District 2B, City of Waco, Cameron Park Zoo staff, and other volunteers have placed almost 50 artificial fish habitat structures called Crappie condos. Additional fish attractors are needed to accommodate a growing contingent of urban anglers.

MANAGEMENT STRATEGIES

1. Utilize side scan sonar to monitor artificial fish habitat structure condition.
2. Continue working with partners to organize placement of new fish habitat structures.
3. Update artificial fish habitat structure maps for angler/constituent use upon request.
4. Explore new concepts for fish attractors and implement as feasible.

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 City of Waco to post appropriate signage at access points around the reservoir.
2. Provide technical support and informational materials for the City of Waco's "Clean, Drain, Dry" initiative. Eight interns will conduct inspections at ramps on Lake Brazos and Lake Waco during Summer, 2013.
3. Contact and educate business owners about invasive species, and provide them with posters, literature, etc., so that they can in turn educate their customers.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule includes standard electrofisher, trap net, and gill net sampling in 2016-2017, annual monitoring of noxious vegetation, and an access survey prior to the 2016 report (Table 8).

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- 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.
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Table 1. Characteristics of Lake Brazos, Texas.

Characteristic	Description
Year Constructed	1965
Controlling authority	City of Waco
County	McLennan
Reservoir type	Main stem Brazos River
Shoreline Development Index (SDI)	N/A
Conductivity	1200 umhos/cm

Table 2. Boat ramp characteristics for Lake Brazos Reservoir, Texas, August, 2012. Latitude and longitude are in decimal degrees.

Boat ramp	Latitude; Longitude	Public?	Parking capacity	Condition
Brazos Park East I	31.5897; -97.1543	Y	53	Good, no issues
Brazos Park East II	31.5829; -97.1511	Y	15	Good, no issues
Brazos Park East III	31.5886; -97.1546	Y	7	Good, no issues
MCC	31.594; -97.1701	Y	24	Good, no issues
Baylor University	31.5507; -97.1116	Y	7	Good, no issues

Table 3. Harvest regulations for Lake Brazos, 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, Palmetto	5	18-inch minimum
Bass, Striped	5	18-inch minimum
Bass, Largemouth and Smallmouth	5 ^a	14-inch minimum
Bass, Spotted	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 Smallmouth Bass = 5 fish in any combination.

Table 4. Stocking history of Brazos Lake, 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	2008	47,400	FGL	2.0
	2009	47,491	FGL	2.0
	Total	94,891		
Bluegill	2007	10,203	AFGL	2.0
	2008	47,890	AFGL	2.1
	Total	58,093		
Channel Catfish	1989	2,700	FGL	3.9
	1990	5,456	FGL	2.4
	2006	19,609	AFGL	8.5
	2007	99,090	FGL	2.4
	Total	126,855		
Florida Largemouth Bass	2007	35,640	FRY	0.3
	2008	49,860	FGL	1.7
	2010	47,025	FGL	1.8
	Total	132,525		
Largemouth Bass	2007	12,712	FGL	1.1
	Total	12,712		

Table 5. Survey of structural habitat types, Lake Brazos, Texas, 2008. Shoreline habitat type units are in miles.

Habitat type	Estimate (miles)	% of total
Bulkhead	4.06	11.45
Gravel shoreline (rocks < 4")	0.10	0.30
Gravel shoreline (rocks > 4")	3.52	9.91
Rock bluff	0.95	2.68
Natural	26.67	75.20
Giant Reed	0.88	2.48
Boat docks and Ramps	0.52	1.47

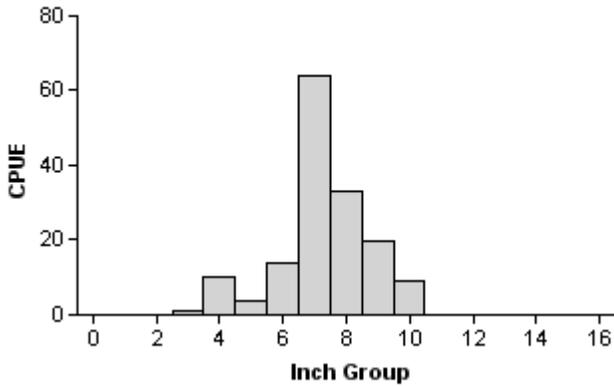
Table 6. Survey of aquatic vegetation, Lake Brazos, Texas, 2009 – 2012. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Vegetation	2009	2010	2011	2012
Native emergent	3.84 (<1.0)	--	--	--
Giant reed	3.61 (2.5)	6.58 (1.3)	6.23 (1.2)	7.52 (1.4)

Gizzard Shad

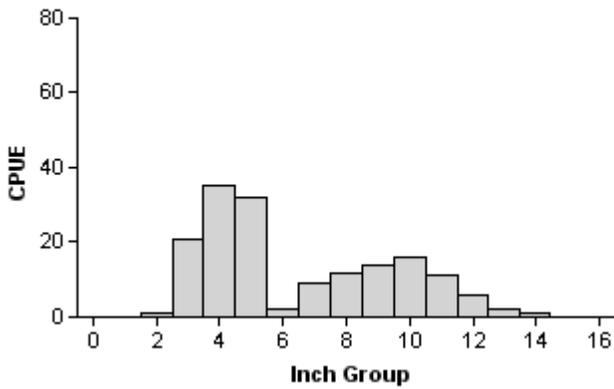
2008

Effort = 1.0
 Total CPUE = 155.0 (18; 155)
 Stock CPUE = 126.0 (19; 126)
 IOV = 60 (10.6)



2010

Effort = 1.0
 Total CPUE = 162.0 (26; 162)
 Stock CPUE = 71.0 (32; 71)
 IOV = 62 (5.8)



2012

Effort = 1.0
 Total CPUE = 96.0 (41; 96)
 Stock CPUE = 71.0 (48; 71)
 IOV = 58 (10.8)

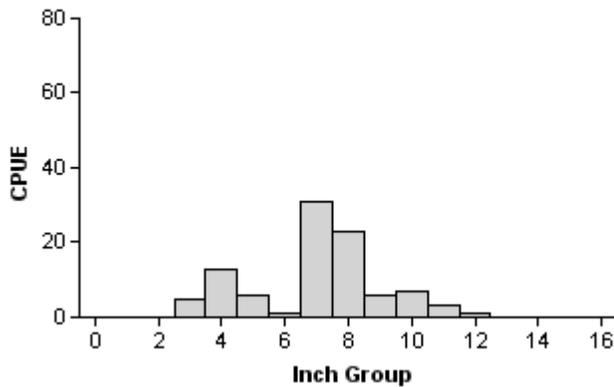
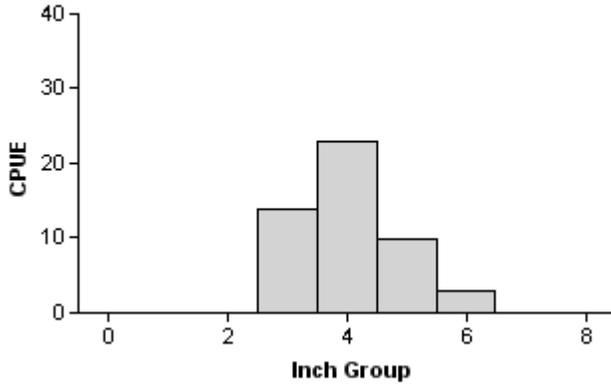


Figure 1. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Lake Brazos, Texas, 2008, 2010 and 2012.

Bluegill

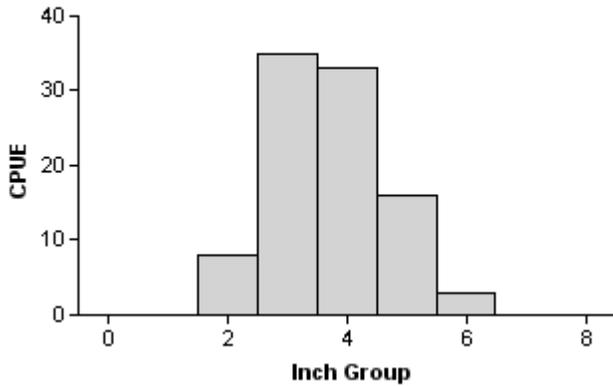
2008

Effort = 1.0
 Total CPUE = 50.0 (21; 50)
 Stock CPUE = 50.0 (21; 50)
 PSD = 6 (4)



2010

Effort = 1.0
 Total CPUE = 95.0 (23; 95)
 Stock CPUE = 87.0 (21; 87)
 PSD = 3 (1.6)



2012

Effort = 1.0
 Total CPUE = 119.0 (27; 119)
 Stock CPUE = 102.0 (28; 102)
 PSD = 10 (3.2)

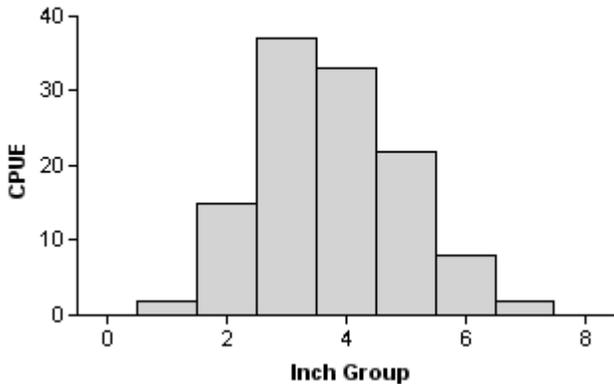
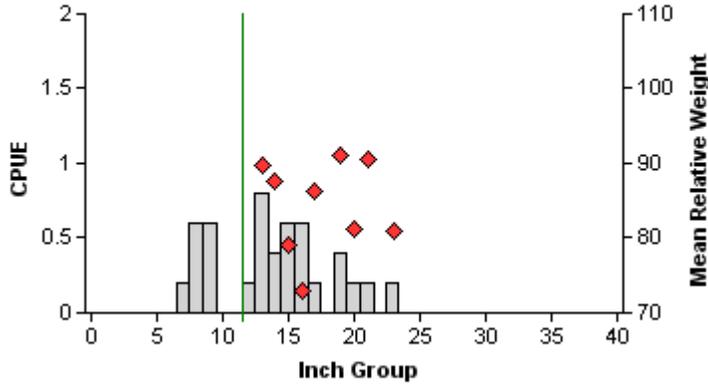


Figure 2. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parenthesis) for fall electrofishing surveys, Lake Brazos, Texas, 2008, 2010 and 2012.

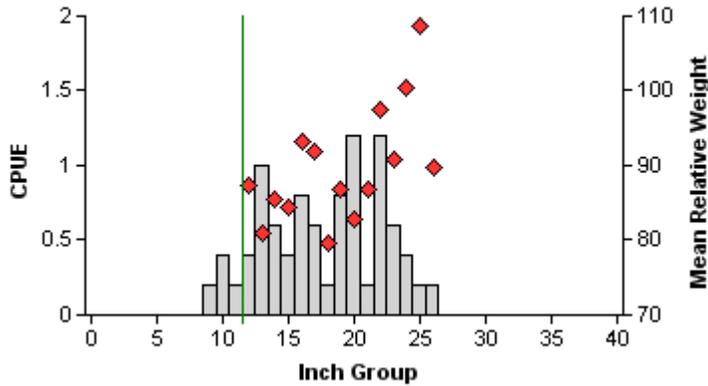
Blue Catfish

2009



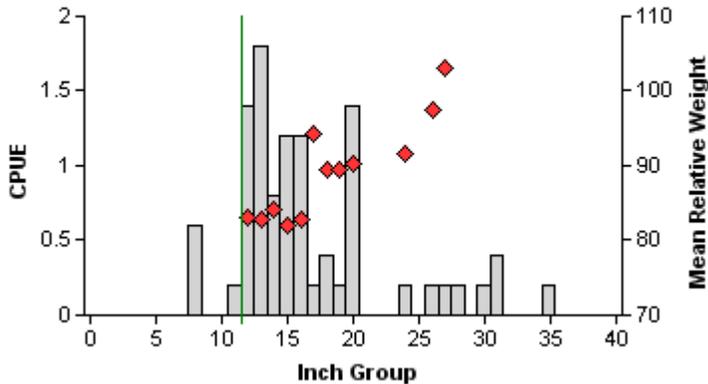
Effort = 5.0
 Total CPUE = 5.2 (41; 26)
 Stock CPUE = 3.8 (36; 19)
 PSD = 16 (5.9)
 PSD-12 = 100 (0)

2011



Effort = 5.0
 Total CPUE = 9.6 (10; 48)
 Stock CPUE = 8.8 (10; 44)
 PSD = 45 (10.7)
 PSD-12 = 100 (0)

2013

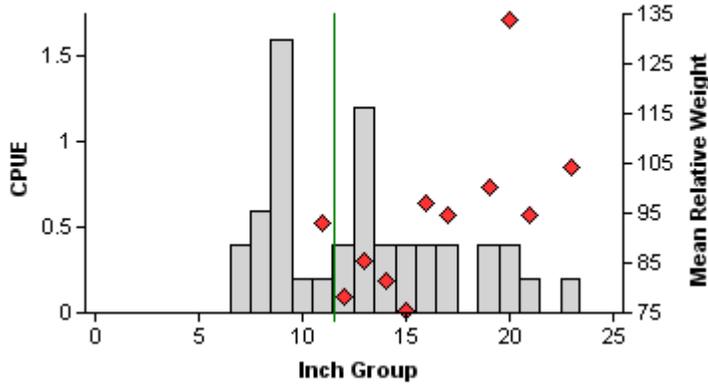


Effort = 5.0
 Total CPUE = 11.0 (29; 55)
 Stock CPUE = 10.2 (28; 51)
 PSD = 29 (8.7)
 PSD-12 = 100 (0)

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, Lake Brazos, Texas, 2009, 2011 and 2013. Minimum length limit represented by vertical line.

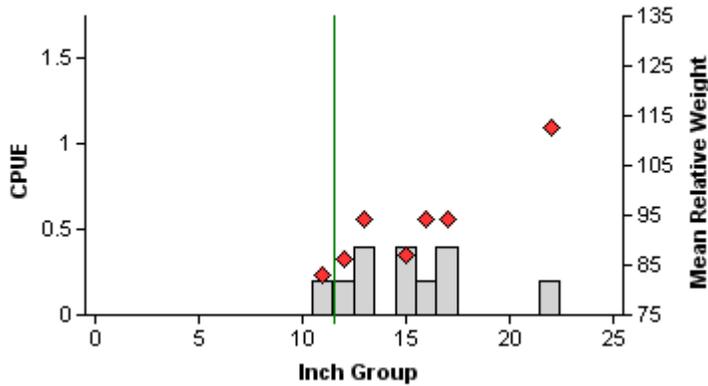
Channel Catfish

2009



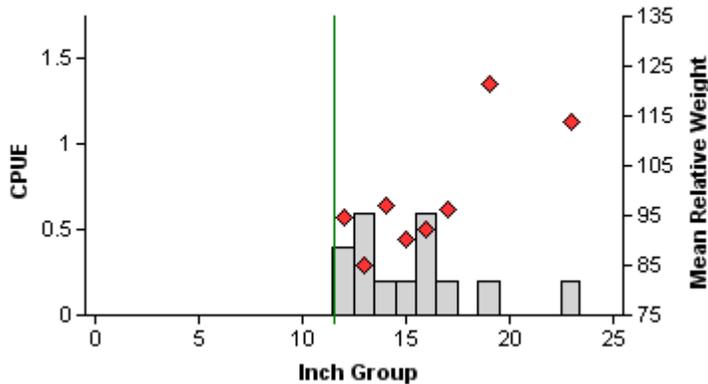
Effort = 5.0
 Total CPUE = 7.4 (23; 37)
 Stock CPUE = 4.6 (31; 23)
 PSD = 43 (5.5)
 PSD-12 = 96 (3.5)

2011



Effort = 5.0
 Total CPUE = 2.0 (27; 10)
 Stock CPUE = 2.0 (27; 10)
 PSD = 40 (13)
 PSD-12 = 90 (10.4)

2013

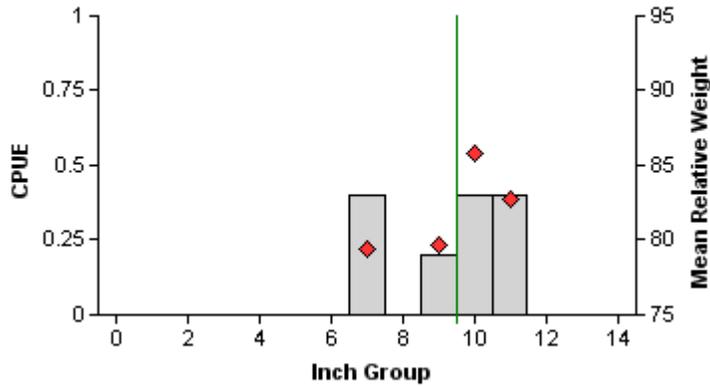


Effort = 5.0
 Total CPUE = 2.6 (20; 13)
 Stock CPUE = 2.6 (20; 13)
 PSD = 46 (20.2)
 PSD-12 = 100 (0)

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, Lake Brazos, Texas, 2009, 2011 and 2013. Minimum length limit represented by vertical line.

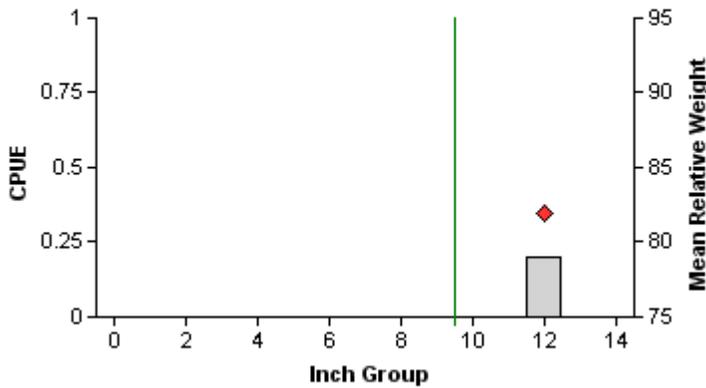
White Bass

2009



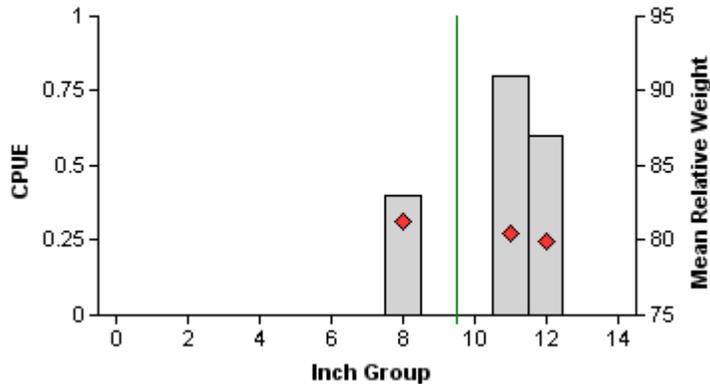
Effort = 5.0
 Total CPUE = 1.4 (29; 7)
 Stock CPUE = 1.4 (29; 7)
 PSD = 71 (26.6)
 PSD-10 = 57 (23.9)

2011



Effort = 5.0
 Total CPUE = 0.2 (100; 1)
 Stock CPUE = 0.2 (100; 1)
 PSD = 100 (0)
 PSD-10 = 100 (0)

2013



Effort = 5.0
 Total CPUE = 1.8 (44; 9)
 Stock CPUE = 1.8 (44; 9)
 PSD = 78 (13.6)
 PSD-10 = 78 (13.6)

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, Lake Brazos, Texas, 2009, 2011 and 2013. Minimum length limit represented by vertical line.

White Bass Cont.

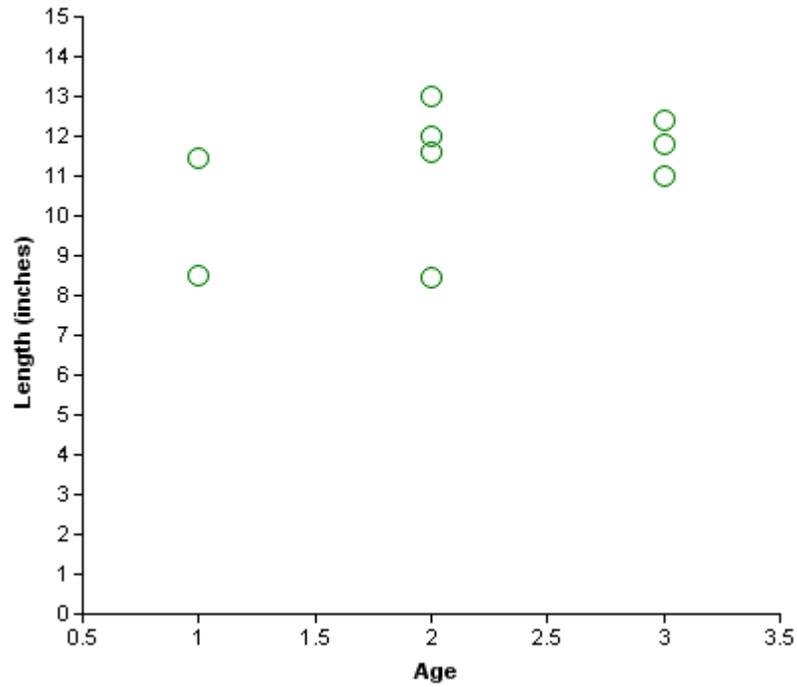


Figure 6. Length at age for White Bass collected from gill nets at Lake Brazos, Texas, 2013. Sample size, N = 9.

Largemouth Bass

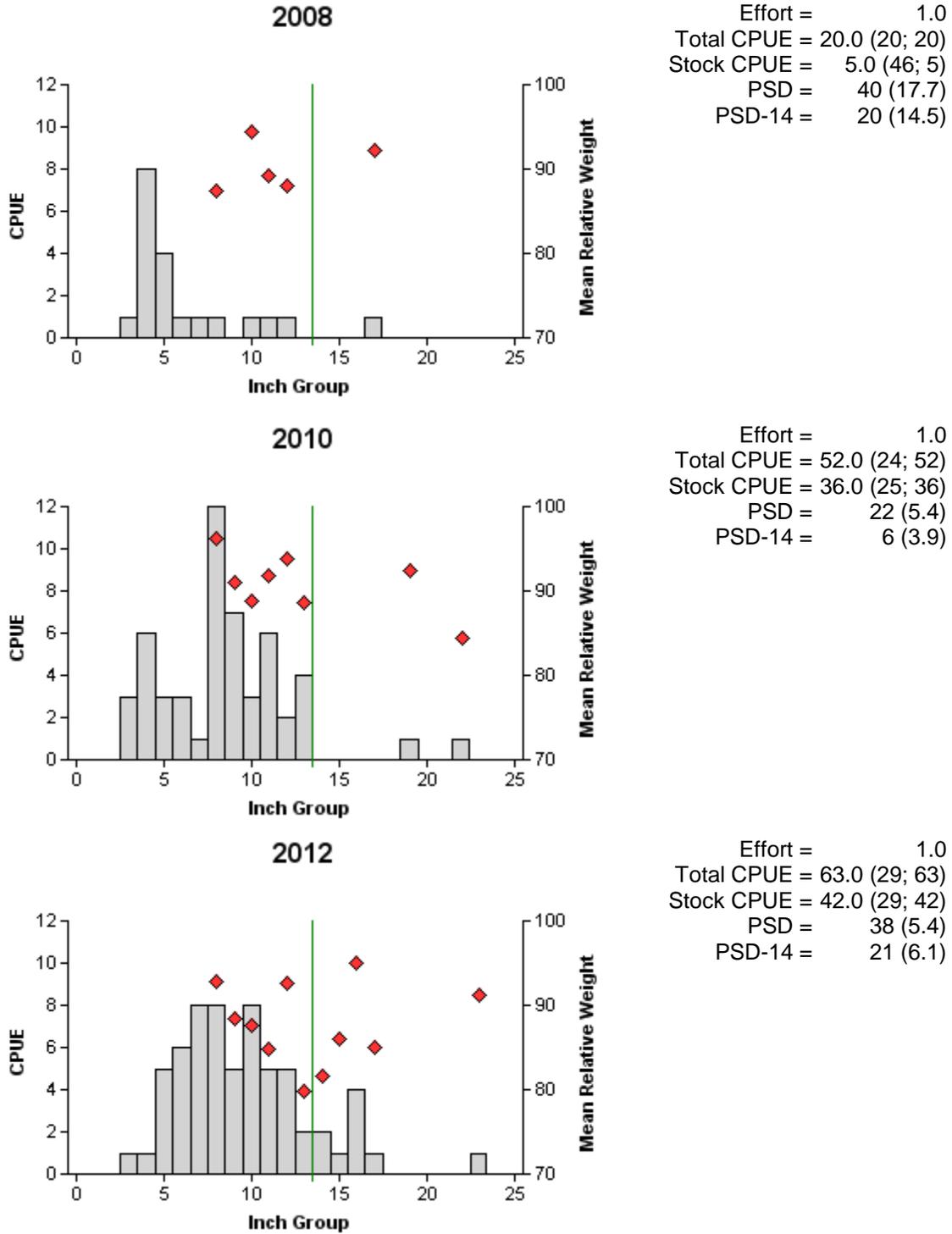


Figure 7. Number of Largemouth Bass caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Brazos, Texas, 2008, 2010 and 2012. Minimum length limit represented by vertical line.

Largemouth Bass Cont.

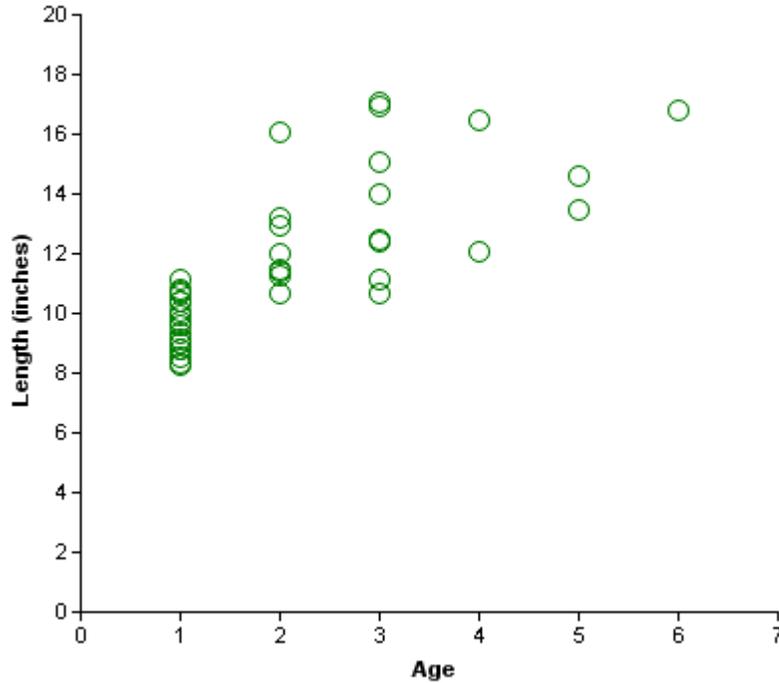


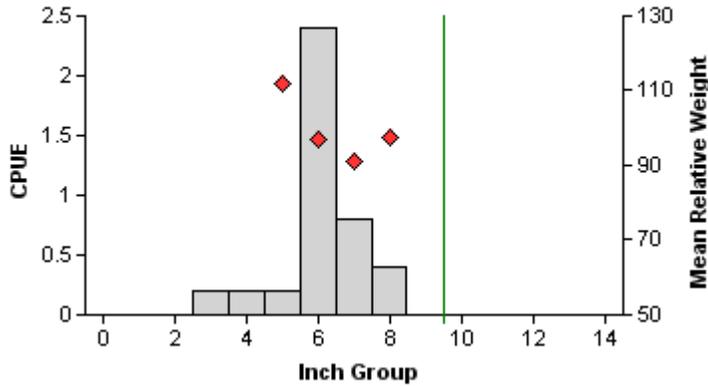
Figure 8. Length at age for Largemouth Bass collected from electrofisher at Lake Brazos, Texas, 2013. Sample size, N = 40.

Table 7. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Lake Brazos, Texas, 2008. 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.

Year	Sample size	Number of fish			% FLMB alleles	% FLMB
		FLMB	Intergrade	NLMB		
2008	15	0	13	2	33	0

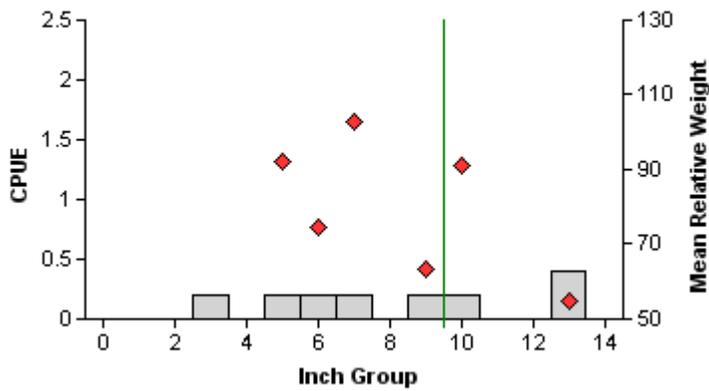
White Crappie

2008



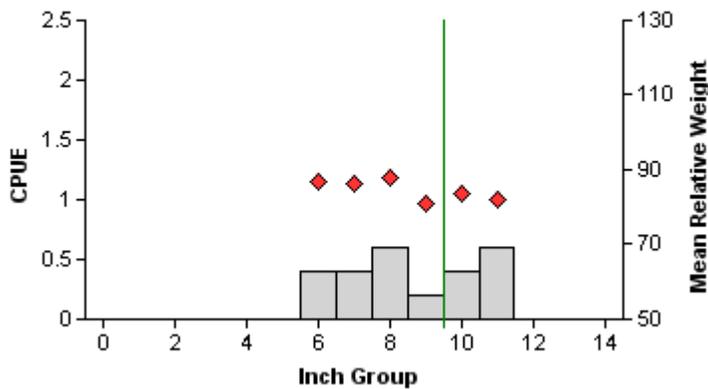
Effort = 5.0
 Total CPUE = 4.2 (45; 21)
 Stock CPUE = 3.8 (47; 19)
 PSD = 11 (2)

2010



Effort = 5.0
 Total CPUE = 1.6 (51; 8)
 Stock CPUE = 1.4 (53; 7)
 PSD = 57 (14.8)

2012



Effort = 5.0
 Total CPUE = 2.6 (73; 13)
 Stock CPUE = 2.6 (73; 13)
 PSD = 69 (4.3)

Figure 9. 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 net surveys, Lake Brazos, Texas, 2008, 2010 and 2012. Minimum length limit represented by vertical line.

White Crappie Cont.

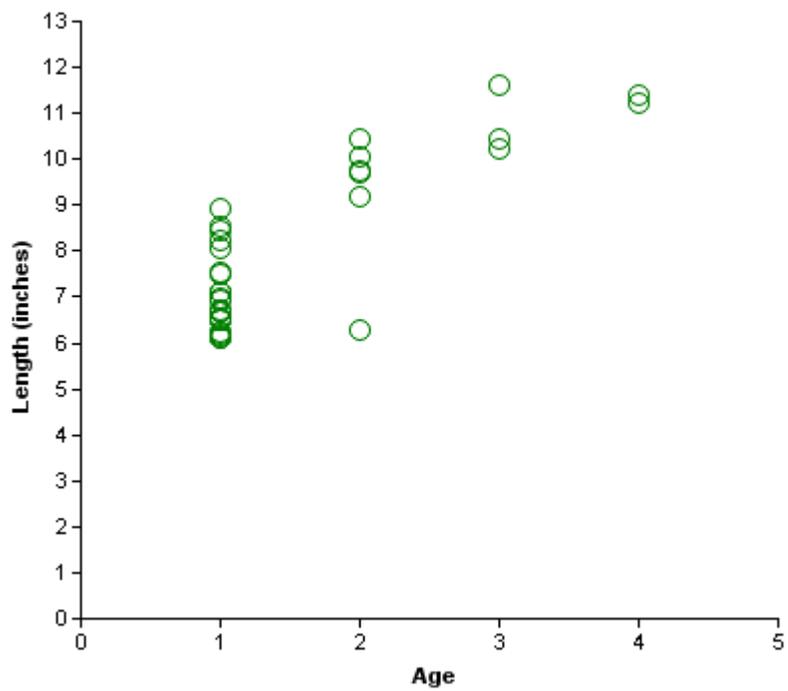


Figure 10. Length at age for White Crappie collected from trap nets at Lake Brazos, Texas, 2013. Sample size, N = 33.

Table 8. Proposed sampling schedule for Lake Brazos, 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	Electrofishing Fall (Spring)	Trap net	Gill net	Habitat			Creel survey	Report
				Structural	Vegetation	Access		
2013-2014					A			
2014-2015					A			
2015-2016					A			
2016-2017	S	S	S		S	S		S

APPENDIX A

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Lake Brazos, Texas, 2012-2013. Sampling effort was 5 net nights for gill netting, 5 net nights for trap netting, and 1 hour for electrofishing.

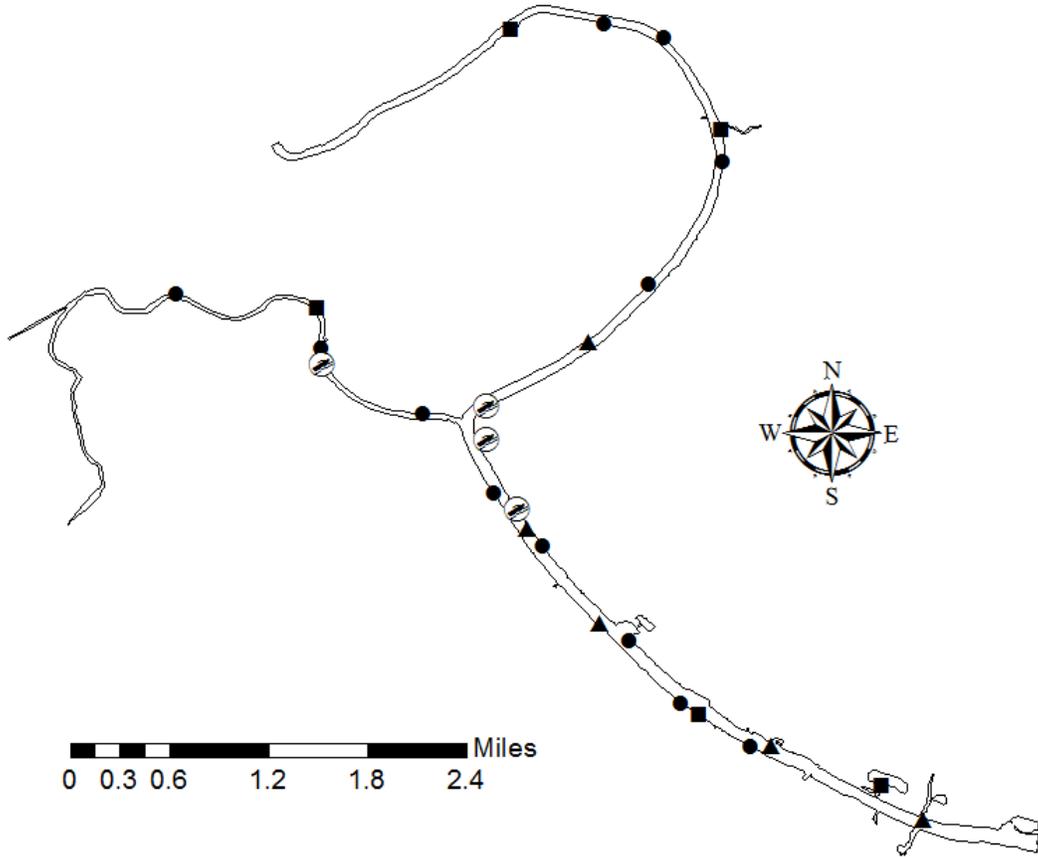
Species	Gill Netting		Trap Netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Gizzard Shad					96	96.00
Threadfin Shad					17	17.00
Blue Catfish	55	11.0				
Channel Catfish	13	2.60				
White Bass	9	1.80				
Striped Bass	3	0.60				
Palmetto Bass	2	0.40				
Warmouth					2	2.00
Bluegill					119	119.00
Longear Sunfish					133	133.00
Redear Sunfish					5	5.00
Smallmouth Bass					2	2.00
Spotted Bass					13	13.00
Largemouth Bass					63	63.00
White Crappie			13	2.60		

APPENDIX B

Historical catch rates (CPUE) of targeted species by gear type for standard surveys on Lake Brazos, Texas, 2008 to present. All stations were randomly selected. Electrofishing stations were shocked with a 7.5 Smith-Root GPP (Gas Powered Pulsator). Species averages are in bold.

Gear	Species	2008	2009	2010	2011	2012	2013	Avg.
Electrofisher	Largemouth Bass	20.0		52.0		63.0		45.0
	Smallmouth Bass	0		0		2.0		0.7
	Spotted Bass	13.0		7.0		13.0		11.0
	Gizzard Shad	155.0		162.0		96.0		137.7
	Threadfin Shad	21.0		12.0		17.0		16.7
	Bluegill Sunfish	50.0		95.0		119.0		88.0
	Redear Sunfish	12.0		2.0		5.0		6.3
	Longear Sunfish	41.0		119.0		133.0		97.6
	Green Sunfish	5.0		2.0		0		2.3
	Warmouth	0		4.0		2.0		2.0
Gill nets	Blue Catfish		5.2		9.60		11.0	8.6
	Channel Catfish		7.4		2.00		2.60	4.0
	White Bass		1.4		0.20		1.80	1.13
	Palmetto Bass		0		0		0.40	0.13
	Striped Bass		0.6		1.60		0.60	0.93
	Flathead Catfish		0		0.40		0	0.13
Trap nets	White Crappie	4.2		1.60		2.60		2.8
	Black Crappie	0		0.20		0		0.07

APPENDIX C



Location of electrofishing (circles), trap netting (squares), and gill netting (triangles) sites, Lake Brazos, Texas, 2012 and 2013. Boat ramps are also marked.