

PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

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FEDERAL AID PROJECT F-30-R-35

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2009 Survey Report

Lake Raven

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SURVEY AND MANAGEMENT SUMMARY

The Lake Raven fish community was surveyed from June 2009 through May 2010 using electrofishing, gill netting, and trap netting. A habitat and vegetation survey was conducted in August 2009 and a spring quarter access point creel survey was conducted from March through May 2010. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir description:** Lake Raven is a 203-acre reservoir located in Huntsville State Park. The reservoir was repaired and re-impounded in 1956 by the Texas Parks & Wildlife Department for recreational use.
- **Management history:** Lake Raven has a history of producing trophy largemouth bass. The population has been managed with a catch-and-release regulation since September 1996. Largemouth bass ≥ 24 inches may be temporarily retained in a live well or other aerated holding device and immediately weighed using personal scales. Bass weighing 13 pounds or more may be donated to the Toyota ShareLunker Program; otherwise, the fish must be immediately released. Lake Raven has been included in Operation World Record (OWR), a project designed to compare growth of selectively-bred ShareLunker largemouth bass offspring to resident bass.

Alligatorweed, hydrilla, giant salvinia, and water hyacinth have all been problem exotic plants. Hydrilla was greatly reduced following integrated treatment (herbicide and triploid grass carp) in 2001. By September 2009, hydrilla recurred and covered about 28% of the total surface acreage, requiring additional grass carp in fall 2009. Alligatorweed flea beetles were introduced in the summer of 2003 and spring of 2006. Alligatorweed was chemically treated in 2006, 2007, and 2008 and is currently not problematic. Water hyacinth continues to be a problem and was chemically treated in spring 2006, 2007, and 2008. Giant salvinia was discovered in 2009 and treated with a glyphosate herbicide. It is not impeding recreation at this time. A Houston-based bass club has agreed to remove water hyacinth and giant salvinia by hand when necessary.

- **Fish community**
 - **Prey species:** The prey fish community at Lake Raven consists primarily of threadfin shad, bluegill, and redear sunfish. Gizzard shad are also present but provide limited prey.
 - **Catfishes:** Blue catfish and channel catfish are present in Lake Raven in moderate numbers. Blue catfish are most abundant and grow to large sizes.
 - **Largemouth bass:** Largemouth bass are abundant in Lake Raven and provide high-quality angling opportunities. The lake has a history of producing trophy largemouth bass.
 - **Crappie:** Crappie are present but do not comprise a significant component of the fishery at Lake Raven.
- **Management strategies:** We will continue to monitor the largemouth bass population annually with fall electrofishing. Florida largemouth bass fingerlings will be requested for stocking when stocking criteria are met. Catfish populations will be monitored every 4 years by gill nets. Crappie populations will be monitored with an angler creel survey, as trap netting as proven ineffective at Lake Raven. An access point creel survey will be conducted in the spring of 2014. We will continue to work with park personnel to assess exotic vegetation coverage and implement integrated pest management (IPM) treatment strategies as needed including enhancement of the native aquatic vegetation community.

INTRODUCTION

This document is a summary of fisheries data collected from Lake Raven from June 2009 through June 2010. The purpose of this document is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other species of fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data is presented with the 2009-2010 data for comparison.

Reservoir Description

Lake Raven is a 203-acre reservoir located within Huntsville State Park. Drainage area for Lake Raven is approximately 1,556 square miles with rainfall in the watershed averaging 46 inches per year. The reservoir has a maximum depth of 28 feet, a mean depth of 6 feet, a shoreline length of 6.3 miles, and a Shoreline Development Index of 2.3. Lake Raven lies within the Piney Woods Land Resource Area with deep, sandy (Lakeland Association) soils. Land use around the reservoir is recreational. Boat access is excellent. Bank access is impeded by hydrilla. Other descriptive characteristics from Lake Raven are found in Table 1.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Henson and Webb 2006) included the following:

1. Lake Raven bass fishery is subject to high fishing pressure.
Action: To prevent over-exploitation, management was continued under a catch-and-release-only regulation. Electrofishing surveys were conducted to monitor bass population in the fall of 2006, 2008, and 2009. Lake Raven is included in the OWR study and has been intensively sampled as part of that evaluation.
2. Hydrilla coverage created access problems on Lake Raven.
Action: After chemical treatments in June 2006 (hydrilla), April and June 2007 (water hyacinth), June 2008 (water hyacinth), and April 2009 (giant salvinia), and the re-introduction of grass carp in 2009, nuisance exotic vegetation has been significantly reduced.

Harvest regulation history: In 1996, a catch-and-release-only regulation for largemouth bass was enacted allowing the temporary retention of a bass 22 inches or longer for weighing at a lake-side weigh station and immediate release, or if qualifying, donation to the ShareLunker Program. In 2001, the length of the retained bass was lowered to 21 inches and then raised to 24 inches or more in 2008 with the added caveat that the fish must be weighed on personal scales and then released, or if qualifying, the fish could be donated to the ShareLunker Program. Blue catfish and channel catfish are managed under Community Fishing Lake regulations. All other species are under statewide regulations (Table 2).

Stocking history: Fish stockings began at Lake Raven in 1966 with the introduction of channel catfish. Periodic stockings of channel catfish continued over the next 40 years, but a self-sustaining population has never been created. Blue catfish were stocked in 2000 and 2003. No reproduction and recruitment have been observed; however, blue catfish are growing to quality size. Florida strain largemouth bass were first introduced in 1979 and have been stocked nine times for a total of over 57,000 fingerlings. In 2005 and 2007, a total of 10,989 ShareLunker advanced-fingerling (6-inch) largemouth bass were stocked as part of Operation World Record, a research project designed to compare growth of selectively-bred ShareLunker offspring to that of resident bass of similar ages. Both hybrid grass carp (grass carp X bighead carp) and triploid grass carp have been stocked for the control of aquatic vegetation. A complete stocking history is provided in Table 3.

Vegetation/habitat history: The primary habitat in Lake Raven is aquatic vegetation, both native and

exotic. Hydrilla has caused severe access problems in past years and has been successfully controlled since 2002; however, a recurrence in 2009 has grown to levels that inhibit bank access. Other problem plants include alligatorweed and water hyacinth; however, alligatorweed is now under control. The water hyacinth persists as a problem plant and was chemically treated in 2006, 2007, and 2008. Giant salvinia appeared in 2009 and was treated with a glyphosate herbicide. Beginning in June 2010, Texas Black Bass Unlimited committed to provide volunteers to hand-collect and dispose of water hyacinth and giant salvinia.

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). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing and for gill nets as the number of fish per net night (fish/nn). All survey sites were randomly selected, and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2009).

An access point creel survey was conducted during March through May of 2010. Five weekend days and four weekdays were surveyed during the creel period. Each 12-hour creel day was divided into 4 time periods of 3 hours each. A randomly chosen time period was surveyed each creel day. Shoreline structural habitat and vegetation were surveyed in the summer of 2009 according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2009).

Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD) as described 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). Relative standard error ($RSE = 100 \times SE$ of the estimate/estimate) was calculated for all CPUE statistics and for creel statistics, and SE was calculated for structural indices and IOV.

RESULTS AND DISCUSSION

Habitat: A physical habitat survey in 2009 revealed very little diversity of abiotic habitat. The shoreline was predominantly featureless with various mixed stands of native emergent and flooded terrestrial vegetation and overhanging brush. Submersed aquatic macrophytes, both native and exotic, were present in substantial quantities. Hydrilla had been very problematic, but after a chemical treatment and grass carp stocking in 2001, coverage was reduced to about an acre. As of September 2009, approximately 58 acres of hydrilla were present and impeded bank angling access. Approximately 80 acres of native aquatic vegetation were present, primarily native emergent plants. Also present were water hyacinth (0.4 acres), alligatorweed (5.2 acres), and giant salvinia (3.9 acres). The results of the 2009 structural habitat and vegetation survey are presented in Table 4.

Creel: Largemouth bass are the most popular sport fish at Lake Raven accounting for 84% of all directed angling effort (Table 5). During the period March through May 2010, anglers spent an estimated 14,603 hours seeking largemouth bass. Trip expenditures for that period were \$81,933 dollars with an estimated total fishing effort of 17,403 hours. Since 2001, total effort and expenditures have steadily increased (Table 6).

Prey species: Bluegill and redear sunfish were the most abundant prey fishes in the 2009 electrofishing survey (349.0/h and 280.0/h, respectively). This is a three-fold increase in bluegill CPUE and more than a two-fold increase in redear sunfish from 2005 (Figures 2 and 3). The PSD-6 of bluegill and redear were 5 and 55, respectively in 2009. This indicates particularly high numbers of quality-sized redear sunfish available for anglers. The CPUE of threadfin shad decreased from 176.0/h in 2005 to 56.0/h in 2009. The concomitant increase in relative abundance of sunfish with the decline in threadfin shad relative abundance may be a result of the recurrence of submersed aquatic vegetation, primarily hydrilla. We have observed similar inverse relationships between threadfin shad abundance

and sunfish abundance in other reservoirs relative to the abundance of aquatic macrophytes. Gizzard shad are also present, but few are available as largemouth bass prey (IOV=7.1) (Figure 1).

Anglers spent approximately 600 hours seeking sunfish with an angler catch rate of 2.7/h. An estimated 154 sunfish were harvested by anglers during the creel period (Table 7).

Catfishes: Blue catfish are now present in Lake Raven after stockings in 2000 and 2003. The gill net CPUE was 10.0/nn in 2010 (Figure 4). No evidence of natural spawning and recruitment of blue catfish was noted. The gill net catch rate of channel catfish was 2.6/nn, down from 8.0/nn in 2006 (Figure 5). In the 2010 survey, channel catfish up to 22 inches were collected in the sample. The channel catfish population in Lake Raven is sustained by occasional stockings of advanced fingerlings, with no evidence of spawning and recruitment success observed. Directed effort for catfishes remains low at Raven, accounting for only 2.4% of the total directed effort (Table 5). No catches of catfish were reported by anglers during the creel period.

Largemouth bass: The relative abundance of quality-sized largemouth bass decreased from 2006 and 2008 (Figure 6). This is likely temporary and the result of a large age sample taken as part of the OWR sampling in the spring of 2009. Largemouth bass were in good condition with mean W_r consistently at or above 100 in all length groups (Figure 6). Approximately 84% of the total directed effort for the spring quarter 2010 was spent seeking largemouth bass (Table 5). Directed effort for largemouth bass is very high and has dramatically increased over the past 9 years. Anglers spent approximately 72h/acre seeking bass during the spring 2010 creel period, quadruple the effort in 2001 and almost double that in 2005.

White crappie and black crappie: The 2009 trap net survey yielded only two white crappie. Seven black crappie were collected in the spring 2010 gill net survey, but length frequency was not evaluated. The spring 2005 creel survey indicated crappie were quite popular with anglers (19% of all directed effort); however, in the 2010 creel, only 4.2% of directed effort was for crappie (Table 5).

Fisheries management plan for Lake Raven, Texas

Prepared – July 2010

ISSUE 1 Exotic aquatic macrophytes have recurred at levels that are impeding bank angler access. Hydrilla is the most abundant and has almost completely cut off all bank access. Giant salvinia is now present, along with water hyacinth and alligatorweed.

MANAGEMENT STRATEGIES

1. Treat hydrilla in cooperation with the Huntsville State Park personnel during the summer of 2010. Monitor hydrilla abundance annually and treat with herbicides as needed.
2. Working with volunteers from the Texas Black Bass Unlimited organization, manually remove giant salvinia and water hyacinth for disposal beginning in June 2010. Continue to closely monitor giant salvinia and water hyacinth.
3. Assist Huntsville State Park personnel with an annual reservoir drawdown during January for vegetation control.
4. Seek funding for enhancement of native aquatic vegetation population to provide both quality fish habitat and increased competition with exotic plant species.

ISSUE 2 The creel conducted in spring 2010 indicates that directed angling pressure for largemouth bass is very high.

MANAGEMENT STRATEGIES

1. Continue to manage the largemouth bass population under a catch-and-release regulation with the caveat that anglers may retain a bass 24 inches or greater for immediate weighing with a personal scale and release or donation to the ShareLunker Program (if qualifying).
2. Annually monitor the largemouth bass population relative abundance, size distribution, and condition by electrofishing.
3. Continue to support the Operation World Record study.
4. Support efforts by Huntsville State Park personnel to obtain largemouth bass catch information through a volunteer creel.
5. Conduct a spring creel survey from March through May of 2014 to reassess angling effort.

ISSUE 3 Catfishes and sunfish are also abundant at Lake Raven but are under-utilized.

MANAGEMENT STRATEGIES

1. Work with Huntsville State Park personnel to create a brochure highlighting all available fisheries. Include specific angling techniques and best areas to fish for different species.
2. Enhance fishing piers with lights and fish attracting structures to increase angler access to catfish and sunfish.
3. Monitor catfish populations with gill nets in the spring of 2014.
4. Monitor the sunfish populations by electrofishing in the fall of 2011 and 2013.
5. Conduct a spring creel survey from March through May 2014 to assess directed angling effort for these species.

ISSUE 4 Huntsville State Park personnel are interested in expanding angling and interpretation opportunities afforded by the resources at Lake Raven.

MANAGEMENT STRATEGIES

1. Support Huntsville State Park personnel in developing paddling trails for angling and interpretation. Incorporate paddling trails into the Park's "Saddles to Paddles" program bridging equestrian packages at their riding livery with canoe rentals.
2. Support Huntsville State Park staff in creating tackle packages for sale in the Park Store specific to different angling opportunities available at Lake Raven.
3. Work with Huntsville State Park personnel to develop fishing "hot spots" consisting of areas of submersed brush and other fish attractors located around the reservoir in 10 to 15 feet of

water.

4. Assist Huntsville State Park personnel in selecting habitat enhancing materials such as large riprap for shoreline stabilization efforts.

ISSUE 5 Zebra mussels pose a threat to all inland waters of Texas.

MANAGEMENT STRATEGIES

1. Provide educational support and materials regarding zebra mussel infestation to Huntsville State Park personnel and visitors.
2. Install Portland samplers under the courtesy pier at the Lake Raven boat ramp and under the boat house to monitor for possible zebra mussel infestations.

SAMPLING SCHEDULE JUSTIFICATION: Annual fall electrofishing surveys will be conducted to monitor largemouth bass, with prey fish being included biennially. Annual vegetation surveys will be conducted to monitor exotic aquatic vegetation. Crappie populations will be monitored with an angler creel survey as trap netting is ineffective at Lake Raven. We will conduct a spring quarter creel survey every four years to monitor angler catch, harvest, and expenditures. Gill net surveys will be conducted every four years to monitor catfish populations. Access and structural habitat surveys will also be conducted every four years (Table 11).

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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.
- 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. 32(7):348.
- Henson, J. C. and M. A. Webb. 2006. Statewide freshwater fisheries monitoring and management program survey report for Lake Raven, 2005. Texas Parks and Wildlife Department, Federal Aid Report F-30-R-31, Austin.

Table 1. Characteristics of Lake Raven, Texas.

Characteristic	Description
Year constructed	1956
Controlling authority	Texas Parks and Wildlife Department
Counties	Walker (location of dam)
Reservoir type	State Park
Shoreline Development Index (SDI)	2.3
Conductivity	160 μ mhos/cm

Table 2. Harvest regulations for Lake Raven, Texas.

Species	Bag Limit	Minimum-Maximum Length (inches)
Bass, largemouth	0	Catch-and-release-only*
Catfish, flathead	5	18 – No limit
Catfish, channel and blue catfish, their hybrids and subspecies	5 (in any combination)	No limit
Crappie, white and black crappie, their hybrids and subspecies	25 (in any combination)	10 – No limit

* Catch and release only for largemouth bass except that any bass 24 inches or greater caught may be temporarily retained alive in a live well or other aerated holding device, weighed on personal scales, and then immediately released, or if qualifying, donated to the Toyota ShareLunker Program.

Table 3. Stocking history of Lake Raven, Texas. Size Categories are FRY =<1 inch, FGL = 1-3 inches, AFGL = 8 inches, and ADL = adults.

Species	Year	Number	Size
Northern pike	1974	1,160	FGL
N pike X muskellunge	1976	2,100	FGL
Blue catfish	2000	1,591	AFGL
	2003	5,157	AFGL
	Total	6,748	
Channel catfish	1966	9,900	AFGL
	1971	52,000	AFGL
	1972	57,400	AFGL
	1980	80	ADL
	1982	2,016	AFGL
	1987	21,087	AFGL
	1992	5,252	AFGL
	1996	5,250	AFGL
	1998	5,256	AFGL
	1999	5,251	AFGL
	2000	3,672	AFGL
	2001	5,253	AFGL
	2002	5,237	AFGL
	2004	2,034	AFGL
	2005	12,084	AFGL
2006	2,930	ADL	
Total	194,702		
Black crappie	1968	30	ADL
	1970	4,120	ADV
	Total	4,150	
Florida largemouth bass	1979	10,800	FGL
	1980	338	ADL
	1987	16,850	FGL
	1991	22,487	FGL
	1996	142	ADL
	1998	952	AFGL
Total	51,569		
Sharelunker largemouth bass	2005	5,901	AFGL
	2007	5,088	AFGL
	Total	10,989	
Green X redear	1968	13	ADL
	1972	300	FGL
	Total	313	

Table 3. Stocking history of Lake Raven, Texas, continued. Size Categories are FRY =<1 inch, FGL = 1-3 inches, AFGL = 8 inches, and ADL = adults.

Species	Year	Number	Size
Triploid grass carp	2001	400	ADL
	2009	400	ADL
	Total	800	
Bighead X grass carp	1989	3,038	FGL
	1990	400	ADL
	Total	3,438	

Table 4. Survey of littoral zone and physical habitat types, Lake Raven, Texas, 2009. A linear shoreline distance (miles) was recorded for each habitat type found. Surface area (acres) and percent of reservoir surface area was determined for each type of aquatic vegetation found.

Shoreline habitat type	Shoreline Distance		Surface Area	
	Miles	Percent of total	Acres	Percent of reservoir surface area
Natural shoreline	0.1	2.1		
Natural shoreline/bulkhead	0.2	2.9		
Natural shoreline/flooded terrestrial/ native emergent	0.7	10.4		
Natural shoreline/bulkhead/ native emergent/native floating	0.2	3.7		
Natural shoreline/flooded terrestrial/ native emerged	0.6	9.0		
Natural shoreline/native emergent/flooded terrestrial/native floating	4.1	65.0		
Natural shoreline/native emergent/flooded terrestrial/ native submerged/native floating	0.4	6.9		
Alligatorweed			5.2	2.5
Water hyacinth			0.4	0.1
Giant salvinia			3.9	1.9
Hydrilla			57.7	28.4
Natives			80.1	39.4

Table 5. Percent directed angler effort by species for Lake Raven, Texas, March through May 2001, 2005, and 2010.

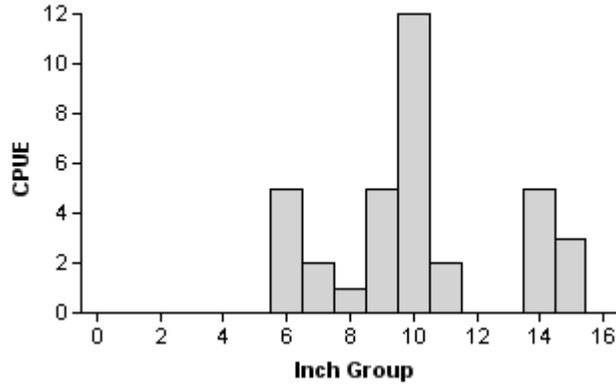
Species	Year		
	2001	2005	2010
Crappies	5.3	19.6	4.2
Sunfishes	3.8	0.0	3.6
Catfishes	0.0	0.0	2.4
Largemouth bass	87.5	69.2	83.9
Anything	3.5	11.2	5.9

Table 6. Total fishing effort (h) for all species and total directed expenditures at Lake Raven, Texas, March through May 2001, 2005, and 2010.

Creel Statistic	Year		
	2001	2005	2010
Total fishing effort (h)	4,042	13,621	17,403
Total directed expenditures	\$14,147	\$63,017	\$81,933

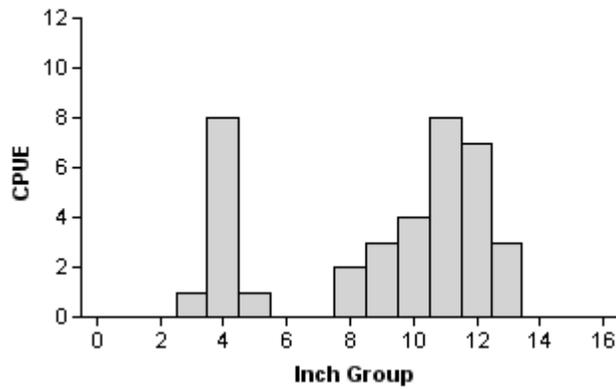
Gizzard Shad

2002



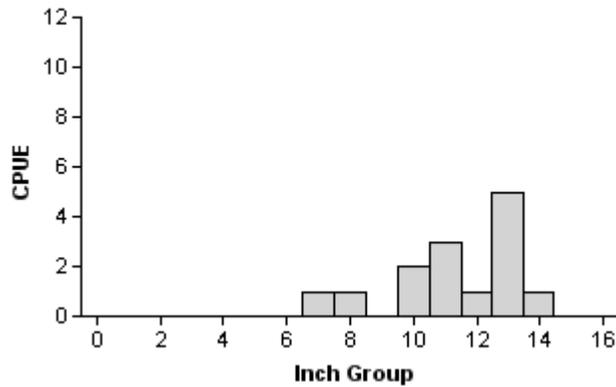
Effort = 1.0
 Total CPUE = 35.0 (33; 35)
 Stock CPUE = 30.0 (35; 30)
 IOV = 20.0 (4.9)

2005



Effort = 1.0
 Total CPUE = 37.0 (24; 37)
 Stock CPUE = 27.0 (32; 27)
 IOV = 24.39 (11.3)

2009



Effort = 1.0
 Total CPUE = 14.0 (30; 14)
 Stock CPUE = 14.0 (30; 14)
 IOV = 7.14 (6.4)

Figure 1. Number of gizzard shad caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Raven, Texas, 2002, 2005, and 2009.

Bluegill

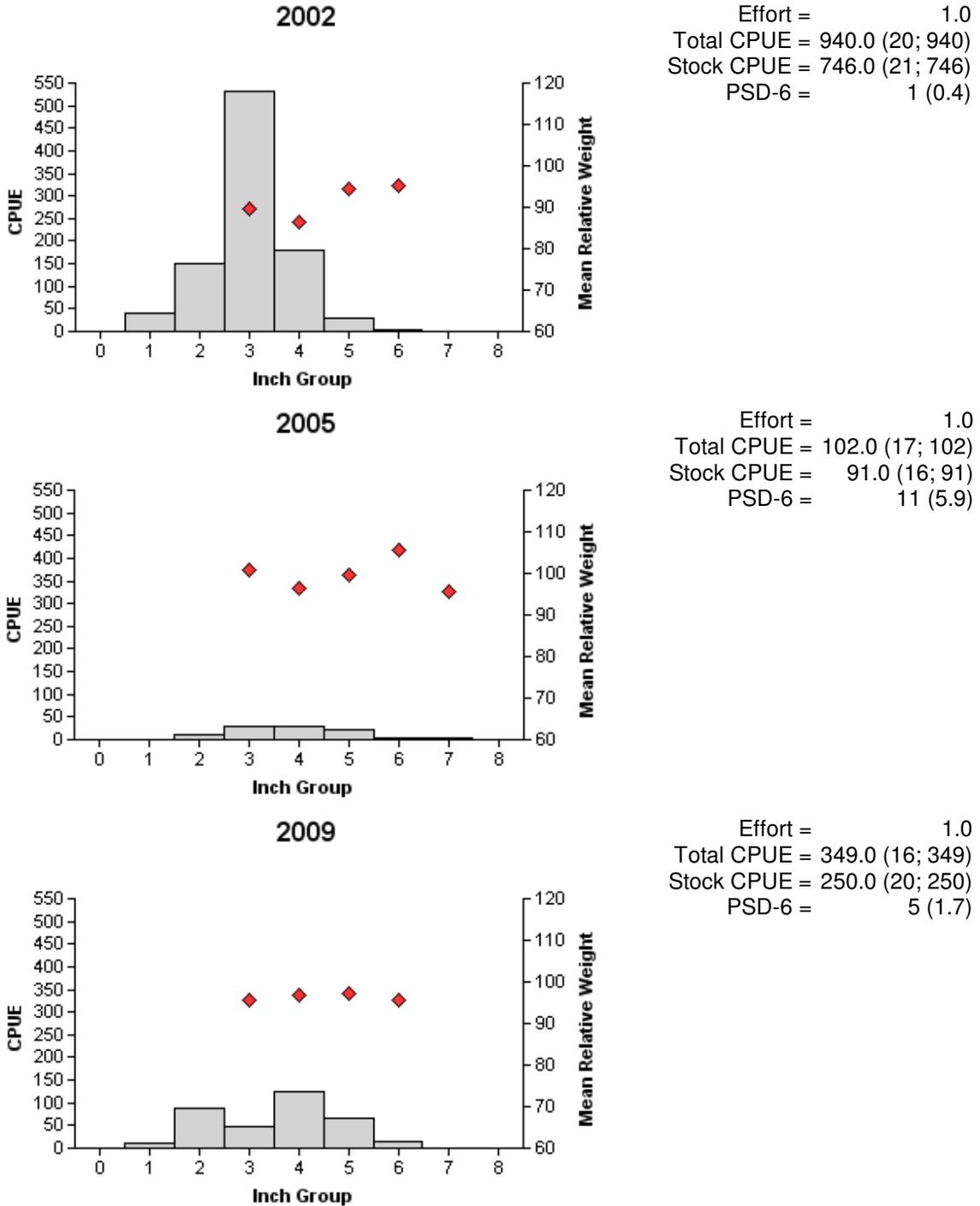
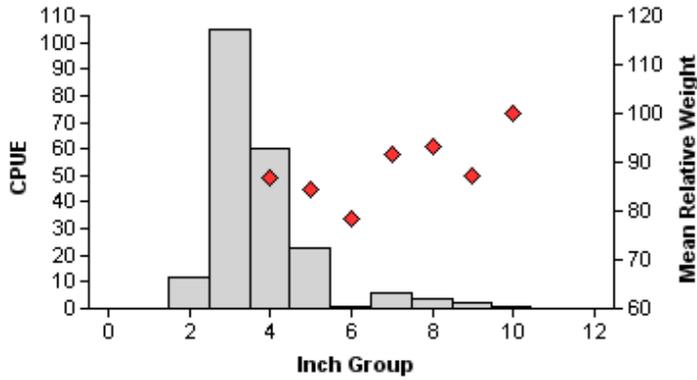


Figure 2. Number of bluegill caught per hour (CPUE, bars), mean Relative Weight (W_r , diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Raven, Texas 2002, 2005, and 2009.

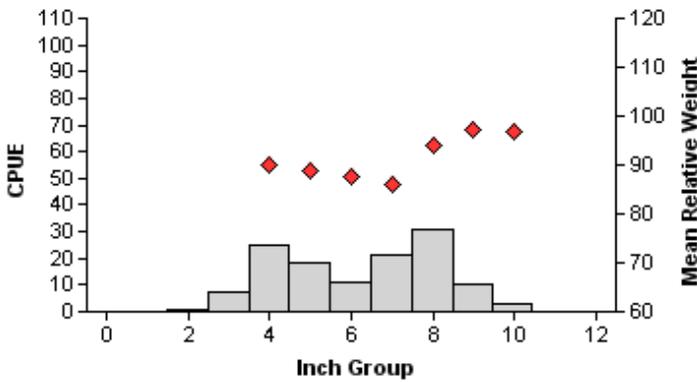
Redear Sunfish

2002



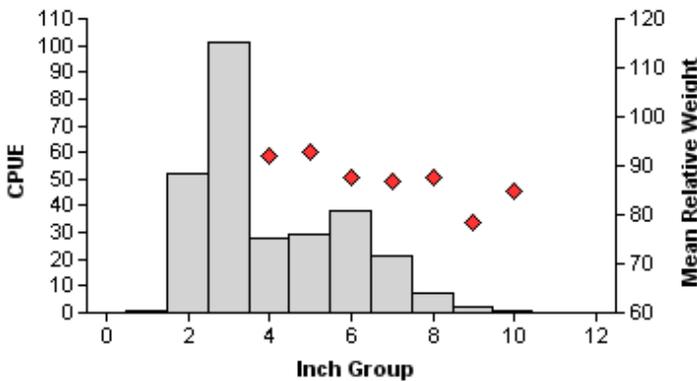
Effort = 1.0
 Total CPUE = 214.0 (23; 214)
 Stock CPUE = 97.0 (23; 97)
 PSD-6 = 14 (9.3)

2005



Effort = 1.0
 Total CPUE = 127.0 (14; 127)
 Stock CPUE = 119.0 (14; 119)
 PSD-6 = 65 (6.5)

2009



Effort = 1.0
 Total CPUE = 280.0 (15; 280)
 Stock CPUE = 126.0 (17; 126)
 PSD-6 = 55 (3.4)

Figure 3. Number of redear sunfish caught per hour (CPUE, bars), mean Relative Weight (W_r , diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Raven, Texas, 2002, 2005, and 2009.

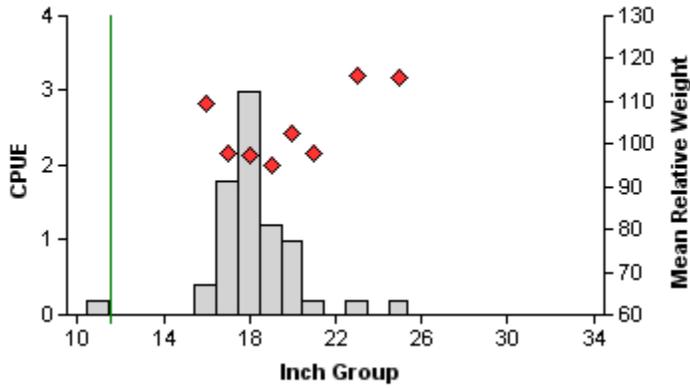
Sunfishes

Table 7. Creel survey statistics for sunfishes at Lake Raven from March through May 2001, 2005, and 2010 where total catch per hour is for anglers targeting sunfishes and total harvest is the estimated number of sunfishes harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year		
	2001	2005	2010
Directed effort (h)	151.6 (103.9)	0.0	626.6 (88.4)
Directed effort/acre	0.74 (103.9)	0.0	3.1 (88.4)
Total catch per hour	1.06 (n/a)	0.0	2.7 (n/a)
Harvest/acre	0.0	0.2 (224.4)	0.8 (100.0)
Total harvest	0	45 (224.4)	154 (100.0)

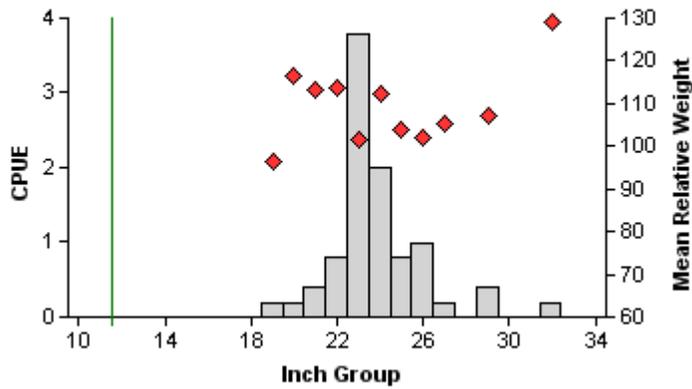
Blue Catfish

2006



Effort = 5.0
 Total CPUE = 8.2 (14; 41)
 Stock CPUE = 8.0 (13; 40)
 PSD-12 = 100 (0)

2010



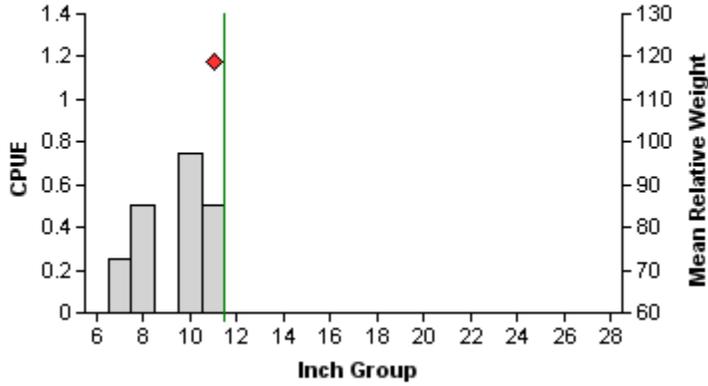
Effort = 5.0
 Total CPUE = 10.0 (21; 50)
 Stock CPUE = 10.0 (21; 50)
 PSD-12 = 100 (0)

Figure 4. Number of blue catfish caught per net night (CPUE, bars), mean Relative Weight (W_r , diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill netting surveys, Lake Raven, Texas, 2006 and 2010. No blue catfish were captured in the 2002 survey.

Channel Catfish

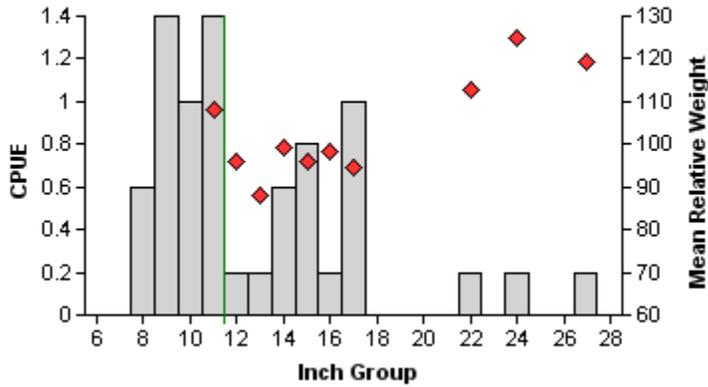
2002

Effort = 4.0
 Total CPUE = 2.0 (68; 8)
 Stock CPUE = 0.5 (100; 2)
 PSD-12 = 0 (0)



2006

Effort = 5.0
 Total CPUE = 8.0 (58; 40)
 Stock CPUE = 5.0 (66; 25)
 PSD-12 = 72 (7.7)



2010

Effort = 5.0
 Total CPUE = 2.6 (36; 13)
 Stock CPUE = 2.6 (36; 13)
 PSD-12 = 100 (0)

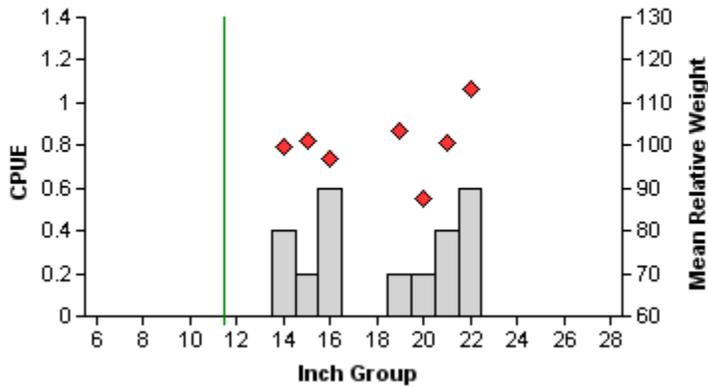
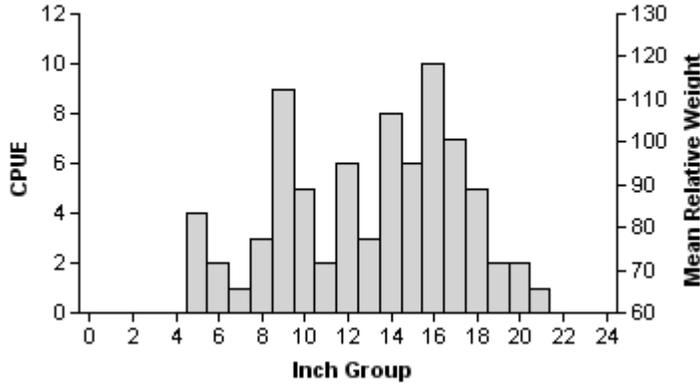


Figure 5. Number of channel catfish caught per net night (CPUE, bars), mean Relative Weight (Wr, diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill netting surveys, Lake Raven, Texas, 2002, 2006, and 2010.

Largemouth Bass

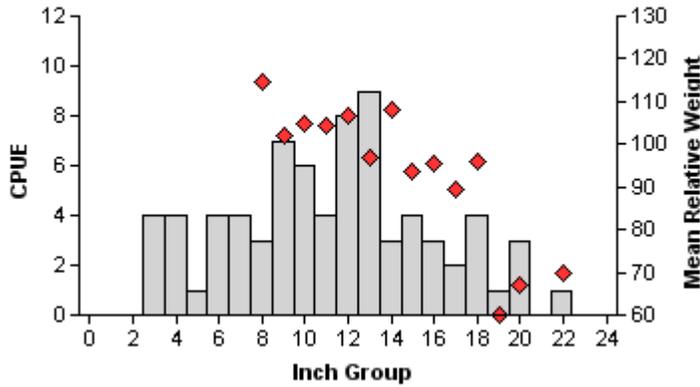
2006

Effort = 1.0
 Total CPUE = 76.0 (17; 76)
 Stock CPUE = 69.0 (18; 69)
 PSD-18 = 14 (3.2)



2008

Effort = 1.0
 Total CPUE = 75.0 (16; 75)
 Stock CPUE = 58.0 (15; 58)
 PSD-18 = 16 (6.1)



2009

Effort = 1.0
 Total CPUE = 87.0 (18; 87)
 Stock CPUE = 51.0 (18; 51)
 PSD-18 = 8 (3.3)

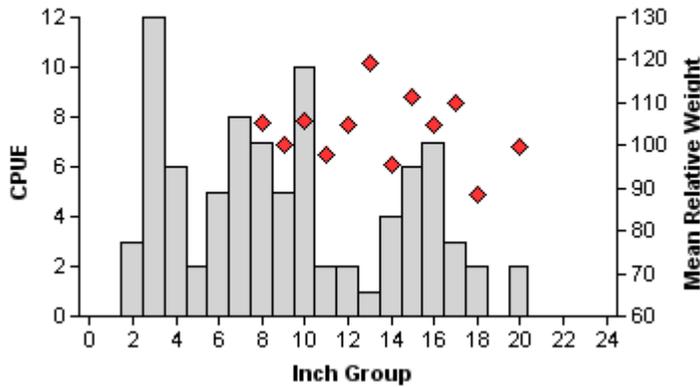


Figure 6. Number of largemouth bass caught per hour (CPUE, bars), mean Relative Weight (W_r , diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Raven, Texas, 2006, 2008, and 2009. Relative weight was not evaluated in 2006.

Largemouth Bass

Table 8. Creel survey statistics for largemouth bass at Lake Raven from March through May 2001, 2005, and 2010 where total catch per hour is for anglers targeting largemouth bass and total harvest is the estimated number of largemouth bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year		
	2001	2005	2010
Directed effort (h)	3,536 (22.9)	9,420 (32.6)	14,603 (32.1)
Directed effort/acre	17.42 (22.9)	46.4 (32.6)	71.9 (32.1)
Total catch per hour	0.49 (21.7)	0.30 (54.5)	0.49 (26.5)

Largemouth Bass

Table 9. Results of genetic analysis of largemouth bass collected by fall electrofishing at Lake Raven, Texas, 1994, 1997, 2001, and 2005. The 2006 data are age-0 largemouth bass collected in a spring sample. FLMB = Florida largemouth bass, NLMB = Northern largemouth bass, F1 = first generation hybrid between a FLMB and a NLMB, Fx = second or higher generation hybrid between a FLMB and a NLMB.

Year	Sample size	Genotype				% FLMB alleles	% pure FLMB
		FLMB	F1	Fx	NLMB		
1994	18	3	6	3	1	55.8	16.7
1997	39	14	4	21	0	76.0	35.9
2001	15	3	2	10	0	71.7	20.0
2005	19	2	2	6	0	77.1	10.0
2006	59	49	0	10	0	96.7	3.3

Crappies

Table 10. Creel survey statistics for crappies (species combined) at Lake Raven, Texas, from March through May 2001, 2005, and 2010 where total catch per hour is for anglers targeting crappies and total harvest is the estimated number of crappies harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year		
	2001	2005	2010
Directed effort (h)	212 (87.9)	2,673 (60.5)	732 (82.5)
Directed effort/acre	1.04 (87.9)	13.2 (60.5)	3.6 (82.5)
Total catch per hour	0.0	0.33 (n/a)	0.0
Harvest/acre	0.0	1.55 (60.0)	0.0
Total harvest	0.0	315 (60.0)	0.0
Percent legal released	n/a	0	n/a

Table 11. Proposed sampling schedule for Lake Raven, Texas. Gill netting surveys are conducted in the spring while electrofishing surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

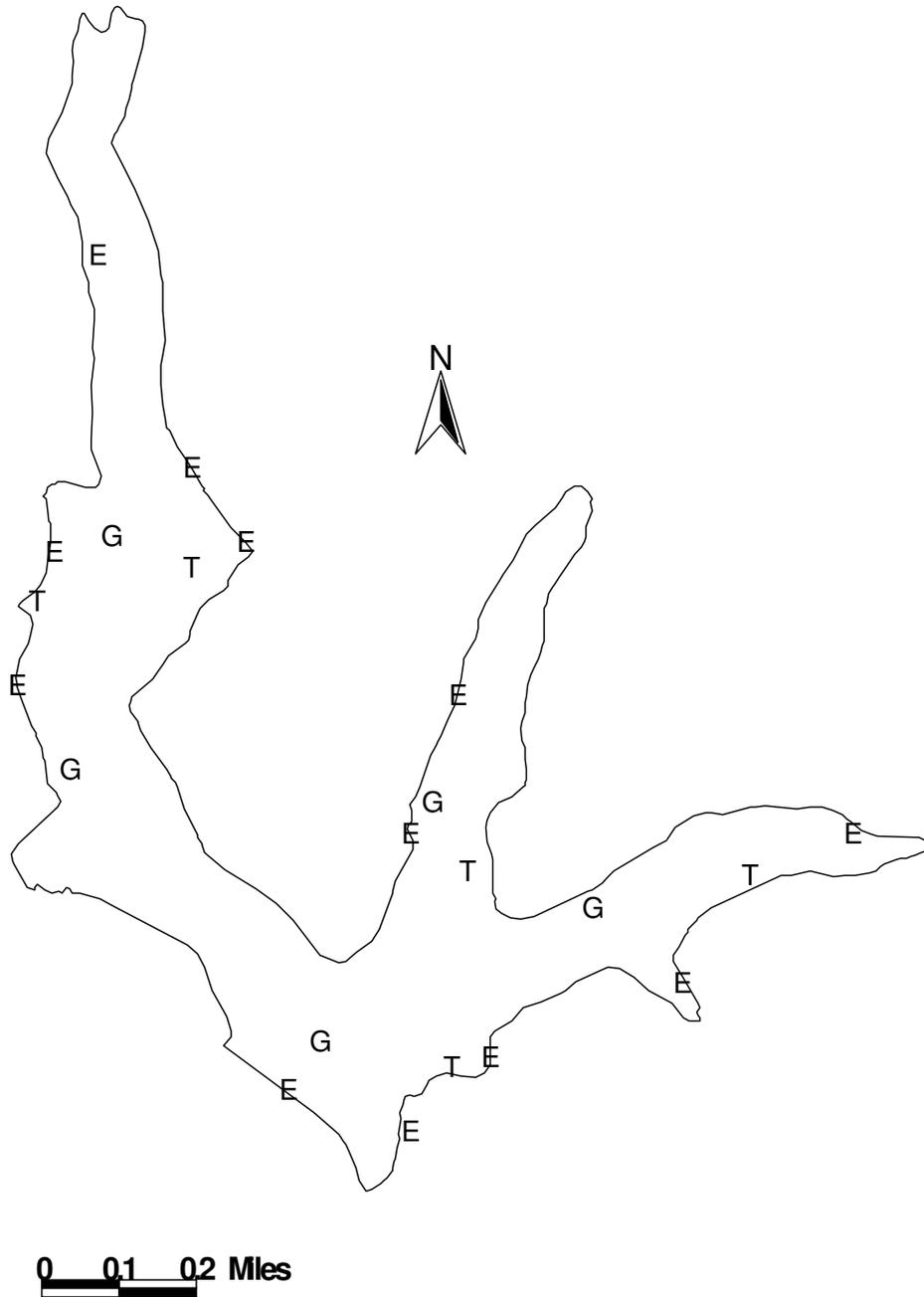
Survey Year	Electrofishing	Gill Net	Creel Survey	Vegetation Survey	Habitat Survey	Access Survey	Report
June 2010-May 2011	A			A			
June 2011-May 2012	A			A			
June 2012-May 2013	A		A	A			
June 2013-May 2014	S	S		S	S	S	S

APPENDIX A

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Lake Raven, Texas, 2009 through 2010.

Species	Gill Netting		Electrofishing		Trap Nets	
	N	CPUE	N	CPUE	N	CPUE
Gizzard shad			14	14.0		
Threadfin shad			56	56.0		
Golden shiner			9	9.0		
Inland silverside			14	14.0		
Blue catfish	50	10.0				
Channel catfish	13	2.6				
Pirate perch			5	5.0		
Warmouth			2	2.0		
Bluegill			349	349.0		
Redear sunfish			280	280.0		
Spotted sunfish			16	16.0		
Largemouth bass			64	64.0		
White crappie					2	0.4
Black crappie	7	1.4	5	5.0		

APPENDIX B



Location of sampling sites, Lake Raven, Texas, 2009-2010. Gill netting, trap netting, and electrofishing stations are indicated by G, T, and E, respectively.