

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 Nacogdoches

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Lake Nacogdoches were surveyed in 2012 using fall electrofishing and in 2013 using gill netting and spring electrofishing. Anglers were surveyed from March through May 2013 with a creel survey. 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 Nacogdoches is located on Loco Bayou, a tributary of the Angelina River in the Neches River basin. The City of Nacogdoches is the controlling authority. Primary uses are municipal water supply and recreation. At conservation pool elevation, Lake Nacogdoches is 2,212 surface acres and a mean depth of 15 feet. Water level fluctuations average 2 feet annually. Habitat in the lake consists of submerged and emergent aquatic vegetation (mainly hydrilla and American lotus) and standing timber. Most of the land around the reservoir is used for timber production, agriculture, and residential use.
- **Management History:** Important sport fish include Largemouth Bass and White and Black Crappie. The 14- to 21-inch slot-length limit for Largemouth Bass (implemented in 1988) was changed to a 16-inch maximum length limit in 2008. A voluntary trophy bass catch reporting program was implemented in 2009 to assist with evaluation of the length limit. Florida and Sharelunker Largemouth Bass fingerlings were stocked from 2008 - 2011 to maximize trophy bass potential. Hydrilla is present in the reservoir but is not considered problematic.
- **Fish Community**
 - **Prey species:** Abundant prey species included Threadfin Shad, Gizzard Shad, and Bluegill. Electrofishing catch of Gizzard Shad was moderate and stable, but more Gizzard Shad were available as prey in 2012. Electrofishing catch of Bluegill was high, with most fish <5 inches in length and available as prey.
 - **Catfishes:** Historically, abundance of Channel Catfish has been relatively low but a few large fish (> 16 inches) were present. In 2013, catch rates did increase but high Largemouth Bass abundance likely limits recruitment of Channel Catfish. Few anglers target catfish at Lake Nacogdoches ($\leq 2\%$ of total fishing effort).
 - **Black basses:** Spotted Bass abundance has increased over past survey years but all fish collected were small (≤ 12 inches). Largemouth Bass were abundant with stable size structure. Approximately 80% of anglers target black bass. Angler effort has decreased but catch rate was high (1.3 fish/hour). Since 2009, 5,105 Largemouth Bass ≥ 5 pounds were estimated (adjusted for non-reporting) as caught by anglers via a voluntary reporting program (945 > 8 pounds; 290 > 10 pounds). The current Largemouth Bass water body record is 14.02 pounds set in March 1986.
 - **Crappies:** White Crappie and Black Crappie were present in the reservoir. Approximately 20% of anglers target crappies. Directed angling effort in spring 2013 was higher than it was in the previous survey. Angler catch rate was high and 2,376 fish were harvested.
- **Management Strategies:** Continue to manage Largemouth Bass with a 16-inch maximum length limit. Continue to monitor trends of hydrilla coverage through annual aquatic vegetation surveys (2013-2016). Conduct spring electrofishing surveys in 2015 and 2017 and a spring quarter (March-May) creel survey in 2015 and 2017. Conduct standard monitoring with gill nets, fall electrofishing, and an angler access survey in 2016. Continue voluntary angler survey to monitor catch of largemouth bass ≥ 5 pounds.

INTRODUCTION

This document is a summary of fisheries data collected from Lake Nacogdoches 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 Nacogdoches is a 2,212-acre impoundment constructed in 1976 on Loco Bayou. It is located in Nacogdoches County approximately 10 miles west of Nacogdoches and is operated and controlled by the City of Nacogdoches. Primary water uses include municipal water supply and recreation. At conservation pool, Lake Nacogdoches has a shoreline length of 27 miles and a mean depth of 15 feet. Secchi disc readings average 2-4 feet. Water fluctuations average 3 feet annually (Figure 1). Habitat at time of sampling consisted of aquatic vegetation (primarily hydrilla and American lotus) and standing timber. The reservoir was mesotrophic with a mean Trophic State Index chl-*a* of 43.3 (Texas Commission of Environmental Quality 2011). The majority of the land surrounding the reservoir is used for agriculture, timber production, and residential development. Other descriptive characteristics for Lake Nacogdoches are in Table 1.

Angler Access

Lake Nacogdoches has two public access areas, East Park and West Park. Both parks have boat ramps, but the East Park ramp was not available to anglers in 2012 due to low water levels. Extension of this ramp is feasible. Additional boat ramp characteristics are in Table 2. Shoreline access is limited to the public boat ramp areas and the fishing pier located at West Park.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Ashe and Driscoll 2008) included:

1. Conduct annual vegetation surveys to monitor hydrilla coverage, and if problems were to arise with water usage, consult with the City of Nacogdoches to develop a management plan for hydrilla control.
Action: Aquatic vegetation surveys were conducted annually from 2009 to 2012. Currently, no problems concerning hydrilla have been reported by the City of Nacogdoches.
2. Maintain a voluntary angler reporting program for Largemouth Bass to monitor the success of the 16-inch maximum length limit and to justify future stockings of Florida Largemouth Bass fingerlings.
Action: A voluntary angler reporting program was conducted from 2009 through 2013, and a total of 1,021 Largemouth Bass \geq 5-pounds have been reported to the program.
3. Conduct a creel survey in 2013 to monitor catch, harvest, and directed effort of Largemouth Bass and to further evaluate the success and angler satisfaction of the 16-inch maximum length limit. Incorporate supplementary questions to monitor catch of fish \geq 4, 7, and 10 pounds.
Action: A spring quarter (March-May) creel survey was conducted in 2013.
4. Continue to monitor Largemouth Bass population size structure and growth to assess the success of the 16-inch maximum length limit by fall and spring electrofishing.
Action: Spring electrofishing surveys were conducted in 2011 and 2013. A fall electrofishing survey was conducted in 2012.

5. Continue annual stockings of Florida Largemouth Bass at a rate of 50 fish/acre to maximize trophy fish abundance.

Action: Sharelunker Largemouth Bass were stocked in 2008 and Florida Largemouth Bass were stocked from 2008-2011. The 2012 stocking was cancelled due to poor habitat associated with low water levels.

Harvest regulation history: Sport fishes in Lake Nacogdoches are currently managed with statewide regulations with the exception of Largemouth Bass (Table 3). From 1988 to 2008, Largemouth Bass were managed with a 14- to 21-inch slot length limit. A 16-inch maximum length limit was implemented in 2008 to increase the number of large fish available for catch by anglers.

Stocking history: Channel Catfish were stocked in 1976 and 1977 (210,300 total) (Table 4). Florida Largemouth Bass were stocked in 2000, 2002, and 2008-2011 at a rate of 50 fish/acre (901,312 total). In 2008, 19,991 Sharelunker Largemouth Bass fingerlings were stocked.

Vegetation/habitat management history: In 2011 and 2012, hydrilla coverage decreased significantly due to low water levels (Table 6). Hydrilla coverage has historically been as high as 40% of reservoir surface area. Low water levels also reduced coverage of coontail, pondweed, and watershield. Coverage of American lotus increased to 27% of the reservoir surface area in 2012.

Water transfer: Lake Nacogdoches is primarily used for municipal water supply, recreation, and flood control. At this time there is no interbasin transfer of water.

METHODS

Fishes were collected by electrofishing (1 hour at 12, 5-min stations during fall and spring) and gill netting (10 net nights at 10 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 2011).

A spring quarter access-point creel survey was conducted in 2013. The creel period was March through May. Angler interviews were conducted on 5 weekend days and 4 weekdays to assess angler use and fish catch/harvest statistics in accordance with the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2011). Total angler catch of Largemouth Bass \geq 4, 7, and 10 pounds was also estimated. Anglers were asked if released fish were within weight categories. Harvested fish lengths were converted to weights for classification (19 inches = 4 pounds; 23 inches = 7 pounds; 25 inches = 10 pounds).

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. Average age of 14-inch (13.0 – 15.0 inches) Largemouth Bass was determined from otoliths.

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 2008 and 2012 and by electrophoresis for 2004.

Source for water level data was the United States Geological Survey (USGS) website.

RESULTS AND DISCUSSION

Habitat: Littoral zone habitat consisted of aquatic vegetation, primarily American lotus and hydrilla (Table 5). Low lake levels during 2011-2012 caused declines of all prevalent species, with the exception of American lotus. Aquatic vegetation coverage was approximately 34% of the reservoir surface area.

Creel: Similar to previous years, directed fishing effort by anglers was highest for black basses (78.0%), followed by anglers fishing for crappies (17.6%) (Table 7). Total fishing effort for all species declined from previous surveys but direct expenditures were relatively similar (Table 8).

Prey species: Abundant prey species include Threadfin Shad, Gizzard Shad, and Bluegill. Electrofishing catch rates of Gizzard Shad were relatively stable over the last three survey years (range = 71.0 – 87.0/h). Index of Vulnerability (IOV) was 33 and increased from previous years (Figure 2). In 2012, the catch rate of Bluegill (538.0/h) was higher than it was in 2008, but similar to that of 2004 (Figure 3). The majority of catch was < 5 inches in length for all three survey years. In 2013, no angler effort was directed towards sunfishes, and only 52 Bluegills were estimated as harvested (Table 9).

Channel catfish: Historically, Channel Catfish abundance has been low. Channel Catfish recruitment is likely limited by Largemouth Bass predation. In addition, high vegetative cover during most years likely limits nutrients available for preferred food items (i.e., benthic invertebrates). The gill net catch rate in 2013 (5.0/nn) was higher than catch rates observed in 2005 (0.8/nn) and 2009 (1.2/nn), and some large fish (> 16 inches) were available to anglers (Figure 4). Most relative weights exceeded 85 and were similar to those of the past two survey years. Few anglers targeted catfish ($\leq 2.0\%$ of directed fishing effort) (Table 7) and harvest was limited to 418 fish (Table 10 and Figure 5).

Black basses: Electrofishing catch rates of Spotted Bass have been historically low and no fish were collected during 2004 and 2008. In 2012/2013, catch rates from fall and spring electrofishing were 47.0 and 17.0/h, respectively (Figures 6 and 7). The increase in Spotted Bass abundance may be due to a reduction in aquatic vegetation and turbid conditions during low water periods in 2011-2012. The majority of fish were ≤ 8 inches in length and 26 fish were estimated as harvested during the spring creel survey.

Fall electrofishing catch rates of Largemouth Bass ranged from 96.0-166.0/h during 2004, 2008, and 2012 (Figure 8). Sampling efficiency was relatively poor during 2004 and 2008 due to thick hydrilla coverage. Population size structure was favorable across years (PSD range = 32-74). Relative weights exceeded 80, indicating Largemouth Bass were in moderate condition. Growth of Largemouth Bass was adequate; average age at 14 inches (13.5-14.5 inches) was 3.0 years (N = 13; range = 2 – 6 years). Spring electrofishing catch rates in 2009 (226.0/h) and 2013 (251.0/h) were relatively high and size structure was good (PSD range = 68–76; PSD-16 range 16-26) (Figure 9). In 2011, catch rate was relatively low (91.0/h) and likely due to low water level and poor sampling habitat. Florida Largemouth Bass influence has remained relatively constant as Florida Largemouth Bass alleles have ranged from 52.6 to 73.0% (Table 12). However, the percent of pure Florida largemouth bass increased to 20% in 2012.

Similar to previous years, the black bass fishery accounted for the majority of annual fishing effort (78.0%; Table 7) during the 2013 spring creel survey. However, directed effort declined to 4.9 h/acre in 2013 (Table 11). Total angler catch rates were high during the last three survey periods (range = 0.77-1.28/h). Total estimated harvest was relatively low during the last three creel surveys and declined to 626 fish during 2013 (90% of legal fish released). Catch of Largemouth Bass ≥ 4 pounds and ≥ 7 pounds was high during 2009 (3,211 and 701 fish, respectively) but declined during 2013 (1,221 and 204 fish, respectively).

A voluntary angler reporting program was implemented in 2009 to increase information on catch ≥ 21 inches or 5 pounds and to provide greater insight regarding large fish abundance. A total of 1,021 Largemouth Bass have been voluntarily reported. Angler reporting rates were estimated in 2009 (20%), 2011 (20%), and 2013 (25%). Adjusting for non-reporting, an estimated total of 5,105 Largemouth Bass ≥ 21 inches/5 pounds were caught by anglers from 2009 through 2012 (945 > 8 pounds; 290 > 10 pounds) (Appendix D).

Crappies: A total of 17.6% of angler effort was directed towards crappies in 2013 (Table 7). Angler catch rate was high (1.8/h) and total harvest (2,376 fish) was higher than it was in previous survey years. Fish 10 – 12 inches in length comprised most of the harvest (nearly all were Black Crappie) (Figure 11).

Fisheries management plan for Lake Nacogdoches, Texas

Prepared – July 2013.

ISSUE 1: Historically, hydrilla coverage in Lake Nacogdoches has exceeded 40%. In 2012, hydrilla coverage declined to 7.1% of the reservoir surface area.

MANAGEMENT STRATEGY

1. Continue to monitor aquatic vegetation annually (2013-2016). If hydrilla coverage expands and prompts public complaint, meet with city officials and angling public to develop an integrated aquatic vegetation management plan.

ISSUE 2: In 2008, a 16-inch maximum length limit was implemented prohibiting the retention of Largemouth Bass ≥ 16 inches unless the fish is greater than 24 inches and 13 pounds. Under this scenario, the fish must be donated to the Sharelunker program. All other fish greater than 16 inches must be immediately released back into the reservoir. The purpose of this length limit is to maximize trophy bass production.

MANAGEMENT STRATEGIES

1. Maintain the voluntary trophy bass reporting program to monitor the success of the 16-inch maximum length regulation and to justify future stockings of Florida Largemouth Bass fingerlings. Calculate angler reporting rates every two years via spring quarter creel survey.
2. A spring quarter creel survey will be conducted in 2015 and 2017 to monitor catch and harvest of Largemouth Bass, and directed effort of anglers toward Largemouth Bass.
3. Continue to monitor Largemouth Bass population size structure by spring electrofishing (2015 and 2017) and fall electrofishing (2016). Examine Largemouth Bass growth in 2016.
4. Continue annual stockings of Florida Largemouth Bass at a rate of 50 fish/acre to maximize trophy fish abundance.

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 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 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 aquatic vegetation surveys (2013-2016), spring electrofishing surveys (2015 and 2017), and a spring (March-May) creel in 2015 and 2017 (Table 14). Standard monitoring with fall electrofishing and an angler access survey will be conducted in 2016-2017. Additional aquatic vegetation surveys are required to monitor hydrilla coverage. Additional spring electrofishing and creel surveys are conducted to evaluate the 16-inch maximum length limit regulation.

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.
- Ashe, D., and T. Driscoll. 2008. Statewide freshwater fisheries monitoring and management program survey report for Nacogdoches Reservoir, 2007. Texas Parks and Wildlife Department, Federal Aid Report F-30-R, Austin.
- DiCenzo, V. J., M. J. Maceina, and M. R. Stimert. 1996. Relations between reservoir trophic state and gizzard shad population characteristics in Alabama reservoirs. North American Journal of Fisheries Management 16:888-895.
- Guy, C. S., R. M. 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.
- Texas Commission on Environmental Quality. 2011. Trophic Classification of Texas Reservoirs: 2010 Texas Water Quality Inventory and 303(d) List, Austin. 18 pp.

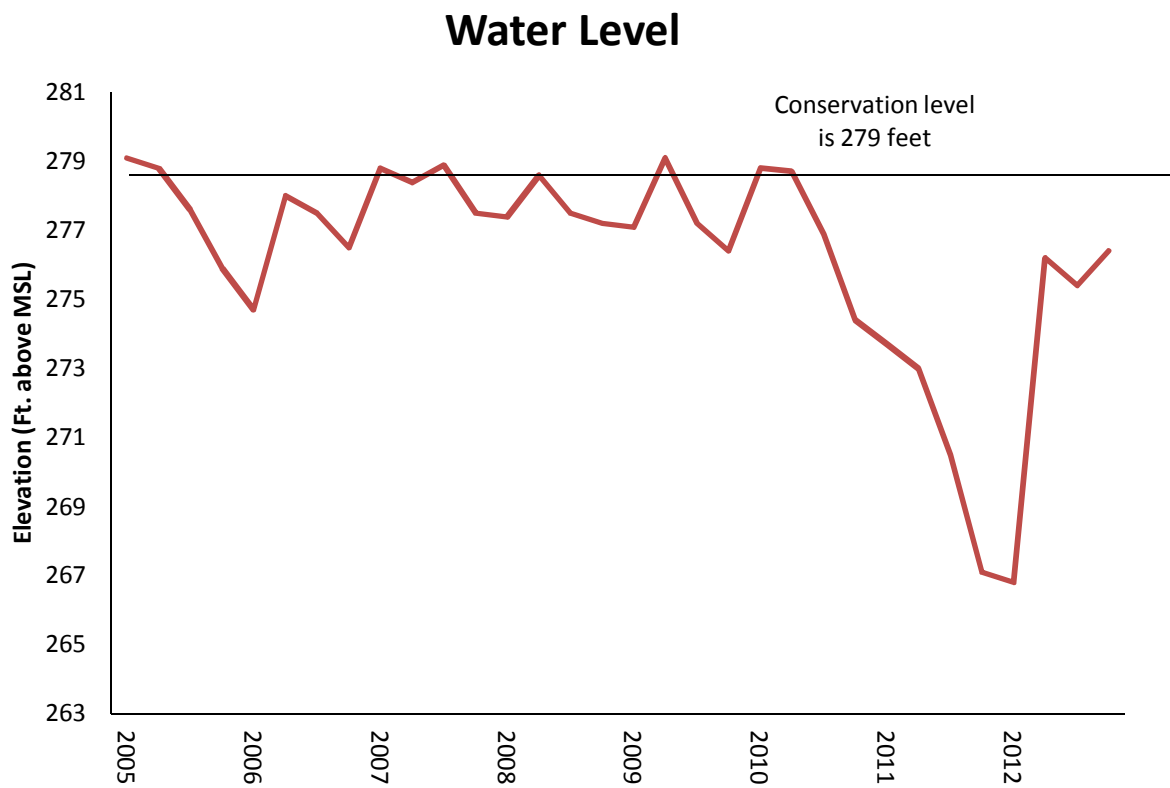


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Lake Nacogdoches, Texas.

Table 1. Characteristics of Lake Nacogdoches, Texas.

Characteristic	Description
Year constructed	1976
Controlling authority	City of Nacogdoches
Counties	Nacogdoches
Reservoir type	Secondary Stream
Shoreline Development Index (SDI)	2.3
Conductivity	120 umhos/cm

Table 2. Boat ramp characteristics for Lake Nacogdoches, Texas, August, 2012. Reservoir elevation at time of survey was 275 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
East Park	31.58849 -94.82183	Y	15	276	Out of water. Extension is feasible
West Park	31.59314 -94.83738	Y	20	275	Nearly out of water. Extension is feasible

Table 3. Harvest regulations for Lake Nacogdoches, 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: Largemouth	5 ^{a,b}	16-inch maximum
Bass: Spotted	5 ^a	None
Crappie: White and Black Crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum

^aDaily bag for Largemouth Bass and Spotted Bass = 5 fish in any combination.

^bLargemouth Bass 24 inches or greater in length may be temporarily retained in a live well or other aerated holding device and immediately weighed using personal scales. Fish weighing 13 pounds or more may be donated to the Sharelunker program; otherwise, the fish must be immediately released in Lake Nacogdoches.

Table 4. Stocking history of Lake Nacogdoches, Texas. FGL = fingerling; AFGL = advanced fingerling.

Species	Year	Number	Life Stage	Mean TL (in)
Channel Catfish	1976	110,000	AFGL	7.9
	1977	100,300	AFGL	7.9
	Total	210,300		
Florida Largemouth Bass	1977	221,400	FRY	1.0
	1999	500	FGL	2.9
	2000	110,743	FGL	1.4
	2002	110,152	FGL	1.6
	2008	110,762	FGL	1.6
	2009	110,661	FGL	1.7
	2010	112,475	FGL	1.4
	2011	124,619	FGL	1.6
	Total	901,312		
ShareLunker Largemouth Bass	2008	19,991	AFGL	6.4
	Total	19,991		

Table 5. Survey of structural habitat types, Lake Nacogdoches, Texas, 2008. Shoreline habitat type units are in miles and standing timber is acres.

Habitat type	Estimate	% of total
Natural shoreline	19.5 miles	71.6
Rocky shoreline	7.8 miles	28.4
Standing timber	10.0 acres	

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

Vegetation	2009	2010	2011	2012
Coontail			3.0 (<0.1)	
Pondweed	11 (0.5)	36 (1.6)	3.0 (<0.1)	
Watershield	56 (2.5)	93 (4.2)		
American lotus	415.0 (18.8)	687.0 (31.1)	3.0 (<0.1)	595.0 (26.9)
Hydrilla	536.0 (24.2)	540.0 (24.4)	10.0 (0.5)	157.0 (7.1)

Table 7. Percent directed angler effort by species for Lake Nacogdoches, Texas, 2005, 2009, and 2013. Survey periods were from 1 March through 31 May.

Species	2005	2009	2013
Catfishes	0.1	1.9	2.0
Sunfishes	2.8	1.3	0.0
Black basses	62.6	85.6	78.0
Crappies	25.4	6.5	17.6
Anything	9.1	4.7	2.4

Table 8. Total fishing effort (h) for all species and total directed expenditures at Lake Nacogdoches, Texas, 2005, 2009, and 2013. Survey periods were from 1 March through 31 May. Relative standard error is in parentheses.

Creel statistic	2005	2009	2013
Total fishing effort	19,473 (29)	20,664 (35)	13,939 (28)
Total directed expenditures	\$78,751 (37)	\$97,189 (41)	\$75,853 (40)

Gizzard Shad

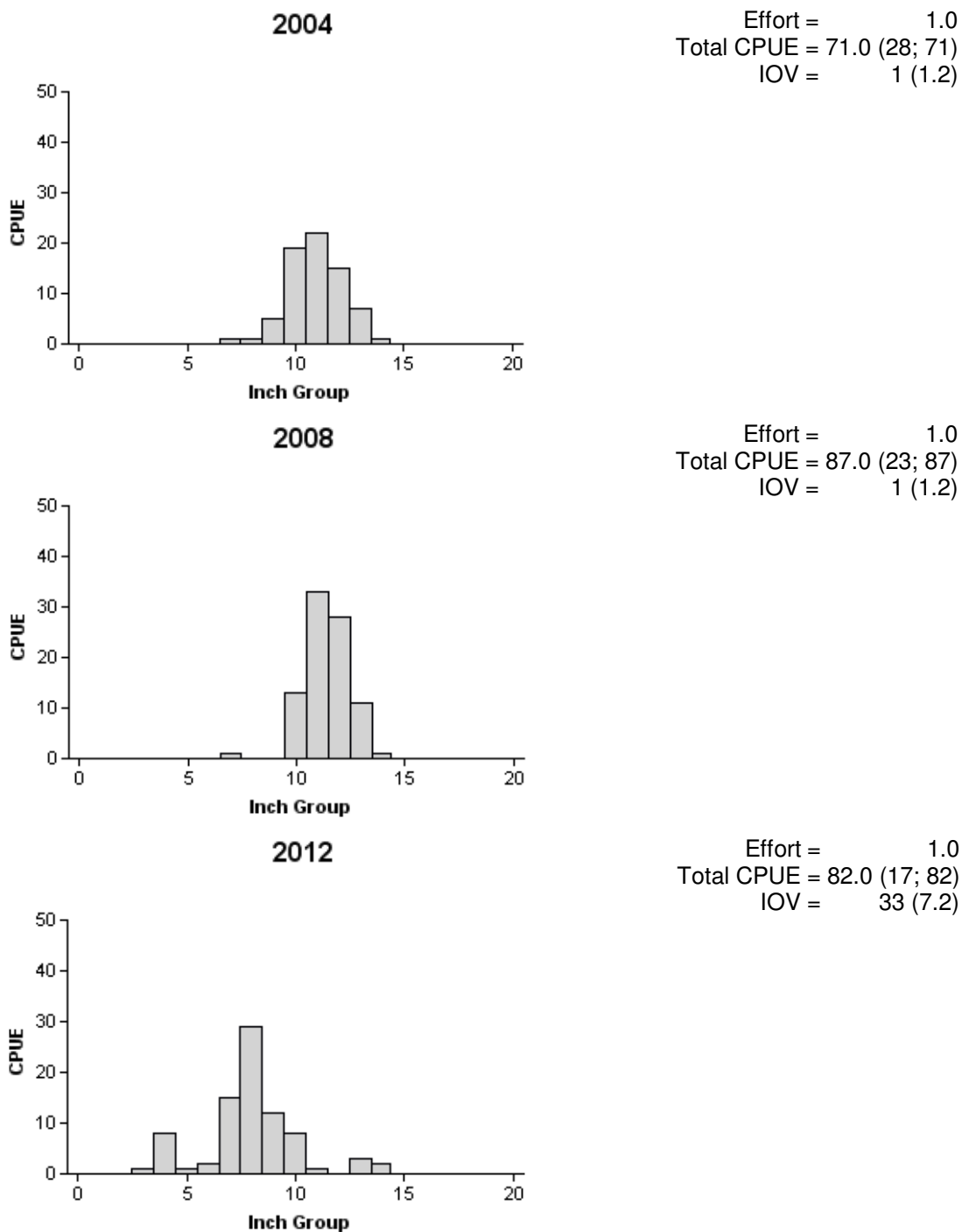


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Lake Nacogdoches, Texas, 2004, 2008, and 2012.

Bluegill

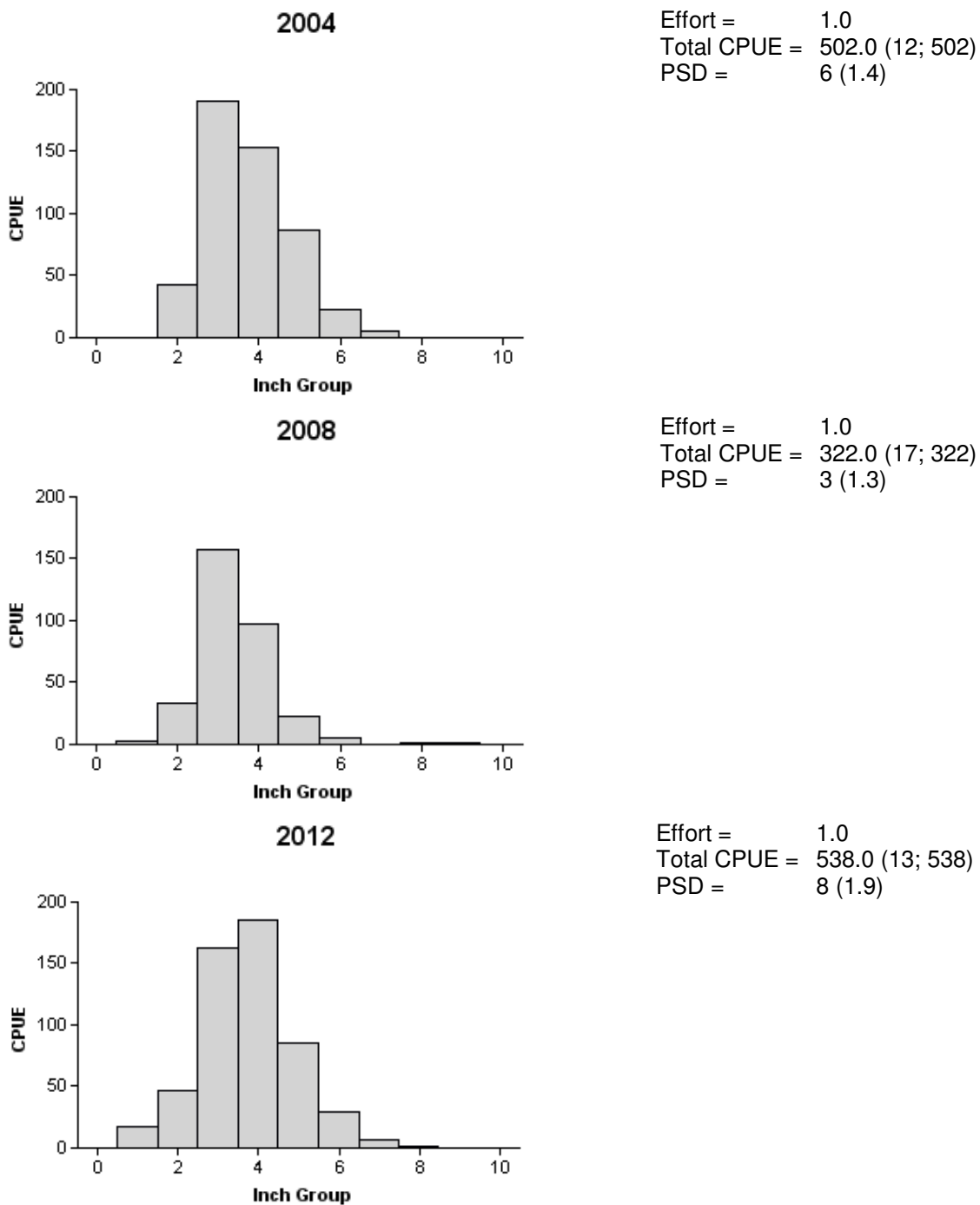


Figure 3. Number of Bluegill caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Nacogdoches, Texas, 2004, 2008, and 2012.

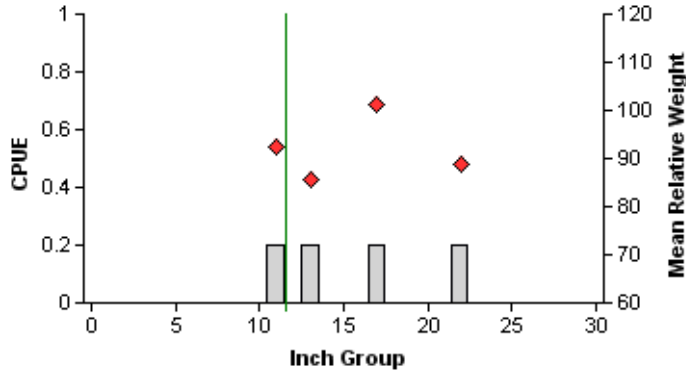
Table 9. Creel survey statistics for sunfishes at Lake Nacogdoches from March through May 2005, 2009, and 2013. Total catch per hour is for anglers targeting sunfishes and total harvest is the estimated number of sunfishes harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2005	2009	2013
Directed effort (h)	542.09 (58)	262.46 (84)	
Directed effort/acre	0.25 (58)	0.12 (84)	
Total catch per hour	1.51 (80)	8.25 (.)	
Total harvest	36.10 (755)	0.00 (0)	52.20 (316)
Harvest/acre	0.02 (755)	0.00 (0)	0.02 (316)
Percent legal released	96	100	93

Channel Catfish

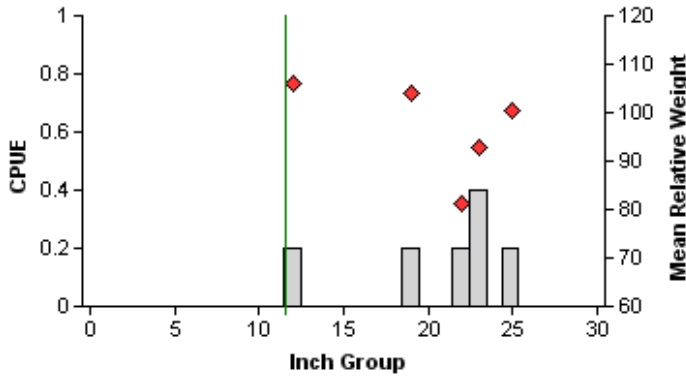
2005

Effort = 5.0
 Total CPUE = 0.8 (47; 4)
 PSD = 50 (34.2)



2009

Effort = 5.0
 Total CPUE = 1.2 (49; 6)
 PSD = 83 (15.9)



2013

Effort = 5.0
 Total CPUE = 5.0 (29; 25)
 PSD = 38 (13.6)

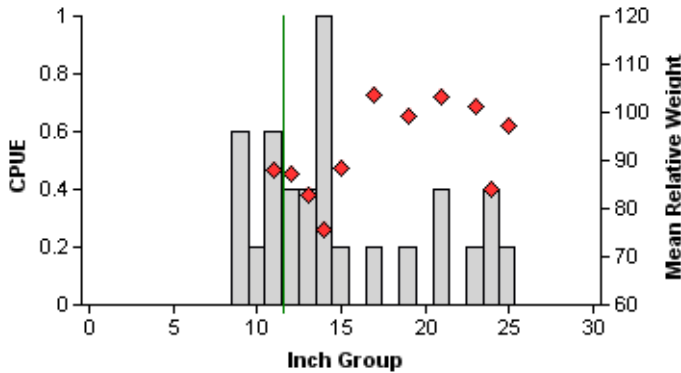


Figure 4. Number of Channel Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Nacogdoches, Texas, 2005, 2009, and 2013. Vertical lines indicate minimum length limit.

Catfishes

Table 10. Creel survey statistics for catfishes at Lake Nacogdoches from March through May 2005, 2009, and 2013. Total catch per hour is for anglers targeting catfishes and total harvest is the estimated number of catfishes harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2005	2009	2013
Directed effort (h)	14.68 (233)	393.68 (71)	279.59 (84)
Directed effort/acre	0.01 (233)	0.18 (71)	0.12 (84)
Total catch per hour	0.00 (0)	0.28 (20)	0.50 (40)
Total harvest	93.21 (276)	213.77 (102)	417.81 (90)
Harvest/acre	0.04 (276)	0.10 (102)	0.19 (90)
Percent legal released	13.8	0.1	0.0

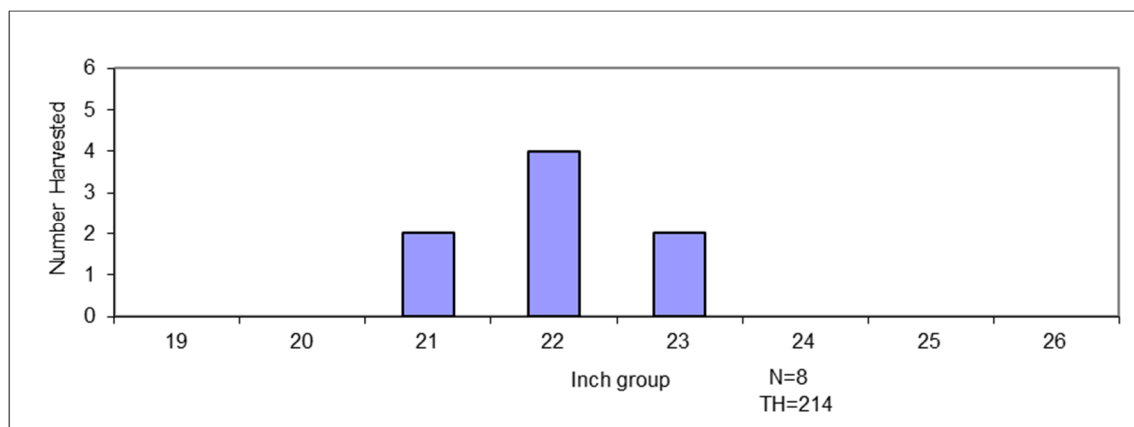


Figure 5. Length frequency of harvested Channel Catfish observed during creel surveys at Lake Nacogdoches, Texas, March through May 2013, all anglers combined. N is the number of harvested Channel Catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

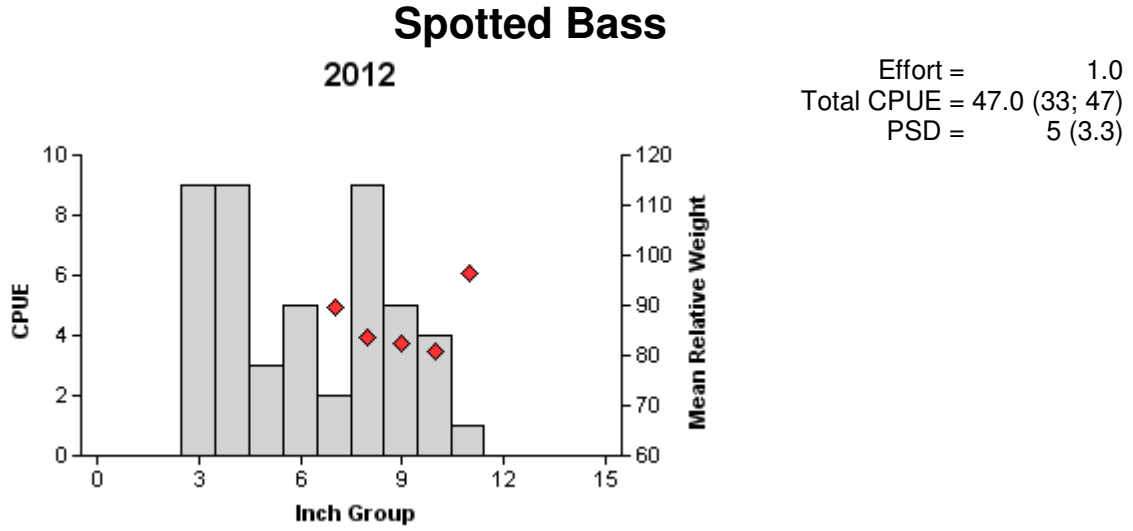


Figure 6. Number of Spotted Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing survey, Lake Nacogdoches, Texas, 2012. No Spotted Bass were collected during the 2004 and 2008 fall electrofishing surveys.

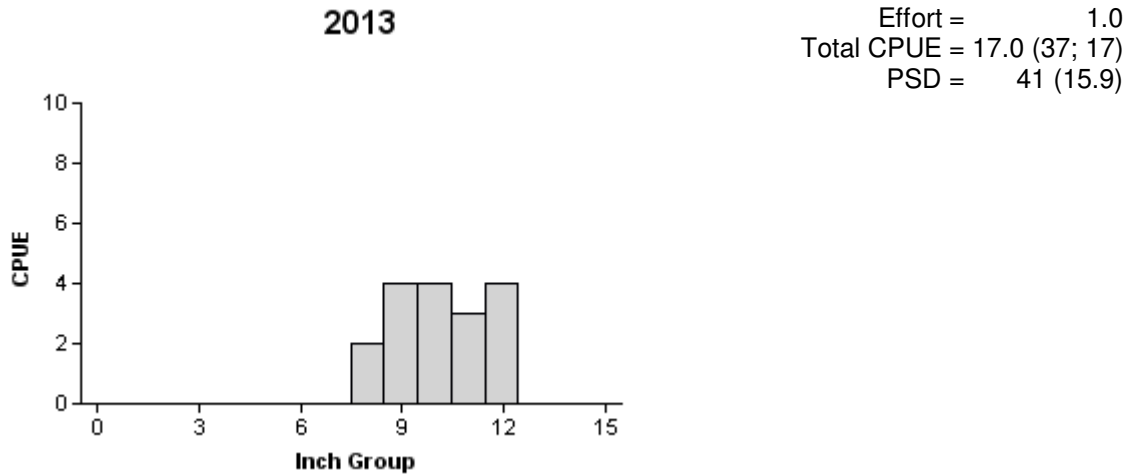


Figure 7. Number of Spotted Bass caught per hour (CPUE, bars), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring electrofishing survey, Lake Nacogdoches, Texas, 2013. No Spotted Bass were collected during the 2009 and 2011 spring electrofishing surveys.

Largemouth Bass

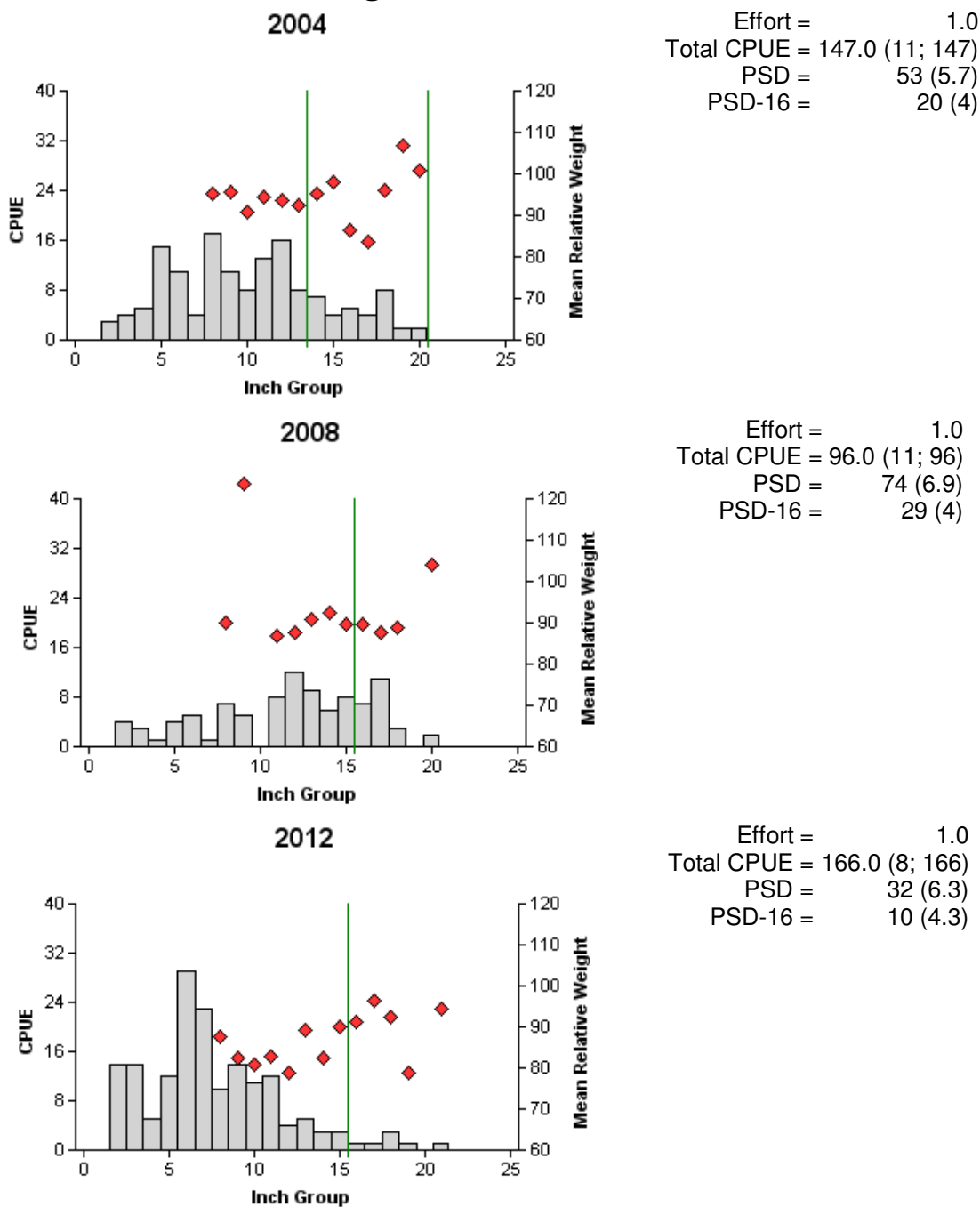


Figure 8. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Nacogdoches, Texas, 2004, 2008, and 2012. Vertical lines indicate slot length limit for 2004 and maximum length limit for 2008 and 2012.

Largemouth Bass

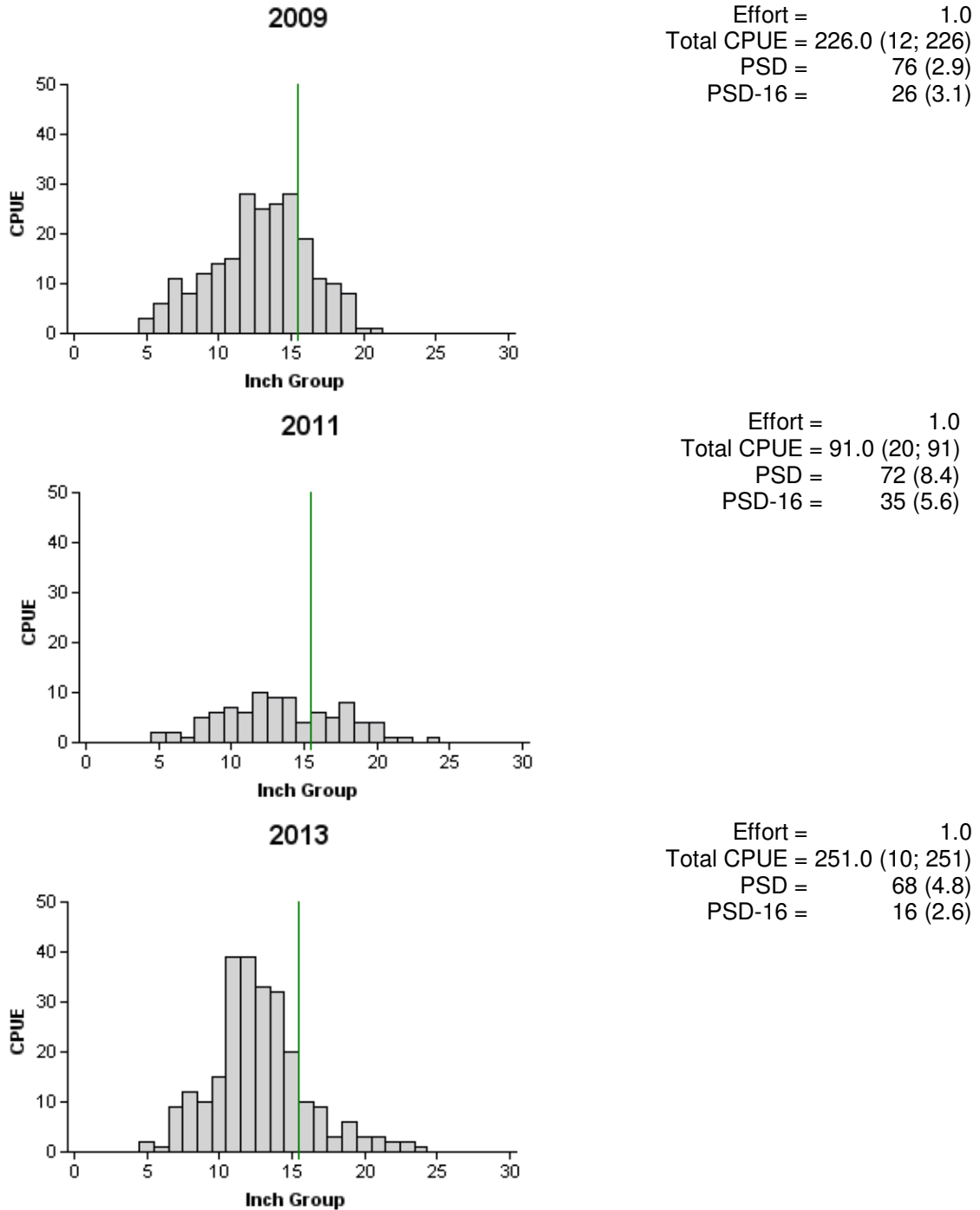


Figure 9. Number of Largemouth Bass caught per hour (CPUE, bars), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring electrofishing surveys, Lake Nacogdoches, Texas, 2009, 2011, and 2013. Vertical line indicates maximum length limit.

Largemouth Bass

Table 11. Creel survey statistics for Largemouth Bass at Lake Nacogdoches from March through May 2005, 2009, and 2013. Total catch per hour and estimated number of fish released by weight category is for anglers targeting Largemouth Bass and total harvest is for all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2005	2009	2013
Directed effort (h)	12,191.39 (29)	17,684.22 (34)	10,871.48 (29)
Directed effort/acre	5.51 (29)	7.99 (34)	4.91 (29)
Total catch per hour	0.95 (10)	0.77 (11)	1.28 (15)
Total catch	11,729 (29)	13,918 (40)	18,195 (34)
Total harvest	926.61 (50)	774.90 (38)	626.72 (57)
Harvest/acre	0.42 (50)	0.35 (38)	0.28 (57)
Release by weight			
<4.0 lbs		9,932	16,347 (35)
4.0-6.9 lbs		2,510	1,017 (57)
7.0-9.9 lbs		664	170 (118)
≥10.0 lbs		37	34 (255)
Percent legal released	87	93	90

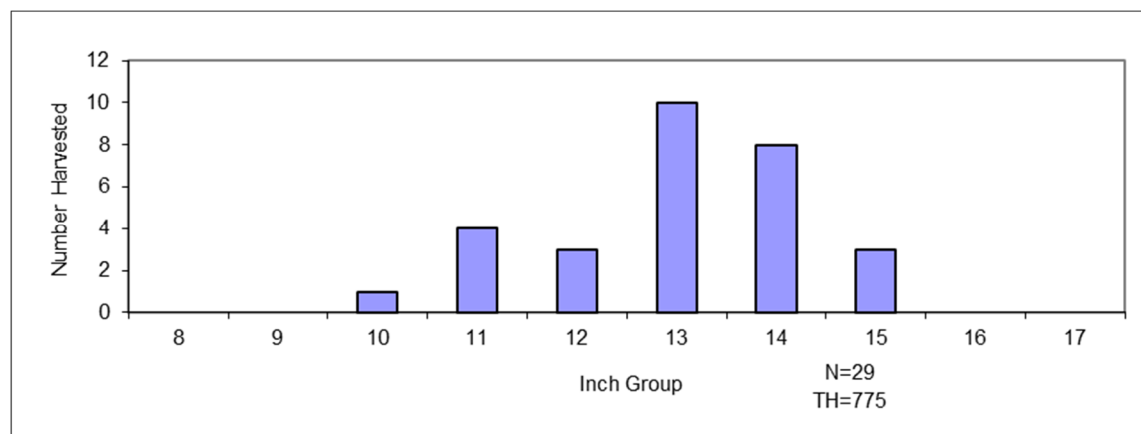


Figure 10. Length frequency of harvested Largemouth Bass observed during creel surveys at Lake Nacogdoches, Texas, March through May 2013, all anglers combined. N is the number of harvested Largemouth Bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Table 12. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Lake Nacogdoches, Texas, 2004, 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.

Year	Sample size	Number of fish			% FLMB alleles	% FLMB
		FLMB	Intergrade	NLMB		
2004	38	3	34	1	52.6	7.9
2008	30	1	30	0	73.0	3.3
2012	30	6	24	0	72.0	20.0

Crappies

Table 13. Creel survey statistics for crappies at Lake Nacogdoches from March through May 2005, 2009, and 2013. 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		
	2005	2009	2013
Directed effort (h)	4,948.86 (32)	1,356.51 (45)	2,452.49 (37)
Directed effort/acre	2.24 (32)	0.61 (45)	1.11 (37)
Total catch per hour	1.73 (15)	1.11 (67)	1.76 (46)
Total harvest	356.96 (100)	1,068.82 (84)	2,376.31 (68)
Harvest/acre	0.16 (100)	0.48 (84)	1.07 (68)
Percent legal released	0	7	12

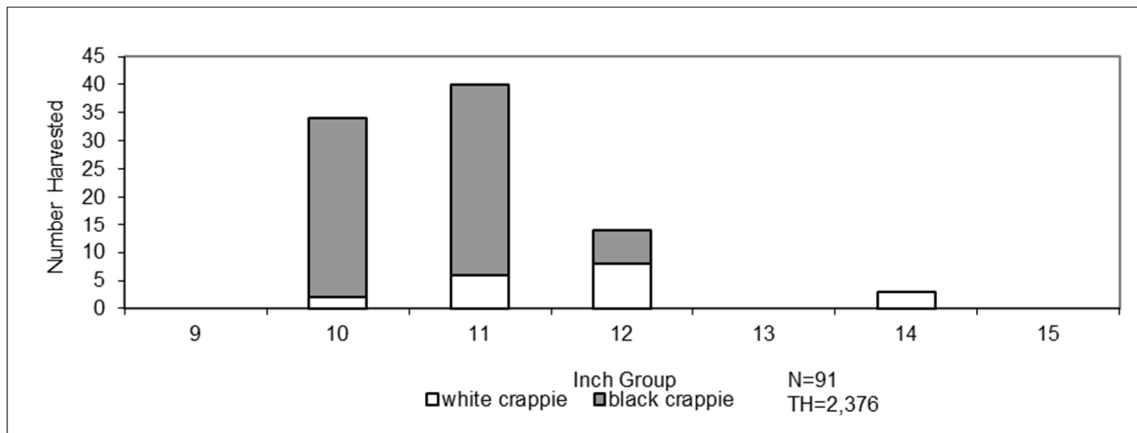


Figure 11. Length frequency of harvested crappies (white = White Crappie; grey = Black Crappie) observed during creel surveys at Lake Nacogdoches, Texas, March through May 2013, all anglers combined. N is the number of harvested crappies observed during creel surveys, and TH is the total estimated harvest for the creel period.

Table 14. Proposed sampling schedule for Lake Nacogdoches, Texas. Survey period is June through May. Gill netting surveys are conducted in the spring, while standard electrofishing is conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

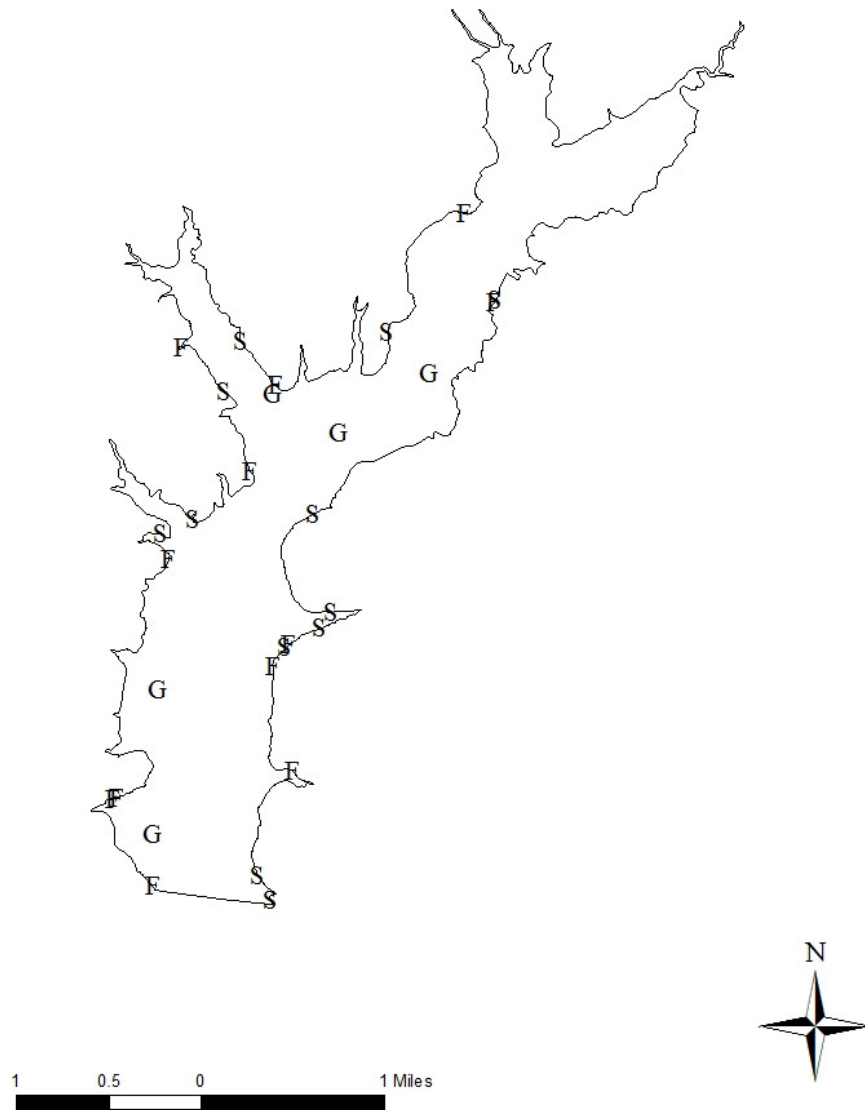
Survey year	Electrofishing Fall(Spring)	Gill net	Habitat		Access	Creel survey	Report
			Structural	Vegetation			
2013-2014				A			
2014-2015	(A)			A		A	
2015-2016				A			
2016-2017	S (A)			S	S	S	S

APPENDIX A

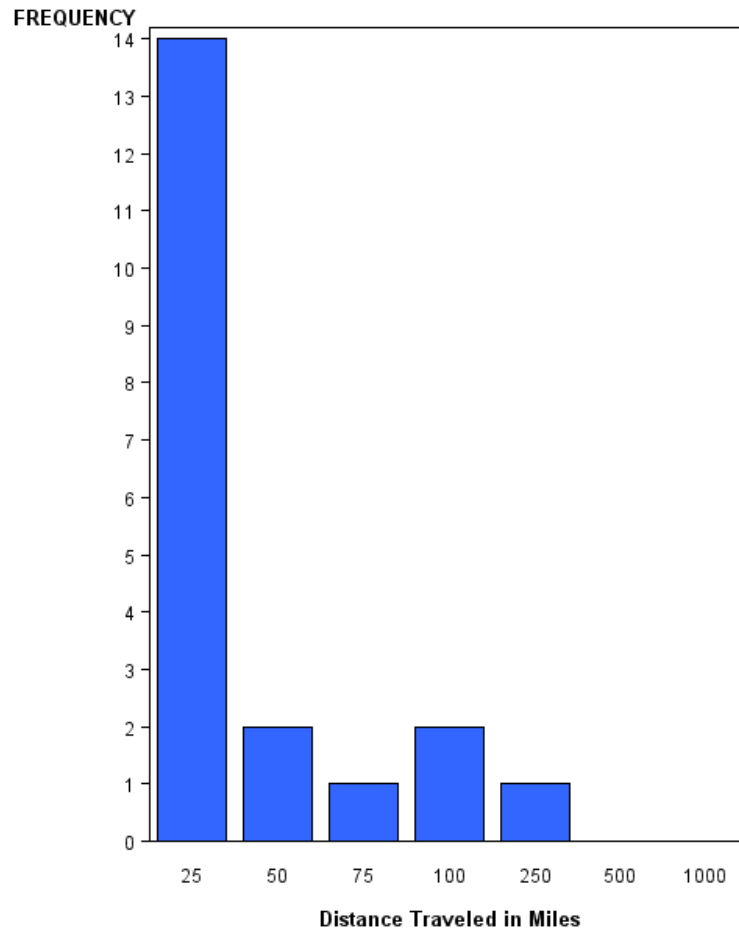
Number (N) and catch rate (CPUE) of all target species collected from all gear types from Lake Nacogdoches, Texas, 2012-2013. Sampling effort was 5 net nights for gill netting and 1 hour for fall and spring electrofishing.

Species	Gill Netting		Fall Electrofishing		Spring Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Gizzard Shad	1	0.2	82	82.0		
Threadfin Shad			78	78.0		
Spotted Sucker	27	5.4				
Channel Catfish	25	5.0				
Warmouth			6	6.0		
Bluegill			538	538.0		
Longear Sunfish			16	16.0		
Redear Sunfish			90	90.0		
Redspotted Sunfish			8	8.0		
Spotted Bass	5	1.0	47	47.0	17	17.0
Largemouth Bass	5	1.0	166	166.0	251	251.0
Black Crappie	2	0.4				

APPENDIX B

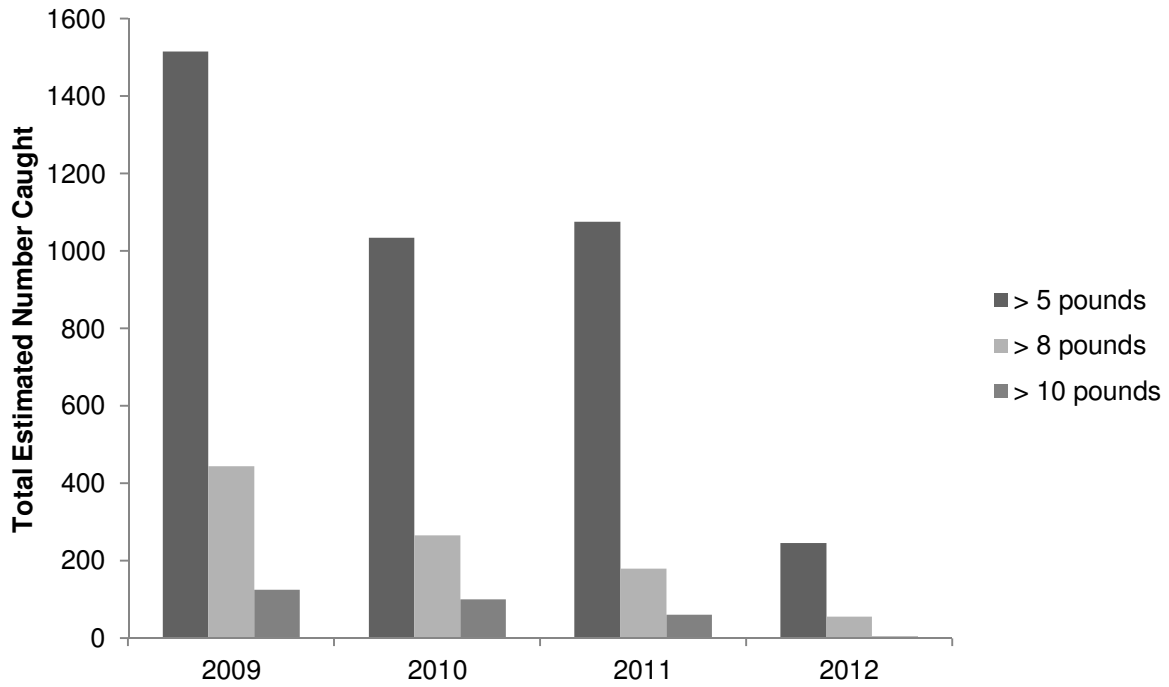


Location of sampling sites, Lake Nacogdoches, Texas, 2012-2013. Gill net, fall electrofishing, and spring electrofishing stations are indicated by G, F, and S respectively. Water level was 1-4 feet below full pool at time of sampling.

APPENDIX C

Frequency of anglers that traveled various distances (miles) to Lake Nacogdoches, Texas, as determined from the March through May 2013 creel survey.

APPENDIX D



Total estimated number of largemouth bass entered in the voluntary trophy bass angler survey, Lake Nacogdoches, Texas, 2009 - 2012.