

PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

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FEDERAL AID PROJECT F-221-M-2

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2016 Fisheries Management Survey Report

Lake Nacogdoches

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July 31, 2017

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Lake Nacogdoches were surveyed in 2016 using fall electrofishing and in 2015 and 2017 using spring electrofishing. Anglers were surveyed from March through May 2017 with a creel survey. Historical data are presented with the 2016-2017 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 has a mean depth of 15 feet. Water level fluctuations average 3 feet annually. Habitat in the lake consists of submerged and emergent aquatic vegetation (mainly hydrilla, American lotus, and torpedograss) 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, White Crappie, 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. Florida and Sharelunker Largemouth Bass fingerlings were stocked from 2008–2016 with the exception of 2012-2014 to maximize trophy bass potential.
- **Fish Community**
 - **Prey species:** Primary prey species included Threadfin Shad, Gizzard Shad, and Bluegill. Electrofishing catch of Gizzard Shad was low compared to previous surveys. Electrofishing catch of Bluegill was moderate, with most fish <5 inches in length and available as prey.
 - **Channel Catfish:** Historically, abundance of Channel Catfish has been relatively low. Gill net surveys were discontinued in 2016. Few anglers target catfish at Lake Nacogdoches (< 3% of total fishing effort).
 - **Black basses:** Spotted Bass were present in low abundance and all fish collected were small (≤ 12 inches). Largemouth Bass were abundant with stable size structure. Approximately 85% of anglers target black bass. Directed angler effort increased in 2017, and angler catch rates remained relatively high and stable (range = 0.8 – 1.3/h). From 2009 - 2014, 5,394 Largemouth Bass ≥ 5 pounds were estimated as caught by anglers via a voluntary reporting program (1,181 > 8 pounds; 426 > 10 pounds).
 - **Crappies:** White Crappie and Black Crappie were present in the reservoir. In 2017, 8.2% of anglers targeted crappies, similar to 2009 when 6.5% of anglers targeted crappies, but down from the 17% observed in 2013. Angler catch rate was high in 2017 (1.5/h) and 5,195 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 (2017-2020). Conduct spring electrofishing surveys in 2019 and 2021 and a spring quarter (March-May) creel survey in 2021. Conduct standard monitoring with fall electrofishing, and an angler access survey in 2020.

INTRODUCTION

This document is a summary of fisheries data collected from Lake Nacogdoches 2016-2017. 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 2016-2017 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, American lotus, and torpedograss) 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 in good condition. 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 2013) included:

1. Conduct annual vegetation surveys to monitor hydrilla coverage, and if problems were to arise prompting public complaint, consult with the City of Nacogdoches to develop a management plan for hydrilla control.
Action: Aquatic vegetation surveys were conducted annually from 2013 to 2016. Currently, no problems concerning hydrilla have been reported by the City of Nacogdoches or the angling public.
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 2014. An average estimated reporting rate of 20-25% was maintained throughout the survey period.
3. Conduct creel surveys to monitor catch, harvest, and directed effort of Largemouth Bass and evaluate the success of the 16-inch maximum length limit.
Action: A spring quarter (March-May) creel survey was conducted in 2017.
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 2015 and 2017. A fall electrofishing survey was conducted in 2016.
5. Continue annual stockings of Florida Largemouth Bass to maximize trophy fish abundance.
Action: Florida Largemouth Bass were stocked in 2015 and 2016.

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 abundance of large fish.

Stocking history: Channel Catfish were stocked in 1976 and 1977 (Table 4). Florida Largemouth Bass were stocked in 2000, 2002, and 2008-2011 at a rate of 50 fish/acre, and in 2015 and 2016 at a rate of 1,000 fish/km of shoreline. In 2008, 19,991 Sharelunker Largemouth Bass fingerlings were stocked.

Vegetation/habitat management history: Historically, hydrilla has not negatively impacted angler access, and no treatments have been conducted. Torpedograss has been problematic in designated swimming areas, but herbicide use restrictions relative to municipal water use have prevented treatment.

Water transfer: Lake Nacogdoches is primarily used for municipal water supply, recreation, and flood control. There are no interbasin transfers of water.

METHODS

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Lake Nacogdoches (TPWD unpublished). Primary components of the OBS plan are listed in Table 5. All survey sites were randomly selected and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Electrofishing – Largemouth Bass, Spotted Bass, Sunfishes, Gizzard Shad, and Threadfin Shad were surveyed by electrofishing (1 hour at 12, 5-min stations). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing. Ages for Largemouth Bass were determined using otoliths from 15 randomly-selected fish (range 13.5 to 14.5 inches).

Statistics – 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_i]) 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.

Creel survey – A spring quarter access-point creel survey was conducted from March through May 2017. 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 2015).

Habitat – A structural habitat survey was conducted in 2008 (Ashe and Driscoll 2008). Vegetation surveys were conducted in 2013–2016 to monitor hydrilla coverage. Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Water level – Source for water level data was the United States Geological Survey (USGS 2017).

RESULTS AND DISCUSSION

Habitat: Hydrilla coverage has historically been as high as 40% of reservoir surface area. In 2014, hydrilla increased to 34% coverage from 19% observed the previous year in 2013, but decreased significantly in 2015 and 2016 due to increased inflows and turbidity from heavy rainfall. Coverage of American lotus decreased to trace amounts in 2011 due to drought conditions but has since rebounded to historical levels of 20-30% coverage.

Creel: Similar to previous years, directed angling effort was highest for black basses (88%), followed by anglers fishing for crappies (8%) (Table 7). Total angling effort for all species and direct expenditures increased from previous surveys (Table 8).

Prey species: Primary prey species include Threadfin Shad, Gizzard Shad, and Bluegill. Electrofishing catch rates of Gizzard Shad declined significantly in 2016 (5.0/h) when compared to previous surveys in 2008 (87.0/h) and 2012 (82.0/h) (Figure 2). Index of Vulnerability (IOV) was 40 and similar to that observed in 2012. In 2016, the catch rate of Bluegill (265.0/h) was lower than it was in 2012 (538.0/h), but similar to that of 2008 (322.0/h) (Figure 3). The majority of catch was ≤ 5 inches in length for all three survey years. Few anglers target sunfish; estimated total harvest was 265 Bluegill during the 2017 spring creel survey (Table 9).

Channel Catfish: Historically, Channel Catfish abundance has been low with little directed angling effort. Beginning in 2016, no directed catfish sampling was conducted. Few anglers targeted catfish (3% of directed effort) (Table 7). However, anglers targeting catfish experienced high catch rates of 1.6 fish/h (Table 10). Estimated total harvest was 2,068 fish.

Black basses: Electrofishing catch rates of Spotted Bass have been historically low with catch rates of 47.0/h and 15.0/h during fall electrofishing surveys in 2012 and 2016, respectively (Figure 5). In 2013 and 2015, catch rates during spring electrofishing were 17.0 and 2.0/h, respectively (Figure 6). All fish were ≤ 12 inches in length, and 53 fish were estimated as harvested during the 2017 spring creel survey.

Fall electrofishing catch rates of Largemouth Bass ranged from 96.0-166.0/h during 2008 (96.0/h), 2012 (166.0/h), and 2016 (137.0/h) (Figure 7). Population size structure was favorable across years (PSD range = 32-74). Relative weights exceeded 80 for most inch groups, indicating fish were in moderate condition. Growth of Largemouth Bass was adequate; average age at 14 inches (13.5-14.5 inches) was 3.1 years (N = 15; range = 2-4 years). Spring electrofishing catch rate in 2017 (225.0/h) was higher than that observed in 2015 (119.0/h) and similar to that seen in 2013 (251.0/h) (Figure 8). Size structure was good (PSD range = 68-87; PSD-16 range 16-24).

Similar to previous years, the black bass fishery accounted for the majority of annual fishing effort (88%; Table 7) during the 2017 spring creel survey. Directed effort for black basses was 11.7 h/acre in 2017 (Table 11). Total angler catch rates were high during the last three survey periods (range = 0.8-1.3/h). Total estimated harvest was relatively low in 2009 (775 fish) and 2013 (627 fish) creel surveys, but increased to 3,261 fish during 2017 (84% of legal fish released). Total catch increased in 2017 driven by increased effort (25,835 h) compared to 2013 (10,871 h) and 2009 (17,684 h). However, catch of fish > 4 pounds was similar to previous surveys.

A voluntary angler reporting program was conducted from 2009-2014 to increase information on catch of Largemouth Bass greater than 21 inches or 5 pounds, and abundance of large fish. A total of 1,148 Largemouth Bass were voluntarily reported. Angler reporting rates were estimated in 2009 (20%), 2011 (20%), and 2013 (25%). Adjusting for non-reporting, an estimated total of 5,394 Largemouth Bass ≥ 21 inches/5 pounds were caught by anglers from 2009 through 2014 (1,181 > 8 pounds; 426 > 10 pounds).

Crappies: A total of 8.2% of angler effort was directed towards crappies in 2017 (Table 7). Angler catch rate (1.5/h) in 2017 was similar to the previous survey in 2013 (1.8/h) (Table 12). Harvest increased to 5,195 fish in 2017 compared to 2,376 and 1,069 fish harvested in 2013 and 2009, respectively.

Fisheries management plan for Lake Nacogdoches, Texas

Prepared – July 2017.

ISSUE 1: Historically, hydrilla coverage in Lake Nacogdoches has exceeded 40%. In 2016, hydrilla coverage declined to 3% of the reservoir surface area.

MANAGEMENT STRATEGIES

1. Continue to monitor aquatic vegetation annually (2017-2020). If hydrilla coverage expands and prompts public complaint, meet with city officials and angling public to develop an integrated aquatic vegetation management plan.
2. Permit lakeside homeowners to conduct herbicide treatments (at homeowner expense) adjacent to their property.

ISSUE 2: In 2008, a 16-inch maximum length limit was implemented prohibiting the retention of Largemouth Bass greater than 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. A spring quarter creel survey will be conducted in 2021 to monitor catch, harvest, and directed angling effort.
2. Continue to monitor Largemouth Bass population size structure by spring electrofishing (2019 and 2021) and fall electrofishing (2020). Examine Largemouth Bass growth in 2020.
3. Continue annual stockings of Florida Largemouth Bass to maximize trophy fish abundance.

ISSUE 3: Due to poor sampling efficiency and catch rates, no directed sampling effort is conducted for crappies (discontinued in 2004) and catfishes (discontinued in 2016).

MANAGEMENT STRATEGY

1. A spring quarter creel survey will be conducted in 2021 to monitor these fisheries and make inferences about the populations.

ISSUE 4: Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels 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. Discuss invasive species when presenting to constituent and user groups.

5. Document existing and future inter-basin water transfers to facilitate potential invasive species responses.

Objective-Based Sampling Plan and Schedule, 2017-2021

Sport fish, forage fish, and other important fishes

Sport fishes in Lake Nacogdoches include Largemouth Bass, Black Crappie, White Crappie, and Channel Catfish. Important forage species include Bluegill, Threadfin Shad, and Gizzard Shad.

Low density fisheries

Historically, few anglers target Channel Catfish (< 3% of annual angling effort) and population abundance has been low. Beginning in 2016, no future directed sampling is planned, but the Channel Catfish fishery will be monitored via spring quarter creel surveys (2017, and every four years thereafter) directed at the Largemouth Bass fishery.

Survey objectives, fisheries metrics, and sampling objectives

Largemouth Bass: Largemouth Bass are the most popular sport fish in Lake Nacogdoches, accounting for approximately 85% of the annual angling effort. 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 trophy fish. Since 2002, trend data on CPUE, size structure, and body condition have been collected every four years with fall electrofishing, and biennially with spring electrofishing. The population is abundant, recruitment rates have been high and steady, and size structure has been desirable and stable. Continuation of trend data with nighttime electrofishing in the fall (2020, and every four years thereafter) and spring (biennially, 2019 and 2021) will allow for determination of any large-scale changes in the Largemouth Bass population that may spur further investigation. The minimum of 12 randomly selected 5-min electrofishing sites will be sampled, but the anticipated effort to meet sampling objectives ($N = 50$ stock-size fish; $RSE-S \leq 25$) is 5-8 stations with 80% confidence.

The Largemouth Bass fishery (i.e., angling effort, catch rates, size distribution of catch and harvest) will be monitored with a spring quarter access point creel survey in 2021 (5 weekend and 4 week days) and every four years thereafter.

Average age of Largemouth Bass between 13.0 and 14.9 inches (Category 2; $N = 13$) will be estimated in 2020, and every four years thereafter. If growth problems are detected from this cursory estimate, mean length-at-age will be estimated from a random population sample of 400 fish > 6 inches, subsampled at 10 fish per 0.4-inch strata (Category 4).

Crappies: The crappie fishery is the second most popular at Lake Nacogdoches, accounting for approximately 10% of the annual angling effort. Historically, trap netting resulted in low catch rates, and sampling was discontinued in 2004. Since then, spring quarter creel surveys (per Largemouth Bass sampling above) have been used to monitor the crappie fishery and make inferences about the population.

Prey species: Bluegill, Threadfin Shad, and Gizzard Shad are the primary forage at Lake Nacogdoches. Fall electrofishing in 2020 and every four years thereafter, sampling the minimum of 12 random sites, will result in sufficient numbers of Bluegill and Gizzard Shad to achieve sampling objectives ($N = 50$ stock-size fish; $RSE-S \leq 25$). Largemouth Bass body condition (fish ≥ 8 " TL) will be used to provide additional information on forage abundance and vulnerability.

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Water Level

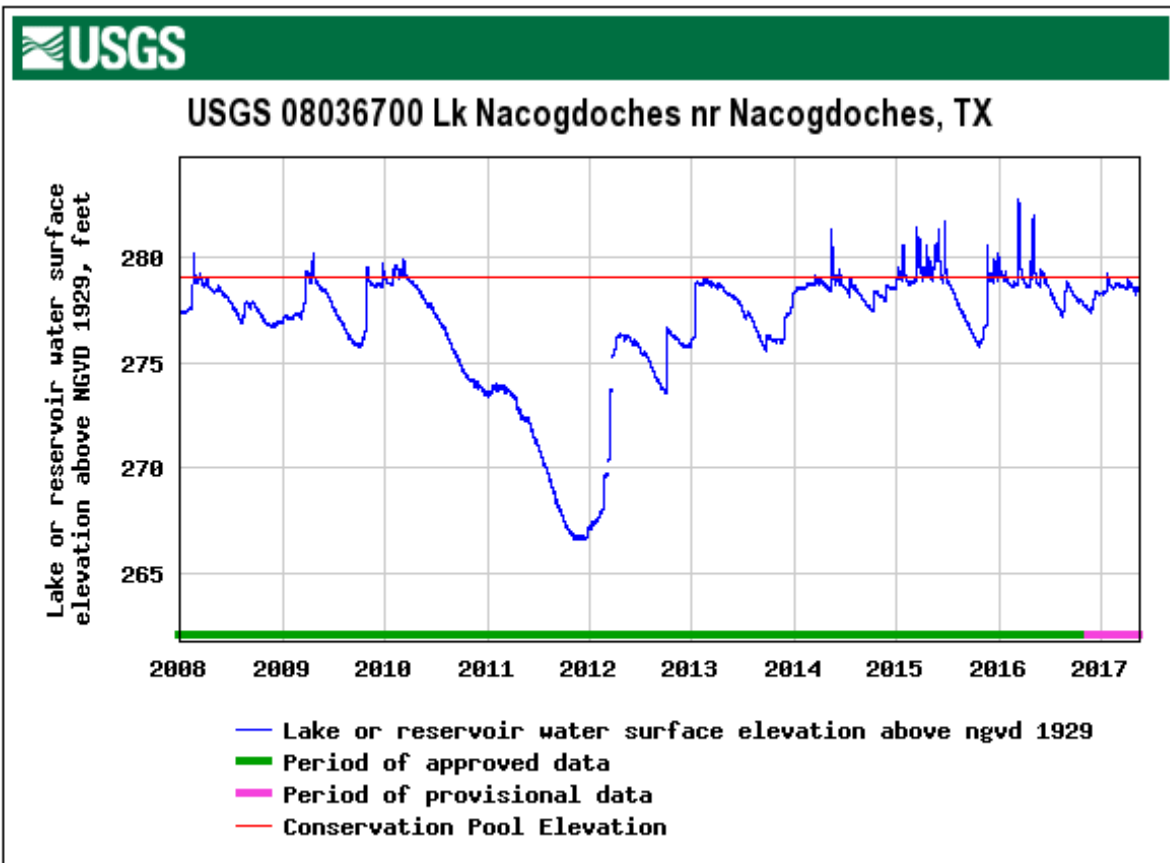


Figure 1. Water level elevations in feet above mean sea level (MSL) recorded for Lake Nacogdoches, Texas.

Table 1. Characteristics of Lake Nacogdoches, Texas.

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

Table 2. Boat ramp characteristics for Lake Nacogdoches, Texas, May 2017. Reservoir elevation at time of survey was 278 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	30	276	Excellent
West Park	31.59314 -94.83738	Y	20	275	Excellent

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 = advance fingerling.

Species	Year	Number	Size
Channel Catfish	1976	110,000	AFGL
	1977	100,300	AFGL
	Total	210,300	
Florida Largemouth Bass	1977	221,400	FRY
	1999	500	FGL
	2000	110,743	FGL
	2002	110,152	FGL
	2008	110,762	FGL
	2009	110,661	FGL
	2010	112,475	FGL
	2011	124,619	FGL
	2015	48,734	FGL
	2016	47,847	FGL
	Total	997,893	
Sharelunker Largemouth Bass	2008	75,000	FGL

Table 5. Objective-based sampling plan components for Lake Nacogdoches, Texas 2016–2017.

Gear/target species	Survey objective	Metrics	Sampling objective
<i>Electrofishing</i>			
Largemouth Bass	Abundance	CPUE – stock	RSE-Stock ≤ 25
	Size structure	PSD, length frequency	$N \geq 50$ stock
	Age-and-growth	Age at 14 inches	$N = 13, 13.0 - 14.9$ inches
	Condition	W_r	10 fish/inch group (max)
Bluegill ^a	Abundance	CPUE – Total	
	Size structure	PSD, length frequency	$N \geq 50$
Gizzard Shad ^a	Abundance	CPUE – Total	
	Size structure	PSD, length frequency	$N \geq 50$
	Prey availability	IOV	$N \geq 50$
Threadfin Shad ^a	Abundance	CPUE – Total	

^a No additional effort will be expended to achieve an $RSE \leq 25$ for CPUE of Bluegill, Gizzard Shad, and Threadfin Shad if not reached from designated Largemouth Bass sampling effort. Instead, Largemouth Bass body condition can provide information on forage abundance, vulnerability, or both relative to predator density.

Table 6. Survey of aquatic vegetation, Lake Nacogdoches, Texas, September 2012-2016. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Species	2012	2013	2014	2015	2016
Torpedograss	0	41 (2)	78 (4)	78 (4)	46 (2)
Giant cutgrass	0	0	0	114 (5)	0
Watershield	0	0	0	Trace	Trace
Pondweed	0	0	0	Trace	44 (2)
American lotus	595 (27)	167 (8)	426 (19)	502 (23)	565 (26)
Hydrilla (Tier III)*	157 (7)	417 (19)	759 (34)	0	58 (3)

*Tier III is Watch Status

Table 7. Percent directed angler effort by species group for Lake Nacogdoches, Texas, 2009, 2013, and 2017. Survey periods were from 1 March through 31 May.

Species	2009	2013	2017
Catfishes	1.9	2.0	2.8
Sunfishes	1.3	0.0	0.7
Black basses	85.6	78.0	87.7
Crappies	6.5	17.6	8.2
Anything	4.7	2.4	0.6

Table 8. Total fishing effort (h) for all species and total directed expenditures at Lake Nacogdoches, Texas, 2009, 2013, and 2017. Survey periods were from 1 March through 31 May. Relative standard error is in parentheses.

Creel statistic	2009	2013	2017
Total fishing effort	20,664 (35)	13,939 (28)	29,452 (23)
Total directed expenditures	\$97,189 (41)	\$75,853 (40)	\$141,470 (42)

Gizzard Shad

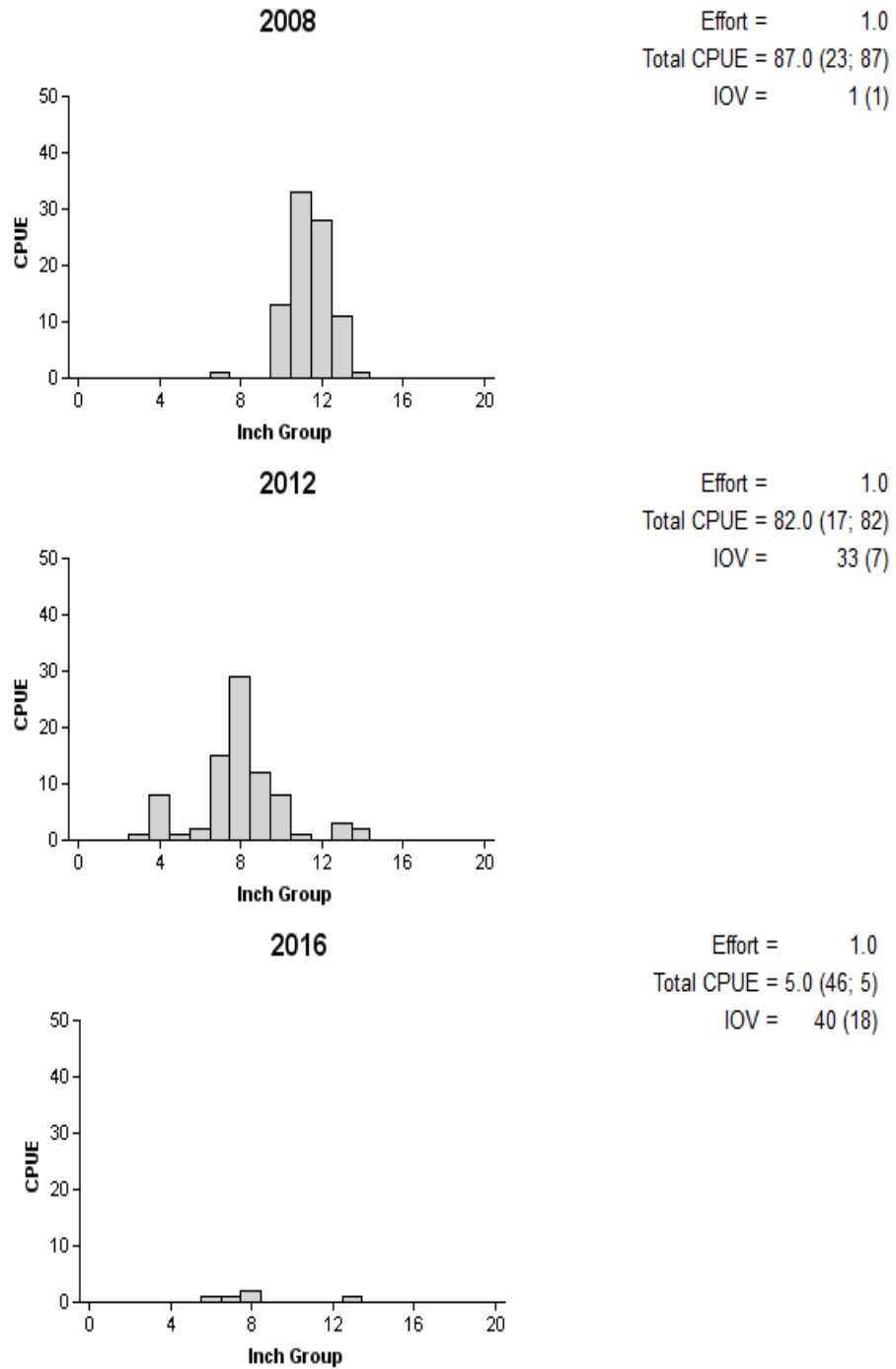


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Lake Nacogdoches, Texas, 2008, 2012, and 2016.

Bluegill

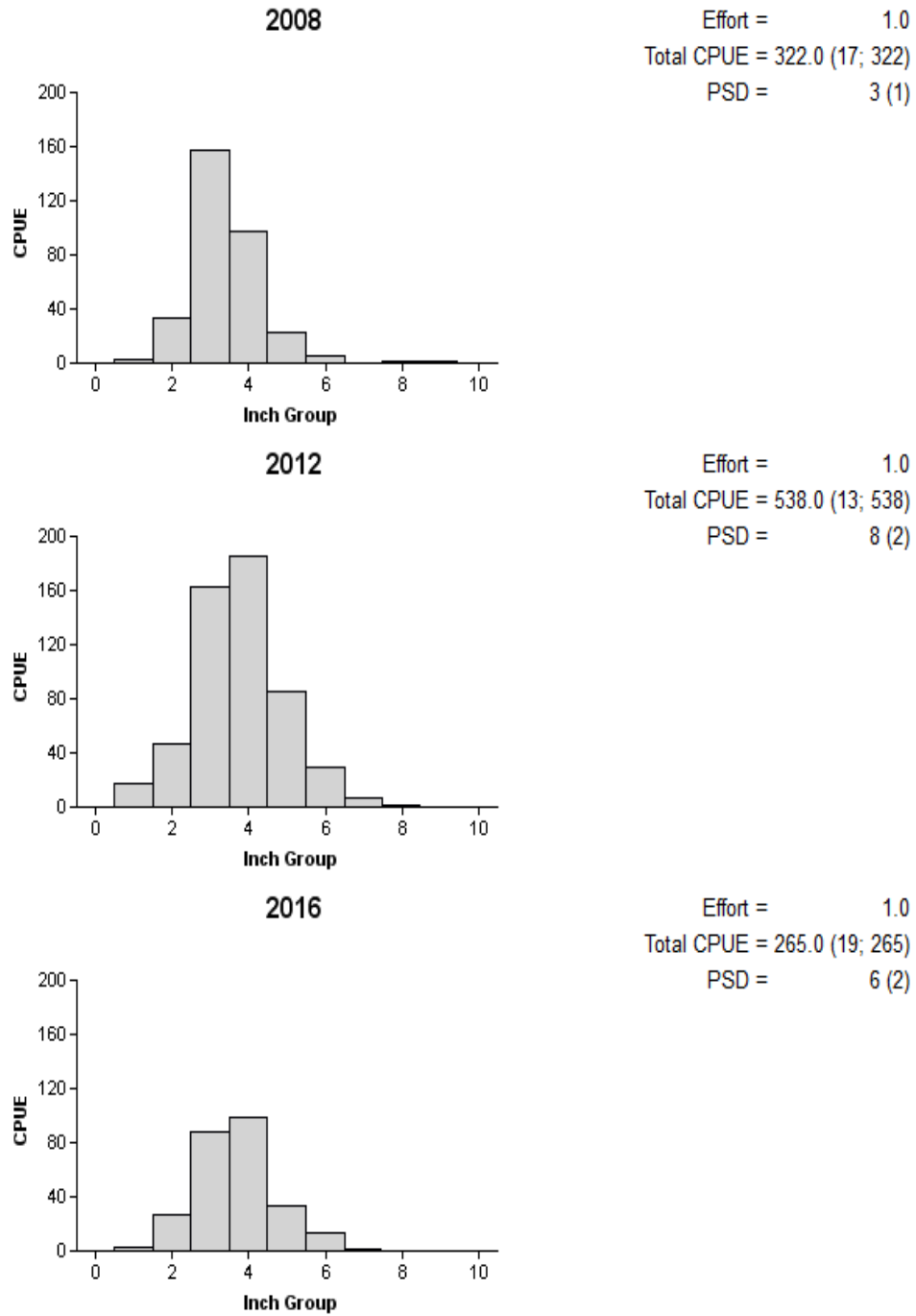


Figure 3. Number of Bluegill caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Nacogdoches, Texas, 2008, 2012, and 2016.

Sunfishes

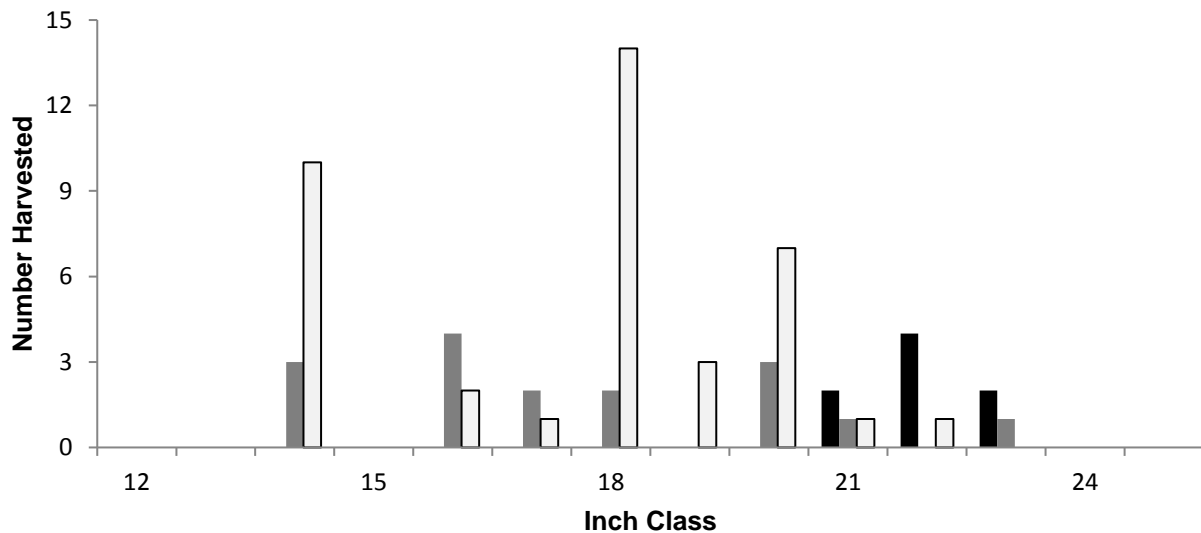
Table 9. Creel survey statistics for sunfishes at Lake Nacogdoches, Texas from March through May 2009, 2013, and 2017. Total catch per hour is for anglers targeting sunfishes and total harvest is the estimated number of sunfishes harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	Year		
	2009	2013	2017
Surface area (acres)	2,212	2,212	2,212
Directed effort (h)	262.46 (84)		213.66 (100)
Directed effort/acre	0.12 (84)		0.10
Total catch per hour	8.25 (NA)		1.52 (NA)
Total harvest	0.00 (0)	52.20 (316)	265.08 (342)
Harvest/acre	0.00 (0)	0.02 (316)	0.12 (342)
Percent legal released	100	93	0

Channel Catfish

Table 10. Creel survey statistics for catfishes at Lake Nacogdoches, Texas from March through May 2009, 2013, and 2017. 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		
	2009	2013	2017
Surface area (acres)	2,212	2,212	2,212
Directed effort (h)	393.68 (71)	279.59 (84)	810.71 (54)
Directed effort/acre	0.18 (71)	0.12 (84)	0.37 (54)
Total catch per hour	0.28 (20)	0.50 (40)	1.57 (66)
Total harvest	213.77 (102)	417.81 (90)	2,067.60 (57)
Harvest/acre	0.10 (102)	0.19 (90)	0.93 (57)
Percent legal released	0	0	5



■ 2009 N= 8; TH = 214 ■ 2013 N= 16; TH = 418 □ 2017 N= 39; TH = 2,068

Figure 4. Length frequency of harvested Channel Catfish observed during creel surveys at Lake Nacogdoches, Texas, March through May 2009, 2013, and 2017, 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.

Spotted Bass

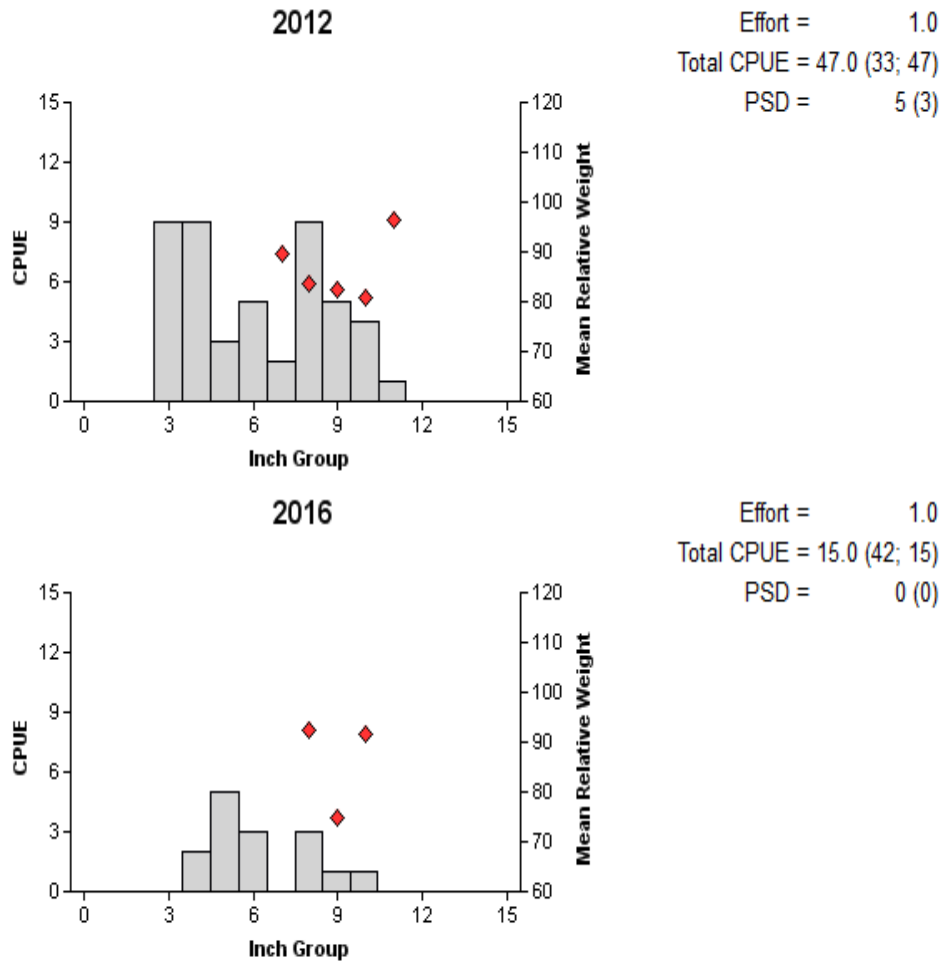
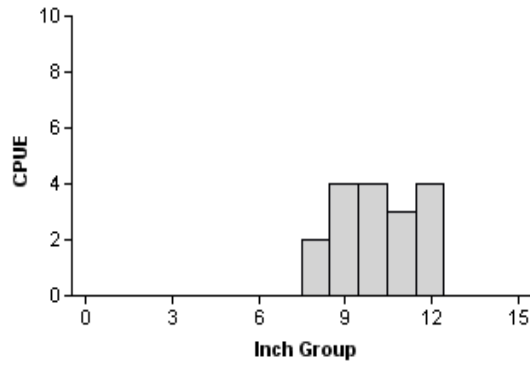


Figure 5. Number of Spotted Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing survey, Lake Nacogdoches, Texas, 2012 and 2016. No Spotted Bass were collected during the 2008 fall electrofishing survey.

Spotted Bass

2013

Effort = 1.0
 Total CPUE = 17.0 (37; 17)
 PSD = 41 (16)



2015

Effort = 1.0
 Total CPUE = 2.0 (100; 2)
 PSD = 100 (0)

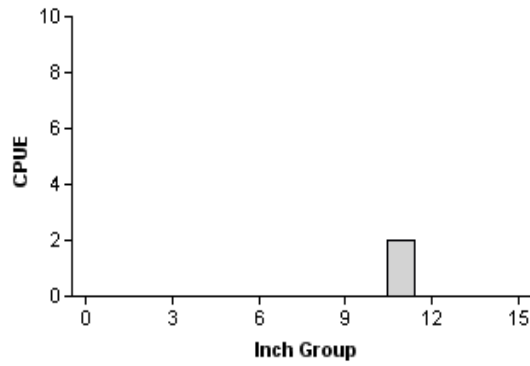


Figure 6. Number of Spotted Bass caught per hour (CPUE, bars), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring electrofishing survey, Lake Nacogdoches, Texas, 2013 and 2015. No Spotted Bass were collected during the 2017 spring electrofishing survey.

Largemouth Bass

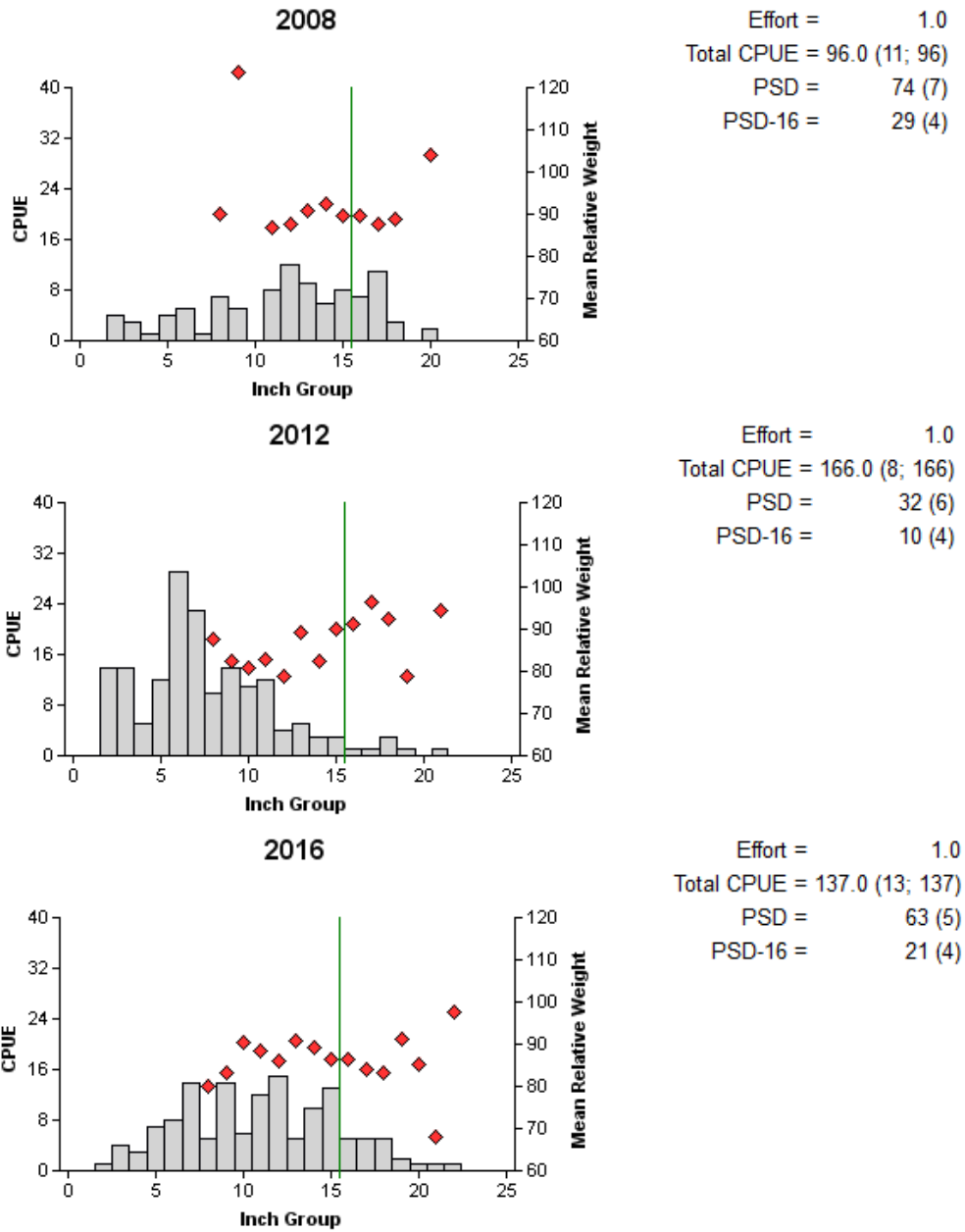


Figure 7. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Nacogdoches, Texas, 2008, 2012, and 2016. Vertical line indicate maximum length limit.

Largemouth Bass

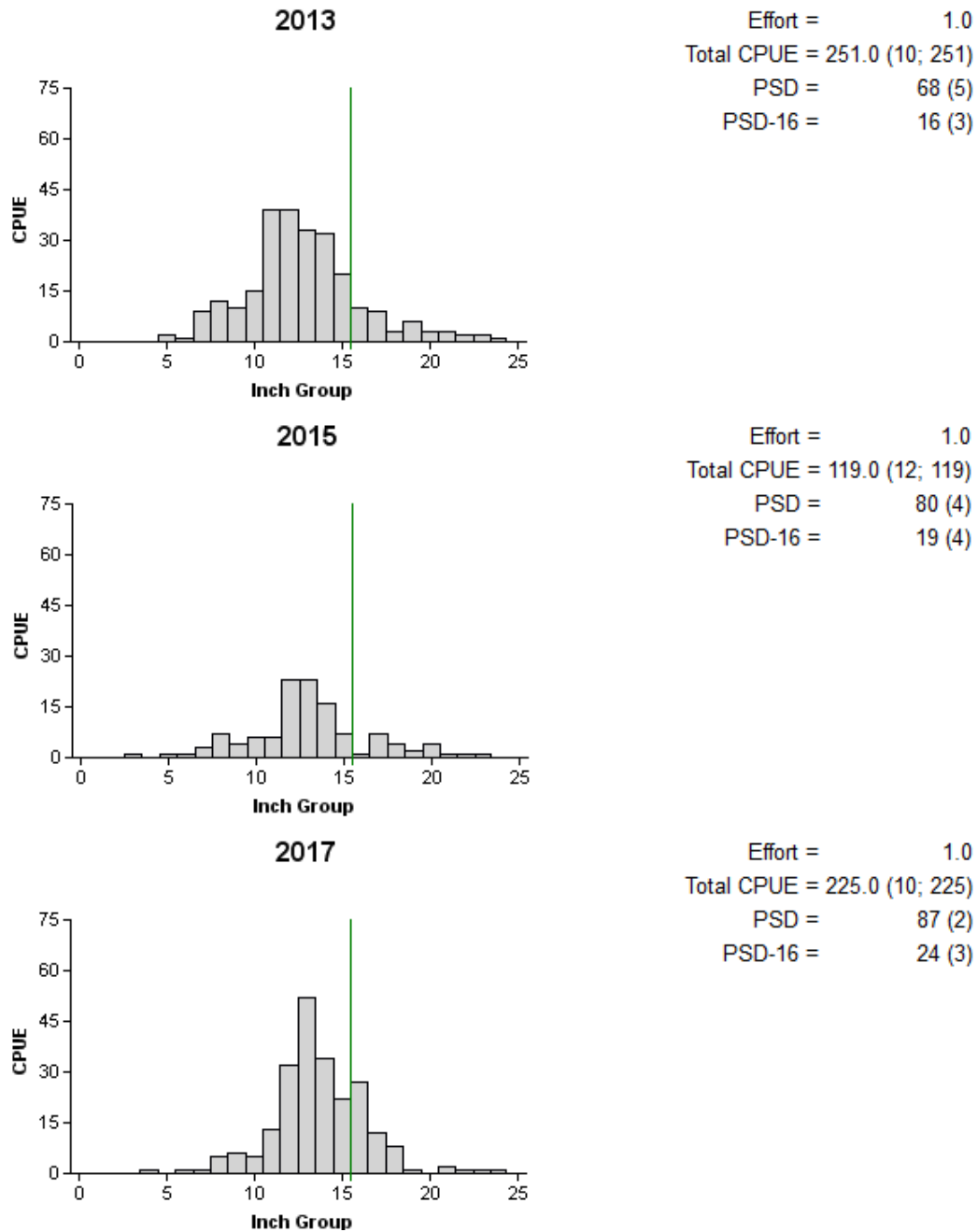


Figure 8. Number of Largemouth Bass caught per hour (CPUE, bars), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring electrofishing surveys, Lake Nacogdoches, Texas, 2013, 2015, and 2017. Vertical line indicates maximum length limit.

Black Basses

Table 11. Creel survey statistics for black basses at Lake Nacogdoches, Texas March through May 2009, 2013, and 2017. Catch rate is for all anglers targeting black basses. Harvest is partitioned by the estimated number of fish harvested by non-tournament anglers and the number of fish retained by tournament anglers for weigh-in and release. The estimated number of fish caught by weight category is for all anglers. Relative standard errors (RSE) are in parentheses.

Statistic	2009	2013	2017
Surface area (acres)	2,212	2,212	2,212
Directed angling effort (h)			
Tournament	3,102 (39)	0	4,821 (29)
Non-tournament	14,582 (35)	10,871 (29)	21,014 (23)
All black bass anglers combined	17,684 (34)	10,871 (29)	25,835 (23)
Angling effort/acre	7.99 (34)	4.91 (29)	11.68 (23)
Catch rate (number/h)	0.77 (11)	1.28 (15)	1.00 (12)
Harvest			
Non-tournament harvest	775 (73)	627 (57)	3,261 (40)
Harvest/acre	0.35 (73)	0.28 (57)	1.47 (40)
Tournament weigh-in and release	0	0	0
Release by weight			
< 4.0 lbs	9,932	16,347 (35)	25,276 (28)
≥ 4–6.9 lbs	2,510	1,017 (57)	1,239 (46)
≥ 7–9.9 lbs	664	170 (118)	59 (175)
≥ 10 lbs	37	34 (255)	0
Percent legal released (non-tournament)	92	90	84

Largemouth Bass

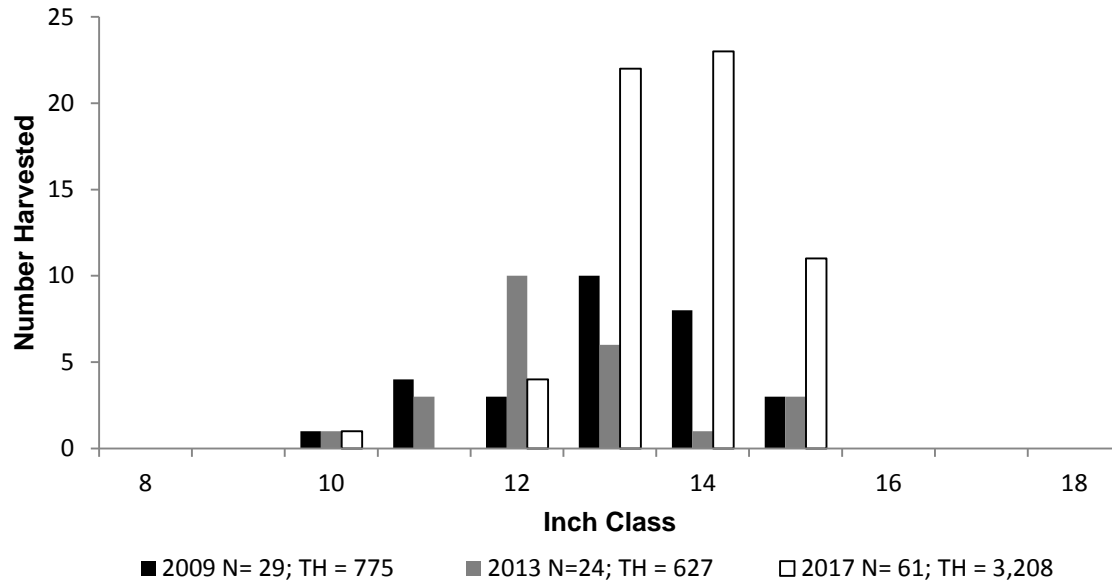


Figure 9. Length frequency of non-tournament harvested Largemouth Bass observed during creel surveys at Lake Nacogdoches, Texas, March through May 2009, 2013, and 2017, all anglers combined. N is the number of harvested Largemouth Bass observed during creel surveys, and TH is the estimated non-tournament harvest for the creel period.

Crappies

Table 12. Creel survey statistics for crappies at Lake Nacogdoches from March through May 2009, 2013, and 2017. 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		
	2009	2013	2017
Surface area (acres)	2,212	2,212	2,212
Directed effort (h)	1,356.51 (45)	2,452.49 (37)	2,429.87 (36)
Directed effort/acre	0.61 (45)	1.11 (37)	1.10
Total catch per hour	1.11 (67)	1.76 (46)	1.52 (39)
Total harvest	1,068.82 (84)	2,376.31 (68)	5,195.49 (24)
Harvest/acre	0.48 (84)	1.07 (68)	2.35 (24)
Percent legal released	7	12	5

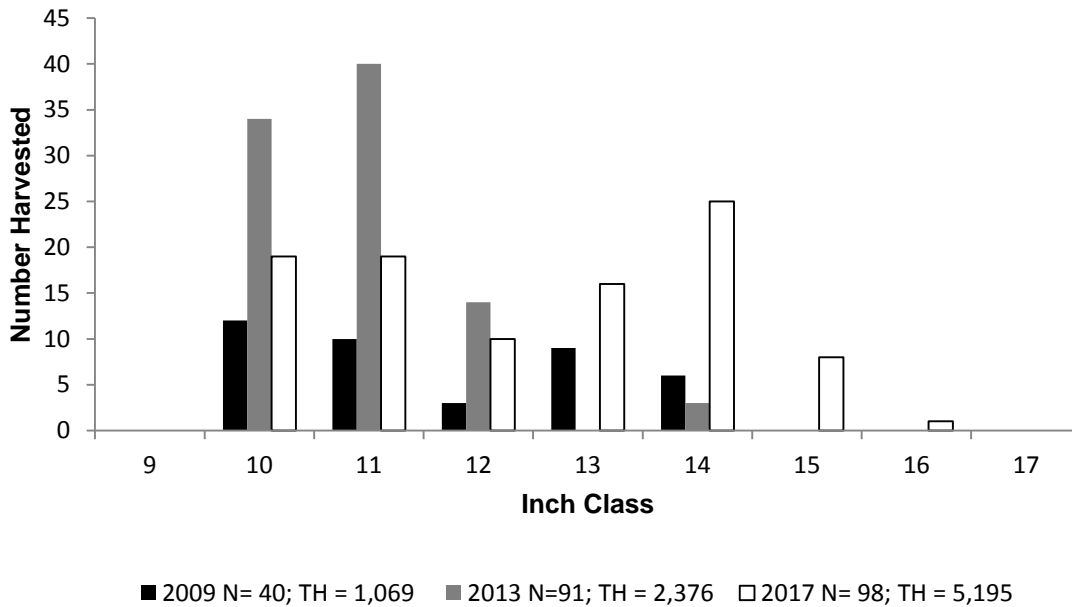


Figure 10. Length frequency of harvested crappies observed during creel surveys at Lake Nacogdoches, Texas, March through May 2009, 2013, and 2017, all anglers combined. N is the number of harvested crappies observed during creel surveys, and TH is the total estimated harvest for the creel period.

Table 13. Proposed sampling schedule for Lake Nacogdoches, Texas. Survey period is June through May. Standard electrofishing is conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

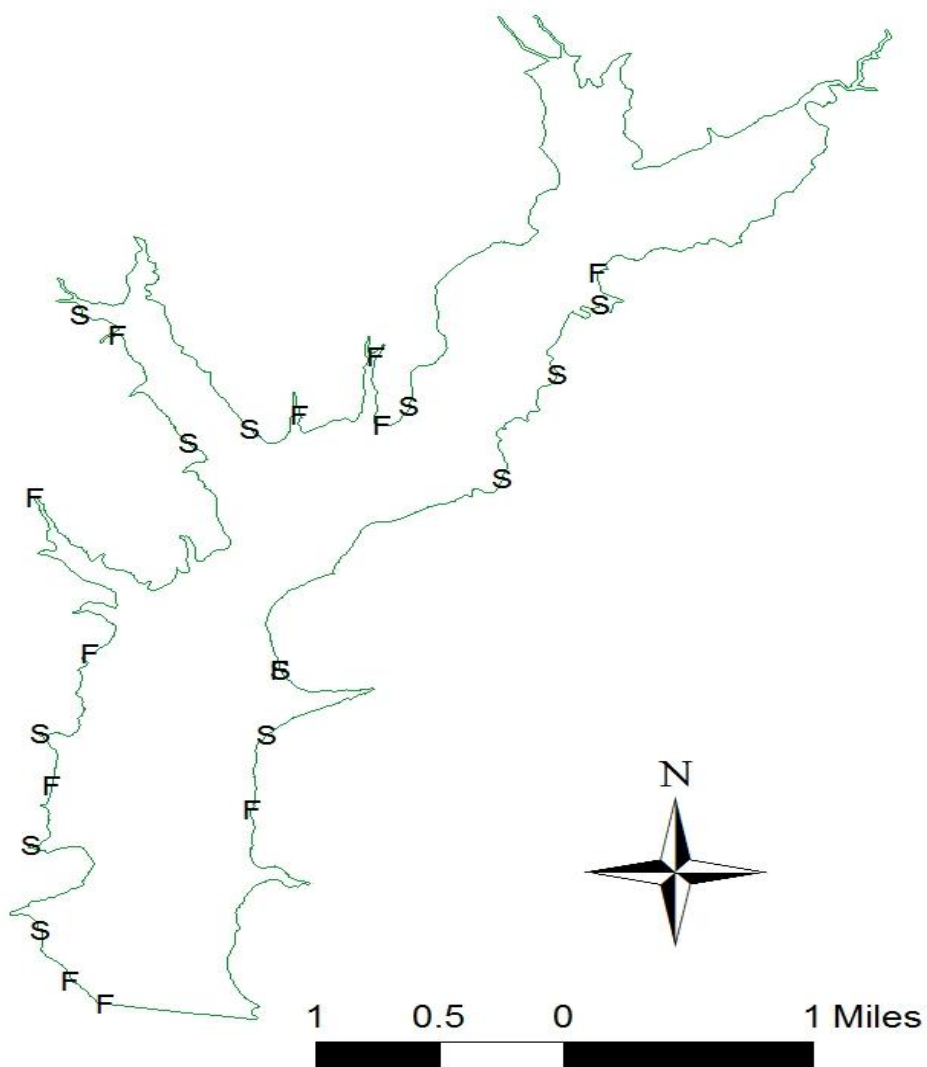
Survey year	Electrofishing Fall(Spring)	Habitat		Access	Creel survey	Report
		Structural	Vegetation			
2017-2018			A			
2018-2019	(A)		A			
2019-2020			A			
2020-2021	S (A)	S	S	S	A	S

APPENDIX A

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Lake Nacogdoches, Texas, 2016-2017. Sampling effort was 1 hour for electrofishing.

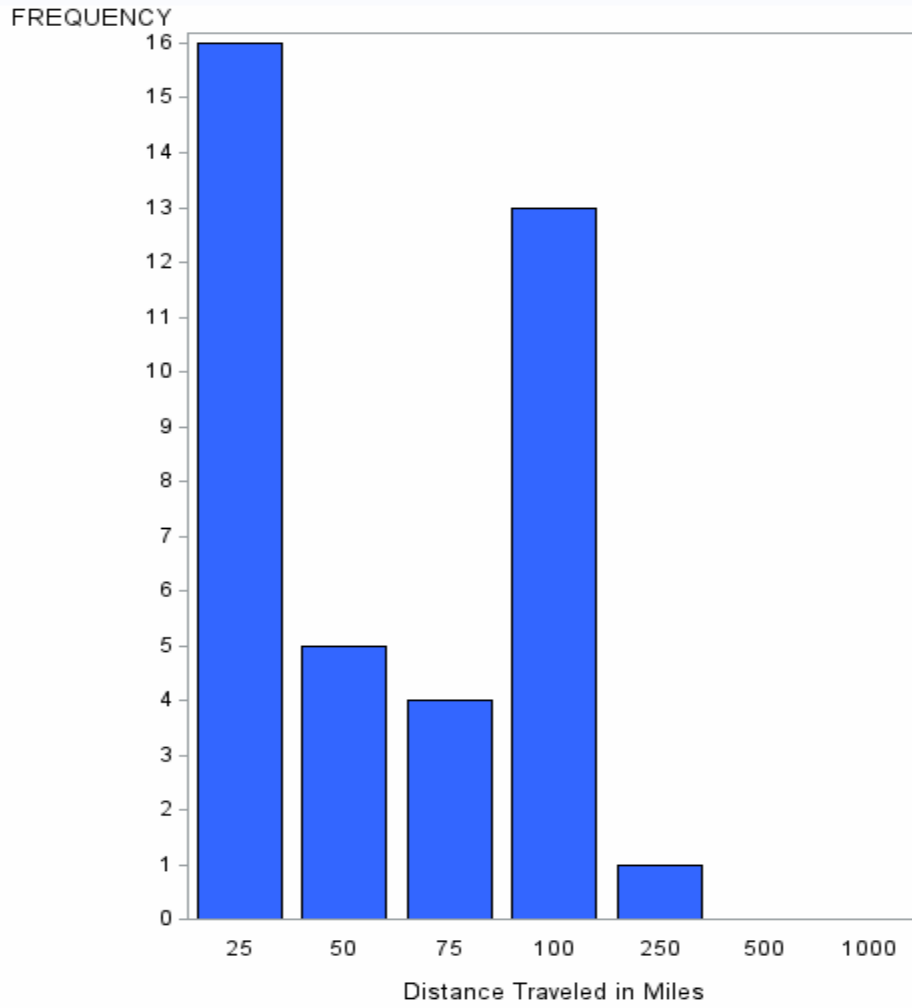
Species	Fall Electrofishing		Spring Electrofishing	
	N	CPUE	N	CPUE
Gizzard Shad	5	5.0		
Threadfin Shad	230	230.0		
Warmouth	2	2.0		
Bluegill	265	265.0		
Longear Sunfish	13	13.0		
Redear Sunfish	14	14.0		
Redspotted Sunfish	2	2.0		
Spotted Bass	15	15.0		
Largemouth Bass	137	137.0	225	225.0

APPENDIX B



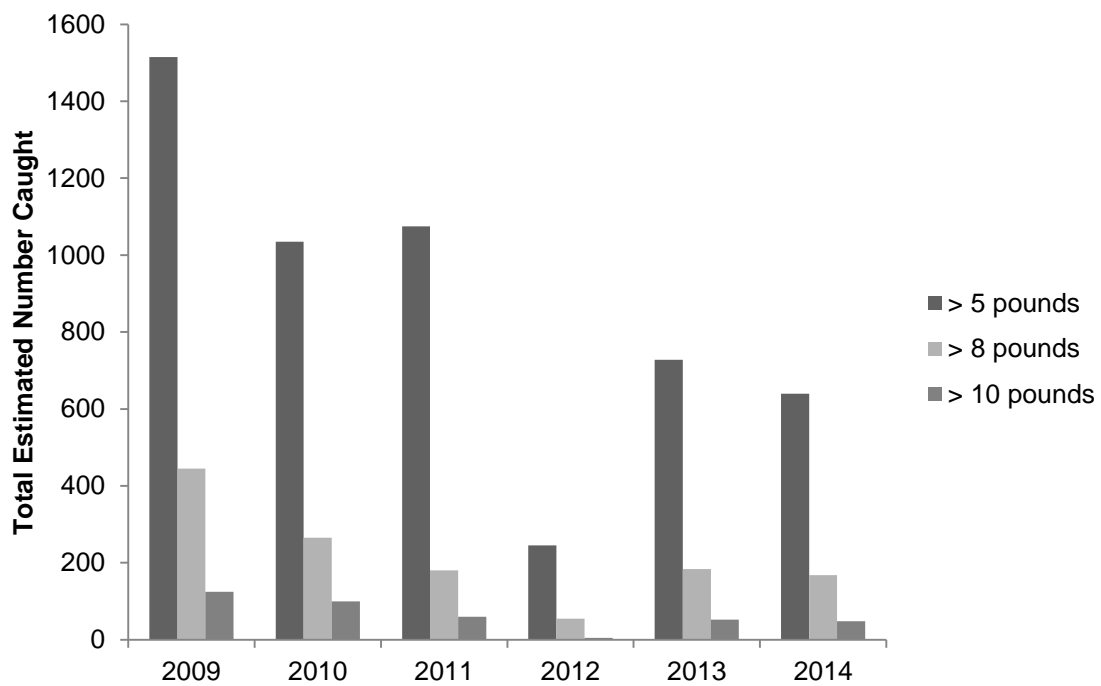
Location of sampling sites, Lake Nacogdoches, Texas, 2016-2017. Fall electrofishing and spring electrofishing stations are indicated by F, and S respectively. Water level was near full pool at time of sampling.

APPENDIX C



Frequency of anglers that traveled various distances (miles) to Lake Nacogdoches, Texas, as determined from the March through May 2017 creel survey.

APPENDIX D



Total estimated number of largemouth bass entered in the voluntary trophy bass angler survey, Lake Nacogdoches, Texas, 2009 - 2014.