PERFORMANCE REPORT

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INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2016 Fisheries Management Survey Report

Navarro Mills Reservoir

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Navarro Mills Reservoir were surveyed in 2016 using electrofishing and trap netting and in 2017 using gill netting. 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:** Navarro Mills Reservoir is a 4,336-acre impoundment located on Richland Creek in the Trinity River Basin approximately 9 miles north of Dawson, Texas. Navarro Mills is operated by the U.S. Army Corps of Engineers (USACE); there is no residential shoreline development and angler access is excellent. Habitat features consisted of standing timber, rocks, and terrestrial vegetation.

- **Management History:** Important sport fish include Largemouth Bass, Blue and Channel Catfish, White Bass, and White Crappie. No stocking has been conducted at Navarro Mills Reservoir since 2003. Fish community surveys are conducted every four years. Statewide harvest regulations are in effect for all species.

- **Fish Community**
  - **Prey species:** Threadfin Shad were present in the reservoir. Electrofishing catch of Gizzard Shad was moderate and most were available as prey to most sport fish. Electrofishing catch of Bluegills was poor, but all collected were less than 4-inches long.

  - **Catfishes:** Blue and Channel Catfish are present in the reservoir; both species were abundant and have the potential to provide excellent angling opportunities.

  - **Temperate basses:** White Bass were present in the reservoir. Population densities continue to fluctuate in relation to reservoir elevation and spring-time precipitation.

  - **Largemouth Bass:** Largemouth Bass remain at low densities within the reservoir. The population is likely limited by high turbidity, extreme water level fluctuation and poor littoral habitat.

  - **Crappie:** Black and White Crappie are present within the reservoir. White Crappie continued to dominate the population and displayed excellent size structure during the 2016 survey. Growth of White Crappie sampled during the 2016 survey was fast.

Management Strategies: Inform the public about the negative impacts of aquatic invasive species. Conduct general monitoring surveys with electrofishing, trap nets, and gill net surveys in 2020-2021. Access and vegetation surveys will be conducted in 2020.

INTRODUCTION

This document is a summary of fisheries data collected from Navarro Mills Reservoir in 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

Navarro Mills Reservoir is a 4,336-acre impoundment on Richland Creek, a tributary of the Trinity River approximately 9 miles north of Dawson, Texas. It was constructed by the U.S. Army Corps of Engineers (USACE) in 1963 to provide flood control, recreation, and water for municipal and industrial purposes. Navarro Mills is turbid and eutrophic with a mean TSI chl-a of 52.9 (Texas Commission on Environmental Quality 2011). Land use surrounding the reservoir is primarily agricultural and contributes to high turbidity and accelerated siltation. The habitat types within the littoral zone are not particularly diverse (Table 6) and aquatic vegetation is scarce. The majority of the shoreline is eroded bank, with small areas of rocky shoreline or riprap. Because Navarro Mills Reservoir is operated by USACE, no residential shoreline development exists. Other descriptive characteristics for Navarro Mills Reservoir are found in Table 1.

Angler Access

Navarro Mills Reservoir has four access areas with public boat ramps at each. A marina is present at Liberty Hill Park and offers boat storage, bait, and snacks. The ramps at Oak Park, Wolf Creek, Brushy Prairie, and Liberty Hill were all accessible at the time of the survey. Additional boat ramp characteristics are presented in Table 2. Shoreline access is excellent at each access area.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Ott and Norman 2013) included:
1. Continue monitoring Blue Catfish population with standard gill net surveys and promote the fishery through local media outlets.
   Action: Gill netting was conducted in March 2017 and district Facebook page is utilized when appropriate to promote Navarro Mills Reservoir fishery.
2. Consult with USACE staff and local angling groups about the possibility of placing artificial habitat structures in the reservoir.
   Action: USACE staff was consulted regarding a brush pile enhancement project. Initially interest was high, however USACE staff was reluctant to deploy artificial materials into the watershed and no further actions have been taken.
3. Monitor presence of exotic species in reservoir through vegetation surveys.
   Action: A comprehensive vegetation survey was conducted in summer 2016. USACE personnel were notified about Zebra Mussel presence in the watershed.

Harvest regulation history: All sport fishes in Navarro Mills Reservoir are currently managed with statewide harvest regulations (Table 3).

Stocking history: No stocking has been conducted at Navarro Mills Reservoir since 2003. A complete stocking history is presented in Table 4.

Habitat/vegetation management history: No habitat or vegetation management has occurred in this reservoir.

Water transfer: Navarro Mills is primarily used for flood control, municipal water supply and recreation. One permanent pumping station on the reservoir is operated by the City of Corsicana Water Supply for use as municipal water. Downstream flow from Navarro Mills Reservoir is direct to Richland Chambers Reservoir but no inter-basin transfers exist.

METHODS

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Navarro Mills (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 – Gizzard Shad and Threadfin Shad, sunfishes, and Largemouth Bass were collected by daytime 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.

Trap netting – Crappie were collected using trap nets (10 net nights at 10 stations). CPUE for trap netting was recorded as the number of fish caught per net night (fish/nn).

Gill netting –Blue Catfish, Channel Catfish, and White Bass were collected by gill netting (10 net nights tat 10 stations). CPUE for gill netting was recorded as the number of fish caught per net night (fish/nn).

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_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.

Habitat – A vegetation survey was conducted in 2016. 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: A physical habitat survey was last conducted in 2000 (Ott and Bister 2001). Water level fluctuation (Figure 1), high siltation and turbidity severely limit the potential for aquatic macrophyte growth. Navarro Mills Reservoir was several feet over conservation pool for much of 2015-2016, resulting in flooded terrestrial vegetation along approximately 28 miles of shoreline (Table 6).

Prey species: Threadfin and Gizzard Shad were the primary prey base within the reservoir; sunfish were present at low densities. Electrofishing catch rates of Bluegill and Gizzard Shad were 5.0/h and 136.0/h, respectively (Figures 2-5). Index of vulnerability (IOV) for Gizzard Shad was good, indicating that 81% of Gizzard Shad were available to existing predators. Low catch rate of Bluegill could potentially be attributed to daytime electrofishing, although previous surveys conducted under standard night-time procedures did not produce substantially better results.

Catfish: The gill net catch rate of Blue Catfish was 7.7/nn in 2017; higher than 2009 (4.4/nn) but lower than the 2013 survey (8.4/nn; Figure 6). Size structure (PSD=19) was dominated primarily by 10-16 inch fish. Body condition was moderate in 2017; relative weights (Wr) averaged 80-90 for most size classes and were slightly lower than previous surveys.

Gill net catch rates of Channel Catfish have varied over the last three surveys, ranging from 2.2 – 9.6/nn (Figure 7). While the 2017 survey suggests a slight improvement in relative abundance, overall low and variable catch rates over the last three surveys make it difficult to identify significant trends in population indices.

White Bass: The 2017 gill net survey indicated White Bass were still present within the reservoir (Figure 8). Similar to Channel Catfish, small sample sizes prevent identifying significant trends in population indices. It is likely that the White Bass population will continue to fluctuate in relation to reservoir elevation, precipitation, and inflow during the spawning season.

Largemouth Bass: The daytime electrofishing catch rate of Largemouth Bass was 24.0/h in 2016 (Figure 10); the majority of fish collected were less than legal length. Relative weights were moderate to high (W_r ≥ 90 for most size classes) and are indicative of adequate prey availability. Overall poor littoral habitat and high turbidity likely limit the Largemouth Bass population within the reservoir.

Crappie: White Crappie continued to be the most abundant sport fish within the reservoir. Trap net catch rates have remained high and stable over the last three surveys (range = 37.6 – 42.0/nn), while size structure improved over the same time frame (PSD = 47, 57 and 81; Figure 11).   Relative weights were high from the 2016 survey (Wr averaged 95-110 for all size classes). White Crappie growth rate in 2016 was fast; average age at 10 inches (9.4 – 10.8 inches) was 1.4 years (N = 13; range: 1-2 years). Black Crappie were present in the reservoir, but abundance was low (0.7/nn).

Fisheries management plan for Navarro Mills Reservoir, Texas

Prepared – July 2017.

ISSUE 1: Crappie continue to be the most dominant sport fish. While current trend data suggest the population is stable, the rapidly aging reservoir could pose future problems for crappie recruitment and angling success

MANAGEMENT STRATEGY
1. Continue monitoring crappie population trend data with trap net survey in 2020.
2. Consult with USACE staff again to gauge interest in artificial fish attractor installment to augment degrading natural habitat and increase fishing success.
3. Promote crappie fishery through local media outlets when appropriate.

ISSUE 2: 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.

Objective-Based Sampling Plan and Schedule

Sport fishes in Navarro Mills Reservoir include White Crappie, Blue and Channel Catfish, White Bass, and Largemouth Bass. Important forage species are primarily Gizzard and Threadfin Shad.

Survey objectives, fisheries metrics, and sampling objectives

White Crappie: While there is not recent creel data, anecdotal information suggests crappie are a popular fishery in Navarro Mills Reservoir. Historical trap net data conducted every four years indicates an abundant population of White Crappie within the reservoir, with catch rates of 42.0/nn, 37.6/nn and 39.1/nn over the last three surveys. Due to the popularity of this fishery and the potential to advertise this fishing opportunity, crappie trend data on relative abundance, size structure, and body condition (measured by CPUE, PSD and W_r) will continue to be monitored every four years. A minimum of 10 randomly selected trap netting sites will be sampled in the fall of 2020; random sampling will continue up to 20 net nights, until 50 stocked-sized fish are collected and relative abundance estimates (CPUE-S) contain a precision of <25. Historical data suggests the 2020 sampling objectives can be met with 15 sites (80% confidence).

Catfish: Blue and Channel Catfish are present within Navarro Mills Reservoir, however recent gill net surveys have indicated decreasing Channel Catfish relative abundance and increasing Blue Catfish relative abundance. While limited information exist pertaining to the quality of the catfish fisheries, trend data will still be monitored to document the shifts in species composition within the reservoir, particularly Blue Catfish. Historical data suggest Blue Catfish relative abundance can be estimated (CPUE-Total; RSE<25) with 10 net nights of gill netting. However, Blue Catfish size structure, and all Channel Catfish trend data will take a minimum of 20 net nights to estimate with 80% confidence. In the spring of 2021, 10 randomly selected sites will be sampled with gill nets to estimate Blue Catfish relative abundance. Attempts will be made to estimate size structure and relative abundance for both catfish species, however the limited knowledge on the importance of the Navarro Mills Reservoir catfish fishery does not warrant additional effort to obtain these population indices. If an inadequate sample of Channel Catfish (RSE>35, N<50) is collected after 10 net nights, they will be simply monitored and reported for presence/absence.

White Bass: The White Bass population has been traditionally surveyed every four years with gill netting. Catch rate data has ranged from 1.4/nn – 6.6/nn over the last three surveys; this data suggests it would take a minimum of 18 net nights to estimate relative abundance (CPUE-S; RSE<25) and 23 net nights to estimate size structure with 80% confidence. In accordance with the catfish sample objectives, 10 randomly selected gill netting sites will be sampled in the spring of 2021 to monitor White Bass trend data. Attempts will be made to estimate size structure and relative abundance of White Bass, however the limited knowledge on the importance of the Navarro Mills Reservoir White Bass fishery does not warrant additional effort to obtain these population indices. If an inadequate sample of White Bass (RSE>35, N<50) is collected after 10 net nights, they will be simply monitored and reported for presence/absence.

Largemouth Bass: Navarro Mills Reservoir has historically supported a low-density Largemouth Bass population; catch rates from standard night-time electrofishing surveys ranged from 17/h – 70/h. Limited stable littoral habitat and high turbidity has likely limited recruitment of bass within the reservoir. Due to low abundance and high turbidity, traditional nighttime electrofishing surveys will cease in substitution of day-time surveys. Twelve randomly selected day-time electrofishing sites will be sampled in the fall of 2020 to determine presence/absence of Largemouth Bass. Relative weight data will be collected on all stock-size Largemouth Bass as an auxiliary method of monitoring the prey base..

Prey Species: Gizzard Shad and Threadfin Shad are the primary prey species in Navarro Mills Reservoir. Traditionally, trend data on relative abundance and size structure (CPUE, IOV) of Gizzard Shad was monitored every four years with fall nighttime electrofishing. In accordance with the Largemouth Bass sample objectives, 12 randomly selected daytime electrofishing sites will be sampled in the fall of 2020 to monitor the prey base. No additional effort will be expended, regardless of survey precision or sample size; relative weight of Largemouth Bass will provide additional information on the prey base availability within Navarro Mills Reservoir.

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.

DiCenzo, V. J., M. J. Maceina, and M. R. Stimpert. 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.

Ott, R. A., Jr., and T. J. Bister. 2001. Statewide freshwater fisheries monitoring and management program survey report for: Navarro Mills Reservoir, 2000. Texas Parks and Wildlife Department, Federal Aid in Sport Fish Restoration, Grant F-30-R, Performance Report. 22 pp.

Ott, R. A., Jr. and J. D. Norman, 2013. Statewide freshwater fisheries monitoring and management program survey report for Navarro Mills Reservoir 2008. Texas Parks and Wildlife Department, Federal Aid Report F-221-M-3, Austin. 24 pp.

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

United States Geological Society (USGS). 2017. National water information system: Web interface. Available: http://waterdata.usgs.gov/tx/nwis (July 2017).
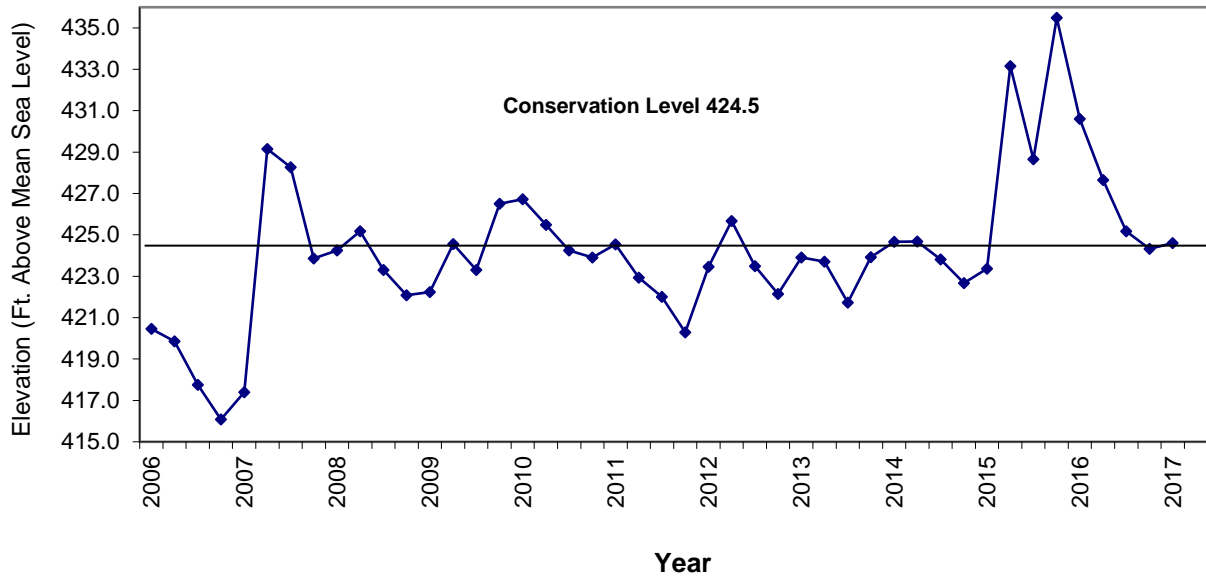
Water Level

Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Navarro Mills Reservoir, Texas.

Table 1. Characteristics of Navarro Mills Reservoir, Texas.

Characteristic	Description
Year constructed	1963
Controlling authority	U.S. Army Corps of Engineers
County	Navarro
Reservoir type	Flood control
Shoreline Development Index (SDI)	3.8
Conductivity	365 µS/cm

Table 2. Boat ramp characteristics for Navarro Mills Reservoir, Texas, August, 2016. Reservoir elevation at time of survey was 428.5 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Oak Park	31.96602 -96.69666	Y	25	422	Accessible
Wolf Creek	31.96867 -96.72806	Y	25	421	Accessible
Brushy Prairie	31.96850 -96.73198	Y	25	421	Accessible
Liberty Hill 1	31.94602 -96.71028	Y	24	421	Accessible
Liberty Hill 2	31.95146 -96.72025	Y	20	419	Excellent

Table 3. Harvest regulations for Navarro Mills Reservoir, Texas.

Species	Bag limit	Length limit
Catfish: Channel and Blue Catfish, their hybrids and subspecies	25 (in any combination)	12-inch minimum
Catfish, Flathead	5	18-inch minimum
Bass, White	25	10-inch minimum
Bass, Largemouth	5	14-inch minimum
Crappie: White and Black crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum

Table 4. Stocking history of Navarro Mills Reservoir, Texas. FGL = fingerling; UNK = unknown.

Species	Year	Number	Size
Channel Catfish	1984	50,600	FGL
	1985	9,680	FGL
	1986	<u>50,814</u>	FGL
	Total	111,094	
Flathead Catfish	1968	<u>500</u>	UNK
Striped Bass	1967	400,000	FRY
	1968	176,500	FRY
	1969	31,900	FGL
	1970	32,800	FGL
	1971	<u>21,000</u>	FGL
	Total	662,280	
Palmetto Bass	1975	51,748	UNK
	1979	52,750	UNK
	1982	50,945	UNK
	1984	127,252	FGL
	1986	75,050	FGL
	1991	76,468	FGL
	1992	41,240	FGL
	1994	77,400	FGL
	1995	107,415	FGL
	1996	77,845	FGL
	1997	76,569	FGL
	1998	<u>82,546</u>	FGL
	Total	897,228	
Florida Largemouth Bass	1976	266,000	FGL
	1990	232,037	FRY
	1990	17,482	FGL
	1995	253,996	FGL
	1998	49,973	FGL
	2002	218,491	FGL
	2003	<u>218,684</u>	FGL
	Total	1,256,663	

Table 5. Objective-based sampling plan components for Navarro Mills Reservoir, Texas 2016 – 2017.

Gear/target species	Survey objective	Metrics	Sampling objective
Electrofishing			
Largemouth Bass	Relative abundance	CPUE-Total	
	Size structure	PSD, length frequency	
Bluegill	Relative abundance	CPUE-Total	
	Size structure	PSD, length frequency	
Gizzard Shad	Relative abundance	CPUE – Total	RSE ≤ 25
	Prey availability	IOV	N ≥ 50
Trap netting			
Crappie	Relative abundance	CPUE – Total	RSE ≤ 25
	Size structure	PSD, length frequency	N = 50
	Age-and-growth	Age at 10 inches	N = 13, 9.0 – 10.9 inches
	Condition	W_r	10 fish/inch group (max)
Gill netting			
White Bass	Relative abundance	CPUE – stock	RSE-Stock ≤ 25
	Size structure	PSD, length frequency	N = 50
Blue Catfish	Relative abundance	CPUE – stock	RSE-Stock ≤ 25
	Size structure	PSD, length frequency	N = 50
Channel Catfish	Relative abundance	CPUE-Total	
	Size structure	PSD, length frequency	

Table 6. Survey of aquatic vegetation, Navarro Mills Reservoir, Texas, 2012 and 2016.

Vegetation	2012[a]	2016[b]
Native submersed		
Pondweed	<1.0 (<0.1)	
Native emergent		
Giant bulrush	5.0 (0.1)	
Water willow	10.0 (0.2)	
Flooded terrestrial		28.0

[a] Surface area (acres) is listed with percent of total reservoir surface area in parentheses
[b] Habitat was measured as approximate linear shoreline miles because reservoir elevation was > 4 feet above conservation pool.

Gizzard Shad

2008

Effort = 1.0
Total CPUE = 275.0 (28; 275)
IOV = 98 (1)

2012

Effort = 1.0
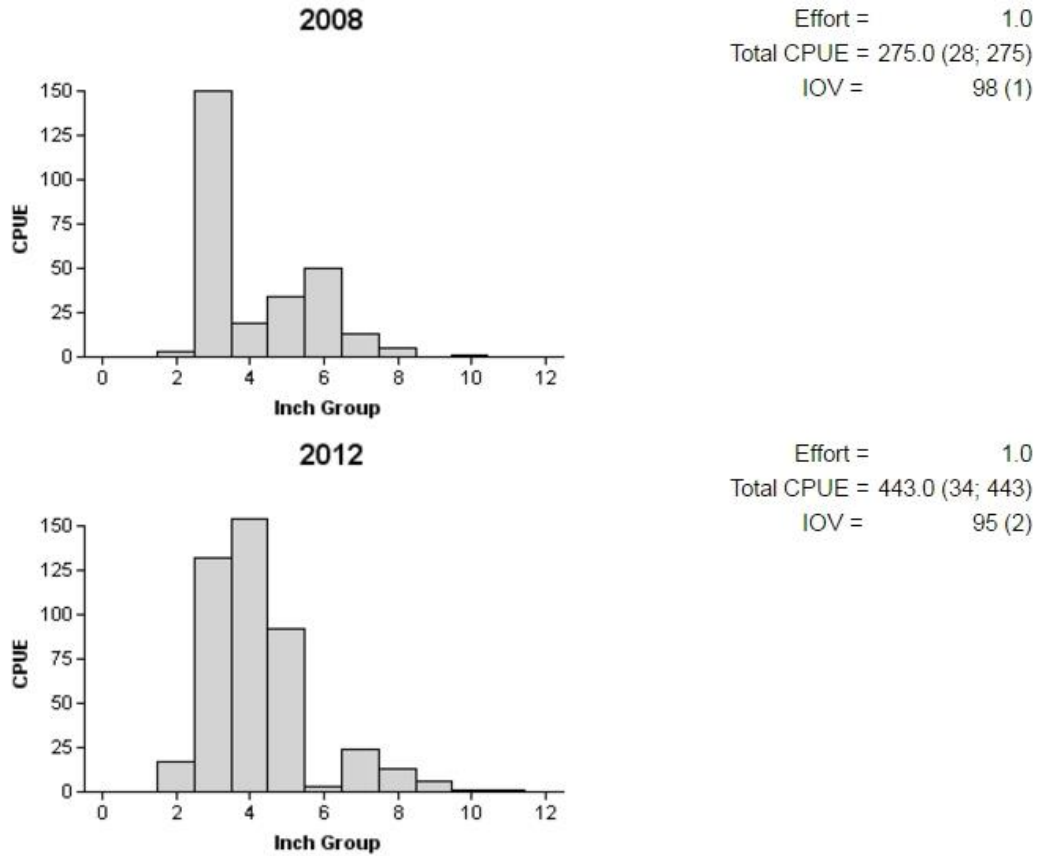Total CPUE = 443.0 (34; 443)
IOV = 95 (2)

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 nighttime electrofishing survey, Navarro Mills Reservoir, Texas, 2008 and 2012.
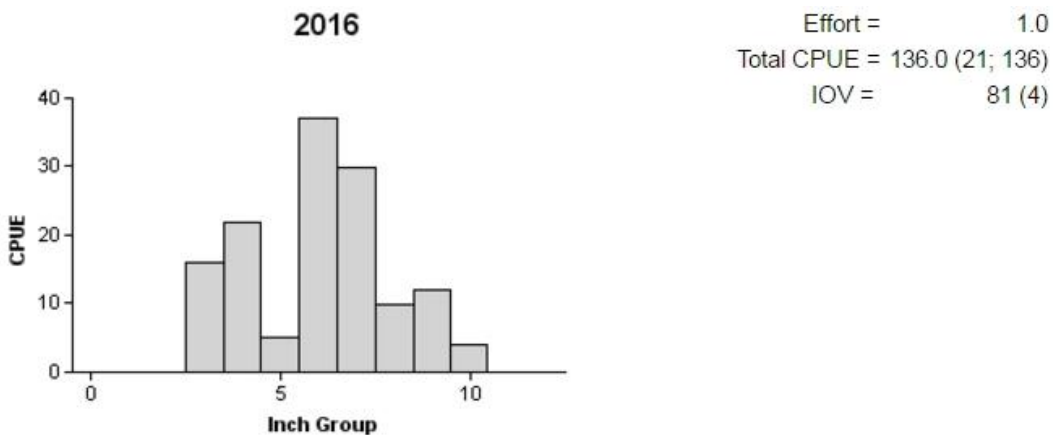
2016

Effort = 1.0
Total CPUE = 136.0 (21; 136)
IOV = 81 (4)

Figure 3. 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 daytime electrofishing survey, Navarro Mills Reservoir, Texas, 2016.

Bluegill

2008

Effort = 1.0
Total CPUE = 41.0 (28; 41)
PSD = 3 (2)

2012

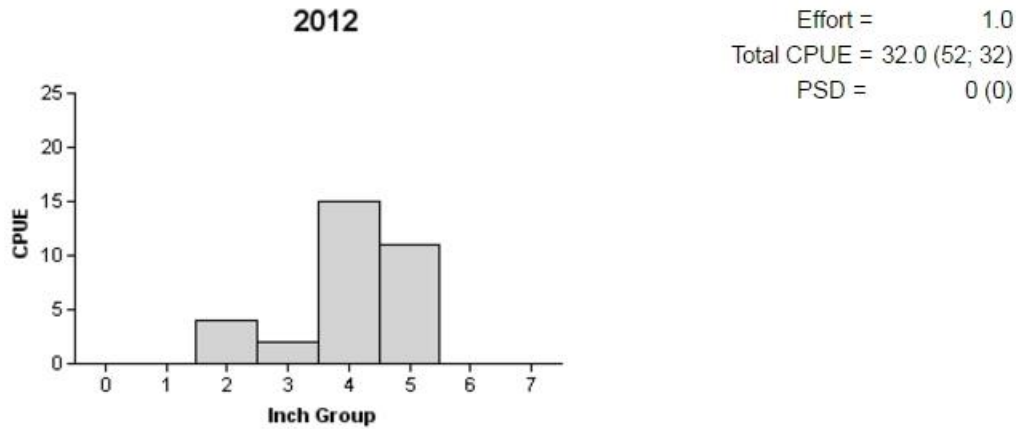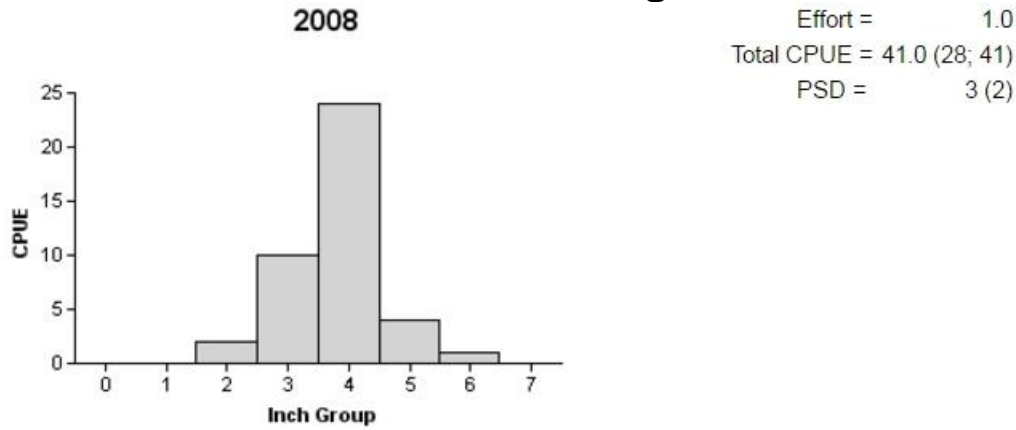Effort = 1.0
Total CPUE = 32.0 (52; 32)
PSD = 0 (0)

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

2016

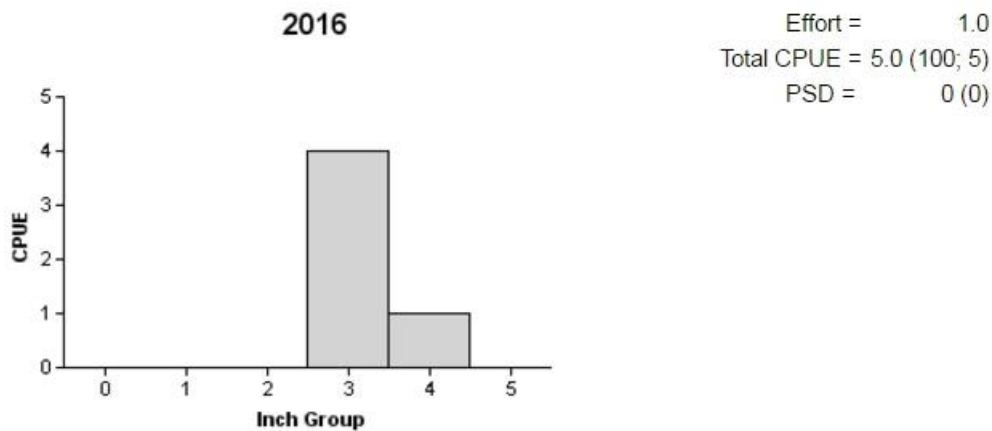Effort = 1.0
Total CPUE = 5.0 (100; 5)
PSD = 0 (0)

Figure 5. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall daytime electrofishing surveys, Navarro Mills Reservoir, Texas, 2016.

Blue Catfish

2009

Effort = 5.0
Total CPUE = 4.4 (24; 22)
Stock CPUE = 4.0 (26; 20)
PSD = 75 (10)

2013

Effort = 5.0
Total CPUE = 8.4 (24; 42)
Stock CPUE = 3.2 (27; 16)
PSD = 62 (20)

2017

Effort = 10.0
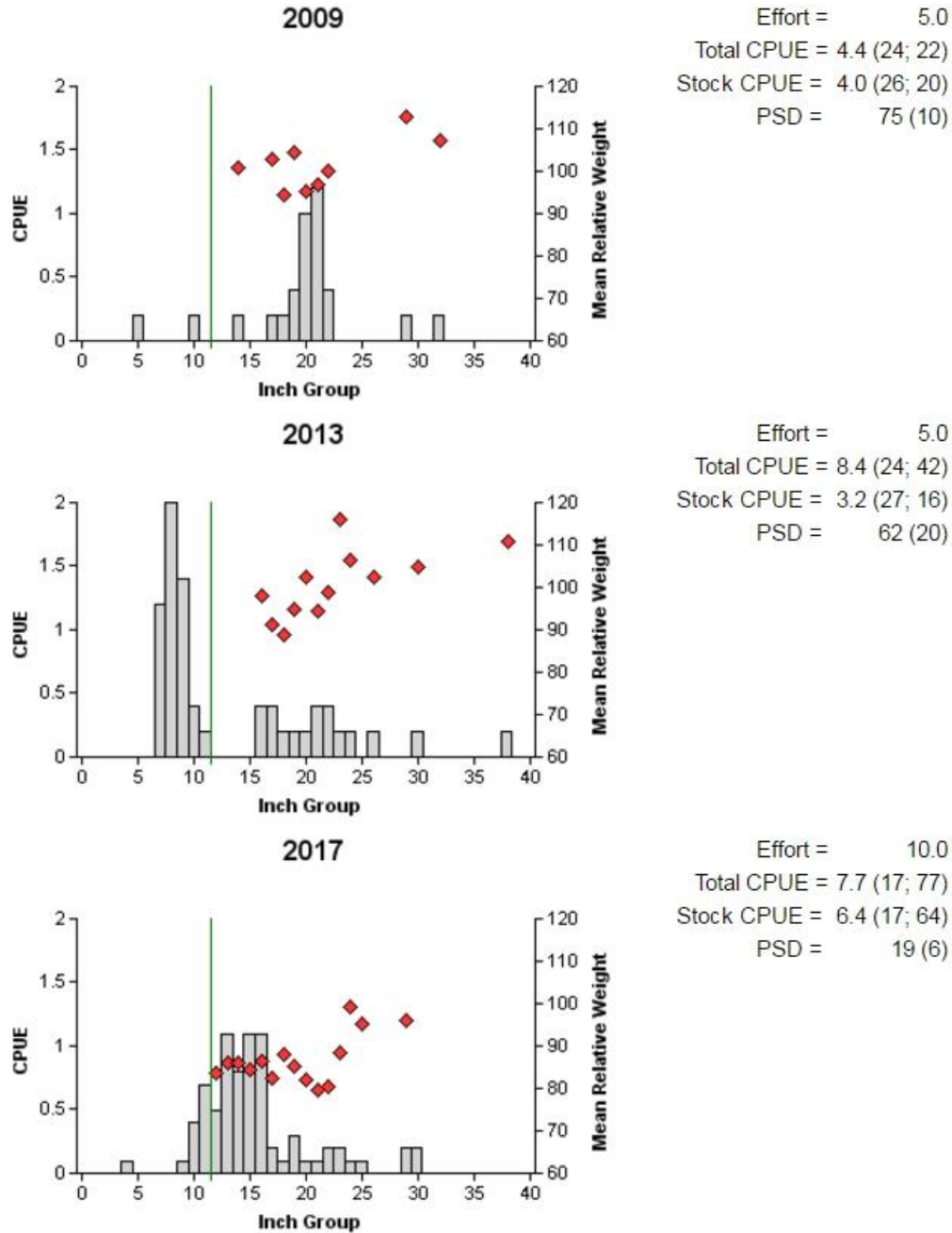Total CPUE = 7.7 (17; 77)
Stock CPUE = 6.4 (17; 64)
PSD = 19 (6)

Figure 6. Number of Blue 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, Navarro Mills Reservoir, Texas, 2009, 2013, and 2017. Vertical line indicates minimum length limit.

Channel Catfish

2009

Effort = 5.0
Total CPUE = 9.6 (35; 48)
Stock CPUE = 9.0 (34; 45)
PSD = 27 (6)

2013

Effort = 5.0
Total CPUE = 2.2 (44; 11)
Stock CPUE = 0.8 (47; 4)
PSD = 50 (34)

2017

Effort = 10.0
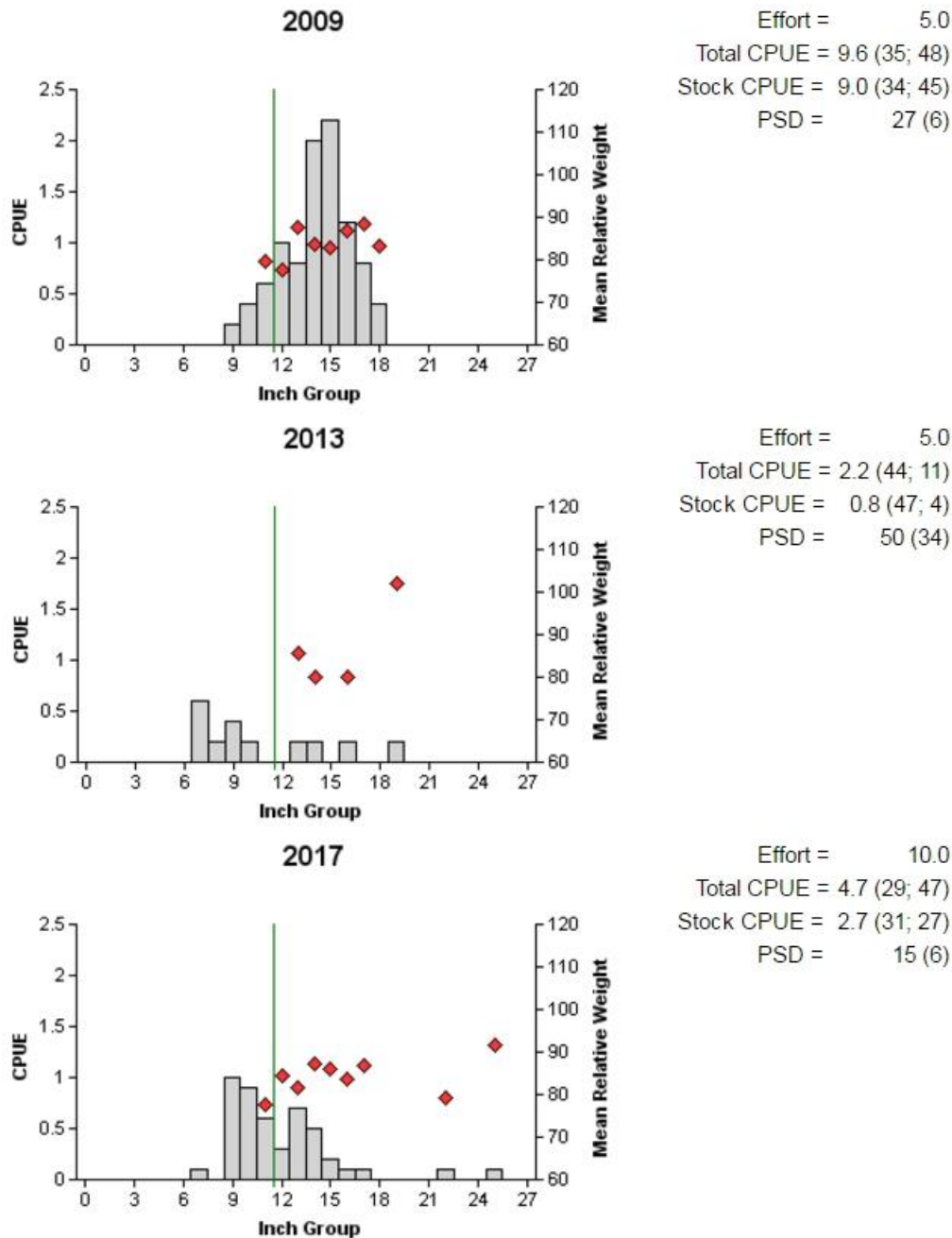Total CPUE = 4.7 (29; 47)
Stock CPUE = 2.7 (31; 27)
PSD = 15 (6)

Figure 7. 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, Navarro Mills Reservoir, Texas, 2009, 2013, and 2017. Vertical line indicates minimum length limit.
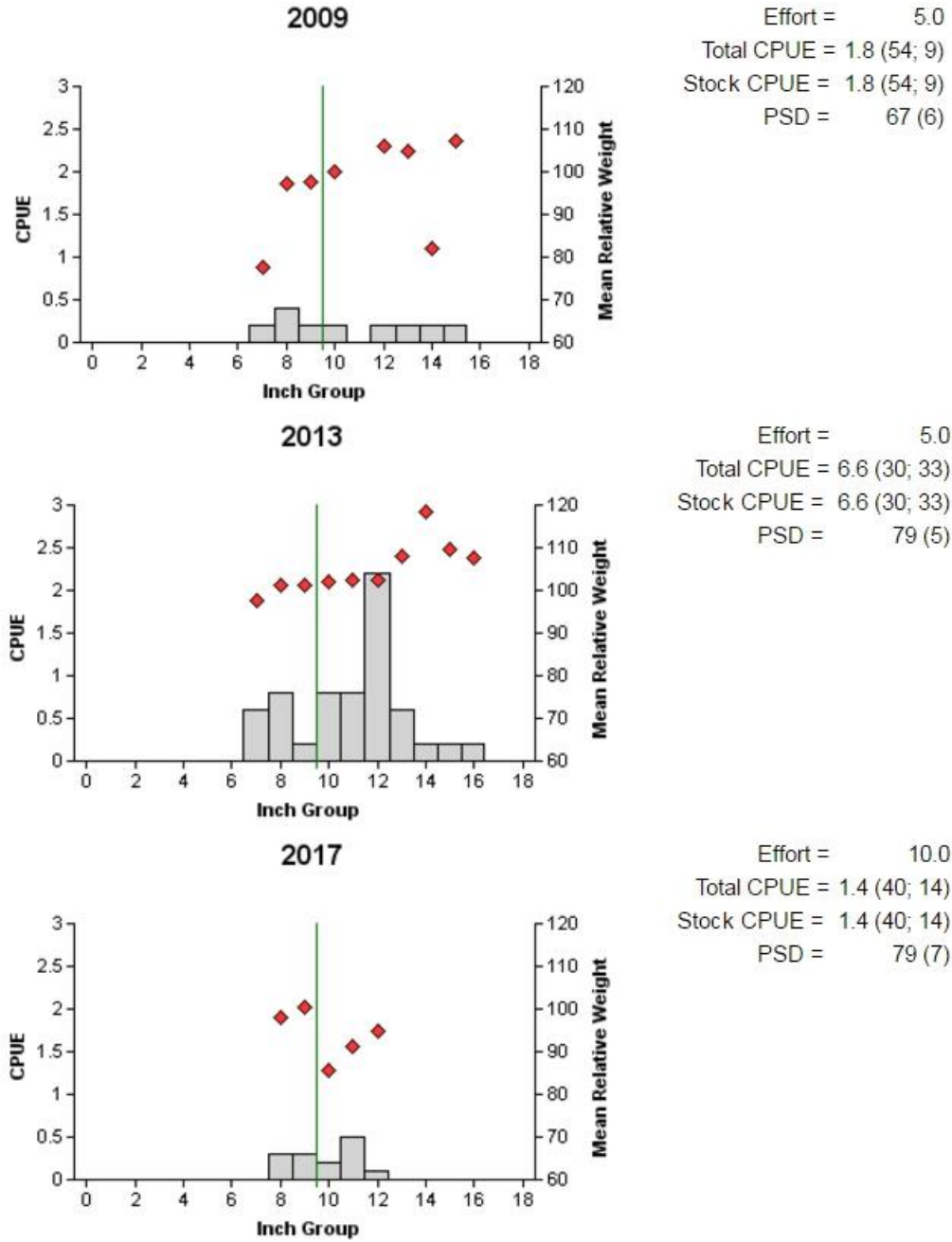
White Bass

Figure 8. Number of White Bass 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, Navarro Mills Reservoir, Texas, 2009, 2013, and 2017. Vertical line indicates minimum length limit.

Largemouth Bass

2008

Effort = 1.0
Total CPUE = 74.0 (18; 74)
Stock CPUE = 64.0 (22; 64)
PSD = 55 (4)

2012

Effort = 1.0
Total CPUE = 40.0 (44; 40)
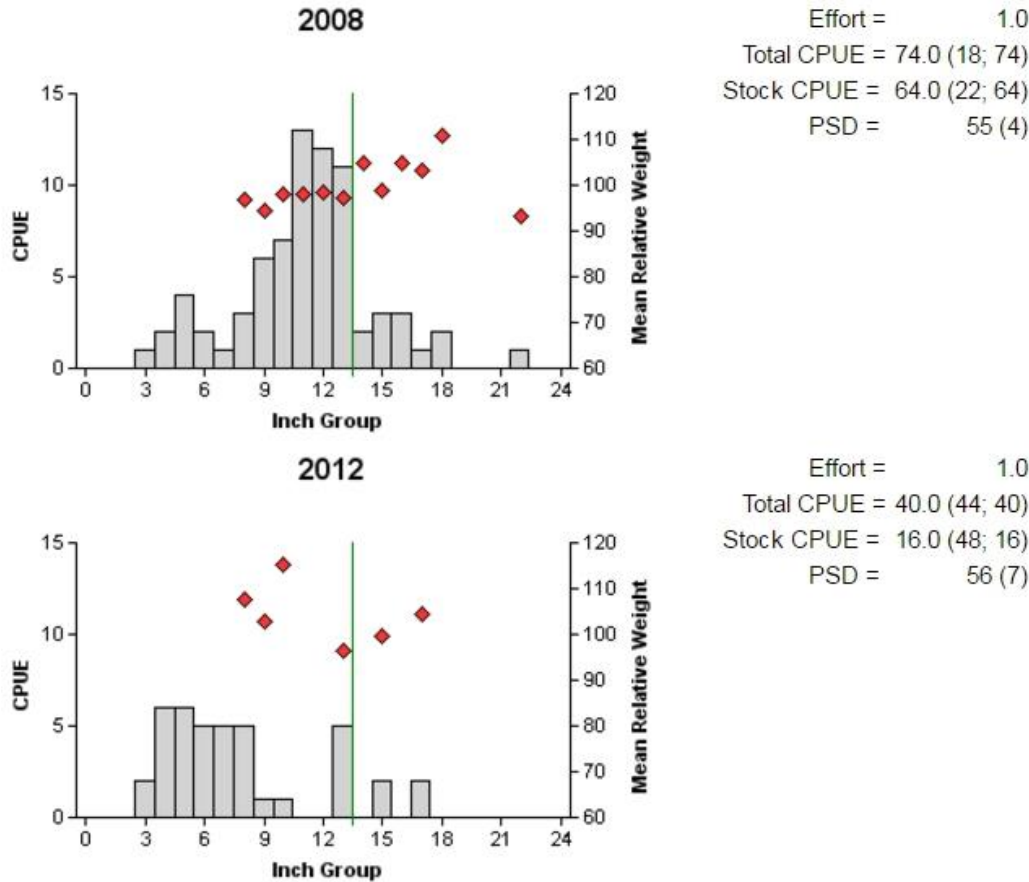Stock CPUE = 16.0 (48; 16)
PSD = 56 (7)

Figure 9. 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 nighttime electrofishing surveys, Navarro Mills Reservoir, Texas, 2008, and 2012. Vertical line indicates minimum length limit.

2016

Effort = 1.0
Total CPUE = 24.0 (42; 24)
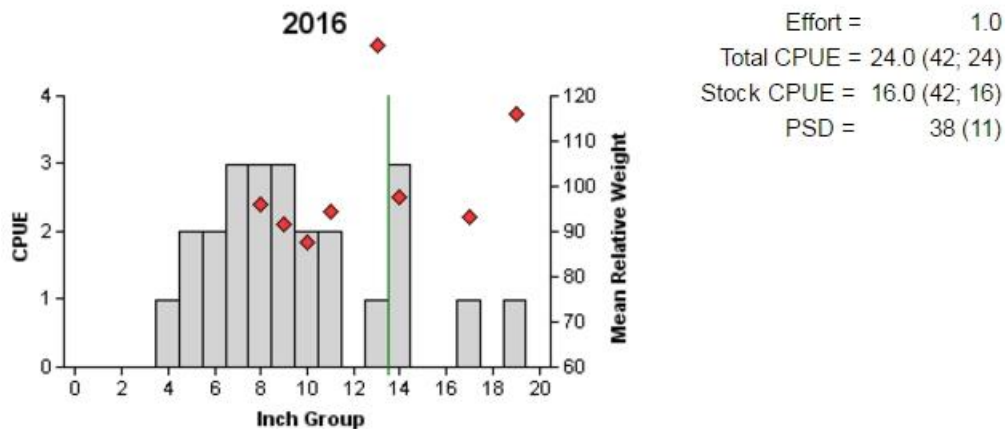Stock CPUE = 16.0 (42; 16)
PSD = 38 (11)

Figure 10. 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 daytime electrofishing surveys, Navarro Mills Reservoir, Texas, 2016. Vertical line indicates minimum length limit.

White Crappie

2008

2012

Effort = 5.0
Total CPUE = 37.6 (35; 188)
CPUE-10 = 5.2 (48; 26)
PSD = 57 (7)
PSD-P = 36 (7)

2016

Effort = 10.0
Total CPUE = 39.1 (23; 391)
CPUE-10 = 13.3 (16; 133)
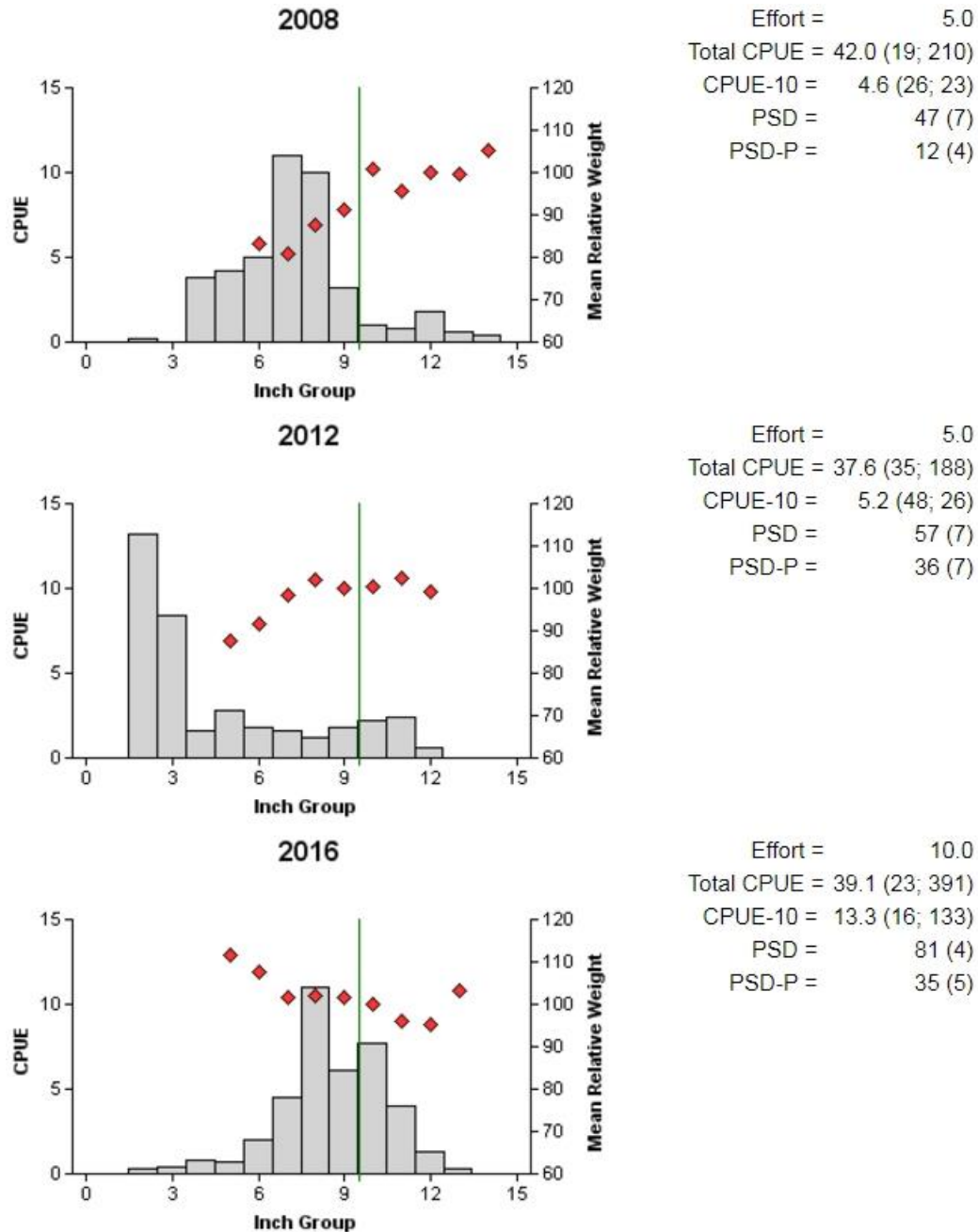PSD = 81 (4)
PSD-P = 35 (5)

Figure 11. Number of White Crappie 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 fall trap netting surveys, Navarro Mills Reservoir, Texas, 2008, 2012, and 2016. Vertical line indicates minimum length limit.

Table 7. Proposed sampling schedule for Navarro Mills Reservoir, Texas. Survey period is June through May. Gill netting surveys are conducted in the spring, while electrofishing and trap netting surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

| Survey year	Electrofish Fall	Trap net	Gill net	Vegetation	Access	Report
2017-2018						
2018-2019						
2019-2020						
2020-2021	S	S	S	S	S	S

APPENDIX A

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Navarro Mills Reservoir, Texas, 2016-2017. Sampling effort was 10 net nights for gill netting, 10 net nights for trap netting, and 1 hour for electrofishing.

Species	Gill Netting		Trap Netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Gizzard Shad					136	136.0
Threadfin Shad					79	79.0
Blue Catfish	77	7.7				
Channel Catfish	47	4.7				
White Bass	14	1.4				
Bluegill					5	5.0
Tilapia sp.					1	1.0
Redear Sunfish					1	1.0
Largemouth Bass					24	24.0
White Crappie			391	39.0		
Black Crappie			7	0.7		

APPENDIX B
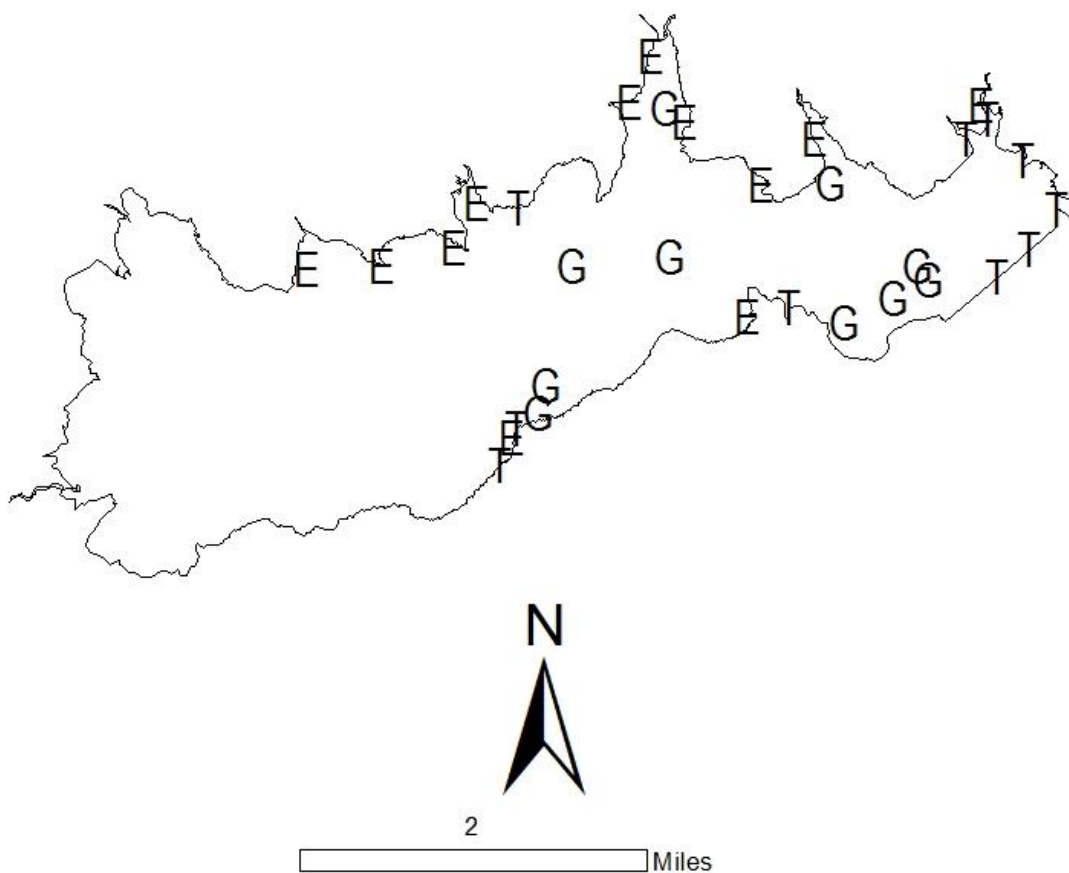
Location of sampling sites, Navarro Mills Reservoir, Texas, 2016-2017. Trap net, gill net, and electrofishing stations are indicated by T, G, and E, respectively. Water level was at or above full pool at time of sampling.