Daniel Reservoir

2017 Fisheries Management Survey Report

PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-3

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

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Survey and Management Summary

Fish populations in Daniel Reservoir were surveyed in 2014-2018 using gill nets, tandem hoop nets, electrofishing, and trap nets. Historical data are presented with the 2014-2018 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: Daniel Reservoir is a 950-acre impoundment constructed in 1948 on Gunsolus Creek. The reservoir is in Stephens County, approximately 65 miles northeast of Abilene, and it is owned and operated by the City of Breckenridge. The reservoir provides municipal water supply for the City of Breckenridge. Daniel Reservoir was nearly dry from fall 2003 to spring 2007. After filling in June 2007, the water level began to decline. By 2014, the reservoir was nearly 11 feet below conservation pool, but substantial rainfall refilled it in 2015. All boat ramps were usable after the reservoir refilled. Bank fishing access was limited to the boat ramp areas.

Management History: Important sport fishes include Largemouth Bass, Channel Catfish, and crappie. Previous management history included re-establishment of all sport and forage fish by stocking fish, inform anglers of new fishing opportunities, discuss water conservation and stricter water restriction trigger points for municipal water use with the City of Breckenridge. The most recent stockings included Florida Largemouth Bass in 2016 and 2017 after the lake refilled. Angler harvest of all sport fishes has been regulated according to statewide size and bag limits.

Fish Community

- **Prey species:** Gizzard Shad relative abundance was good and most were available to sport fish. Relative abundance of Bluegill was high, but Bluegill >6-inches long were uncommon.
- **Catfishes:** The Channel Catfish population was good with many fish available for anglers. Other catfish species were not encountered during the surveys.
- **White Bass:** White Bass were recently discovered in the trap net survey in 2013. White Bass sampled were of harvestable sizes, and representation of smaller individuals indicated that the population had reproduction and recruitment.
- **Largemouth Bass:** Largemouth Bass were relatively abundant. Legal-size fish were available to anglers. Largemouth Bass body condition was fair to excellent. Growth to legal length was average.
- **White Crappie:** White Crappie were greatly abundant, and legal-size fish up to 15 inches were available to anglers. Most crappie reached legal size within one or two years.

Management Strategies: Survey Channel Catfish, White Crappie, Black Crappie, Largemouth Bass, and forage fish populations every four years. Meet with the City of Breckenridge to discuss water use plans for Daniel Reservoir and strategies for water conservation. Promote the quality White Crappie fishery to constituents. Inform the public of the threat of invasive species and their impacts.

Introduction

This document is a summary of fisheries data collected from Daniel Reservoir in 2014-2018. 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 2014-2018 data for comparison.

Reservoir Description

Daniel Reservoir is a 950-acre impoundment constructed in 1948 on Gunsolus Creek. The reservoir is in Stephens County approximately 65 miles northeast of Abilene, and it is owned and operated by the City of Breckenridge. The reservoir provides municipal water and recreation for the City of Breckenridge. Land use around the reservoir is primarily agricultural. The reservoir experiences substantial water level fluctuation. The reservoir was nearly dry prior to filling in 2007. After filling, the water level had declined and by January 2014, the reservoir water level was nearly 11 feet below conservation pool (CP; Figure 1). The U.S. Geological Survey's water level gauge was removed in 2014, and a new gauge has not been installed since. In 2015, the reservoir filled because of substantial rainfall. Other descriptive characteristics for Daniel Reservoir are in Table 1.

Angler Access

Daniel Reservoir has three public boat ramps and no private boat ramps. All three boat ramps were useable since the reservoir refilled in 2015. Additional boat ramp characteristics are in Table 2. Shoreline access is limited to the public boat ramp areas.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Amoroso and Homer 2014) included:

1. Discuss water use plan with the City of Breckenridge and the possible impacts on the fish populations.

   Action: Spoke with a City of Breckenridge representative about the surface water pump that was to be installed for municipal use. The pump has not been installed, and no water has been removed from Daniel Reservoir for municipal purposes.

2. Determine a conservation and access threshold elevation at which the reservoir could be managed to allow controlling authority operations as well as provide adequate angler access to persist.

   Action: Conservation thresholds were not calculated, and no further discussion has resulted since the City of Breckenridge is currently not using Daniel Reservoir water for municipal use.

3. Continue to monitor fish populations to determine any changes in relative abundance, growth, and size structure that may correlate with water level fluctuations.

   Action: Largemouth Bass were surveyed by electrofishing. Crappie were surveyed by trap netting. Channel Catfish were surveyed by tandem hoop netting. Relative abundance, growth, and size structure were determined for all fish species sampled.

4. Discuss the possibility of a low-water ramp with the City of Breckenridge.

   Action: Discussions regarding the development of low-water ramps did not occur with the City of Breckenridge since the water level of the reservoir increased. Development of such ramps or extensions of existing ramps would be most practical when reservoir water

level is low. Therefore, discussions with the City of Breckenridge will be initiated if the water level drops again.

5. Promote White Crappie fishing at Daniel Reservoir.

   Action: Popular press articles were written that highlighted White Crappie fishing at Daniel Reservoir and were sent to local newspapers.

6. Prevent the spread of invasive species.

   Action: Popular press articles were written about how to prevent the spread of invasive species and were sent to local newspapers and social media. All presentations to constituents and user groups discussed the importance of preventing the spread of invasive species. Signage was displayed at Daniel Reservoir's boat ramp to encourage users to comply with state laws requiring all the water to be drained from vessels once they leave the waterbody.

Harvest regulation history: Sport fishes have been managed with statewide harvest regulations (Table 3).

Stocking history: By early 2007, most of the fish previously stocked were assumed to be lost due to extremely low water level. All fishes reintroduced after the reservoir refilled in 2007 were part of a drought recovery plan to restore popular fisheries. During 2016 and 2017, Florida Largemouth Bass fingerlings were stocked. Florida Largemouth Bass were first stocked in 1983. The complete stocking history is shown in Table 4.

Vegetation/habitat management history: Daniel Reservoir has no history of management for vegetation or structural habitat.

Water transfer: No interbasin transfers are known to exist. Daniel Reservoir provides municipal water supply for the City of Breckenridge. A water usage plan was established during the winter of 2013-2014 to mix 15% Daniel Reservoir water with 85% Hubbard Creek Reservoir water for the City of Breckenridge. Modifications of water pumping from the reservoir may be made based on water level of Daniel Reservoir and Hubbard Creek Reservoir. A surface water pump would remove the water from Daniel Reservoir to be pumped directly to a water treatment plant for city use.

Methods

Surveys were conducted to achieve survey and sampling objectives in based sampling (OBS) plan for Daniel Reservoir (TPWD unpublished). plan are listed in [table 3]. 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, sunfishes, and Gizzard Shad were collected by electrofishing (1.2 h at 14, 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 from otoliths collected from 11 randomly-selected fish (range 13.0 to 14.9 inches).

Trap netting – Crappie were collected by using trap nets (9 net nights at 9 stations). Catch per unit effort for trap netting was recorded as the number of fish caught per net night (fish/nn). Ages for crappie were determined using otoliths from 13 randomly-selected fish (range 9.0 to 10.9 inches).

Tandem hoop nets – Channel Catfish were collected using 8 tandem hoop net series at 8 stations. Nets were baited with soap and deployed for two-nights set duration. Catch per unit effort for tandem hoop netting was recorded as the number of fish caught per tandem hoop net series (fish/series).

Genetics – Genetic analysis of Largemouth Bass was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015). Micro-satellite DNA analysis was used to determine genetic composition of individual fish.

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.

Habitat – A structural habitat survey and vegetation habitat survey were conducted in summer 2017 using the random point method (TPWD Inland Fisheries Division, unpublished manual revised 2015). For the structural habitat survey, a total of 79 points were randomly selected along the shoreline and 20 points were discarded because they could not be sampled. During the vegetation habitat survey, a total of 200 points were randomly selected throughout the reservoir and 35 points were discarded because they could not be sampled. During both habitat surveys, presence/absence was determined for habitat types identified at or below the waterline at all points. Percent occurrence (% = [# stations present / total stations sampled] X 100) and associated Wilson 95% confidence intervals (Ausvet 2018) were calculated for each habitat feature type.

Water level – Water level data were collected until the water level gauge was removed in 2014 (USGS 2014).

Results and Discussion

Habitat: Littoral zone structural habitat consisted of primarily natural/featureless shoreline and rocky shoreline (Table 6). Most of the vegetation throughout the reservoir consisted of standing timber (27.9%) and flooded terrestrial plants (26.1%). Aquatic plants such as common buttonbush, black willow, American lotus, smartweed, and water primrose were sampled in 2017 (Table 7). No aquatic plants were sampled during the 2013 vegetation survey (Amoroso and Homer 2014).

Prey species: Gizzard Shad and sunfishes have been the predominant prey species in the reservoir. Electrofishing catch rates of Gizzard Shad was (192.0/h) in 2017, which was considerably lower than the 2015 survey (999.0/h) and 2013 survey (647.0/h; Figure 2). Index of Vulnerability for Gizzard Shad was

89, which suggested that the majority of Gizzard Shad were available to sport fishes; this was slightly lower than IOV estimates from the previous two surveys. CPUE-Total of Bluegill in 2017 (461.1/h) was higher than CPUE-Total from surveys in 2015 (206.0/h) and 2013 (78.0/h), and size structure (PSD = 0) continued to be dominated by small individuals (Figure 3). PSD has remained low over the past few surveys with few quality-sized Bluegill.

Channel Catfish: Catch rate during gill netting surveys from 1997 to 2016 was variable and ranged from 1.6-8.6/nn. When Channel Catfish were sampled by tandem hoop nets in 2009, catch rate was 9.0/series. In the 2017 tandem hoop net survey, the catch rate was 79.3/series. Channel Catfish ranged in size from 8-26 inches. The PSD decreased from 56 in 2009 to 21 in 2017, which suggested that the population became more comprised of smaller individuals (i.e., ≤stock size) compared to fish ≥16 inches. In 2017, there was a high number of fish from 11-15 inches compared to 2009. However, most fish sampled were above 12 inches and were legally harvestable (Figure 4).

White Bass: White Bass were first observed in a 1994 gill netting survey when a single 12-inch fish was caught. White Bass were not seen in surveys again until a trap netting survey in 2013. During the 2016 gill netting survey, the catch rate was 5.6/nn. Sizes of White Bass in the 2016 gill netting survey ranged from 7-18 inches. Mean relative weights of fish ≥10 inches exceeded 100 (Figure 5). Most individuals caught in the 2016 survey were legal-size fish available to anglers, with a bimodal length frequency, which suggested multiple year classes have recruited to the population. All White Bass sampled were aged using otoliths (N = 28). Average age for fish at 10 inches (9.0 to 10.9 inches; N=6) was 1.0 year. Mean length for three-year-old fish was 16.2 inches (N = 13; 15.5-17.1 inches), and mean length for four-year-old fish was 18.0 inches (N = 3; 17.8-18.1 inches).

Largemouth Bass: The catch rate of Largemouth Bass in 2017 (64.3/h) was similar to the survey conducted in 2015 (74.0/h). Catch rate of stock-size Largemouth Bass was similar in 2017 (53.1/h) and 2015 (57.0/h). In 2015, most of the stock-size fish that were sampled were less than 13 inches, indicative of a recovering population dominated by new recruits to the population. In 2017, size structure shifted to greater representation of stock-sized fish, which PSD increased to 65 from 16 reported in 2015. Growth of Largemouth Bass in Daniel Reservoir was good; average age at 14 inches (13.0 to 14.9 inches) was 2.0 years (N = 11; all fish sampled were 2 years old). Body condition (i.e., mean relative weights) in 2017 ranged from fair to excellent for nearly all size classes of fish ≥stock size in the sample (Figure 6). Florida Largemouth Bass alleles decreased from 69.5% to 44.6%, percentage of pure Florida-strain Largemouth Bass decreased from 31.0% to 10.0%, and the percentage of pure Northern Largemouth Bass increased from 0.0 to 20.0% (Table 8). Likely there was a large influx of Northern strain Largemouth Bass during the 2015 flooding events that altered the genetic composition of the bass population.

White Crappie: Catch rate for White Crappie fluctuated from 130.4/nn in 2013 to 13.2/nn in 2015 and to 100.8/nn in 2017. Variability in relative abundance was likely attributed to water level fluctuation and changes in habitat availability. Catch rate of stock-size individuals also fluctuated from 105.4/nn in 2013, to 6.6/nn in 2015, and to 81.0/nn in 2017. Size structure was also similar in 2015 (PSD=58) and 2017 (PSD=48). These size structure indices are indicative of a desirable and balanced population (Anderson and Neumann 1996). In 2017, body condition varied per inch-group, but most inch-groups had mean relative weight values >100. Fish ≥10 inches had excellent body condition (Figure 7). Average age at legal length was approximately 1.8 years (N = 13; range = 1-2 years).

Fisheries Management Plan for Daniel Reservoir, Texas

Prepared – July 2018

ISSUE 1: A plan to modify the municipal water pump system at Daniel Reservoir has been approved, and a surface water pump will be installed. Municipal water uses in combination with drought-induced fluctuating water level could be detrimental to established fisheries.

MANAGEMENT STRATEGIES

1. Reinitiate discussions with the City of Breckenridge regarding water use plans for Daniel Reservoir and discuss concerns surrounding the fisheries. Discuss the benefits of water conservation for fishing at Daniel Reservoir with the City of Breckenridge. Highlight the Largemouth Bass and White Crappie fisheries and explain how these fish populations are affected by water level fluctuation.
2. Continue to monitor fish populations with standard survey methods to determine any changes in relative abundance, growth, and size structure that may correlate with water level fluctuation.

ISSUE 2: Daniel Reservoir has an excellent White Crappie population with large numbers of harvestable-size fish with good body condition.

MANAGEMENT STRATEGIES

1. Write popular press articles on White Crappie fishing at Daniel Reservoir and distribute to newspapers in the surrounding cities within proximity to Daniel Reservoir.
2. Promote White Crappie fishing opportunities at Daniel Reservoir through online social media.

ISSUE 3: Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels (*Dreissena polymorpha*) can multiply rapidly and attach themselves to any available hard structure, restricting water flow in pipes, fouling swimming beaches, and plugging engine cooling systems. Giant salvinia (*Salvinia molesta*) and other invasive vegetation species can form dense mats, interfering with recreational activities like fishing, boating, skiing, and swimming. The financial costs of controlling and/or eradicating these types of invasive species are significant. Additionally, the potential for invasive species to spread to other river drainages and reservoirs via watercraft and other means is a serious threat to all public waters of the state.

MANAGEMENT STRATEGIES

1. Cooperate with the controlling authority to post appropriate signage at access points around the reservoir.
2. Educate the public about invasive species by using media and the internet.
3. Make a speaking point about invasive species when presenting to constituent and user groups.
4. 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 (2018–2022)

Sport fishes, forage fish, and other important fishes: Daniel Reservoir's prey community is comprised mostly of Gizzard Shad and Bluegill. Important sport fish species include Channel Catfish, Largemouth Bass, Black Crappie, and White Crappie. Proposed sampling schedule is in Table 9.

Low-density fisheries: Flathead Catfish have been present in prior surveys, but many were thought to be lost because of the previous prolonged drought. Historical relative abundance of Flathead Catfish in monitoring surveys were low, and the species is currently considered to have low population density. Monitoring of presence/absence for low-density species will be conducted in conjunction with surveys for other sport fishes.

White Bass are an introduced species in Daniel Reservoir and were first observed in the 1994 gill netting survey when a single 12-inch fish was caught. Following that survey, White Bass had not been observed during routine monitoring until being caught in a 2013 trap netting survey. In the 2016 gill net survey, relative abundance of White Bass was low. Continuation of monitoring for presence/absence will be conducted with other sampling. However, no gill netting will be conducted in the 2018-2022 monitoring cycle. White Bass are a developing population in Daniel Reservoir, and few anglers likely target them.

Survey objectives, fisheries metrics, and sampling objectives:

Prey Species: Gizzard Shad and Bluegill are the predominant prey species in the reservoir. Traditional monitoring of prey species had been conducted by electrofishing for 1.0 h at 12, 5-minute randomly selected stations. Most sampling events from 2008-2017 achieved precise (RSE≤25) CPUE estimates for Gizzard Shad and Bluegill. Electrofishing will be conducted during fall 2021 to monitor prey species' relative abundance (i.e., CPUE-Total) and size structures. To monitor prey availability for Gizzard Shad, ≥50 fish will be collected to calculate and evaluate Index of Vulnerability. To evaluate the size structure (PSD) for Bluegill, 50 stock-size fish will be attempted to be collected. If desired precision for relative abundance estimates and/or sample sizes are not achieved, no additional sampling will be conducted unless additional electrofishing is needed to fulfill objectives set for Largemouth Bass.

Largemouth Bass: Largemouth Bass support a fishery at the reservoir, and they have been managed by statewide regulations. Traditionally, Largemouth Bass have been monitored by fall electrofishing. Largemouth Bass relative abundance has been variable, which is likely linked to water level fluctuation and changes in habitat availability. In 2015, the reservoir caught substantial rainfall after being about 11-12 feet low, which resulted in increased fish habitat availability and production of Largemouth Bass. Largemouth Bass were stocked during 2016 and 2017 to boost recruitment in the population. Continuation of monitoring trends in relative abundance and size structure is necessary to inform fisheries biologists about the status of the fishery, disseminating information to constituents, as well as to ascertain needs for stocking. Electrofishing will be conducted during fall 2021 for 1.0 h at 12, 5-minute randomly selected stations. The CPUE-Total and CPUE-Stock fish will be calculated at a target precision of RSE≤25; the CPUE-14 will be estimated, but no target for precision will be set. A sample of ≥50 stock-size fish will be obtained to evaluate size structure (PSD), and 5 fish per inch-group will be weighed to evaluate body condition. If sampling objectives are not achieved with the initial 12 stations and if catch rates indicate collecting our size structure target is reasonable, up to an additional half-hour of sampling will be conducted if deemed feasible.

Channel Catfish: Channel Catfish have been managed with statewide regulations. Historical monitoring has been conducted with gill nets and tandem hoop nets. From 1997 to 2016, three gill netting surveys were conducted, and catch rates were variable from 1.6-8.6/nn (Effort= 5 net nights/survey). Gill netting surveys did not produce sample sizes >50 fish, and precision was low (RSE ≥30). During 2009 and 2017, summer tandem hoop netting surveys were conducted. The use of tandem hoop netting yielded similar size distributions to prior gill netting surveys, adequate sample size to assess body condition and size structure, as well as achieving desirable levels of precision for CPUE-Total, CPUE-Stock, and CPUE-12. Tandem hoop nets will be used to sample Channel Catfish in summer 2021 at four randomly selected stations. The CPUE-Total, CPUE-Stock, and CPUE-12 will be calculated at a target precision of RSE≤25.

A sample of ≥50 stock-sized fish will be obtained to evaluate size structure (PSD), and 5 fish per inch-group will be weighed to evaluate body condition. If sampling objectives are not achieved, up to five additional tandem series will be deployed if deemed feasible.

White and Black Crappie: Both White and Black Crappie have been managed with statewide harvest regulations, and they have been traditionally monitored by trap netting. White Crappie have been more abundant than Black Crappie in previous surveys. Prior surveys have suggested that the White Crappie population can provide ample legal-size fish in good body condition. Trap netting effort of 5-10 net nights has been effective in producing desirable levels of precision for crappie relative abundance estimates and sample sizes for effectively monitoring changes in size structure and body condition. Trap netting will be conducted in fall 2021 to monitor trends in relative abundance, size structure (i.e., PSD), and body condition. Data collected will be used to inform fisheries biologists about the status of the crappie fishery and disseminating information to constituents. Trap nets will be deployed overnight at 5 randomly selected stations to sample White and Black Crappie. As a result of the historical low density of Black Crappie, only CPUE-Total will be estimated, and there will be no target level of precision. Target precision for White Crappie CPUE-Total and CPUE-Stock will be RSE≤25; there will be no target precision for CPUE-10. A sample of 50 White Crappie ≥stock size will be collected to assess size structure. Five fish per represented inch-group will be sampled to evaluate White Crappie body condition. If objectives for White Crappie are not achieved, up to five additional trap nets may be set if deemed feasible.

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Tables and Figures

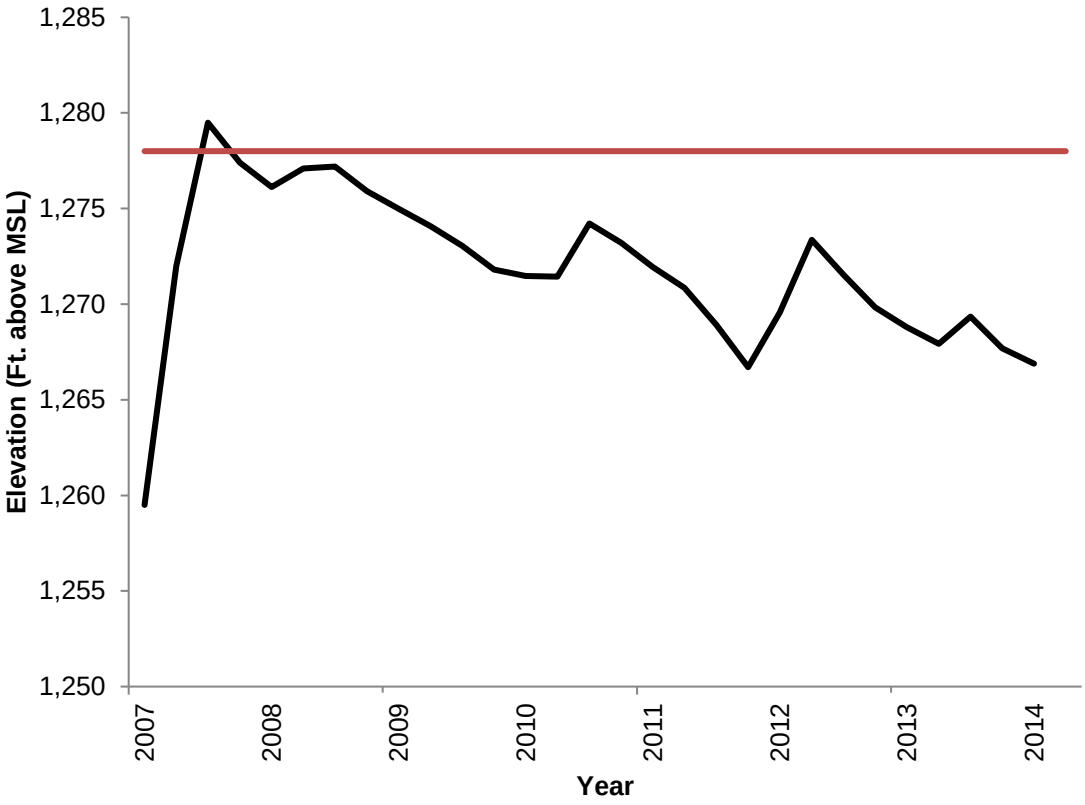


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Daniel Reservoir, Texas, 2007-2014 (USGS 2014). Conservation pool elevation is 1,278 feet above mean sea level, shown in red. Dead pool elevation is located approximately at 1,250 feet above mean sea level.

Table 1. Characteristics of Daniel Reservoir, Texas.

Characteristic	Description
Year constructed	1948
Conservation pool	1,278 feet above mean sea level
Dead pool	1,250 feet above mean sea level
Controlling authority	City of Breckenridge
County	Stephens
Reservoir type	Tributary
River basin[1]	Brazos (120601)
Sub-basin[1]	Hubbard (12060105)
Watershed[1]	Gunsolus Creek (1206010505)
Sub-watershed[1]	Upper Gunsolus Creek (120601050502)
Shoreline Development Index	4.0
Conductivity	259-435 µS/cm

[1]U.S. Geological Survey Hydrologic Unit Code

Table 2. Boat ramp characteristics for Daniel Reservoir, Texas, August, 2017. Reservoir elevation at time of survey was 1,278 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
1	32.64771 -98.87036	Y	5	1,277	Good; Accessible
2	32.64573 -98.87123	Y	5	1,266	Good; Accessible
3	32.64527 -98.87373	Y	5	1,264	Good; Accessible

Table 3. Harvest regulations for Daniel 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 Daniel Reservoir, Texas. FGL = fingerling; FRY = fry; AFGL = advanced fingerling; ADL = adults.

Species	Year	Number	Size
Gizzard Shad	2007	200	ADL
Threadfin Shad	2007	100	ADL
Channel Catfish	2007	90,314	FGL
Inland Silverside	2007	200	ADL
Bluegill	2007	200	ADL
	2007	89,679	FGL
	Total	89,879	
Florida Largemouth Bass	1983	48,072	FGL
	1991	95,000	FGL
	1995	95,785	FGL
	1997	95,502	FGL
	2007	233,338	FRY
	2007	46,148	FGL
	2007	629	AFGL
	2016	96,359	FGL
	2017	93,056	FGL
	Total	803,889	
White Crappie	2007	40	ADL

Table 5. Objective-based sampling plan components for Daniel Reservoir, Texas 2017–2018.

Gear/target species	Survey objective	Metrics	Sampling objective
Electrofishing			
Largemouth Bass	Abundance	CPUE–Total and CPUE–Stock	RSE-Stock≤25
	Size structure	PSD, length frequency	N ≥50 stock
	Age-and-growth	Age at 14 inches	N = 13, 13.0 – 14.9 inches
	Condition	W_r	5 fish/inch group (max)
	Genetics	% FLMB	N = 30, any age
Bluegill [a]	Abundance	CPUE–Total	RSE≤25
	Size structure	PSD, length frequency	N ≥50 stock
Gizzard Shad [a]	Abundance	CPUE–Total	RSE≤25
	Size structure	Length frequency	N ≥50
	Prey availability	IOV	N ≥50
Trap netting			
Crappie	Abundance	CPUE–Total and CPUE–Stock	RSE-Stock≤25
	Size structure	PSD, length frequency	N ≥50 stock
	Age-and-growth	Age at 10 inches	N = 13, 9.0 – 10.9 inches
	Condition	W_r	5 fish/inch group (max)
Tandem hoop netting			
Channel Catfish	Abundance	CPUE–Total and CPUE–Stock	Practical effort
	Size structure	PSD, length frequency	Practical effort

[a] No additional effort was not expended to achieve an RSE≤25 for CPUE of Bluegill and Gizzard Shad if not reached from designated Largemouth Bass sampling effort. Instead, Largemouth Bass body condition provided information on forage abundance, vulnerability, or both relative to predator density.

Table 6. Percent occurrence with lower and upper 95% confidence limits (CL) of vegetative habitat structural habitat at 59 random sites in Daniel Reservoir, Texas, August, 2017. Water level at time of survey approximately at conservation elevation.

Structural habitat type	Percent occurrence	Lower CL	Upper CL
Natural/Featureless shoreline	49.2	36.8	61.6
Rocky shoreline	49.2	36.8	61.6
Gravel	1.7	0.3	9.0

Table 7. Percent occurrence with lower and upper 95% confidence limits (CL) of vegetative habitat structural habitat at 165 random sites in Daniel Reservoir, Texas, August, 2017. Water level at time of survey approximately at conservation elevation.

Structural habitat type	Percent occurrence	Lower CL	Upper CL
Open water	48.5	41.0	56.1
Standing timber	27.9	21.6	35.2
Flooded terrestrial vegetation	26.1	20.0	33.2
Fallen timber or logs	13.9	9.5	20.0
Common buttonbush	5.5	2.9	10.0
Black willow	4.8	2.5	9.3
American lotus	1.2	0.3	4.3
Smartweed	0.6	0.1	3.4
Water primrose	0.6	0.1	3.4

Gizzard Shad

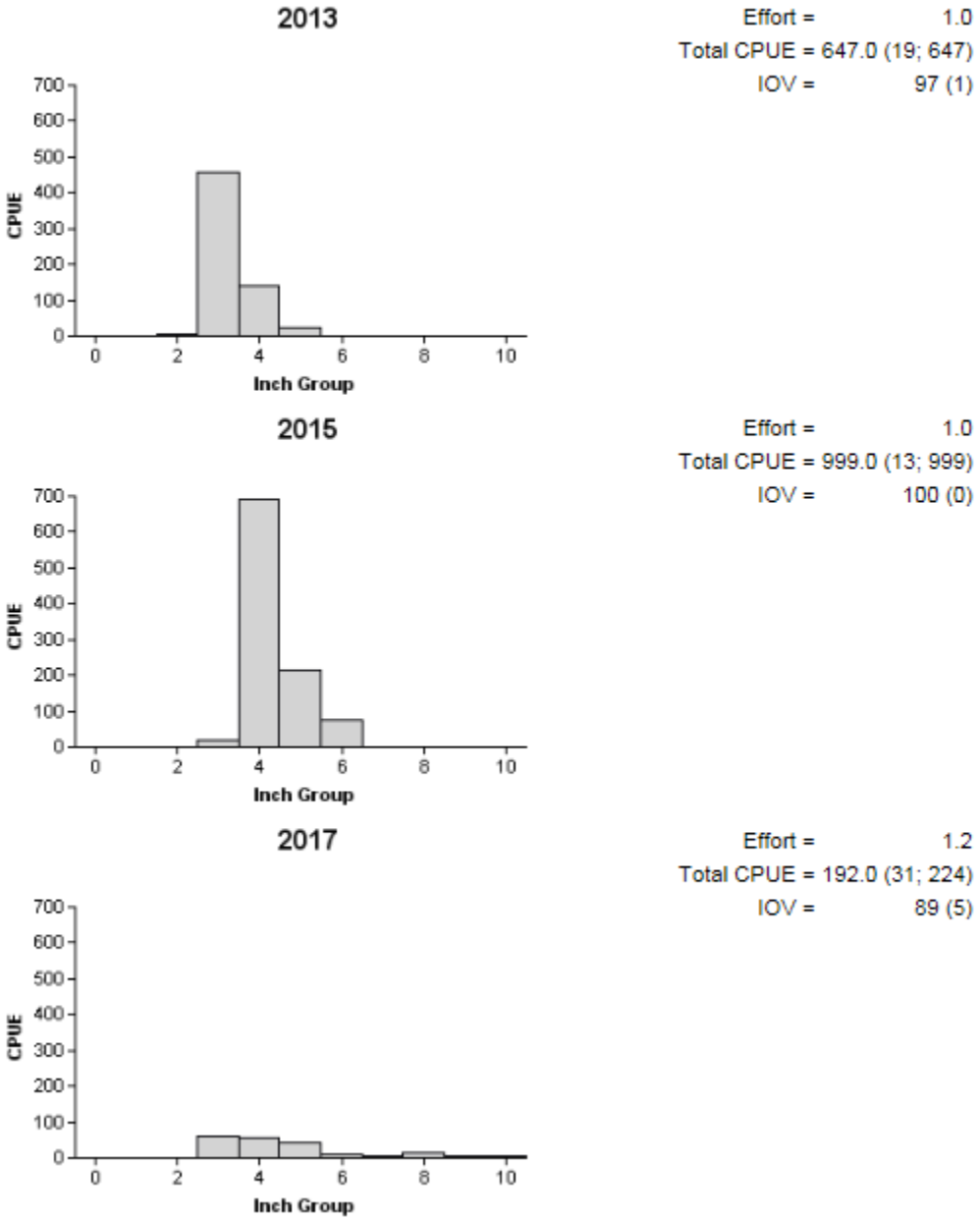


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Daniel Reservoir, Texas, 2013, 2015, and 2017.

Bluegill

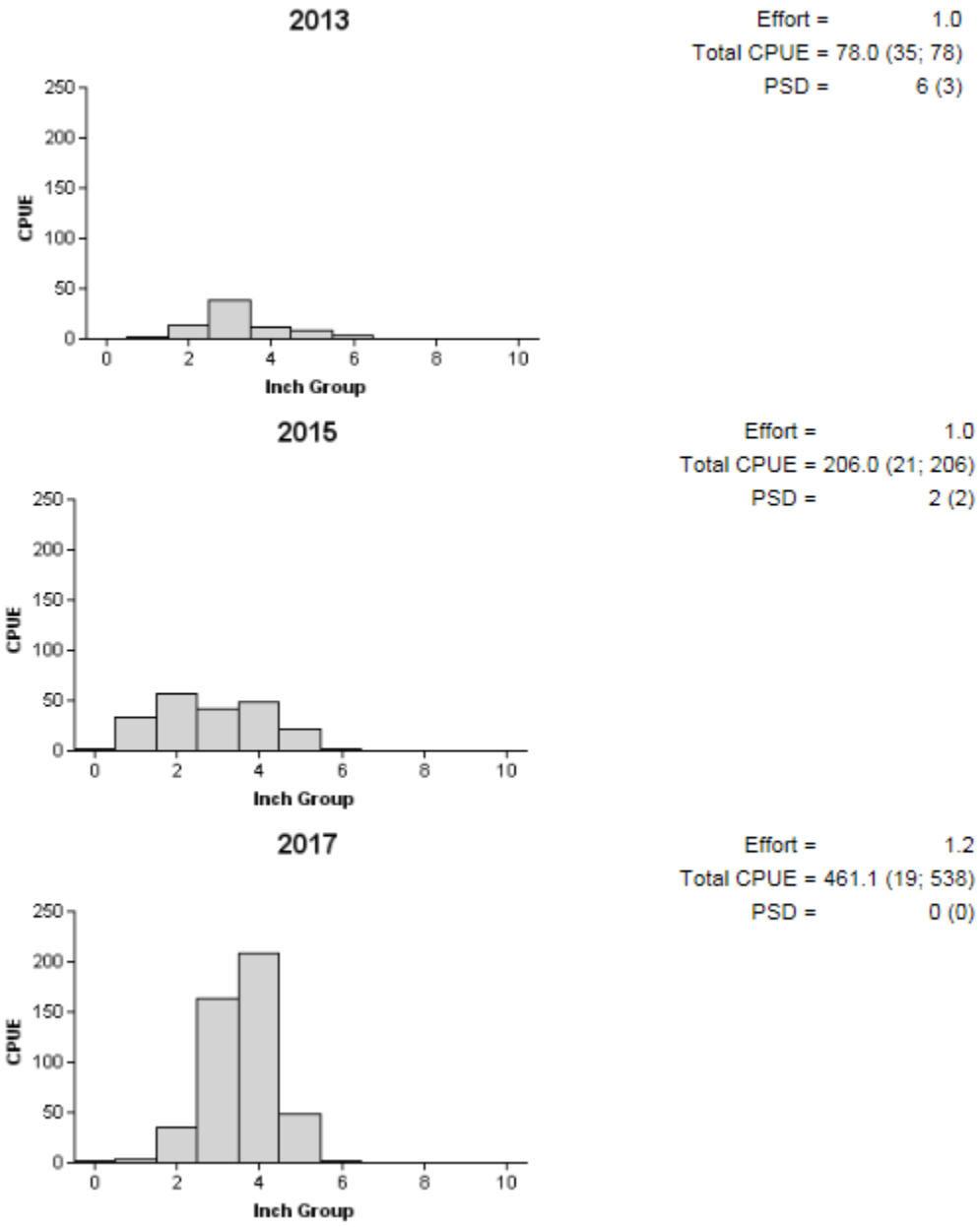


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Daniel Reservoir, Texas, 2013, 2015, and 2017.

Channel Catfish

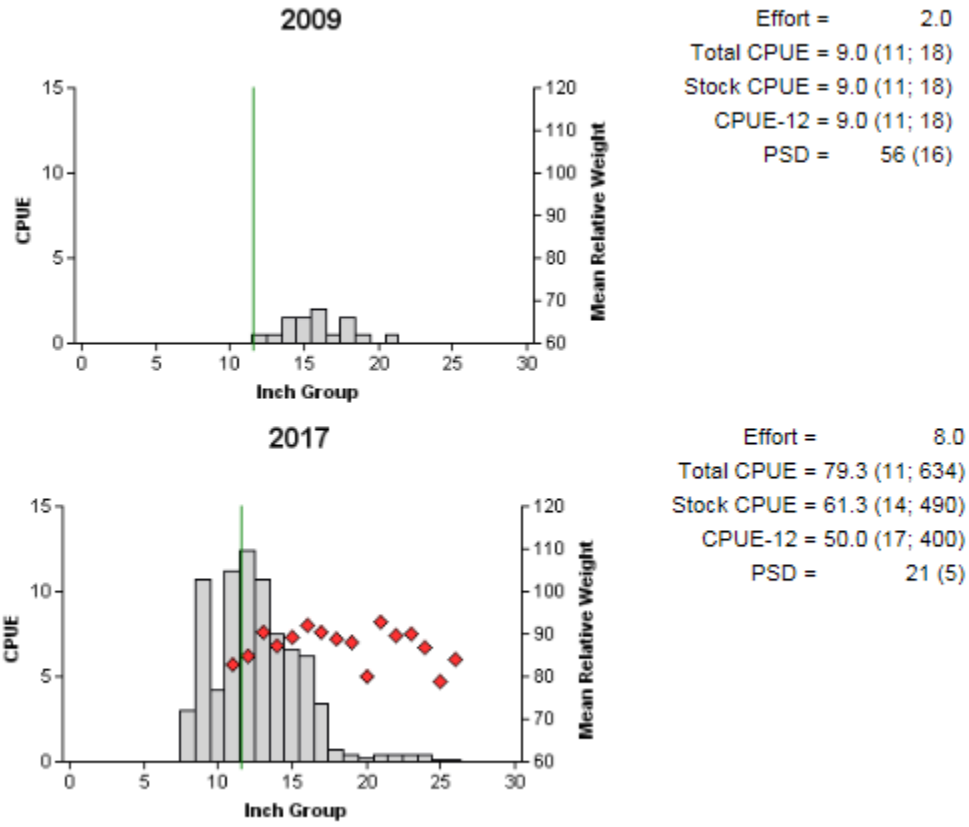


Figure 4. Number of Channel Catfish caught per series (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for summer tandem hoop net surveys, Daniel Reservoir, Texas, 2009 and 2017. Vertical line indicates the minimum length limit.

White Bass

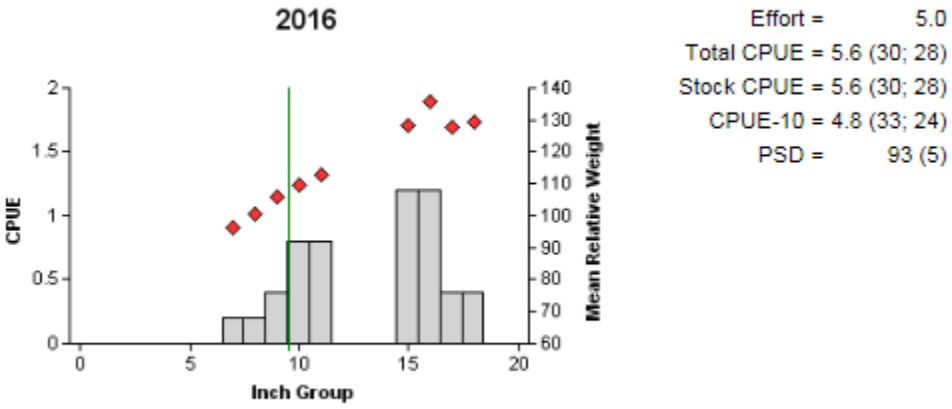


Figure 5. Number of White Bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net survey, Daniel Reservoir, Texas, 2016. Vertical line indicates the minimum length limit.

Largemouth Bass

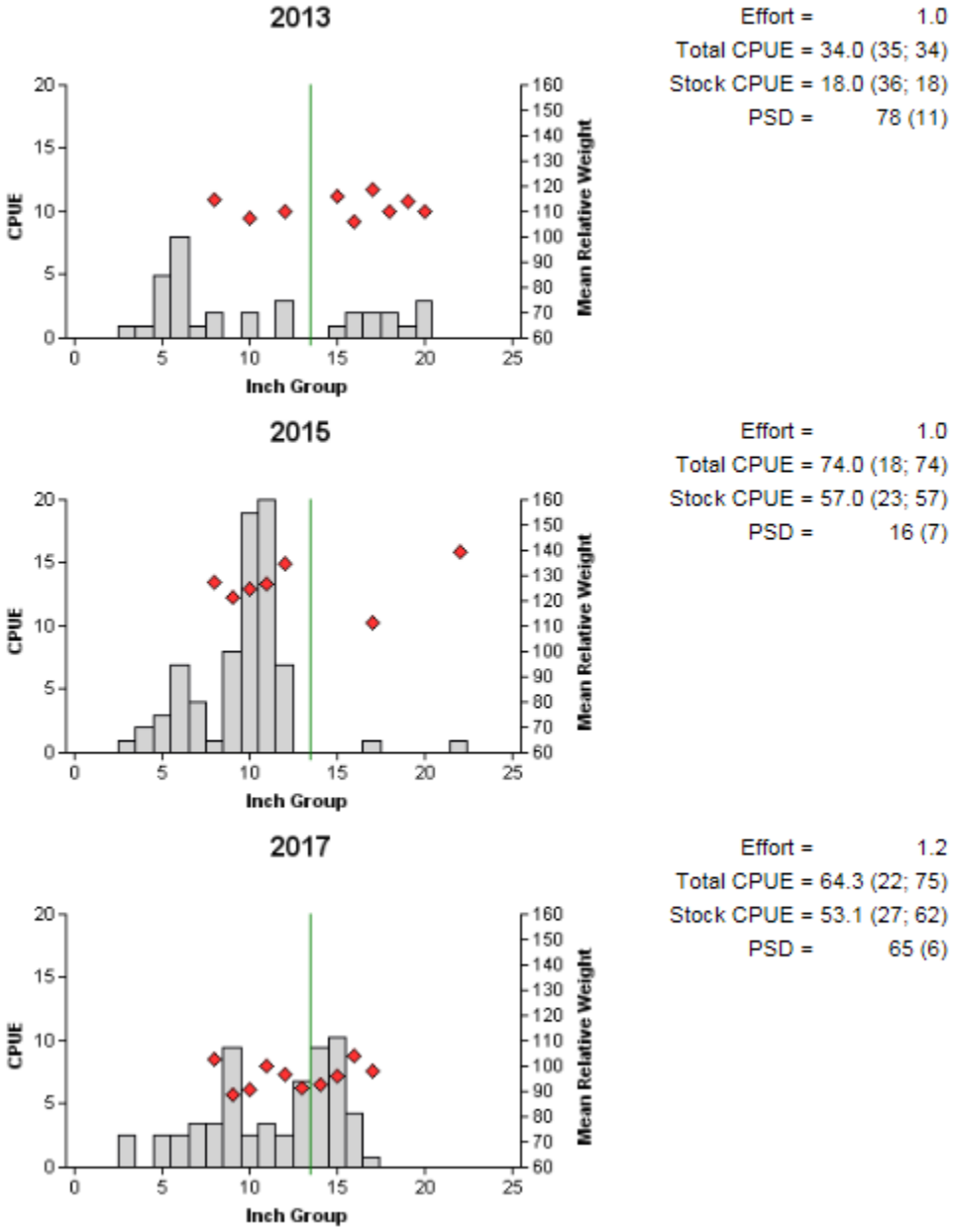


Figure 6. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Daniel Reservoir, Texas, 2013, 2015, and 2017. Vertical line indicates the minimum length limit.

Table 8. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Daniel Reservoir, Texas. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, F1 = first generation hybrid between a FLMB and a NLMB, F*x* = second or higher generation hybrid between a FLMB and a NLMB. Genetic composition was determined with micro-satellite DNA analysis.

Year	Sample size	Number of fish				% FLMB alleles	% pure FLMB
		FLMB	F1	F*x*	NLMB		
2013	29	9	5	15	0	69.5	31.0
2017	30	3	2	19	6	44.6	10.0

White Crappie

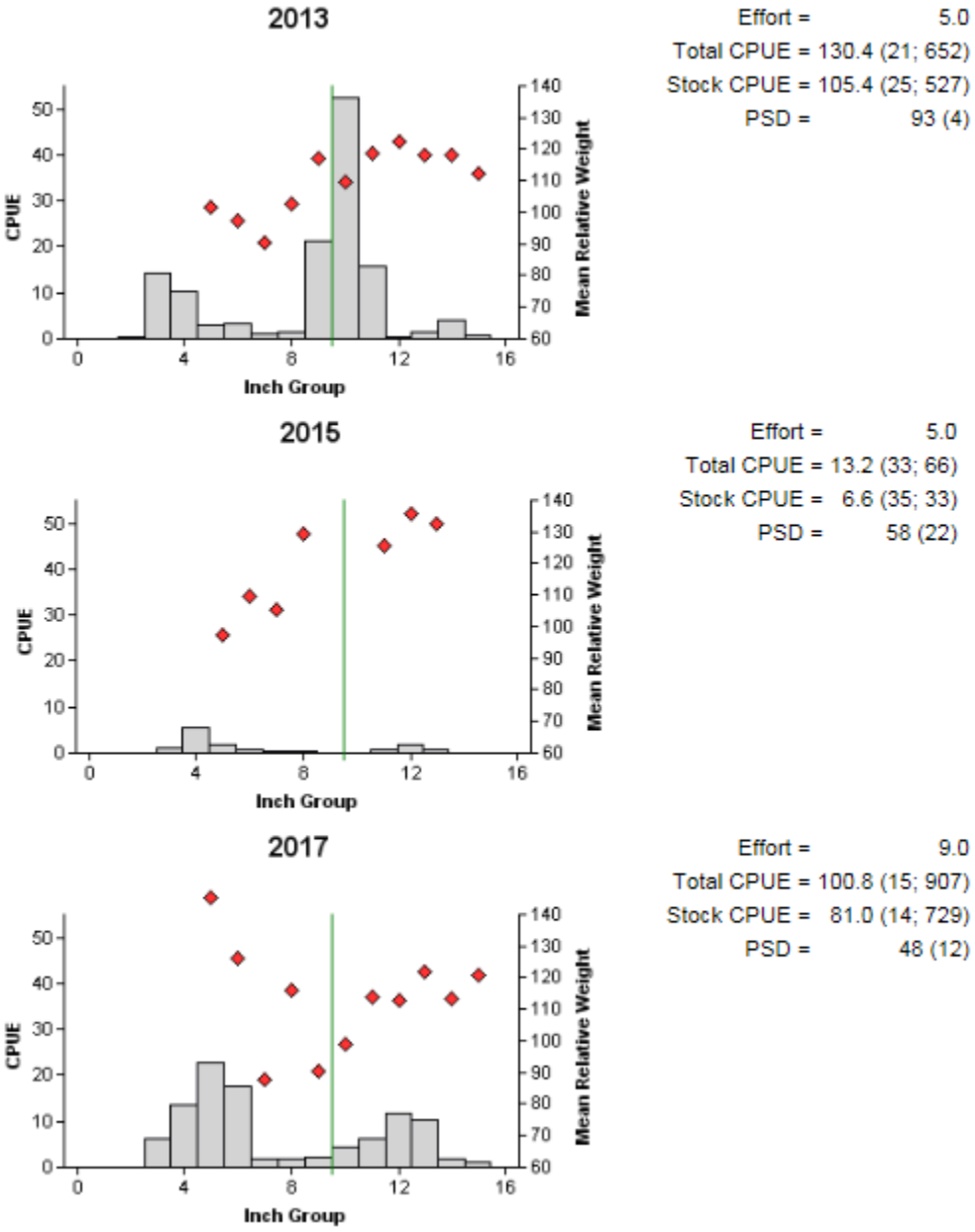


Figure 7. Number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Daniel Reservoir, Texas, 2013, 2015, and 2017. Vertical line indicates the minimum length limit.

Proposed Sampling Schedule

Table 9. Proposed sampling schedule for Daniel Reservoir, Texas. Survey period is June through May. Tandem hoop netting surveys are conducted in the summer, gill netting surveys are conducted in the spring, while electrofishing and trap netting surveys are conducted in the fall. Standard surveys are denoted by S.

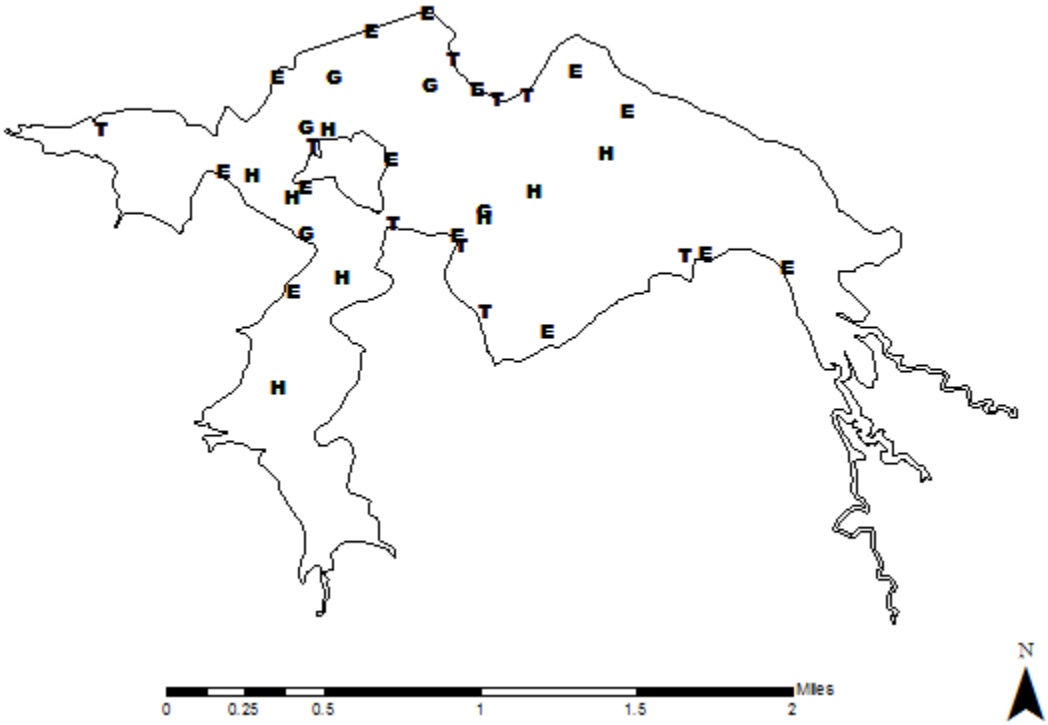
	Survey year			
	2018-2019	2019-2020	2020-2021	2021-2022
Angler Access				S
Structural Habitat				
Vegetation				S
Electrofishing – Fall				S
Electrofishing – Spring				
Electrofishing – Low Frequency				
Trap Netting				S
Gill Netting				
Baited Tandem Hoop Netting				S
Creel Survey				
Report				S

APPENDIX A – Catch rates for all species from all gear types

Number (N) and catch rate (CPUE) (RSE in parentheses) of all target species collected from all gear types from Daniel Reservoir, Texas, 2016-2017. Sampling effort was 5 net nights for gill netting, 9 net nights for trap netting, and 1.2 hours for electrofishing.

Species	Gill Netting		Trap Netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Gizzard Shad					224	192.0 (31)
Channel Catfish	43	8.6 (30)				
White Bass	28	5.6 (30)				
Green Sunfish					150	128.6 (44)
Warmouth					1	0.9 (100)
Bluegill					538	461.1 (19)
Longear Sunfish					113	96.9 (25)
Redear Sunfish					5	4.3 (47)
Hybrid Sunfish					2	1.7 (68)
Largemouth Bass					75	64.3 (22)
White Crappie			907	100.8 (15)		
Black Crappie			1	0.1 (100)		

APPENDIX B – Map of sampling locations



Location of sampling sites, Daniel Reservoir, Texas, 2016-2017. Trap net, gill net, tandem hoop net, and electrofishing stations are indicated by T, G, H, and E, respectively. Water level was near full pool at time of sampling.

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