Brandy Branch Reservoir

2019 Fisheries Management Survey Report

PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-4

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

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Contents

Survey and Management Summary

Fish populations in Brandy Branch Reservoir were surveyed in 2019 using electrofishing. Historical data are presented with the 2019-2020 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: Brandy Branch Reservoir is a 1,257-acre impoundment of Brandy Branch Creek in the Sabine River Basin located in Harrison County. It is used for power plant cooling and recreation. Structural habitat consisted primarily of inundated timber. Hydrilla continues to be the most dominant aquatic plant species in 2015-2019. Eurasian watermilfoil was discovered in 2007 and has expanded in recent years. Giant salvinia was introduced from a boat trailer in 2008 and immediate efforts to eradicate this invasive species were successful. Several other independent introductions of giant salvinia in the past have also been successfully eradicated to date with herbicide application. Tilapia were discovered in the reservoir in 2015. Their presence is likely attributed to an unauthorized introduction as they were not stocked by Texas Parks and Wildlife.

Management History: Largemouth Bass are the primary sport fish in Brandy Branch reservoir. All sport fish have historically been managed with statewide harvest regulations.

Fish Community

- **Prey species:** Threadfin Shad were present in the reservoir. Electrofishing catch of Gizzard Shad was very low (8.0/h). Sunfish formed the reservoirs forage base. There was a significant increase in the catch rates of both Bluegill (1,237.0/h) and Redear sunfish (120.0/h) observed in 2019 compared to previous surveys.
- **Catfishes:** Due to historically low density and lack of directed angling effort, no sampling was conducted to assess the Channel Catfish population.
- **Largemouth Bass:** Largemouth Bass were abundant and total CPUE in 2019 (68.0/h) has decreased from prior surveys. The majority of fish caught in 2019 were of legal length with moderate body condition. Growth rate of Largemouth Bass was excellent and has increased since the last survey with the average 14-inch fish being 1.4 years.
- **Black Crappie:** Historically, crappie populations have low abundance with Black Crappie being the only crappie species collected during previous surveys. The last Black Crappie collected was in 1993. There has been limited directed angling effort and thus no sampling was conducted to index crappie populations.

Management Strategies: Continue biennial electrofishing surveys in 2021 and 2023. Invasive aquatic species will be monitored annually through vegetation surveys. Due to the continued new giant salvinia introductions, boat ramps will be periodically inspected. Signs and boat ramp stencils have been put in place to remind boaters to clean, drain, and dry their boats to prevent additional spread of invasive vegetation. Provide technical guidance to the controlling authority related to invasive species management.

Introduction

This document is a summary of fisheries data collected from Brandy Branch Reservoir in 2019-2020. 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 2019-2020 data for comparison.

Reservoir Description

Brandy Branch Reservoir is a 1,257-acre impoundment constructed in 1983 on Brandy Branch Creek in the Sabine River Basin. It is located in Harrison County, Texas, near the city of Hallsville. The controlling authority is American Electric Power Company. Primary water uses are power plant cooling and public recreation. Brandy Branch has a watershed of approximately 4.1 square miles, a shoreline length of 17 miles, and a shoreline development index of 4.1. Annual water level fluctuation was 1 to 5 feet with a 5 foot decrease in late 2017 (Figure 1). Supplemental water is pumped in from Big Cypress River, below Lake O' the Pines, by the controlling authority to maintain sufficient water level for power plant cooling. Structural habitat consisted primarily of inundated timber with hydrilla being the most abundant aquatic plant. Tilapia were discovered in the reservoir in 2015. The source of their introduction to the reservoir is unknown. Other descriptive characteristics for Brandy Branch Reservoir are in Table 1.

Angler Access

Brandy Branch Reservoir has one public boat ramp. Additional boat ramp characteristics are in Table 2. Shoreline access is limited to the public boat ramp area. However, bank fishing access is available to public groups (e.g. Boy Scouts, Girl Scouts, high school groups, etc.) that request to the use of Pirkey Environmental Park.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Bister and Wright 2016) included:

1. Monitor aquatic invasive vegetation around the boat ramp where giant salvinia has been observed and where separate introductions have been eradicated in the past.

   Action: Annual surveys for invasive aquatic vegetation have been conducted as well as periodic inspections of the public boat ramp. Giant salvinia was observed at the Brandy Branch boat ramp in the spring of 2019. Herbicide was applied and a floating boom was placed around the boat ramp to contain any remaining vegetation. The boat ramp was then periodically monitored for any spread in or re-introduction of giant salvinia. To date, live giant salvinia has not been observed since the controlling actions in the spring and summer of 2019. We continued to coordinate and work with the controlling authority to monitor and manage all invasive aquatic vegetation.

2. Manage aquatic invasive vegetation around the Pirkey Environmental Park to promote good fishing access.

   Action: Aquatic invasive vegetation has been treated around the park shoreline and fishing pier as necessary to facilitate angling access; especially during special events.

3. Invasive species continue to threaten Texas waters.

   Action: Efforts have been made to provide information about invasive species to the controlling authority and the public. Appropriate signs and boat ramp stencils have been erected to inform boats and anglers of the necessity to clean, drain, and dry their boat. American Electric Power transfers water from Big Cypress Bayou below Lake O' the

Pines to Brandy Branch Reservoir to maintain water levels. This inter-basin water transfer is documented to facilitate any future invasive species responses.

Harvest regulation history: Sport fishes in Brandy Branch Reservoir are currently managed with statewide regulations (Table 3).

Stocking history: Brandy Branch Reservoir was stocked initially with Florida Largemouth Bass, Channel Catfish, Coppernose Bluegill, Redear Sunfish, and Green Sunfish in 1983. Gizzard Shad and Threadfin Shad were stocked to supplement the prey base in the late ‘80s and early ‘90s. To improve angling for Pirkey Environmental Park, Channel Catfish were stocked in 2015. The complete stocking history is presented in Table 4.

Vegetation/habitat management history: Hydrilla continues to be the most dominant aquatic vegetation but has not presented frequent angling access problems in Brandy Branch Reservoir, requiring only limited treatment. Giant salvinia and water hyacinth were first introduced in 2008. Both were swiftly eradicated with the help of herbicide application and physical removal. Separate introductions of giant salvinia have occurred since, most recently in the spring of 2019. After the introduction in 2019, TPWD responded quickly to eradicate the giant salvinia through herbicide application and physical removal. A floating boom was also erected to minimize the spread to other locations on the reservoir. No additional giant salvinia plants have been observed to date.

Water transfer: Brandy Branch Reservoir receives water from Big Cypress Bayou (below Lake O’ the Pines) to maintain adequate water level for power plant operation. As such, inter-basin water transfer occurs from the Cypress Creek Basin into the Sabine River Basin.

Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Brandy Branch Reservoir (Bister and Wright, 2016). 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 2017).

Electrofishing – Largemouth Bass, sunfishes, Gizzard Shad, and Threadfin Shad were collected by nighttime electrofishing in the fall (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 13 randomly-selected fish (range 13.0 to 14.9 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_r)] were calculated for target fishes according to Anderson and Neumann (1996). Standard error (SE) was calculated for structural indices. Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUEs.

Habitat – A structural habitat survey was conducted in 2011. Vegetation surveys were conducted in 2016 – 2019. Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2017).

Water level – Source of water level data was American Electric Power.

Results and Discussion

Habitat: Structural habitat was last assessed in 2011 and consisted primarily of standing timber (240 acres) and natural shoreline (Bister and Wright 2012; Table 6). Structural habitat has not substantially changed since 2011. Hydrilla was the dominant aquatic vegetation and coverage has been relatively consistent from 2016 to 2019 (Table 7). Eurasian watermilfoil was still present in the reservoir and acreage has remained consistent since 2016 (range: 48.0 – 57.0 acres; Table 7). Less than 5% of the reservoir area contained native vegetation including cutgrass, American lotus, pondweed, and coontail.

Prey species: Gizzard Shad and Threadfin Shad are present in the reservoir but have relatively low catch rates (8.0/h and 61.0/h, respectively; Appendix A). Tilapia are also present in the reservoir and adds an additional prey species. Both shad species and Tilapia do contribute to the forage base, but sunfish make up the majority of the forage available to predator species. Total CPUE of Bluegill in 2019 (1,237.0/h) was considerably higher than total CPUE from surveys in 2015 and 2017 (279.0/h and 282.0/h, respectively). While the size structure of Bluegill continued to be dominated by small individuals (≤5 inches in length; Figure 2). Redear sunfish CPUE also substantially increased in 2019 (120.0/h) relative to 2015 and 2017 (11.0/h and 7.0/h, respectively). Redear sunfish size structure had a good number of small individuals and several larger fish up to 10 inches were collected providing recreational angling opportunities (Figure 3).

Largemouth Bass: The total CPUE of Largemouth Bass in 2019 was 68.0/h, less than 123.0/h in 2015 and 81.0/h in 2017 (Figure 4). Additionally, stock-sized (≥ 8 inches) CPUE decreased from 94.0/h in 2015 to 60.0/h in both 2017 and 2019. While CPUE has decreased, the size structure has improved, reflecting an increase in the proportion of large individuals as evidenced by PSD indices (2019 PSD = 59; Figure 4). The catch rate of fish 14 inches or greater almost doubled from 13.0/h in 2017 to 35.0/h in 2019 with > 50% of fish in 2019 being legal length (Figure 4). Largemouth Bass growth rates remained relatively fast in Brandy Branch from 2015 to 2019. Age at legal length (14 inches) was 2.0 years (N=13; range = 1 – 2 years) in 2015 and 1.4 years (N = 14; range = 1 – 2 years) in 2019. There was a slight decline in body condition in 2019 from the previous two surveys with roughly half the size classes exhibiting relative weights below 90 (Figure 4).

Fisheries Management Plan for Brandy Branch Reservoir, Texas

Prepared – July 2020

ISSUE 1: Hydrilla was first documented in this reservoir in 1990. The controlling authority occasionally reports issues with keeping intake screens clean of hydrilla fragments. Eurasian watermilfoil was detected in 2007 but has remained at relatively low coverage. At times, the hydrilla, Eurasian watermilfoil, and other plants inhibit good fishing access along the shoreline and the pier in the Pirkey Environmental Park that is used by public user groups (e.g. Boy Scouts, Girl Scouts, fishing clubs, etc.) for fishing events. Giant salvinia was introduced during February 2008 by a boater. The immediate response to contain, remove, and spray with herbicide resulted in the elimination of the infestation. There have been several similar introductions since including the spring of 2019. A floating boom was erected around the boat ramp to contain giant salvinia spread, sprayed with herbicide, and physically removed.

MANAGEMENT STRATEGY

1. Provide technical guidance to American Electric Power Company regarding invasive aquatic plant management including aquatic plant management in Pirkey Environmental Park.
2. Work with American Electric Power Company to maintain the installed floating containment booms at the boat ramp in order to capture any floating invasive plants that are introduced by boaters in the future. The booms have been placed to allow boats to navigate but any plants coming from a boat trailer would be held in the immediate area. During periodic inspections of the containment area, any plants present can be removed by hand and/or treated with herbicide. We hope this strategy will continue to provide optimal protection for the rest of the reservoir by confining any introductions to the boat ramp.
3. Continue to work with TPWD Game Wardens to patrol the boat ramp and check boat trailers for invasive species.
4. Conduct annual surveys to monitor trends and estimate coverage of invasive aquatic plants.

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 (2020–2024)

Sport fish, forage fish, and other important fishes

Largemouth Bass is the primary sport fish in Brandy Branch Reservoir. The most important forage species is Bluegill. Threadfin Shad and Redear Sunfish were present in the most recent survey, but in low numbers. Gizzard Shad have been present in the past, but abundance has historically been very low. The proposed sampling schedule to meet the following OBS plan can be found in Table 8.

Low-density fisheries

Channel Catfish: Channel catfish are present in Brandy Branch Reservoir, but population abundance is extremely low likely attributed to high water clarity, abundant submersed aquatic vegetation, and potential predation from Largemouth Bass on smaller size classes and young of year fish. Gill netting surveys in 2008 and 2012 only caught three Channel Catfish in each year. A creel survey from December 2015 through February 2016 indicated that no directed effort or catch of Channel Catfish occurred. Sampling this population is unnecessary in 2021 – 2024.

Crappie: Trap netting surveys were discontinued in this reservoir due to historically low catch rates. No White Crappie have been caught during any survey and the last survey to collect Black Crappie was in 1993, in which one fish was caught. During the most recent angler creel survey during winter 2015/2016, only 1% of directed effort was toward crappie. Sampling this population is unnecessary in 2021 – 2024.

Survey objectives, fisheries metrics, and sampling objectives

Largemouth Bass: Largemouth Bass are the most popular sport fish in Brandy Branch Reservoir. An angler creel survey conducted December 2015 through February 2016 indicated 98.6% of directed angling effort was for Largemouth Bass. Largemouth Bass have always been managed with the statewide 14-in MLL regulation. Trend data on CPUE, size structure, growth, and body condition have been collected biennially since 1996 with fall nighttime electrofishing. Continuation of biennial trend data in this reservoir with night electrofishing in the fall will allow for determination of any large-scale changes in the Largemouth Bass population that may spur further investigation.

Fall nighttime electrofishing surveys will be conducted in 2021 and 2023 to assess relative abundance (CPUE), size structure (PSD and length frequency), growth, and condition (W_r using lengths and weights from 5 fish per inch group). A minimum of 12 randomly selected 5- min electrofishing sites will be sampled and will continue at an additional 6 randomly selected stations until 50 stock-size fish are collected and the RSE of CPUE-S is < 25. Past sampling has consistently achieved RSE of CPUE-S < 25, so we are confident we will achieve this level of precision with the minimum sampling effort. Otoliths from 13 fish between 13.0 and 14.9 inches will be collected in 2021 and 2023 to determine mean age at 14 inches to monitor large-scale changes in growth that may indicate the need for further investigation. We will continue to monitor W_r, especially in larger fish where recent W_r have declined, to detect any negative impacts hydrilla abundances may have on feeding efficiency. Due to consistent Florida Largemouth Bass genetic influence in the population, and no anticipated stocking plans, genetic analysis will only be conducted once every 8 years beginning in 2023.

Prey Species: Bluegill is the primary prey species at Brandy Branch Reservoir. Redear Sunfish are also present in increasing densities though not in high enough densities to be a primary prey species. Like Largemouth Bass, trend data on CPUE and size structure of Bluegill and Redear Sunfish have been collected biennially since 1996. Continuation of sampling, as per Largemouth Bass, will allow for

monitoring of large-scale changes in prey species relative abundance and size structure. Sampling effort based on achieving sampling objectives for Largemouth Bass will result in sufficient numbers of Bluegill and Redear Sunfish for size structure estimation (PSD; 50 fish at a minimum of 12 stations with 80% confidence). RSE for relative abundance estimates has been < 25 of CPUE-Total using the traditional 12 randomly-selected stations during the past three electrofishing surveys. No additional effort will be expended to achieve an RSE ≤ 25 for CPUE-Total of Bluegill 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. Relative weight of largemouth bass > 8 inch TL will be determined from their length/weight data (maximum of 10 fish weighed and measured per inch class).

Gizzard Shad and Threadfin Shad are present in the reservoir but in low densities. They are not considered primary prey species. Documentation of their presence/absence during fall electrofishing surveys will continue in fall 2021 and 2023.

Creel Survey: An angler creel survey will be conducted December 2023 through February 2024 for general monitoring of total fishing effort, angler expenditures, directed angling effort for all sport fish, catch rates, and number of fish harvested.

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Tables and Figures

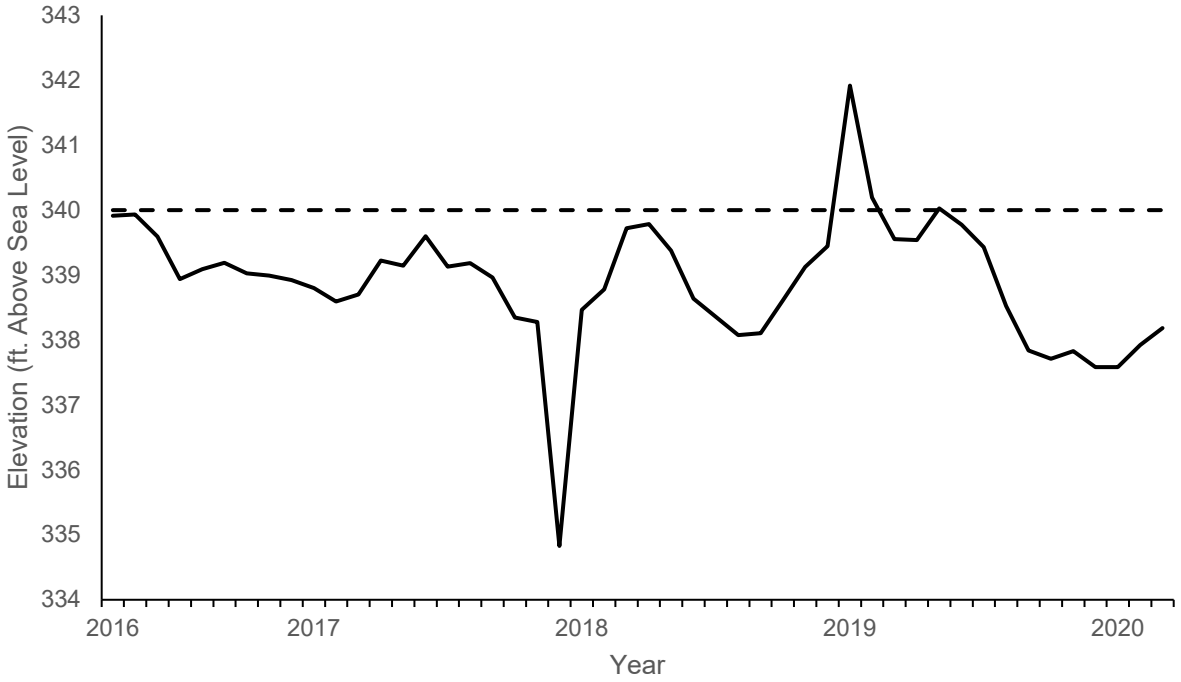


Figure 1. Monthly water level elevations in feet above mean sea level (MSL) recorded for Brandy Branch Reservoir, Texas by the American Electric Power. Conservation pool elevation = 340.0 feet MSL.

Table 1. Characteristics of Brandy Branch Reservoir, Texas.

Characteristic	Description
Year constructed	1983
Controlling authority	American Electric Power Company (AEP)
County	Harrison
Reservoir type	Tributary/Cooling
Shoreline Development Index	4.1
Conductivity	364 µS/cm

Table 2. Boat ramp characteristics for Brandy Branch Reservoir, Texas, August, 2015. Reservoir elevation at time of survey was 338.5 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Public ramp	32.437993 -94.46505	Y	30	*	Excellent, no access issues

* End of ramp is unknown due to sand.

Table 3. Harvest regulations for Brandy Branch Reservoir, Texas.

Species	Bag limit	Length limit
Catfish, Channel	25	12-inch minimum
Catfish, Flathead	5	18-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 Brandy Branch Reservoir, Texas. FRY = fry; FGL = fingerling; AFGL = advanced fingerling; ADL = adults; UNK = unknown.

Species	Year(s) Stocked	Number of Years	Number Stocked	Life Stage
Black crappie	1990	1	78,648	
	Total		78,648	
Bluegill	1993	1	416,780	FGL
	1993	1	9,984	FRY
	Total		426,764	
Channel Catfish	1983 - 1986	2	133,404	AFGL
	1984 - 1986	2	70,687	FGL
	2004	1	10,624	AFGL
	2004	1	64,412	FGL
	2015	1	6,565	ADL
	Total		285,692	
Coppernose Bluegill	1983	1	123,000	UNK
	1985	1	88,014	FRY
	Total		211,014	
Flathead Catfish	1983	1	16	UNK
	Total		16	
Florida Largemouth Bass	1983	1	120,952	FRY
	1984	1	242,000	FGL
	Total		362,952	
Gizzard Shad	1991	1	1,260	UNK
	1992	1	1,000	UNK
	Total		2,260	
Green Sunfish	1983	1	67,200	UNK
	Total		67,200	
Redear Sunfish	1983	1	129,450	UNK
	Total		129,450	
Threadfin Shad	1986	1	1,500	AFGL
	1991 - 1992	2	2,490	ADL
	Total		3,990	
White Crappie	1986	1	170	ADL
	1987	1	15,072	FRY
	Total		15,242	

Table 5. Objective-based sampling plan components for Brandy Branch Reservoir, Texas 2019–2020.

Gear/target species	Survey objective	Metrics	Sampling objective
Electrofishing			
Largemouth Bass	Abundance	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	10 fish/inch group (max)
Bluegill [a]	Abundance	CPUE–Total	RSE ≤ 25
	Size structure	PSD, length frequency	N ≥ 50
Gizzard Shad [a]			Presence/Absence
Threadfin Shad [a]			Presence/Absence

[a] No additional effort was expended to achieve an RSE ≤ 25 for CPUE of Bluegill and shad species if not reached from designated Largemouth Bass sampling effort.

Table 6. Survey of structural habitat types, Brandy Branch Reservoir, Texas, 2011 (Bister and Wright, 2012). Shoreline habitat type units are in miles and standing timber is acres.

Habitat type	Estimate	% of total
Natural	17.2 miles	97.0
Concrete	0.5 miles	3.0
Standing Timber	240.0 miles	19.0

Table 7. Survey of aquatic vegetation, Brandy Branch Reservoir, Texas, 2016–2019. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Vegetation	2016	2017	2018	2019
Native submersed				20.0 (1.6)
Native floating-leaved				2.0 (0.2)
Native emergent				24.0 (1.9)
Non-native				
Giant salvinia (Tier I)*	0[a]	0[a]	0[a]	0[a]
Hydrilla (Tier III)*	340.0 (27.0)	342.0 (26.6)	430.0 (34.2)	443.0 (35.2)
Eurasian Milfoil (Tier III)*	48.0 (3.8)	50.0 (4.0)	50.0 (4.0)	57.0 (4.5)

*Tier I is immediate Response, Tier III is Watch Status

[a] Giant Salvinia not found during surveys, but has been repeatedly found at the boat ramp and control measures implemented.

Bluegill

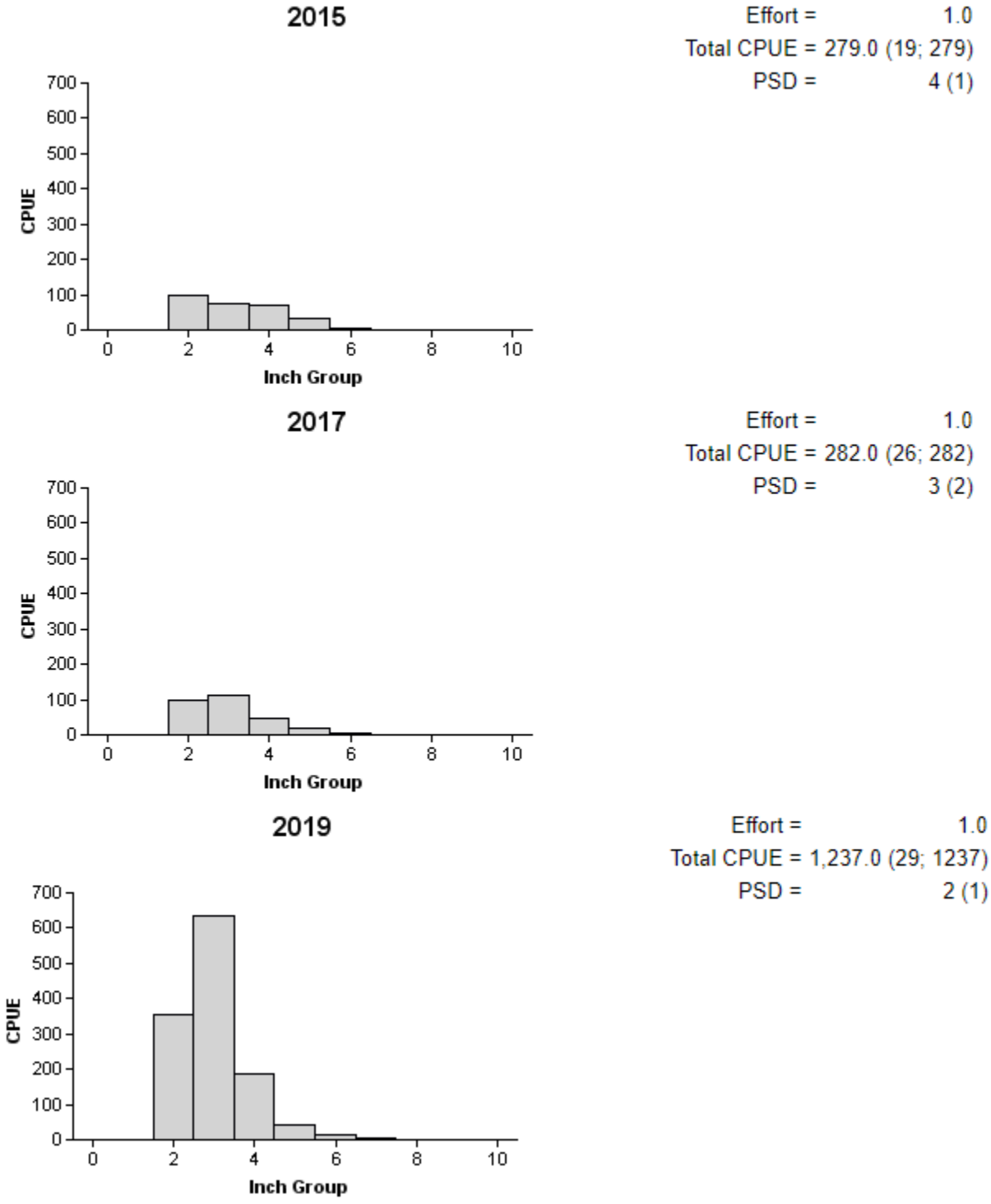


Figure 2. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Brandy Branch Reservoir, Texas, 2015, 2017, and 2019.

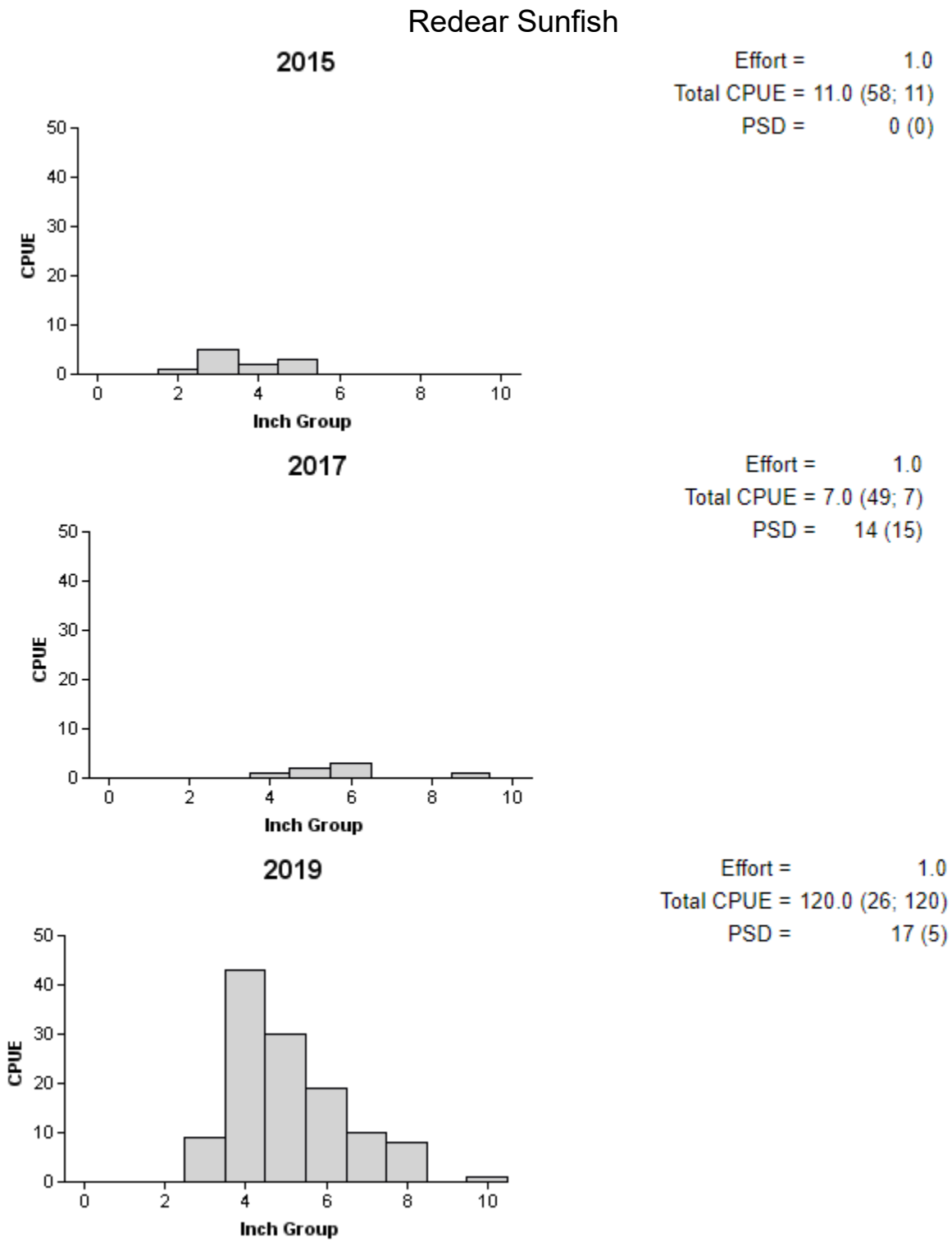


Figure 3. Number of Redear sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Brandy Branch Reservoir, Texas, 2015, 2017, and 2019.

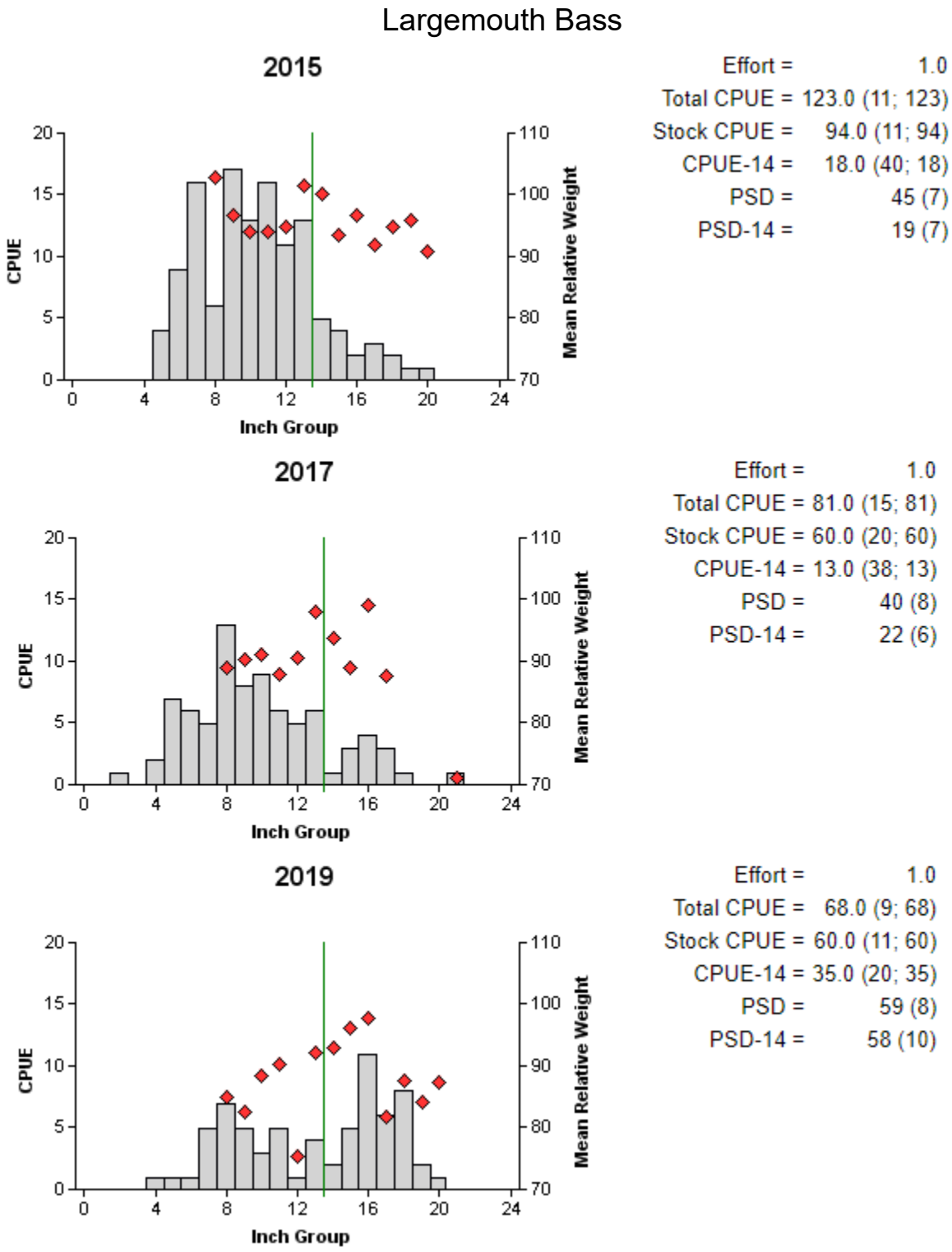


Figure 4. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Brandy Branch Reservoir, Texas, 2015, 2017, and 2019.

Proposed Sampling Schedule

Table 8. Proposed sampling schedule for Brandy Branch Reservoir, Texas. Survey period is June through May. Electrofishing surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

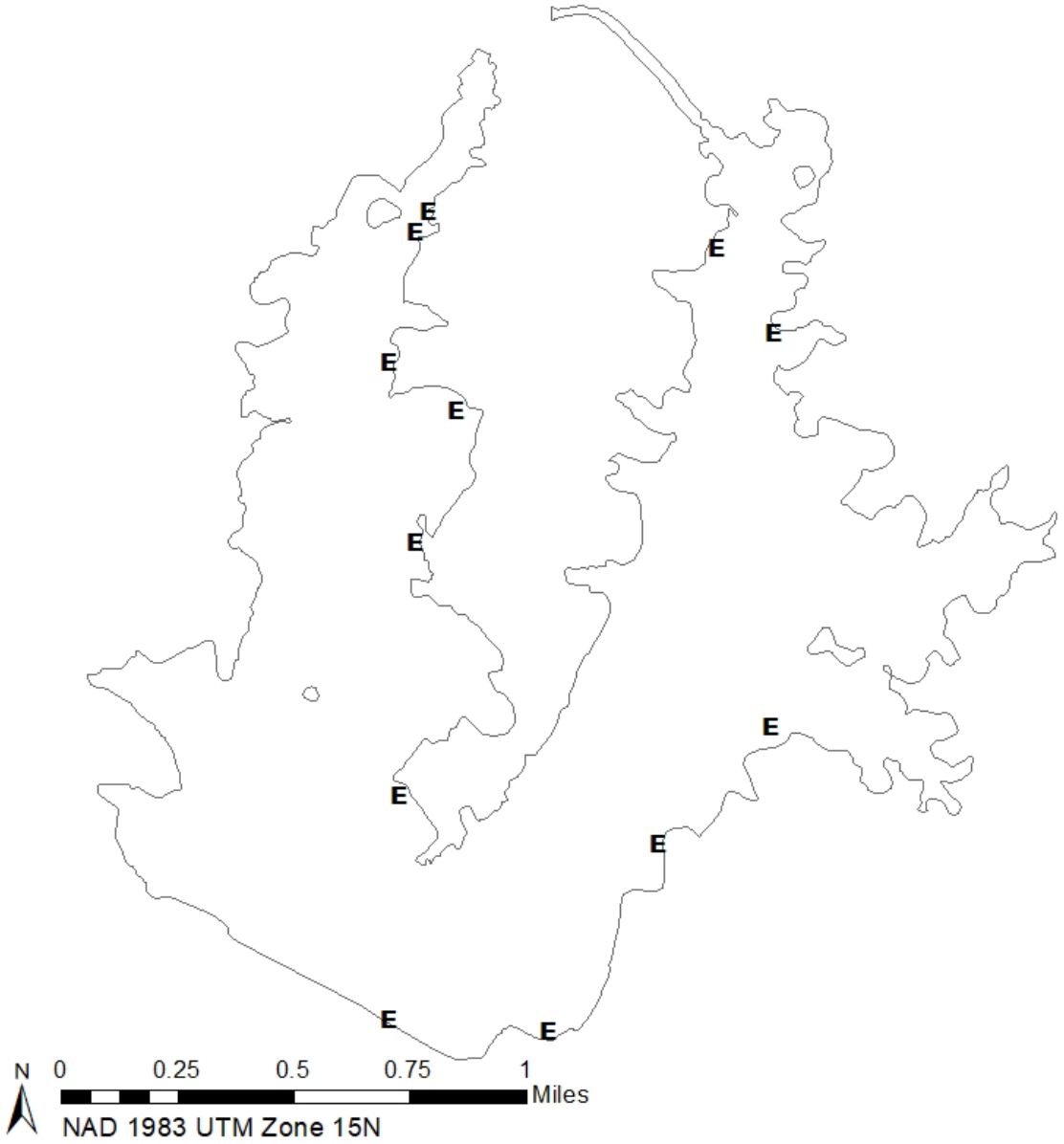
	Survey year			
	2020-2021	2021-2022	2022-2023	2023-2024
Angler Access				S
Vegetation	A	A	A	S
Electrofishing – Fall		A		S
Creel survey				S
Report				S

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 electrofishing surveys from Brandy Branch Reservoir, Texas, 2019-2020. Sampling effort was 1 hour for electrofishing.

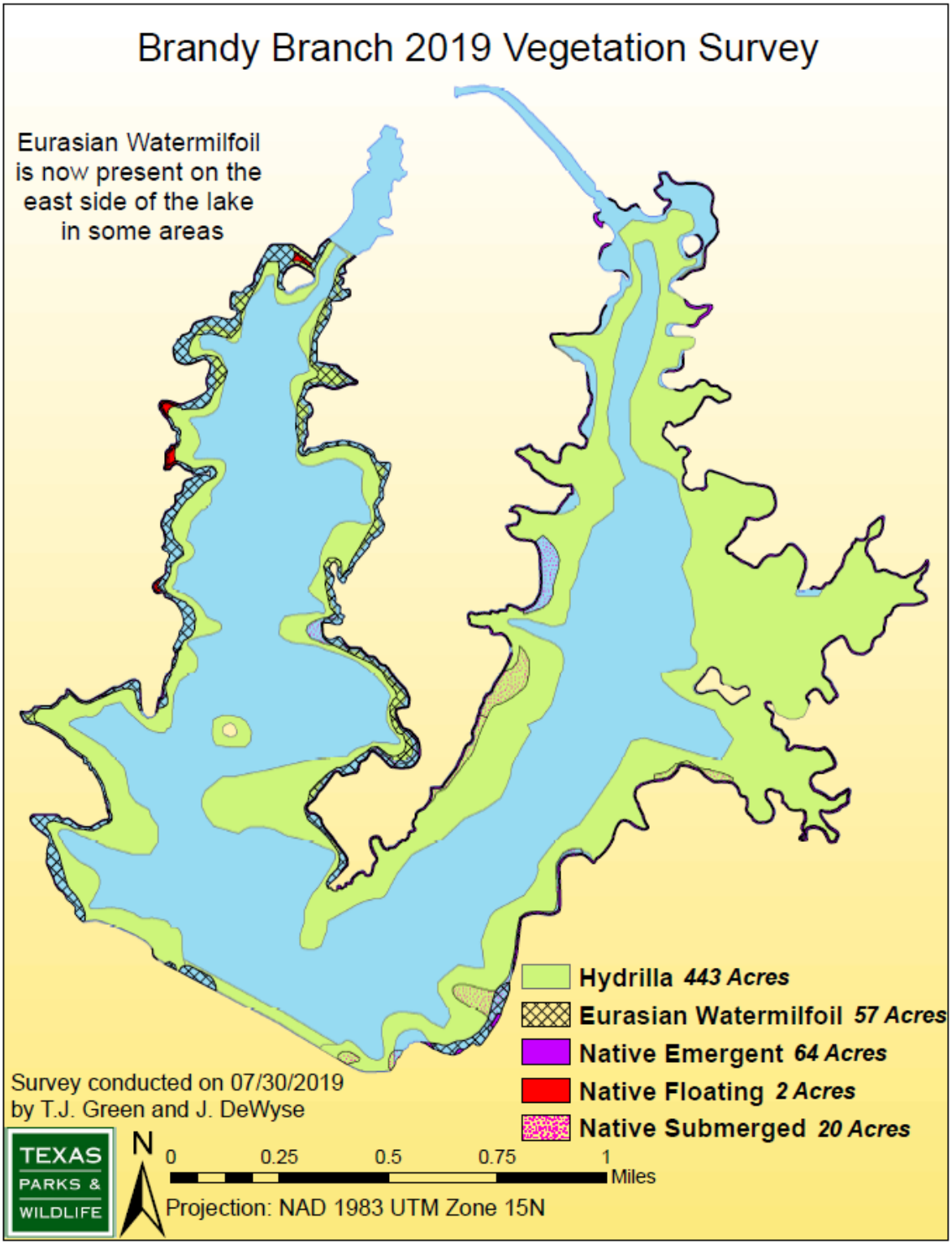
Species	Electrofishing	
	N	CPUE
Gizzard Shad	8	8.0 (100)
Threadfin Shad	61	61.0 (35)
Warmouth	3	3.0 (100)
Bluegill	1237	1237.0 (29)
Redear Sunfish	120	120.0 (26)
Largemouth Bass	68	68.0 (9)

APPENDIX B – Map of sampling locations



Location of sampling sites, Brandy Branch Reservoir, Texas, 2019-2020. Electrofishing stations are indicated by an E. Water level was 3 feet low at the time of sampling.

Appendix C – 2019 Distribution map of aquatic vegetation



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