

Whitney 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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Survey and Management Summary

Fish populations in Whitney Reservoir were surveyed in 2019 using electrofishing and in 2020 using gill nets. 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: Whitney Reservoir is a 23,200-acre impoundment of the Brazos River, in Bosque and Hill Counties. Water level has fluctuated from 6 feet below conservation pool (approximately 527.0 feet above mean sea level [MSL]) to 22 feet above conservation pool (approximately 555.0 feet above MSL) since 2015. Water levels were six feet low during the 2019 electrofishing survey and 4 feet low during the 2020 gill net survey. Fish habitat at the time of sampling was dominated by natural rock shorelines. Boat access (23 ramps) on the reservoir is excellent.

Management History: Important sport fish include Striped Bass, White Bass, Largemouth Bass, White Crappie, and catfishes. All have been impacted by periodic toxic golden alga blooms which started in 2001. Efforts to mitigate these losses have included enhanced collection of fisheries data, annual Striped Bass stockings, and Smallmouth Bass stocking requests. Golden alga was not a major issue during the four years covered by this report. Recent management efforts include cooperating with the controlling authority to post appropriate signage at access points to try and prevent the spread of the invasive zebra mussel into the reservoir.

Fish Community

- **Prey species:** Threadfin Shad, Gizzard Shad and Bluegill catch rates were above historical averages. Other minor forage species included Redear Sunfish, Longear Sunfish, Green Sunfish, Warmouth and Redbreast Sunfish.
- **Catfishes:** The Blue Catfish catch rate was the highest on record and the Channel Catfish catch rate was well above the historical average. Individuals of both species were in good body condition.
- **Temperate Bass:** The White Bass catch rate was well above the historical average and body condition was good. The Striped Bass catch rate was higher than any other year except in 1991 and body condition was also good.
- **Black Bass:** The Largemouth Bass catch rate was the highest on record and body condition was good to excellent although it declined with increasing length. Most importantly, catch rate of legal-sized fish increased. Smallmouth Bass were not collected, but Spotted Bass were collected at a low rate.
- **White Crappie:** White Crappie were collected with a non-standard gear and in too few numbers to draw any meaningful conclusions.

Management Strategies: Continue managing sport fishes at Whitney Reservoir with statewide regulations. Continue requesting Smallmouth Bass stockings. Evaluate effects of river inflows on the Striped Bass population using a variety of approaches. Conduct access and vegetation surveys in summer 2023, and general monitoring surveys with electrofishing, gill nets, and an angler creel survey in 2023 and 2024. Maintain invasive species signage and inform the public about the negative impacts of aquatic invasive species.

Introduction

This document is a summary of fisheries data collected from Whitney 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 2015-2016 data for comparison.

Reservoir Description

Whitney Reservoir is a 23,200-acre impoundment of the Brazos River in Bosque and Hill counties and was completed in 1951. It is owned and operated by the United States Army Corps of Engineers (USACE) and primary water uses include power generation, flood control, and recreation. The reservoir has a drainage area of 17,656 square miles, a storage capacity of 627,100 acre-feet, and a shoreline length of 225 miles at the conservation pool of 533 feet above MSL. Whitney Reservoir is eutrophic with a TSI *chl-a* of 59.12 (Texas Commission on Environmental Quality 2015). Habitat at time of sampling was dominated by natural and rock shoreline, rock bluff, with a few piers and boat docks (Table 6). Littoral vegetation is dominated by common buttonbush with some giant reed, which is an invasive species (Table 7). Water level has varied from 6 feet below conservation pool (approximately 527.0 feet above MSL) to over 22 feet above conservation pool (approximately 559.0 feet above MSL) since 2015. Water levels were six feet low during the 2019 electrofishing survey and four feet low during the 2020 gill netting survey. Other descriptive characteristics for Whitney Reservoir are in Table 1.

Angler Access

Whitney Reservoir has 23 public boat ramps including several marina boat ramps (Table 2). Much of Whitney Reservoir's shoreline is accessible to anglers through USACE and other publicly-owned property; however convenient shoreline access is limited to the public boat ramp and camping areas.

Management History

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

1. Continue annual stocking requests of Smallmouth Bass.

Action: Smallmouth stockings have been requested every year and 24,133 were stocked in 2020.

2. Publicize the large numbers of striper available for catch. Evaluate angling pressure and economic impact.

Action: Authored the Lake Whitney Fishing Forecast through 2019, when the current online host for the article became defunct. Promoted the striper fishery using social media, outdoor writers, and when talking to angler groups. The planned year-long creel was reduced to a spring quarter creel which was then cancelled due to the onset of Covid 19.

3. Cooperate with the controlling authority to post appropriate invasive species signage at access points throughout the reservoir. Educate the public about invasive species using social and other media. Make a speaking point about invasive species when presenting to constituent and user groups. Keep track of (i.e., map) all existing and future inter-basin water transfer routes to facilitate potential invasive species responses.

Action: Invasive species signage was maintained at all Whitney Reservoir access points. District biologists have made a speaking point about invasive species over the past

several years and included . Inter-basin water transfers will be updated as needed.

Harvest Regulation History: All sport fishes are currently managed with statewide regulations (Table 3).

Stocking History: Whitney Reservoir received stockings of Striped Bass from 2016 through 2019, and Smallmouth Bass in 2020. The complete stocking history is in Table 4.

Vegetation/habitat management history: Invasive aquatic vegetation has never been an issue in Whitney Reservoir. The size of the reservoir and fluctuating water levels makes any attempt to improve habitat very difficult beyond deploying fish attractors.

Water Transfer: There are currently no major raw water intake stations on the reservoir. However, the Brazos River Authority has water rights and a contract with the USACE to use approximately 50,000 acre-feet of water per year from the reservoir. Currently, this water is released through the dam to meet water supply needs downstream. There is also a proposal to install a raw water intake station on Whitney Reservoir to be used by the city of Cleburne for municipal purposes. If constructed, the City of Cleburne could withdraw up to 10,000 acre-feet of water per year from the lake. This volume of water is relatively small in comparison to the size of Whitney Reservoir and represents only about six inches of depth when the lake is full.

Reservoir capacity: Whitney Reservoir was impounded in 1951. A US Army Corps of Engineers resurvey conducted in 1959 calculated the reservoir's capacity at conservation pool (533 feet above MSL) to be 627,100 acre-feet with a surface area of 23,560 acres. A volumetric survey was conducted by the Texas Water Development Board (TWDB) on Whitney in 2005. This survey found a volume of 554,203 acre-feet and a surface area of 23,200 acres at conservation pool elevation. The difference between the two surveys suggests an 11.6% decrease in volume and 1.4% decrease in surface area.

Methods

Surveys were conducted to achieve objectives in accordance with the objective-based sampling (OBS) plan for Whitney Reservoir (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 2017).

Electrofishing – Largemouth Bass, sunfishes, Gizzard Shad and Threadfin Shad were collected by electrofishing (23, 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.

Gill netting – White and Striped Bass, Blue Catfish, Channel Catfish, and White Crappie were collected by gill netting (10 net nights at 10 stations). Catch per unit effort for gill netting was recorded as the number of fish caught per net night (fish/nn). For Striped Bass, all stock-size and larger fish were aged. Only 6 of the 56 fish less than stock size were aged, and comprised of the largest individuals of that cohort. Based on these data, all sub-stock size Striped Bass were presumed to be from the 2019-year class.

Genetics – Genetic analysis of Largemouth Bass was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2017). 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 statistics.

Golden alga – Water samples were collected on a monthly basis during winter every year and tested for the presence of golden alga and toxicity at the A. E. Wood Laboratory in San Marcos.

Habitat –Vegetation surveys were conducted using an adaptation of the point method during 2015 and 2019 (TPWD, Inland Fisheries Division, unpublished manual revised 2017). Points were randomly generated on the shoreline and averaged a minimum of one point per shoreline mile. Aquatic vegetation has generally been found close to the shore in Whitney Reservoir, so stratifying the random points to exclude deep-water areas increased precision and resulted in better data. Only vegetation available to fish as habitat during the time of the survey was reported on.

Water level – Source for water level data was the United States Geological Survey (USGS 2020).

Results and Discussion

Habitat: Whitney is a mainstem reservoir with stained water in the upper end and clear, deep water in the lower end. Habitat was last surveyed in 2011 and consisted primarily of natural shoreline, rocky shoreline, and rock bluff (Tibbs and Baird, 2012). A full vegetation survey conducted during summer 2015 found dominant shoreline vegetation to be common buttonbush (*Cephalanthus occidentalis*) (37%) and one noxious species of vegetation, giant reed (*Arundo donax*), which comprised 2.5% of the littoral shoreline (Table 6). No aquatic vegetation was observed during the summer 2019 survey of 236 random shoreline points. The lack of buttonbush as aquatic habitat is due to 5' lower water during the 2019 survey as compared to the 2015 survey. None of the buttonbush was anywhere near the water's edge.

Prey species: Threadfin and Gizzard Shad were collected by electrofishing at catch rates of 51.6/h and 127.8/h respectively in 2019, down from 2015 but similar to historical averages (Figure 2 and Appendices A and B). The IOV for Gizzard Shad was good, with 92% of Gizzard Shad available to existing predators as forage although most were small. The Bluegill catch rate was 193.0/h, down from 2015 but well above the historical average (Figure 3 and Appendices A and B). Some fish exceeding eight inches were present. Other forage species collected included Longear Sunfish (9.9/h), Redear Sunfish (4.7/h), Redbreast Sunfish (9.9/h) Warmouth (1.0/h), and Green Sunfish (4.2/h), (Appendices A and B).

Catfishes: Blue Catfish were collected from gill nets at 6.8/nn in 2020, easily a historical high (Figure 4; Appendices A and B). The OBS target of 50 stock-size fish was achieved. The PSD remained similar to the previous survey but catch rates of fish larger than 20" increased. Catch of fish between 12" and 16" also increased, suggesting better spawning and recruitment in recent years. Body condition (*Wr*), ranged from good to excellent and generally increased with size.

Channel Catfish were collected from gill nets at 4.7/nn in 2020, similar to 2016 and well above the historical average (Figure 5; Appendices A and B). A total of 47 fish were collected so the OBS target of 50 stock-size fish was not achieved. Proportional size distribution was 46, indicative of a balanced population. Body condition was good to excellent and generally increased with size.

Flathead Catfish are a low-density population in Whitney Reservoir, and are generally caught incidentally to other targeted species. This species was not targeted or collected during the 2020 survey, but are still included in Appendices A and B.

Temperate Bass: White Bass were collected from gill nets at a catch rate of 8.1/nn in 2020, similar to 2016 and well above the historical average (Figure 6; Appendix A and B). The OBS target of 50 stock-size fish was achieved. The PSD for White Bass (79) increased from the previous survey due to higher catch rates of legal-sized fish. Body condition was good with relative weights averaging around 90.

Striped Bass were collected from gill nets at a catch rate of 8.6/nn in 2020, an increase over 2016, well above the historical average, and the highest catch rate since 1991 (Figure 7; Appendix A and B). The

OBS target of 50 stock-size fish was achieved. The catch rate of legal-sized Striped Bass remained similar to 2016 but the 2018 year-class was mostly missing. Body condition was generally good with relative weights averaging around 95 although it was depressed in some cases due to the presence in the sample of three stripers with only one eye.

The missing year-class and injured stripers was likely due to two events. The first is a fish kill/injury event investigated on July 9, 2019 in the lower end of the lake. During the investigation scattered dead Striped Bass were observed on the lower end of the reservoir. In addition, many Striped Bass were observed swimming aimlessly near the surface in the backs of Little Rocky and Big Rocky Creeks. A specimen was netted that had both eyes severely damaged, and subsequently many anglers reported seeing the same phenomenon. Later in the year, there were widespread reports from anglers and guides of stripers caught with only one functioning eye, and this was confirmed in our 2020 gill net sample.

The second event was a fish kill on the lower end of the lake that killed primarily small stripers from the 2018 year-class that was investigated on September 5, 2019. Appendix E details the temperature profile data following the September event compared to available historical profile data. The data show that the thermal refuge that is important for Striped Bass survival in the summer did not exist at that time. It is possible that it never formed, or a weak thermocline could have been established that disappeared during a turnover event that caused the observed steeper mortality.

There was strong evidence of natural recruitment in 2019 and possibly 2016 based on high year class strength in the most recent gill net survey, favorable hydrographs for spawning below Granbury reservoir, and historically low stocking rates during those two years (Figure 8, Table 4, and Appendix D). The catch of the 2019 year-class of Striped Bass (N = 56) was the highest ever recorded.

Black Basses: Largemouth Bass were collected by electrofishing at a rate of 181.6/h in 2019. This was lower than the previous survey but well above the historical average for the reservoir (Figure 9 and Appendices A and B). The RSE value for the Largemouth Bass sample was less than 25, which was the desired level of precision in the OBS plan. Proportional size distribution was 38, an increase over the previous survey and reflective of the increased catch of legal-sized fish. Body condition was good but declined with increasing size. Percent Florida Largemouth Bass alleles in 2019 (61%) were similar to 2015 (66%, Table 7). No pure FLMB were observed in the genetic sample.

Smallmouth and Spotted Bass are species with low-density populations in Whitney Reservoir, and are generally caught incidentally to other targeted species. No Smallmouth and only one Spotted Bass were collected during the 2019 electrofishing survey (Appendices A and B).

White Crappie: The OBS plan did not call for any trap netting because it has been ineffective at sampling crappie in Whitney in the past. Only seven White Crappie and 3 Black Crappie were sampled in 2020 using gill nets. Crappie can be effectively targeted by experienced anglers but are not a large component of the fishery.

Fisheries Management Plan for Whitney Reservoir, Texas

Prepared – July 2020

ISSUE 1: The Smallmouth Bass fishery in Whitney Reservoir is mostly dependent on stocking. Golden alga has abated over the past several years, and there have been substantiated reports this spring of larger Smallmouth Bass caught by anglers indicating that golden alga hasn't been a problem for the population for some time. Smallmouth Bass fingerling production continues to be an issue for our hatcheries. Since there is a limited supply, optimizing allocation among several Smallmouth Bass fisheries in Central Texas is another way to improve availability. A recent management research project found that natural recruitment of Smallmouth in Belton Reservoir is sufficient to maintain the fishery in years with stable water levels near conservation pool. In the past, Belton has been high on the stocking list since it was an important broodfish source. With this information, that status could change in years when water levels would promote natural recruitment.

MANAGEMENT STRATEGY

1. Continue requesting Smallmouth Bass for stocking on an annual basis. If conditions are suitable for natural recruitment in Belton, elevate Whitney above Belton on the priority list.

ISSUE 2: For the second survey in a row, gill net catch rates of Striped and White Bass were near all-time highs, with even more legal-sized fish in the population compared to 2016. The same was true for Blue and Channel Catfish as well as Largemouth Bass. This is tremendously good news, the public needs to know, and angling pressure and economic impact need to be assessed. In addition, the TPWD Inland Fisheries Catfish Regulation Committee is finalizing a draft regulation suite to present to the Commission for consideration. There may be a more suitable or desirable regulation for the current population available in the future.

MANAGEMENT STRATEGIES

1. Publicize the fisheries via news releases and social media.
2. Complete a creel survey in 2023-2024 to quantify angling pressure and success, as well as basic information on the economic impacts of anglers fishing Whitney reservoir. Use this opportunity to obtain additional information regarding the suitability of new catfish regulations.
3. Discuss management options with guides to incorporate their information in Striped Bass and catfish management decisions.

ISSUE 3: This report period highlighted the importance of river inflows into the reservoir especially to the Striped Bass population. Some information was very positive, with natural recruitment strongly suggested in 2016 and 2019. This was based on high year class strength in the most recent gill net survey, favorable hydrographs for spawning below Granbury reservoir, and historically low stocking rates during those two years. Unfortunately, high inflows from mid-April through mid-July 2019 may have prevented or delayed the reservoir from stratifying. This could have eliminated the all-important thermal refuge for Striped Bass during some or all of the summer and resulted in what appears to be significant mortality of the 2018 year-class, and some mortality and injury to the 2017 and 2016 year-classes during two fish kill events. Additional Striped Bass mortality was observed immediately below the Granbury Dam in early July 2019 following cessation of this high flow event.

MANAGEMENT STRATEGIES

1. Collect a practical effort age sample from Striped Bass in 2024 to compare year-class strength to stocking information to evaluate natural recruitment as well as recruitment of traditional fry and fingerling stockings.
2. Collect temperature and dissolved oxygen profiles in 2021 and 2023. These will start in May and continue monthly until stratification is documented. These data will guide future monitoring efforts.
3. Work with the Brazos River Authority (BRA) toward optimizing shutdown of the outflow from Granbury Dam to reduce Striped Bass mortality immediately below the dam. Effectiveness of these efforts could be evaluated using continuous monitoring of water temperature. The BRA has been facilitating our use of the stilling basin as a broodfish source for statewide stocking efforts, so these efforts are important.

ISSUE 4: Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels (*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. On June 11, 2014, one of three PCR replicates on Lake Whitney was positive, indicating the presence of zebra mussel genetic material. Follow up tests and inspections did not detect any zebra mussels. 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 USACE to maintain appropriate signage at access points around the reservoir.
2. Educate the public about invasive species using social 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.
5. Continue monitoring for the presence of zebra mussels.

Objective - Based Sampling Plan and Schedule 2020-2024

Sport fish, forage fish and other important fishes

Sport fishes in Whitney Reservoir include Largemouth Bass, Striped Bass, White Bass, Channel Catfish, and Blue Catfish. Important forage fish species include Gizzard Shad, Threadfin Shad, Bluegill, Redear and Longear Sunfish. Other less common prey species include Warmouth and Redbreast Sunfish.

Low-density fisheries

Smallmouth Bass, Spotted Bass, Flathead Catfish, White and Black Crappie occur in very low abundance in Whitney Reservoir and are generally caught incidentally to other targeted species. We will continue collecting and reporting data for these species and upgrade their status if appropriate.

Reservoir-specific issue - Golden Alga

Golden alga first altered the dynamics of the Whitney fishery in 2000 but has abated in recent years. The fisheries response to these kills is predictable except for the year in which the kill occurs and the magnitude of its effects. During years when golden alga kills are minimal, angling pressure increases as fish populations improve. Inevitably every few years a golden alga kill will occur, and angling success and pressure may decline. Recovery begins with a massive spawn of prey, followed by high relative weights of predator species and subsequent repopulation either by spawning (e.g. Black Bass, White Bass) or stocking (e.g. Striped Bass). This cycle has been well documented with standard and non-standard sampling over the past 15 years. Based on current data it appears that circumstances may have changed, and golden alga has not significantly affected current fish populations for several years.

Survey objectives, fisheries metrics, and sampling objectives

Fall Electrofishing: This survey will be used to evaluate Largemouth Bass and the primary forage species (Bluegill, Redear Sunfish, Longear Sunfish, Gizzard Shad and Threadfin Shad). The goal of the 2023 electrofishing survey would be general monitoring of trend data to characterize the Largemouth Bass population and make comparisons with historical and future data. Catch rates of Largemouth Bass during 2019 electrofishing were enough to achieve a CPUE RSE ≤ 25 in 23 stations. A minimum of 18 randomly selected 5-minute stations will be sampled at night in fall 2023. This will allow us to compare CPUE data among years with a calculated RSE ≤ 25 . If the Largemouth Bass objective is not attained in 18 stations, sampling may continue if catch rates indicate that collecting the proposed number of fish is reasonable. Since the forage species survey objectives are only exploratory, additional sampling will not be necessary beyond that which is done for Largemouth Bass.

Spring Gill Netting: This survey will be used to evaluate temperate bass (Striped and White Bass), and Blue and Channel Catfish. Collecting a minimum of 50 stock-length fish of each species during spring 2024 gill netting will allow us to calculate proportions (i.e., size structure indices) with an 80% confidence interval. If the goal for a species isn't attained in 10 randomly selected stations, and catch rates indicated that collecting the proposed number of fish is reasonable, sampling will continue at random stations until a minimum of 50 stock size fish have been collected. Age structures for Striped Bass will be collected using Category III protocols (i.e. 5 fish per cm group; 200 stock length fish sample). If catch rates are too low on the initial 10 nets for a 200 fish sample to be practical using additional nets, collect otoliths from all stock-size fish that are available in the sample.

Angler Creel: This survey will be used to evaluate angler effort, success, preferences, and economic impact in 2023-2024. The purpose would be to document angler response to the tremendously improved fishery and help determine the direction of future efforts including possible regulation changes.

Literature Cited

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Tables and Figures

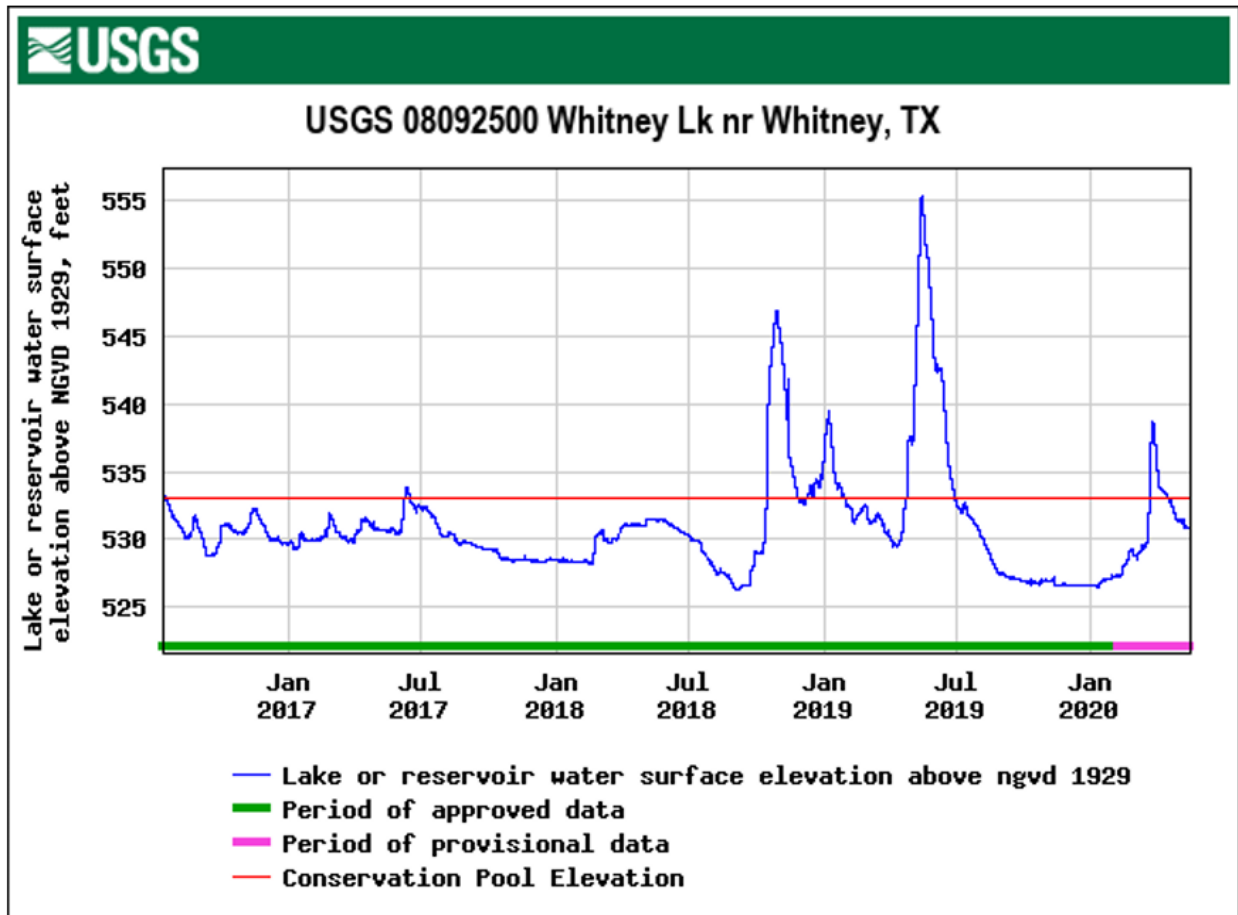


Figure 1a. Daily mean water levels for Whitney Reservoir from July 15, 2016 through May 14, 2020. NAVD 1988 refers to the North American Vertical Datum of 1988. The solid line indicates Conservation pool (533.0). Figure from the USGS website.

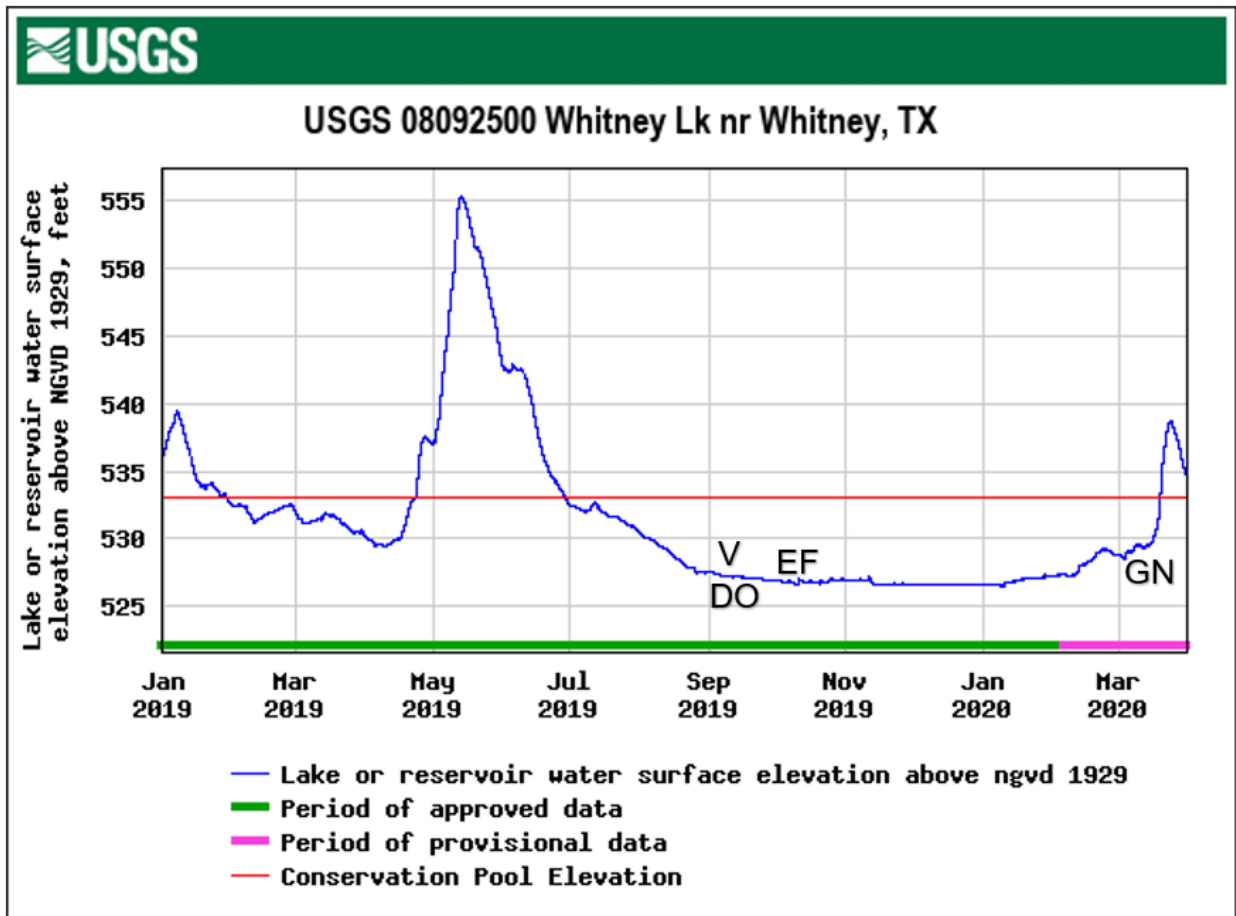


Figure 1b. Daily mean water level elevations in feet above mean sea level (MSL) recorded for Whitney Reservoir, Texas, January 2019 through March 2020. NAVD 1988 refers to the North American Vertical Datum of 1988. The solid line indicates Conservation pool (533.0) and surveys are indicated by DO (Dissolved Oxygen Profile), V (Vegetation), EF (Electrofishing) and GN (Gill Netting).

Table 1. Characteristics of Whitney Reservoir, Texas (2019-2020).

Characteristic	Description
Year Constructed	1951
Controlling authority	U.S. Army Corps of Engineers
Counties	Bosque and Hill
Reservoir type	Mainstem
Shoreline Development Index	10.5
Conductivity	1,800 umhos/cm

Table 2. Boat ramp characteristics for Whitney Reservoir, Texas, September 2019. Reservoir elevation at time of survey was 527.3 feet above mean sea level (5.7' below conservation pool). Parking capacity numbers are for trucks with boat trailers/vehicles.

Boat ramp	Latitude Longitude (dd)	Parking capacity (N)	Condition
Ham Creek Park	32.17212/-97.48740	28/0	Good
Kimball Bend Park	32.12149/-97.49361	38/0	Good
Nolan River Park	32.09584/-97.45181	6/4	Fair
Plowman Creek Park	32.06656/-97.49241	18/0	Good
Lakeside Park	32.02402/-97.49062	12/0	Fair
Steele Creek Park (N)	32.00980/-97.44907	16/0	Good
Steele Creek Park (S)	32.00232/-97.45099	12/0	Good
White Bluff Park	32.01299/-97.41491	20/26	Good
Cedar Creek Park	31.98830/-97.37279	20/0	Good
Juniper Cove Park	31.98597/-97.37005	24/10	Fair
Serenity Cove Ramp	31.97377/-97.37463	6/0	Fair
McCown Valley Park	31.94879/-97.40074	48/0	Good
Cedron Creek Park	31.96025/-97.41684	20/0	Good
Long Branch Ramp	31.90623/-97.41938	8/0	Fair
FM1630 Ramp	31.88259/-97.39296	18/0	Good
Uncle Gus' Marina	31.87524/-97.40196	6/0	Fair
Cliffview Resort Ramp	31.85714/-97.38667	12/0	Fair
Lofers Bend Park Day Use	31.87364/-97.36716	74/0	Good
Lofers Bend Park West	31.88261/-97.37188	10/0	Good
Lofers Bend East	31.88934/-97.35715	10/0	Good
Walling Bend	31.89919/-97.39574	10/0	Good
Harbor Master Marina	31.88697/-97.35855	6/0	Fair
Lake Whitney State Park	31.92361/-97.37323	15/0	Good

Table 3. Harvest regulations for Whitney Reservoir, 2019 – 2020.

Species	Bag Limit	Minimum-Maximum Length (inches)
Catfish, Blue	25 (in any combination)	12 - No Limit
Catfish, Channel	25 (in any combination)	12 - No Limit
Catfish, Flathead	5	18 - No Limit
Bass, White	25	10 - No Limit
Bass, Striped	5	18 - No Limit
Bass: Largemouth and Smallmouth	5 (in any combination)	14 - No Limit
Bass: Spotted, Guadalupe ² and hybrids	5 (in any combination)	No Limit – No Limit
Crappie: White and Black Crappie, their hybrids and subspecies	25 (in any combination)	10 - No Limit

Table 4. Stocking history for Whitney Reservoir, Texas. Life stages are fry (FRY), fingerlings (FGL), advanced fingerlings (AFGL), adults (ADL) and unknown (UNK). Life stages for each species are defined as having a mean length that falls within the given length range. For each year and life stage the species mean total length (Mean TL; in) is given. For years where there were multiple stocking events for a particular species and life stage the mean TL is an average for all stocking events combined.

Species	Year	Number	Life Stage	Mean TL (in)
Blue Catfish	1966	8,000	UNK	0.0
	Total	8,000		
Bluegill	2005	13,747	AFGL	2.1
	Total	13,747		
Channel Catfish	1970	61,000	AFGL	7.9
	Total	61,000		
Florida Largemouth Bass	1985	204,099	FGL	2.0
	1986	151,900	FRY	1.0
	2003	760,159	FGL	1.5
	2004	589,978	FGL	1.7
	Total	1,706,136		
Largemouth Bass	1966	280,000	UNK	0.0
	1968	250,000	UNK	0.0
	1969	350,000	FRY	0.7
	1971	220,000	UNK	0.0
	Total	1,100,000		
Smallmouth Bass	1983	65,400	UNK	0.0
	1984	235,505	FGL	2.0
	1985	162,976	FGL	2.0
	1985	39,167	FRY	1.0
	1986	24,435	FGL	2.0
	1986	124,700	FRY	1.0
	1992	29,253	FGL	1.3
	1994	262,402	FGL	1.2
	1995	40,670	FGL	1.3
	1996	333,282	FGL	1.3
	1997	714,665	FGL	1.2
	1998	353,100	FGL	1.2
	1999	351,302	FGL	1.3
	2000	589,849	FGL	1.4
	2004	5,609	FGL	1.9
	2010	73,644	FGL	1.6
	2011	134,722	FGL	1.5
2020	24,133	FGL	1.8	
Total	3,564,814			
Striped Bass	1973	267,711	FGL	1.7

Table 4. Stocking history for Whitney Reservoir, Texas. Life stages are fry (FRY), fingerlings (FGL), advanced fingerlings (AFGL), adults (ADL) and unknown (UNK). Life stages for each species are defined as having a mean length that falls within the given length range. For each year and life stage the species mean total length (Mean TL; in) is given. For years where there were multiple stocking events for a particular species and life stage the mean TL is an average for all stocking events combined.

Species	Year	Number	Life Stage	Mean TL (in)
	1974	229,291	FGL	1.7
	1975	17,090	UNK	0.0
	1976	232,123	UNK	0.0
	1984	351,581	FGL	2.0
	1985	172,115	FRY	1.0
	1986	354,130	FGL	1.7
	1987	121,525	FGL	2.0
	1987	237,232	FRY	1.0
	1988	235,900	FRY	1.0
	1989	235,923	FGL	1.2
	1990	240,219	FGL	1.4
	1991	331,827	FGL	1.3
	1992	123,161	FGL	1.2
	1994	448,490	FGL	1.2
	1995	237,566	FGL	1.2
	1996	113,057	FGL	1.3
	1997	235,226	FGL	1.2
	1998	145,768	FGL	1.3
	1999	236,400	FGL	1.5
	2000	476,600	FGL	1.5
	2001	1,400,000	FRY	0.8
	2002	353,587	FGL	1.6
	2003	223,892	FGL	1.7
	2004	84,184	FGL	1.5
	2005	332,999	FGL	1.7
	2006	322,532	FGL	1.9
	2007	495,015	FGL	1.6
	2008	332,262	FGL	1.8
	2009	543,846	FGL	1.8
	2010	148,055	FGL	1.7
	2010	415,763	FRY	0.2
	2013	237,052	FGL	1.6
	2013	614,994	FRY	0.2
	2014	380,641	FGL	1.5
	2015	325,028	FGL	1.7
	2016	103,841	FGL	1.5
	2017	340,316	FGL	1.7
	2017	688,065	FRY	0.2
	2018	1,006,185	FRY	0.2
	2019	191,848	FGL	1.6

Table 4. Stocking history for Whitney Reservoir, Texas. Life stages are fry (FRY), fingerlings (FGL), advanced fingerlings (AFGL), adults (ADL) and unknown (UNK). Life stages for each species are defined as having a mean length that falls within the given length range. For each year and life stage the species mean total length (Mean TL; in) is given. For years where there were multiple stocking events for a particular species and life stage the mean TL is an average for all stocking events combined.

Species	Year	Number	Life Stage	Mean TL (in)
	Total	13,583,040		

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

Gear/target species	Survey objective	Metrics	Sampling objective
<i>Electrofishing</i>			
Largemouth Bass	General monitoring Genetics	CPUE, Size structure, Wr % FLMB	RSE- Stock \leq 25; 10 per cm N = 30, all sizes
Bluegill ^a	Exploratory	Presence/Absence	Practical effort
Redear Sunfish ^a	Exploratory	Presence/Absence	Practical effort
Longear Sunfish ^a	Exploratory	Presence/Absence	Practical effort
Gizzard Shad ^a	Exploratory	Presence/Absence	Practical effort
Threadfin Shad ^a	Exploratory	Presence/Absence	Practical effort
<i>Gill netting</i>			
Channel Catfish	General monitoring	Size structure	N \geq 50 stock
Blue Catfish	General monitoring	Size structure	N \geq 50 stock
Striped Bass	General monitoring	Size structure, Age	N \geq 50 stock, practical effort
White Bass	General monitoring	Size structure	N \geq 50 stock
White Crappie	General monitoring	Size structure	N \geq 50 stock

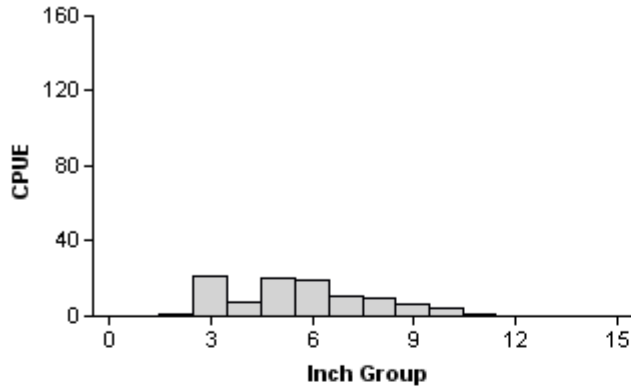
^a No additional effort will be expended to achieve an RSE \leq 25 for CPUE of prey species if not reached

Table 6. Survey of aquatic vegetation, Whitney Reservoir, Texas, 2015 and 2019. In July 2015, an adaptation of the point method was used to determine percent of shoreline distance, in which values represent the percentage of the randomly selected points where species occurred. Only two species were observed in 2015; none were observed during the September 2019 survey. Water level was roughly 6 feet below conservation pool at the time of the 2019 survey.

Vegetation	2015	2019
Common Buttonbush (<i>Cephalanthus occidentalis</i>)	37% (88 of 236)	0% (0 of 236)
Giant Reed (<i>Arundo donax</i>)	2.5% (6 of 236)	0% (0 of 236)

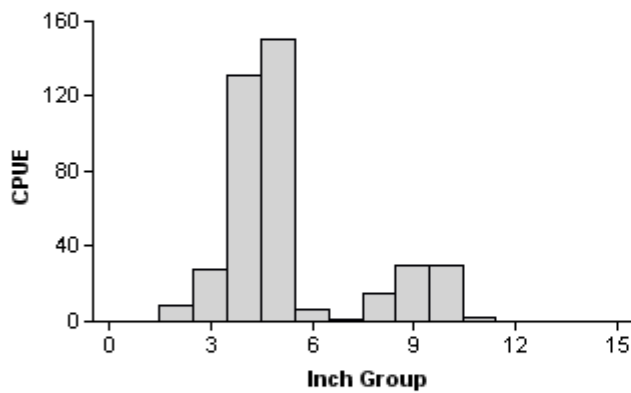
Gizzard Shad

2011



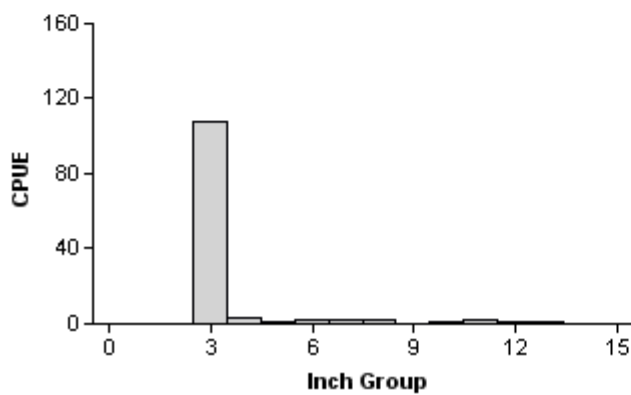
Effort = 2.0
 Total CPUE = 101.0 (25; 202)
 Stock CPUE = 32.5 (33; 65)
 IOV = 79 (4)

2015



Effort = 1.7
 Total CPUE = 400.8 (28; 668)
 Stock CPUE = 76.2 (41; 127)
 IOV = 81 (9)

2019



Effort = 1.9
 Total CPUE = 127.8 (33; 245)
 Stock CPUE = 12.0 (33; 23)
 IOV = 92 (3)

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, Whitney Reservoir, Texas, 2011, 2015 and 2019.

Bluegill

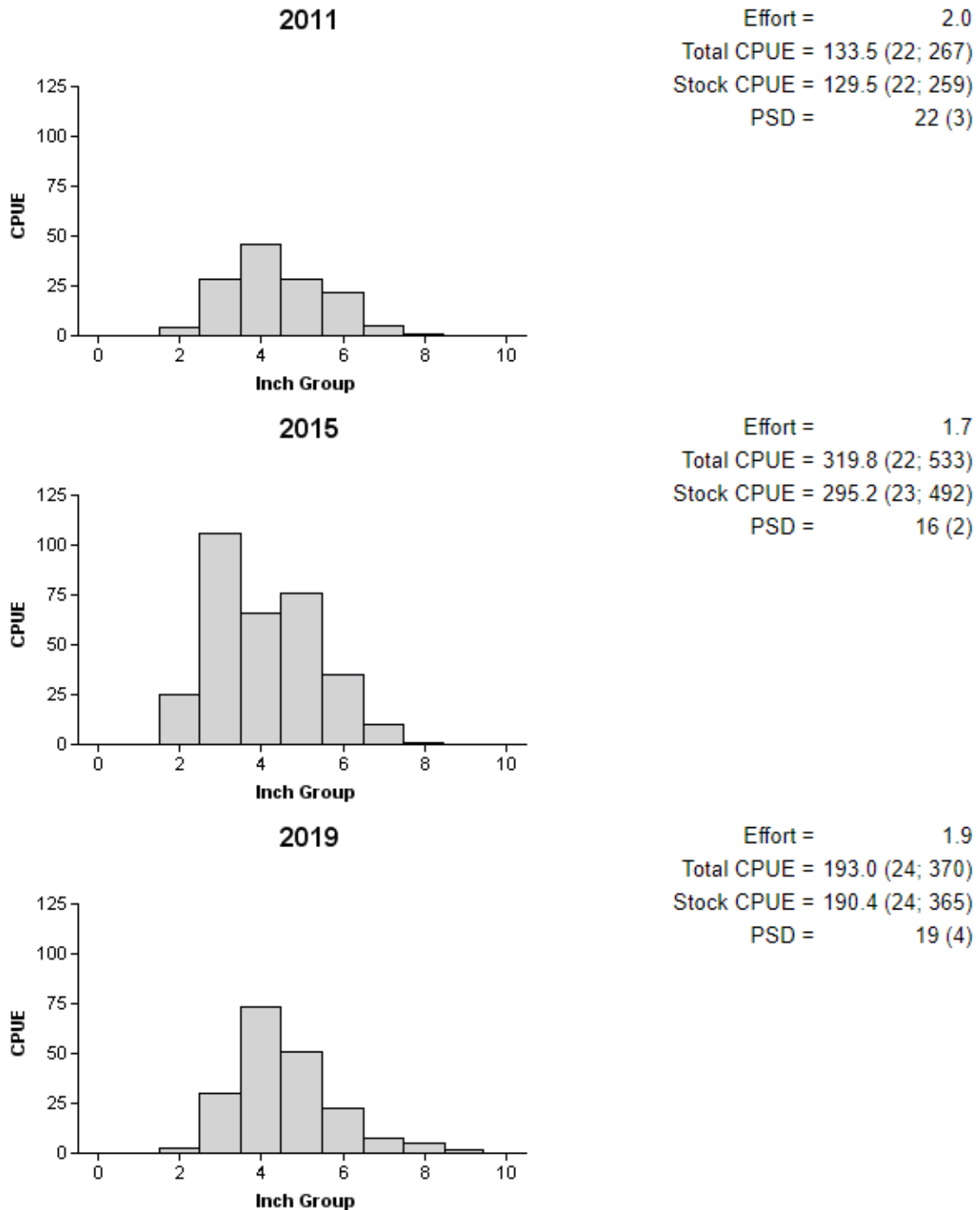


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Whitney Reservoir, Texas, 2011, 2015 and 2019.

Blue Catfish

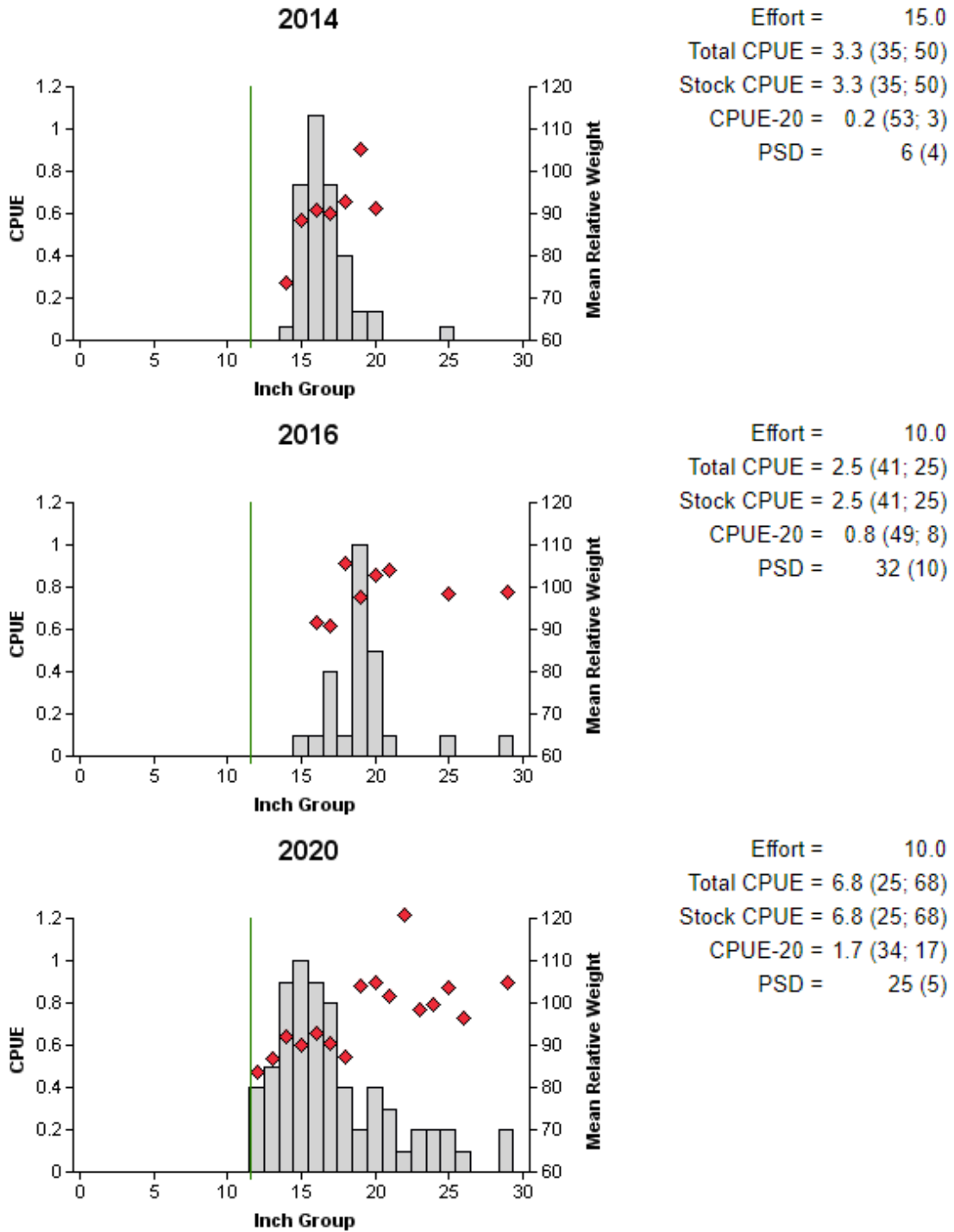


Figure 4. Number of Blue Catfish caught per net night (CPUE), mean relative weights (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Whitney Reservoir, Texas, 2014, 2016 and 2020. Vertical line represents the 12-inch minimum length limit.

Channel Catfish

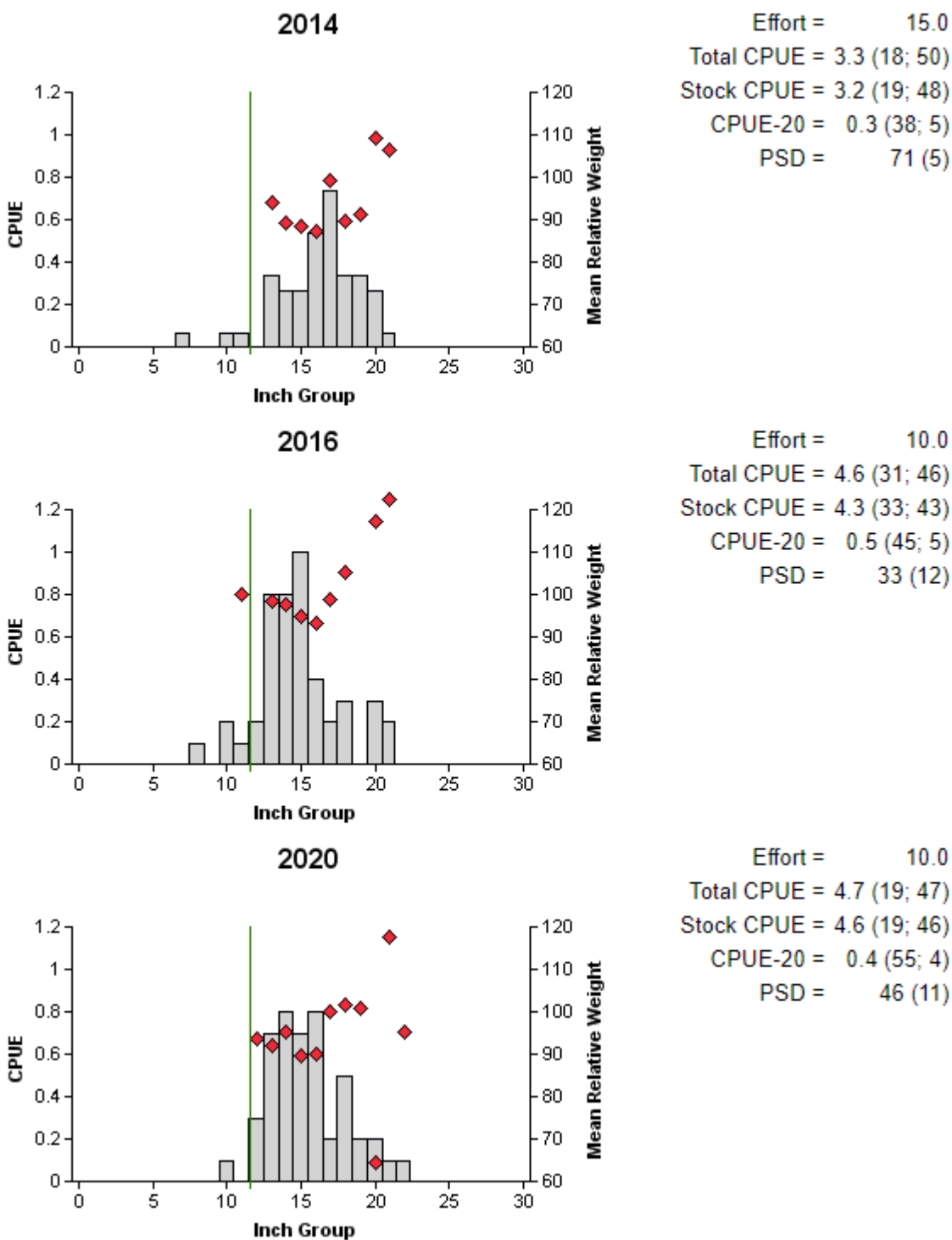


Figure 5. Number of Channel Catfish caught per net night (CPUE), mean relative weights (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Whitney Reservoir, Texas, 2014, 2016 and 2020. Vertical line represents the 12-inch minimum length limit.

White Bass

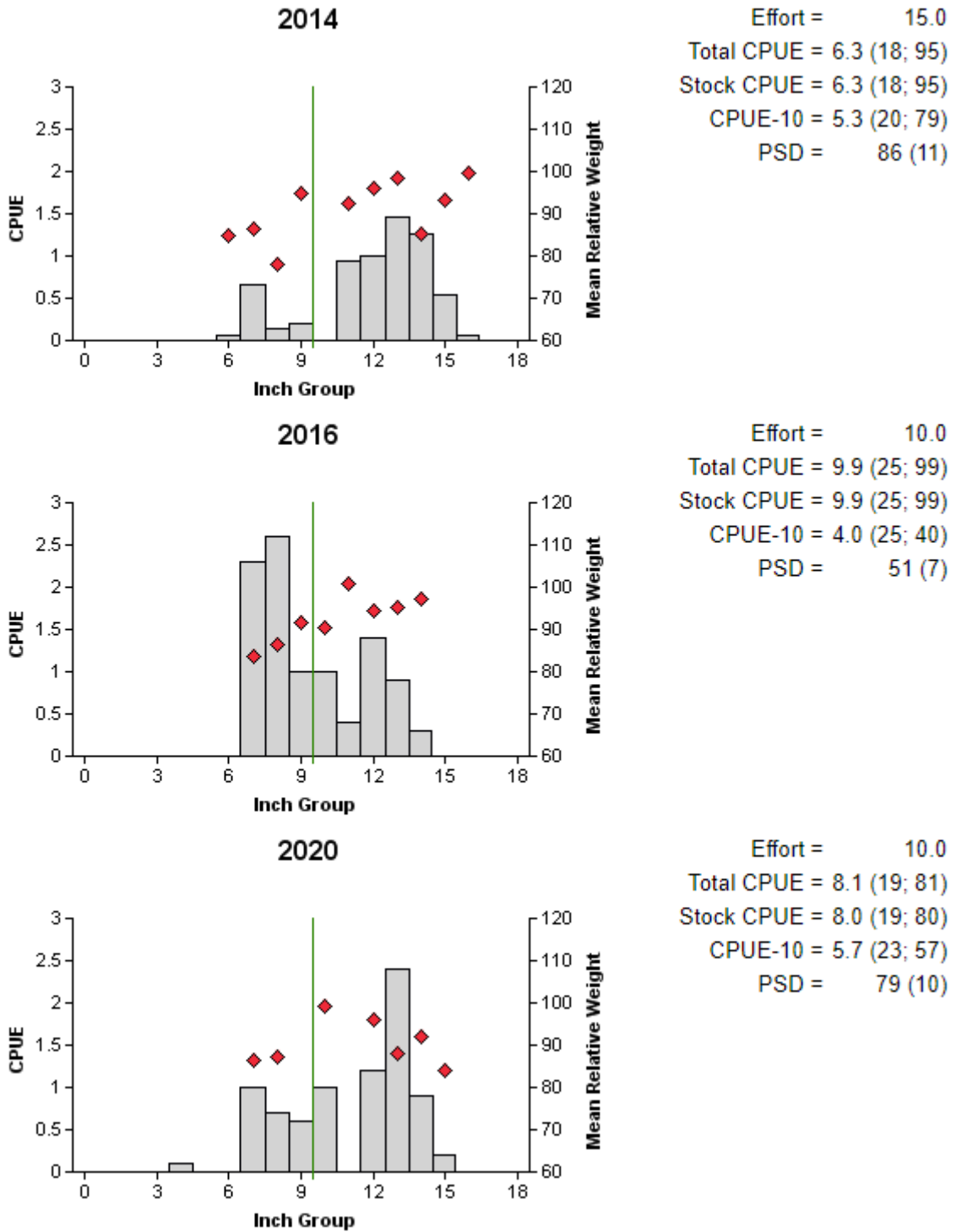


Figure 6. Number of White Bass caught per net night (CPUE), mean relative weights (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Whitney Reservoir, Texas, 2014, 2016 and 2020. Vertical line represents the 10-inch minimum length limit.

Striped Bass

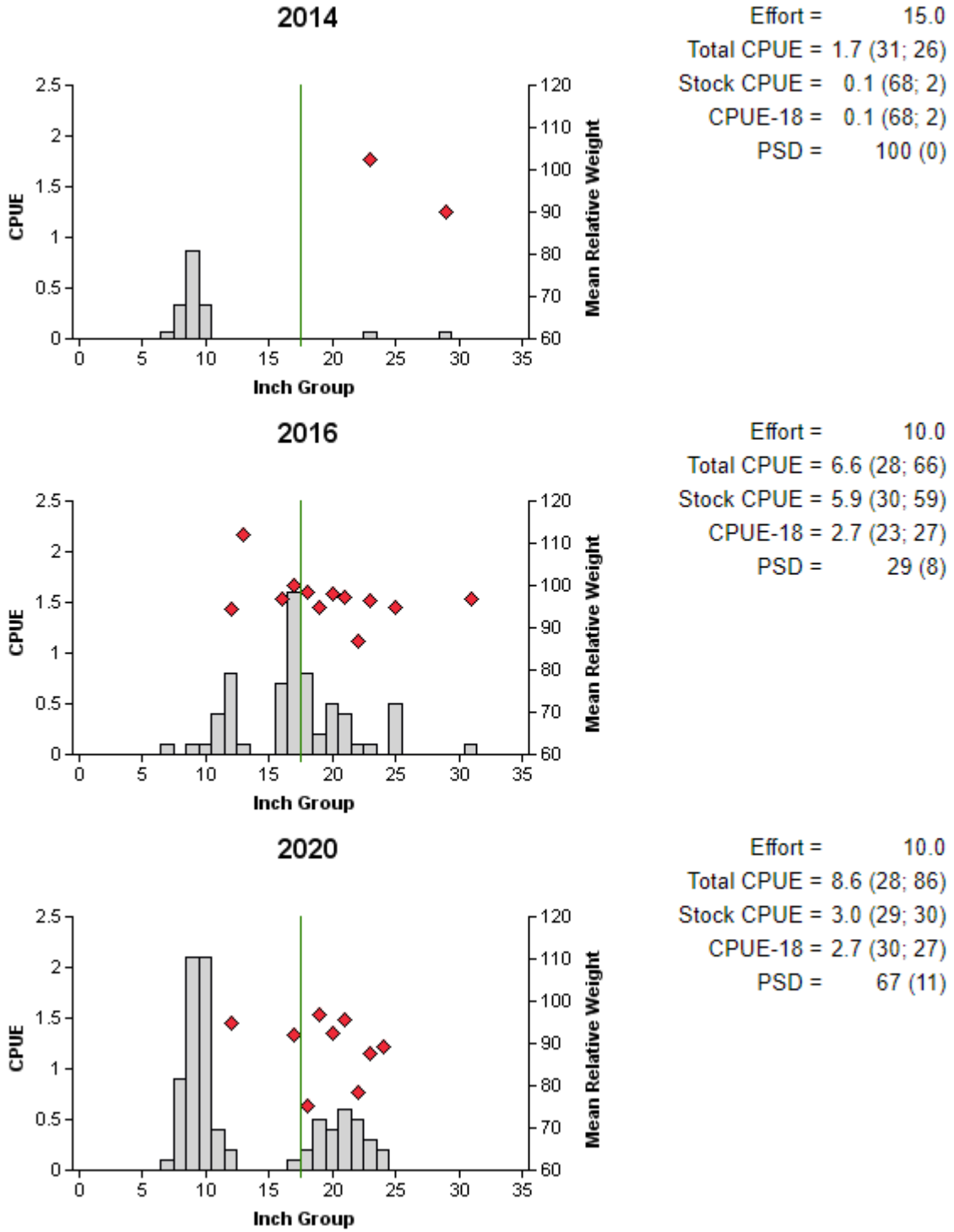


Figure 7. Number of Striped Bass caught per net night (CPUE), mean relative weights (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Whitney Reservoir, Texas, 2014, 2016 and 2020. Vertical line represents the 18-inch minimum length limit.

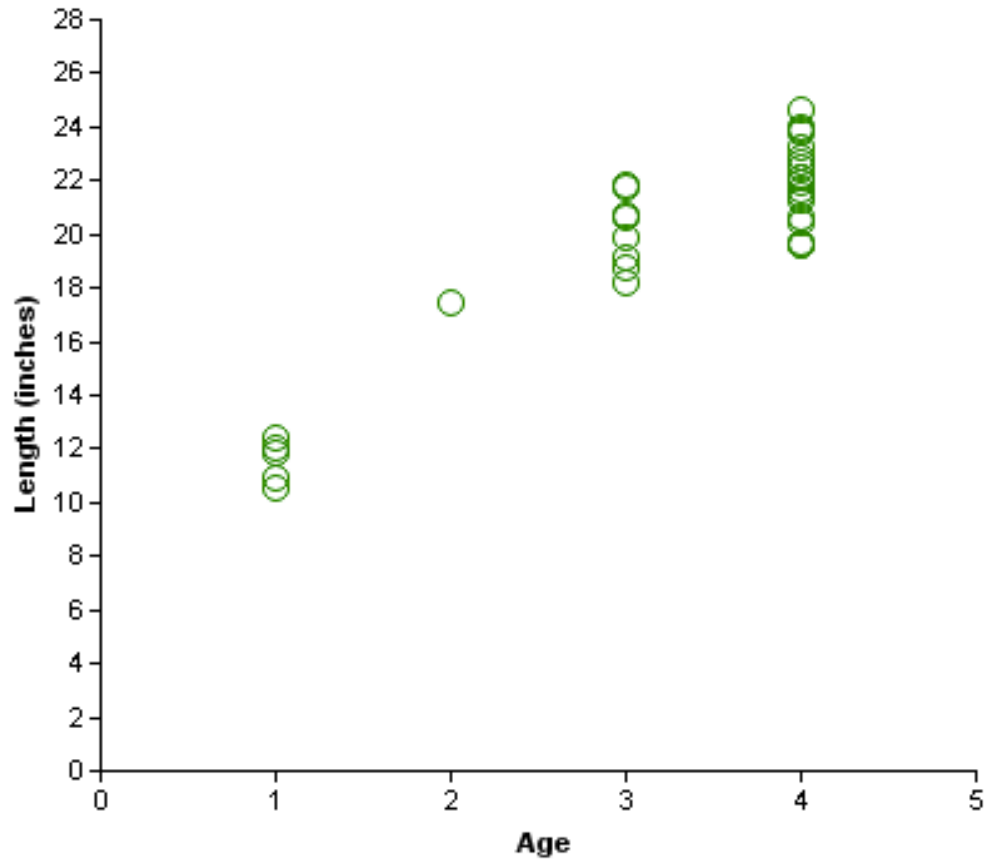


Figure 8. Length at age for Striped Bass collected by gill netting, Whitney Reservoir, Texas, 2020. Only a subset of the 56 fish less than stock size were aged, comprised of the largest individuals of that cohort. Based on these data, all sub-stock size Striped Bass were presumed to be from the 2019-year class.

Largemouth Bass

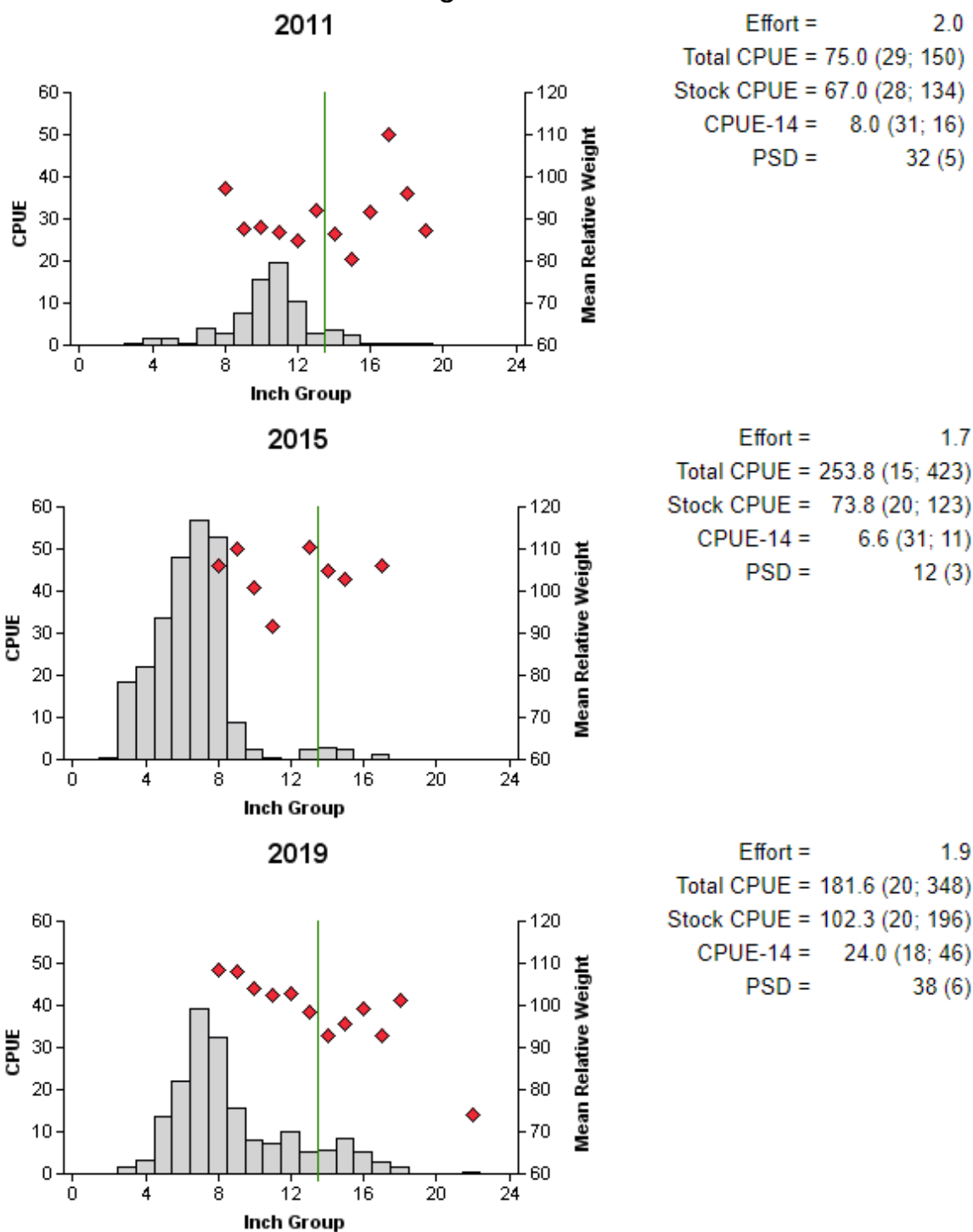


Figure 9. Number of Largemouth Bass caught per hour (CPUE), mean relative weights (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Whitney Reservoir, Texas, 2011, 2015 and 2019. Vertical line represents the 14-inch minimum length limit.

Table 7. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Whitney Reservoir, Texas, 2005, 2007, 2015 and 2019. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB. Genetic composition was determined with micro-satellite DNA analysis.

Year	Sample size	Number of Fish			% FLMB alleles	% FLMB
		FLMB	Intergrade	NLMB		
2005	26	1	25	0	49	4
2007	30	0	29	1	49	0
2015	30	3	26	1	66	10
2019	30	0	30	0	61	0

Proposed Sampling Schedule

Table 8. Proposed sampling schedule for Whitney 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. Structural habitat surveys are required only if large changes in structural habitat are suspected, i.e. increases in bulkhead, loss of standing timber, etc.

	Survey year			
	2020-2021	2021-2022	2022-2023	2023-2024
Angler Access				S
Structural Habitat				S
Vegetation				S
Electrofishing – Fall				S
Gill netting				S
Creel survey				S
Report				S

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

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Whitney Reservoir, Texas, 2019-2020

Species	Gill Netting		Electrofishing	
	CPUE	(N/RSE)	CPUE	(N/RSE)
Gizzard Shad			127.8	(245/33)
Threadfin Shad			51.6	(99/47)
Blue Catfish	6.8	(68/25)		
Channel Catfish	4.7	(47/19)		
White Bass	8.1	(81/19)		
Striped Bass	8.6	(86/28)		
White Crappie	0.7	(7/37)		
Black Crappie	0.3	(3/71)		
Redbreast Sunfish			9.9	(19/52)
Green Sunfish			4.7	(8/46)
Warmouth			1.0	(2/69)
Orangespotted sunfish			0.5	(1/100)
Bluegill			193.0	(370/24)
Longear Sunfish			9.9	(19/43)
Redear Sunfish			4.7	(9/38)
Spotted Bass			0.5	(1/100)
Largemouth Bass			181.6	(348/20)

APPENDIX B – Historical catch rates for targeted species by gear type

Catch rates (CPUE) of targeted species by gear type for standard surveys on Whitney Reservoir, Texas, 1990 to present. Surveys prior to 1996 utilized biologist-selected stations while those after 1996 utilized randomly selected stations. Electrofishing stations were shocked with a 5.0 Smith-Root GPP (Gas Powered Pulsator) until 2010, when a 7.5 Smith-Root GPP was used. Species averages are in bold. Asterisk denotes collection by a non-standard gear.

Year	Electrofishing							
	Shad			Sunfish				
	Gizzard	Threadfin	Bluegill	Redear	Longear	Green	Warmouth	Redbreast
1990	47.0	2.5	25.5	3.5	10.5	0	4.0	8.5
1991	19.5	1.5	26.0	0.5	8.0	0.5	2.0	1.5
1992	10.0	0	45.5	0.5	14.5	3.0	2.0	0
1993	69.0	2.0	30.0	2.0	5.5	1.5	0	18.0
1994	38.5	5.5	125.5	1.5	31.5	8.0	1.0	66.0
1995	206.5	87.5	252.0	5.5	22.0	3.5	8.5	45.5
1996	180.0	7.5	16.5	3.5	15.0	3.5	0.5	14.0
1997	62.0	12.0	74.5	1.0	2.5	1.0	0.5	30.0
1998	61.5	15.5	168.5	1.0	1.5	4.5	0	74.5
1999	11.0	14.0	43.0	1.5	6.0	9.0	1.0	22.0
2001	281.5	198.5	382.0	3.0	54.5	27.0	10.0	107.5
2003	149.5	15.0	179.0	0.5	8.0	25.0	0.5	13.5
2005	36.5	30.0	64.0	5.0	6.5	0	2.5	1.0
2007	144.0	130.5	139.5	36.0	9.0	4.0	0	0
2009	183.0	39.5	158.5	13.0	15.0	4.5	1.5	7.0
2011	101.0	49.5	133.5	12.5	8.0	0.5	0.5	1.0
2015	400.8	90.0	319.8	18.6	48.0	18.6	5.4	15.0
2019	127.8	51.6	193.0	4.7	9.9	4.2	1.0	9.9
Avg.	118.3	41.8	132.0	6.3	15.3	6.6	2.3	24.2

APPENDIX B Continued

Electrofishing			
Bass			
Year	Largemouth	Smallmouth	Spotted
1990	28.5	2.0	5.0
1991	14.5	0	1.5
1992	23.0	0	0
1993	50.5	3.0	14.0
1994	49.5	2.0	16.5
1995	119.5	16.5	13.0
1996	15.5	10.0	3.0
1997	56.5	12.5	3.5
1998	100.0	25.5	12.5
1999	35.0	4.0	6.0
2001	85.0	1.0	2.5
2003	49.0	0.5	2.5
2005	25.5	0	0.5
2007	113.0	0	0
2009	40.0	0.5	0
2011	75.0	1.0	0
2015	253.8	0	8.4
2019	181.6	0	0.5
Avg.	73.1	4.4	5.0

APPENDIX B Continued

Year	Gill nets					Trap nets	
	Catfish			Bass		Crappie	
	Blue	Channel	Flathead	White	Striped	White	Black
1990	1.3	4.4	0	15.0	5.2	13.1	0
1991	0.6	3.0	0.1	14.6	9.3	7.7	0.5
1992	0.8	2.6	0	4.3	6.9	32.9	0.7
1993	0.5	4.3	0.1	11.1	6.3	9.9	0
1994	1.3	1.2	0	5.1	7.9	4.8	0.1
1995	1.3	1.1	0	5.5	3.2	11.3	0
1996	1.6	1.7	0	7.5	4.7	0.8	0.1
1997	2.3	0.8	0.2	1.6	3.5	10.8	0
1998	1.4	1.6	0.1	1.9	2.1	28.4	0.4
1999	1.2	1.5	0.3	0.5	2.5	3.9	0.2
2000	1.5	1.3	0.3	4.1	1.8	-	-
2001	1.9	3.9	0.1	2.4	1.1	-	-
2002	0.9	3.1	0.7	0.7	2.3	-	-
2003	0.6	4.7	0.2	1.0	0.6	1.9	0.2
2004	1.1	2.1	0.1	1.1	1.5	-	-
2005	-	-	-	-	-	13.5	0.1
2006	0.3	4.6	0.1	4.0	1.5	-	-
2008	0.4	8.9	0	7.4	1.4	-	-
2010	1	6.1	0.1	6.5	5.5	-	-
2012	3.1	2.2	0.1	3.4	1.5	-	-
2014	3.3	3.3	0	6.3	1.7	-	-
2016	2.5	4.6	0	9.9	6.6	-	-
2020	6.8	4.7	0	8.1	8.6	-	-
Avg.	1.6	3.3	0.1	5.5	3.9	11.6	0.2

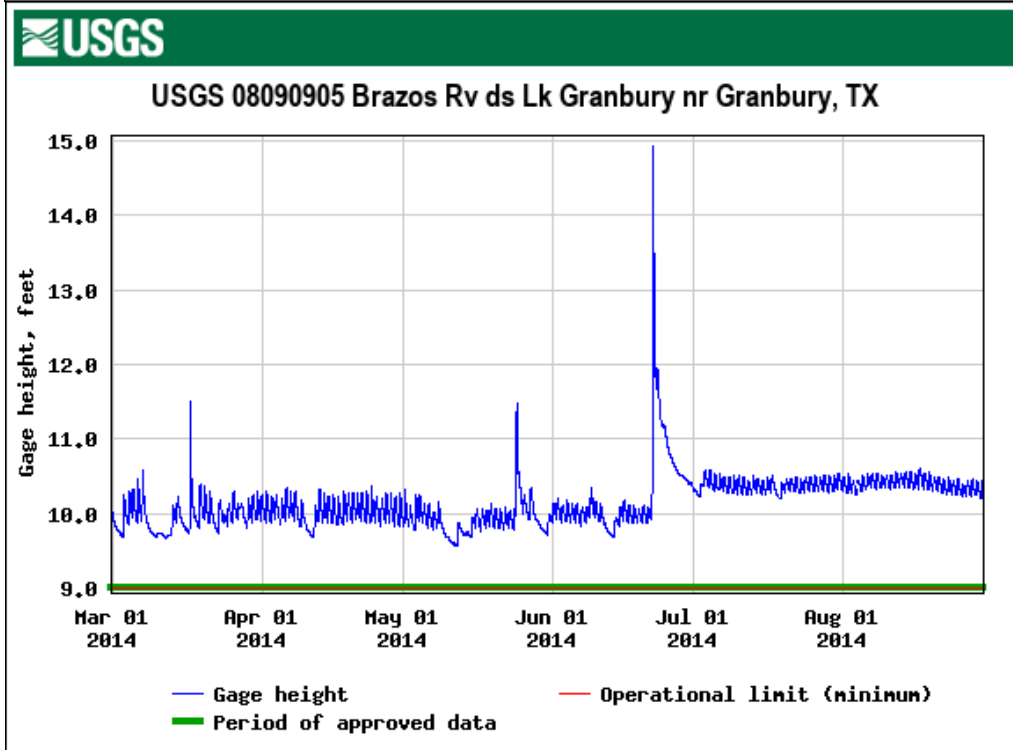
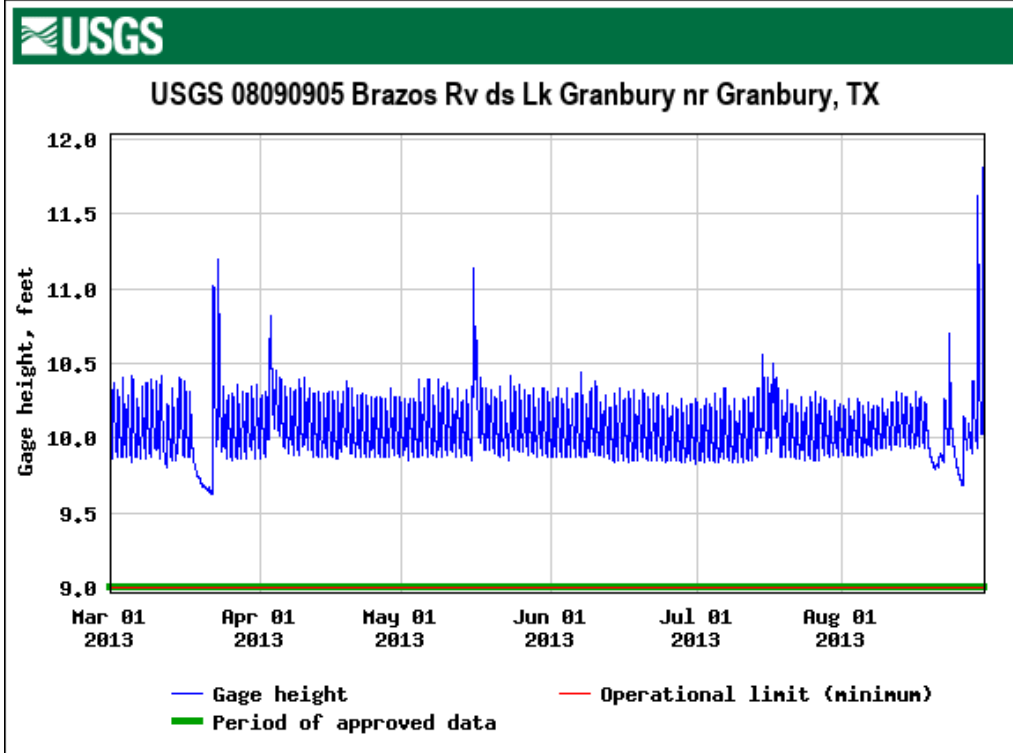
APPENDIX C – Map of sampling locations



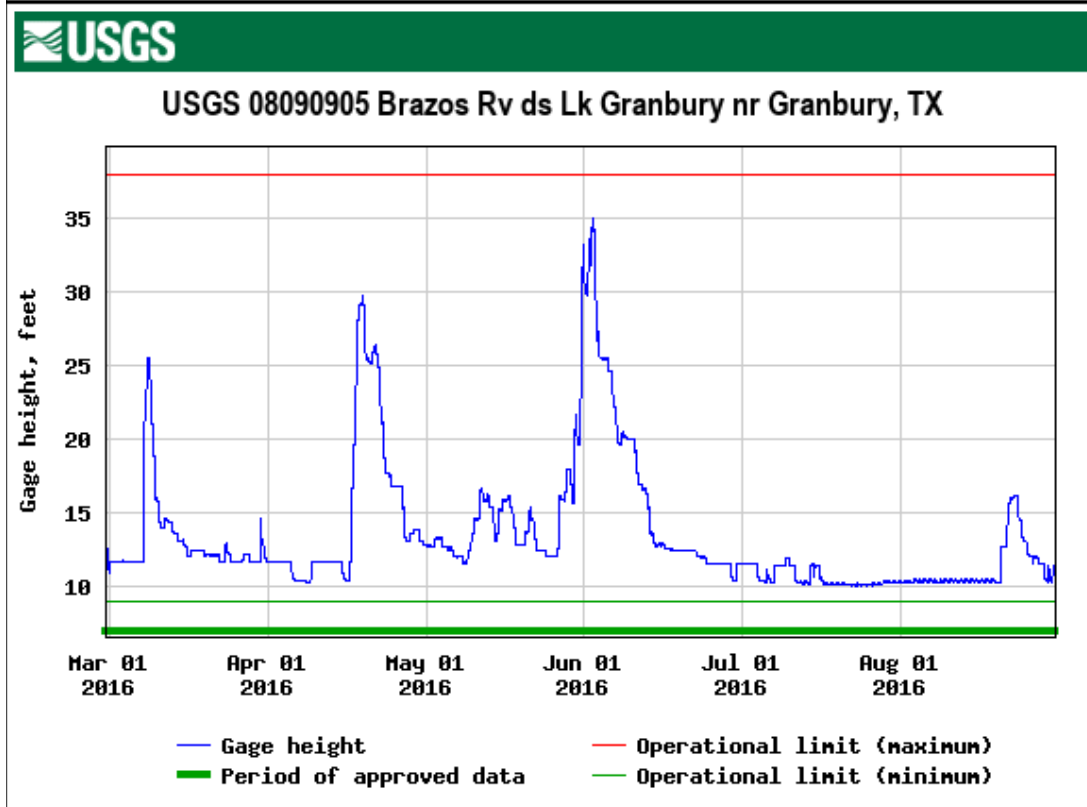
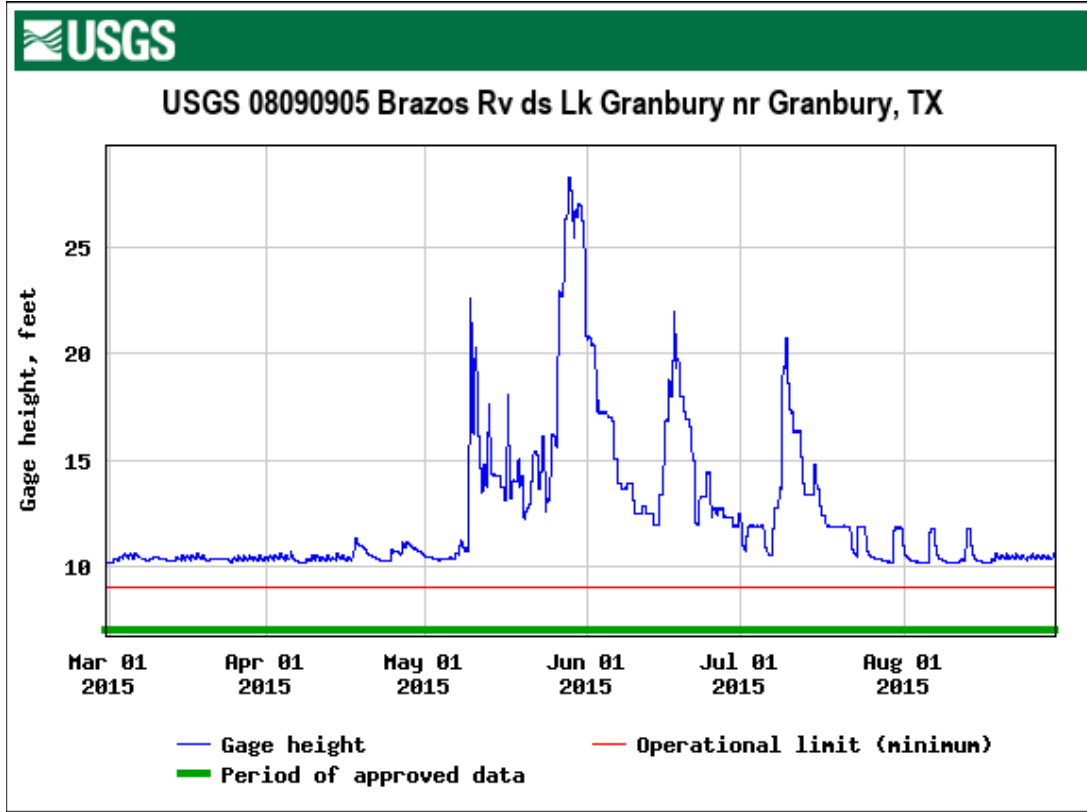
Location of sampling sites, Whitney Reservoir, Texas, 2015-2016. Standard electrofishing and gill netting stations are indicated by circles and triangles respectively. Water level was within 3.0' of full pool at the time of sampling.

APPENDIX D – Whitney Hydrographs

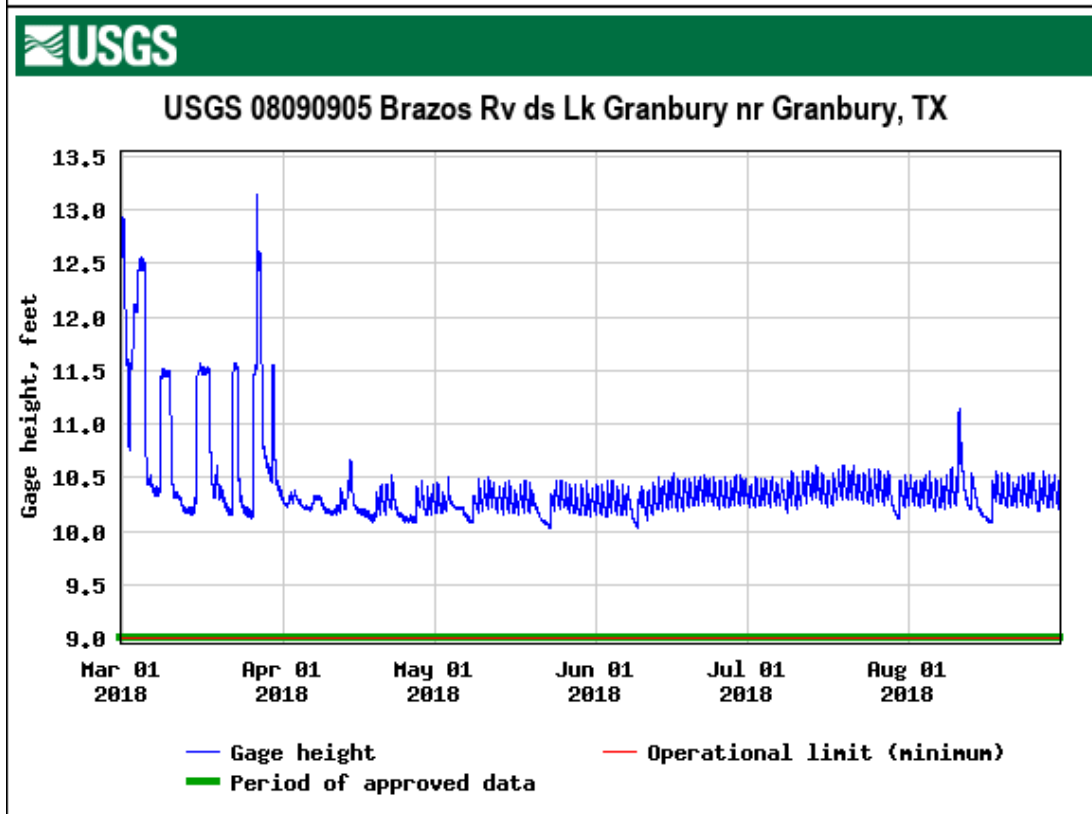
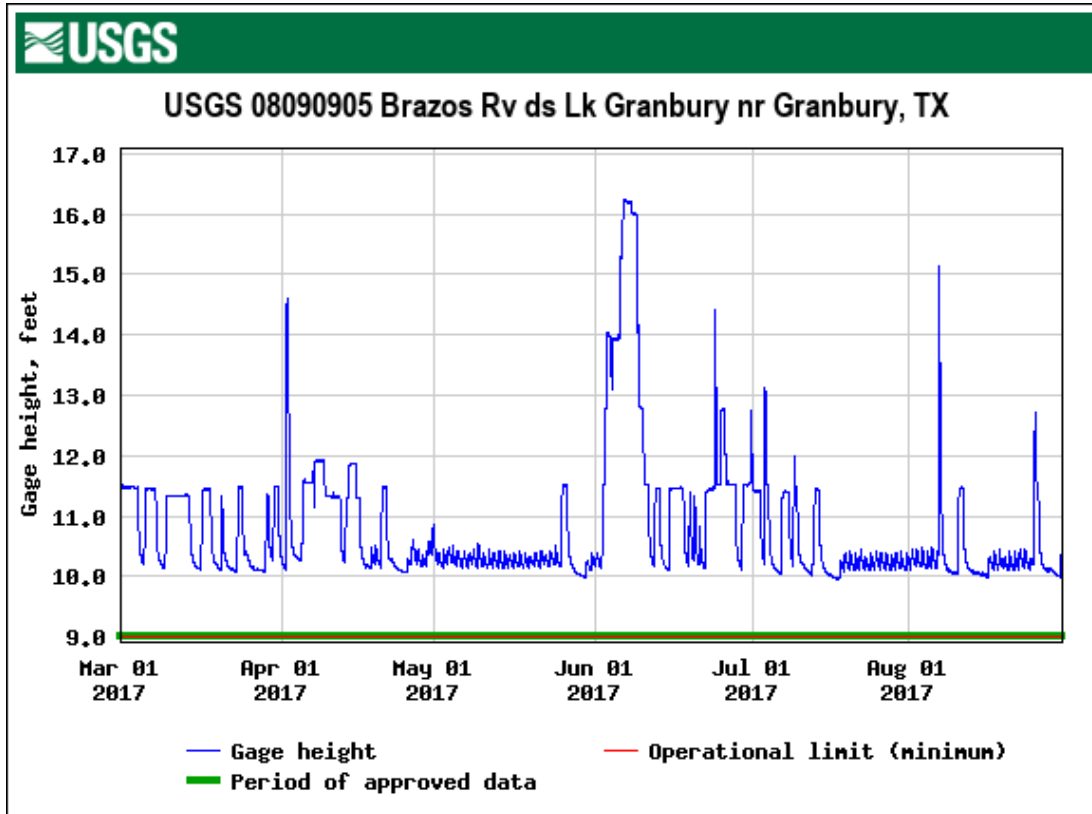
All available hydrographs for the period March 1 – August 31 for the gauging station just downstream of the Granbury dam 2013-2020. A map detailing the location of the gauging station is included.



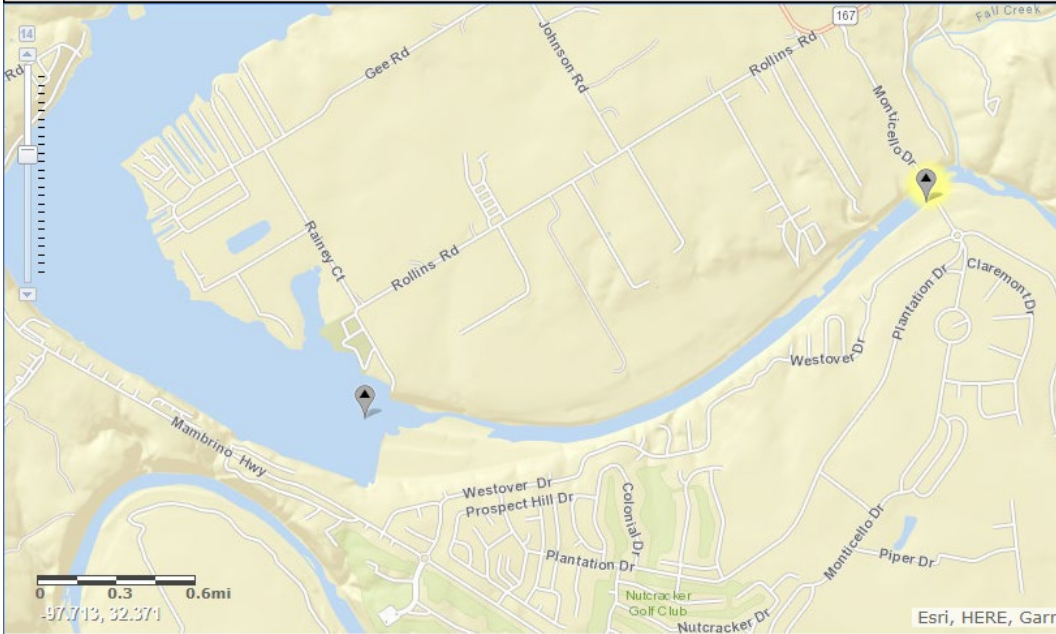
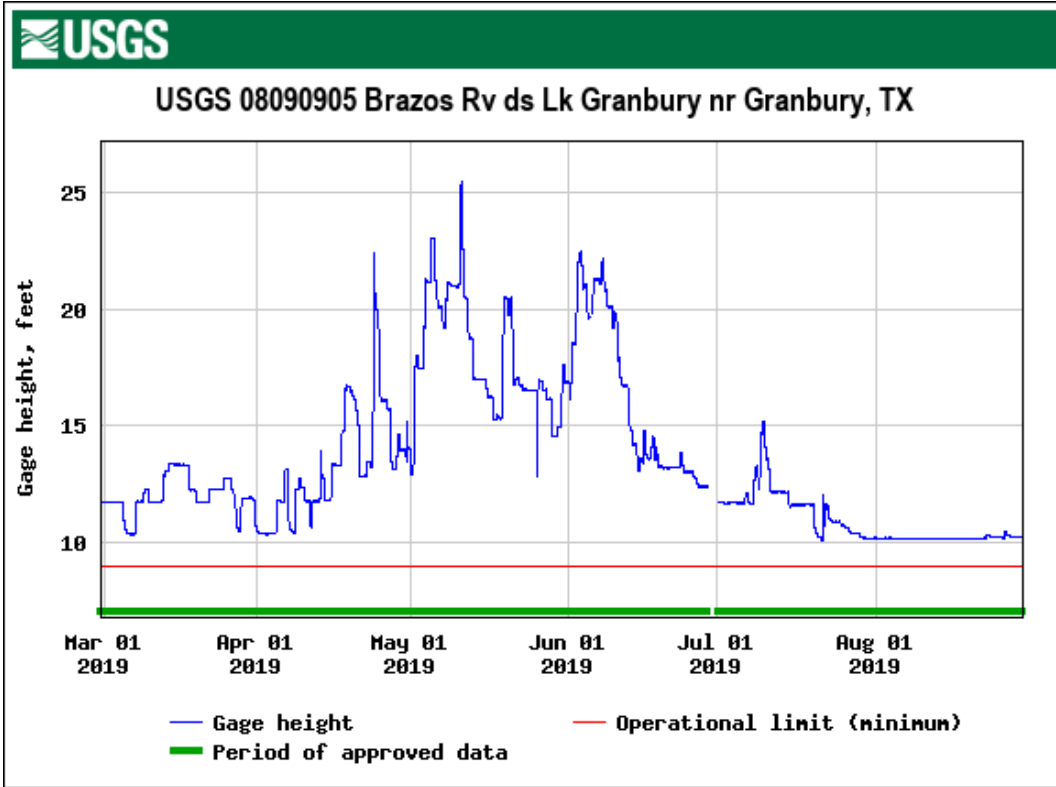
APPENDIX D Continued



APPENDIX D Continued



APPENDIX D Continued



APPENDIX E – Temperature and Dissolved Oxygen Profiles

Historical temperature and dissolved oxygen data collected in Whitney Reservoir showing the presence of a thermal refugia. Temperature data was collected on 9/5/2019 and no thermal refuge was found. The hypothesis is that much higher than normal flows in late spring/early summer prevented stratification early in the year, and no cold water remained when it did form.

Depth(m)	1994		1996		1998		2019	
	Temp(c)	DO(ppm)	Temp(c)	DO(ppm)	Temp(c)	DO(ppm)	Temp(c)	DO(ppm)
0	29	9.5	28	7.5	31	10	30.7	
1	29	9.5	28	7.5	30	10.1	30.5	
2	28	9.5	28	6.8	30	9.7	30.5	
3	28	9.5	28	5	30	9.7	30.3	
4	28	9.2	27.5	4	30	9.7	29.6	
5	28	9.1	27.5	3.5	30	9.7	29.4	
6	27	9	27.5	3	30	9.7	29.3	
7	27	8.4	27	2.5	30	9.7	29.2	
8	27	7.5	27	2.2	29	7.8	29.1	
9	27	6	26.5	1.5	29	6.4	29	
10	26	4.6	26	0.8	29	5.7	28.9	
11	25	2.8	26	0.6	29	4.8	28.9	
12	25	1	25	0.2	28	2.6	28.8	
13	24	0.5	25	0.2	28	1.5	28.7	
14	22	0.4	24.5	0	27	0.3	28.7	
15	22	0.3	24	0	26	0.1	28.5	
16	21	0.2	23	0	25	0	28.4	
17	20	0.2	23	0	24	0	28.4	
18	20	0.1	23	0	23	0	28.1	
19	20	0.1	23	0	22	0	27.8	
20	19	0.1	23	0	22	0	27.6	
21	19	0.1	22	0	21	0	27.4	
22	19	0.1	22	0	21	0	27.2	
23	19	0.1	21	0	21	0	26.8	
24			20	0	21	0	26.5	
25			20	0			26.3	
26							26	
27							25.6	
28							25.3	
29							25.4	
	Mortality observed							
	Ken Sellers memo							
	collected 6/23/1994		collected 7/18/96		collected 7/7/98		collected 9/5/19	



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