

Meredith Reservoir

2022 Fisheries Management Survey Report

PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

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INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

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Survey and Management Summary

Fish populations in Meredith Reservoir were surveyed in 2020 and 2022 using electrofishing, in 2021, 2022 and 2023 using gillnetting, and in 2022 using trap netting. Anglers were surveyed March through November 2022 and March through May 2023. Historical data are presented along with the 2022-2023 data for comparison. This report summarizes the survey results and contains a management plan for the reservoir based on those findings.

Reservoir Description: Meredith Reservoir is a 16,411-acre impoundment on the Canadian River 35 miles northeast of Amarillo, Texas. It was constructed in 1965 to provide municipal and industrial water. Meredith Reservoir has experienced substantial water level fluctuations and covered approximately 6,500 acres during 2022-2023, down from 6,990 acres in 2018-2019. Habitat was primarily silt and rock, with some non-native macrophytes. At the current elevation there are three usable boat ramps and one ADA compliant fishing pier.

Management History: Important sport fish include Channel Catfish, White Bass, Largemouth Bass, White Crappie, and Walleye. The management plan from the 2019 survey report included stocking Walleye and completing an angler creel survey. Additionally, Channel Catfish, Smallmouth Bass, and Bluegill were stocked in 2022-2023. Meredith Reservoir is managed using statewide regulations.

Fish Community

- **Prey species:** Electrofishing catch of Gizzard Shad was fair, and most Gizzard Shad were available as prey to most sport fish. Electrofishing catch of Bluegill was very low.
- **Channel Catfish:** The Channel Catfish population remained low and stable. There was little directed effort targeting Channel Catfish.
- **White Bass:** White Bass populations continue to expand and size structure is good. Directed effort targeting White Bass was low but angler catch rates were high.
- **Largemouth Bass:** Largemouth Bass electrofishing catch rates were low. Low catch rates were likely due to decreased electrofishing efficiency caused by increased conductivity. Angler effort was low and angler success was fair.
- **Crappies:** White Crappie catch rates were very low in trap nets. Angler catch data indicated that directed effort was low but catch rate was good. Black Crappie were also present.
- **Walleye:** Walleye catch rates were good but size structure is skewed toward fish less than 16 inches. Walleye growth was slow and directed angling effort and catch was high. Walleye are the most sought after species according to angler survey data.

Management Strategies: Reduce Walleye stocking frequency to decrease competition and increase growth rates. Monitor Channel Catfish populations and stock if necessary to reestablish populations. Inform the public about the negative impacts of aquatic invasive species. Conduct electrofishing surveys in 2024 and 2026, and gill net annually. Access, habitat, and vegetation surveys will be conducted in 2026/2027.

Introduction

This document is a summary of fisheries data collected from Meredith Reservoir from 2019-2023. 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 2019-2023 data for comparison.

Reservoir Description

Meredith Reservoir is a 16,411-acre impoundment on the Canadian River 35 miles northeast of Amarillo, Texas. The reservoir was built in 1965 to provide municipal and industrial water. Reservoir elevation is managed by the Canadian River Municipal Water Authority (CRMWA) and lake access is controlled by the National Park Service (NPS). Meredith Reservoir has experienced substantial water level fluctuations and covered approximately 6,600 acres during 2022-2023, down from 6,990 acres in 2018-2019. A record low of 26.14 feet ft maximum water depth (2,839.14 MSL) was documented on 8 July 2013 (Figure 1). The first documented golden alga kill occurred 20 December 2010 into March 2011 (Munger and Clayton 2015). An additional golden alga kill occurred in spring 2012 (Munger and Clayton 2015). Golden alga kills have ceased with increased water levels, and the fishery is recovering. There were no documented fish kills during this report cycle. Habitat was primarily silt and rock, with some non-native macrophytes and flooded timber. Other descriptive characteristics for Meredith Reservoir are in Table 1.

Angler Access

Meredith Reservoir has seven public boat ramps and no private boat ramps. Two of the public ramps have been unusable due to low water levels for over 20 years. Recovering water levels increased the number of available ramps. Sanford-Yake Marina, Blue West, and Fritch Fortress ramps were the most used boat ramps by anglers in 2022-2023. Limited boat access was possible at Cedar Canyon and at a low water ramp in Harbor Bay. Dredging is performed as needed to maintain boat access as water levels fluctuate. The extension of boat ramps was not feasible due to shallow slope or excessive distance from the water. A complete list of boat ramps and additional characteristics is provided in Table 2. There were ADA compliant fishing docks at Sanford-Yake Marina. Shoreline access is good in areas adjacent to boat ramps or in areas with public access roads. Shoreline access in other areas is poor due to the steep terrain and rocky shoreline.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Huber and Clayton 2019) included:

1. Stock Walleye to continue rebuilding the population following multiple Golden Algae Kills from 2010-2012.

Action: Walleye fry were stocked in 2021, 2022, and 2023. Data collected during this period suggest that there were relatively few mature females due to angling harvest. Regular stockings were conducted to prevent missing year classes.

2. Conduct an angler creel survey to ascertain current angler use and preferences.

Action: An access creel survey was conducted from March through November 2022 and March through May 2023.

3. Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically.

Action: Cooperated with the controlling authorities (CRMWA and NPS) and educated the public during contacts about the risks of invasive species.

Harvest regulation history: Sport fishes in Meredith Reservoir are currently managed with statewide regulations (Table 3). From 1988 to 1992, Smallmouth Bass were managed with a 14-inch minimum

length limit; a 12- to 15-inch slot length limit was implemented in 1992 to improve population size structure but was removed in 2011. Walleye regulations were first implemented in 1965 as a catch and release fishery. A 5 fish daily bag was implemented in 1968 and a 10-inch minimum length limit was implemented in 1970. The daily bag for Walleye was increased to 10 fish in 1980 and a 16-inch minimum length limit was implemented in 1987. The daily bag was reduced to 5 in 1987 but the 16-inch minimum length limit was retained. The current Walleye regulation of no minimum length limit with only 2 fish less than 16 inches and a daily bag limit of 5 was implemented in 1999 and is still in effect. The statewide catfish regulation was changed in 2022 to no minimum length limit with a daily bag of 25 of which, only 10 fish can be greater than 20 inches.

Stocking history: Previous to 2000, Meredith Reservoir was stocked regularly with multiple species including but not limited to Walleye, Largemouth Bass, Smallmouth Bass, Channel Catfish, and Flathead Catfish (Table 4). No fish were stocked from 2000-2016. In order to rebuild the fishery following multiple golden alga kills and major drought conditions, regular stockings were scheduled beginning in 2016. Walleye fry were stocked in 2021, 2022, and 2023. Channel Catfish fingerlings and Smallmouth Bass adults were stocked in 2022. Gizzard Shad adults were stocked in 2020 and Bluegill fingerlings were stocked in 2023. The complete stocking history can be found in Table 4.

Vegetation/habitat management history: Meredith Reservoir had a history of non-problematic Eurasian Watermilfoil which was the primary aquatic vegetation (Huber and Clayton 2019). Eurasian Watermilfoil typically is only present July through October and exhibits significant die-back during the winter. The Canadian River Municipal Water Authority and the National Park Service both have active salt cedar treatment programs.

Water transfer: Meredith Reservoir is primarily used for municipal water supply and recreation. The reservoir supplies water to 11-member cities via a 358-mile pipeline system. When functioning, the water system transfers water from the Canadian River Basin to the Brazos and Red River Basins.

Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Meredith Reservoir (Huber and Clayton 2019). Primary components of the OBS plan are listed in Table 5. All electrofishing and gillnet survey sites were randomly selected, trap net sites were biologist selected, and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2022).

Electrofishing – Largemouth Bass, sunfishes, and Gizzard Shad were collected by electrofishing (1 hour at 12, 5-min stations). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing.

Trap netting – Crappie were collected using trap nets (5 net nights at 5 stations). CPUE for trap netting was recorded as the number of fish caught per net night (fish/nn).

Gill netting – Channel Catfish, White Bass, and Walleye were collected by gill netting (6 net nights at 6 stations). CPUE for gill netting was recorded as the number of fish caught per net night (fish/nn). Ages for Walleye were determined using otoliths from all fish collected during scheduled gill net surveys.

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 ($RSE = 100 \times SE$ of the estimate/estimate) was calculated for all CPUE and creel statistics.

Creel survey – An access-point creel survey was conducted from March through November 2022 and March through May 2023. Angler interviews were conducted on 10 weekend and 8 weekdays for the March through May quarters and 5 weekend days and 4 weekdays for all other quarters to assess angler use and fish catch/harvest statistics in accordance with the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2022). Average surface acres for each quarter were 6,800 acres Spring 2022, 6,800 acres Summer 2022, 6,600 acres Fall 2022, and 6,500 acres Spring 2023.

Habitat – A structural habitat survey was conducted in 2022. Vegetation surveys were conducted in 2022 to monitor expansion of Eurasian watermilfoil. Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2022).

Water level – Source for water level data was the United States Geological Survey (USGS 2023).

Results and Discussion

Habitat: Littoral zone structural habitat consisted primarily of natural shoreline with a small amount of rip rap and rocky shoreline (Table 6). There was no native vegetation present at the time of survey, but staff documented 28.1 acres of non-native Eurasian watermilfoil (Table 7).

Creel: Directed fishing effort by anglers was highest for Walleye (56.8% in 2022 and 55.3% in 2023), followed by anything anglers, Largemouth Bass, and White Crappie anglers (Table 8). Total directed effort for all species was 41,491 hours March through May 2022, 107,997 hours March through November 2022 and decreased to 30,671 hours March through May 2023 (Table 9). A similar trend was seen for total directed expenditures (\$338,919 in Spring 2022, \$950,208 in 2022 and \$235,832 in Spring 2023) (Table 9). Most anglers encountered reside in the Texas Panhandle and the counties surrounding Meredith Reservoir. A graphical representation of interviewee ZIP code data can be found in Appendix C.

Prey species: Reservoir conductivity increased from 2640 $\mu\text{S}/\text{cm}$ in 2018, to 3005 $\mu\text{S}/\text{cm}$ in 2020, and finally to 3318 $\mu\text{S}/\text{cm}$ in 2022. Increased reservoir conductivity in 2022 and the corresponding reduced electrofishing efficiency negatively impacted the total catch rates of both Gizzard Shad and Bluegill. Total CPUE of Gizzard Shad was 165.0/h in 2018, 116.0/h in 2020, and 100.0/h in 2022 (Figure 2-3). Index of

Vulnerability (IOV) for Gizzard Shad was good, indicating that 78% of Gizzard Shad were available to existing predators; this was higher than data from 2020 (IOV = 6) and 2018 (IOV = 57; Figures 2-3). Total CPUE of Bluegill in 2022 was 1.0/h which was much lower than the 2018 and 2020 catch rates (Figures 4-5). Size structure of Bluegill in 2020 (PSD =17) indicated that the population was dominated by small individuals. The catch rate was too low in 2022 to make any meaningful inference regarding population size structure (Figure 5). Survey objectives were achieved for Gizzard Shad however, size structure objectives were not met for Bluegill. Poor catch rates and high conductivity made it impractical to increase survey effort.

Channel Catfish: The total gillnet catch rate of Channel Catfish was 1.5/nn in 2023. The Channel Catfish population continued to have a low and stable relative abundance (Figure 6). Size structure was variable with PSD values of 83 in 2021, 25 in 2022, and 63 in 2023. Mean relative weights were acceptable for most length groups but catch rates were low and caution is advised when interpreting those values (Figure 6). Directed fishing effort, catch per hour, and total harvest for Channel Catfish showed a minimal fishery (Table 10). Channel Catfish were a release-oriented fish as 86 % (2022) and 100% (2023) of the legal-sized fish were released (Table 10). Total length of harvested catfish in 2022 ranged from 13 to 20 inches (Figure 7) and no harvested fish were documented in 2023. The higher than expected rate of release may be due to the number of catfish released by anglers targeting other species such as Walleye. Size structure survey objectives (N>50 stock length) were not met in 2023 (Table 5) and low catch rates made it impractical to achieve specified objectives.

White Bass: The total gill net catch rate of White Bass was 9.7/nn in 2023. Catch rates indicated that White Bass population expanded markedly from 2021 to 2022 and remained stable in 2023 (Figure 8). Size structure was good, and PSD was stable with values of 96 in 2022 and 90 in 2023. Data indicated that the population was dominated by quality length and larger fish. Mean relative weight for most size classes was acceptable. Directed effort, catch per hour, and total harvest for White Bass was 2,549 h, 0.53 fish/h, and 6,940 fish in 2022 and 668.46h, 0.23 fish/h, and 2396 fish in spring 2023 (Table 11). White Bass were a moderately harvest-oriented fish as approximately 42% of the legal-sized fish were released in 2022 and 24.5% in Spring 2023. Observed harvest in 2022 and 2023 indicated good angler compliance, and harvested fish ranged in length from 10 to 15 inches (Figure 9).

Largemouth Bass: The electrofishing total catch rate of Largemouth Bass was 1.0/h in 2022, down from 9.0/h in 2020, and 30.0/h in 2018 (Figure 10). A meaningful interpretation of size structure and mean relative weight was not possible due to the low catch rates in 2020 and 2022. Poor catch rates in 2022 were likely due to increased reservoir conductivity which negatively affected electrofishing efficiency. Directed fishing effort, catch per hour, and total harvest for Largemouth Bass was 2,550.17 h, 0.19 fish/h, and 110 fish, respectively, during Spring 2022 and 5,906 h, 0.15 fish/h, and 110.01 fish for the entire 2022 creel period. Directed fishing effort, catch per hour, and total harvest for Largemouth Bass was 3,800.22 h, 0.15 fish/h, and 29 fish, during Spring 2023 (Table 12). Most legal Largemouth Bass were released. Percent legal released was estimated to be 89.2% in 2022 and 66% in spring 2023 (Table 12). Compliance was mixed as several fish under the minimum length limit were documented in 2022 but compliance was good in 2023 (Figure 11). Survey objectives were not met for Largemouth Bass in 2022 (Table 5). High conductivity and very low catch rates (1.0 fish/h) made it impractical to attempt achieving specified objectives.

Crappies: The total trap net catch rate of White Crappie was 1.0/nn in 2023 (Figure 12). Directed fishing effort, catch per hour, and total harvest for White Crappie was 3,603h, 0.21 fish/h, and 3057 fish, respectively, during Spring 2022 and 9,082.63 h, 0.39 fish/h, and 5,511 fish, respectively, for the entire 2022 creel period (Table 13). Directed fishing effort, catch per hour, and total harvest for White Crappie was 1,633 h, 0.38 fish/h, and 1,020 fish, during Spring 2023 and 9,083 h, 0.39 fish/h, and 5,511 fish, during 2022 (Table 13). White Crappie were a harvest-oriented fishery and percent legal released ranged from 15.2% to 14.4% in 2022-23. Compliance was good and harvested White Crappie ranged from 10 to 13 inches across both years (Figure 13). Black Crappie were also present in the reservoir, but sampling catch rates were very low and most anglers were unable differentiate them from the more abundant White Crappie during angler survey interviews. Size structure (N=50 fish) objective was not achieved in 2022 (Table 5). A catch rate of 1 fish/nn made it impractical to attempts achieving specified objectives.

Walleye: The gill net catch rate of stock-length Walleye was 18.0/nn in 2023, slightly lower than the 19.4/nn in 2022, and higher than 15.3/nn in 2021 (Figures 14-15). A decline in PSD from 52 to 19 since 2021 indicated that the size structure shifted towards smaller fish (Figure 15). Body condition (W_r) ranged from 82 to 104 in 2023, 76 to 106 in 2022, and 71 to 109 in 2021 (Figures 14-15). Body condition was generally poor with some variability across length groups but improved slightly in 2023 compared to recent data (Figure 15). Growth was below optimal (Figure 16) and slow when compared to historical growth in Munger and Clayton 2010. Actual Walleye stocking rates have been variable since 2016 but range from 47 fry/acre in 2019 to 562 fry/acre in 2022 (Appendix C). Directed fishing effort, catch per hour, and total harvest for Walleye was 28,914 h, 0.59 fish/h, and 6,097 fish, respectively, from March through May 2022 and, 61,304 h, 0.51 fish/h, and 10,947 fish from March through November 2022 (Table 14). Directed fishing effort, catch per hour, and total harvest for Walleye was 16,952 h, 0.32 fish/h, and 2,194 fish, respectively, from March through May 2023. The bulk of harvested Walleye were 12 to 16 inches with very few fish documented greater than 16 inches total length (Figure 17). An aggressive stocking schedule, expanding White Bass population, declining water levels and historically high angler harvest resulted in an abundance of 13-16 inch Walleye with relatively poor body condition. This shift may be due to slow growth (Figure 16) and increased angler pressure compared to historic data (Table 14). Initial analyses was conducted, using creel data, to estimate the percent of anglers that would be affected by theoretical changes to the existing Walleye regulation (Appendix E). Potential regulation changes included implementation of a traditional 16 inch minimum length limit, no minimum length limit with no more than 2 fish greater than 18 inches, and a reduction to a daily bag limit of 3 Walleye. It was determined that none of the proposed regulation changes would achieve the goal of improving Walleye size structure and growth rates because the regulations either did not affect enough anglers or the regulation was deemed inappropriate to address the truncated nature of the current Walleye population. Survey objectives for size structure ($N \geq 50$ stock) and condition (10 fish/inch-group) were met in 2023 (Table 5), but survey objectives for abundance ($RSE\text{-Stock} \leq 25$) were not met in 2023. The RSE for stock-length fish was 29 in 2023 and staff made the determination that the RSE was adequate and survey data were representative of the Walleye population. This shift could be due to slow growth (Figure 16) and higher angler pressure (Table 14).

Fisheries Management Plan for Meredith Reservoir, Texas

Prepared – July 2023

ISSUE 1: The Walleye population at Meredith Reservoir is currently dominated by fish less than 16 inches total length. Additionally, body condition indices are less than optimal and growth rates have slowed which indicates forage size and numbers are inadequate and competition is high particularly for Walleye less than 18 inches total length. Directed effort has increased substantially (6,887h in 2010 to 61,304h in 2022) and population size structure was similar in angler interview and gill net catch data. A reduction in stocking rate and frequency will be implemented to decrease competition which should improve both body condition and growth rates.

MANAGEMENT STRATEGIES

1. Continue annual monitoring of Walleye populations with gill nets. Annual monitoring is needed to evaluate the current regulations and maintain population trend data, condition factor, and growth.
2. Age and growth data will be collected on all Walleye caught during spring gill net surveys to continue monitoring growth rates.
3. Stock Walleye at a rate of 50 fry/acre in 2024 and 2025 and 250 fry/acre in 2026. Stocking rates and frequency after 2026 will be based on survey data collected including age and growth.

ISSUE 2: Channel Catfish populations have been slow to recover at Meredith Reservoir following drought and Golden Algae kills from 2010-2013. Channel Catfish were stocked in 2022 to bolster existing populations. Reproduction rates may be inadequate and occasional stockings may be necessary in the future if catch rates remain low and angler effort increases.

MANAGEMENT STRATEGIES

1. Continue monitoring of Channel Catfish populations using spring gill nets and angler creel data.
2. Evaluate the 2022 stocking using scheduled gillnetting, to determine if Channel Catfish stockings are an effective tool to address what appears to be low abundance likely due to low recruitment.

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 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 National Parks Service 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 (2023–2027)

Sport fish, forage fish, and other important fishes

Sport fishes in Meredith Reservoir include Channel Catfish, Flathead Catfish, Largemouth Bass, Smallmouth Bass, White Crappie, Black Crappie, White Bass, and Walleye. The primary forage species are Bluegill and Gizzard Shad

Low-density fisheries

Flathead Catfish: Flathead Catfish have not been documented since 2009. According to angler creel data, there was no directed effort, and no Flathead Catfish were caught for the entire survey period. It is assumed that Flathead Catfish are no longer present in Meredith Reservoir. Any Flathead Catfish sampled will be documented and if populations recover or are restocked the sampling schedule and objectives will be reevaluated.

Black Crappie: Black Crappie were introduced to Meredith reservoir in 1966 and more recently stocked by the National Park Service in 2016. Historical catch rates are very low and there has been a lack of natural recruitment. Species specific sampling is not necessary, and any Black Crappie will be documented during other scheduled surveys.

Survey objectives, fisheries metrics, and sampling objectives

White Bass: Combined directed effort for White bass was 2.4% in 2022 and 2.2% in 2023. Even though White Bass make up a small percentage of the total directed effort, the population is expanding and possibly impacting Walleye populations, which makes it necessary to collect relevant data on this species. Analysis of historical data estimates that more than 13 random stations would be necessary to achieve minimum population abundance trend data (CPUE-S $RSE \leq 25$) and size structure (PSD; 50 fish stock length fish minimum with 80% confidence). Based on low directed effort, White Bass data will be collected using the same strategy as Walleye. No additional stations are planned if Walleye objectives are met.

Black Basses: Combined directed effort for all black basses was 5.6% in 2022 and 12.4% in 2023. Trend data on relative abundance and size structure has been collected regularly from 1996-2018 and in 2020 and 2022 using fall electrofishing. Only one black bass was sampled in 2022 in 12, 5min stations. Low catch rates are due to decreased electrofishing efficiency caused by high reservoir conductivity. Analysis of historical data indicates that more than 100 random stations would be necessary to achieve minimum population abundance trend data (CPUE-S $RSE \leq 25$) and size structure (PSD; 50 fish stock length fish minimum with 80% confidence). Due to the excessive effort anticipated to meet these standards, a practical effort of 12 randomly selected 5-min electrofishing stations will be sampled in 2024 and 2026 (Table 15) to maintain population trend data if conductivity is favorable ($< 4,000 \mu S/cm$). Reservoir conductivity greater than $4,000 \mu S/cm$ would reduce efficiency to the point that survey data is not meaningful.

White Crappie: Directed effort for White Crappie was approximately 8.4% in 2022 and 5.3% in 2023. Trap net data has been highly variable and catch rates have been low (1.0/nn in 2022 and 0.2/nn in 2016). Analysis of historical data indicates that an estimated 60 random stations would be necessary to achieve minimum population abundance trend data (CPUE-S $RSE \leq 25$) and an estimated 25 random station would be necessary to achieve minimum size structure data (PSD; 50 fish stock length fish minimum with 80% confidence). Thus, a practical effort of 6 trap net stations will be sampled in 2026 to

maintain population data (Table 15). Typically fall/winter trap nets have resulted in low catch rates. Spring trap netting will be conducted in 2026 based on improved sampling success at some waterbodies across the state to monitor large changes in the population. Sampling sites will be biologist selected to maximize catch rates. Gill net and electrofishing data will be used to determine presence/absence of crappie. Personnel will document any crappie sampled during planned gill net and electrofishing surveys. Data collected during the scheduled angler creel survey will also be used to determine presence/absence of crappie and size structure.

Walleye: Directed effort for Walleye was 56.8% in 2022 and 55.3% in 2023 which indicated that Walleye are the most important species to anglers at Meredith Reservoir. Analysis of 2023 data estimate that 12 random stations would be necessary to achieve minimum population abundance trend data (CPUE-S $RSE \leq 25$) and 6 random stations would be necessary to achieve minimum size structure (PSD; 50 fish stock length fish minimum with 80% confidence). Annual minimum sampling effort from 2024 to 2027 will be 6 randomly selected stations (Table 15). If objectives for both abundance and size structure are not met, additional sites may be included if catch rates indicate that goals are achievable, however the total sampling effort will not exceed 12 randomly selected gill net stations annually. Strong spring winds and the resulting data quality and safety concerns have resulted in a historically wide sampling window. Staff will strive to schedule spring gillnetting from April 1 through April 15 to minimize yearly variability of catch rates and body condition if weather conditions allow. Due to slowed growth rates and variability of length at age, category 2 data collection is unlikely to provide adequate accuracy and precision. Additionally, the truncated nature of the current population makes it unlikely that staff would be able to collect the total number of fish required per 10mm length group (particularly Walleye > 16 inches) for a Category 3 age and growth survey. Due to these limitations, staff will collect age and growth data for all Walleye caught during scheduled gill net surveys (Category 1). Walleye will be aged using otoliths following established TPWD protocols. Additionally, Walleye will be sexed when extracting otoliths. Sex data is easily obtained when processing fish and may be beneficial in future analysis.

Channel Catfish: Creel data indicates that Channel Catfish received 2.4% of the direct angler effort in 2022 and 2.1% in Spring 2023. Due to low angler demand and low catch rates, general monitoring and trend data will be collected to document any large-scale changes in the fish population. Analysis of 2022 and 2023 data estimate that 9 random stations would be necessary to achieve minimum population abundance trend data (CPUE-S $RSE \leq 25$) and 45 random stations would be necessary to achieve minimum size structure (PSD; 50 fish stock length fish minimum with 80% confidence). Due to excessive effort, lack of angler demand and the potential for high sport fish bycatch, Channel Catfish data will be collected using the same strategy as Walleye (minimum of 6 random gill net stations) with no specified objectives of abundance or size structure.

Forage fish: Bluegill and Gizzard Shad are the primary forage species at Meredith Reservoir. Trend data has been collected regularly from 1996-2018 and in 2020 and 2022 using fall electrofishing. Sampling, as per black basses above, will allow for general monitoring of large-scale changes of relative abundance, size structure, and IOV data for forage species. No additional effort will be extended beyond what is used for black bass sampling.

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Tables and Figures

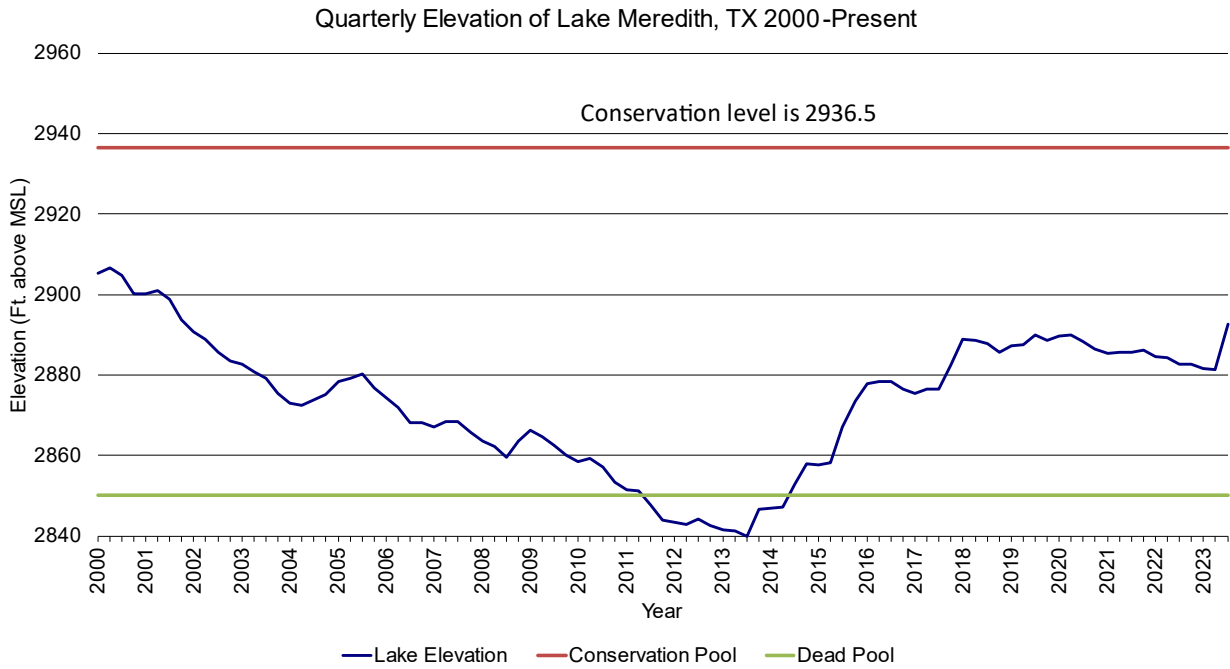


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Meredith Reservoir, Texas.

Table 1. Characteristics of Meredith Reservoir, Texas.

Characteristic	Description
Year constructed	1965
Controlling authority	Canadian River Municipal Water Authority and National Park Service
County	Hutchinson, Moore, Potter
Reservoir type	Main Stem
Shoreline Development Index	2.51
Conductivity	3,318 μ S/cm

Table 2. Boat ramp characteristics for Meredith Reservoir, Texas, August 2022. Reservoir elevation at time of survey was 2,882 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Sanford-Yake	35.707534 -101.555136	Y	120	2,844	Usable at elevation
Cedar Canyon	35.694990 -101.573509	Y	60	2,903	End of ramp (EOR) elevation is 16 ft above water. Extension is not feasible.
Fritch Fortress	35.688489 -101.592646	Y	80	2,863	Usable at current elevation.
Harbor Bay	35.652362 -101.628718	Y	40	2,912	EOR elevation is 26 ft above water. Extension is not feasible. There is a low water ramp at Harbor Bay that is currently usable
Blue West	35.68815 -101.63032	Y	50	2,895	EOR elevation is 9 ft above water. Extension is not feasible
Alibates	35.587616 -101.708155	Y	20	2,912	EOR elevation is 26 ft above water. Extension is not feasible
Plum Creek	35.597238 -101.713031	Y	20	2,915	EOR elevation is 29 ft above water. Extension is not feasible

Table 3. Harvest regulations for Meredith Reservoir, Texas.

Species	Bag limit	Length limit
Catfish: Channel and Blue Catfish, their hybrids and subspecies	25 (only 10 \geq 20 inches)	None
Catfish, Flathead	5	18-inch minimum
Bass, White	25	10-inch minimum
Bass, Largemouth and Smallmouth	5 ^a	14 inch minimum
Crappie: White and Black crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum
Walleye	5 (no more than 2 under 16 inches)	None

^a Daily bag for Largemouth Bass, Spotted Bass, and Guadalupe Bass = 5 fish in any combination.

Table 4. Stocking history of Meredith Reservoir, Texas. FRY = fry, FGL = fingerling; AFGL = advanced fingerling; ADL = adults.

Species	Year	Number	Size
Gizzard Shad	2018	150	ADL
	2020	180	ADL
	Total	330	
Rainbow Trout	1973	50,000	ADL
	1989	3,000	ADL
	Total	53,000	
Brown Trout	1973	30,000	ADL
Blue Catfish	1965	2,500	FGL
	1966	9,000	FGL
	1971	12,000	FGL
	1972	30,000	FGL
	1988	160,500	FRY
Total	214,000		
Channel Catfish	1965	421,500	FGL
	1966	360,000	FGL
	1970	9,680	FGL
	1971	12,000	FGL
	1973	107,690	FGL
	2022	9,716	FGL
Total	920,586		
Flathead Catfish	1966	15,000	FGL
	1966	18	ADL
	2016	30,670	FRY
Total	45,688		
White Bass	1965	15	ADL
Smallmouth Bass	1974	11,100	FGL
	1975	28,000	FGL
	1976	66,000	FGL
	1977	322,700	FGL
	2017	39,463	FGL
	2018	50,405	FGL
	2019	50,410	FGL
	2022	95	ADL
Total	568,173		

Table 4. Stocking history continued.

Species	Year	Number	Size
Largemouth Bass	1965	480,000	FGL
	1966	432,000	FGL
	1973	88,000	Mix
	1983	553	ADL
	1993	10,200	FGL
	1994	160,400	FGL
	1995	586,663	FGL
	2000	20,370	FGL
	2019	277,723	FGL
	Total	2,055,909	
Florida Largemouth Bass	1986	631	ADL
	1990	401,749	FGL
	1993	100,000	FGL
	1997	177,000	FGL
	Total	679,380	
Kemp's Largemouth Bass	1988	412,727	FGL
	1990	189	ADL
	2001	32,000	FGL
	Total	444,916	
Mixed Largemouth Bass	1989	197	ADL
	1990	40	ADL
	Total	237	
Bluegill	2016	82,611	FGL
	2018	25	ADL
	2023	41,438	FGL
	Total	124,074	
Crappie	1994	308	ADL
White Crappie	1966	50,000	FGL
	1993	161	ADL
	Total	50,161	
Black Crappie	1966	150,000	FGL
	2016	5,992	ADL
	Total	155,992	

Table 4. Stocking history continued.

Species	Year	Number	Size
Yellow Perch	1980	2,500	ADL
	1981	2,500	ADL
	1983	2,212	ADL
	1984	400	ADL
	1992	165,116	FGL
	1995	30,381	FGL
	Total	203,109	
Walleye	1965	500,000	FRY
	1966	2,000,000	FRY
	1969	750,000	FRY
	1998	5,096,000	FRY
	2000	290,196	FGL
	2016	2,709,402	FRY
	2017	3,066,592	FRY
	2018	1,720,560	FRY
	2019	334,136	FRY
	2021	2,131,820	FRY
	2022	3,818,068	FRY
	2023	2,800,520	FRY
	Total	25,217,294	

Table 4. Objective-based sampling plan components for Meredith Reservoir, Texas 2019-2023.

Gear/target species	Survey objective	Metrics	Sampling objective
<i>Electrofishing</i>			
Largemouth Bass	Abundance	CPUE–Stock	Practical Effort, Trend data
	Size structure	PSD, length frequency	N ≥ 50 stock
	Condition	W _r	10 fish/inch group (max)
Bluegill ^a	Abundance	CPUE–Total	Practical Effort, Trend data
	Size structure	PSD, length frequency	N ≥ 50
Gizzard Shad ^a	Abundance	CPUE–Total	Practical Effort, Trend data
	Size structure	PSD, length frequency	N ≥ 50
	Prey availability	IOV	N ≥ 50
<i>Gill Netting</i>			
Channel Catfish	Abundance	CPUE–stock	Practical Effort, Trend data
	Size structure	Length frequency	N ≥ 50 stock
Walleye	Abundance	CPUE–Stoc	RSE–Stock ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock
	Condition	W _r	10 fish/inch group (max)
<i>Trap netting</i>			
Crappie	Size structure	PSD, length frequency	N = 50

^a No additional effort will be 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 can provide information on forage abundance, vulnerability, or both relative to predator density.

Table 5. Survey of structural habitat types, Meredith Reservoir, Texas, 2022. Shoreline habitat type units are in miles and standing timber is acres.

Habitat type	Estimate	% of total
Natural	20.7 miles	73.1
Rip Rap or Dam	0.6 miles	2.1
Rocky	6.99 miles	24.7
Standing timber	401.3 acres	6.0

Table 6. Survey of aquatic vegetation, Meredith Reservoir, Texas, 2022. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Vegetation	2022
Non-native	
Eurasian watermilfoil (Tier III)*	28.1 (<0.1)

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

Table 7. Percent directed angler effort by species for Meredith Reservoir, Texas, 2019-2023. Survey periods were from 1 April through 31 September in 2010, 1 March through 30 November in 2022, and 1 March through 31 May in 2023.

Species	2010	2022	2023
Channel Catfish	18.6	2.4	2.1
White Bass	6.6	2.4	2.2
Bluegill	0.0	1.1	0.0
Smallmouth Bass	0.6	0.1	0.0
Largemouth Bass	4.8	5.5	12.4
White Crappie	7.3	8.4	5.3
Walleye	22.1	56.8	55.3
Anything	38.7	21.2	21.2

Table 8. Total fishing effort (h) for all species and total directed expenditures at Meredith Reservoir, Texas, 2009-2012. Survey periods were from 1 April through 31 September in 2010, 1 March through 30 November in 2022, and 1 March through 31 May in 2023. Relative standard error is in parentheses.

Creel statistic	2010	Spring 2022	2022	Spring 2023
Total fishing effort	31,158 (17)	41,491 (37)	107,997 (28)	30,671 (25)
Total directed expenditures	\$110,286 (41)	\$338,919 (43)	\$950,208 (34)	\$235,832 (31)

Gizzard Shad

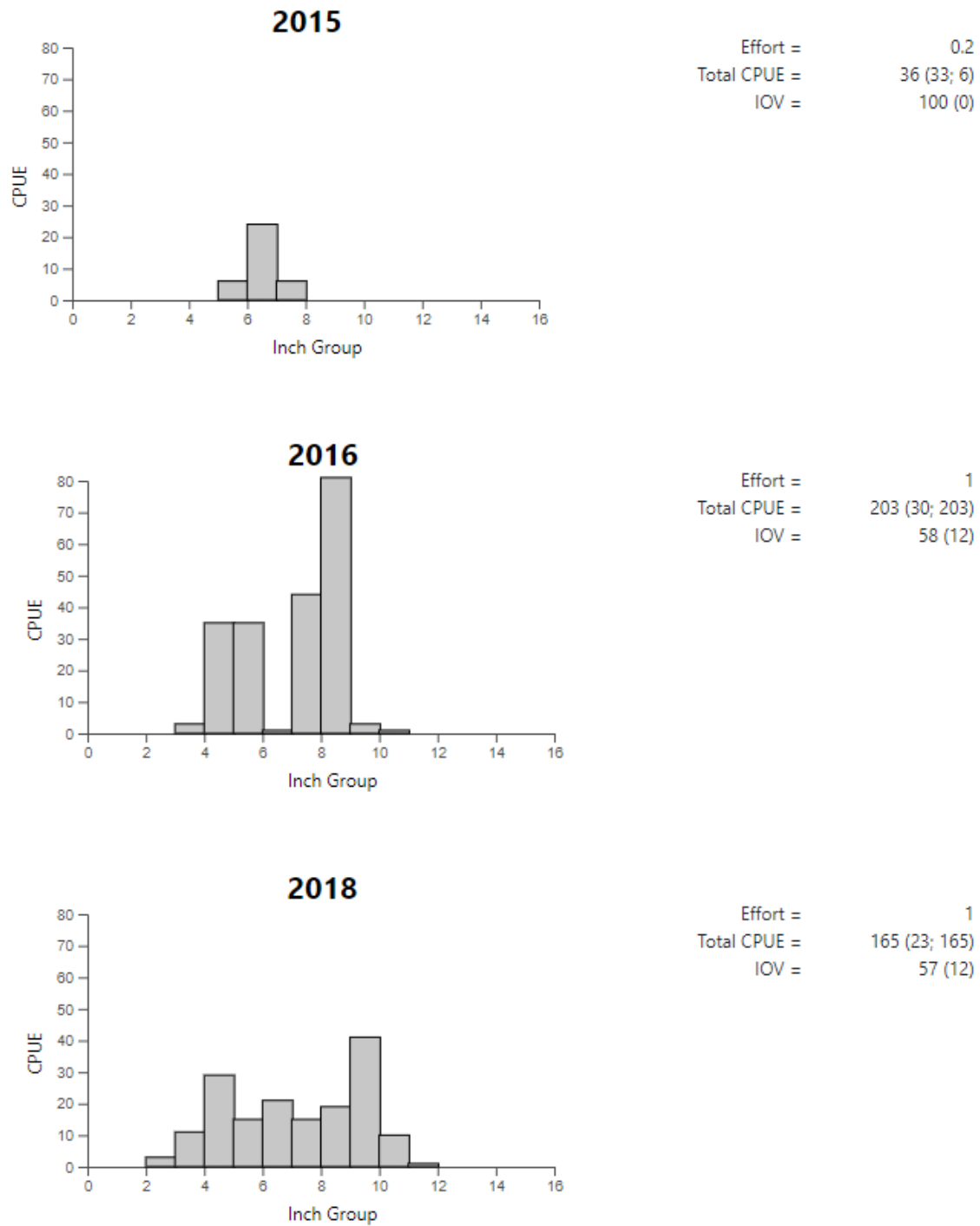


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Meredith Reservoir, Texas, 2015, 2016, and 2018.

Gizzard Shad Cont.

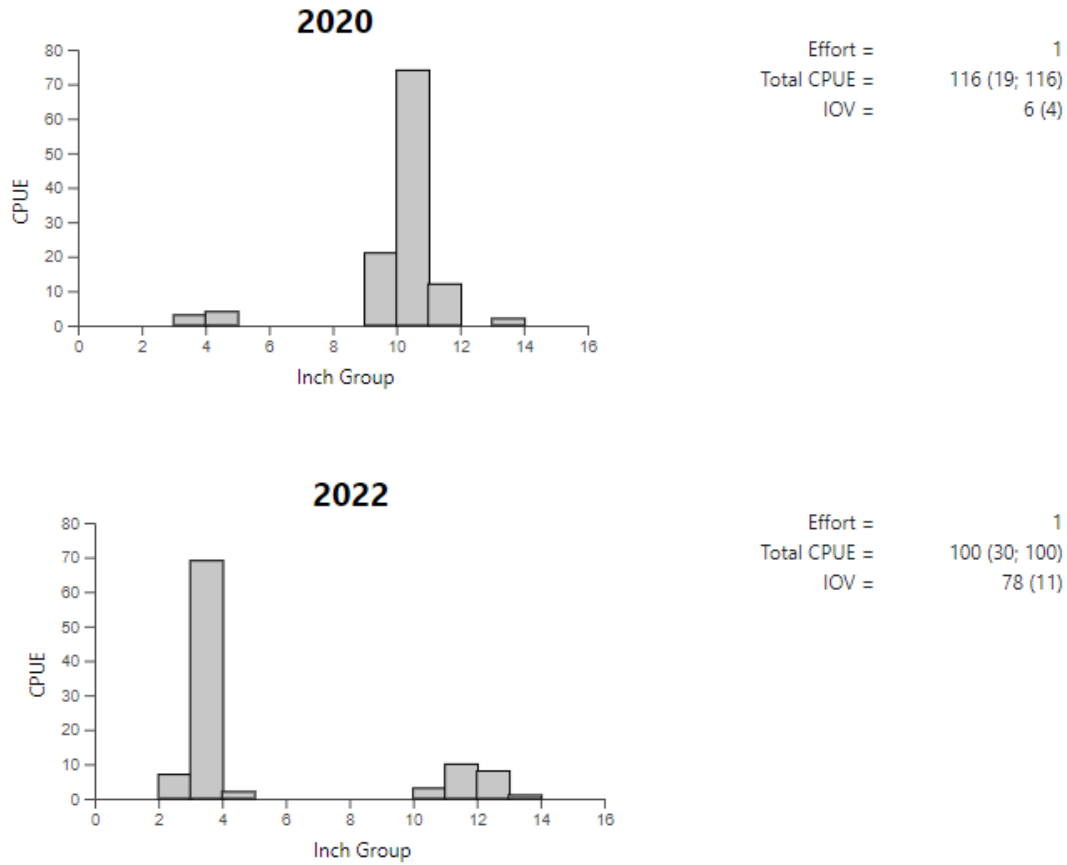


Figure 3. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Meredith Reservoir, Texas, 2020 and 2022.

Bluegill

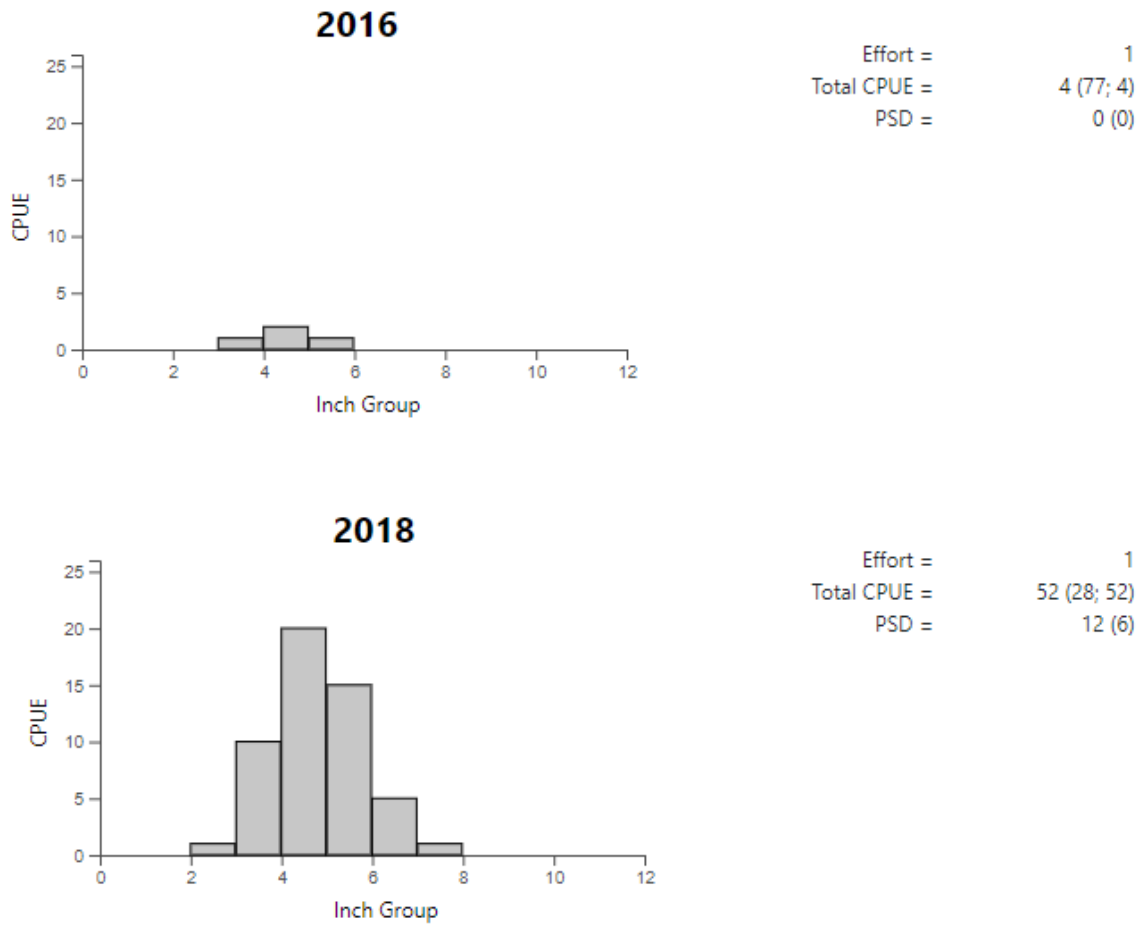


Figure 4. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Meredith Reservoir, Texas, 2016 and 2018.

Bluegill Cont.

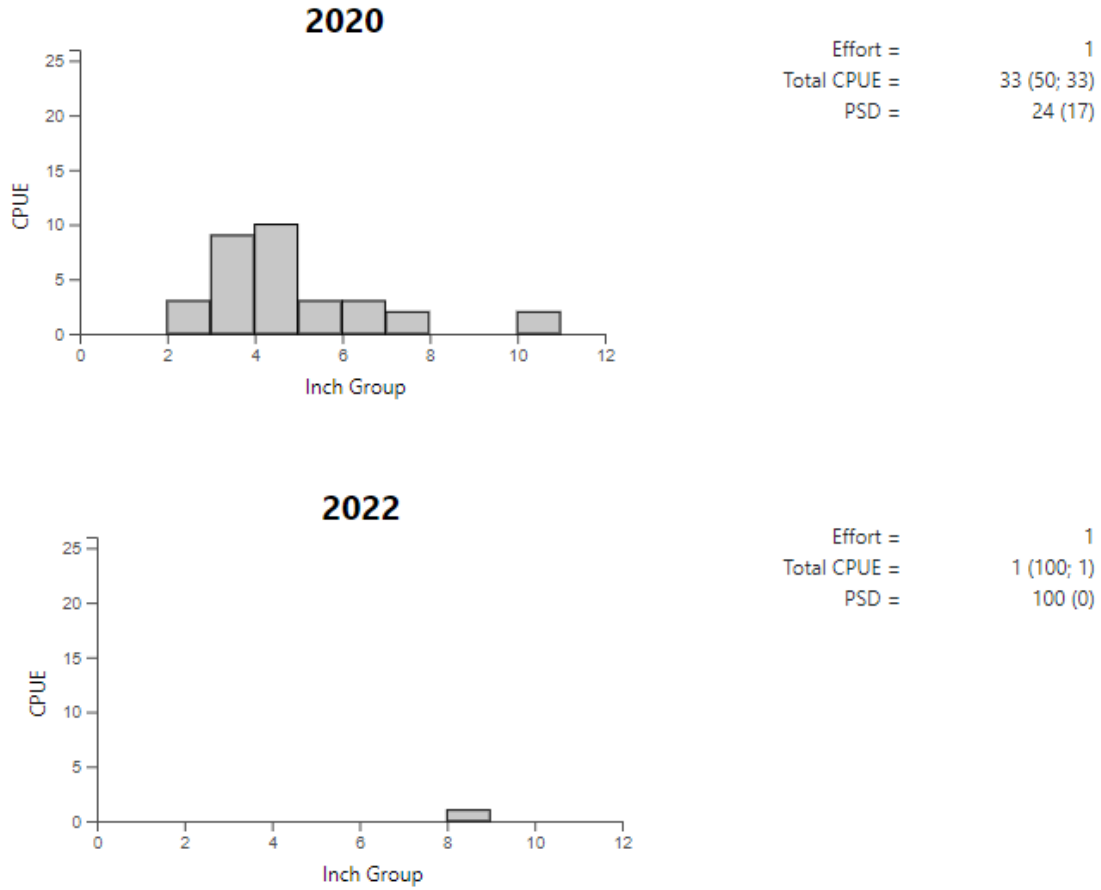


Figure 5. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Meredith Reservoir, Texas, 2020 and 2022.

Channel Catfish

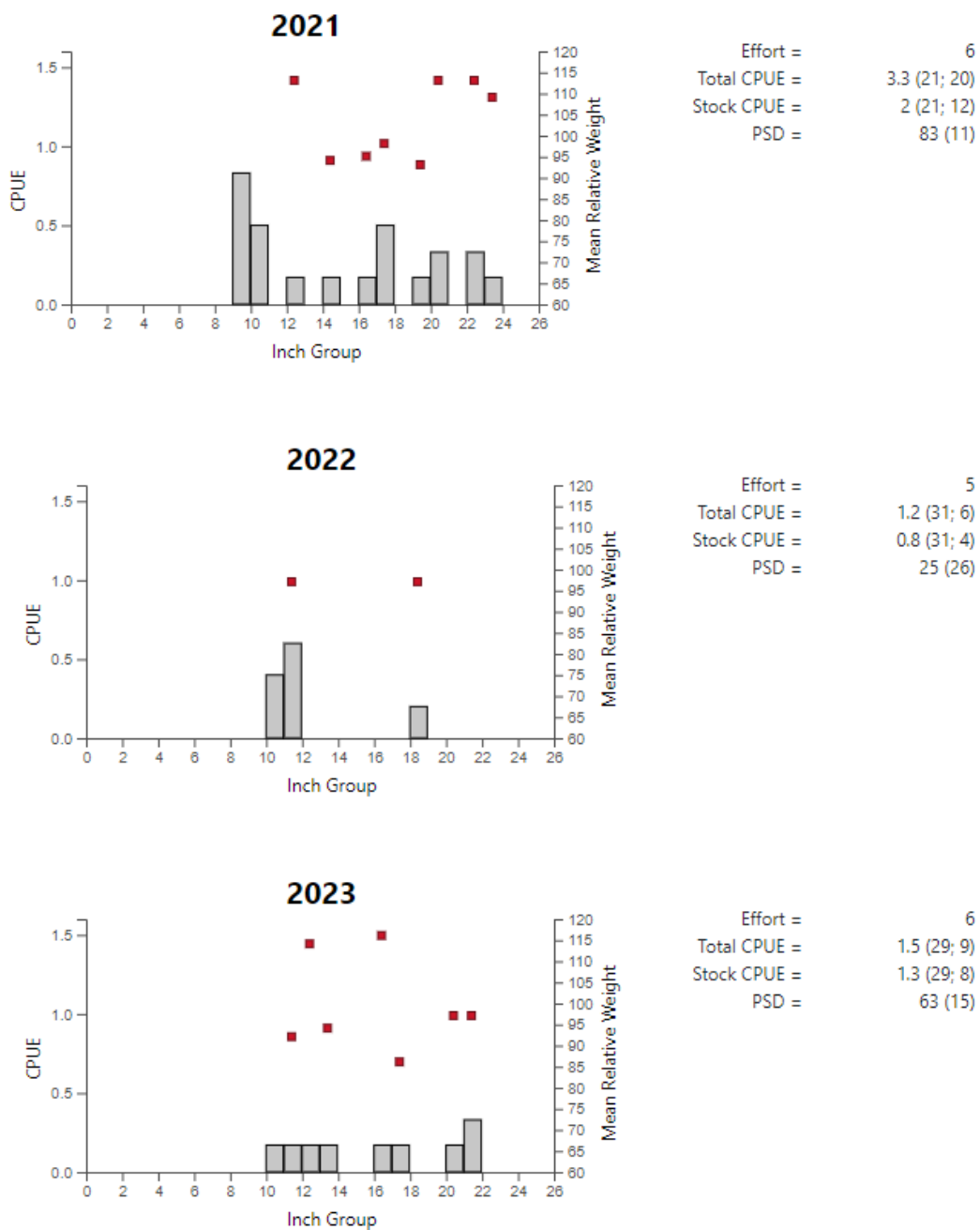


Figure 6. Number of Channel Catfish caught per net night (CPUE), mean relative weight (squares), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Meredith Reservoir, Texas, 2019, 2022, and 2023.

Table 9. Creel survey statistics for Channel Catfish at Meredith Reservoir, Texas, from 1 April through 31 September in 2010, 1 March through 30 November in 2022, and 1 March through 31 May in 2023 Total catch per hour is for anglers targeting Channel Catfish and total harvest is the estimated number of Channel Catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	2010	Spring 2022	2022	Spring 2023
Surface area (acres)	4,200	6,800	6,700	6,500
Directed effort (h)	5,785.47 (24)	786.36 (57)	2,616.46 (48)	637.80 (60)
Directed effort/acre	1.38 (24)	0.11 (57)	0.39 (48)	0.09 (60)
Total catch per hour	0.37 (52)	0.11 (00)	0.03 (00)	0.05 (117)
Total harvest	1,518 (45)	66.01 (330)	285.76 (136)	0 (-)
Harvest/acre	0.36 (45)	0.01 (330)	0.04 (136)	0 (-)
Percent legal released	21	79.9	86.2	100

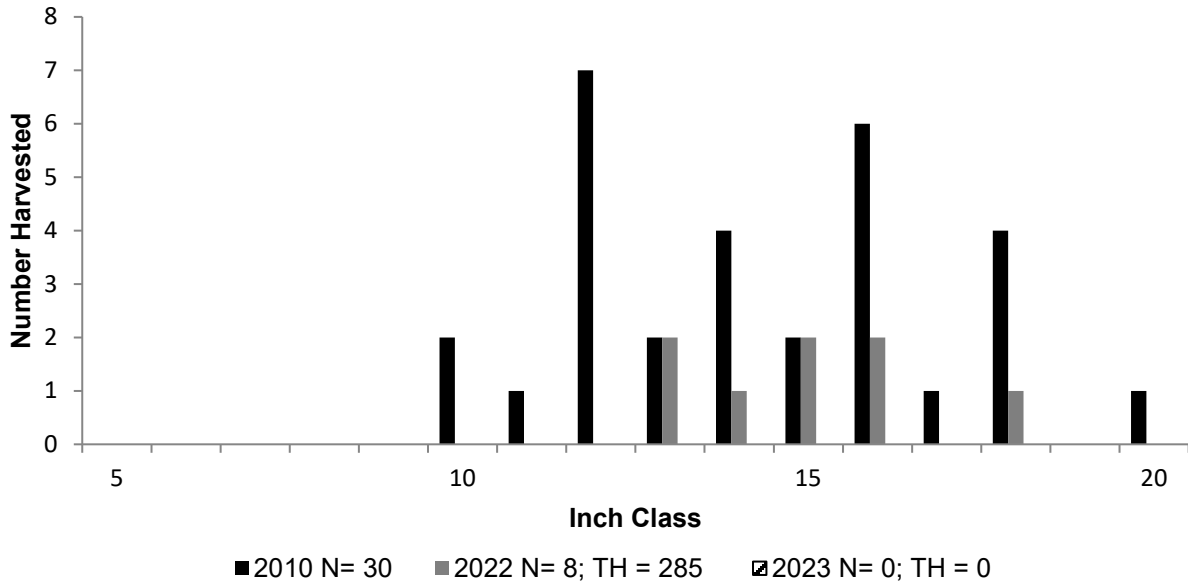


Figure 7. Length frequency of harvested Channel Catfish observed during creel surveys at Meredith Reservoir, Texas, 1 April through 31 September in 2010, 1 March through 30 November in 2022, and 1 March through 31 May in 2023, all anglers combined. N is the number of harvested Channel Catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

White Bass

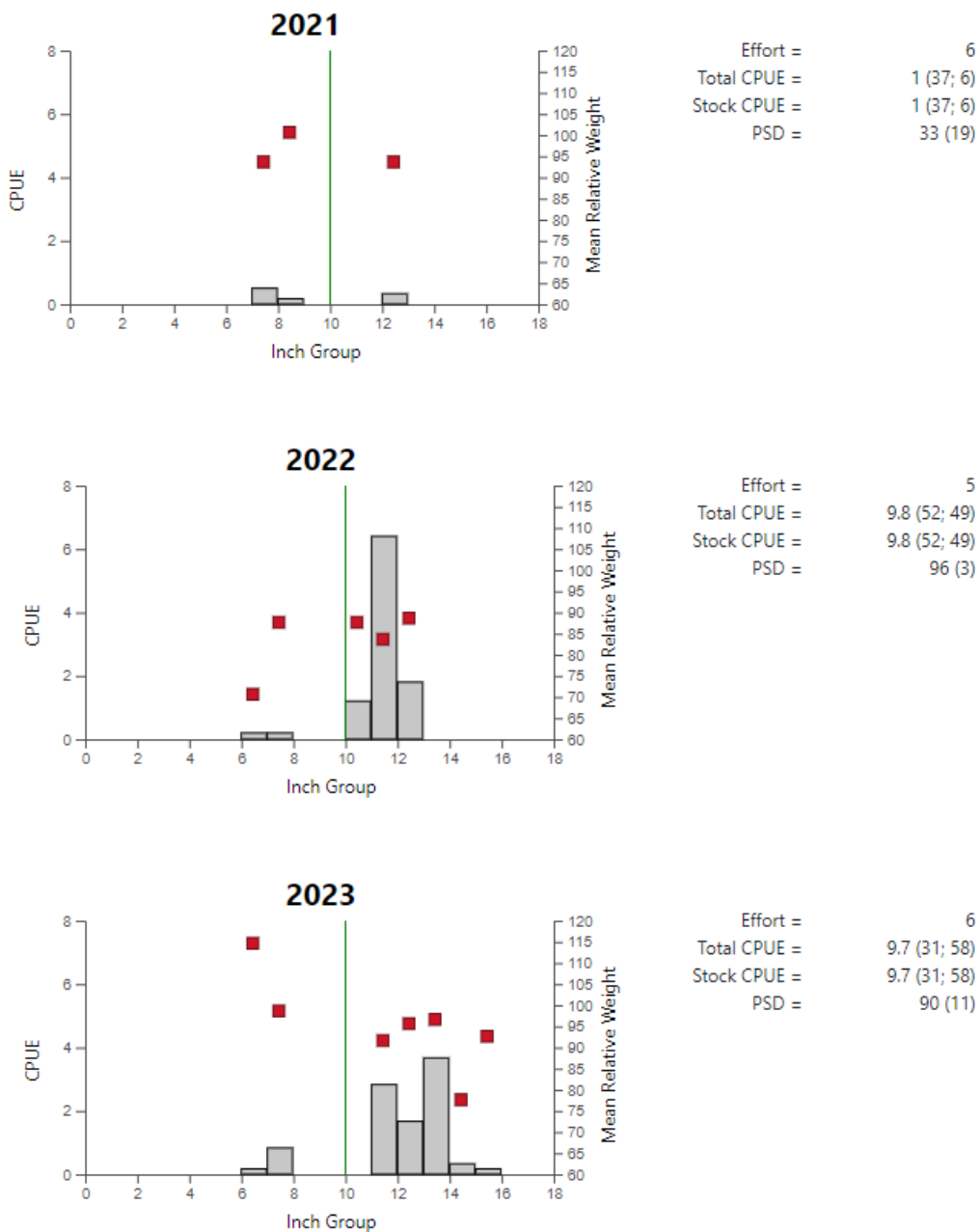


Figure 8. Number of White Bass caught per net night (CPUE), mean relative weight (squares), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Meredith Reservoir, Texas, 2021, 2022, and 2023. Vertical line indicates minimum length limit.

Table 10. Creel survey statistics for White Bass at Meredith Reservoir, Texas, from 1 April through 31 September in 2010, 1 March through 30 November in 2022, and 1 March through 31 May in 2023. Total catch per hour is for anglers targeting White Bass and total harvest is the estimated number of White Bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	2010	Spring 2022	2022	Spring 2023
Surface area (acres)	4,200	6,800	6,700	6,500
Directed effort (h)	2,054.50 (35)	NA	2,549.11 (53)	668.46 (59)
Directed effort/acre	0.49 (35)	NA	0.38 (53)	0.10 (59)
Total catch per hour	0.31 (115)	NA	0.53 (82)	0.23 (.)
Total harvest	1,843 (45)	2,232 (52)	6,940.54 (33)	2,396.14 (43)
Harvest/acre	0.44 (45)	0.33 (52)	1.04 (33)	0.37 (43)
Percent legal released	11	12.0	42.2	24.5

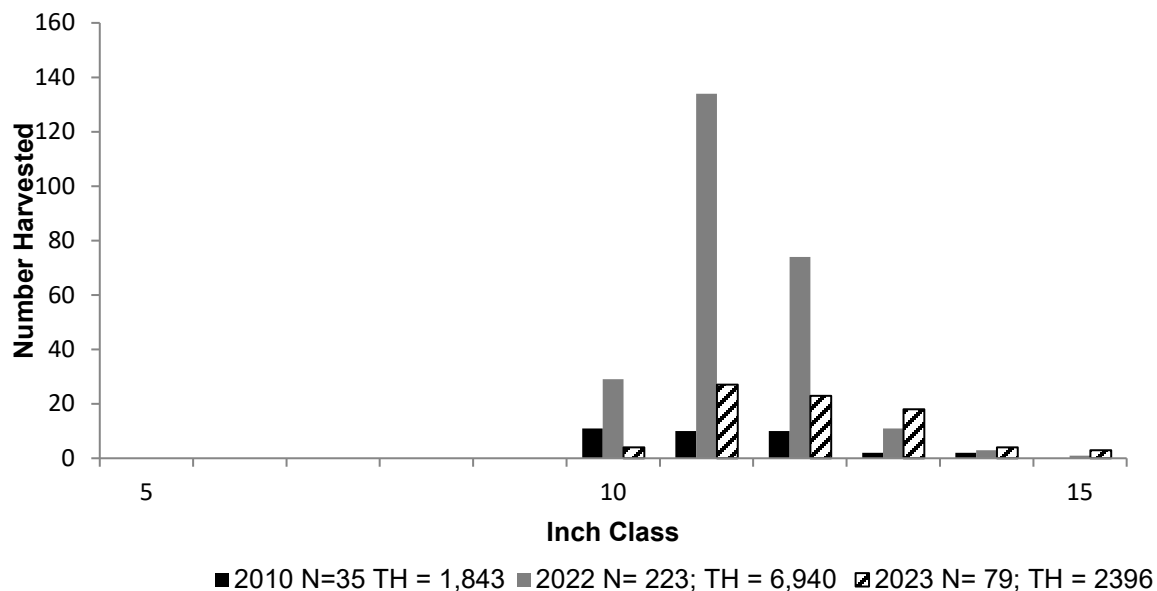


Figure 9. Length frequency of harvested White Bass observed during creel surveys at Meredith Reservoir, Texas, 1 April through 31 September in 2010, 1 March through 30 November in 2022, and 1 March through 31 May in 2023, all anglers combined. N is the number of harvested White Bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Largemouth Bass

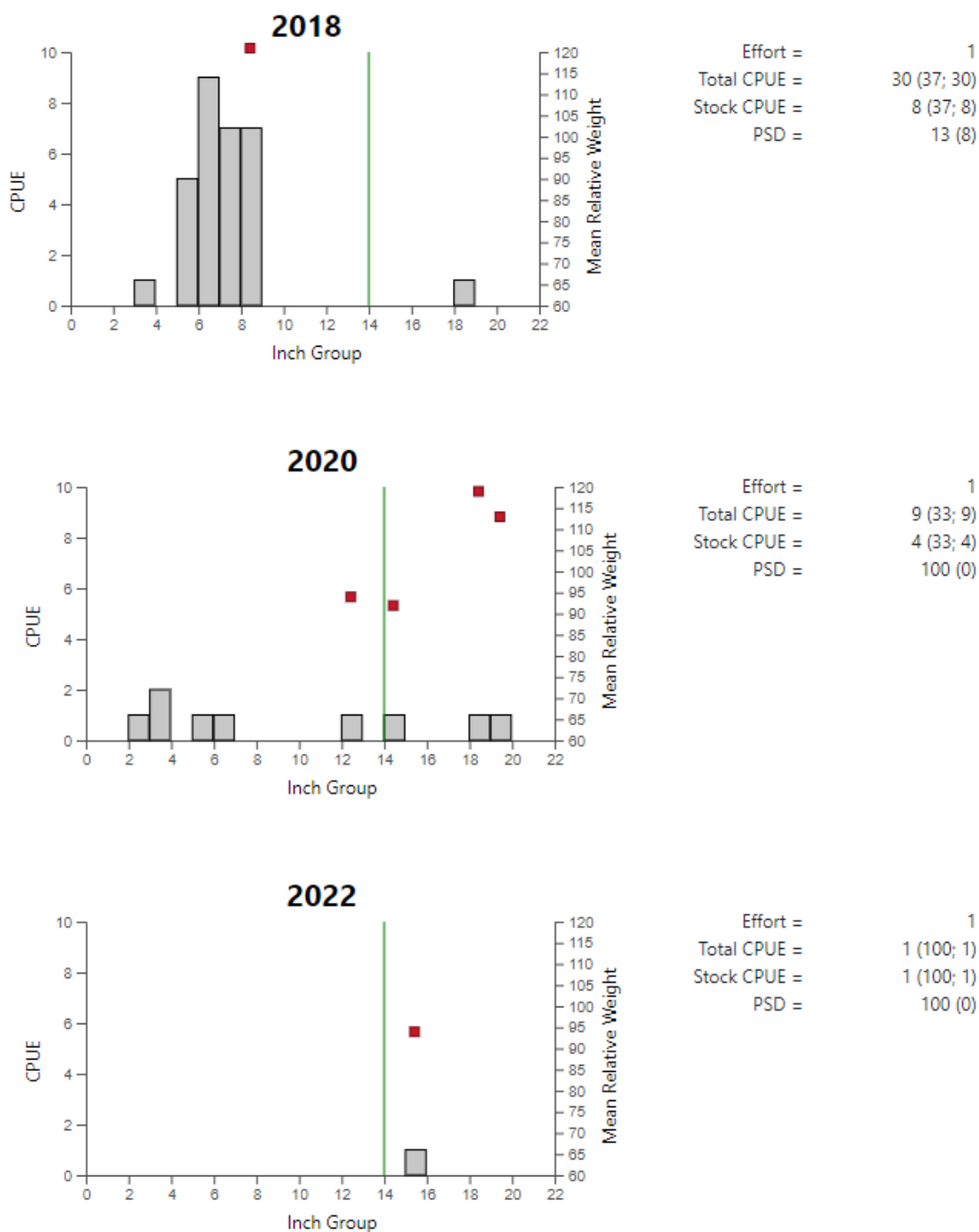


Figure 10. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (squares), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Meredith Reservoir, Texas, 2018, 2020, and 2022. Vertical line indicates minimum length limit.

Table 12. Creel survey statistics for Largemouth Bass at Meredith Reservoir, Texas from 1 April through 31 September in 2010, 1 March through 30 November in 2022, and 1 March through 31 May in 2023. Total catch per hour is for anglers targeting White Bass and total harvest is the estimated number of White Bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	2010	Spring 2022	2022	Spring 2023
Surface area (acres)	4,200	6,800	6,700	6,500
Directed effort (h)	1,484.28 (40)	2,550.17 (48)	5,906 (42)	3,800.22 (37)
Directed effort/acre	0.35 (40)	0.37 (48)	0.88 (42)	0.58 (37)
Total catch per hour	0.00 (-)	0.19 (47)	0.15 (54)	0.15 (51)
Total harvest	0 (-)	110.01 (193)	110.01 (193)	29.58 (344)
Harvest/acre	0.00 (-)	0.02 (96)	0.02 (193)	0.00 (344)
Percent legal released	0	73.5	89.2	66

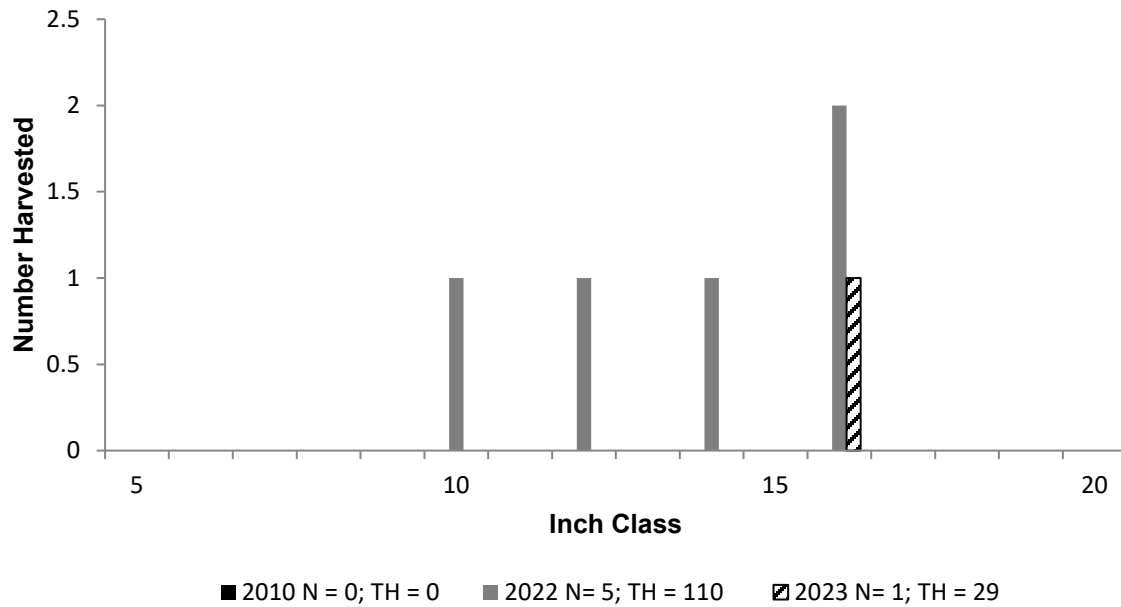


Figure 11. Length frequency of harvested Largemouth Bass observed during creel surveys at Meredith Reservoir, Texas, 1 April through 31 September in 2010, 1 March through 30 November in 2022, and 1 March through 31 May in 2023, all anglers combined. N is the number of harvested Largemouth Bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

White Crappie

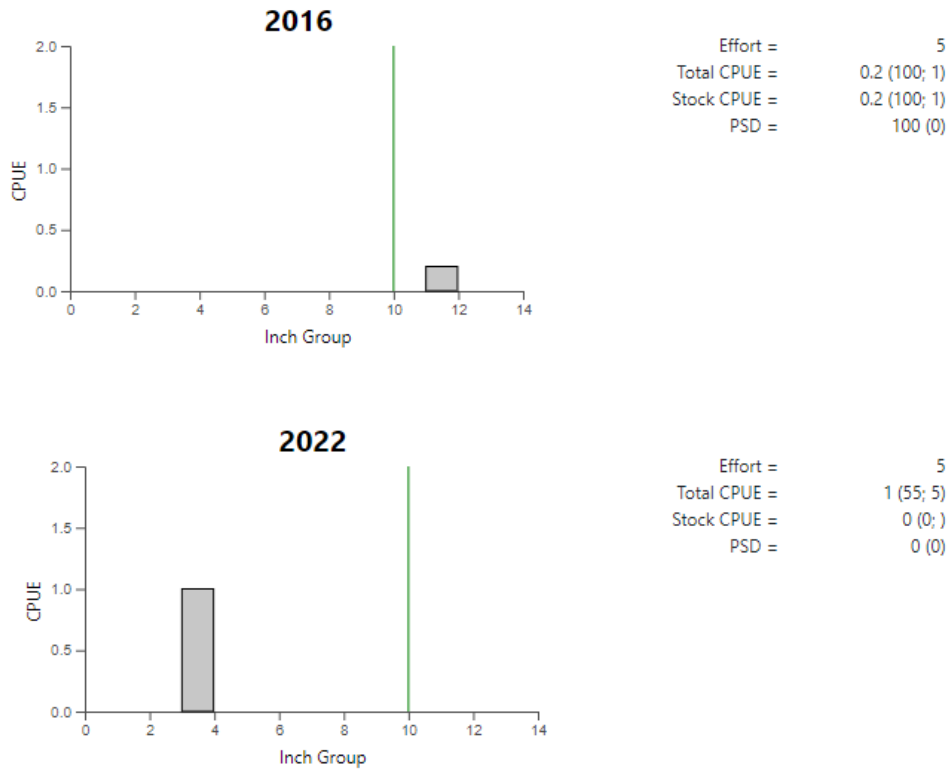


Figure 12. Number of White Crappie caught per net night (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Meredith Reservoir, Texas, 2016 and 2022. Vertical line indicates minimum length limit.

Table 13. Creel survey statistics for White Crappie at Meredith Reservoir, Texas, from 1 April through 31 September in 2010, 1 March through 30 November in 2022, and 1 March through 31 May in 2023. Total catch per hour is for anglers targeting White Crappie and total harvest is the estimated number of White Crappie harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	2010	Spring 2022	2022	Spring 2023
Surface area (acres)	4,200	6,800	6,700	6,500
Directed effort (h)	2,267.76 (38)	3,603 (40)	9082.63 (36)	1632.96 (43)
Directed effort/acre	0.54 (38)	0.53 (40)	1.36 (36)	0.25 (43)
Total catch per hour	2.08 (26)	0.21 (37)	0.39 (43)	0.38 (52)
Total harvest	857 (55)	3057 (42)	5,511.18 (36)	1020.58 (58)
Harvest/acre	0.204 (55)	0.45 (42)	0.82 (36)	0.15 (58)
Percent legal released	3	3.4	14.4	15.2

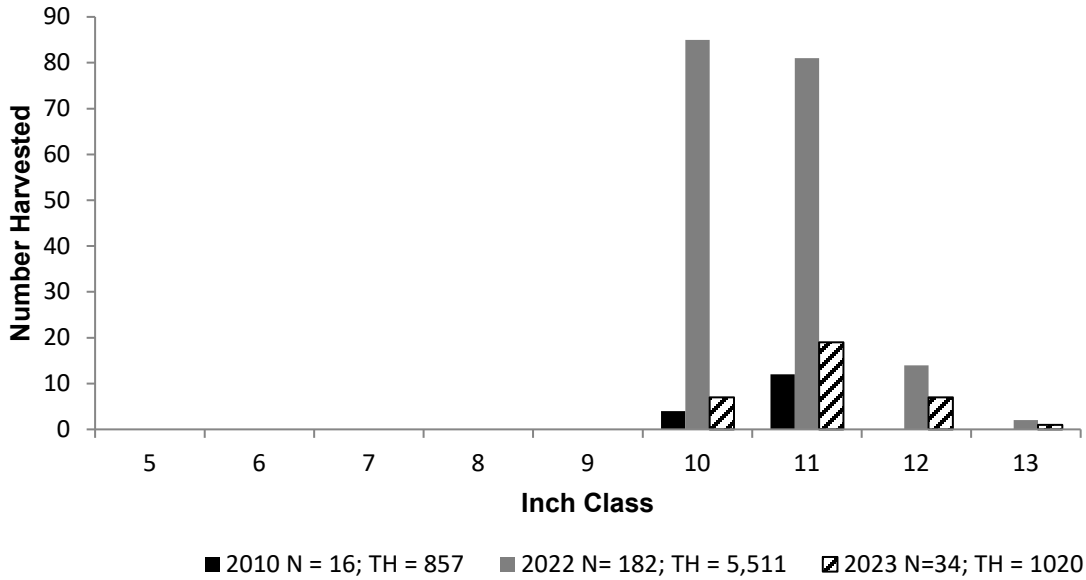


Figure 13. Length frequency of harvested White Crappie observed during creel surveys at Meredith Reservoir, Texas, 1 April through 31 September in 2010, 1 March through 30 November in 2022, and 1 March through 31 May in 2023, all anglers combined. N is the number of harvested White Bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Walleye

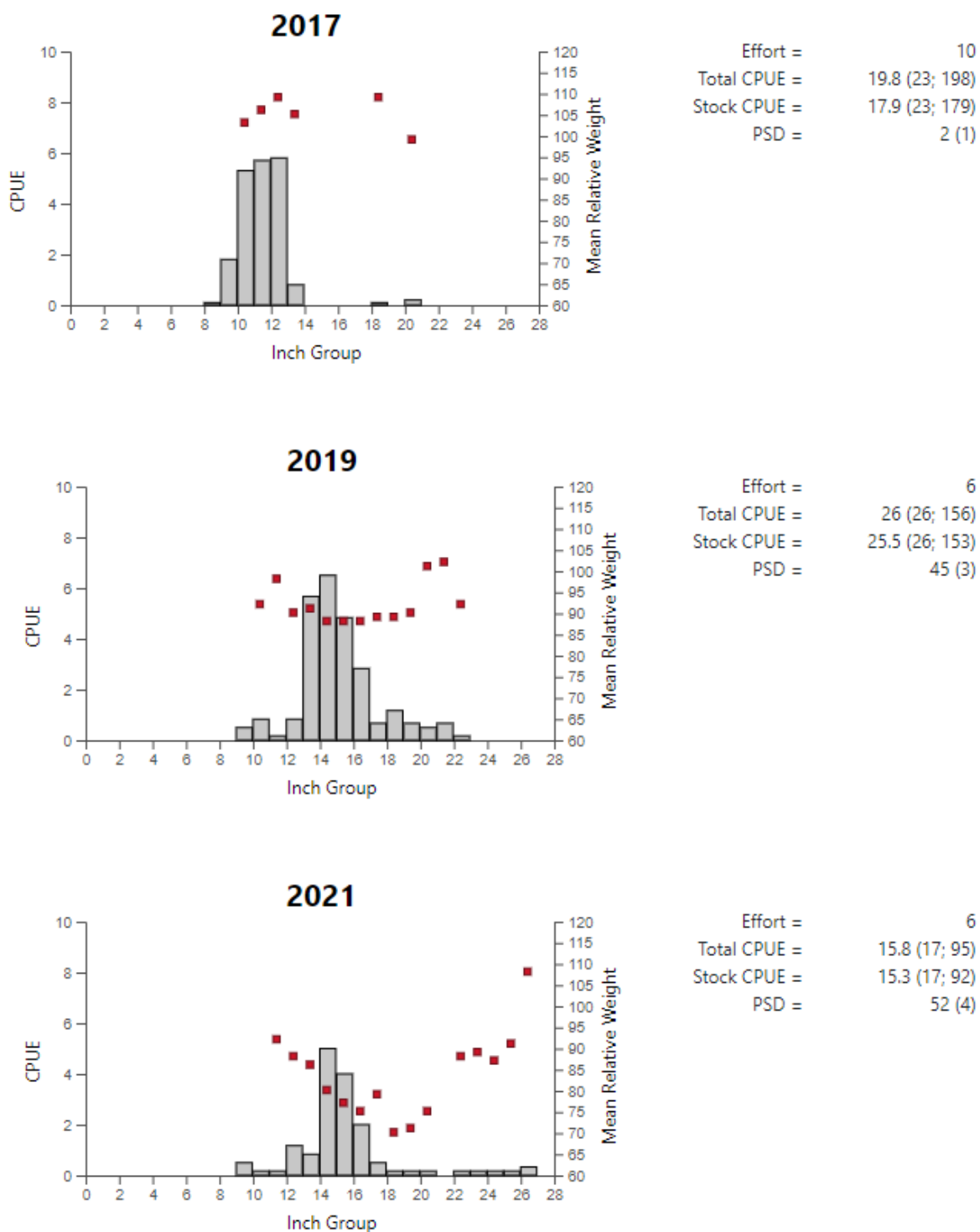


Figure 14. Number of Walleye caught per net night (CPUE), mean relative weight (squares), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Meredith Reservoir, Texas, 2017, 2019, and 2021.

Walleye Cont.

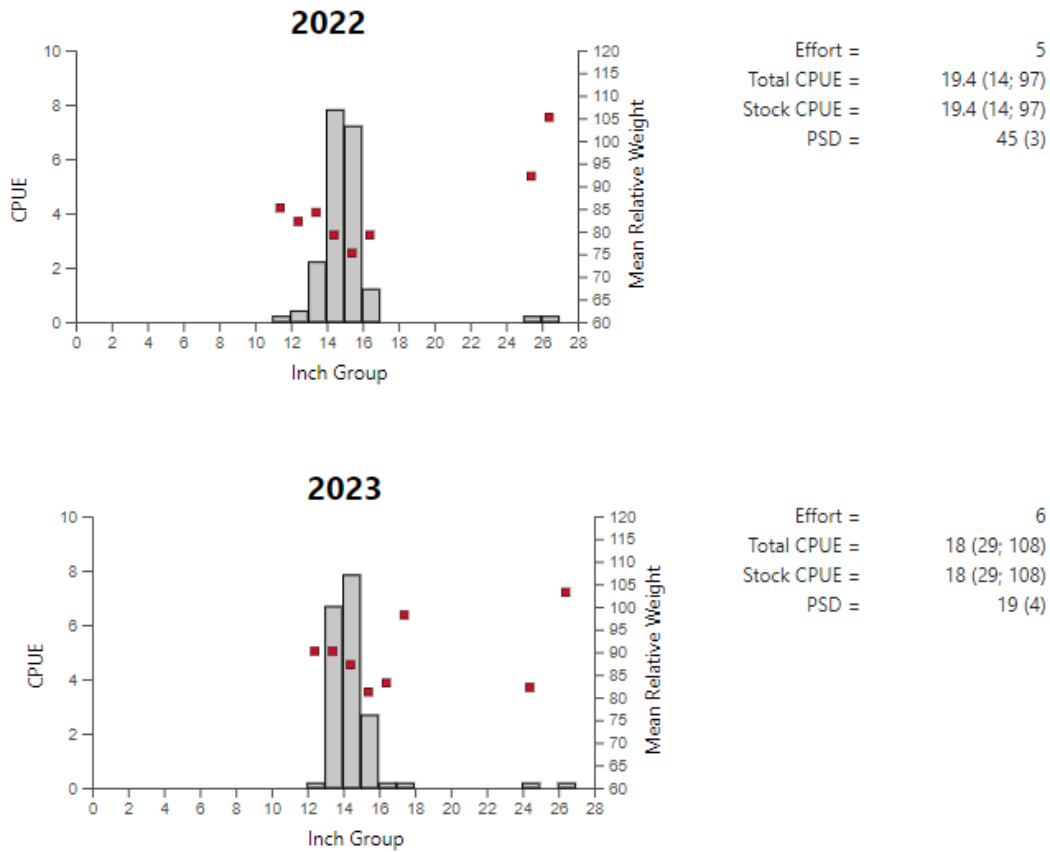


Figure 15. Number of Walleye caught per net night (CPUE), mean relative weight (squares), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Meredith Reservoir, Texas, 2022, and 2023.

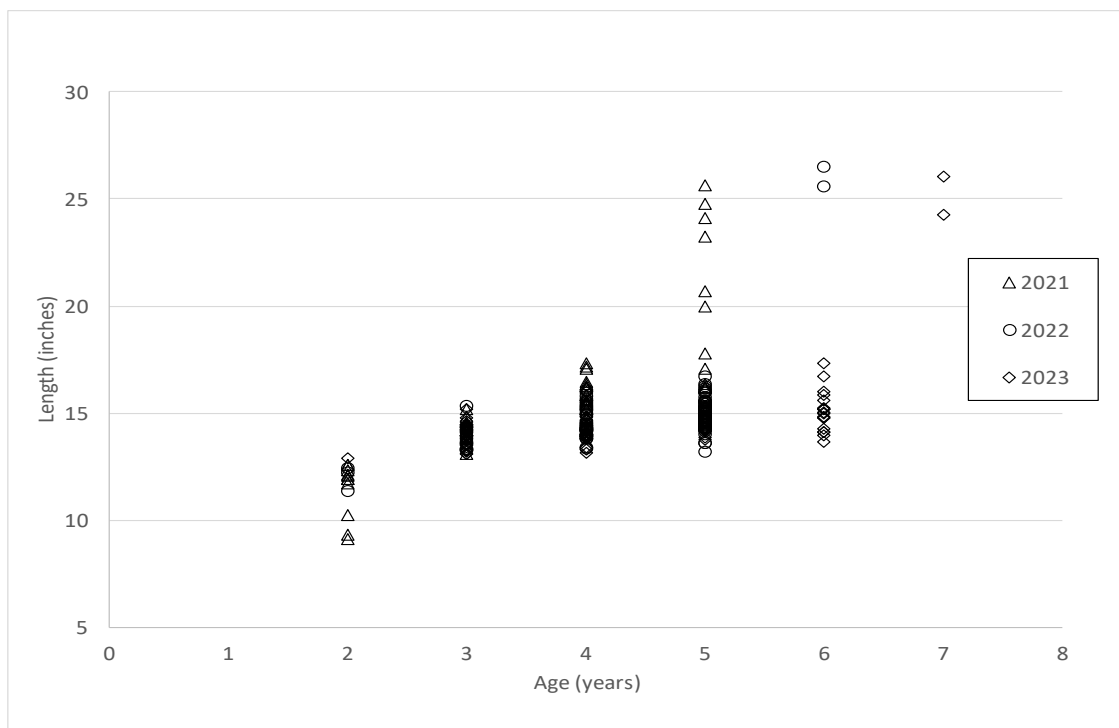


Figure 16. Length at age for Walleye collected from gill netting at Meredith Reservoir, Texas, Spring 2021, 2022, and 2023.

Table 14. Creel survey statistics for Walleye at Meredith Reservoir, Texas, from 1 April through 31 September in 2010, 1 March through 30 November in 2022, and 1 March through 31 May in 2023. Total catch per hour is for anglers targeting White Bass and total harvest is the estimated number of White Bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel survey statistic	2010	Spring 2022	2022	Spring 2023
Surface area (acres)	4,200	6,800	6,700	6,500
Directed effort (h)	6,886.39 (23)	28,914 (34)	61,304 (25)	16,951.67 (22)
Directed effort/acre	1.64 (23)	4.25 (34)	9.15 (25)	2.61 (22)
Total catch per hour	0.36 (83)	0.59 (15)	0.51 (23)	0.32 (41)
Total harvest	1,109 (46)	6097.82 (39)	10,947.25 (33)	2,194.01 (39)
Harvest/acre	0.26 (46)	0.89 (39)	1.63 (33)	0.33 (39)
Percent legal released	0	70.2	79.6	48.2

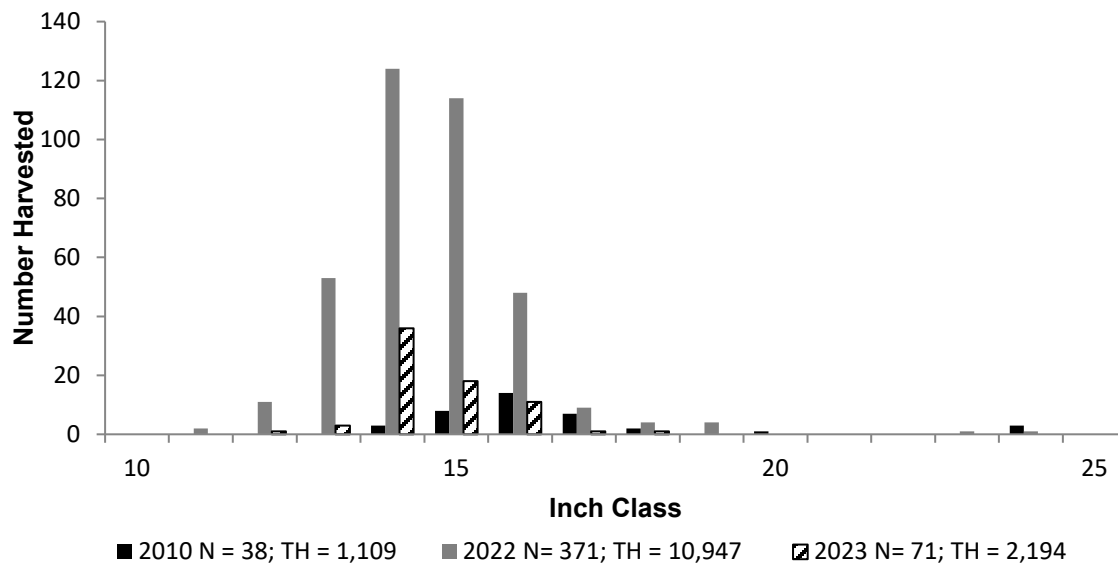


Figure 17. Length frequency of harvested Walleye observed during creel surveys at Meredith Reservoir, Texas, 1 April through 31 September in 2010, 1 March through 30 November in 2022, and 1 March through 31 May in 2023, all anglers combined. N is the number of harvested White Bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Proposed Sampling Schedule

Table 15. Proposed sampling schedule for Meredith 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.

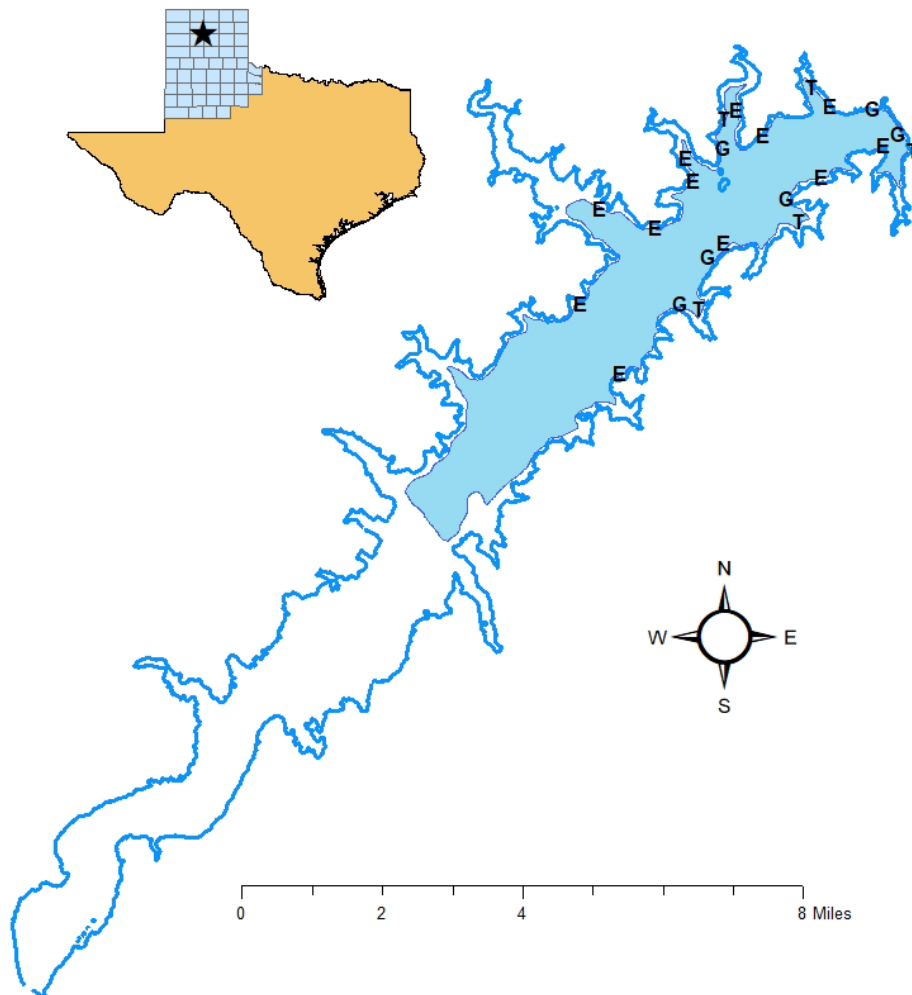
	Survey year			
	2023-2024	2024-2025	2025-2026	2026-2027
Angler Access				X
Structural Habitat				X
Vegetation				X
Electrofishing – Fall		X		X
Trap netting				X
Gill netting	X	X	X	X
Creel survey			X	
Report				X

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

Number (N) and catch rate (CPUE;RSE in parentheses) of all species collected from all gear types from Meredith Reservoir, Texas, 2022-2023. Sampling effort was 1 hour for electrofishing, 6 net nights for gill netting, and 5 net nights for trap netting.

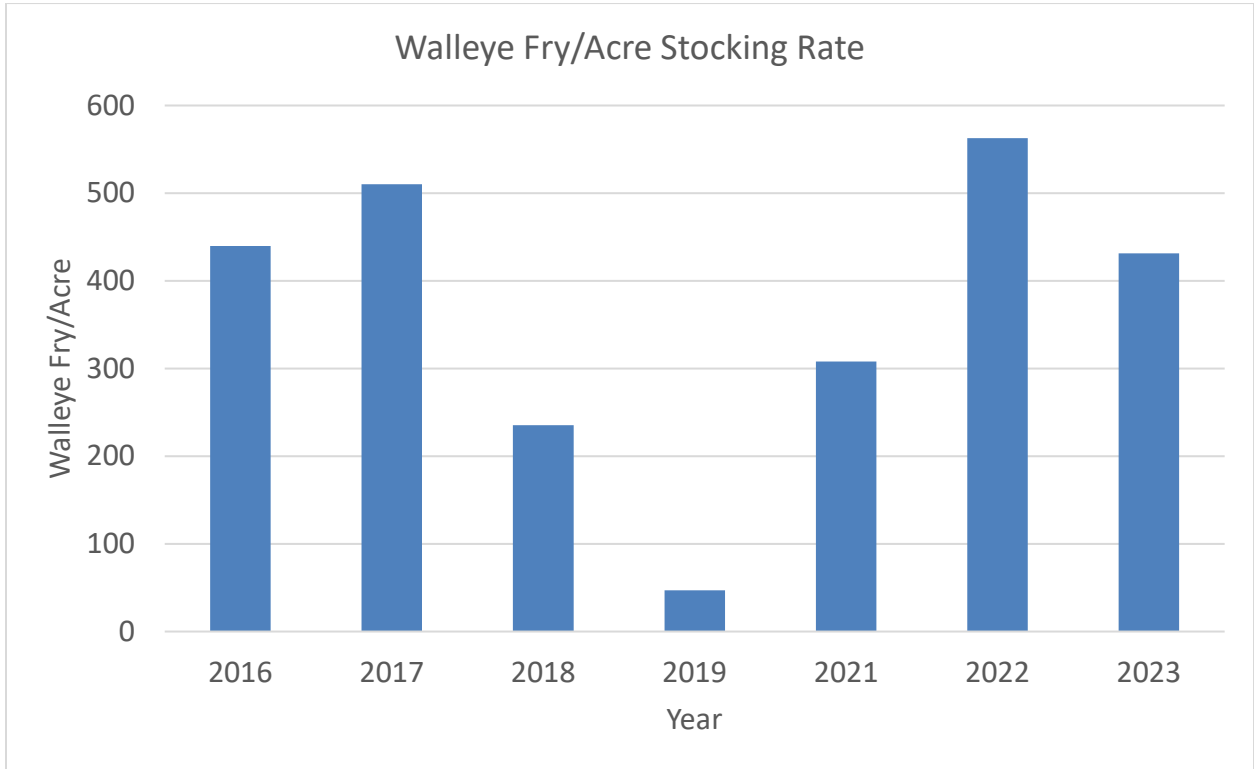
Species	Electrofishing		Gill Netting		Trap Netting	
	N	CPUE	N	CPUE	N	CPUE
Gizzard Shad	100	100.0 (30)	19	3.17 (59)	1	0.2 (100)
Common Carp	2	2.0 (67)	27	4.5 (25)	1	0.2 (100)
River Carpsucker			21	3.5 (55)	1	0.2 (100)
Channel Catfish			9	1.5 (29)		
White Bass	2	2.0 (100)	58	9.7 (31)		
Green Sunfish	2	2.0 (67)				
Bluegill	1	1.0 (100)			4	0.8 (73)
Longear Sunfish	1	1.0 (100)				
Largemouth Bass	1	1.0 (100)	1	0.2 (100)		
White Crappie			3	0.5 (68)	5	1.0 (55)
Black Crappie			1	0.2 (100)	1	0.2 (100)
Walleye	1	1.0 (100)	108	18.0 (29)		

APPENDIX B – Map of sampling locations



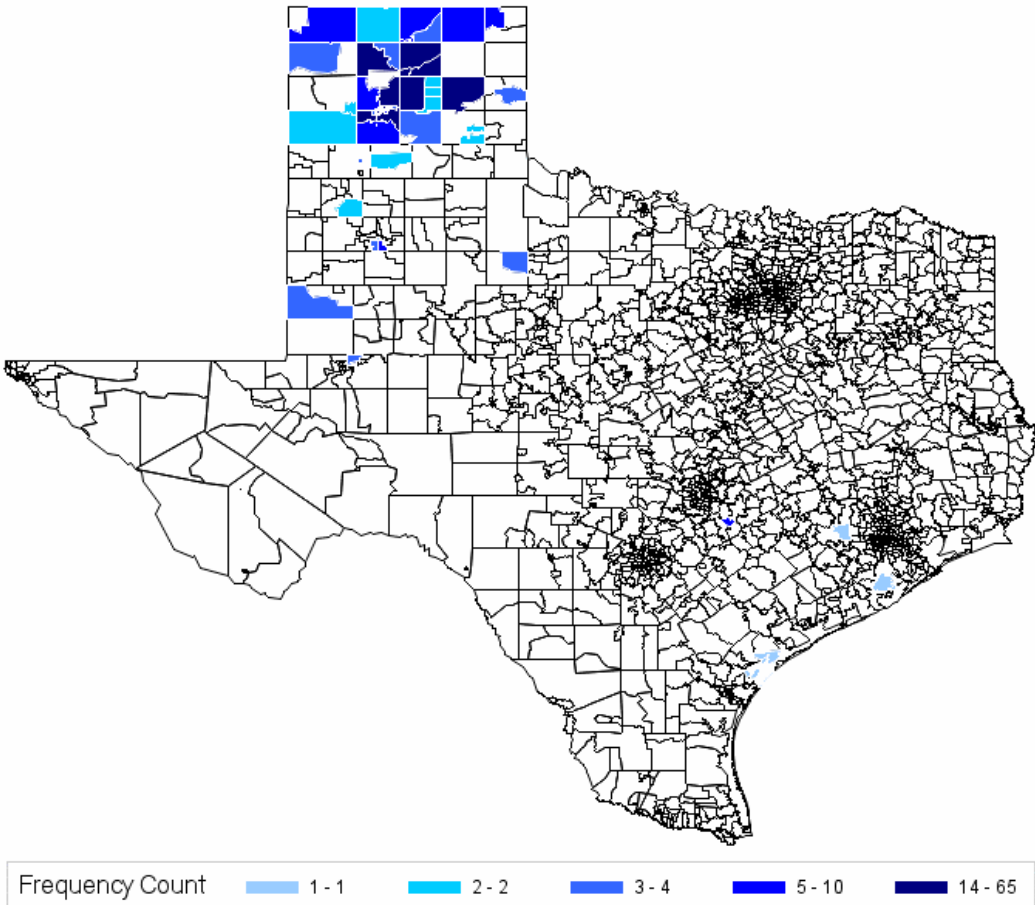
Location of sampling sites, Meredith Reservoir, Texas, 2022-2023. Trap net, gill net, and electrofishing stations are indicated by T, G, and E, respectively. Reservoir acreage was approximately 6,500 acres at time of sampling.

APPENDIX C – Actual per acre stocking rates of walleye fry

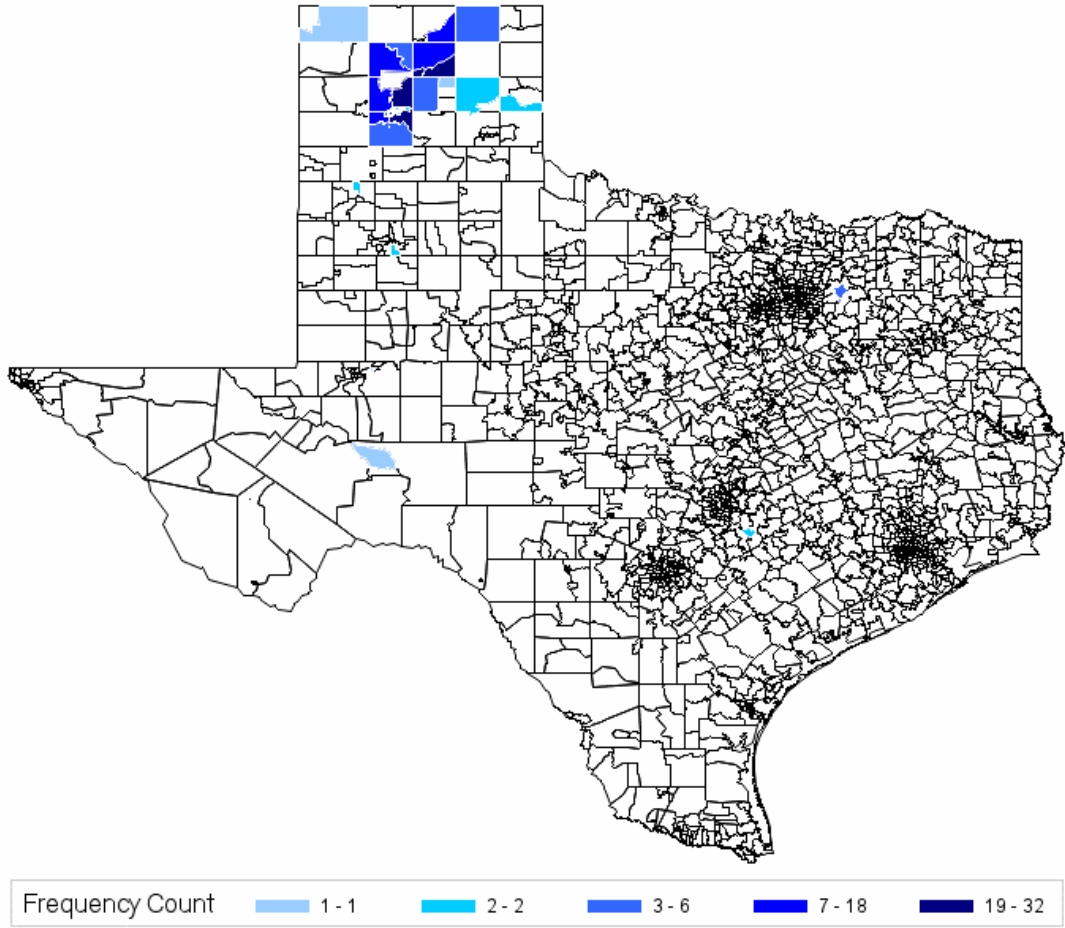


Graphical depiction of actual Walleye fry stocking rates at Meredith Reservoir, Texas, 2016-2023. All acreages are calculated based on reservoir elevation on 1 April of the corresponding year.

APPENDIX D – Reporting of creel ZIP code data



Location, by ZIP code, and frequency of anglers that were interviewed at Meredith Reservoir, Texas, during the March through November 2022 creel survey.



Location, by ZIP code, and frequency of anglers that were interviewed at Meredith Reservoir, Texas, during the March through May 2023 creel survey.

APPENDIX E – Walleye regulation modeling

Modeled Regulation	Year	
	2022	2023
16 inch minimum length limit	100.0	88.5
No minimum length limit (only 2 fish > 18 inches)	23.1	7.7
Daily bag limit = 3	7.7	0.0

Estimated percent of anglers interviewed during angler surveys targeting Walleye whose daily harvest would be affected by theoretical regulation changes at Meredith Reservoir, Texas. Angler interviews occurred March through November 2022 and March through May 2023



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