Falcon Reservoir

2021 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 Falcon Reservoir were surveyed in 2020-2022 using electrofishing. The reservoir sport fishery was quantified in 2022 using a creel survey. Historical data are presented for comparison. This report summarizes the results of these surveys and contains a management plan for the reservoir based on those findings.

Reservoir Description: Falcon Reservoir (83,654 acres when full) was constructed in 1954 on the Rio Grande River and forms the border with Mexico. The reservoir experiences extreme water level fluctuations due to variable rainfall and water releases for downstream agricultural irrigation. Fisheries habitat was poor during the study period. During the study period, water level ranged from 37 to 48 feet below conservation pool elevation, and occurrence of flooded terrestrial vegetation was low (8%).

Management History: Fish harvest is regulated according to the standard statewide restrictions, except for Alligator Gar. The daily bag limit for Alligator Gar is 5 fish/day. In 2019, the commercial sale of catfishes was legalized by the Texas Legislature in Starr and Zapata counties, which encompass Falcon Reservoir (Parks and Wildlife Code, Title 7, Chapter 351). On the Mexico side, fish harvest is unregulated, and a substantial commercial gill net fishery exists primarily targeting Blue Tilapia. Florida Largemouth Bass (FLMB) fingerlings were stocked annually in recent years to maintain high FLMB genetic introgression and Largemouth Bass trophy potential.

Fish Community

- **Prey species:** Relative abundance of Gizzard Shad and Bluegill was low in 2021 and similar to previous years. Threadfin Shad abundance was much higher in 2019 than in 2021. Overall, prey species abundance and size was sufficient to support existing predator species populations.
- **Alligator Gar:** Spawning habitat availability was low in 2020 and 2021 resulting in less than a 35% probability of strong year class formation in each year. Angling for this species accounted for 5.3% of total angling effort occurring on the reservoir, and few fish were harvested (87 fish) from January through June 2022.
- **Catfishes:** In 2022, catfish angling comprised 11.3% of total angling effort and anglers harvested more Channel Catfish than Blue Catfish. Catfish catch success (mean catch/h) was improved compared to 2019 but was lower than the historical average.
- **White Bass:** In 2022, minimal angling effort was expended targeting White Bass, and anglers harvested substantially fewer White Bass compared to 2019.
- **Largemouth Bass:** Abundance of Largemouth Bass was decreased during the study period due to low and declining water level. The population was mostly comprised of quality-length individuals and their condition was good. In 2022, Largemouth Bass angling accounted for 73.5% of the total angling effort occurring on the reservoir. Tournament-angling comprised 4% of total Largemouth Bass angling effort. Largemouth Bass harvest was lower in 2022 than in previous years. Angler catch success was improved in 2022, but was still below the historical average. Fish >4 lbs. represented 18% of all released Largemouth Bass in 2022.
- **Black Crappie:** Angling for this species accounted for 6.6% of total angling effort and more angling effort was expended targeting Black Crappie in 2022 than in previous years. Catch success rebounded in 2022 and harvest was substantially higher than previous surveys. Percent legal release was low for the species.

Management Strategies: Biennially monitor the Largemouth Bass population and annually stock Florida Largemouth Bass fingerlings. Annually assess Alligator Gar recruitment potential using the spawning habitat availability-year class strength model in Myers et al. (2020). Monitor for presence of invasive aquatic species and conduct control activities as needed.

Introduction

This document is a summary of fisheries data collected from Falcon Reservoir in 2020-2022. 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 2020-2022 data for comparison.

Reservoir Description

Falcon Reservoir is a Texas-Mexico border impoundment constructed on the Rio Grande River. The reservoir encompasses 83,654 acres at conservation pool elevation, with 38,360 acres located within Texas' jurisdiction. The reservoir was built in 1954 for water conservation, flood control, hydroelectric energy, and recreation. Ownership of water is shared between Mexico (44%) and the U.S. (56%). Discharge from the reservoir is managed by the International Boundary and Water Commission (IBWC) and Texas Commission on Environmental Quality according to the 1944 Water Treaty established between the U. S. and Mexico. The reservoir experiences dramatic water level fluctuations due to variable inflow and water releases for downstream agricultural irrigation (Figure 1). Record low water level occurred in 2002 (54 feet below conservation pool) and record high water level occurred in 2010 (8 feet above conservation pool). When water level recedes, dense terrestrial vegetation becomes established on the exposed reservoir bottom and is the predominant structural fisheries habitat when inundated. Terrestrial vegetation species include mesquite, retama, huisache, acacia, salt cedar, and various grasses. Aquatic vegetation rarely occurs in the reservoir due to the presence of a reproducing population of Grass Carp, presumably introduced into the Rio Grande system by Mexican officials. Other descriptive characteristics for the reservoir are in Table 1.

Angler Access

There are two public boat ramps (Zapata County Park and Falcon State Park) and several private boat launches associated with motels and RV parks adjacent to the reservoir. Characteristics of the two public boat ramps are provided in Table 2. Public shoreline angling access is limited to areas around the boat ramps.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Myers and Nisbet 2020) included:

1. Conduct spring and fall electrofishing surveys biennially to assess Largemouth Bass population parameters.

   Action: Electrofishing surveys were completed in fall 2021 and spring 2022. Additionally, a creel survey was conducted from January through June 2022

2. Stock 500,000 FLMB annually to maintain and possibly increase Largemouth Bass trophy potential.

   Action: A total of 136,000 FLMB were stocked in 2020 and 159,000 FLMB were stocked in 2021. In 2022 for the first time Lone Star Bass were stocked (266,444 fingerlings), which are 2nd generation offspring of pure Florida strain ShareLunker Largemouth Bass that have proven to be able to grow to ≥ 13 pounds.

3. Assess Alligator Gar year-class success using the model contained in Myers et al. 2020.

   Action: Alligator Gar recruitment was likely low during the study period. Probability of strong year class was 29% and 35% in 2020 and 2021, respectively.

4. Conduct creel survey sampling in 2023 to estimate Alligator Gar angling effort and harvest.

   Action: Alligator Gar angling effort and harvest were estimated using creel survey sampling from January through June 2022. Creel was moved up to accommodate a reservoir water level study conducted in 2021-2022.

5. Monitor for the presence of aquatic invasive species and cooperate with the controlling authority to inform users about such and measures to take to reduce risk of introductions.

   Action: A habitat/vegetation survey was conducted in 2021, and no invasive aquatic plants were found. "Clean, Drain, and Dry" signage remains posted at the two public boat ramps.

Harvest regulation history: Except for Alligator Gar, all sport fishes have historically been managed with statewide regulations (Table 3). The Alligator Gar daily bag limit increased from 1 to 5 fish in September 2015. In 2021, the Channel and Blue Catfish harvest regulation was changed to coincide with a new statewide harvest regulation. The regulation changed from a 25-fish aggregate daily bag limit (DBL) and 12-inch minimum length limit (MLL) to a 25-fish aggregate DBL of which only 10 can be greater than 20-inches and no MLL. Fish harvest is unregulated by the Mexico government in Mexico waters of the reservoir.

Stocking history: Numerous fishes have been stocked into the reservoir; however, only Florida Largemouth Bass and ShareLunker Largemouth Bass have been stocked since 2010. Annual stockings of FLMB have been conducted since 2010 to maintain high FLMB genetic introgression and Largemouth Bass trophy potential. See Table 4 for fish stocking history at the reservoir.

Vegetation/habitat management history: No planned habitat or vegetation management activities have been conducted on this reservoir. A small amount of giant salvinia was found growing adjacent to the Zapata County Boat Ramp in May 2016 and was removed (Myers and Dennis 2016).

Water transfer: No interbasin transfers are known to exist.

Methods

An objective-based sampling plan (OBS) was implemented for the reservoir in 2020. Sampling activities were conducted to achieve survey and sampling objectives specified in the Falcon Reservoir OBS (Myers and Nisbet 2020). Primary components of the 2020 OBS plan are listed in Table 5. Sampling activities conducted prior to 2020 were conducted in accordance with previous OBS plans and using TPWD Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual, revised 2017). All survey sites were randomly selected (Appendix A).

Electrofishing – Largemouth Bass, sunfishes, Gizzard Shad, and Threadfin Shad were collected during daytime by electrofishing (24, 5-minute stations) in fall 2021. Largemouth Bass were collected during daytime by electrofishing (24, 5-minute stations) in spring 2022. Catch-per-unit-effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing. Largemouth Bass mean age at 14 inches were determined using otoliths from 13.0-14.9 inch fish collected during fall sampling.

Genetics – Genetic analysis was performed on Largemouth Bass collected in fall 2021 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 since 2005. Electrophoresis analysis was used prior to 2005.

Statistics – Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD), terminology modified by Guy et al. 2007], and condition indices [relative weight (W_r)]

were calculated for target fishes according to Anderson and Neumann (1996). Index of vulnerability (IOV) was calculated for Gizzard Shad (DiCenzo et al. 1996). Standard error (SE) was calculated for structural indices and IOV. Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE and creel statistics.

Creel survey – A 6 months access creel survey was conducted from January through June 2022 following TPWD Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual, revised 2017). Sampling occurred on 8 random weekend days and 8 random weekdays per quarter. Each sample day was split into equal duration time periods, with random time period selection and one time period sampled per sample day. Sampling occurred at one of two possible access points via random selection each sample day. The creel survey was originally scheduled for 2023 or 2024. The state legislature mandated a water level study be conducted at Falcon Reservoir in 2021-2022. Thus, the creel survey was moved forward a year so that recent fishery data could be used in the study.

Habitat – A habitat survey was conducted using the random point sampling method during September 2021 (TPWD Inland Fisheries Division, unpublished manual, revised 2017). The last structural habitat survey (i.e., shoreline substrate) was completed in 2009, (Myers and Dennis 2010).

Water level - Source for water level data was the International Boundary Water Commission (IBWC 2022).

Results and Discussion

Habitat: Water level during the study period ranged from 37 to 44 feet below conservation pool elevation and has consistently decreased since December 2018 (Figure 1). Occurrence of flooded terrestrial vegetation in 2019 (8%) was lower than in previous years due to the persistent low water level (Figure 2 and Table 6).

Creel: Angling for Largemouth Bass continued to comprise the majority of the total angling effort expended on the reservoir (73.5% in 2022; Table 7). Other species targeted by anglers in 2022 included catfishes (11.3%), Black Crappie (6.6%), and Alligator Gar (5.3%). Total angling effort expended on the reservoir from January to June 2022 was substantially lower than total angling effort estimated occurring in previous years (Table 8). Total direct angling expenditures were 48% lower in 2022 than 2019.

Prey species: Electrofishing CPUE of Gizzard Shad in 2021 (56 fish/h) was similar to previous years (63.5-65.0 fish/h; Figure 3). Gizzard Shad IOV in 2021 was high (88) and within the range of previous estimates (65-95). Electrofishing CPUE of Threadfin Shad was 110.5 fish/h in 2021 (Appendix B), which was substantially lower than in 2019 (541.0 fish/h; Myers and Nisbet 2020). Electrofishing CPUE of Bluegill remained low in 2021 (6.0/h) similar to in past years (2.5-5.5/h; Figure 4). Blue Tilapia were present in high abundance and are likely important prey species. However, their abundance could not be determined because of low susceptibility to electrofishing. Rapid growth of Largemouth Bass and mean relative weights exceeding 90 for most size classes of Largemouth Bass in 2020 and 2021 (see below) suggest prey availability was sufficient.

Alligator Gar: Anglers, including bow anglers, expended 2,191 h targeting this species and harvested 87 fish from January to June 2022 (Table 9). Low and declining water level in 2020 and 2021 were not conducive to successful Alligator Gar reproduction and recruitment; probability of strong year class formation was 29% in 2020 and 35% in 2021.

Catfishes: Anglers expended 4,617 h targeting catfishes and harvested 58 Blue Catfish, 2,107 Channel Catfish, and 491 unidentified catfish from January to June 2022 (Table 10). Similar catfish angling effort occurred in previous surveys. However, harvest of Channel Catfish nearly doubled compared to 2019, while Blue Catfish harvest declined substantially. Catch success (average catch/h) in 2022 (0.74 fish/h) was similar to catch success in 2016 and 2019 (0.37-0.83 fish/h). Harvest size ranged from 10-30 inches for Channel Catfish and 11-21 inches for Blue Catfish in 2019 (Figure 7 and Figure 8).

White Bass: Anglers expended zero hours targeting White Bass and harvested 534 fish from January to June 2022 (Table 11). Previous creel surveys revealed similar; few anglers targeted this species and minimal harvest occurred (507 fish in 2016) The exception was 2019 when 5,371 fish were harvested. Harvest size ranged from 10 to 12 inches (Figure 9).

Largemouth Bass: Electrofishing CPUE of Largemouth Bass in fall 2021 (32.0 fish/h) was similar to in 2017 (26.5 fish/h) and 2019 (34.5 fish/h), but lower than in 2015 (91.5 fish/h; Figure 10). Electrofishing CPUE in spring 2022 (57.5 fish/h) was higher than in previous years (12.5-34.0 fish/h; Figure 11). Fall 2021 electrofishing CPUE was similar to the historic average and spring 2020 electrofishing CPUE was higher than the historic average (Figure 12). Low and declining water level in recent years has negatively impacted Largemouth Bass recruitment. Fewer fish <8 inches were collected in spring and fall samples taken since 2017 relative to the sample taken in 2015 when water level was higher. Quality-length fish accounted for the majority of stock-length fish in fall 2021(PSD = 84) and spring 2022 (PSD = 90). Largemouth Bass condition was good with W_r values exceeding 90 for the majority of fish collected in fall 2021 and 100 for the majority of fish collected in spring 2022. Introgression of FLMB into the population was most recently estimated in 2021 and was 82% FLMB alleles (Table 12). This was higher than in 2005-2018 when percent FLMB alleles ranged from 68%-77%. Of the 13 fish between 13 and 15 inches collected in fall 2021, 7 were age-1 and 6 were age-2 fish, which suggests rapid growth (average age at 14 inches = 1.5 years).

Anglers expended 30,089 h targeting Largemouth Bass from January to June 2022 which was substantially lower than angling effort expended during the two previous January-June creel surveys (99,654-110,930 h; Table 13). Tournament angling represented 5% of total largemouth angling effort during the 2022 creel survey period. Mean angler catch rate in 2022 was higher in 2022 (0.59 fish/h) compared to 2019 (0.36 fish/h) but was lower than all other previous years (1.04 -1.40 fish/h). Fewer Largemouth Bass were harvested during the 2022 creel survey (303 fish) than during the previous January to June surveys (4,689-19,196 fish). In 2022, the number of fish retained by tournament anglers for weigh-in (504 fish) was similar to the number of fish harvested by non-tournament anglers (303). This ratio of tournament-weighed fish to non-tournament harvest (1.6:1) was below the threshold level (3:1) corresponding to potential tournament mortality induced size structure degradation (Allen et al. 2004). Fish harvested by non-tournament anglers in 2022 ranged from 14 to 19 inches (Figure 13). Percent legal release of Largemouth Bass remained high in 2022 (98%), with 18% of released fish exceeding 4 lbs. Fish > 4 lbs. accounted for 7 and 26% percent of all released fish in 2016 and 2011, respectively. Electrofishing sampling objectives for CPUE-stock (RSE $\leq$25) was not achieved in spring and fall surveys (RSE = 28), but was achieved for size structure ($\geq$50 stock-length fish) and age and growth (13 fish between 13.0 and 14.9 inches). The creel sampling objectives for Largemouth Bass angling effort (RSE $\leq$25) was achieved, but harvest (RSE $\leq$50) and harvest size structure (>100 fish) was not achieved (RSE$\leq$52 and N = 21 fish, respectively).

Black Crappie: Anglers expended 2,701 h targeting Black Crappie during the January-June period in 2022, which was greater than during previous creel surveys (Table 14). Anglers harvested 8,836 Black Crappie during the 2022 creel survey and experienced catch success (0.98 fish/h) similar to the historic average. Percent legal release was low in 2019 (9%). Harvest length ranged from 10 to15 inches in 2022 (Figure 14).

Fisheries Management Plan for Falcon Reservoir, Texas

Prepared - July 31, 2022

ISSUE 1: Falcon Lake has consistently ranked as one the best bass fishing lakes in the U.S. and has a history of providing trophy catches. However, its Largemouth Bass population fluctuates in response water level and concomitant changes in habitat quantity (amount of flooded terrestrial vegetation). Likewise, Largemouth Bass harvest varies considerably across years according to 6-month creel surveys.

MANAGEMENT STRATEGIES

1. Conduct spring and fall electrofishing surveys every two years to monitor Largemouth Bass population parameters. Estimate FLMB introgression in fall 2023.
2. Stock 500,000 Lone Star Bass fingerlings, which are 2nd generation offspring of pure Florida strain ShareLunker Largemouth Bass that have proven to be able to grow to ≥ 13 pounds, annually to maintain and possibly increase trophy Largemouth Bass potential.
3. Conduct creel survey sampling in 2026 to quantify and monitor the Largemouth Bass fishery.

ISSUE 2: Alligator Gar is listed as a species of greatest conservation need in Texas. The statewide daily bag limit for the species is 1 fish/day, however at Falcon Reservoir, 5 fish are allowed to be harvested per day.

MANAGEMENT STRATEGIES

1. Assess annual recruitment using the model contained in Myers at al. (2020) that predicts probability of strong year class formation based on spawning habitat availability.
2. Conduct creel survey sampling in 2026 to estimate angling effort and harvest.

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

MANAGEMENT STRATEGIES

1. Check for presence of giant salvinia and other aquatic invasive species at reservoir boat ramps during all visits to the reservoir.
2. Coordinate control activities (if needed) with the controlling authority (IBWC) and the Zapata County government.
3. Cooperate with the controlling authority to post appropriate signage at access points around the reservoir.
4. Contact and educate marina owners about invasive species, and provide them with posters, literature, etc., so that they can in turn educate their customers.
5. Educate the public about invasive species through the use of media and the internet.
6. Make a speaking point about invasive species when presenting to constituent and user groups.
7. 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 (2022-2026)

Sport fish, forage fish, and other important fishes

Sport fishes in Falcon Reservoir include Largemouth Bass, Blue Catfish and Channel Catfish, Black Crappie, Alligator Gar, and White Bass. Known important forage species include Gizzard Shad, Blue Tilapia, Threadfin Shad, and Bluegill.

Survey objectives, fisheries metrics, and sampling objectives

Largemouth Bass: Largemouth Bass are the most sought after sport fish in Falcon Reservoir. This fishery has been ranked in the top 10 of the 100 best bass fishing lakes in multiple years as compiled by the Entertainment and Sports Programming Network. The reservoir produces numerous trophy catches, and thus is a popular destination of out-of-state anglers. The reservoir experiences extreme water level fluctuations that control habitat availability and quality, and in turn, Largemouth Bass abundance, size structure, and fishing quality. Our objectives are to monitor for changes in the population and assess the quality of the fishery on a routine basis with creel surveys. In the past, the population has been sampled biennially with spring and fall electrofishing to track trends in abundance, size structure, and growth. Continued biennial sampling is needed because of the dynamic nature of the fish community, importance of the fishery, and to have current data available to address management questions and issues when they arise. Sampling will consist of spring day-time, bass-only electrofishing and fall all-species daytime electrofishing surveys using 24 randomly selected stations for each survey. This level of effort should allow the collection of ≥50 stock-size bass for size structure determination, result in RSE's ≤25 for stock CPUE, and at least 13 fish between 13.0 and 14.9 inches for age and growth analysis. In the past, the average number of stations to achieve RSE ≤25 was 15 for spring and 17 for fall. We chose a total of 24 stations to sample because an overnight stay is required for a Falcon electrofishing survey due to its distant location from the office (4 h drive), and 15-17 stations may not provide 13 fish between 13.0 and 14.9 inches to estimate age at minimum length limit. In the past, the fishery has been assessed about every four years with a 6-month creel survey to estimate targeted angling effort, catch, harvest, and size of fish harvested. Creel survey sampling was last conducted in 2022 and the next creel survey will be conducted in 2026. As in the past, creel sampling intensity will exceed 30 days as recommended by (McCormick and Meyer 2017). Based on past creel surveys, this sampling intensity should result in a RSE ≤25 for estimated angling effort and a RSE ≤50 for catch and harvest estimates, and measurement of >100 harvested fish. Trophy potential of Largemouth Bass has been linked to FLMB introgression level. Thus, genetic analysis of Falcon Reservoir Largemouth Bass is necessary to monitor for changes in FLMB introgression. Genetic analysis will be performed on a minimum of 30 random fish collected during the fall 2023 electrofishing survey.

Blue and Channel Catfishes: According to recent creel survey results, catfishes provide a growing fishery at Falcon Reservoir accounting for 11.3% of the total angling effort in 2022. Our objective is to continue to monitor for large-scale changes in the fishery. This will be accomplished using creel survey sampling in 2026.

Black Crappie: Black Crappie historically provided a fishery at the reservoir, but trap-net sampling and creel surveys revealed a poor population and fishery existed between the mid-1990s and 2011. More recent creel surveys indicate resurgence in the Black Crappie fishery. Our objective is to continue to monitor for large-scale changes in the fishery. This will be accomplished by conducting a creel survey in 2026.

Alligator Gar: The Alligator Gar harvest regulation for Falcon Reservoir changed from a 1 fish to a 5 fish daily bag limit September 1, 2015. Evaluation of this regulation change was completed in 2019 and the TPWD Commission ruled the special regulation remain in place. Our objective for this species is to

annually estimate year class strength using the predictive model found in Myers et al. (2020) and monitor for large-scale changes in the fishery using a creel survey in 2026.

Gizzard Shad, Threadfin Shad, and Bluegill: Gizzard Shad, Threadfin Shad and Bluegill are the primary forage fishes at Falcon Reservoir. The CPUE of both species is highly variable, but major changes in their relative abundances may be indicated in CPUE trend data. Sampling of these species will be done concurrently with Largemouth Bass sampling conducted during fall. No additional effort will be expended to increase the number of Gizzard Shad, Threadfin Shad or Bluegill collected.

White Bass: White Bass historically provided a fishery at the reservoir, however similar to crappie, population sampling and creel surveys revealed a poor population and fishery for a long period. Our objective is to continue to monitor for large-scale changes in the White Bass fishery and this will be accomplished by using creel survey sampling in 2026.

Low-density fisheries

None

Literature Cited

Allen, M. S., M. W. Rogers, R. A. Myers, W. M. Bivin. 2004. Simulated impacts of tournament-associated mortality on largemouth bass fisheries. North American Journal of fisheries Management 32:429:436.

Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

DiCenzo, V. J., M. J. Maceina, and M. R. Stimpert. 1996. Relations between reservoir trophic state and gizzard shad population characteristics in Alabama reservoirs. North American Journal of Fisheries Management 16:888-895.

Guy, C. S., R. M. Neumann, D. W. Willis, and R. O. Anderson. 2007. Proportional size distribution (PSD): a further refinement of population size structure index terminology. Fisheries 32(7): 348.

International Boundary and Water Commission (IBWC). 2020. Web interface. http://www.ibwc.gov/home.html (2020).

McCormick, J. L., and K. A. Meyer. 2017. Sample size estimation for on-site creel surveys. North American Journal of Fisheries Management 37:970-980.

Myers, R. A., and Dennis, J. A. 2010. Statewide freshwater fisheries monitoring and management program survey report for Falcon Reservoir, 2009. Texas Parks and Wildlife Department, Federal Aid Report F-30-R-34, Austin.

Myers, R. A., and Dennis, J. A. 2016. Statewide freshwater fisheries monitoring and management program survey report for Falcon Reservoir, 2015. Texas Parks and Wildlife Department, Federal Aid Report F-30-R, Austin.

Nisbet, M, and R. A. Myers. 2020. Statewide freshwater fisheries monitoring and management program survey report for Falcon Reservoir, 2017. Texas Parks and Wildlife Department, Federal Aid Report F-30-R, Austin.

Tables and Figures

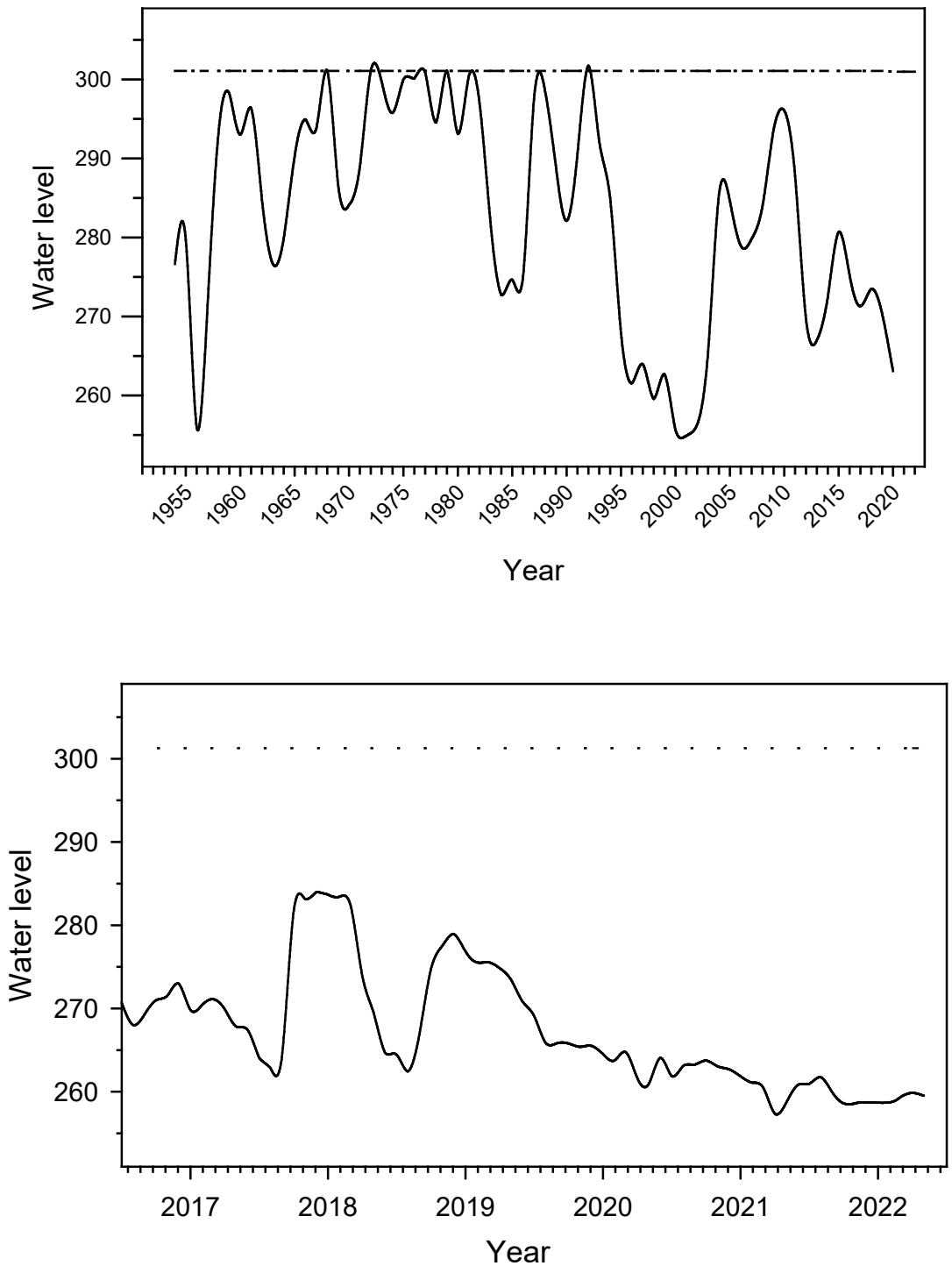


Figure 1. Average annual water level from 1954 to 2022 (top) and average monthly water level from June 2016 to April 2022 (bottom) at Falcon Reservoir. Water level is reported in feet above mean sea level and dashed line represents water level at conservation pool elevation.

Table 1. Characteristics of Falcon Reservoir, Texas

Characteristic	Description
Year constructed	1954
Controlling authority	International Boundary and Water Commission
Counties	Zapata and Starr
Reservoir type	Mainstream
Shoreline Development Index (SDI)	10.64
Conductivity	712 umhos/cm

Table 2. Boat ramp characteristics for Falcon Reservoir, Texas, 2021. Reservoir elevation at time of survey was 265.6 feet above mean sea level. Latitude and longitude are in decimal degrees.

Boat ramp	Latitude Longitude	Public	Parking capacity (N)	Elevation at end of boat ramp	Condition
Zapata County Park	26.86156 -99.2622	Y	50-100*	Unknown	Adequate
Falcon State Park	26.58721 -99.15250	Y	61	Unknown	Adequate

*Water level dependent, parking capacity increases as water level decreases

Table 3. Harvest regulations for sport fishes Falcon Reservoir, Texas.

Species	Bag Limit	Minimum length limit (inches)
Gar, Alligator	5	None
Catfish: Channel and Blue catfish, their hybrids and subspecies	25*	None
Catfish, Flathead	5	18
Bass, White	25	10
Bass, Largemouth	5	14
Crappie: White and Black Crappie, their hybrids and subspecies	25*	10

*in any combination, only 10 can be greater than 20-inches in length

Table 4. Stocking history of Falcon Reservoir, Texas. Size categories are: FRY =<1 inch, FGL = 1-3 inches, ADL = adults, and UNK = unknown.

Species	Year	Number	Size
Rainbow Trout	1994	2,012	ADL
	1996	1,743	ADL
	1997	1,335	ADL
	1999	1,255	ADL
Blue Catfish	2003	28,043	FGL
White Bass	2003	29	ADL
	2004	110	ADL
	2007	9,048	FRY
	2008	125,187	FRY
	2009	1,162,094	FRY
Striped Bass	1976	149,804	UNK
	1977	725,692	UNK
	1978	186,287	UNK
	1979	174,638	UNK
	1983	386,503	UNK
	1988	617,902	FGL
	1989	4,786,960	FRY
	1994	685,542	FGL
	1995	782,685	FGL
	1997	78,837	FGL
	1998	78,645	FGL
	1999	390,919	FGL
	2000	39,600	FGL
	2002	769,406	FGL
Palmetto Bass	1984	222,174	FGL
	1987	665,000	FRY
Bluegill	2003	215,718	FGL
Smallmouth Bass	1984	20,265	FGL
Largemouth Bass	1984	6,000	ADL
	1989	219,316	FGL
	2004	174,241	FGL

Table 4. Stocking history continued.

Species	Year	Number	Size
Florida Largemouth Bass	1975	750,000	FGL
	1976	2,250	FGL
	1978	451,049	FGL
	1979	131,455	FGL
	1981	67,000	FGL
	1984	18,375	FGL
	1985	102,000	FGL
	1989	117	ADL
	1997	501,783	FGL
	2001	131,021	FGL
	2003	313,739	FGL
	2004	185	ADL
	2004	664,165	FGL
	2005	11,995	FGL
	2010	238,244	FGL
	2011	270,159	FGL
	2012	250,276	FGL
	2013	514,858	FGL
	2014	502,052	FGL
	2015	462,885	FGL
	2016	347,467	FGL
	2017	459,000	FGL
	2018	447,124	FGL
	2019	355,008	FGL
	2020	136,000	FGL
	2021	159,116	FGL
Lone Star Bass[b]	2022	266,444	FGL
Sharelunker Florida Largemouth Bass	2008	2,842	FGL
	2010	2,091	FGL
	2011	30,488	FGL
	2012	25,067	FGL
	2013	4,315	FGL

[b] Lone Star Bass are 2nd generation offspring of pure Florida strain ShareLunker Largemouth Bass that have proven to be able to grow to ≥ 13 pounds.

Table 5. Objective-based sampling plan components for Falcon Reservoir, Texas, 2020-2022.

Gear/target species	Survey objective	Metrics	Sampling objective
Electrofishing			
Largemouth Bass	Abundance	CPUE-stock	RSE-Stock ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock
	Age-and-growth	Age at 14 inches	N = 13, 13.0 – 14.9 inches
Bluegill	Abundance	CPUE-total	Practical effort
	Size structure	Length frequency	Practical effort
Shad spp.	Abundance	CPUE-total	Practical effort
	Size structure	Length frequency	Practical effort
	Prey availability	IOV	Practical effort
Creel[a]			
Largemouth Bass	Angling effort	hours	RSE ≤25
	Catch and harvest	Number of fish	RSE ≤50
	Size	Length frequency	N > 100 fish
Blue and Channel Catfish	Angling effort	hours	Practical effort
	Catch and harvest	Number of fish	Practical effort
	Size	Length frequency	Practical effort
Black Crappie	Angling effort	hours	Practical effort
	Catch and harvest	Number of fish	Practical effort
	Size	Length frequency	Practical effort
White Bass	Angling effort	hours	Practical effort
	Catch and harvest	Number of fish	Practical effort
	Size	Length frequency	Practical effort
Alligator Gar	Angling effort	hours	Practical effort
	Harvest	Number of fish	Practical effort
	Size	Length frequency	Practical effort

[a] 32 creel days from January 1 to June 30.

No additional electrofishing and creel sampling effort will be expended to achieve sampling objectives.

Table 6. Results of habitat surveys conducted at Falcon Reservoir (Texas-side only) in September 2021. Percent occurrence is shown for predominate habitat types along with lower and upper 95% confidence limits (in parentheses). Reservoir elevation (in feet) relative to conservation pool elevation (301.2 feet above mean sea level) and number of random points sampled are provided for reference.

Habitat type/survey metric	2021
Open water	92 (87-97)
Flooded terrestrial vegetation	8 (3-13)
Relative reservoir elevation	-41
Number of random points	111

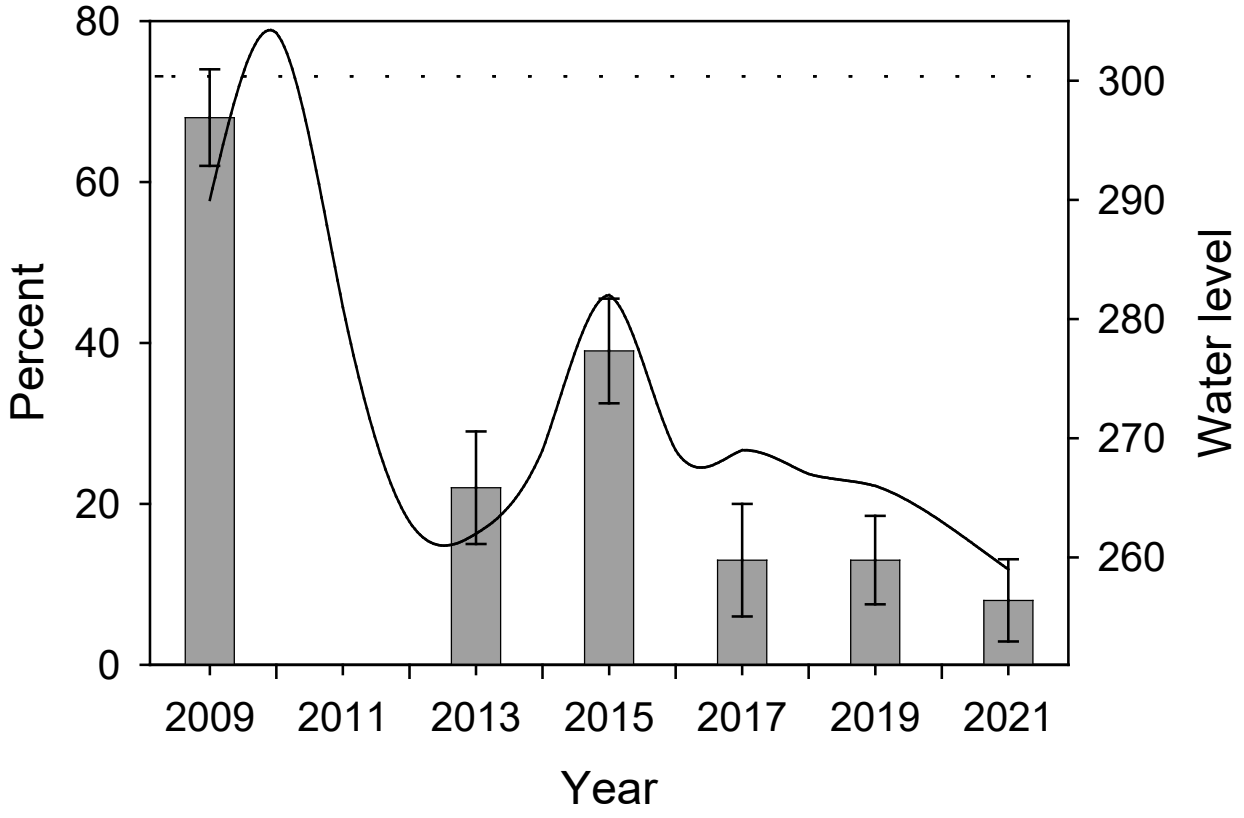


Figure 2. Percent occurrence of flooded terrestrial vegetation (bars) and water level when habitat surveys were conducted (solid line, feet above mean sea level) by survey year from 2009 to 2021 for the Texas-side of Falcon Reservoir. Error bars represent 95% confidence interval and dashed line represents water level at conservation pool elevation.

Table 7. Percent directed angling effort by species of boat anglers at Falcon Reservoir, Texas, from January to June in 2006, 2011, 2016, and 2022 and from April to September in 2019.

Species	2006	2011	2016	2019	2022
Catfishes	16.3	4.8	3.5	4.6	11.3
White Bass	0	0	0	0.8	0
Sunfishes	0.3	0	0	0	0
Largemouth Bass	83.3	91.9	92.7	87.2	73.5
Black Crappie	0	0.4	1.1	1.9	6.6
Alligator Gar	0	0	1.4	3.4	5.3
Blue Tilapia	0	0	0	0.3	0
Anything	0	2.8	1.2	1.7	3.3

Table 8. Total angling effort (h) and directed angling expenditures ($US) of boat anglers at Falcon Reservoir, Texas, from January to June in 2006, 2011, 2016, and 2022 and from April to September in 2019. Relative standard error is in parentheses.

Creel Statistics	2006	2011	2016	2019	2022
Total fishing effort	50,939 (17)	108,427 (24)	119,634 (19)	123,898 (24)	40,947 (22)
Total directed expenditures	453,115 (39)	1,289,845 (54)	1,209,834 (28)	841,789 (45)	437,839 (41)

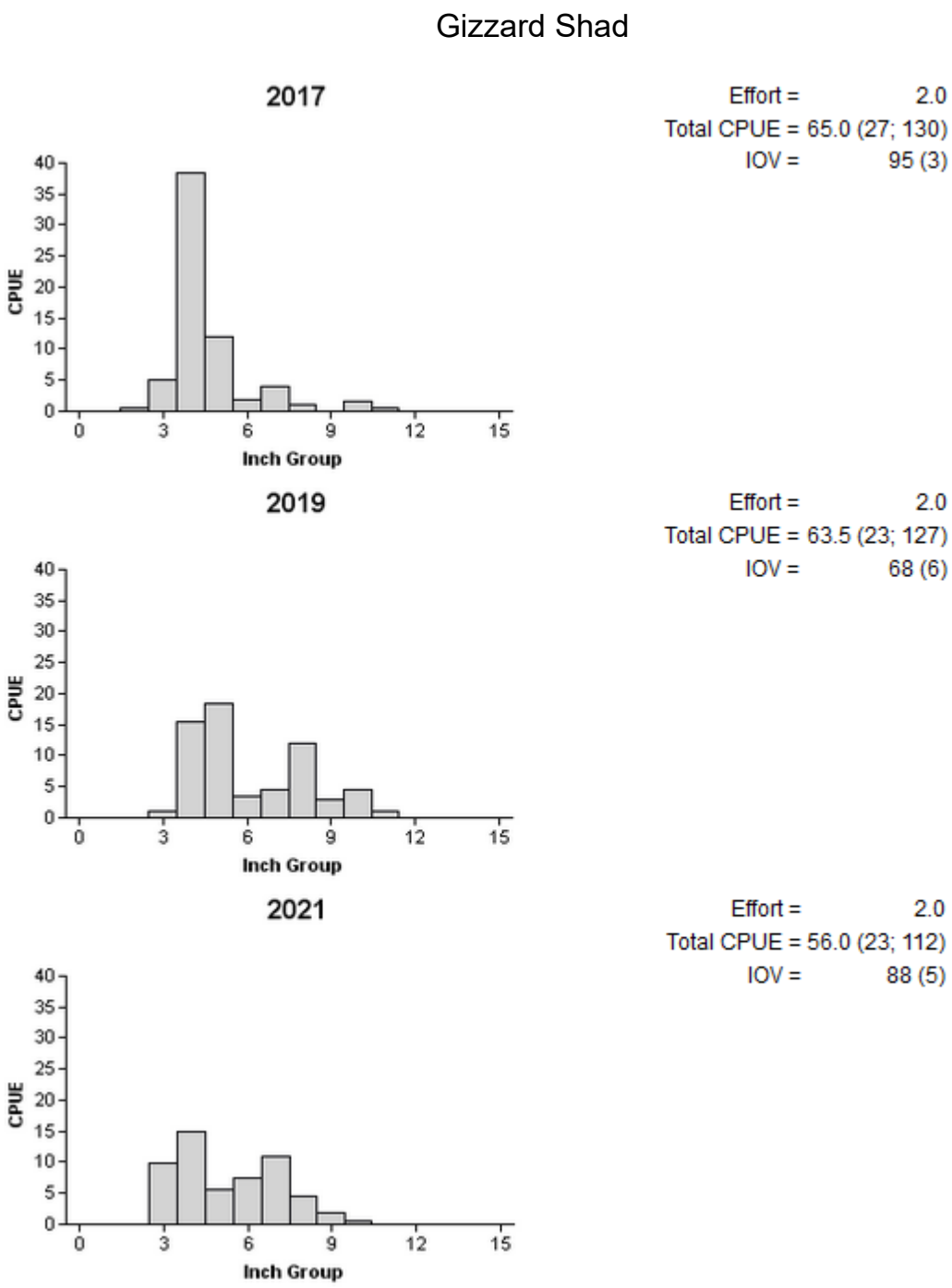


Figure 3. Number of Gizzard Shad caught per h (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall daytime electrofishing surveys, Falcon Reservoir, Texas, 2017, 2019, and 2021.

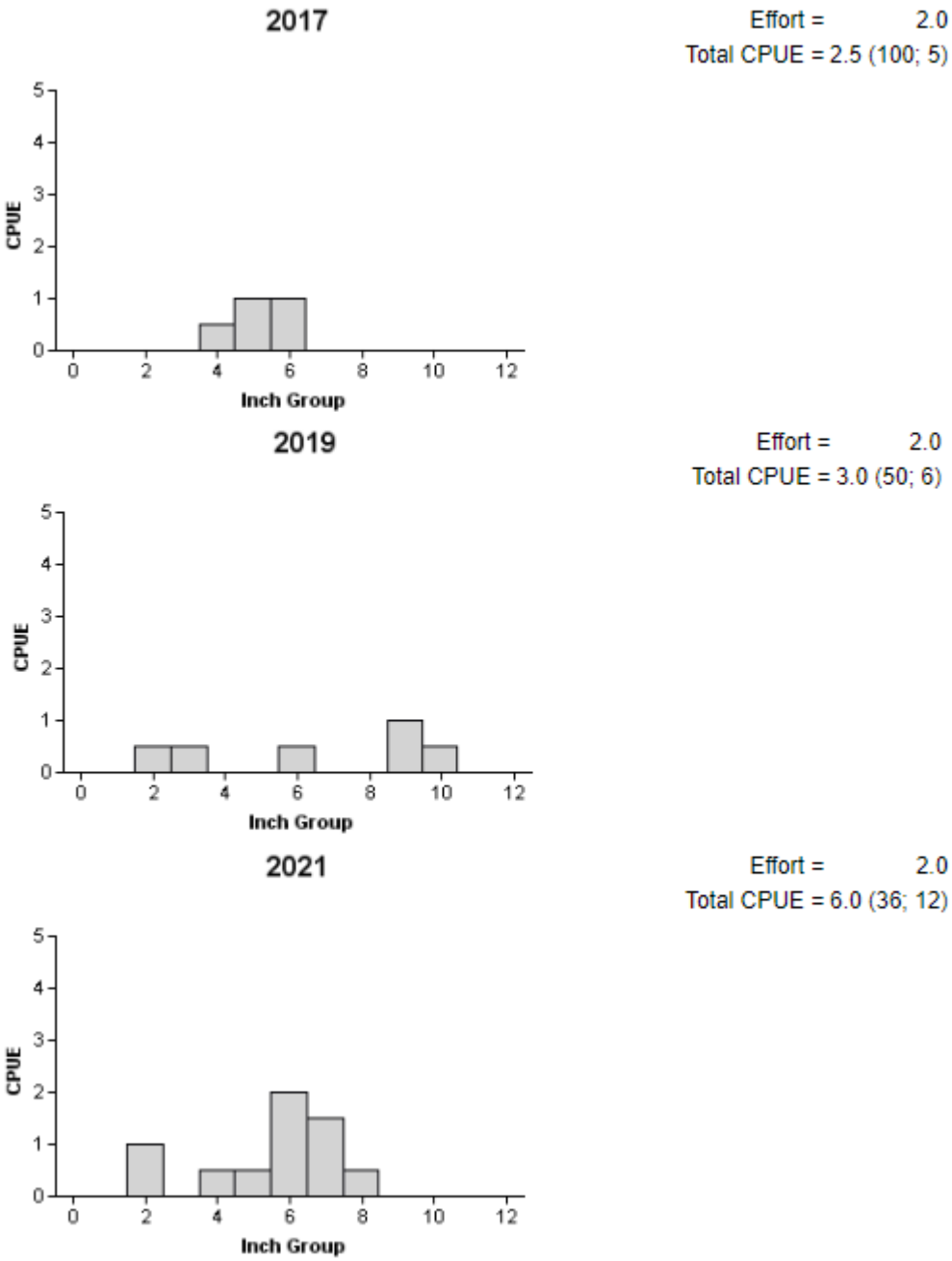


Figure 4. Number of Bluegill caught per h (CPUE) and population indices (RSE and N for CPUE are in parentheses) for fall daytime electrofishing surveys, Falcon Reservoir, Texas, 2017, 2019, and 2021.

Alligator Gar

Table 9. Creel survey statistics for Alligator Gar Falcon Reservoir, Texas, from January to June in 2006, 2011, 2016, and 2022 and from April to September in 2019. Estimates are for boat anglers only. Relative standard errors are shown in parentheses.

Creel survey statistic	2006	2011	2016	2019	2022
Surface area (acres)	54,882	76,580	57,291	33,608	26,784
Directed effort total (h)	0	0	1,668 (47)	4,202 (38)	2,191 (44)
Directed effort/acre (h)	0	0	0.03 (47)	0.13 (38)	0.08 (44)
Average catch per h	0	0	0.11 (86)	0.04 (61)	0.06 (60)
Total harvest	0	0	187 (284)	85 (693)	87 (186)
Harvest/acre	0	0	<0.01	<0.01	<0.01
Percent legal release (%)	0	0	0	0	0

Catfishes

Table 10. Creel survey statistics for catfishes at Falcon Reservoir, Texas, from January to June in 2006, 2011, 2016, and 2022 and from April to September in 2019. Estimates are for boat anglers only. Estimates are combined for Blue and Channel catfishes unless otherwise indicated. Relative standard errors are shown in parentheses.

Creel Survey Statistic	2006	2011	2016	2019	2022
Surface area (acres)	54,882	76,580	57,291	33,608	26,784
Directed effort total (h)	8,308 (25)	5,213 (36)	4,224 (33)	5,693 (35)	4,617 (33)
Directed effort/acre (h)	0.10	0.06	0.07	0.17 (35)	0.17 (33)
Average catch/h	1.20 (25)	2.70 (36)	0.83 (37)	0.37 (77)	0.74 (29)
Total harvest (fish)					
Blue Catfish	3,232 (57)	6,112 (77)	1,423 (74)	1,070 (85)	58 (276)
Channel Catfish	9,309 (43)	8,664 (63)	687 (102)	1,076 (108)	2,107 (16)
Unidentified Catfish	0	0	0	0	491 (79)
Harvest/acre					
Blue Catfish	0.06 (57)	0.11 (77)	0.02 (74)	0.03 (85)	<0.01 (>100)
Channel Catfish	0.17 (43)	0.15 (63)	0.01 (102)	0.03 (108)	0.08 (16)
Percent legal release	0	0	0	0	35

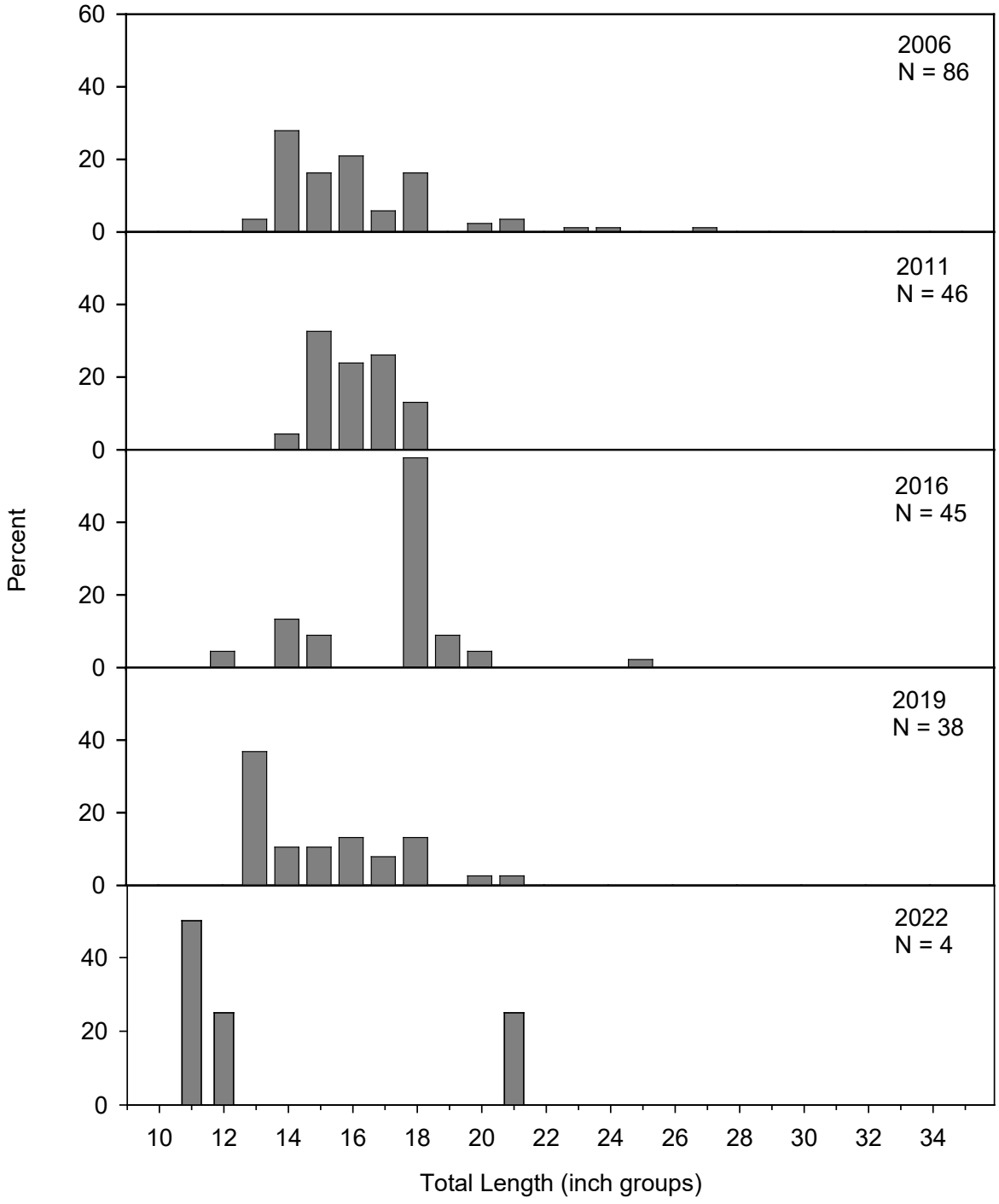


Figure 5. Length frequency distributions of Blue Catfish harvested by boat anglers from Falcon Reservoir in 2006, 2011, 2016, 2019, and 2022.

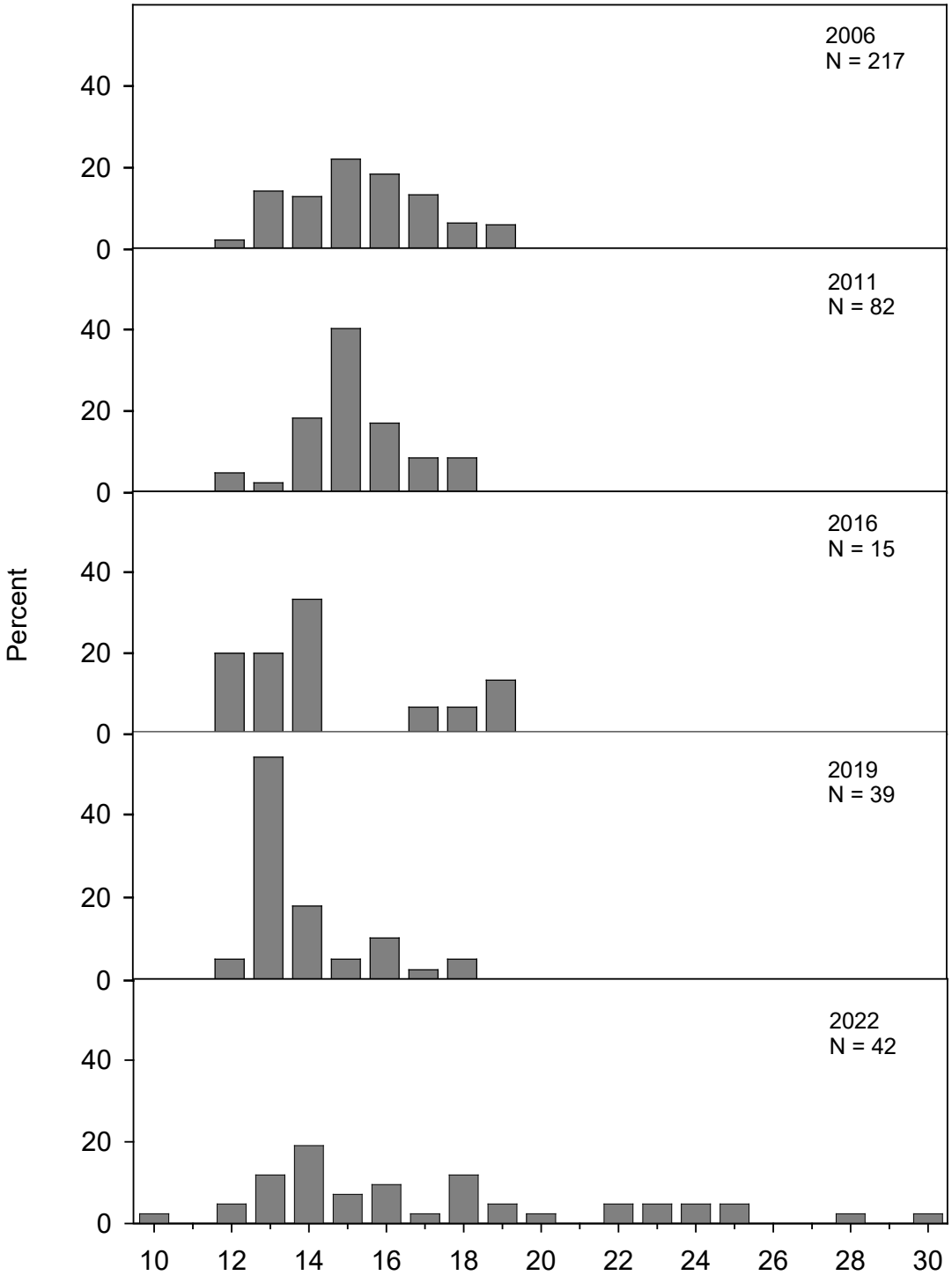


Figure 6. Length Frequency distributions of Channel Catfish harvested by boat anglers from Falcon Reservoir in 2006, 2011, 2016, 2019, and 2022.

White Bass

Table 11. Creel survey statistics for White Bass at Falcon Reservoir, Texas, from January to June in 2006, 2011, 2016, and 2022 and from April to September in 2019. Estimates are for boat anglers only. Relative standard errors are shown in parentheses.

Creel survey statistic	2006	2011	2016	2019	2022
Surface area (acres)	54,882	76,580	57,291	33,608	26,784
Directed effort total (h)	0	0	0	1,008 (71)	0
Directed effort/acre (h)	0	0	0	0.03 (71)	0
Average catch per h	0	0	0	4.25 (17)	0
Total harvest	0	0	507 (100)	5,371 (34)	534 (51)
Harvest/acre	0	0	<0.01	0.16 (34)	0.02 (51)
Percent legal release	0	0	20	73	74

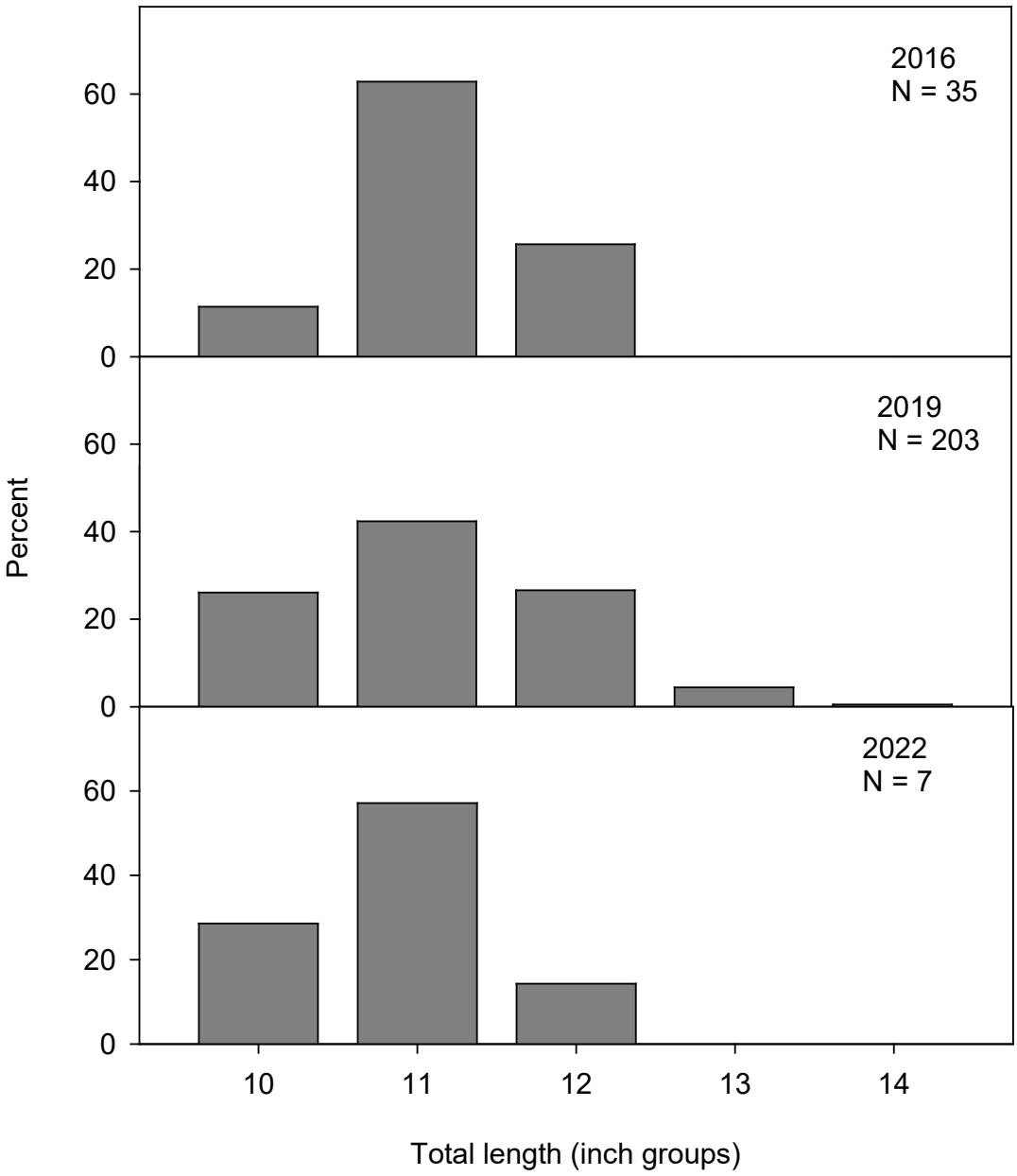


Figure 7. Length frequency distributions of White Bass harvested by boat anglers from Falcon Reservoir in 2016, 2019, and 2022.

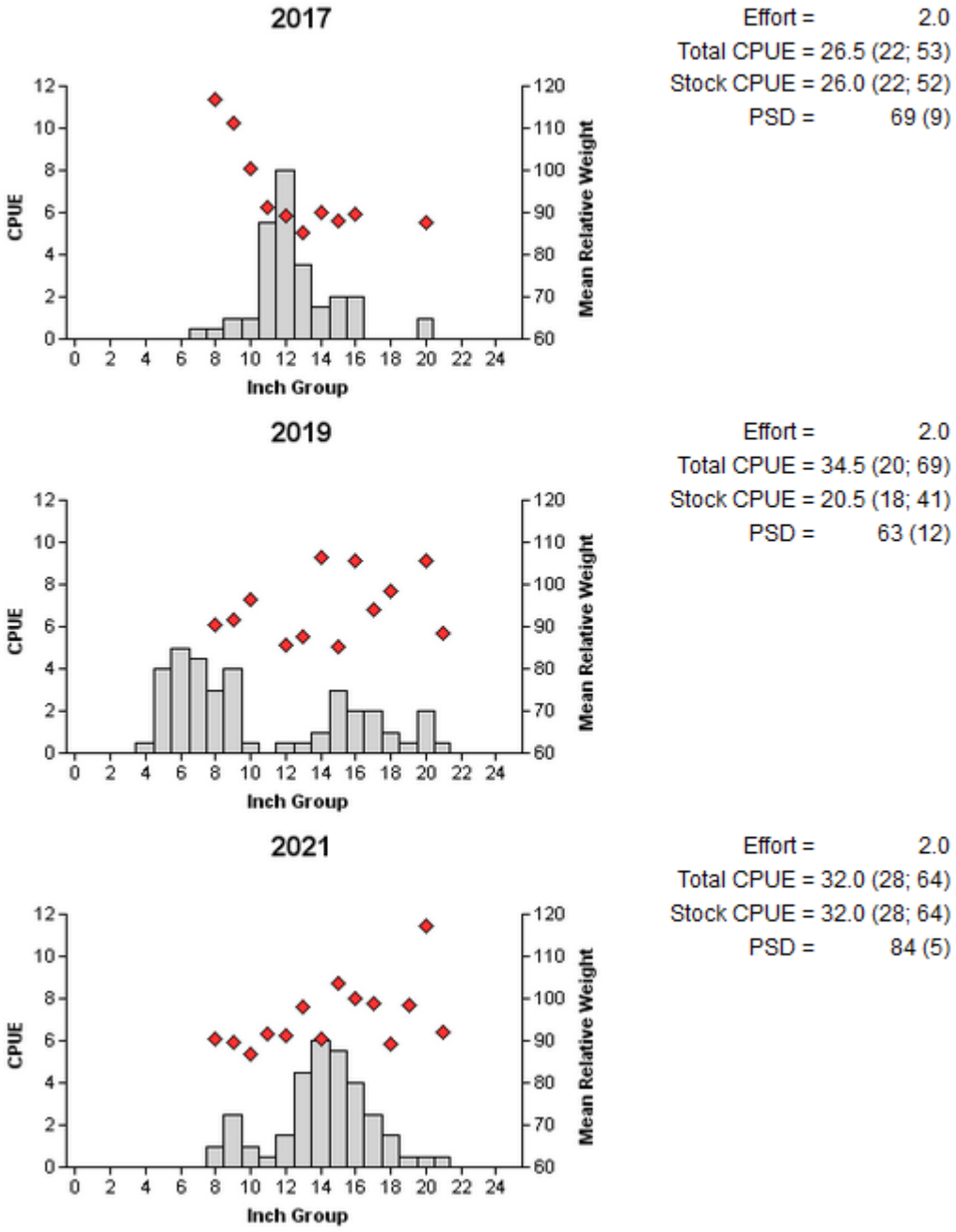


Figure 8. Number of Largemouth Bass caught per h (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall daytime electrofishing surveys, Falcon Reservoir, Texas, 2017, 2019 and 2021.

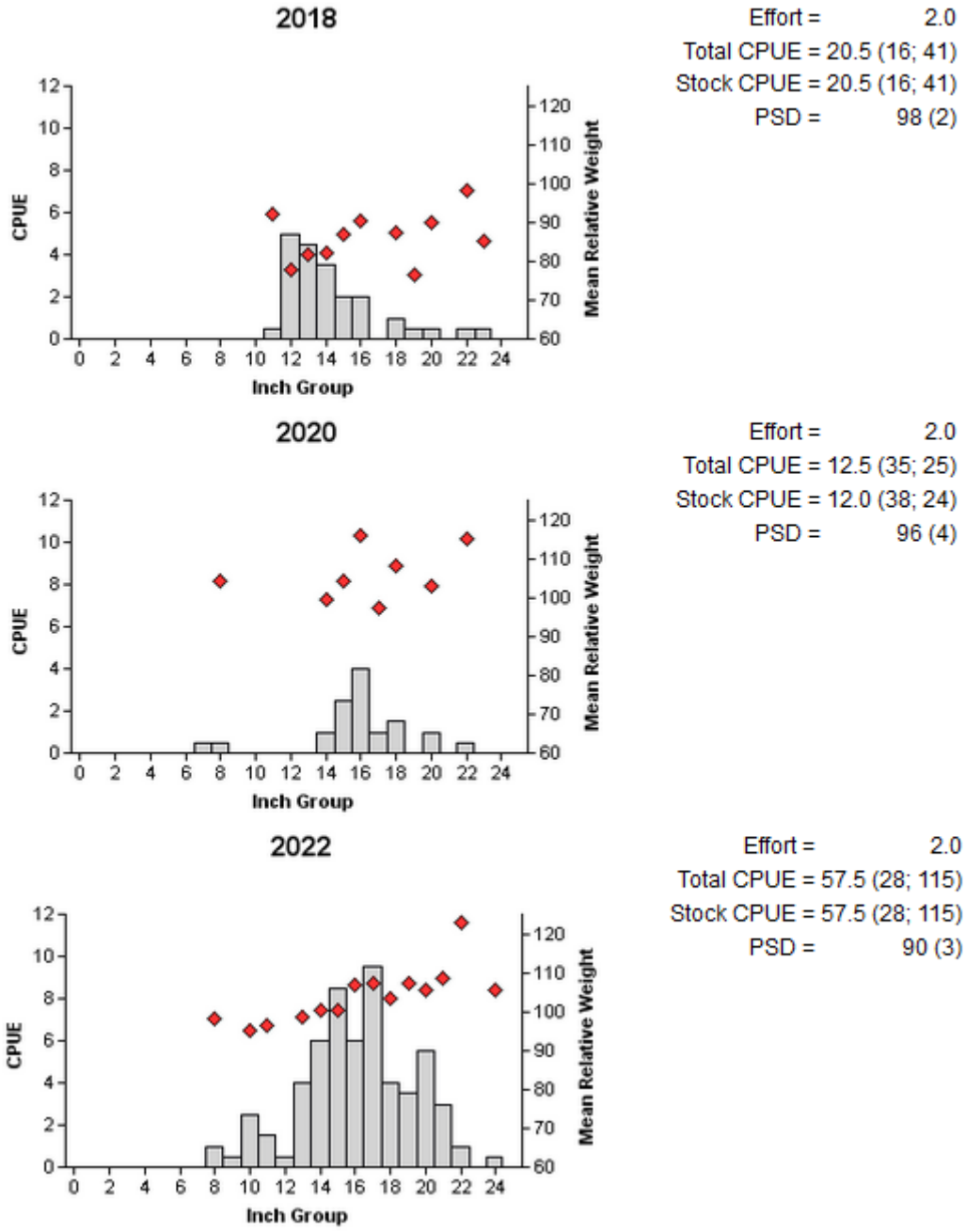


Figure 9. Number of Largemouth Bass caught per h (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring daytime electrofishing surveys, Falcon Reservoir, Texas, 2018, 2020, and 2022.

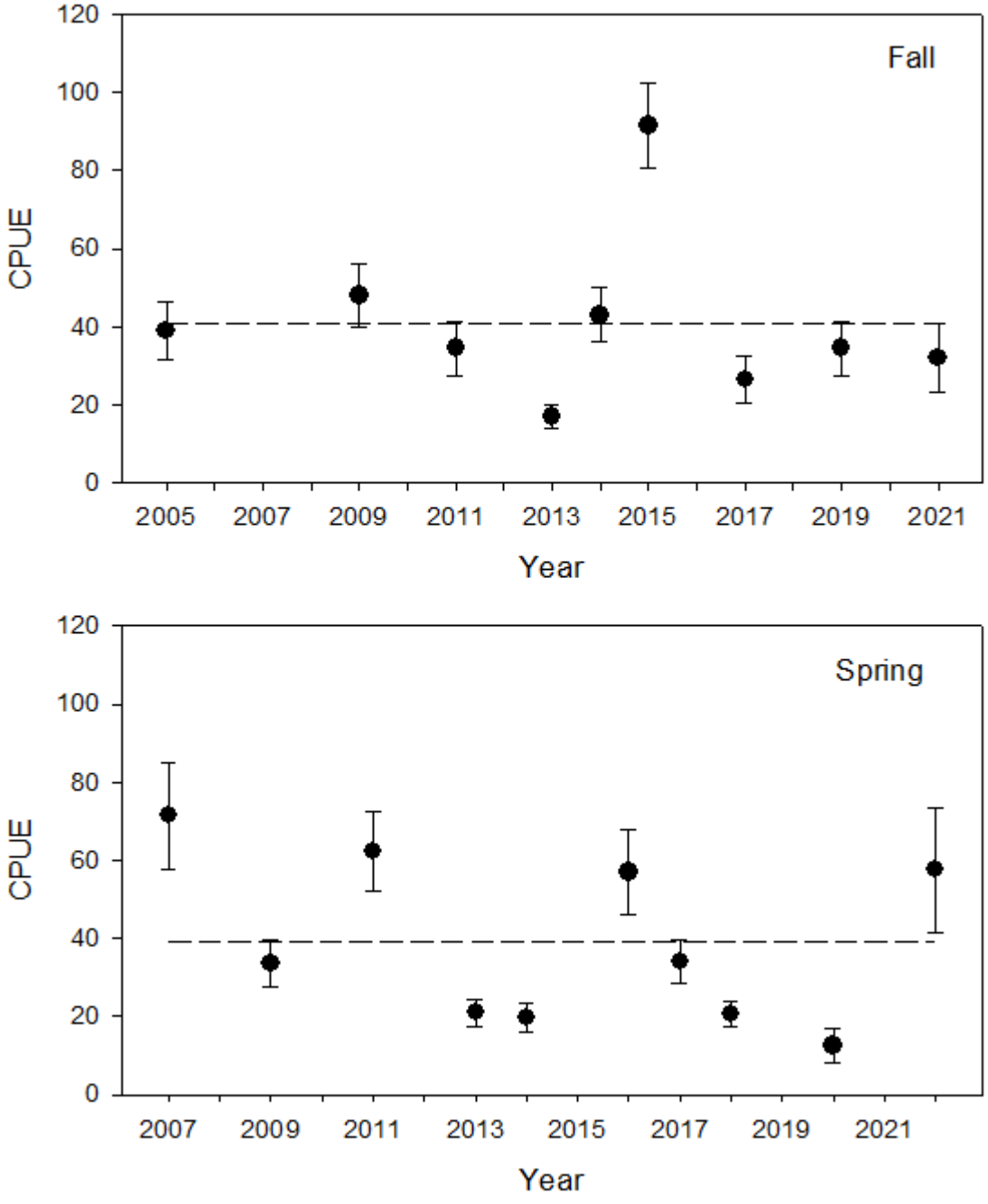


Figure 10. Average number of Largemouth Bass collected per 1 h of electrofishing effort (CPUE) at Falcon Reservoir from 2005 to 2022. Error bars represent ±1 standard error. Dashed line represents running average CPUE.

Table 12. Genetic analysis results for Largemouth Bass collected from Falcon Reservoir, Texas. Fish were collected using electrofishing except in 2011 when fish were angler-caught. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB. Genetic composition was determined by electrophoresis prior to 2005 and with micro-satellite DNA analysis since 2005. Fish classified as “trophy” weighed >10 lbs. Fish classified as “control” were random fish <10 lbs. weighed-in at tournaments.

Year	Sample size	FLMB	Intergrade	NLMB	% FLMB alleles	% FLMB
2000	34	14	20	0	81	41
2001	32	13	19	0	84	41
2005	33	4	29	0	68	12
2009	30	0	30	0	77	0
2011						
Trophy	56	4	52	0	76	7
Control	165	25	140	0	74	15
2018	30	0	30	0	73	0
2021	29	11	18	0	82	38

Table 13. Creel survey statistics for Largemouth Bass at Falcon Reservoir, Texas, from January to June in 2006, 2011, 2016, and 2022 and from April to September in 2019. Relative standard error is shown in parentheses. Number released by weight was not available for 2006. Number released by weight estimate for category "<4 lbs." in 2011 does not include fish <14, whereas in subsequent years it does.

Creel survey statistic	2006	2011	2016	2019	2022
Surface area (acres)	54,882	76,580	57,291	33,608	26,784
Directed angling effort (h)					
Tournament	10,778 (24)	9,336 (40)	22,309 (23)	33,089 (25)	1,624 (46)
Non-tournament	31,694 (19)	90,318 (24)	88,621 (19)	74,918 (25)	28,464 (24)
Combined	42,472 (18)	99,654 (25)	110,930 (19)	108,007 (24)	30,089 (24)
Angling effort/acre	0.72 (18)	1.30 (25)	1.90 (19)	3.21 (24)	1.12 (24)
Average catch per h	1.40 (15)	1.20 (8)	1.04 (9)	0.36 (15)	0.59 (15)
Harvest					
Non-tournament anglers	9,839 (41)	19,196 (42)	4,689 (29)	2,608 (39)	303 (52)
Average harvest/acre	0.18 (41)	0.25 (42)	0.08 (29)	0.08 (39)	0.01 (52)
Tournament weigh-in and release	6,649 (47)	7,739 (79)	2,148 (36)	2,858 (41)	504 (314)
Number released by weight					
Fish <4 lbs.		58,453 (30)	100,583 (27)	46,681 (33)	13,402 (43)
Fish ≥4 to <7 lbs.		17,782 (34)	7,124 (37)	4,509 (41)	2,666 (50)
Fish >7 to 10 lbs.		3,216 (54)	492 (112)	555 (79)	331 (89)
Fish ≥10 lbs.		189 (193)	79 (210)	0	0
Percent legal release[1]	54	78	90	92	98

[1]non-tournament anglers only

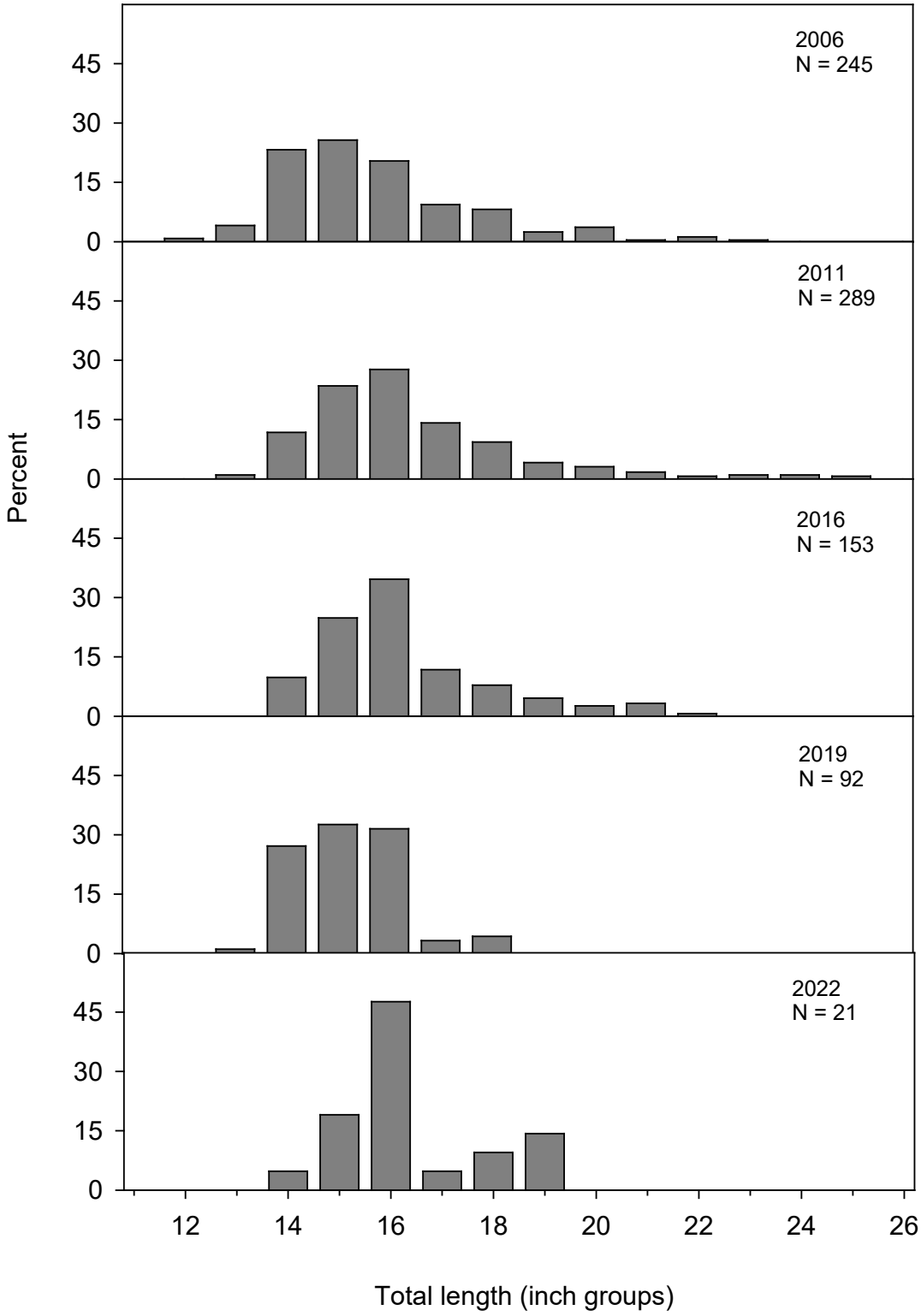


Figure 11. Length frequency distributions of Largemouth Bass harvested by non-tournament boat anglers from Falcon Reservoir in 2006, 2011, 2016, 2019, and 2022.

Black Crappie

Table 14. Creel survey statistics for Black Crappie at Falcon Reservoir, Texas, from January to June in 2006, 2011, 2016, and 2022 and from April to September in 2019. Relative standard errors are shown in parentheses.

Creel survey statistic	2006	2011	2016	2019	2022
Surface area (acres)	54,882	76,580	57,291	33,608	26,784
Directed effort total (h)	0	477 (101)	1,342 (54)	2,307 (52)	2,701 (44)
Directed effort/acre (h)	0	<0.01 (101)	0.02 (54)	0.07 (52)	0.10 (44)
Average catch per h	0	1.85 (56)	1.17 (35)	0.54 (21)	0.98 (43)
Total harvest	0	2,651 (164)	676 (96)	2,009 (69)	8,836 (68)
Harvest/acre	0	0.03 (164)	0.01	0.06 (69)	0.33 (68)
Percent legal release	0	2	42	43	9

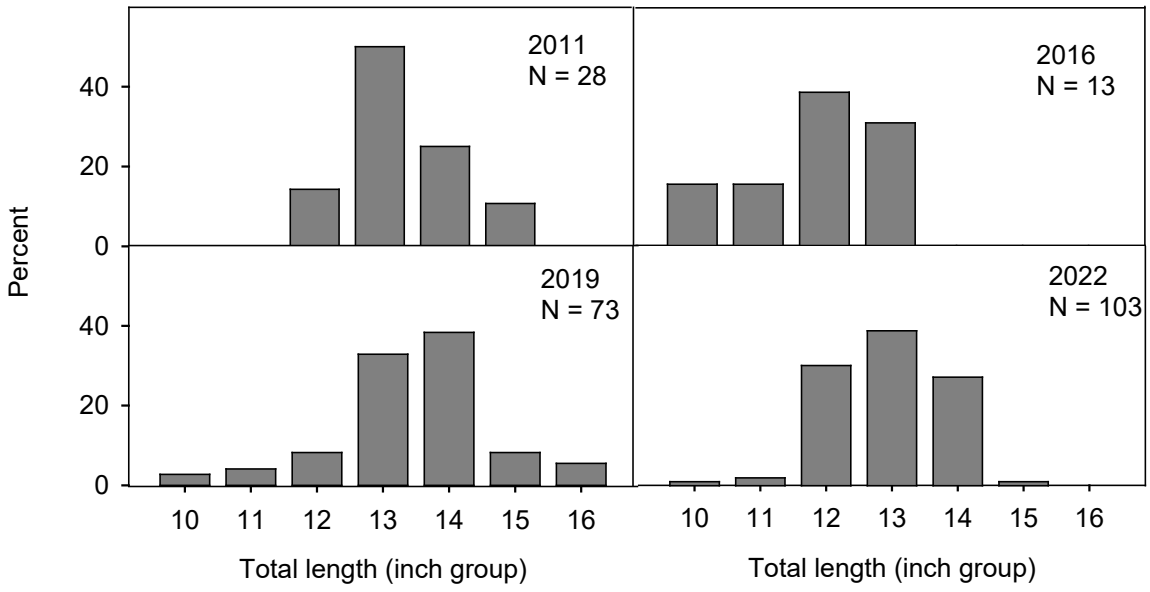


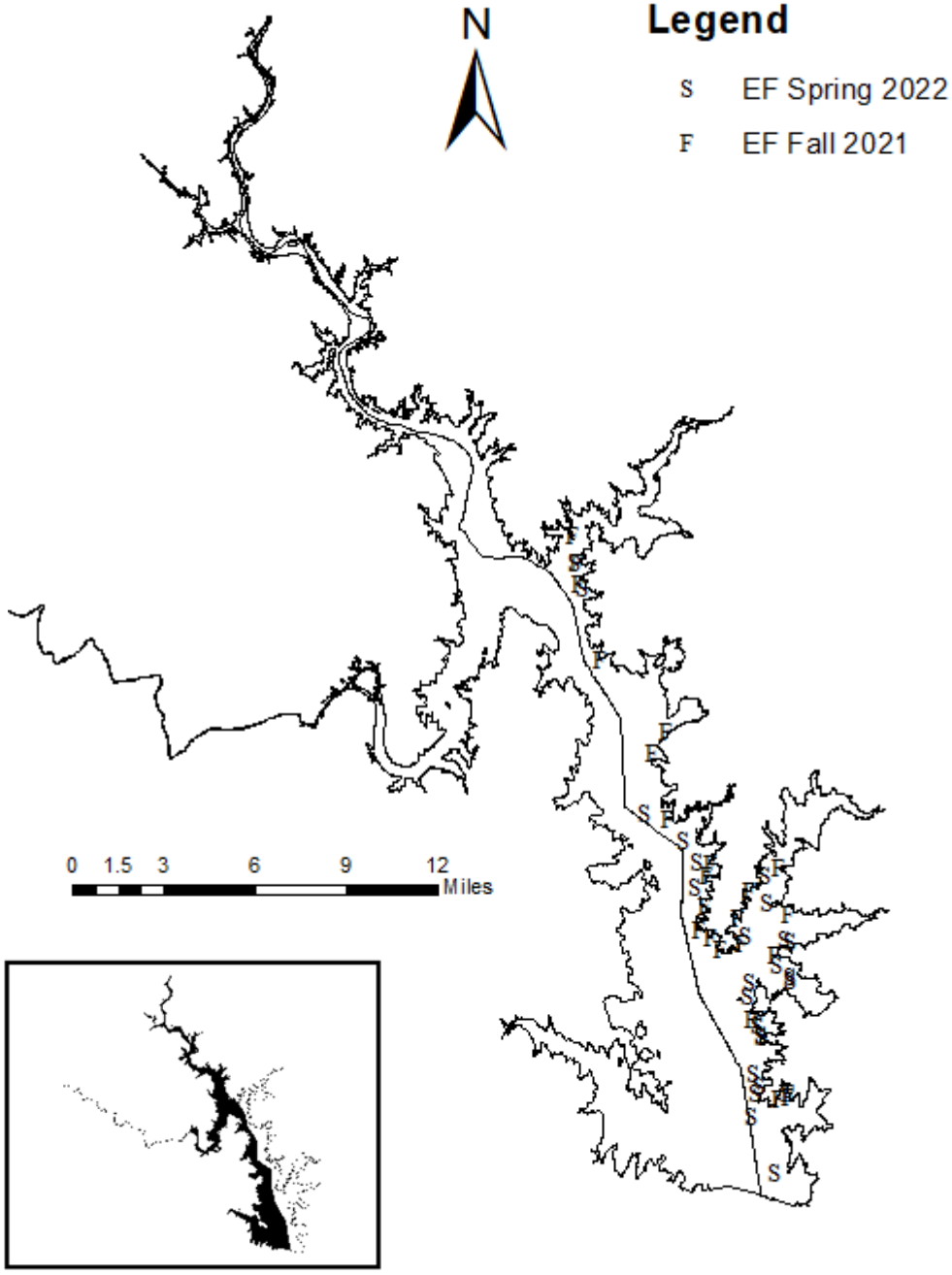
Figure 12. Length frequency distributions of Black Crappie harvested by boat anglers from Falcon Reservoir in 2011, 2016, 2019, and 2022.

Proposed Sampling Schedule

Table 15. Proposed sampling schedule for Falcon Reservoir, Texas. Survey period is June through May. The creel survey denoted for 2022-2023 will be conducted January-June 2023. Standard survey denoted by S and additional survey denoted by A.

	Survey year			
	2022-2023	2023-2024	2024-2025	2025-2026
Angler Access		X		X
Vegetation		X		
Electrofishing – Fall		X		
Electrofishing – Spring		X		
Creel survey				X
Report				X

APPENDIX A – Map of Sampling Locations



Location of spring (S) and fall (F) electrofishing sample sites, Falcon Reservoir, Texas 2021-2022.

APPENDIX B – Catch Rates for All Species and Gear Types

Number (N) and catch rate (CPUE) of all target species collected daytime electrofishing, fall 2021. Sampling effort was two hours of electrofishing. RSE is shown in parentheses.

	Electrofishing	
Species	N	CPUE
Gizzard Shad	112	56 (23)
Threadfin Shad	221	110.5 (25)
Green Sunfish	4	2.0 (100)
Warmouth	3	1.5 (73)
Bluegill	10	5.0 (41)
Largemouth Bass	64	32.0 (28)
Rio Grande Cichlid	4	2.0 (69)

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