

Falcon Reservoir

2017 Fisheries Management Survey Report

PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-3

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

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Survey and Management Summary

Fish populations in Falcon Reservoir were surveyed in 2016-2018 using electrofishing and gill netting since the last report (2016). Anglers were surveyed from January through June 2016 using a creel survey. Historical data are presented for comparison. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

Reservoir Description: Falcon Reservoir (83,654 acres when full) borders Mexico and was constructed in 1954 on the Rio Grande River. The reservoir experiences extreme water level fluctuations due to variable rainfall and water releases for downstream agricultural irrigation. Water level declined about 10 feet during the survey period (06/2016-05/2018) before abruptly increasing about 20 feet in October 2017. This water level increase, however, was short-lived as water level declined about 13 feet from March through May 2018, and as of May 15, 2018 was 30 feet below conservation pool elevation. In September 2017, occurrence of flooded terrestrial vegetation was low (13%) by historic standards on the Texas-side of the reservoir.

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. On the Mexico side, fish harvest is unregulated and a substantial commercial gill net fishery exists targeting primarily Blue Tilapia according to anecdotal reports. Florida Largemouth Bass (FLMB) fingerlings have been stocked annually in recent years to increase FLMB genetic introgression and in turn, Largemouth Bass trophy potential. Giant salvinia was found growing near a boat ramp in 2016 and was removed.

Fish Community

- **Prey species:** Relative abundance of Gizzard Shad and their index of vulnerability (IOV) was comparatively high in 2017. Threadfin Shad, Bluegill, and Blue Tilapia were other important species present in the reservoir. Overall, prey species abundance and size was sufficient to support existing predator species populations.
- **Alligator Gar:** Relative abundance and size structure in 2018 was similar to 2014 according to gill net sampling conducted in April of each year. From January to June 2016, anglers expended 1,668 h bow-fishing and harvested 187 Alligator Gar. Non bow-fishing effort has been observed, but was not captured in our surveys.
- **Catfishes:** Directed angling effort, angling success, and harvest were lower in 2016 than in previous years. Fishing for catfishes accounted for 3.5% of the total angling effort occurring on the reservoir in 2016.
- **White Bass:** No angling effort directed towards White Bass occurred during the 2016 creel survey period. However, an estimated 507 White Bass were incidentally caught and harvested by anglers targeting other species.
- **Largemouth Bass:** Relative abundance of Largemouth Bass has decreased in recent years. The population is mostly comprised of quality-sized fish (≥ 12 inches) in 2017-2018. Directed angling effort was greater in 2016 than in previous years, however harvest was much lower. Anglers caught and released an estimated 108,278 fish from January to June 2016 and one of every 14 caught and released exceeded 4 lbs.
- **Black Crappie:** Angling effort directed towards Black Crappie remained low in 2016, however it was greater than in 2011. Despite the increase in angling effort, harvest was considerably lower in 2016 (676 fish) than in 2011 (2,651 fish).

Management Strategies: Concerning Largemouth Bass, stock FLMB annually, frequently monitor the population, and continue to explore the potential effectiveness of alternative harvest regulations. Assess Alligator Gar population relative abundance, size and age structure to determine effects of daily bag limit increase which was implemented in 2015. 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 2016-2018. The purpose of the document is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2016-2018 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 (CP), with 38,360 acres located within Texas' jurisdiction. The reservoir was completed in 1954 and was built for water conservation, flood control, hydroelectric energy, and recreation. Ownership of water is shared between Mexico (41%) and the U.S. (59%). Flows are managed by the International Boundary and Water Commission (IBWC) and Texas Commission on Environmental Quality according to the 1944 Water Treaty established between the two countries. The reservoir experiences dramatic water level fluctuations due to variable rainfall and water releases for downstream agricultural irrigation (Figure 1). Average annual water fluctuation is 19.0 feet. Record low water level occurred in 2002 (54 feet below CP) and record high water level occurred in 2010 (8 feet above CP). From May 2014 to May 2018, water level ranged from 15.5 to 38.5 feet below CP. When water level recedes, dense terrestrial vegetation becomes established on the exposed reservoir bottom and is the predominant structural fisheries habitat when inundated. These 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 Mexico. Other descriptive characteristics for the reservoir are in Table 1.

Angler Access

There are two public boat ramps (Zapata County Park and Falcon Lake 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. Boat angler access from the reservoir proper to approximately 3,000 acres of the reservoir (when at CP) was not possible from late 2015 to present because of bridge construction. Expected completion of bridge construction is late 2018. In 2017, an access road was built to and around a large existing pavilion at the Zapata County Boat Ramp Park (Appendix A) as settlement (restitution) for a fish kill that occurred in 2016. The road will allow Largemouth Bass tournament organizers to use the pavilion and have drive-thru weigh-ins.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Myers and Dennis 2015) included:

1. Conduct additional electrofishing surveys to assess the Largemouth Bass population.

Action: An electrofishing survey was conducted in spring 2018.

2. Stock 500,000 FLMB annually to maintain or increase trophy potential.

Action: A total of 507,866, 459,000 and 447,124 FLMB were stocked in 2016, 2017 and 2018, respectively.

3. Collect fin clips from tournament Largemouth Bass for genetic analyses.

Action: Fin clips were collected from electrofishing-caught fish in spring 2018.

4. Model the potential effects of a daily bag limit reduction for Largemouth Bass.

Action: Creel data from 2006, 2011, and 2016 were used similar to described in Myers and Dennis (2011) to predict the effect of a 3-fish daily bag limit, as well as other potential regulations on Largemouth Bass harvest. Results are contained in Appendix D.

5. Evaluate Alligator Gar size structure and growth by using gill nets.

Action: Gill nets (36 net-nights) were used to collect Alligator Gar in April 2018 to assess relative abundance, size, and age structure. Additional gill net sampling will occur in September 2018. Analyses will be conducted to evaluate for changes in size structure and growth after all 2018 sampling is complete.

6. 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 2017, and no invasive aquatic plants were found. "Clean, Drain, and Dry" signs were posted at 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. 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 increase FLMB genetic introgression and Largemouth Bass trophy potential. The stocking history summary is in **Error! Reference source not found.**

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 2015. Sampling activities that followed were conducted to achieve survey and sampling objectives specified in the OBS. Primary components of the 2015 OBS plan are listed in Table 5. Sampling activities conducted prior to OBS implementation were conducted according to Myers and Dennis (2014) and TPWD Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual, revised 2015), except when otherwise indicated. All survey sites were randomly selected except when otherwise indicated (Appendix B).

Electrofishing – Largemouth Bass, sunfishes, Gizzard Shad, and Threadfin Shad were collected during daytime by electrofishing (24, 5-min stations) during fall 2017 and spring 2017 and 2018. Only Largemouth Bass were collected during spring sampling. Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing. Ages for Largemouth Bass were determined using otoliths from fish between 13.0 and 14.9 inches during spring and fall.

Gill netting – Alligator Gar were collected by using gill nets in April 2018 (36 total net–nights) at biologist-selected stations in three reservoir areas (Velenio, Tigers, and State Park Cove). Gill nets were constructed of nylon and ranged in mesh size from 3.5 to 7.0 inches. Otoliths were removed from 5 fish/10cm length for females and males for ageing. Catch-per-unit-effort for gill netting was recorded as the number of fish caught per net night (fish/nn).

Genetics – Fin clips were collected from Largemouth Bass caught during electrofishing in spring 2018, and assessed using Micro-satellite DNA analysis to assess FLMB introgression.

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 – An access creel survey was conducted from January to June 2016 at the two public boat ramps. Sampling occurred on 10 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 creel survey day. Selection of access point to sample was also random. Voluntary release rates were calculated by the following calculation (Myers et al. 2008):

$$\text{Voluntary Release Rate} = \frac{\sum \text{Legal Fish Released}}{(\sum \text{Harvested Fish} + \sum \text{Legal-sized Fish Released})} \times 100$$

Estimated weights of caught and released Largemouth Bass ≥ 14 inches were obtained from interviewed anglers to estimate number of fish released by weight category. Creel data from 2006, 2011, and 2016 were used similar to Myers and Dennis (2011) to predict the effect of a 3-fish daily bag limit and other regulations on non-tournament angler Largemouth Bass harvest.

Habitat - Surveys were conducted by using the random point sampling method during September 2017 (TPWD Inland Fisheries Division, unpublished manual, revised 2015). The last structural (i.e., shoreline substrate) habitat survey was completed in 2009, (Myers and Dennis 2014).

Water level - Source for water level data was the International Boundary Water Commission (IBWC 2018).

Results and Discussion

Habitat: Flooded terrestrial vegetation (huisache, mesquite, acacia, and salt cedar) was the primary fisheries habitat in the reservoir in 2017. However, percent occurrence was lower in 2017 (13%) than in previous years (22-68%; Table 6), a result of less water level fluctuation and an overall lower water level in 2017 (Figure 1). Average annual water level fluctuation was 15.1 feet from 2014 to 2018, which is slightly lower than the historic average annual water level fluctuation at the reservoir (19.0 feet). The reservoir contains abundant diploid Grass Carp, likely established from stockings into the reservoir and the Rio Grande watershed conducted by Mexican authorities. As such, no aquatic vegetation has been documented occurring in the reservoir since the early 1990s, except for a small amount of giant salvinia that was found growing adjacent to the Zapata County Boat Ramp in May 2016. The giant salvinia was subsequently contained then removed, and has not been found since.

Creel: Fishing for Largemouth Bass continued to comprise the majority of the total fishing effort expended on the reservoir (92.7%; Table 7). Other species targeted by anglers in 2016 included catfishes (3.5%), Black Crappie (1.1%), and Alligator Gar (1.4%). Total angling effort expended on the reservoir was slightly greater in 2016 (119,634 h) than in 2011 (108,427 h) and more than double that in 2006 (50,939 h; Table 8). Total directed angling expenditures were similar in 2016 (\$1,209,834) and 2011 (\$1,289,845).

Prey species: Electrofishing CPUE of Gizzard Shad in 2017 (65.0/h) was similar to that in 2015 (60.0 /h) and greater than in 2014 (16.5/h; Figure 2). Although Gizzard Shad CPUE was similar in recent years, IOV in 2017 (95) was considerably greater than IOV reported in the previous two surveys. Electrofishing CPUE of Threadfin Shad was 55.5/h in 2017. Electrofishing CPUE of Bluegill remained low in 2017 (2.5/h; Figure 3). Blue Tilapia are present in high abundance and thus important prey species in the reservoir. However, relative abundance of Blue Tilapia could not be determined because of low susceptibility to electrofishing. Rapid growth of sport fish species and mean relative weights exceeding 85 for most size classes of Largemouth Bass in 2017 (see below) suggest prey availability was sufficient.

Alligator Gar: A total of 96 Alligator Gar were collected in April 2018. Gill net CPUE was 2.7/nn (RSE = 14; N=36 nn) in 2018, which was similar to 2014 (2.3/nn; RSE=15; N=30 nn). Population size structure was similar in 2018 and 2014 (Figure 4). Average fish length was 56.3 inches TL in 2018 and 56.7 inches TL in 2014. From January to June 2016, anglers expended 1,668 h bow-fishing and harvested 187 Alligator Gar. Non bow-fishing effort has been observed, but was not captured in our surveys.

Catfishes: Directed angling effort for catfishes was slightly lower in 2016 (4,224 h) than in 2011 (5,213 h) and much lower than in 2006 (8,308 h; Table 10). Angling catch rate declined in 2016 (0.8/h) compared to rates reported in 2011 (2.7/h) and 2006 (1.2/h). Likewise, angler harvest for both Blue Catfish and Channel Catfish (2,110 fish) was lower in 2016 compared to the previous two surveys (12,541 and 14,776 fish). In 2016, most of the harvested Blue Catfish were ≤ 18 inches, and most Channel Catfish were ≤ 14 inches (Figure 5).

White Bass: White Bass were first collected in gill nets in 2014 after not having been collected since 1995 due to the effects of an extended low water period in conjunction with intense Mexican commercial netting. Gill net CPUE was 0.5/nn in 2014 (Myers and Dennis 2015). Similar to the prior two creel surveys, anglers did not report angling effort towards White Bass during the 2016 survey (Table 11). However, an estimated 507 White Bass were incidentally caught and harvested by anglers targeting other species. Lengths of harvested fish ranged from 10 to 13 inches (Figure 6). Twenty percent of legal White Bass (>10 inches) caught were voluntarily released.

Largemouth Bass: Electrofishing CPUE of Largemouth Bass was lower in fall 2017 (26.5/h) and spring 2018 (20.5/h) compared to previous surveys (Figure 7 and Figure 8). Largemouth Bass relative abundance has been highly variable (Figure 9) because of fluctuations of water level and habitat availability (i.e., flooded terrestrial vegetation). In fall 2017, all but one fish collected exceeded stock-size. In spring 2018, all fish collected were longer than stock-size. As a result of low recruitment in recent years, PSD was greater in fall 2017 (69) and spring 2018 (98) compared to previous surveys. Mean

relative weight values were acceptable with most size-category specific values exceeding 85 in fall 2017 and 80 in spring 2018. Largemouth Bass exhibited moderate growth, obtaining harvestable length in two growing seasons. Fish ranging from 13 to 14.9 inches TL collected in spring 2018 (N = 16) were all 2015-year class fish, as were 13-14.9 inch TL fish collected in fall 2017 (N=6). Genetic introgression of FLMB into the population has been high at the reservoir ranging from 68 to 84% percent FLMB alleles (Table 12). Percent FLMB allele was 73% in 2017. Percent pure FLMB in the population ranged from 0 to 15% since 2005 and was 0% in 2017. Annual stockings of FLMB fingerlings since 2010 have maintained high FLMB introgression into the population. However, it has not yielded more proportion of fish in the population that were pure FLMB. Angling effort targeting Largemouth Bass was greater in 2016 (110,930 h) than in previous surveys (42,472 h and 99,654 h; Table 13). Tournament angling accounted for 20% of total Largemouth Bass angling effort. Angling success was good in 2016, which anglers reported catching an average of 1.02/h. Non-tournament anglers harvested 4,689 fish in 2016 which was substantially less than in 2011 (19,196 fish) and 2006 (9,839 fish). The length distribution of harvested fish in 2016 was similar to previous years; fish ranging in size from 15 to 16 inches were most frequently harvested (Figure 10). Voluntary release of legal-length fish was substantially greater in 2016 (90%) than in previous years (54% and 78%). The majority of caught and released fish (93%) were <4.0 lbs. However, catch rate of quality size fish (≥ 4.0 lbs) remained very good. On average, one of every 14 fish caught and released was >4.0 lbs.

Black Crappie: Angling effort directed towards Black Crappie remained low in 2016 (1,342 h), but it was greater than in 2011 (Table 14). Despite the increase in angling effort, harvest was considerably lower in 2016 (676 fish) than in 2011 (2,651). Forty-two percent of the legal-length fish caught were released. This high voluntary release was attributable to release of incidental catches of Black Crappie by anglers targeting other species. Length of harvested Black Crappie ranged from 10 to 13 inches in 2016 (Figure 17).

Fisheries Management Plan for Falcon Reservoir, Texas

Prepared - July 31, 2018

ISSUE 1: Falcon Lake has been consistently ranked as one of the best bass fishing lakes in the U.S. However, its Largemouth Bass population fluctuates in response to changes in water level and concomitant changes in habitat quantity (i.e. flooded terrestrial vegetation). Largemouth Bass harvest varies considerably across years, ranging from 4,689 to 19,196 fish since 2006.

MANAGEMENT STRATEGIES

1. Conduct spring and fall electrofishing surveys every two years to monitor Largemouth Bass population parameters.
2. Stock 500,000 FLMB fingerlings annually to increase trophy Largemouth Bass potential.

ISSUE 2: The TPWD Commission approved an Alligator Gar daily bag limit increase from 1 to 5 fish (effective September 2015) along with a provision to provide a status report on the population and fishery in 2020.

MANAGEMENT STRATEGIES

1. Conduct gill net sampling in 2018 to assess Alligator Gar population size structure and growth.
2. Conduct creel survey sampling in 2019 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 (2018-2022)

Sport fish, forage fish, and other important fishes

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

Survey objectives, fisheries metrics, and sampling objectives

Largemouth Bass: Largemouth Bass are the most highly sought after sport fish in the reservoir. This fishery is a popular destination for out-of-state anglers and has been ranked in the top 10 of the 100 Bass fishing lakes as compiled by the Entertainment and Sports Programming Network (ESPN). This reservoir experiences extreme water level fluctuations that affects habitat availability/quality, and in turn, Largemouth Bass abundance, size structure, and fishing quality. Our objectives are to monitor for changes in the population at various water levels/habitat conditions and to 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 to track changes in the population because of its fluctuating nature and to address management questions and issues as they arise. The sampling will consist of spring day-time, bass-only electrofishing and fall all-species daytime electrofishing surveys. The surveys will consist of 24 randomly selected stations. 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 2016 and the next creel survey will be conducted in 2019.

Blue and Channel Catfishes: According to recent creel survey results, catfishes provide a nominal fishery at Falcon Reservoir accounting for 3.5% of the total angling effort in 2016. Our objective is to continue to monitor for large-scale changes in the fishery. This will be accomplished using creel survey sampling in 2019.

Black Crappie: Black Crappie historically provided a fishery at the reservoir; however recent creel survey results show this species accounted for $< 1.0\%$ of total effort. Our objective is to continue to monitor for large-scale changes in the fishery. This will be accomplished by conducting a creel survey in 2019.

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. Our objective is to collect population size structure, age distribution, and angler utilization data to determine the effects of the bag limit increase. Gill net surveys will be conducted in September of 2018 to collect size and age data for comparison to pre-regulation change data. Our target is to collect 100 fish. Otoliths will be removed from 5 fish/10 cm size group for females and males for fish ageing. Directed angling effort, angler harvest, and size at harvest will be collected using creel survey sampling in 2019.

Gizzard Shad and Bluegill: Gizzard 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. No additional effort will be expended to increase the number of Bluegill or Gizzard Shad collected.

White Bass: White Bass historically provided a fishery at the reservoir. However, the 2016 creel survey

sampling showed few, if any, anglers targeted this species. Despite this, some incidental harvest of White Bass did occur. Angler reports and observations by staff indicate White Bass were targeted by anglers in 2017 and 2018 with high angling success. Our objective is to continue to monitor for large-scale changes in the fishery. This will be accomplished by using creel survey sampling in 2019.

Low-density fisheries

None

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Tables and Figures

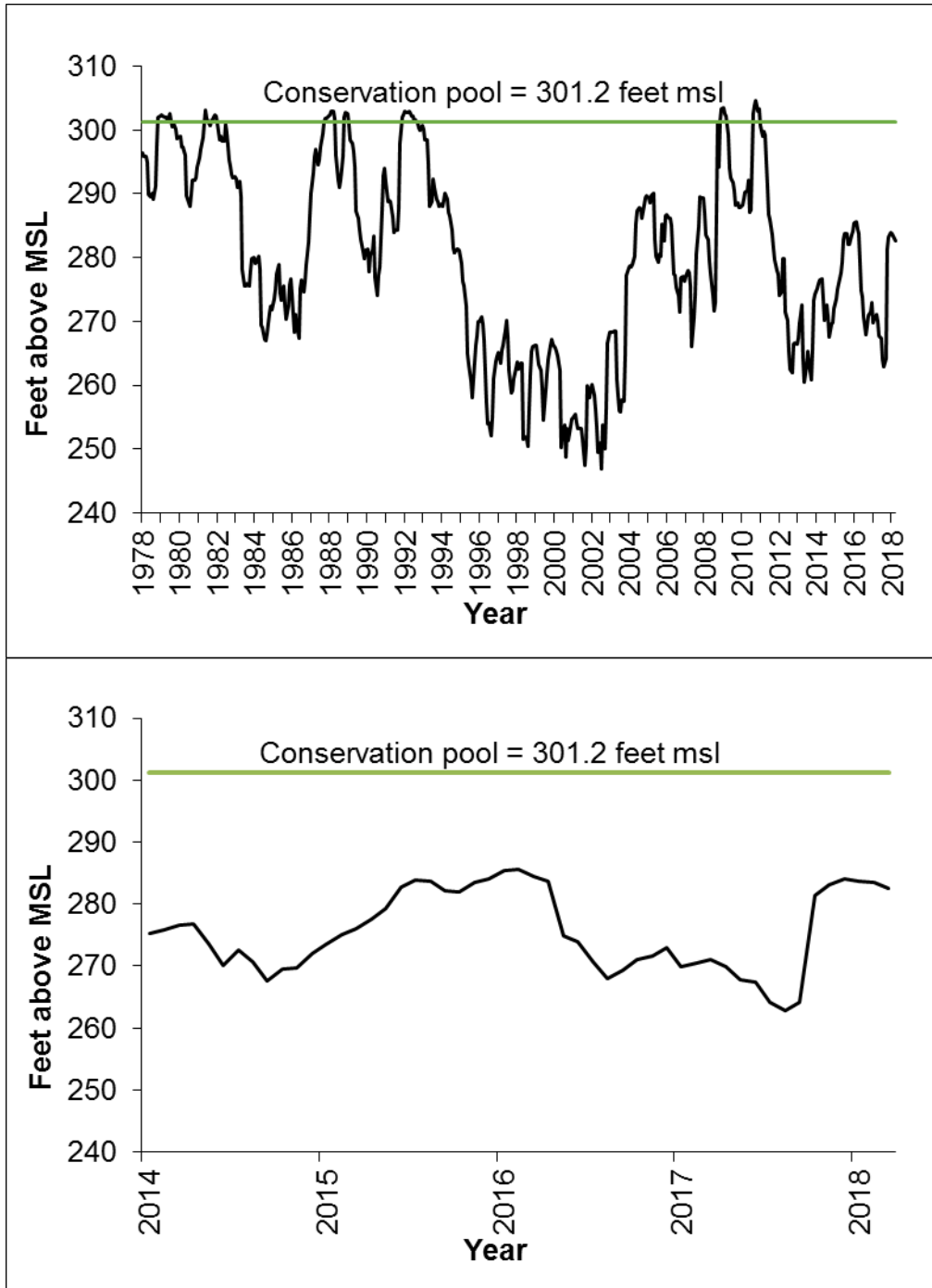


Figure 1. Average monthly water level in feet above mean sea level (MSL) for Falcon Reservoir, Texas, from January 1978 to March 2018 (top graph) and from January 2014 to March 2018 (bottom graph).

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, September 2017. Reservoir elevation at time of survey was 264.2 feet above mean sea level.

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

*Water level dependent

Table 3. Harvest regulations for Falcon Reservoir, Texas.

Species	Bag Limit	Minimum length limit (inches)
Gar, Alligator	5	None
Catfish: Channel and Blue catfish, their hybrids and subspecies	25*	12
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

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	
Sharelunker Florida Largemouth Bass	2008	2,842	FGL
	2010	2,091	FGL
	2011	30,488	FGL
	2012	25,067	FGL
	2013	4,315	FGL

Table 5. Objective-based sampling plan components for Falcon Reservoir, Texas. 2016-2018

Gear/target species	Survey objective	Metrics	Sampling objective
<i>Electrofishing</i>			
Largemouth Bass	Abundance	CPUE – stock	RSE-Stock ≤ 25
	Size structure	PSD, length frequency	$N \geq 50$ 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
Gizzard Shad	Abundance	CPUE – Total	Practical effort
	Size structure	Length frequency	Practical effort
	Prey availability	IOV	Practical effort
<i>Creel^a</i>			
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	RSE ≤ 50
	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
<i>Gill nets</i>			
Alligator Gar ^b	Size structure	Length frequency	$N \geq 200$ fish
	Age and growth	Length at age, age distribution	3 fish/10 cm group/sex

^a 32 creel days from January 1 to June 30.

^b Sampling will occur in April 2018 (2016-2018 study/reporting period) and in September 2018 (2018-2020 study/reporting period).

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

Table 6. Results of random point sampling habitat surveys conducted at Falcon Reservoir (Texas-side only) in August-September of 2009, 2013, 2015, and 2017. Percent occurrence is shown for predominate habitat types along with lower and upper 95% confidence interval (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	2009	2013	2015	2017
Open water	29 (23-35)	78 (70-85)	60 (54-66)	87 (80-93)
Flooded terrestrial vegetation	68 (62-74)	22 (15-29)	39 (33-46)	13 (7-20)
Relative reservoir elevation	-11	-39	-19	-32
Number of random points	382	123	233	112

Table 7: Percent directed angler effort by species for Falcon Reservoir, Texas, from January to June in 2006, 2011, and 2016.

Species	2006	2011	2016
Catfishes	16.3	4.8	3.5
White Bass	0	0	0
Sunfishes	0.3	0	0
Largemouth Bass	83.3	91.9	92.7
Black Crappie	0	0.4	1.1
Alligator Gar	0	0	1.4
Anything	0	2.8	1.2

Table 8. Total fishing effort (h) for all species and total directed expenditures (\$) for Falcon Reservoir, Texas, from January to June in 2006, 2011, and 2016. Relative standard error is in parentheses.

Creel Statistics	2006	2011	2016
Total fishing effort	50,939 (17)	108,427 (24)	119,634 (19)
Total directed expenditures	453,115 (39)	1,289,845 (54)	1,209,834 (28)

Gizzard Shad

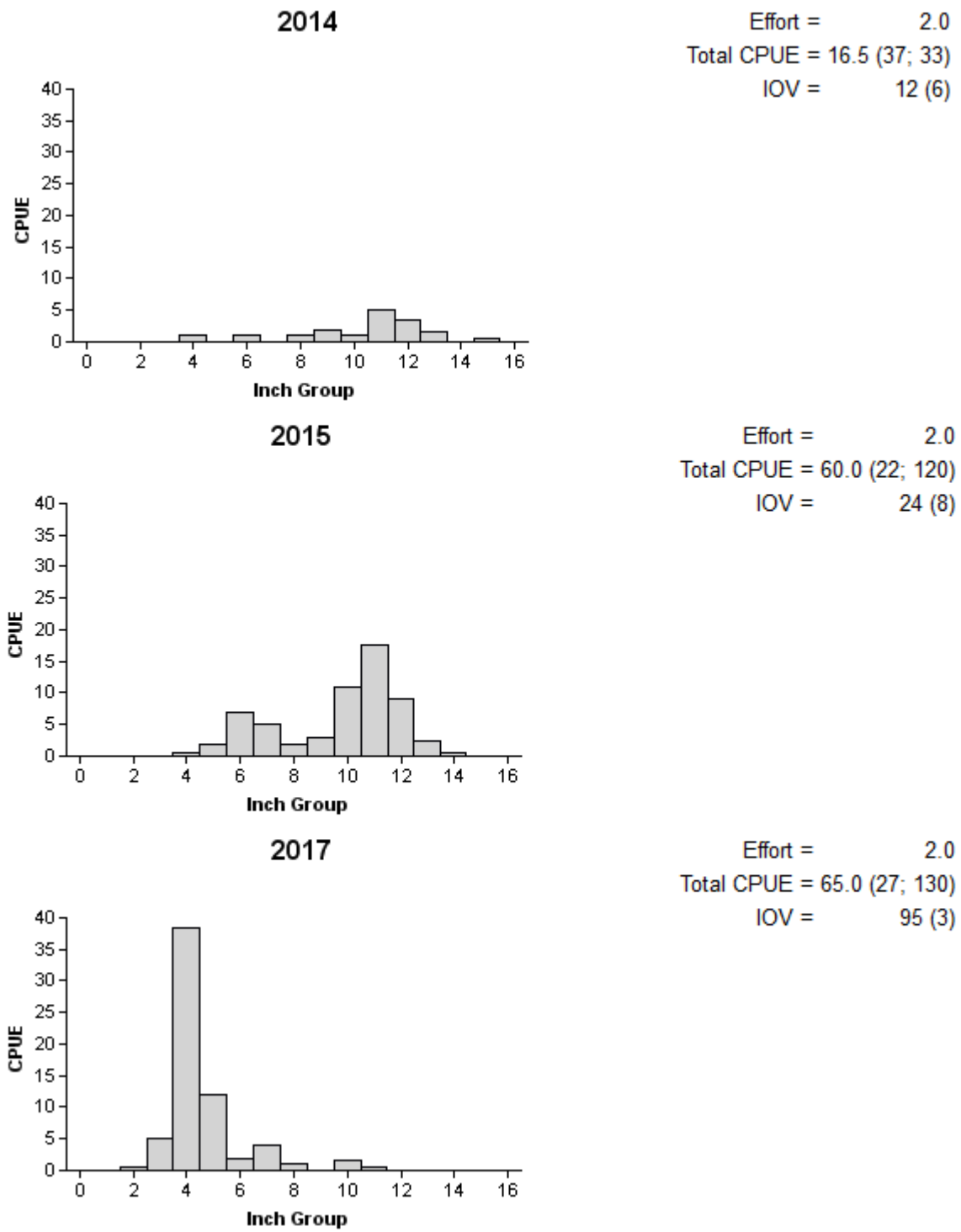


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for all fall electrofishing surveys, Falcon Reservoir, Texas, 2014, 2015, and 2017.

Bluegill

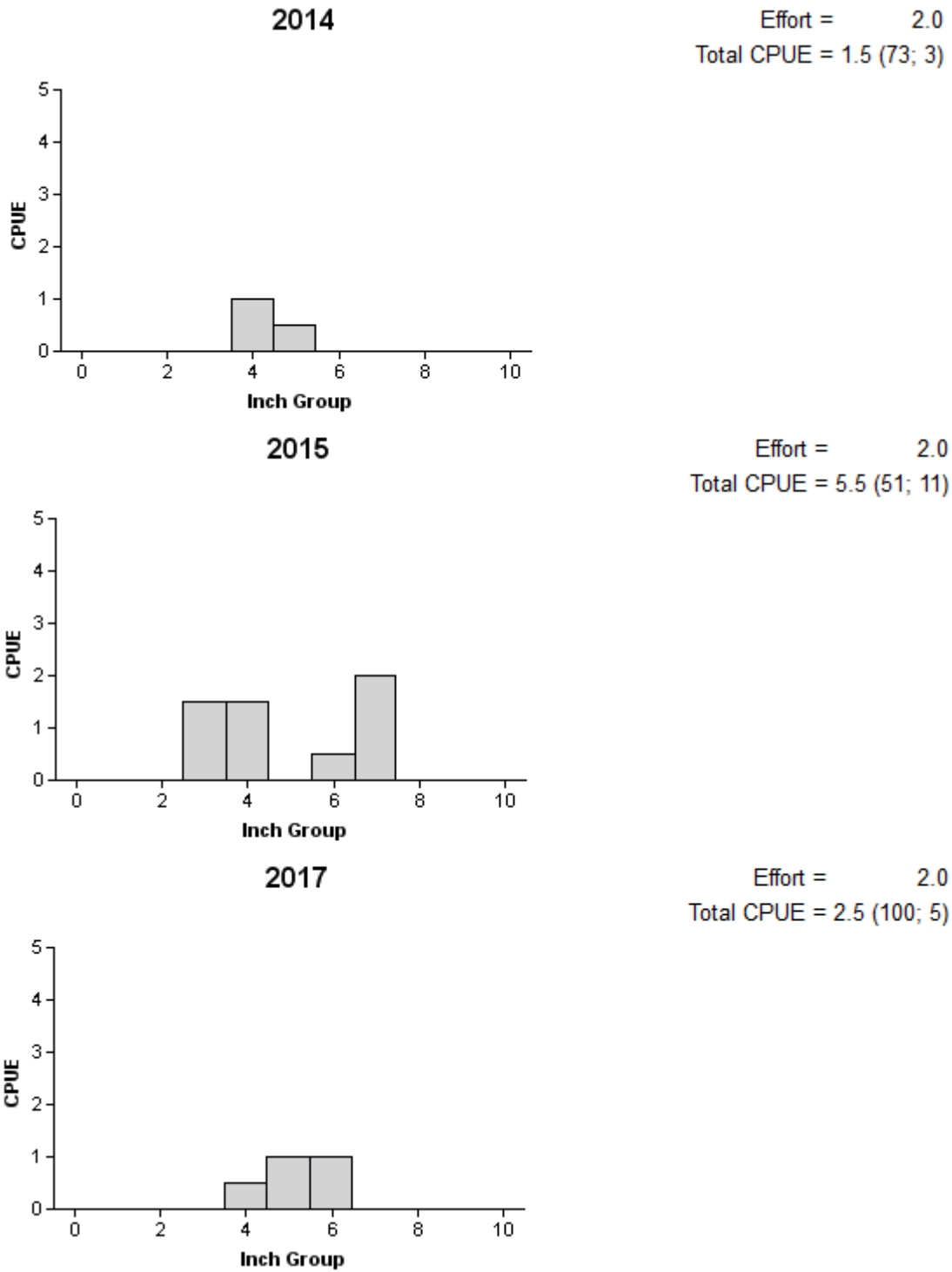


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE are in parentheses) for all fall electrofishing surveys, Falcon Reservoir, Texas, 2014, 2015, and 2017.

Alligator Gar

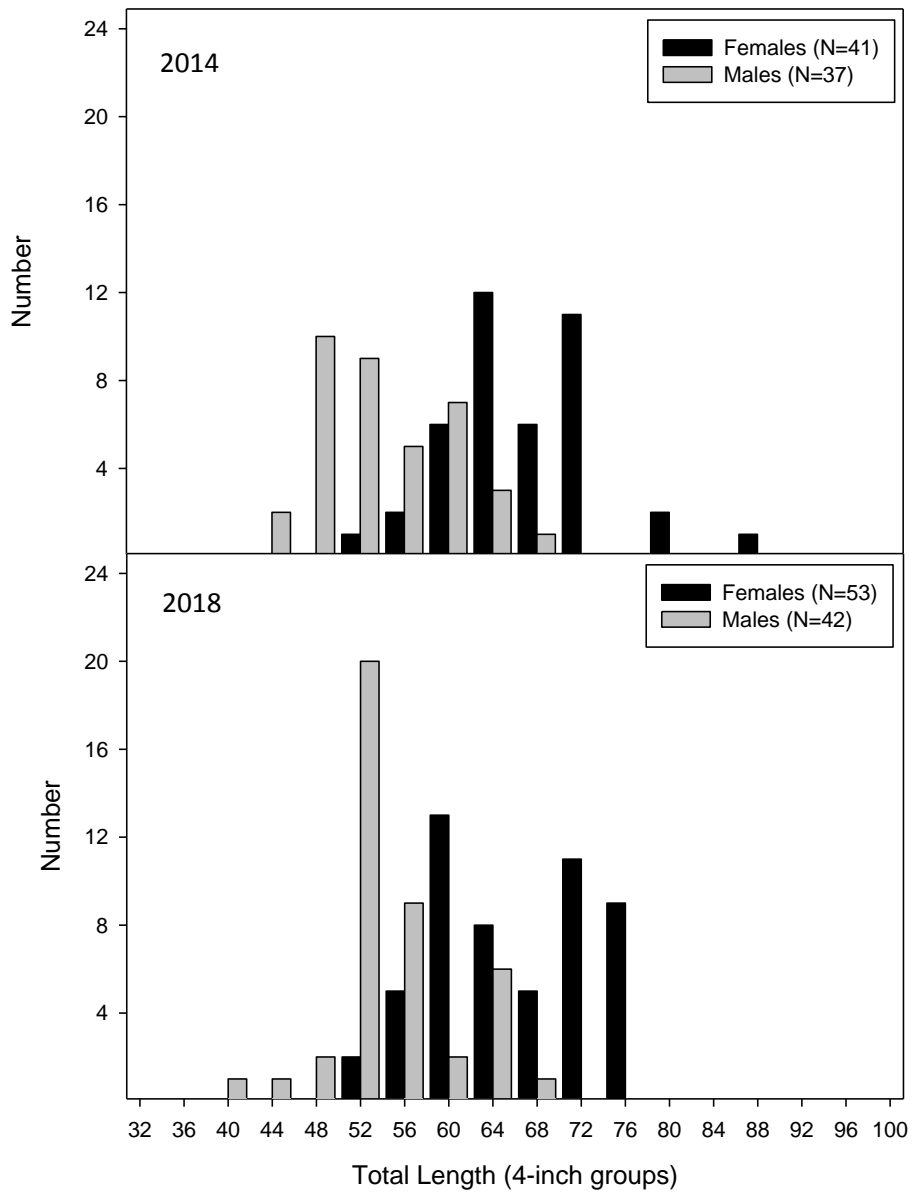


Figure 4. Length frequency distributions of Alligator Gar by sex collected in gill nets in Falcon Reservoir, Texas, April 2014 (top panel) and April 2018 (bottom panel). Day-time and overnight gill net sets were used in 2014 and only overnight sets were used in 2018.

Table 9. Creel survey statistics for Alligator Gar Falcon Reservoir, Texas, from January to June in 2006, 2011, and 2016. Relative standard errors are shown in parentheses.

Creel survey statistic	2006	2011	2016
Surface area (acres)	54,882	76,580	57,291
Directed effort total (h)	0	0	1,668 (47)
Directed effort/acre (h)	0	0	0.03 (47)
Average catch per hour	0	0	0.11 (86)
Total harvest	0	0	187 (284)
Harvest/acre	0	0	<0.01
Voluntary release rate (%)	0	0	0

Catfishes

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

Creel Survey Statistic	2006	2011	2016
Surface area (acres)	54,882	76,580	57,291
Directed effort total (h)	8,308 (25)	5,213 (36)	4,224 (33)
Directed effort/acre (h)	0.10	0.06	0.07
Average catch/hour	1.2 (25)	2.7 (36)	0.83 (37)
Total harvest (fish)			
Blue Catfish	3,232 (57)	6,112 (77)	1,423 (74)
Channel Catfish	9,309 (43)	8,664 (63)	687 (102)
Harvest/acre			
Blue Catfish	0.06 (57)	0.11 (77)	0.02 (74)
Channel Catfish	0.17 (43)	0.15 (63)	0.01 (102)
Voluntary release rate (%)	0	0	0

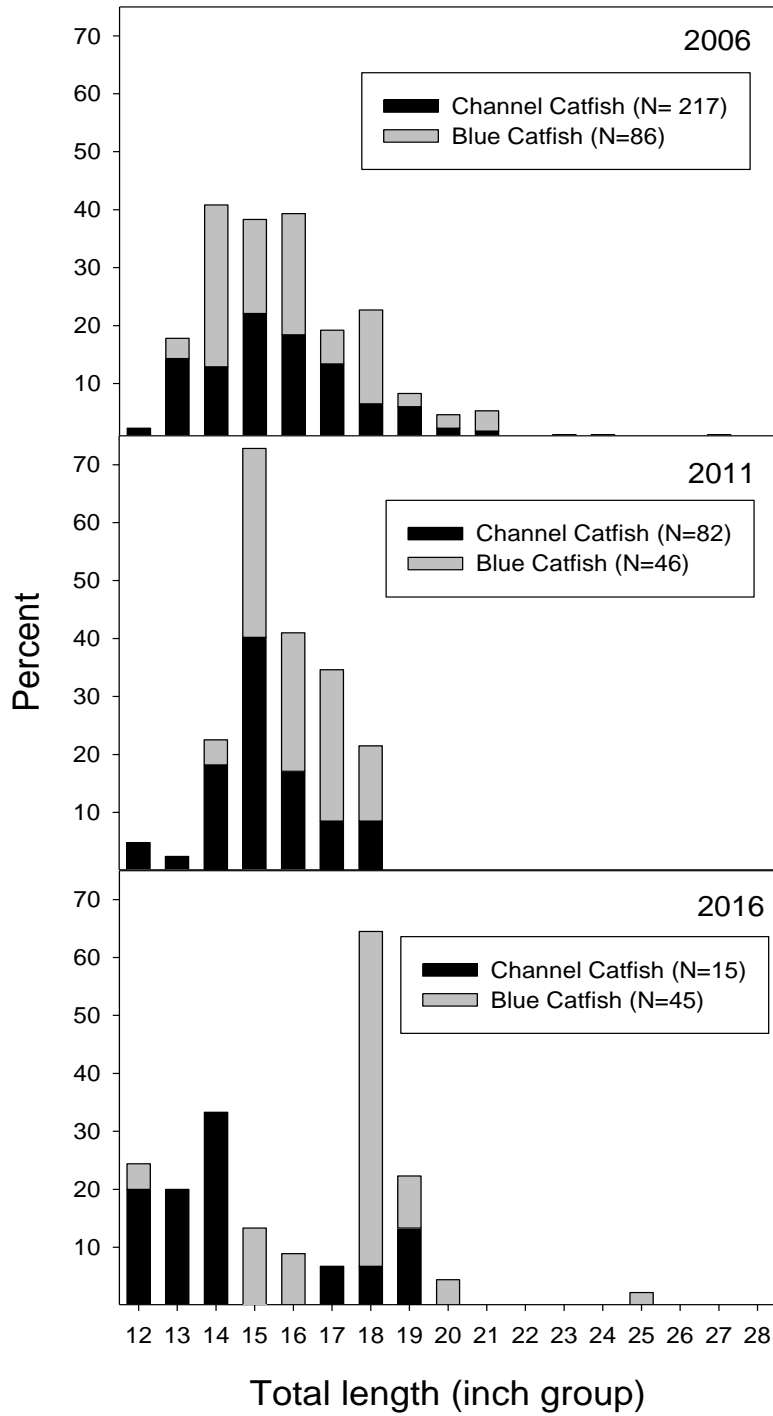


Figure 5. Length frequency distribution of angler-harvested Blue and Channel catfishes measured during creel survey sampling at Falcon Reservoir, Texas, from January to June in 2006, 2011, and 2016.

White Bass

Table 11. Creel survey statistics for White Bass at Falcon Reservoir, Texas, from January to June in 2006, 2011, and 2016. Relative standard errors are shown in parentheses.

Creel survey statistic	2006	2011	2016
Surface area (acres)	54,882	76,580	57,291
Directed effort total (h)	0	0	0
Directed effort/acre (h)	0	0	0
Average catch per hour	0	0	0
Total harvest	0	0	507 (100)
Harvest/acre	0	0	<0.01
Voluntary release rate (%)	0	0	20

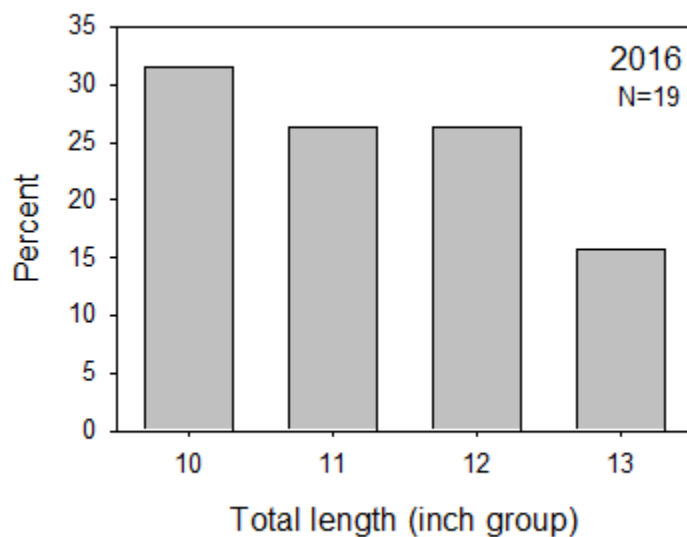


Figure 6. Length frequency of angler-harvested White Bass measured during creel survey sampling at Falcon Reservoir, Texas, January 2016 through June 2016.

Largemouth Bass

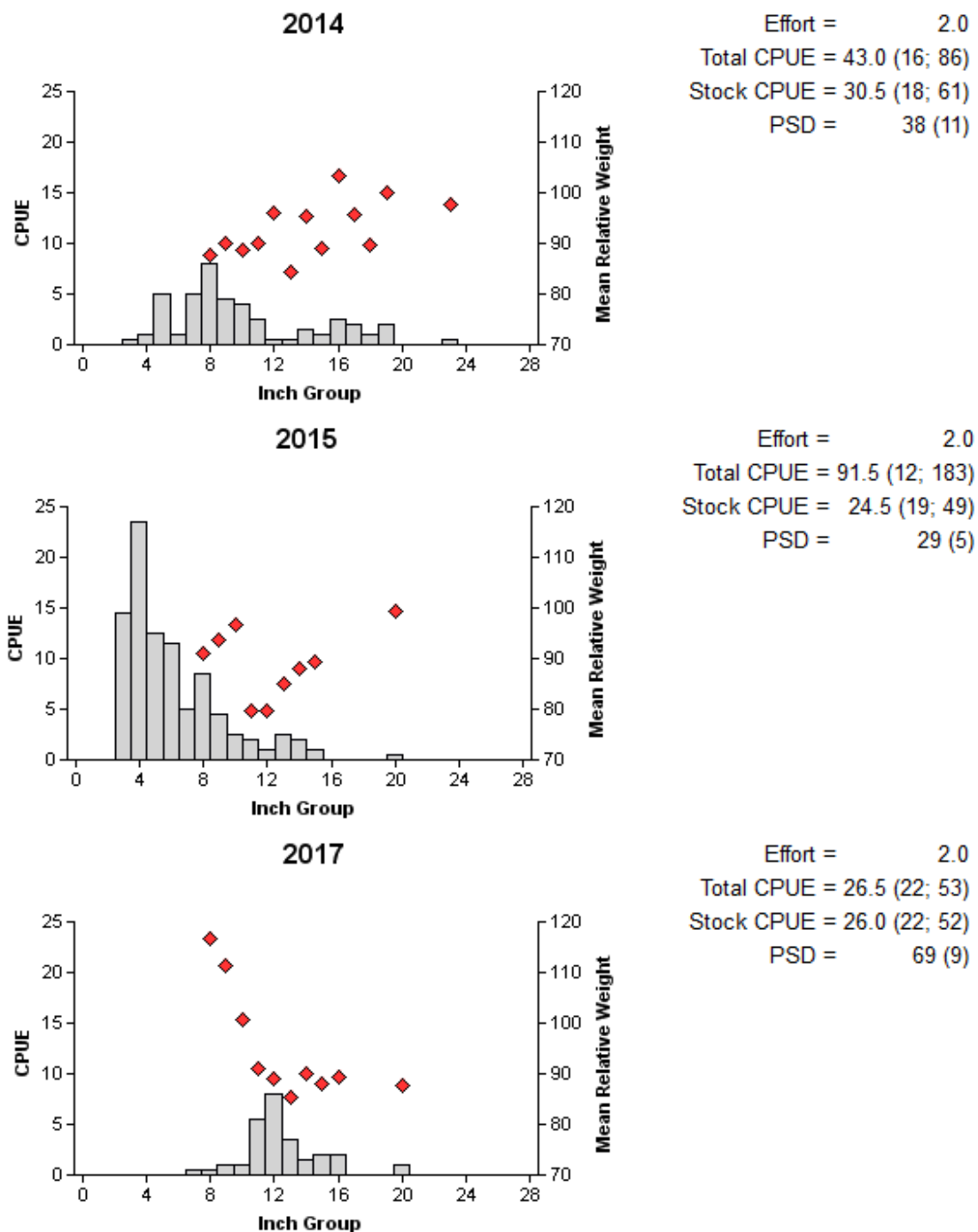


Figure 7. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Falcon Reservoir, Texas, 2014, 2015, and 2017.

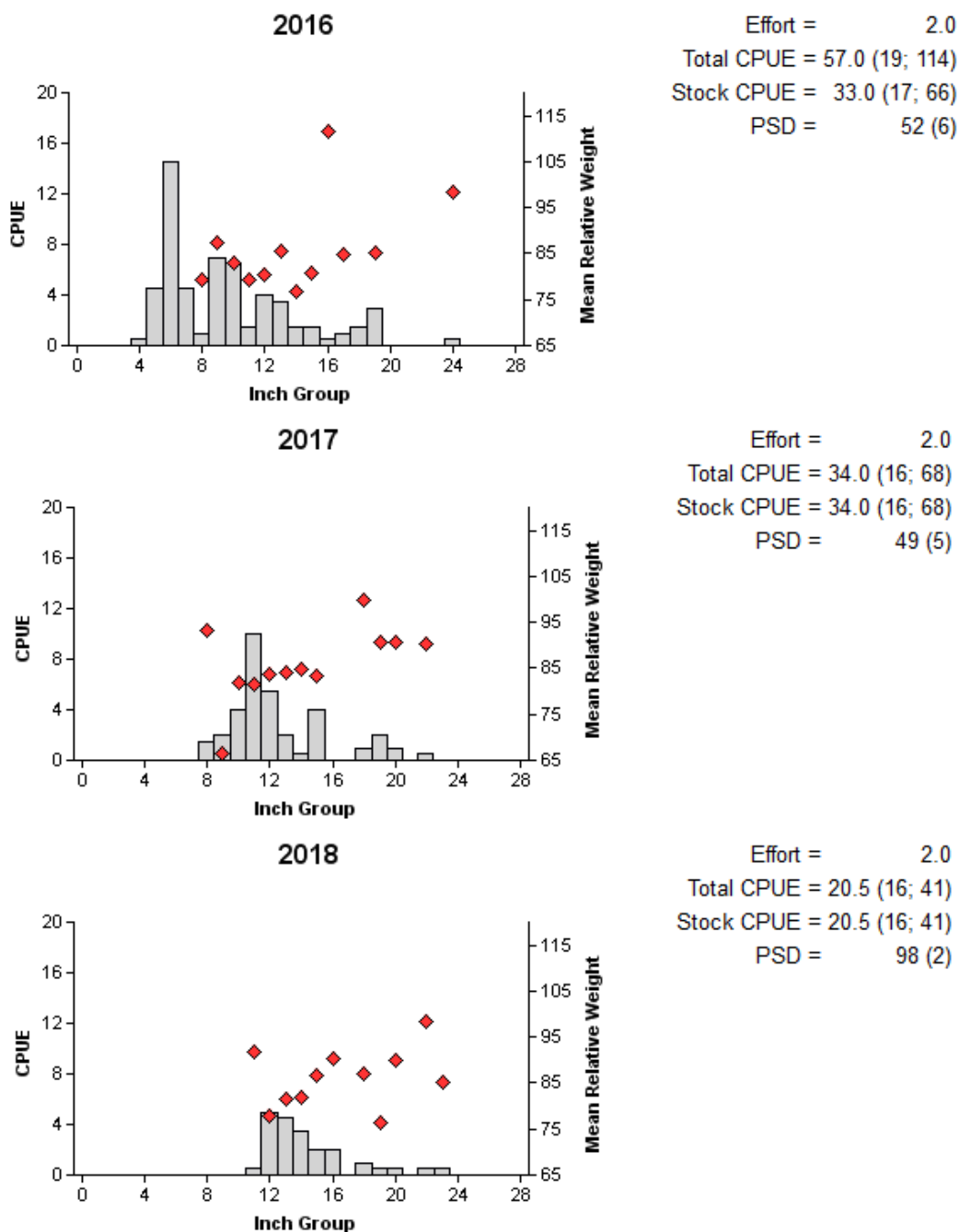


Figure 8. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure) for spring electrofishing surveys, Falcon Reservoir, Texas, 2016, 2017, and 2018.

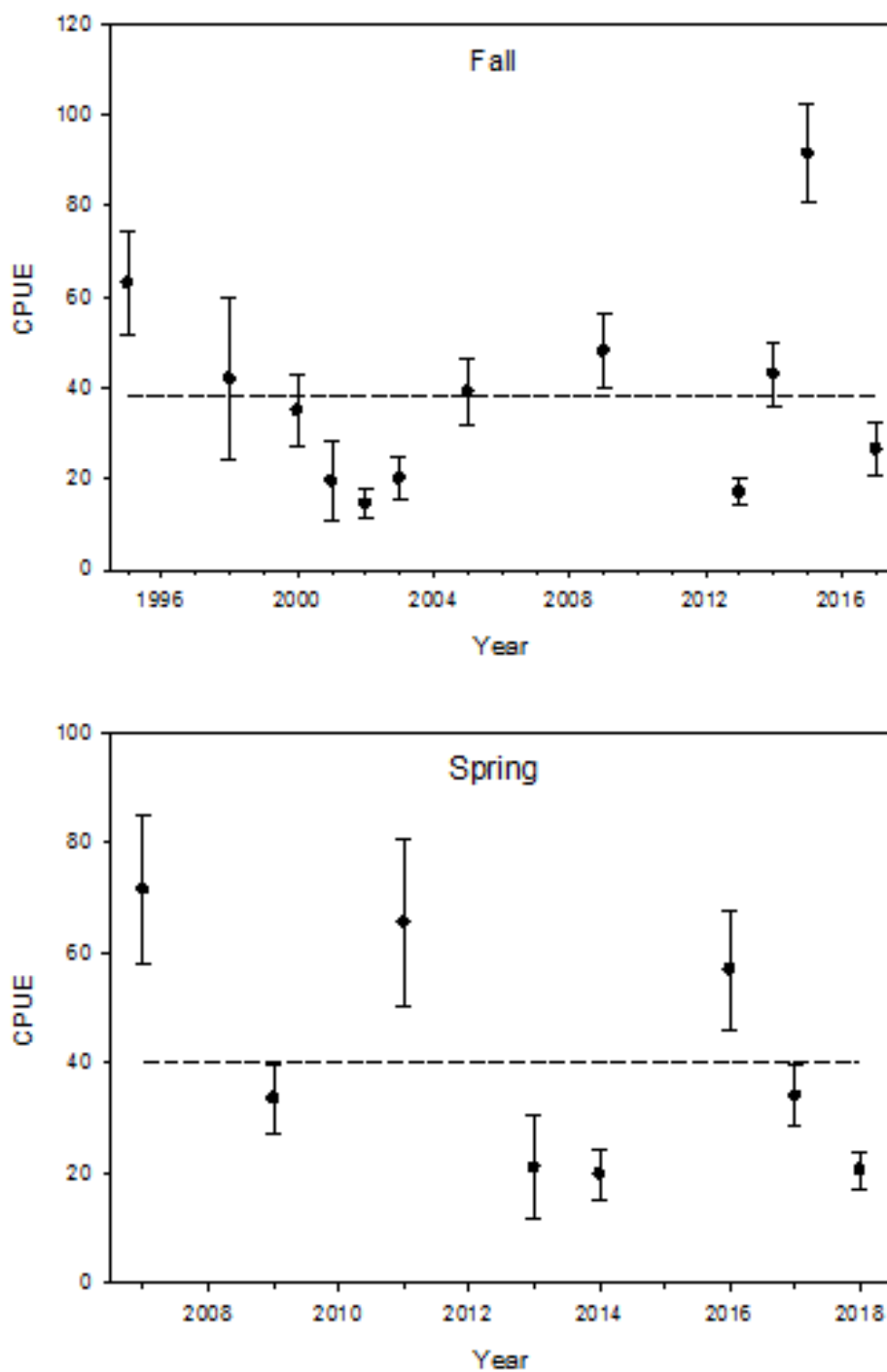


Figure 9. Average number of Largemouth Bass collected per 1 h of electrofishing effort (CPUE) at Falcon Reservoir, Texas, 1995-2017 for fall surveys, and 2007-2017 for spring surveys. Error bars represent ± 1 standard error. Dashed line represents average CPUE.

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

Table 13. Creel survey statistics for Largemouth Bass at Falcon Reservoir, Texas, from January to June in 2006, 2011, and 2016. Relative standard errors, when available, are shown in parentheses. Number released by weight was not available for 2006. Number released by weight estimates for category "<4 lbs. in 2011 does not include fish <14 inches total length, but 2016 estimates do include fish <14 inches total length.

Creel survey statistic	2006	2011	2016
Surface area (acres)	54,882	76,580	57,291
Directed angling effort (h)			
Tournament	10,778 (24)	9,336 (40)	22,309 (23)
Non-tournament	31,694 (19)	90,318 (24)	88,621 (19)
Combined	42,472 (18)	99,654 (25)	110,930 (19)
Angling effort/acre	0.72 (18)	1.30 (25)	1.9 (19)
Average catch per hour	1.4 (15)	1.2 (8)	1.04 (9)
Harvest			
Non-tournament anglers	9,839 (41)	19,196 (42)	4,689 (29)
Average harvest/acre	0.18 (41)	0.25 (42)	0.08 (29)
Tournament weigh-in and release	6,649 (47)	7,739 (79)	2,148 (36)
Number released by weight			
Fish <4 lbs.		58,453 (30)	100,583 (27)
Fish \geq 4 to <7 lbs.		17,782 (34)	7,124 (37)
Fish >7 to 10 lbs.		3,216 (54)	492 (112)
Fish \geq 10 lbs.		189 (193)	79 (210)
Voluntary release rate (%)			
Non-tournament anglers	54	78	90

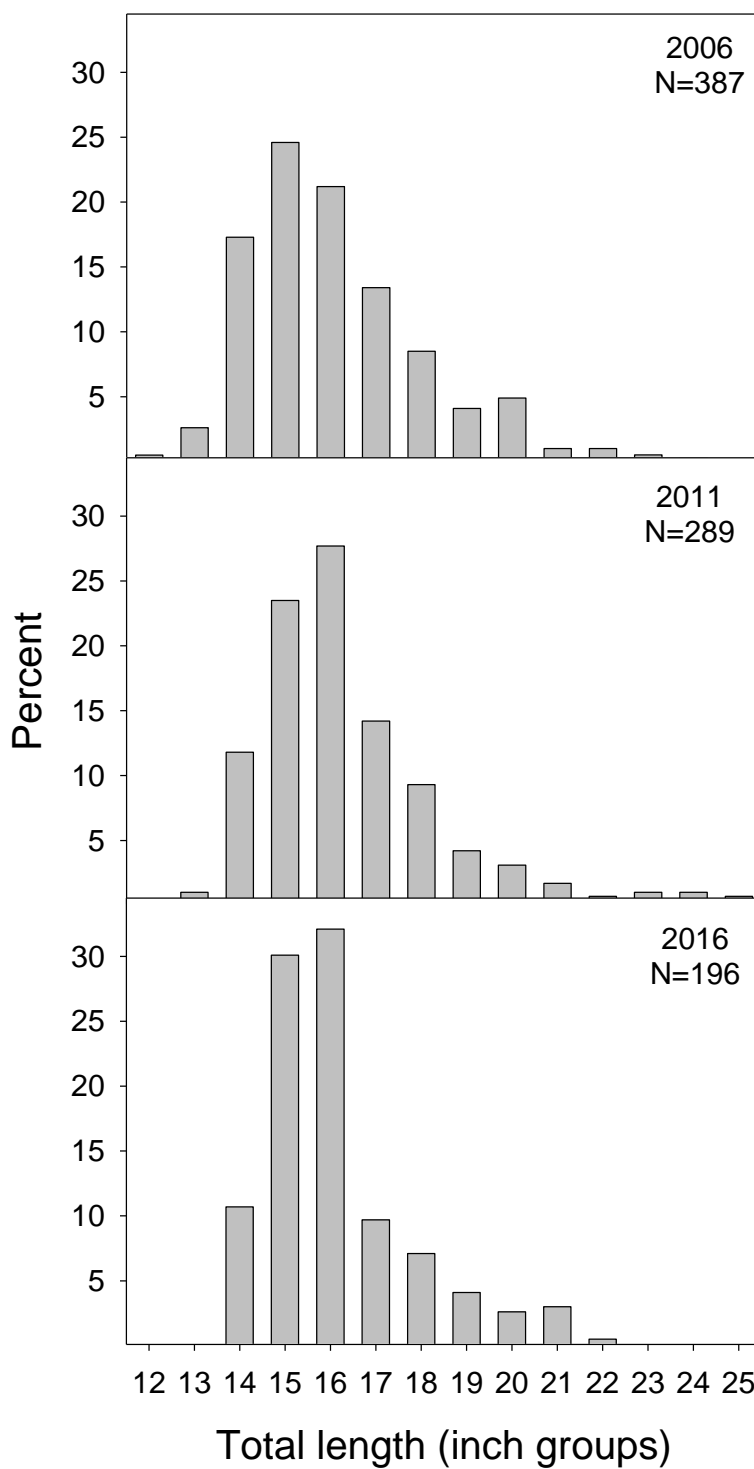


Figure 10. Length frequency distribution of angler-harvested Largemouth Bass measured during creel survey sampling at Falcon Reservoir, Texas, from January to June in 2006, 2011, and 2016. Fish retained by tournament anglers is included for 2006 and 2016, but not included for 2011 because lengths of tournament-retained fish were not recorded.

Black Crappie

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

Creel survey statistic	2006	2011	2016
Surface area (acres)	54,882	76,580	57,291
Directed effort total (h)	0	477 (101)	1,342 (54)
Directed effort/acre (h)	0	<0.01 (101)	0.02 (54)
Average catch per hour	0	1.85 (56)	1.17 (35)
Total harvest	0	2,651 (164)	676 (96)
Harvest/acre	0	0.03 (164)	0.01
Voluntary release rate (%)	0	2	42

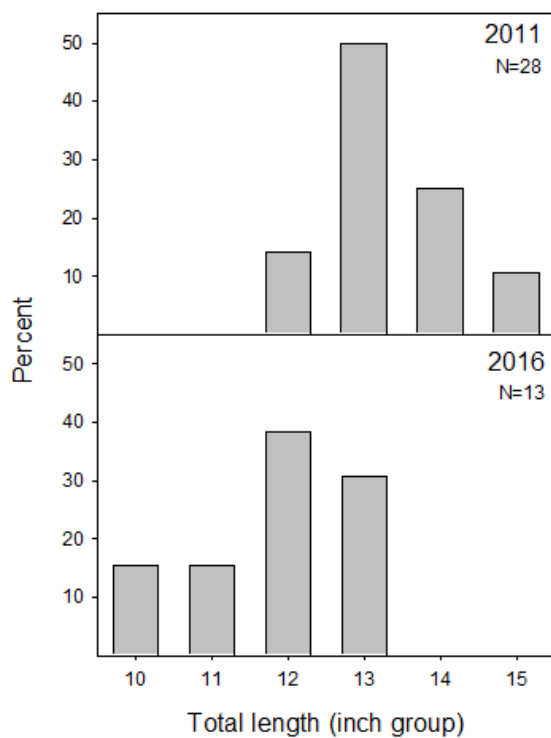


Figure 11. Length frequency of angler-harvested Black Crappie measured during creel survey sampling at Falcon Reservoir, Texas, January through June, in 2011 and 2016.

Proposed Sampling Schedule

Table 15. Proposed sampling schedule for Falcon Reservoir, Texas. Survey period is June through May. Gill netting surveys targeting Alligator Gar will be conducted in September 2018. The creel surveys denoted for 2018-2019 and 2020-2021 will be conducted January-June 2019 and 2021, respectively. Standard survey denoted by S and additional survey denoted by A.

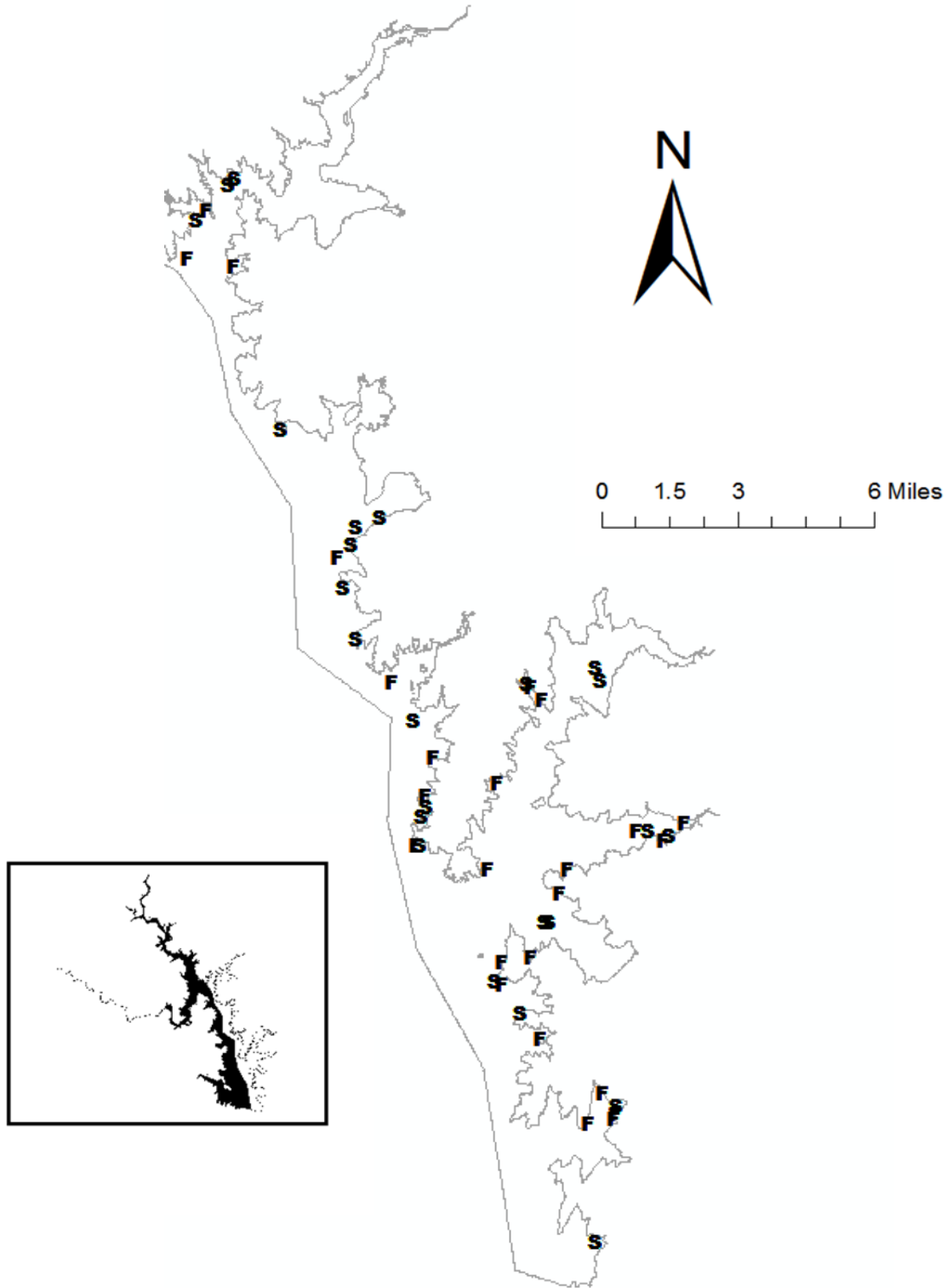
	Survey year			
	2018-2019	2019-2020	2020-2021	2021-2022
Angler Access				
Structural Habitat				
Vegetation		A		S
Electrofishing – Fall		A		A
Electrofishing – Spring		A		A
Electrofishing – Low frequency				
Trap netting				
Gill netting	A			
Baited tandem hoop netting				
Creel survey	A			
Report		A		S

Appendix A – County Park Pavilion Restitution



Photo showing access road constructed to and around large pavilion at Zapata County Boat Ramp Park. The access road will allow Largemouth Bass tournament organizers to use the pavilion and have drive-thru weigh-ins.

Appendix B – Map of Sampling Locations



Location of electrofishing sample sites, Falcon Reservoir, Texas 2017-2018. Fall and spring sample sites are indicated by "F" and "S," respectively. Water level was 281.4 feet above mean sea level (MSL) in fall 2017 and 282.6 feet above MSL in spring 2018.

Appendix C – Catch Rates for All Species and Gear Types

Number (N) and catch rate (CPUE) of all target species collected during electrofishing in fall 2017 at Falcon Reservoir. Sampling effort was two hours of electrofishing.

Species	Fall Electrofishing	
	N	CPUE
Gizzard Shad	130	65.0
Threadfin Shad	111	55.5
Warmouth	1	0.5
Bluegill	5	2.5
Redear Sunfish	1	0.5
Largemouth Bass	53	26.5

Appendix D – Alternative LMB Management Strategies

Predicted harvest of Largemouth Bass by non-tournament anglers at Falcon Reservoir given the harvest regulation scenario of a 14-inch minimum length limit, contrasted with alternative harvest regulations. Actual total harvest values were determined by creel survey sampling while harvest was regulated using 14-inch minimum length and 5-fish daily bag limits. The values below represent the January-June time frame for each year. Percent change is shown in parentheses.

Scenario 1: 3-fish bag limit; 14-inch minimum length limit

Year	Actual total harvest	Predicted harvest under 3-fish bag limit	Percent change in harvest
2006	9,839	8,166	-17%
2011	19,196	16,873	-12%
2016	4,689	4,239	-10%
Average	11,241	9,759	-13%

Scenario 2: 5-fish bag limit; only 1 fish >16 inches; no minimum size length

Year	Actual total harvest	Actual harvest (>16)	Actual harvest (<16)	Predicted total harvest	Predicted harvest (>16)	Predicted harvest (<16)
2006	9,839	5,411	4,428	15,054 (53%)	3,084 (-43%)	11,970 (170%)
2011	19,196	12,285	6,911	28,218 (47%)	7,494 (-39%)	20,724 (200%)
2016	4,689	2,767	1,922	9,706 (107%)	1,770 (-36%)	7,936 (313%)
Average	11,241	6,821	4,420	17,659 (57%)	4,116 (-40%)	13,543 (206%)

Scenario 3: 5-fish bag limit; only 2 fish >18 inches; no minimum size length

Year	Actual total harvest	Actual harvest (>18)	Actual harvest (<18)	Predicted total harvest	Predicted harvest (>18)	Predicted harvest (<18)
2006	9,839	1,997	7,842	18,497 (88%)	1,917 (-4%)	16,580 (111%)
2011	19,196	4,166	15,030	30,137 (57%)	4,082 (-2%)	26,055 (73%)
2016	4,689	797	3,892	9,846 (110%)	797 (0%)	9,049 (133%)
Average	11,241	2,320	8,921	19,493 (73%)	2,265 (-2%)	17,228 (93%)



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