Lake Dunlap

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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July 31, 2018

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Survey and Management Summary

Fish populations in Lake Dunlap were surveyed in 2017 using electrofishing and trap netting and in 2018 using gill netting and additional trap netting. Historical data are presented with the 2017-2018 data for comparison. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

Reservoir Description: Lake Dunlap is a 410-acre impoundment located in New Braunfels, Texas and is part of the Guadalupe River chain lakes. Lake Dunlap is classified as a mainstream reservoir and has a fairly constant water level. Substrate in the upper section is composed primarily of rock and gravel, while the middle and lower sections of the reservoir are composed of clay, sand, and silt. Habitat features included boat docks, rocks, flooded timber, and several native vegetation species.

Management History: Important sport fish include Channel and Flathead Catfishes, Largemouth Bass, and crappie species. The management plan from the 2013 survey report focused on refining trap net sampling for crappies, monitoring and management of invasive vegetation, supplement losses of fisheries habitat with a native vegetation planting, and publicizing the Largemouth Bass and catfish populations.

Fish Community

- **Prey species:** Gizzard Shad and sunfishes (primarily Redbreast Sunfish and Bluegill) formed the reservoirs forage base. Catch rates of Gizzard Shad have increased since the 2013 report whereas sunfish species have decreased within the same timeframe. Prey species populations were comprised primarily of small size classes benefitting most predatory fish species. Several larger (> 6 in) Redbreast Sunfish were collected providing anglers with excellent angling opportunities.
- **Catfishes:** Blue, Channel, and Flathead Catfish were present in the reservoir, with Channel Catfish being the predominant species. Harvestable-sized catfish in the population were abundant; the majority of fish sampled were greater than legal length limits. Body condition of larger-sized Channel and Flathead Catfish was excellent. Two Channel Catfish over 32” were collected signifying Memorable (Memorable-size) opportunities for anglers.
- **Largemouth Bass:** Smallmouth and Largemouth Bass were present in the reservoir with Largemouth Bass being the predominant species. Largemouth Bass relative abundance has decreased since the 2013 report, however, body conditions have since improved. A few Largemouth Bass over 20” were collected during the fall electrofishing survey and two fish were entered into the ShareLunker program in early 2018 as Legacy Class (between 8.0 – 9.9 pounds) catches.
- **White Crappie:** White Crappie were present in the reservoir in low abundance. Fall and spring trap net surveys at both random and biologist-selected stations resulted in low, inconsistent catch rates and poor data resolution (i.e., high RSEs).

Management Strategies: Continue to manage fisheries under the current regulations. Continue to monitor the reservoir for nuisance aquatic vegetation through vegetation surveys. Conduct a creel survey to gather baseline fisheries dependent data. Stock Florida Largemouth Bass to maintain trophy production potential in the population.

Introduction

This document is a summary of fisheries data collected from Lake Dunlap in 2017-2018. 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 species of fishes was collected, this report deals primarily with major sport fishes and important prey species. Management strategies are included to address existing problems or opportunities. Historical data are presented with the 2017-2018 data for comparison.

Reservoir Description

Lake Dunlap is a 410-acre impoundment located on the Guadalupe River in Guadalupe County and is regulated by the Guadalupe-Blanco River Authority (GBRA). The reservoir, impounded in 1928, is used for water supply, hydroelectric power generation, and recreation. The reservoir is mainstream and maintains a fairly consistent water level. Substrate in the upper section is composed primarily of rock and gravel, while the middle and lower sections of the reservoir are composed of clay, sand and silt. Land around the reservoir has been heavily developed for residential use. Shoreline habitat was comprised of bulkhead and undercut bank (Table 6) and several native aquatic species including spatterdock, cattail, and water willow (Table 7). Additional descriptive characteristics of Lake Dunlap can be found in Table 1.

Angler Access

Lake Dunlap has two public boat ramps and several private boat ramps. The upstream-most public ramp, located under the I-35 underpass in New Braunfels, Texas, provides free access to the reservoir. The second public ramp, Schuman's Launch, is located down-lake off Schuman's Beach Road and is a pay-to-use access to the reservoir. Both boat ramps are typically usable as the lake experiences little water level fluctuation. Additional boat ramp characteristics are in Table 2. Shoreline access is limited to the park area in close vicinity to the public access area.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Findeisen and Binion 2014) included:

1. Trap net catch rates of crappie have been low (generally less than 1.0/nn) historically and data are highly variable with poor resolution (i.e., high RSEs). In 2012 and 2014, district staff evaluated differences in catch between random and biologist-selected sampling stations and found biologist-selected sites provided higher catch rates (5.2/nn vs. 2.2/nn) and slightly better RSE values (46 vs. 73) in 2012. Assess differences in CPUE and RSE between spring and fall trap netting at biologist-selected sites and attempt to refine crappie sampling protocol at the reservoir.

   Action: Additional trap netting was not conducted in 2016 due to limited district manpower. Trap netting was conducted in the fall of 2017 and spring of 2018. Differences in catch were negligible and RSE's were beyond acceptable levels of precision.

2. Mitigate losses of fisheries habitat that occurred when local homeowners removed the upper 4-6 feet of timber in roughly 3.8 acres of water containing substantial woody debris.

   Action: District staff initiated and executed a native vegetation planting effort to offset losses of critical habitat within the timber field. Water willow, American and Illinois pondweeds, and wild celery were planted in several locations in the summer of 2014. Introduction of artificial structures were discussed with the controlling authority but tabled due to concerns of structures washing out with flood waters and potentially damaging dam gate infrastructure.

3. Disseminate information regarding Largemouth Bass and catfish angling opportunities.

Action: Two reports were made on our district's Facebook page regarding the memorable-sized (> 28 in) Channel Catfish and larger Flathead Catfish that were collected in our gillnet survey. This post was also tweeted on the main TPWD Twitter platform. One article regarding angling opportunities was also published in the Lone Star Outdoor News. Personal communication with local fishermen about the abundance of larger-sized catfishes were made at the boat ramp and during creel surveys at a nearby reservoir.

4. Invasive species are a threat to aquatic habitats and organisms in Texas. Due to findings of zebra mussels (*Dreissena polymorpha*) being confirmed in Canyon Lake, just upstream of Lake Dunlap attempts to monitor for these threats need to be made. These invasive species can multiply rapidly and attach themselves to any available hard structure, restricting water flow in pipes, fouling swimming beaches and plugging engine cooling systems. Exotic vegetation has been problematic in this reservoir in the past. Cooperate with the controlling authority to post appropriate signage at access points around the reservoir.

   Action: District staff has coordinated with GBRA regarding establishment and spread of invasive species. District staff deployed four zebra mussel settlement samplers in 2017 and has monitored them quarterly. District staff also monitored the spread of nuisance vegetation with vegetation surveys and through routine fisheries surveys. Additionally, district staff installed two invasive species informative signs at the I-35 boat ramp.

Harvest regulation history: Sport fishes in Lake Dunlap have always been managed with statewide regulations (Table 3).

Stocking history: Lake Dunlap was stocked with 6,093 ShareLunker Largemouth Bass fingerlings in 2013. Prior to 2013, the reservoir has not been stocked since 2001 (Blue Catfish). Triploid grass carp were stocked in 1995 and 1996 for hydrilla control. A complete stocking history can be found in Table 4.

Vegetation/habitat management history: Prior to 1996, Lake Dunlap had a severe hydrilla infestation. Through herbicide treatments and the introduction of triploid grass carp, hydrilla was no longer present in the reservoir as of 2005, but was found in the reservoir directly downstream of Lake Dunlap. Water hyacinth was also present in Lake Dunlap prior to 1996 and was discovered again in the reservoir in the Fall 2012. TPWD and GBRA conducted regular water hyacinth surveys and mechanically removed all water hyacinth encountered. The 2012 water hyacinth infestation was the result of a lake-front homeowner introducing the plant in her boat slip. The homeowner has been educated about the legality of her actions and the harmful effects water hyacinth could have on Lake Dunlap. *Hygrophila* sp., an exotic and potential nuisance species, was documented actively growing in Lake Dunlap in 2004. This plant has been present in the Comal River (upstream of Lake Dunlap) for many years. *Hygrophila* sp. fragments began appearing in Lake Dunlap during the summer 2004 and were probably linked to recreational tubing activities in the Comal River during this same time period. Although this species has become established in Lake Dunlap, it is not expected to cause any access problems due to the limited areas for growth. Lake Dunlap has an 8.4 acre submerged timber field located near the dam. This submersed timber field has withstood numerous flood events and is an important habitat feature to the Lake Dunlap aquatic ecosystem. In December 2011 lake-front homeowners, without the permission of GBRA, removed the upper 4-6 feet of timber in 3.8 acres of the submersed timber field while the reservoir was drawn down for dam repairs. District staff initiated and executed a native vegetation planting effort to offset losses of critical habitat within the timber field. Water willow, American and Illinois pondweeds, and wild celery were planted in several locations in the summer of 2014. Introduction of artificial structures were discussed with the controlling authority but tabled due to concerns of structures washing out with flood waters and potentially damaging dam gate infrastructure.

Water transfer: Lake Dunlap is primarily used for hydroelectric power generation, recreation, and to a lesser extent flood control. There are currently no pumping stations on the reservoir and no inter-basin transfers are known to exist.

Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Lake Dunlap (TPWD unpublished). Primary components of the OBS plan are listed in Table 5. All survey sites were randomly selected and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Electrofishing – Largemouth Bass, sunfishes, Gizzard Shad, and Threadfin Shad were collected by electrofishing (1 hour at 12, 5-min stations). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing. Ages for Largemouth Bass were determined using otoliths from 12 randomly-selected fish (range 13.0 to 14.9 inches).

Trap netting – Crappie were collected using trap nets (7 net nights at 7 stations) from biologist-selected station in both fall and spring. CPUE for trap netting was recorded as the number of fish caught per net night (fish/nn).

Gill netting – Channel Catfish, Flathead Catfish, and Blue Catfish were collected by gill netting (10 net nights at 10 stations). CPUE for gill netting was recorded as the number of fish caught per net night (fish/nn).

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.

Habitat – A structural habitat survey was conducted in 2005. A vegetation survey was conducted in 2017. Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Water Level – Lake Dunlap is kept at very consistent water level at 575.75 ft. mean sea level (msl). The daily operation of the hydroelectric generator (approximately 10-12 hours) causes the lake level to drop 6-8” to a water level of 575.3 ft. msl. During dry conditions Guadalupe River flow is 260 cfs and when river flow is greater than 530 cfs the lake remains at 575.75. Drawdowns for repairs to spill gates at the dam drop levels at the minimal level of 574.2 ft. msl. Source for water level data was personal communication with Guadalupe Blanco River Authority (GBRA).

Results and Discussion

Habitat: A habitat survey was last conducted in 2005 (Findeisen and Neahr 2005). Shoreline habitat consisted primarily of bulkheads, and cutbank (Table 6). Native vegetation surface coverage decreased slightly in 2017 (15.1 acres; 3.7%) from 2016 (21.9 acres; 5.3% Table 7). Spatterdock, water willow, cattail and duck weed were the only native species present in 2017. Non-native vegetation included water lettuce and water hyacinth; detected in trace amounts (< 0.1 acres, respectively; Table 7). Native vegetation plantings conducted in 2014 were evaluated in 2017, the water willow was becoming established at the planting site, however the pondweeds and wild celery were flooded out and died out.

Prey species: Electrofishing catch rates of forage composed primarily of Gizzard Shad and Redbreast Sunfish were 128.0/h and 77.0/h, respectively (Figures 1 and 3). Total CPUE of Gizzard Shad was

higher in the 2017 survey compared to the 2013 survey. Index of vulnerability (IOV) for Gizzard Shad was adequate, indicating that 66% of Gizzard Shad were available to existing predators. IOV has ranged from 62-85 in recent years. Bluegill and Redear catch rates were low and considerably lower this season (30.0/h and 2.0/h respectively) compared to the last survey conducted in 2013 (Figure 2 and 4). Total CPUE of Redbreast Sunfish in 2017 was lower than total CPUE from surveys in 2011 and 2013. The majority of Redbreast Sunfish collected were adequate size for prey species, but several larger (> 6 in) individuals were collected adding recreational value to anglers (Figure 3). Decreases in sunfish abundance have not negatively impacted predatory species based on Largemouth Bass W_r (ranging between 90 -110%) and haven't deviated much since 2013.

Blue Catfish: The gill net CPUE for Blue Catfish in 2018 was 0.8/nn, same as the CPUE of 2014, but substantially lower than the previous survey in 2010 (3.6/nn) (Figure 5). All Blue Catfish collected in gill net surveys were larger than the 12-inch minimum length limit. A small proportion exceeded 20-inches in length. Body condition of Blue Catfish determined as relative weight (W_r) ranged from 80 to 120.

Channel Catfish: The gill net catch rate of Channel Catfish was 6.1/nn in 2018, lower than 15.0/nn in 2014, but consistent with CPUE in 2010 (4.2/nn) (Figure 6). The majority of Channel Catfish sampled were greater than the 12-inch minimum length limit. More than a third of these legal-sized fish were greater than the 16-inch, quality-size class with two 32-inch fish approaching the 36-inch trophy size class (Figure 6). Mean relative weights of stock size and greater reflected excellent body condition, with most relative weight values exceeding 110. Overall, Channel Catfish provided anglers with quality fishing opportunities with potential to catch large fish.

Flathead Catfish: The gill net catch rate of Flathead Catfish was 2.1/nn in 2018, which was similar to values observed in 2014 (1.4/nn) and 2010 (1.2/nn) (Figure 7). Fish sizes ranged from 14-28 inches with roughly 67% exceeding the 18-inch minimum length limit. Only a few of these legal-sized fish exceeded the 24-inch preferred size class. Mean relative weights of stock size and greater reflected excellent body condition, with most *Wr* values > 100. Flathead Catfish also provided anglers with ample angling opportunity.

Largemouth Bass: The electrofishing stock-CPUE for Largemouth Bass was 66.0/h for 2017 which is very similar to 2011 and 2013 (Figure 8) which suggests a very stable population of catchable-sized bass. PSD values remained similar among years and were indicative of a balanced population (PSD range: 48 – 68). Catch rates of legal-sized (14-inches) Largemouth Bass have decreased slightly from 24.0/h in 2011 to 17.0/h. Only a few fish exceeded the 20-inch, memorable size class. Mean relative weights indicated condition of Largemouth Bass was good as W_r values were near 100 for most size classes. No pattern in relative weight was discernable based on size. Growth of Largemouth Bass in Lake Dunlap was adequate. Average age at 14 inches was 2.6 years (N = 12; range = 1 – 4 years) falling within the normal range of variation for this species (Table 8).

White Crappie: Historically, fall trap net CPUEs of White Crappie have been low (<1.0/nn) using both random and biologist-selected stations. In fall 2017, CPUE from biologist-selected stations was 1.0/nn (Figure 9), similarly spring biologist selected trap netting occurred in 2012, 2014, and 2018 resulting in a range of CPUE from 0.2 – 5.2/nn with high RSEs (>46) (Figure 10). Randomly selected trap netting in Spring seasons during years 2012 and 2014 were even less productive (CPUE = 2.2 and 0.2/nn respectively, each with high RSEs) (Figure 11). Several attempts have been made to refine sampling for crappies including spring and fall collections from both randomly generated and biologist-selected sampling sites (Table 10). Due to the low, highly-variable catch rates and poor data quality, crappie sampling with trap nets will be discontinued at the reservoir.

Fisheries Management Plan for Lake Dunlap, Texas

Prepared – July 2018

ISSUE 1: Fisheries dependent data such as angler effort, catch, and harvest of sport fishes has never been collected at Lake Dunlap.

MANAGEMENT STRATEGIES

1. Develop an appropriate creel survey design to gather baseline fisheries dependent data.
2. Conduct a creel survey spanning 1 January 2019 through 30 June 2019.

ISSUE 2: The reservoir is capable of producing trophy-sized (≥ 8 pounds) Largemouth Bass. Catch records (water body record = 14.94 pounds), submissions into the ShareLunker program (13.34 pound fish in 2012 and two Lunker Class fish in 2018), and anecdotal reports indicate the reservoir regularly produces large fish.

MANAGEMENT STRATEGY

1. Request FLMB fingerlings annually (1,000 fish/km) for stocking to maintain a high level of Florida Bass introgression and thus maximize production of trophy fish.

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. Zebra mussels recently infested upstream Canyon Lake and other invasive vegetative species (i.e., water hyacinth, hygrophila, hydrilla) have historically been problematic in the reservoir.

MANAGEMENT STRATEGIES

1. Cooperate with the controlling authority to post appropriate signage at access points around the reservoir.
2. Contact and educate marina owners about invasive species, and provide them with posters, literature, etc.. so that they can in turn educate their customers.
3. Educate the public about invasive species through the use of media and the internet.
4. Make a speaking point about invasive species when presenting to constituent and user groups.
5. Keep track of (i.e., map) existing and future inter-basin water transfers to facilitate potential invasive species responses.

6. Continue to maintain zebra mussel settlement samplers and conduct quarterly checks for attachment.

7. Coordinate all invasive species monitoring and control efforts with GBRA staff.

Objective-Based Sampling Plan and Schedule (2018 – 2022)

Sport fish, forage fish, and other important fishes

Sport fish in Lake Dunlap include Blue, Channel and Flathead Catfish, and Largemouth and Smallmouth Bass. Important forage fishes include Gizzard Shad, Redbreast, Redear and Bluegill Sunfishes.

Low-density fisheries

White Crappie: White Crappie are present in the reservoir but are in low abundance. Fall trap netting has resulted in low catches (historical mean CPUE = 1.4/nn; N = 7; standard deviation = 1.3; range: 0.2 – 4.0/nn). Due to low catches that are highly variable in Fall trap netting, additional sampling during the Spring season was implemented for years the 2012, 2014 and 2018. Spring trap netting resulted in similarly low catches that are highly variable (historical mean CPUE = 1.43/nn; N = 3; standard deviation = 1.9; range: 0.2 - 3.7/nn). Due to the extremely low catches and numerous attempts to refine crappie sampling, , we deemed that the population does not warrant expending additional sampling effort and will discontinue use of trap nets. Presence/absence will be documented in other fisheries surveys and large-scale changes in population dynamics will be assessed with a creel survey conducted in 2019 (Table 11).

White Bass: White Bass are present in the reservoir in extremely low abundance. Since 2010, only a single fish has been collected over the last three survey years (2010, 2014, and 2018). Presence/absence will be noted in standard gill net samples. Presently, the population does not warrant expending additional sampling effort.

Smallmouth Bass: Smallmouth Bass are present in the reservoir in extremely low abundance. Only two fish have been collected over the last three survey years (2005, 2009, and 2017). Presence/absence will be noted in standard electrofishing samples. Presently, the population does not warrant expending additional sampling effort.

Blue Catfish: Blue Catfish are present in the reservoir in low abundance. Spring gill nets have resulted in low catches (historical mean CPUE = 0.7/nn; N = 9; standard deviation = 1.1; range: 0.0 – 2.1/nn). In addition to standard gill netting, an exploratory LFE survey will be conducted in summer season of 2018 to determine its efficiency as an additional/alternative sampling gear. A minimum of 20, randomly selected 3-minute stations will be sampled per guidelines set forth by the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015). Future sampling will result in the documentation of presence/absence using our gill netting gear.

Flathead Catfish: Flathead Catfish are present in the reservoir in low abundance. Spring gill nets have resulted in low catches (historical mean CPUE = 0.76/nn; N = 9; standard deviation = 0.7; range: 0.0 – 3.6/nn). In addition to standard gill netting, an exploratory LFE survey will be conducted in summer season of 2018 to determine its efficiency as an additional/alternative sampling gear. A minimum of 20, randomly selected 3-minute stations will be sampled per guidelines set forth by the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015). Future sampling will result in the documentation of presence/absence using our gill netting gear.

Survey objectives, fisheries metrics, and sampling objectives

Largemouth Bass: Largemouth Bass have historically been present in the reservoir in good numbers and has supported a popular fishery. The mean historical total CPUE for Largemouth Bass is 101.0/h (N = 12; standard deviation = 47.8; range: 43.0 – 213.0/h) and mean stock-size CPUE is 72.8/h (N = 12;

standard deviation = 43.9; range: 23.0 – 177.0/h). Catch rates of the last four electroshocking trips have been steady around the historic mean and fish condition have been in excellent condition over the same time period. Trend data on CPUE, size structure, and body condition have been collected at least every fourth year since 1992 with fall electrofishing. The continued collection of trend data with fall electrofishing will allow for determination of large-scale changes in basic population dynamics (abundance, size structure indices, body condition, age-at-length) that may warrant further investigation with more intensive sampling and/or management action. A minimum of 12 randomly selected electrofishing sites will be sampled every two years to collect 50 stock-size fish for PSD indices and relative weight. The desired level of precision is RSE ≤ 25 for CPUE-S. Further, an age and growth analysis [mean age at legal length (14-in.), N = minimum of 13 fish between 13.0-14.9-in.] will be conducted for each survey year to assess any changes in growth to the minimum length limit. Sampling will continue up to an additional 12 stations until all objectives are attained (Table 11).

Channel Catfish: Channel Catfish are present in Lake Dunlap in high abundance and represent a popular recreational fishery. Annual gill net total CPUE since 1988 has averaged 7.4/nn (N = 9; standard deviation = 4.1; range: 0 – 15/nn) and mean stock size CPUE is 6.4/nn (N = 9; standard deviation = 3.8; range: 0 – 13.8/nn). Catch rates of Channel Catfish are highly variable due to the extremely low catches during the 1998 survey (0.0/nn), our most recent survey was only slightly below the historic average catch rate. The body condition for this species is presently excellent with multiple quality, preferred and memorable-sized fish collected. Trend data on CPUE, size structure, and body condition has been collected at least every four years since 1988 with spring gill netting. Collection of trend data once every fourth year with spring gill netting will allow for determination of large-scale changes in basic population dynamics (relative abundance, size frequency and body condition) that may warrant further investigation with more intensive sampling and/or management action. A minimum of 10 randomly selected gill net sites will be sampled every four years to collect a minimum of 50 stock-size fish. A minimum of 20, randomly selected 3-minute stations will be sampled per guidelines set forth by the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015) (Table 11).

Gizzard Shad and Sunfish: Gizzard Shad, Redbreast Sunfish and Bluegill are the primary forage at Lake Dunlap. Trend data on CPUE and size structure of Gizzard Shad and Sunfish have been collected at least every fourth year since 1997 with fall electrofishing. Continuation of sampling, will allow for monitoring of large-scale changes in Gizzard Shad and Sunfish relative abundance and size structure. Sampling effort based on our Fall electrofishing sampling focused on Largemouth Bass collections will be sufficient for estimating size-structure of forage fishes (Gizzard Shad IOV at 12 randomly selected 5-minute stations with 90% confidence) and relative abundance estimates (Gizzard Shad and Sunfish CPUE-Total; RSE ≤ 25). No additional effort will be expended beyond sampling effort conducted for Largemouth Bass at collection (Table 11).

Habitat: Aquatic invasive plants are a serious issue at Lake Dunlap. Water hyacinth, specifically, potentially poses a threat to angler and boater access as well as outcompete desirable native vegetative species. While Lake Dunlap is currently not infested with giant salvinia, this reservoir is at high risk for giant salvinia introduction. Annual aquatic vegetation monitoring is required to identify potential threats to boating and angling access so control and rapid response efforts can be implemented to reduce or eliminate threats associated with invasive aquatic plants. Each summer the reservoir will be circumnavigated and any invasive species encountered will be documented and geo-located.

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Tables and Figures

Table 1. Characteristics of Lake Dunlap, Texas.

Characteristic	Description
Year constructed	1928
Controlling authority	Guadalupe-Blanco River Authority
County	Guadalupe
Reservoir type	Mainstream
Shoreline Development Index	2.25
Conductivity	450-550 µS/cm
Mean Water Level	575.75 ft. msl

Table 2. Boat ramp characteristics for Lake Dunlap, Texas, August, 2017. Reservoir elevation at time of survey was 575.2 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
I-35 Bridge (free)	29.69259 -98.10756	Y	25+	570	Excellent, no access issues
Schuman's Ramp (pay-to-use)	29.67143 -98.06956	Y	8	574.0	Excellent, no access issues

Table 3. Harvest regulations for Lake Dunlap, Texas.

Species	Bag limit	Length limit
Catfish: Channel and Blue Catfish, their hybrids and subspecies	25 (in any combination)	12-inch minimum
Catfish, Flathead	5	18-inch minimum
Bass, White	25	10-inch minimum
Bass, Largemouth	5	14-inch minimum
Bass: Spotted and Guadalupe	5[a]	None
Crappie: White and Black crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum

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

Table 4. Stocking history of Lake Dunlap, Texas. FGL = fingerling; AFGL = advanced fingerling; ADL = adults.

Species	Year	Number	Size
Coppernose Bluegill	1983	15,000	FGL
Blue Catfish	1988	16	ADL
	1995	41,000	FGL
	1996	34,400	FGL
	1997	41,553	FGL
	2001	34,308	FGL
	Total	151,277	
Channel Catfish	1968	2,000	FGL
	1973	6,000	FGL
	Total	8,000	
Florida Largemouth Bass	1978	16,400	FGL
	1988	41,194	FGL
	Total	57594	
Largemouth Bass	1966	8,400	FGL
	1967	10,000	FGL
	1987	20,200	FGL
	Total	38,600	
ShareLunker Largemouth Bass	2013	6,093	FGL
Striped Bass	1978	4,000	FGL
	1983	5,340	FGL
		9,340	
Triploid Grass Carp*	1995	25	ADL
	1996**	3	ADL
		28	

*Radio-tagged fish

** Replace dead radio-tagged fish

Table 5. Objective-based sampling plan components for Lake Dunlap, Texas 2017–2018.

Gear/target species	Survey objective	Metrics	Sampling objective
Electrofishing			
Largemouth Bass	Abundance	CPUE–Stock	RSE-Stock ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock
	Age-and-growth	Age at 14 inches	N = 13, 13.0 – 14.9 inches
	Condition	W_r	10 fish/inch group (max)
Bluegill [a]	Abundance	CPUE–Total	
	Size structure	PSD, length frequency	N ≥ 50
Gizzard Shad [a]	Abundance	CPUE–Total	RSE ≤ 25
	Size structure	PSD, length frequency	N ≥ 50
	Prey availability	IOV	N ≥ 50
Gill netting			
Channel Catfish	Abundance	CPUE – stock	
	Size Structure	PSD, length frequency	N ≥ 50
Trap netting			
Crappie		Size structure	PSD, length frequency

[a] No additional effort will be expended to achieve an RSE ≤ 25 for CPUE of Bluegill and Gizzard Shad if not reached from designated Largemouth Bass sampling effort. Instead, Largemouth Bass body condition can provide information on forage abundance, vulnerability, or both relative to predator density.

Table 6. Survey of structural habitat types, Lake Dunlap, Texas, 2005. Shoreline habitat type units are in miles and standing timber is acres.

Habitat type	Estimate	% of total
Bulkhead	8.67 miles	51.9
Concrete	0.07 miles	0.4
Cutbank	7.98 miles	47.7

Table 7. Survey of aquatic vegetation, Lake Dunlap, Texas, 2005–2017. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Vegetation	2005	2009	2013[a]	2016	2017
Native submersed		0.15 (<0.1)			
Native floating-leaved	29.09 (7.1)	15.90 (3.9)		21.7 (5.3)	14.6 (3.5)
Native emergent	0.02 (<0.1)	0.05 (<0.1)		0.1 (<0.1)	0.5 (0.2)
Non-native					
Water hyacinth (Tier I)*			<0.1 (<1.0)[b]	0.1 (<0.1)	<0.1 (<0.1)
Water lettuce (Tier III)*					<0.1 (<0.1)
Hygrophila (Tier III)*	Floating fragments	Floating fragments			

[a]Vegetation survey was conducted in Summer 2013 but corrupt files would not allow for importation into GIS program.

[b]Estimated coverage based on amount of water hyacinth removed by hand.

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

Gizzard Shad

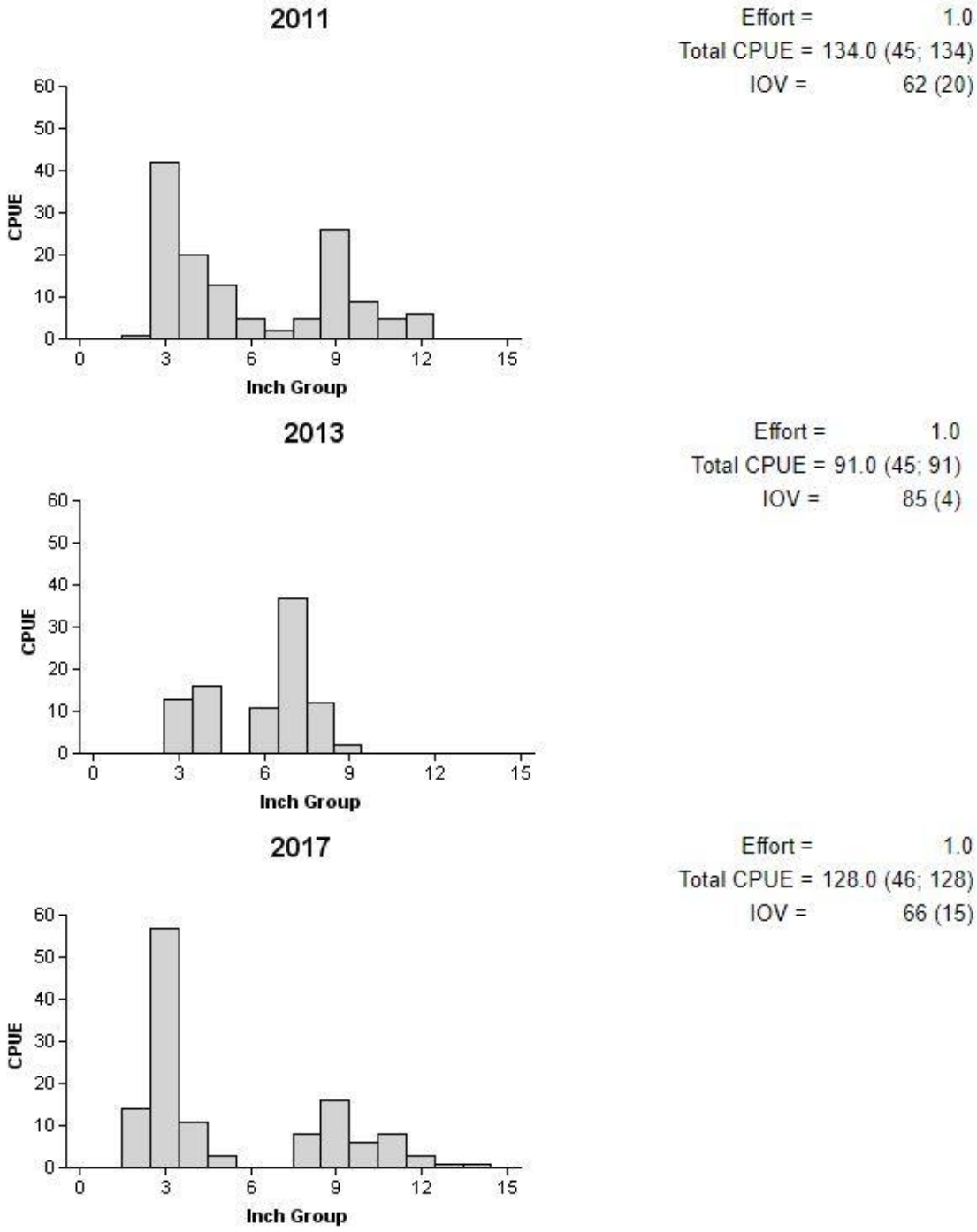


Figure 1. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys Lake Dunlap, Texas, 2011, 2013, and 2017.

Bluegill

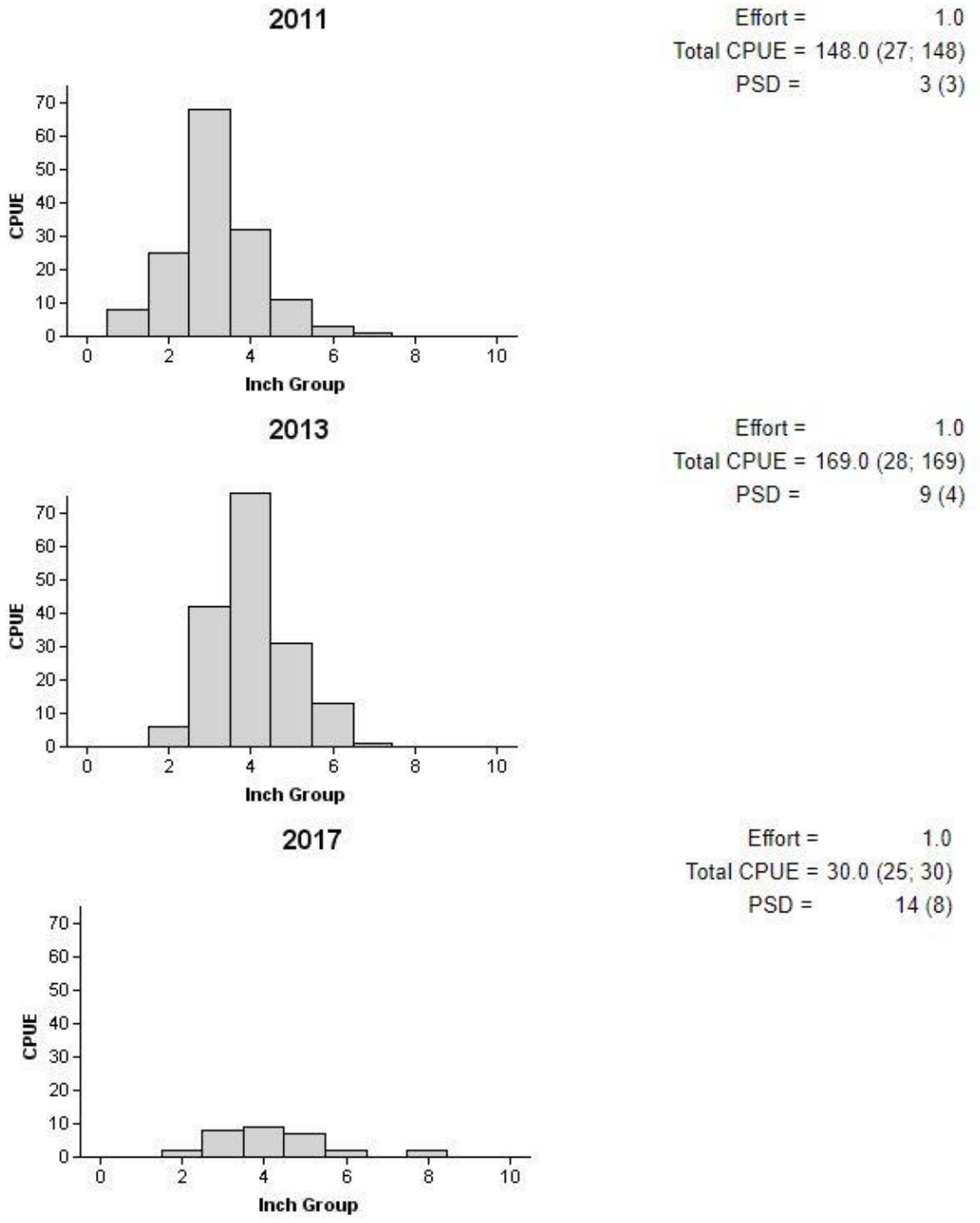


Figure 2. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Dunlap, Texas, 2011, 2013, and 2017.

Redbreast Sunfish

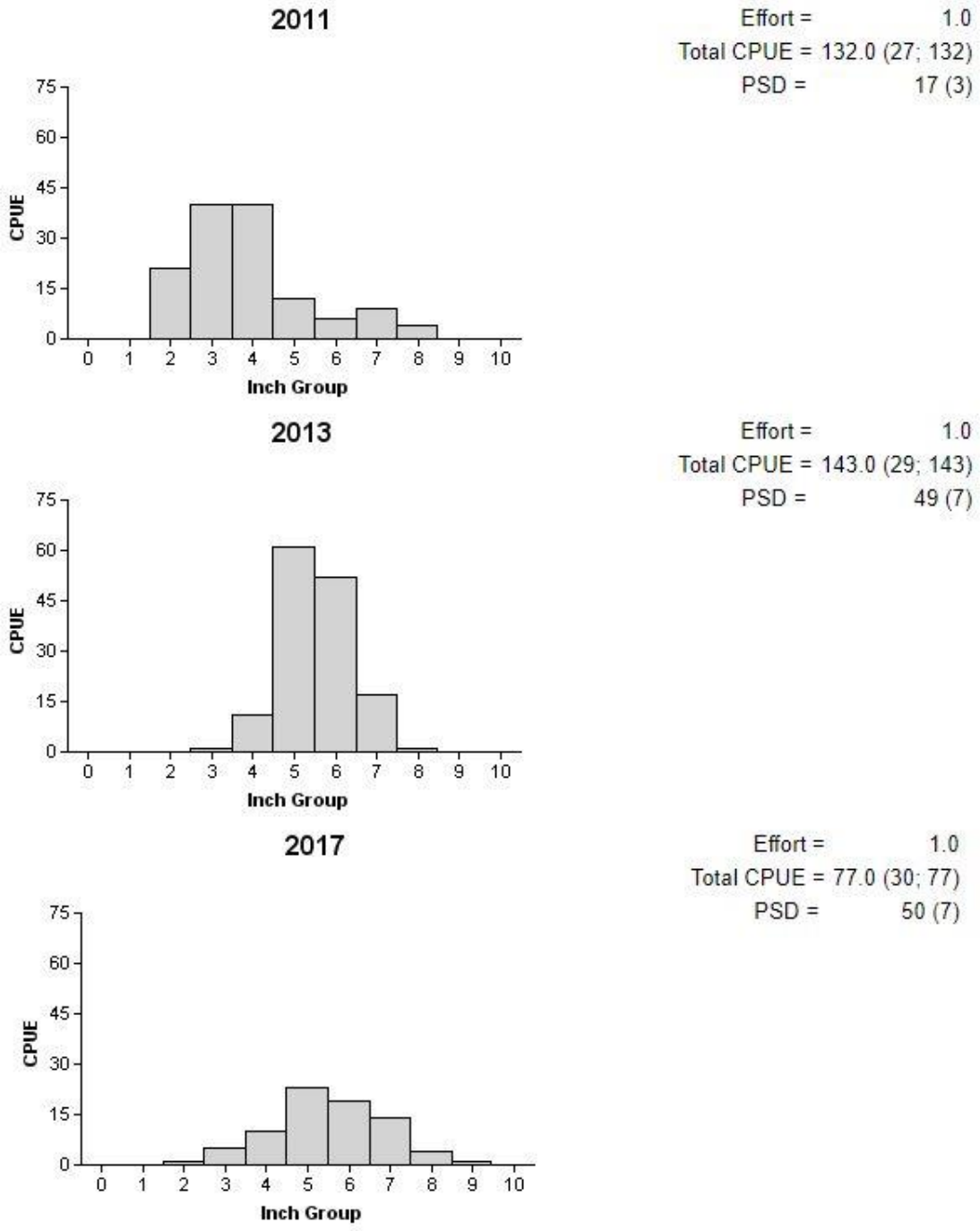


Figure 3. Number of Redbreast Sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Dunlap, Texas, 2011, 2013, and 2017.

Redear Sunfish

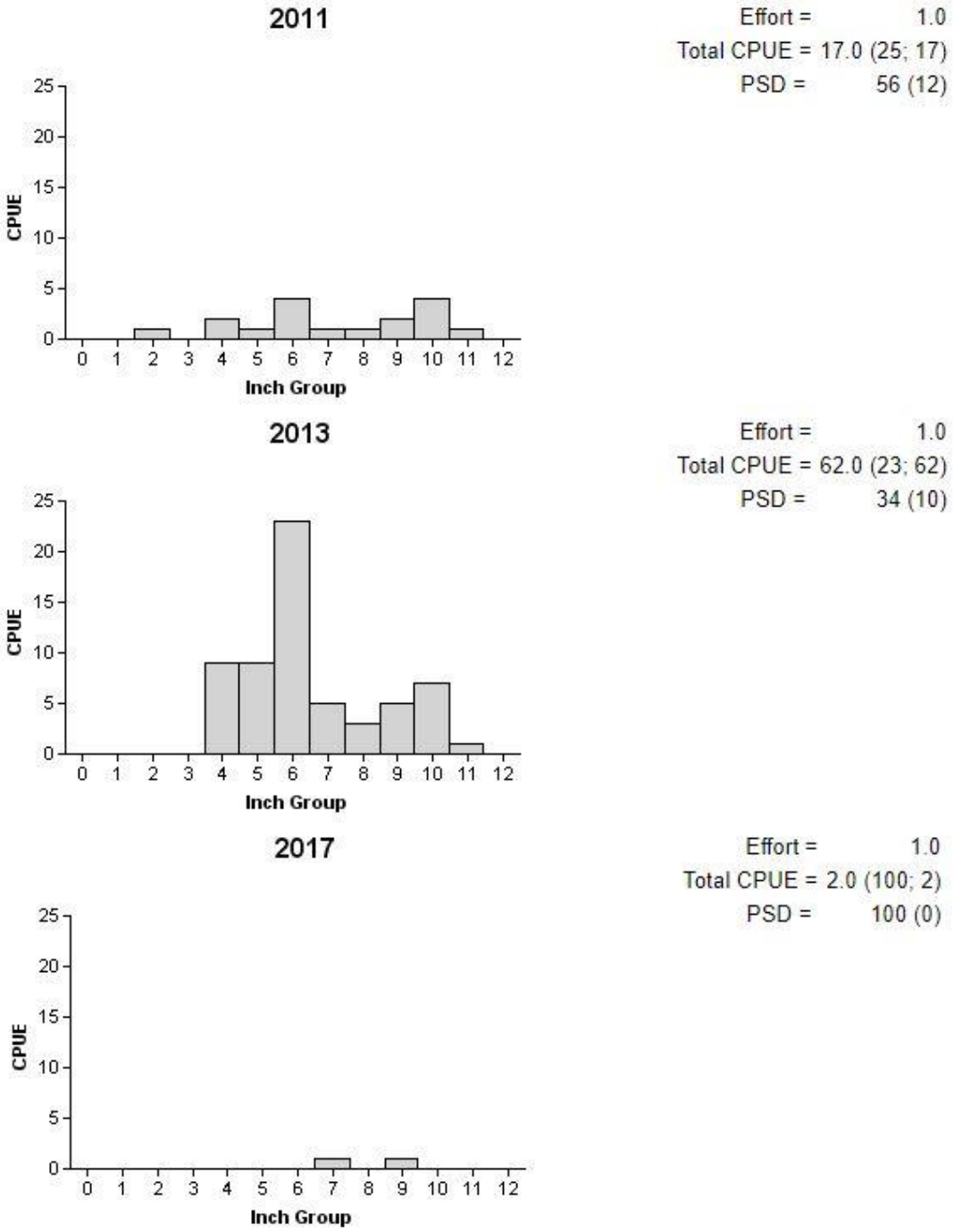


Figure 4. Number of Redear Sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Dunlap, Texas, 2011, 2013, and 2017.

Blue Catfish

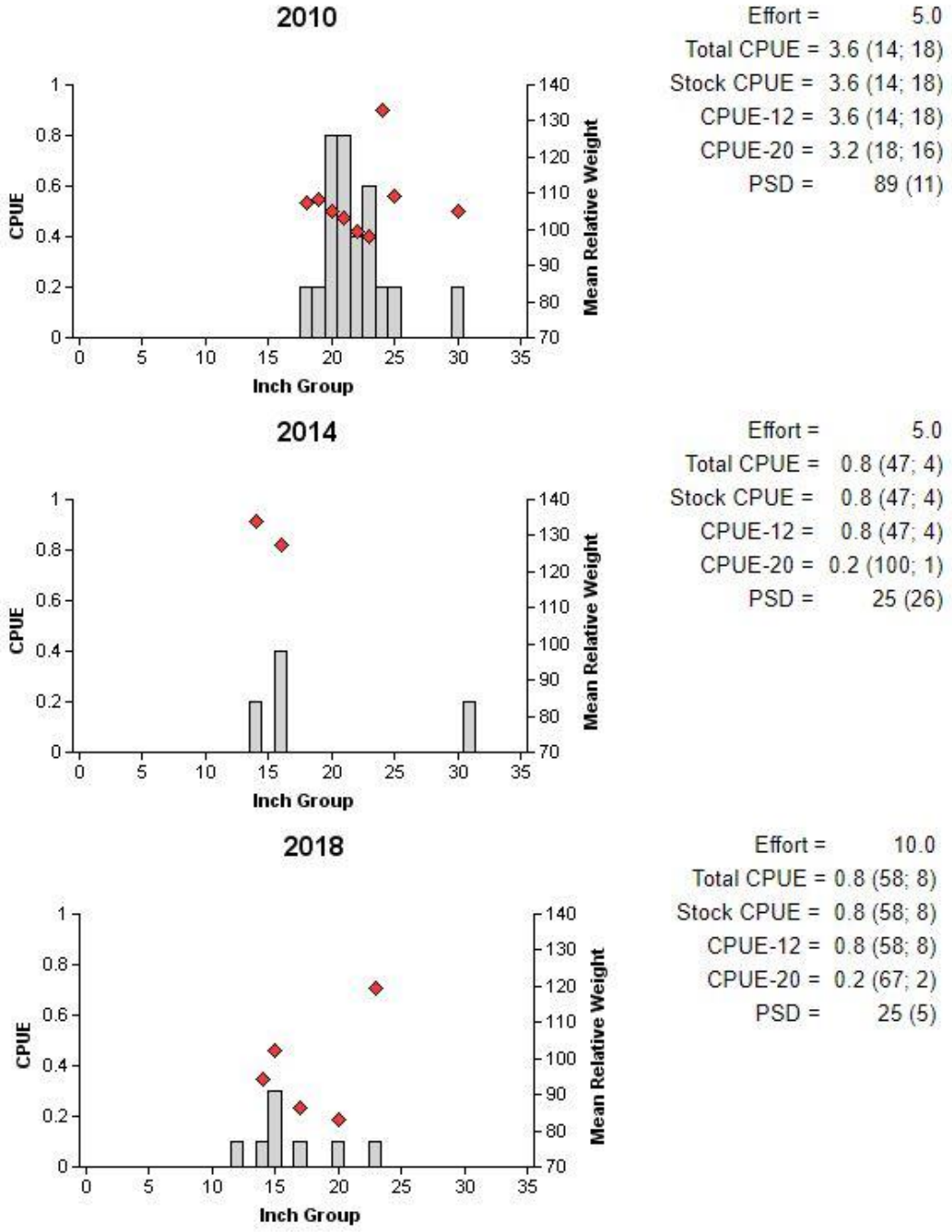


Figure 5. Number of Blue Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Dunlap, Texas, 2010, 2014, and 2018.

Channel Catfish

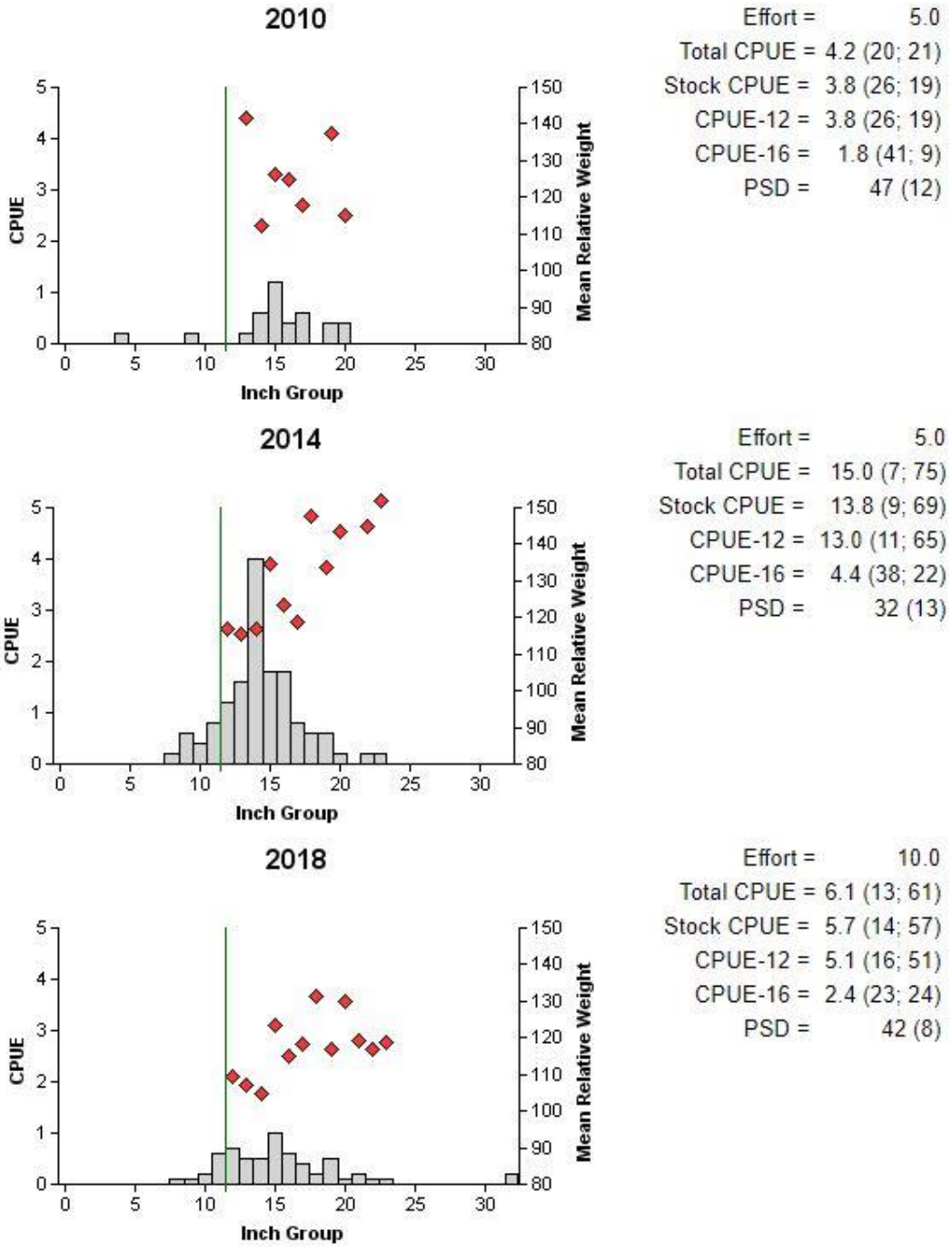


Figure 6. Number of Channel Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Dunlap, Texas, 2010, 2014, and 2018. The vertical line denotes 12-inch minimum length limit.

Flathead Catfish

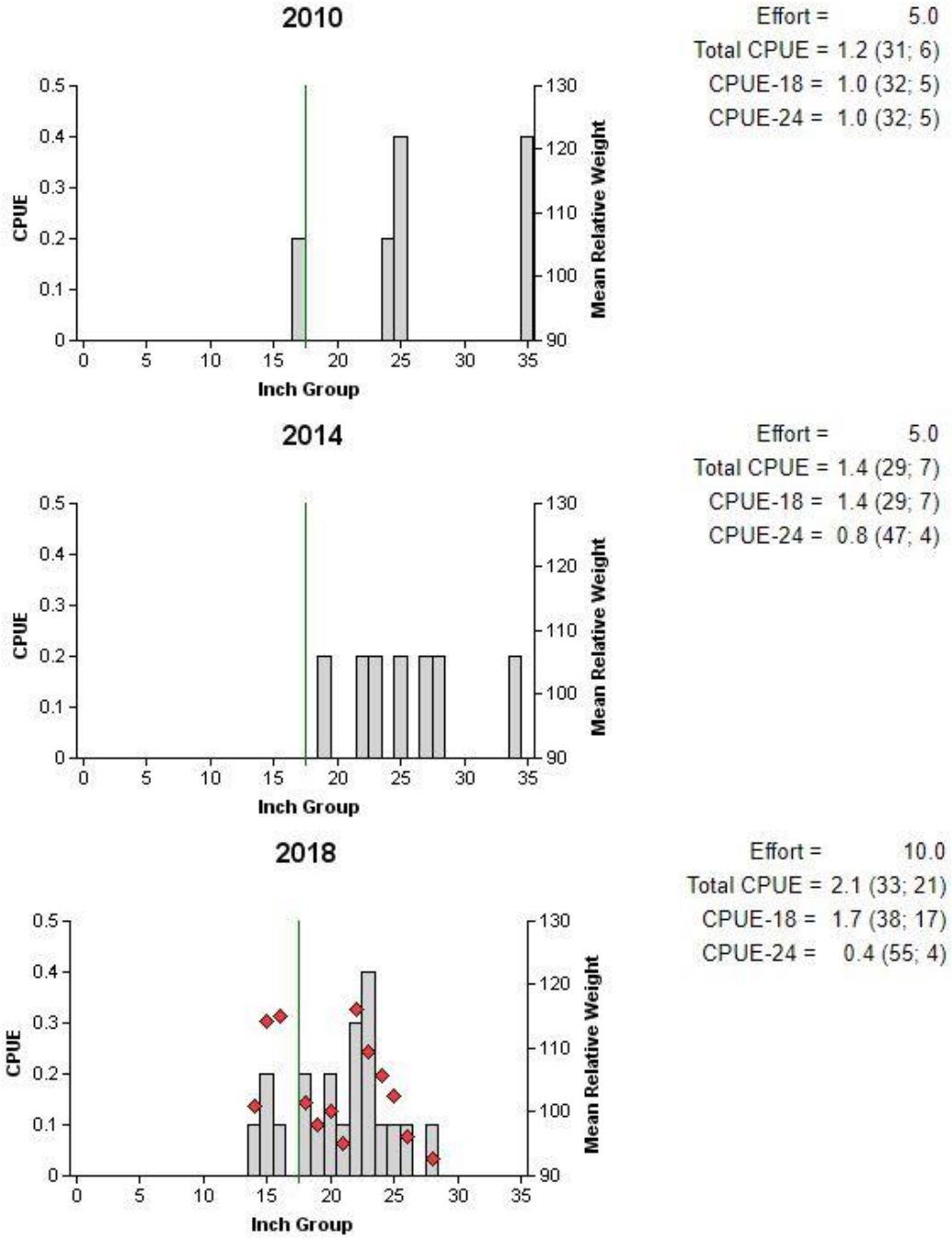


Figure 7. Number of Flathead Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Dunlap, Texas, 2010, 2014, and 2018. The vertical line denotes the 18-inch minimum length limit.

Largemouth Bass

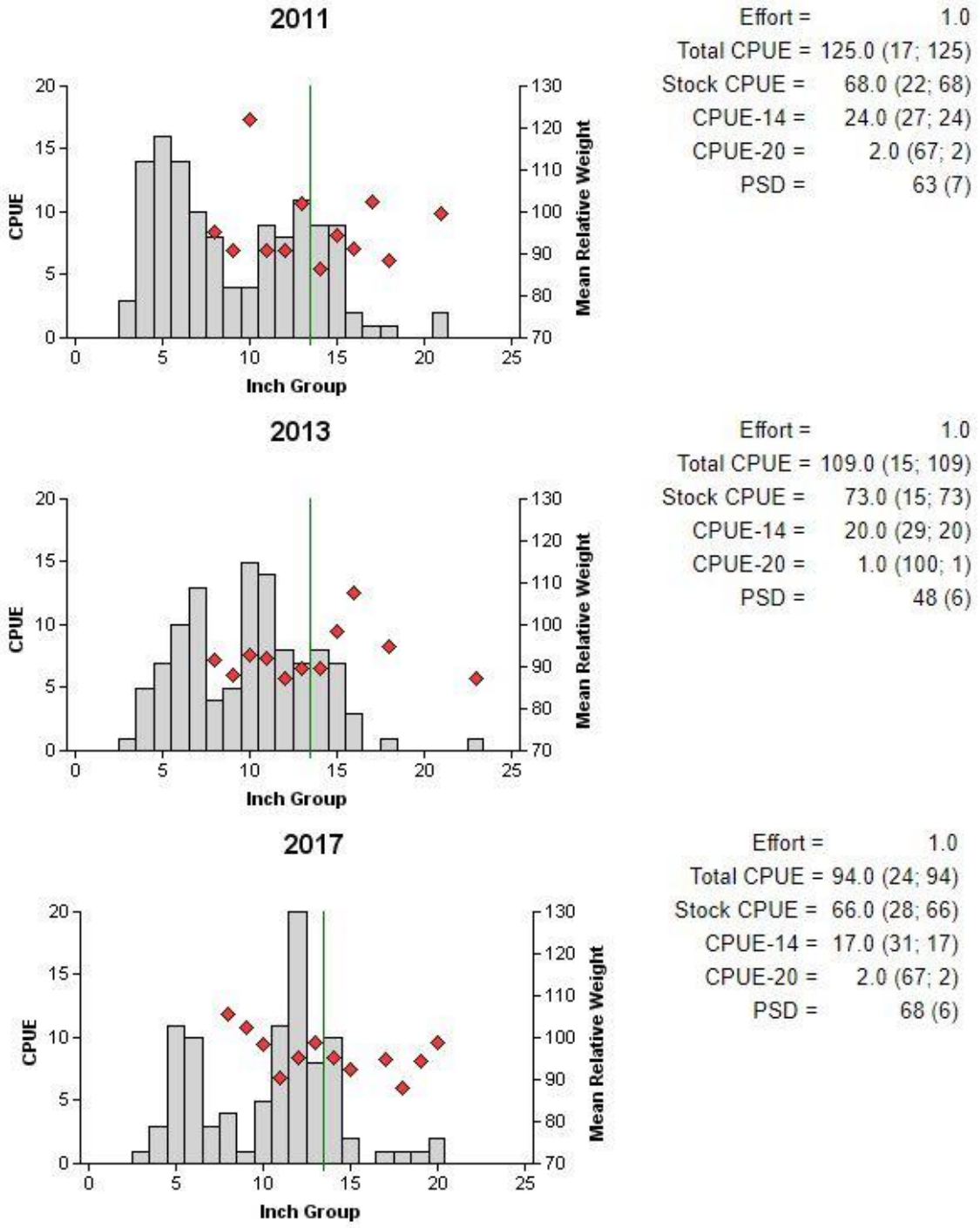


Figure 8. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Dunlap, Texas, 2011, 2013, and 2017. The vertical line denotes the 14-inch minimum length limit.

Table 8. Mean age at legal length (14-inches) for Largemouth Bass collected by fall electrofishing, Lake Dunlap. Standard deviations are in parentheses.

Sampling Year	N	Age Range	Mean Age (St Dev)
2005	13	2-4	2.7 (0.75)
2007	9	2-2	2 (0.00)
2009	15	1-3	1.5 (0.63)
2011	15	2-3	2.3 (0.49)
2013	13	1-2	1.9 (0.28)
2017	12	1-4	2.6 (0.90)

White Crappie

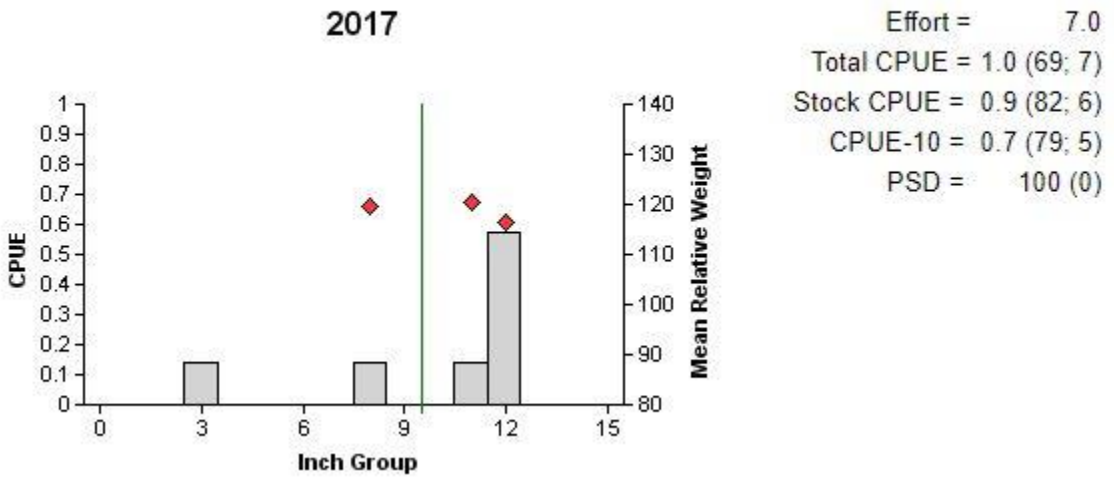


Figure 9. Number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for biologist-selected fall trap netting surveys, Lake Dunlap, Texas, 2017. Vertical line indicates minimum length limit.

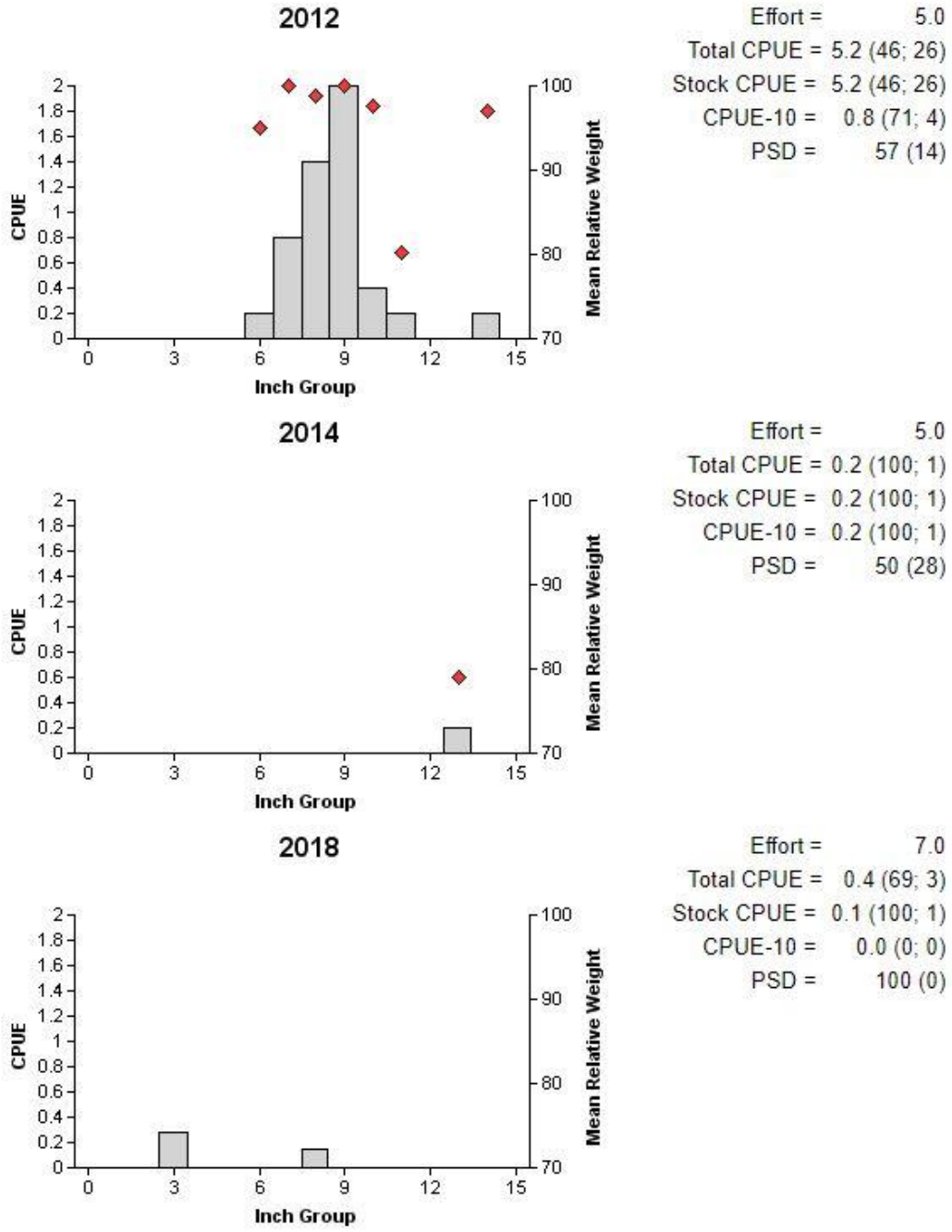


Figure 10. Number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for biologist-selected spring trap netting surveys, Lake Dunlap, Texas, 2012, 2014 and 2018. Vertical line indicates minimum length limit.

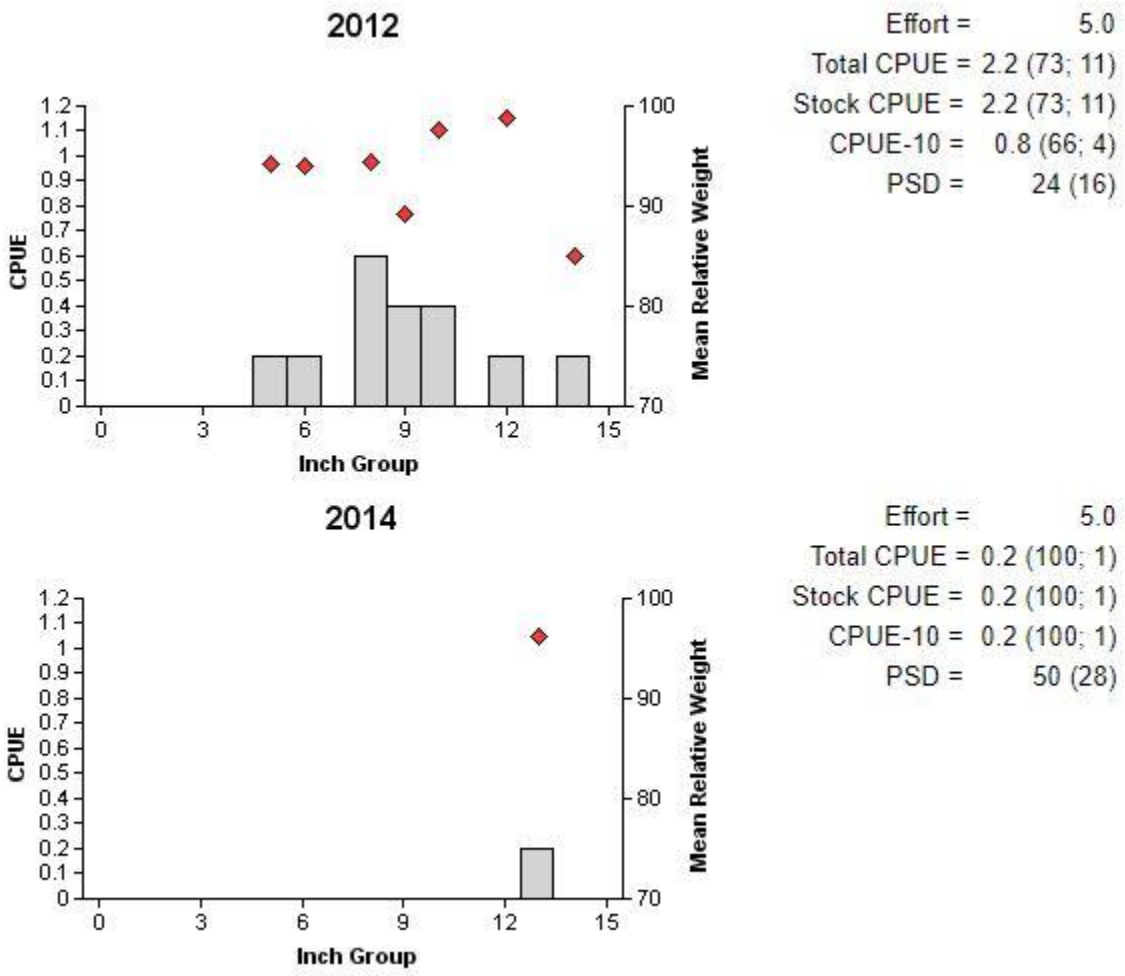


Figure 11. Number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for randomly-selected spring trap netting surveys, Lake Dunlap, Texas, 2012, and 2014. Vertical line indicates minimum length limit.

Table 10. Trap net survey history and associated metrics for Lake Dunlap, TX, 2003 - 2018. Set type refers to single-cod shoreline (S-cod) and dual cod open water (D-cod). Site type was either randomly generated or subjectively-selected at biologist discretion. N = number of net nights, CPUE-T = total catch per unit effort, and RSE = relative standard error.

Set Type	Site Type	Year	Season	N	CPUE-T	RSE
S-cod	Random	2003	Fall	8	0.8/nn	65
S-cod	Random	2005	Fall	5	0.0/nn	100
S-cod	Random	2007	Fall	5	0.2/nn	100
S-cod	Subjective	2005	Fall	5	0.8/nn	73
S-cod	Subjective	2017	Fall	7	1.0/nn	69
D-cod	Random	2009	Fall	10	0.4/nn	100
Combined Mean (Fall)					0.4/nn	85
S-cod	Random	2012	Spring	5	2.2/nn	73
S-cod	Random	2014	Spring	5	0.2/nn	100
S-cod	Subjective	2012	Spring	5	5.2/nn	46
S-cod	Subjective	2014	Spring	5	0.2/nn	100
S-cod	Subjective	2018	Spring	7	0.4/nn	69
Combined Mean (Spring)					1.6/nn	78

Proposed Sampling Schedule

Table 11. Proposed sampling schedule for Lake Dunlap, Texas. Survey period is June through May. Gill netting surveys are conducted in the spring, while electrofishing surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

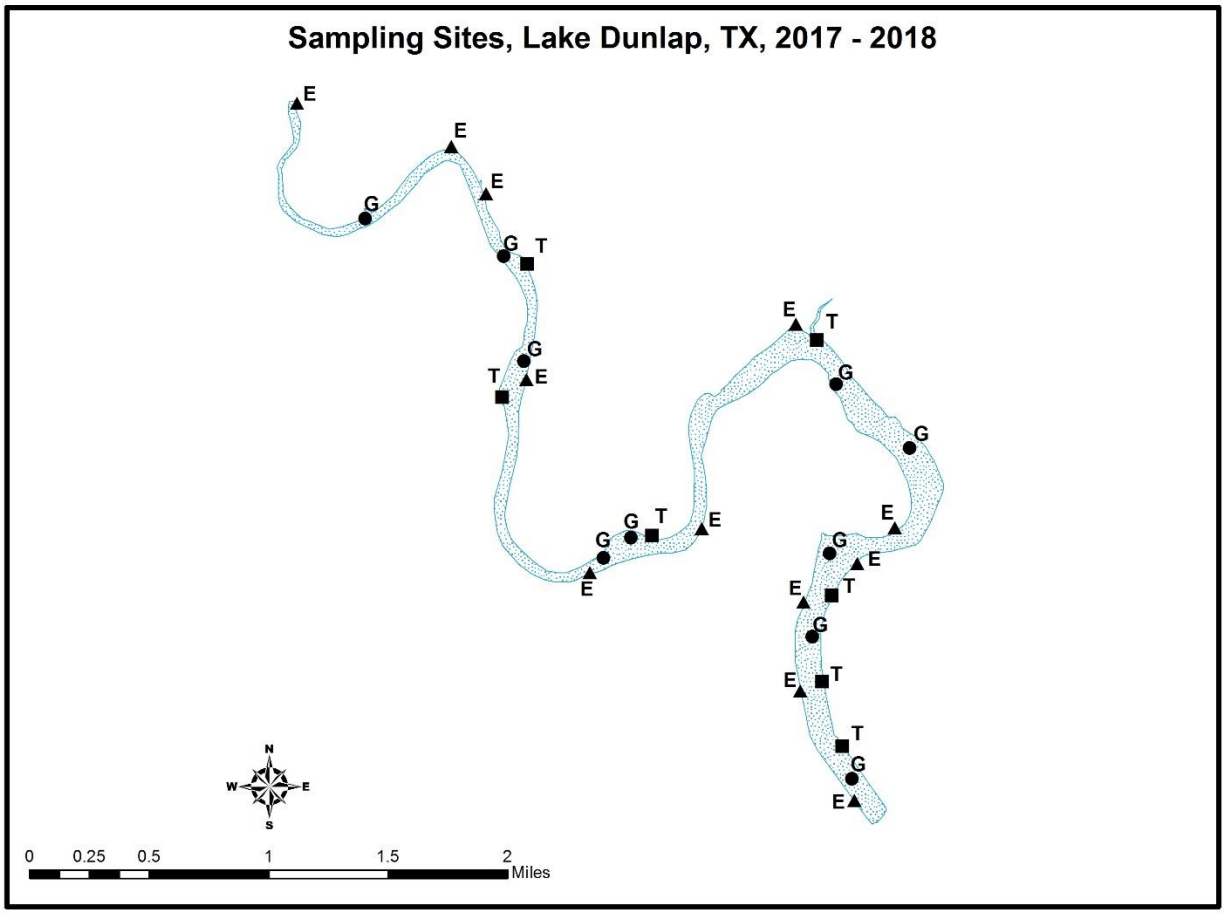
	Survey year			
	2018-2019	2019-2020	2020-2021	2021-2022
Angler Access				S
Vegetation	A	A	A	S
Electrofishing – Fall		A		S
Electrofishing – Low frequency	A			
Gill netting				S
Baited tandem hoop netting	A			
Creel survey	A			
Report				S

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

Number (N) and catch rate (CPUE) (RSE in parentheses) of all target species collected from all gear types from Lake Dunlap, Texas, 2017-2018. Sampling effort was 10 net nights for gill netting, 14 net nights for trap netting, and 1 hour for electrofishing.

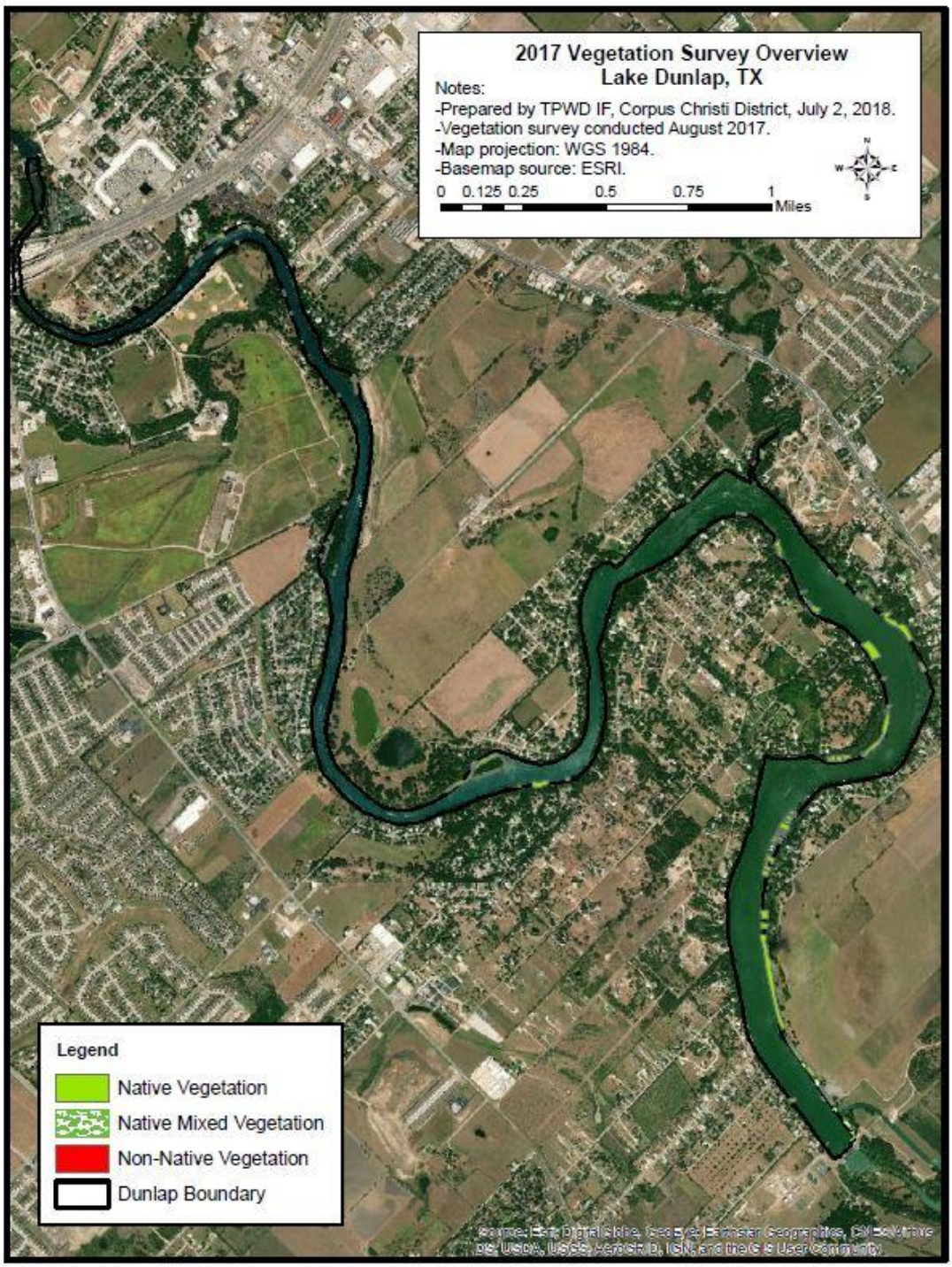
Species	Gill Netting		Trap Netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Gizzard Shad	205	20.5 (28)			128	128.0 (46)
Threadfin Shad			1	0.07 (100)		
Blue Catfish	8	0.8 (58)	1	0.07 (100)		
Channel Catfish	61	6.1 (13)				
Flathead Catfish	21	2.1 (33)	2	0.14 (100)		
Suckermouth Catfish	21	2.1 (34)	2	0.14 (68)		
White Bass	1	0.1 (100)				
Common Carp	5	0.50 (61)				
Redbreast Sunfish	3	0.3 (71)	8	0.57 (60)	77	77.0 (30)
Green Sunfish					3	3.0 (52)
Warmouth			18	1.29 (37)	6	6.0 (39)
Golden Shiner					4	4.0 (100)
Bullhead Minnow					13	13.0 (50)
Inland Silverside					6	6.0 (52)
Blacktail Shiner					15	15.0 (81)
Gray Redhorse	5	0.50 (45)			11	11.0 (100)
Logperch					1	1.0 (100)
Rio Grande Cichlid	1	0.1 (100)	15	1.07 (43)	1	1.0 (100)
Bluegill	8	0.8 (52)	80	5.71 (20)	30	30.0 (25)
Longear Sunfish	3	0.3 (100)	15	1.07 (47)	25	25.0 (47)
Redear Sunfish	8	0.8 (36)	15	1.07 (53)	2	2.0 (100)
Largemouth Bass	5	0.5 (45)	1	0.07 (100)	94	94.0 (24)
Smallmouth Bass					1	1.0 (100)
White Crappie	3	0.3 (71)	10	0.71 (52)		
Longnose Gar	56	5.6 (76)				

APPENDIX B – Map of sampling locations



Location of sampling sites, Lake Dunlap, Texas, 2017-2018. Trap net, gill net, and electrofishing stations are indicated by T, G, and E, respectively. Spring and fall trap nets stations occurred at same location. Water level was near full pool at time of sampling.

APPENDIX C – Map of aquatic vegetation



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