Worth Reservoir

2018 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 Worth Reservoir were surveyed in 2018 using electrofishing, low-frequency electrofishing, and trap netting and in 2019 using gill netting. Historical data are presented with the 2018-2019 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: Worth Reservoir is a 3,489-acre impoundment, located on the West Fork of the Trinity River. The reservoir is located entirely in the city limits of Fort Worth in Tarrant County and was constructed in 1914 by the City as a municipal water supply. Shoreline length is approximately 36 miles. Angler and boat access was adequate. Non-motorized boat access is available in the north end of the reservoir within the Fort Worth Nature Center. There were two handicap-accessible fishing piers on the reservoir. Fishery habitat was primarily rocky shoreline and sporadic stands of native emergent vegetation in the form of water willow, *Justicia americana*, and bulrushes, *Schoenoplectus* species. Water levels do not drop much lower than 3 feet because quality of drinking water decreases below such level. The City of Fort Worth completed a dredging project in 2014 to increase water storage capacity, improve water quality, and increase water recreation.

Management History: Important sport fishes include White Bass, Largemouth Bass, White Crappie, and catfishes. The management plan from the 2014 survey report included informing the public on fish consumption advisories, test planting floating and submersed aquatic vegetation, communicating about the spread of aquatic invasive species, and monitoring Blue Catfish populations with low-frequency electrofishing.

Fish Community

- **Prey species:** Threadfin Shad continued to be abundant. Electrofishing catch of Gizzard Shad was high and 85% were available as prey. Electrofishing catch of Bluegill was higher than the previous survey while catch rate of Longear Sunfish was lower.
- **Catfishes:** The catch rate of Blue Catfish increased over the previous survey. Condition of Blue Catfish over 20 inches was good. Low-frequency electrofishing catch of stock-size Blue Catfish doubled as compared to the 2016 survey, but total catch decreased. The Channel Catfish population decreased as compared to previous surveys.
- **Temperate basses:** White Bass and Yellow Bass were present in the reservoir. White Bass abundance was much lower than previous survey. Yellow Bass were sampled in gill nets for the first time on record. The most likely source of their introduction is downstream movement from Eagle Mountain Reservoir, which is connected via pipeline to Cedar Creek and Richland Chambers Reservoirs.
- **Black Basses:** Total catch of Spotted Bass decreased from the previous two surveys. Total catch of Largemouth Bass increased slightly from 2014 while catch of legal-sized fish remained similar. Condition of 14-18-inch Largemouth Bass was suboptimal. Florida genetic influence decreased slightly.
- **Crappies:** White Crappie abundance decreased slightly and all fish sampled were sub-legal. Mean relative weights of White Crappie were good for fish over 7 inches. Black Crappie were present in low abundance.

Management Strategies: Continue informing public about consumption advisory on Smallmouth Buffalo and catfishes. Monitor Blue Catfish relative abundance with low-frequency electrofishing. Inform the public about the negative impacts of aquatic invasive species. Conduct general monitoring surveys with trap nets, low-frequency electrofishing, and electrofishing surveys in 2022-2023.

Introduction

This document is a summary of fisheries data collected from Worth Reservoir in 2018-2019. 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. Historical data are presented with the 2018-2019 data for comparison.

Reservoir Description

Worth Reservoir is a 3,489-acre impoundment, located on the West Fork Trinity River. The reservoir is located entirely in the city limits of Fort Worth in Tarrant County and was constructed in 1914 by the City as a municipal water supply. The elongated and serpentine reservoir extends approximately 6 miles upstream from the dam. Shoreline length is approximately 36 miles. Water levels do not drop much lower than 3 feet because quality of drinking water decreases below such level (Figure 1). The City of Fort Worth completed a dredging project in 2014 to increase water storage capacity, improve water quality, and increase water recreation. Angler and boat access was adequate. However, areas of the reservoir are very shallow and limit boat traffic. There were two handicap-accessible fishing piers on the reservoir. Fishery habitat was primarily rocky shoreline and sporadic stands of native emergent vegetation in the form of water willow, *Justicia americana*, and bulrushes, *Schoenoplectus species*. Worth Reservoir is currently under a fish-consumption advisory. Worth Reservoir is a eutrophic reservoir with an increase in chlorophyll a trophic state index from 57.0 in 2006 to 63.9 in 2016 (Texas Commission on Environmental Quality 2016). Other descriptive characteristics for Worth Reservoir are in Table 1.

Angler Access

Worth Reservoir has two public boat ramps located at Arrow S Park and Casino Beach Park. Each ramp has adequate parking and a courtesy dock. There is also a small vessel access area along with a courtesy dock on the north end of the reservoir within the Fort Worth Nature Center. Additional boat ramp characteristics are in Table 2. Shoreline access is adjacent to the public boat ramp areas and several public parks around the reservoir. There are combination fishing/loading docks at both public boat ramp and park areas.

Management History

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

1. Continue informing and educating public regarding fish consumption advisory on Smallmouth Buffalo and catfishes.
   Action: Distributed signage relative to consumption advisory to City of Fort Worth personnel. Communicated with anglers when on-site about species safe to consume as well as those with an advisory.

2. Conduct test plantings of floating and submersed aquatic vegetation with plants obtained from TPWD nursery in Athens.
   Action: Water level fluctuations and sustained periods of high water precluded these actions.

3. Communicate with the City of Fort Worth regarding posting of signs educating the public about the spread of aquatic nuisance species. Contact marina operators and emphasize the importance of cleaning, draining, and drying vessels when leaving all reservoirs to reduce risk of spreading zebra mussels.
   Action: Signs were distributed to City of Fort Worth for distribution at public access points. We made a speaking point when talking to the public the importance of cleaning,

draining, and drying vessels prior to launching at other reservoirs. Since Worth does receive water from a pipeline connected to two other reservoirs, TRWD was informed of the risk of zebra mussel movement as well. Despite these efforts, zebra mussels were discovered in 2016 but have not established a reproducing population, leaving Worth classified as positive, but not infested.

4. Conduct low-frequency electrofishing surveys to estimate relative abundance and population indices of Blue Catfish in late summer of 2016 and 2018. Determine if low-frequency electrofishing is a viable alternative to gill netting to obtain similar data.
   Action: Low-frequency surveys were conducted in both 2016 and 2018. Results of those surveys are included in this report.

Harvest regulation history: Sport fish populations in Worth Reservoir have been managed with statewide regulations (Table 3).

Stocking history: Worth Reservoir was last stocked in 2017 with 91,322 Florida Largemouth Bass. The complete stocking history is in Table 4.

Water transfer: Worth Reservoir is a main drinking water supply for the City of Fort Worth. Although no transfer water is pumped directly into the reservoir, water is pumped from Richland Chambers and Cedar Creek Reservoirs into Eagle Mountain Reservoir which releases water directly downstream into Worth Reservoir. All water moved among these reservoirs is intrabasin.

Zebra mussels: As of June 2016, Worth Reservoir is considered zebra mussel positive. Zebra mussels or their larvae have been detected on more than one occasion in Worth, but so far there is no evidence of a reproducing population in the reservoir. Bridgeport Reservoir and Eagle Mountain Reservoir (both classified as infested reservoirs) are directly upstream and release water into Worth Reservoir via the West Fork of the Trinity River.

Fish consumption advisory history: Worth Reservoir is currently under a fish-consumption advisory because of elevated levels of polychlorinated biphenyls (PCBs) in fish tissues. The advisory was first implemented by the Department of State Health Services (DSHS) in April 2000 and advised no consumption of any species. The advisory was amended in 2010 to advise no consumption of Blue and Flathead Catfish and Smallmouth Buffalo. In 2011, 82% of anglers surveyed indicated they were aware of the fish consumption advisory (Brock and Hungerford 2011). The advisory was updated again in March of 2018 to include limits on the number of meals per month on several species including Blue Catfish, Flathead Catfish, Common Carp, Smallmouth Buffalo, Freshwater Drum, Striped Bass[a], and White Bass. More information concerning the advisory can be found at https://www.dshs.state.tx.us/news/releases/2018/20180307.aspx

[a]Striped Bass have never been stocked in Worth Reservoir. It is possible DSHS sampled a Hybrid Striped Bass that migrated downstream from Bridgeport Reservoir.

Methods

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

Electrofishing – Largemouth Bass, Spotted 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.

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

Gill netting – Blue Catfish, Channel Catfish, and White Bass were collected by gill netting (5 net nights at 5 stations). CPUE for gill netting was recorded as the number of fish caught per net night (fish/nn).

Low-frequency electrofishing – Blue Catfish were collected by low-frequency electrofishing at 25 stations. The minimum duration of electrofishing at each station was 5 minutes. CPUE for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing.

Genetics – Genetic analysis of Largemouth Bass was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015). Micro-satellite DNA analysis was used to determine genetic composition of individual fish from 2005 through 2012 and by electrophoresis for previous years.

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.

Water level – Source for water level data was the United States Geological Survey (USGS 2019) and from the Tarrant Regional Water District.

Results and Discussion

Habitat: The last habitat survey was conducted in 2010 (Brock and Hungerford 2011). Fishery habitat has remained consistent. The littoral zone habitat consisted mainly of rocky shoreline and sporadic stands of emergent aquatic vegetation in the form of water willow and bulrushes. In addition to the shoreline stands of emergent aquatic vegetation, flooded timber is also present in the northern end of the reservoir.

Creel: The last creel survey was conducted in 2010 (Brock and Hungerford 2011).

Prey species: Electrofishing catch rates of Gizzard Shad and Bluegill were 491.0/h and 201.0/h, respectively. Index of Vulnerability (IOV) for Gizzard Shad was good, indicating that 85% of Gizzard Shad were available to existing predators; this was similar to IOV estimates in previous years (Figure 2). Total CPUE of Threadfin Shad was 339.0/h during the 2017 survey (Appendix A). Sampling objectives for Gizzard Shad were met (Table 5). Total CPUE of Bluegill (201.0/h) in 2018 was higher than total CPUE from the 2014 survey, but lower than the 2010 survey, and size structure appeared to remain similar (Figure 3). Sampling objectives for Bluegill were met (Table 5).

Catfishes: The gill net catch rate of Blue Catfish was 8.4/nn in 2018, which is higher than the previous survey and similar to the 2011 survey (Figure 4.) All Blue Catfish collected in gill nets were above 10

inches and mean relative weight generally increased with fish length. Objectives for Blue Catfish gill-net sampling fell short of predetermined goals (Table 5). Low-frequency electrofishing surveys were conducted in 2016 and 2018 with stock CPUEs of 20.2/h and 47.0/h, respectively (Figure 5). Size structure indicated a strong year-class of 6-7-inch fish in 2016. Low-frequency electrofishing objectives were met for Blue Catfish in 2018 (Table 5). The first two low-frequency electrofishing surveys for Blue Catfish have produced lower RSEs than traditional gill net surveys typically used to assess population trends. We are trying to replace gill net surveys with low-frequency electrofishing as further described in the objective based sampling plan later in this report. The gill net catch rate of Channel Catfish was 2.0/nn in 2018. The Channel Catfish population continued to have low relative abundance with a similar size structure as compared to the 2015 survey (Figure 6). Body condition of Channel Catfish was poor with values generally in the 80s. The sampling objective for Channel Catfish in Worth Reservoir were met.

Temperate basses: The total catch rate of White Bass was 5.6/nn in the 2019 gill net survey. Catch rates of White Bass decreased from the previous two surveys (Figure 7). Body condition of White Bass was good for fish over 10 inches. Sampling objectives for White Bass were not met in 2019 (Table 5). For the first time ever, Yellow Bass were collected during the 2019 gill netting survey at a rate of 4.4/nn. The most likely source of their introduction is via the TRWD pipeline that moves raw water from Cedar Creek and Richland Chambers Reservoirs to Eagle Mountain Reservoir. Water released from Eagle Mountain directly flows into Worth.

Black basses: The electrofishing catch rate of Spotted Bass was 26.0/h in 2018, which is lower than the two previous surveys (Figure 8). Body condition of Spotted Bass was good for nearly all sizes collected. Electrofishing CPUE of stock-length Largemouth Bass was 41.0/h in 2018, which is similar to the 35.0/h in 2014. Size structure in 2018 indicated a strong year class with an abundance of 6-to-8-inch fish (Figure 9). Body condition in 2018 was good (mean relative weights between 90 and 100) for nearly all size classes of fish and was similar to previous surveys (Figure 9). Florida Largemouth Bass influence remained relatively constant as percent Florida alleles was in the 40s in 2014 and 2018 (Table 6). Two of the sampling objectives for Largemouth Bass were not met: abundance and size structure, while two were: condition and genetics (Table 5).

Crappies: The trap net catch rate of White Crappie was 19.4/nn in 2018, slightly lower than in 2014 (24.0/nn), but 2018 catch was dominated by sub-legal fish. Catch per unit effort of White Crappie over 10 inches (i.e., legal to harvest) was 0.0/nn in 2018 which was a precipitous decrease over the previous two surveys (Figure 10). The PSD of 4 was lower than both the 2010 and 2014 surveys. Mean relative weight increased positively with fish length (Figure 10). The sampling objective of collecting 50 stock-size crappie was achieved (Table 5). Total CPUE of Black Crappie was 0.8/nn in 2018 indicating there are still some present in Worth Reservoir (Figure 11).

Fisheries Management Plan for Worth Reservoir, Texas

Prepared – July 2019

ISSUE 1: Worth Reservoir is currently under a fish-consumption advisory because of elevated levels of polychlorinated biphenyls (PCBs) in fish tissues. The advisory was first implemented by the Department of State Health Services (DSHS) in April 2000 and advised no consumption of any species. The advisory was amended in 2010 to advise no consumption of Blue and Flathead Catfish and Smallmouth Buffalo. The advisory was updated again in March of 2018 to include limits on the number of meals per month on several species including Blue Catfish, Flathead Catfish, Common Carp, Smallmouth Buffalo, Freshwater Drum, Striped Bass, and White Bass.

MANAGEMENT STRATEGIES

1. Continue to inform the public of the risks associated with consuming more than the recommended amount as directed by DSHS.
2. Work with city of Fort Worth staff to provide proper signage at access points to notify anglers of the fish consumption advisory.

ISSUE 2: Blue Catfish were first stocked in 1990 in Worth Reservoir. Since becoming established in the reservoir, the population has typically been in low relative abundance but has produced some trophy-sized fish. The current waterbody record of 75.5 pounds was set in 2012.

MANAGEMENT STRATEGIES

1. Discontinue gill netting surveys every four years.
2. Monitor the Blue Catfish population with summer, low-frequency electrofishing surveys once every four years to assess relative abundance.

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. Worth Reservoir is currently listed as ‘positive’ for zebra mussels

MANAGEMENT STRATEGIES

1. Cooperate with the city of Fort Worth to post appropriate signage at access points around the reservoir.
2. Properly decontaminate all water craft and sampling gear that has been used in Worth Reservoir prior to deployment in other reservoirs.
3. Contact and educate marina owners about invasive species, and provide them with posters, literature, etc.… so that they can in turn educate their customers.

4. Educate the public about invasive species through the use of media and the internet.
5. Make a speaking point about invasive species when presenting to constituent and user groups.
6. 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 (2019–2022)

Sport fish, forage fish, and other important fishes

Important sport fishes in Worth Reservoir include Largemouth Bass, Blue Catfish, and White Crappie. Known important forage species include Bluegill, Longear Sunfish, and Threadfin and Gizzard Shad.

Low density fisheries

White Bass: Previous creel survey data indicated only 2.0% of anglers targeted White Bass. Also, Worth Reservoir has a fish consumption advisory on White Bass meaning harvest-oriented anglers should seek other options.

Spotted Bass: Spotted Bass are present in Worth Reservoir in low density. Data from any Spotted Bass captured during standard electrofishing surveys for Largemouth Bass and forage species will be recorded but no survey metrics will be predetermined for them.

Channel Catfish: Channel Catfish are present in Worth Reservoir in low density. A consumption advisory exists on Channel Catfish in Worth Reservoir so harvest-oriented anglers should seek other reservoirs in the long term.

Flathead Catfish: Flathead Catfish are present in Worth Reservoir; but, in low density. Sampling this population is not a priority moving forward.

Black Crappie: Black Crappie are present in Worth Reservoir in low density. Data from any Black Crappie collected during trapnetting for White Crappie will be recorded but survey objectives will not be set for them.

Survey objectives, fisheries metrics, and sampling objectives

Blue Catfish: Catfishes are the second most sought-after sport fish in Worth Reservoir (11% of total angling effort; Blue and Channel Catfish effort combined; creel conducted 2010-2011). A low frequency electrofishing survey consisting of 20 stations will be conducted in the summer of 2022 to determine CPUE and size structure of the Blue Catfish population. The sampling objective of the low frequency electrofishing survey is obtaining an RSE of CPUE-S $\leq$ 25 and size structure (PSD; 50 fish minimum at 20 stations with 80% confidence). The 2016 and 2018 low-frequency electrofishing surveys for Blue Catfish have been below predetermined RSE targets with 25 stations sampled and because of this, effort will be reduced to 20 stations in the future. If RSE objectives are not met no additional low frequency electrofishing will be conducted.

Largemouth Bass: According to the most recent creel survey conducted on Worth Reservoir (2010-2011), 58 % of anglers target Largemouth Bass and they are the most popular sport fish in the reservoir. The popularity of Largemouth Bass fishing at this reservoir warrant sampling time and effort. Trend data on CPUE, size structure, and body condition have been collected over time with fall nighttime electrofishing. To continue the monitoring of Largemouth bass, fall nighttime electrofishing will be conducted. A minimum of 12 randomly selected 5-min electrofishing sites will be sampled in fall of 2022. Based on past catch rates (excluding 2018), this should be adequate to obtain an RSE of CPUE-S $\leq$ 25 (the anticipated effort to meet the sampling objective is 18 stations with 80% confidence). If the RSE objective is not met, additional electrofishing sampling will only continue if 50 stocked sized fish or larger are not captured in the 12 sample sites. Fin clips from 30 Largemouth Bass (of all sizes) will be collected in 2022 to assess Florida Largemouth Bass stockings.

Bluegill, Longear Sunfish, Threadfin and Gizzard Shad: Bluegill, Longear Sunfish, Threadfin, and Gizzard Shad are the primary forage in Worth Reservoir. Like Largemouth Bass, trend data on CPUE and size structure have been collected with fall nighttime electrofishing. Sampling, as with Largemouth Bass above, will allow for monitoring of large-scale changes in Bluegill, Longear Sunfish, Threadfin and Gizzard Shad relative abundance and size structure. Sampling effort based on achieving sampling

objectives for Largemouth Bass should result in sufficient numbers of Bluegill, Longear Sunfish, Threadfin and Gizzard Shad for size structure estimation (PSD and IOV; 50 fish minimum at 12 stations with 80% confidence)

White Crappie: Both White and Black Crappie populations are present in Worth Reservoir. Previous creel survey data indicate White Crappie angling comprised < 2% of total angling effort. However, with the removal of Crappie from the fish consumption advisory, more anglers could be targeting crappie. A trap-netting survey consisting of 5 single-cod shoreline nets will be conducted in fall of 2022. This level of effort should be sufficient to collect 50 stock size fish for size structure estimation. Based on past surveys, it is unlikely an RSE of CPUE-S < 25 will be met and no objectives will be set for precision of CPUE estimates. No additional sampling will be conducted if objectives are not met in 5 trap net sets. This effort should provide sufficient information for monitoring of large-scale changes of population.

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Tables and Figures

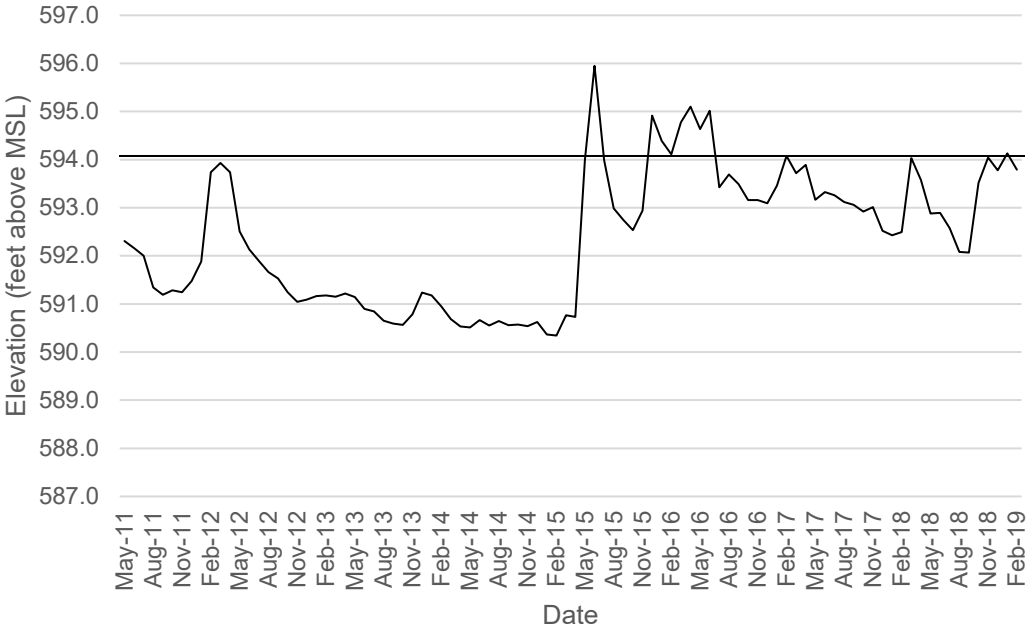


Figure 1. Monthly water level elevations in feet above mean sea level (MSL) recorded for Worth Reservoir, Texas. Conservation pool is 594 ft. MSL.

Table 1. Characteristics of Worth Reservoir, Texas.

Characteristic	Description
Year constructed	1914
Controlling authority	City of Fort Worth
County	Tarrant
Reservoir type	Mainstream
Shoreline Development Index	6.85
Conductivity	350 µS/cm

Table 2. Boat ramp characteristics for Worth Reservoir, Texas, September 2014. Reservoir elevation at time of survey was 590.5 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Casino Beach	32.8188 -97.4524	Y	100	589.0	Good
Arrow S Park	32.7942 -97.4536	Y	50	589.0	Good
Fort Worth Nature Center (Small Vessel Only)	32.8483 -97.4743	Y	20	NA	Good

Table 3. Harvest regulations for Worth Reservoir, Texas.

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

[a]Bag limit of Largemouth and Spotted Bass is 5 fish in any combination.

Table 4. Stocking history of Worth Reservoir, Texas. Life stages are fry (FRY), fingerlings (FGL), advanced fingerlings (AFGL), and unknown (UNK).

Species	Year	Number	Life Stage	Mean TL (in)
Blue Catfish	1990	36,465	FGL	2.0
	Total	36,465		
Channel Catfish	1972	35,000	AFGL	7.9
	Total	35,000		
Florida Largemouth Bass	1975	150,012	FRY	1.0
	1991	178,173	FGL	1.2
	1994	178,606	FGL	1.3
	1999	179,209	FGL	1.3
	2011	173,982	FGL	1.5
	2012	189,000	FGL	1.6
	2013	173,200	FGL	1.5
	2016	95,534	FGL	1.9
	2017	91,322	FGL	1.7
	Total	1,409,038		
Green Sunfish x Redear Sunfish	1972	15,000		UNK
	Total	15,000		
Largemouth Bass	1967	200,000	UNK	UNK
	1969	200,000	UNK	UNK
	1971	50,000	UNK	UNK
	1980	85	UNK	UNK
	Total	450,085		
Palmetto Bass (Striped X White Bass Hybrid)	1978	12,666	UNK	UNK
	1979	1,093,000	FRY	0.4
	1981	948,550	FRY	0.4
	Total	2,054,216		
Threadfin Shad	1984	1,000	AFGL	3.0
	Total	1,000		

Table 5. Objective-based sampling plan components for Worth Reservoir, Texas 2018-2019.

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
	Condition	W_r	10 fish/inch group (max)
	Genetics	% FLMB	N = 30, any age
Bluegill [a]	Abundance	CPUE – Total	RSE ≤ 25
	Size structure	PSD, length frequency	N ≥ 50
Gizzard Shad [a]	Abundance	CPUE – Total	RSE ≤ 25
	Size structure	IOV, PSD, length frequency	N ≥ 50
Trap netting			
Crappie	Size structure	PSD, length frequency	N = 50
Gill netting			
Blue Catfish	Abundance	CPUE	N≥50
	Size structure		N ≥ 50 stock
Channel Catfish[b]	Abundance	CPUE– stock	RSE-Stock ≤ 25
White Bass	Abundance	CPUE-stock	N≥50
	Size structure	PSD, length frequency	N≥50 stock
Low-frequency electrofishing			
Blue Catfish	Abundance	CPUE	RSE-Stock ≤ 25
	Size structure	PSD	N≥50 stock

[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.
[b]No additional effort will be expended to achieve an RSE ≤ 25 for CPUE of Channel Catfish if not reached from designated gill netting effort.

Gizzard Shad

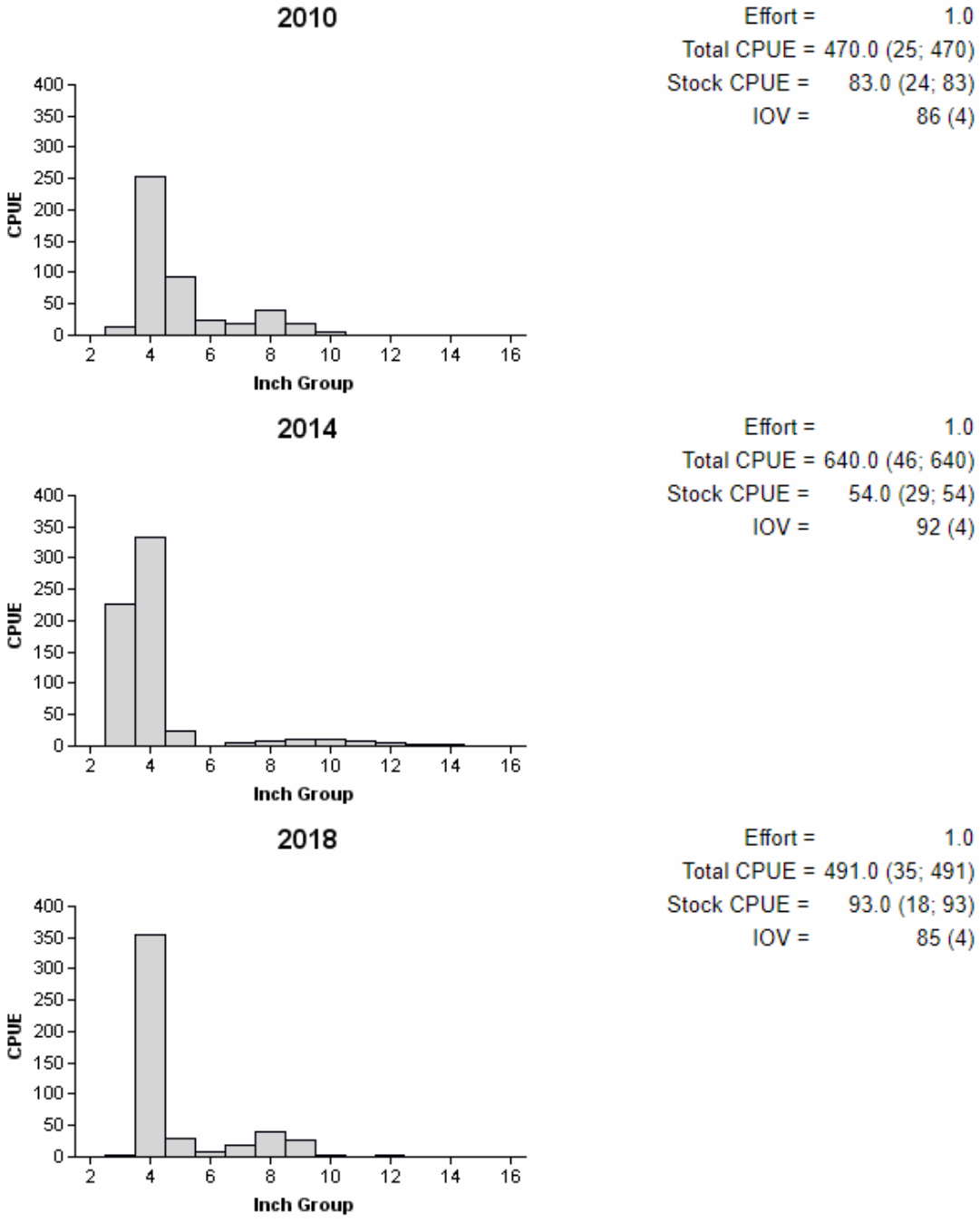


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Worth Reservoir, Texas, 2010, 2014, and 2018.

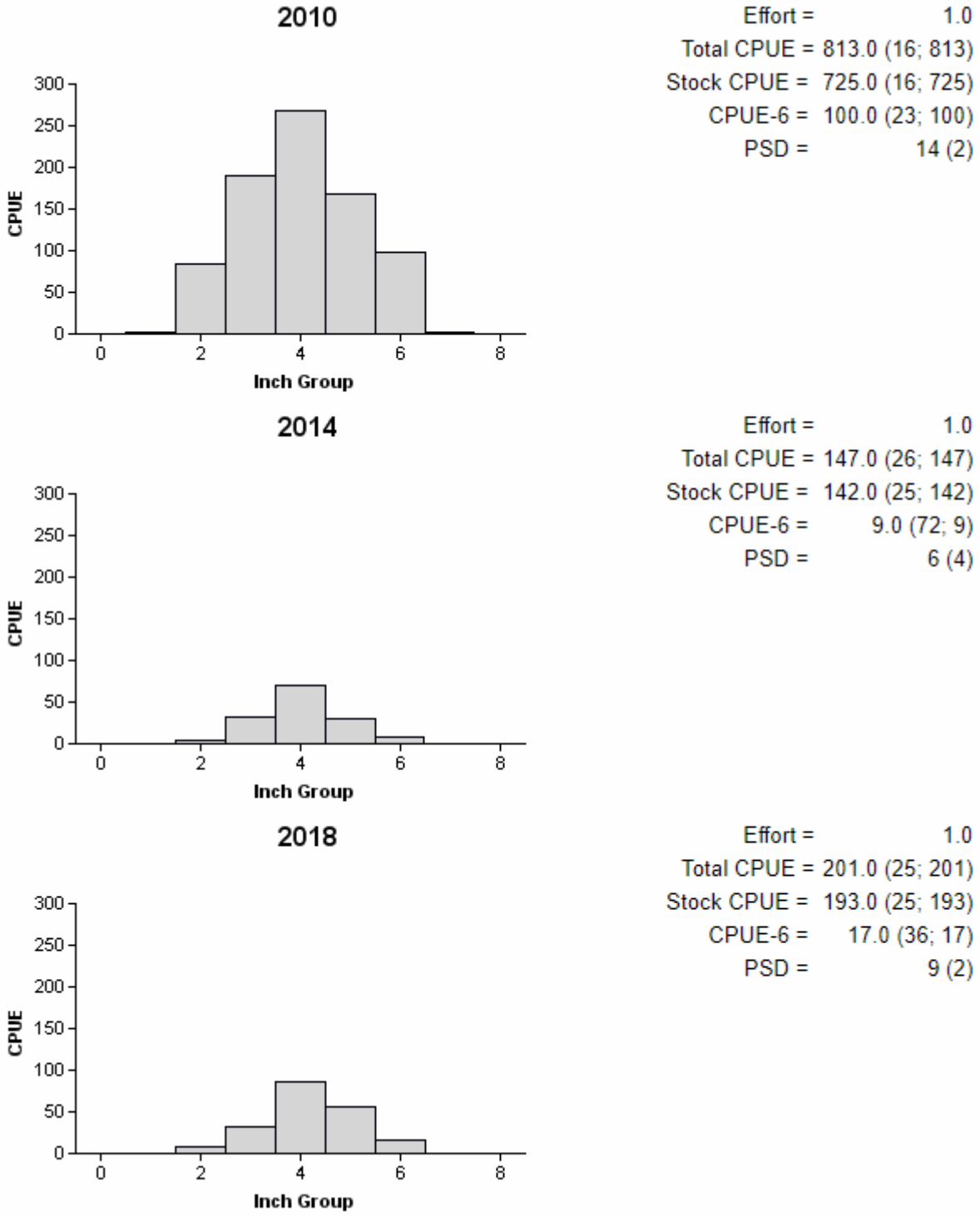


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Worth Reservoir, Texas, 2010, 2014, and 2018.

Blue Catfish

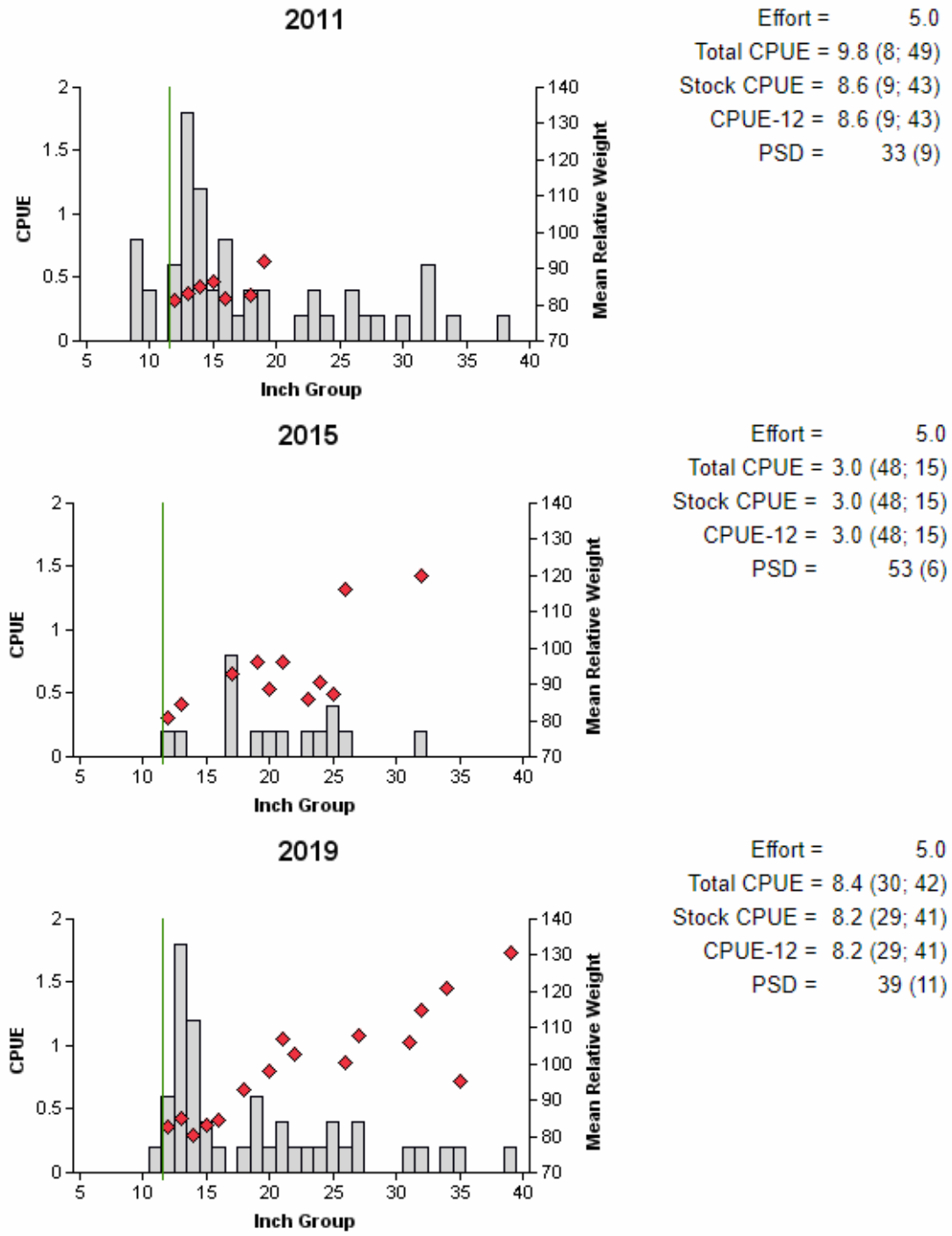


Figure 4. Number of Blue Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill netting surveys, Worth Reservoir, Texas, 2011, 2015, and 2019. Solid vertical lines indicate minimum length limit at time of sampling.

Blue Catfish

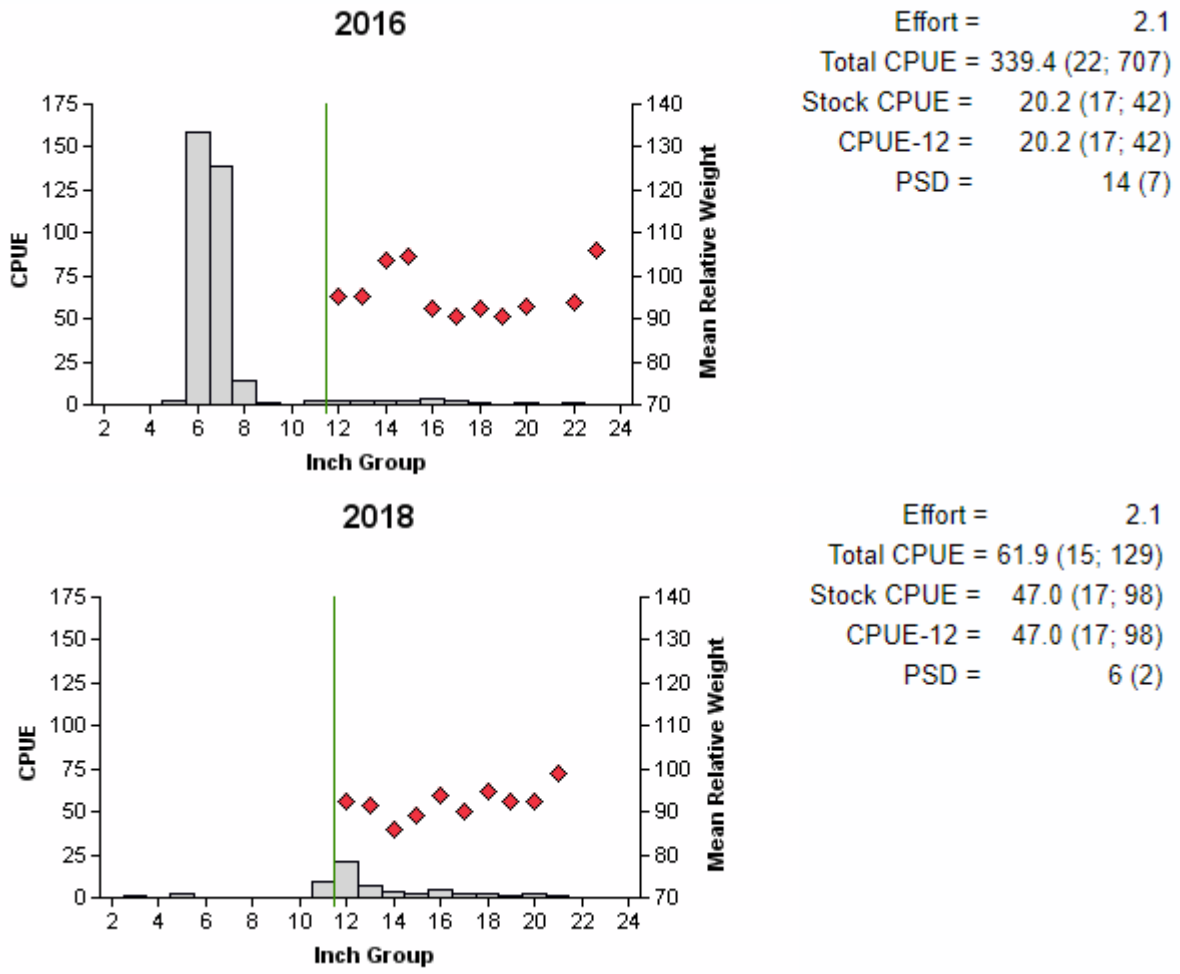


Figure 5. Number of Blue Catfish caught per hour (CPUE), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for summer low-pulse electrofishing surveys, Worth Reservoir, Texas, 2016 and 2018. Solid vertical lines indicate minimum length limit at time of sampling.

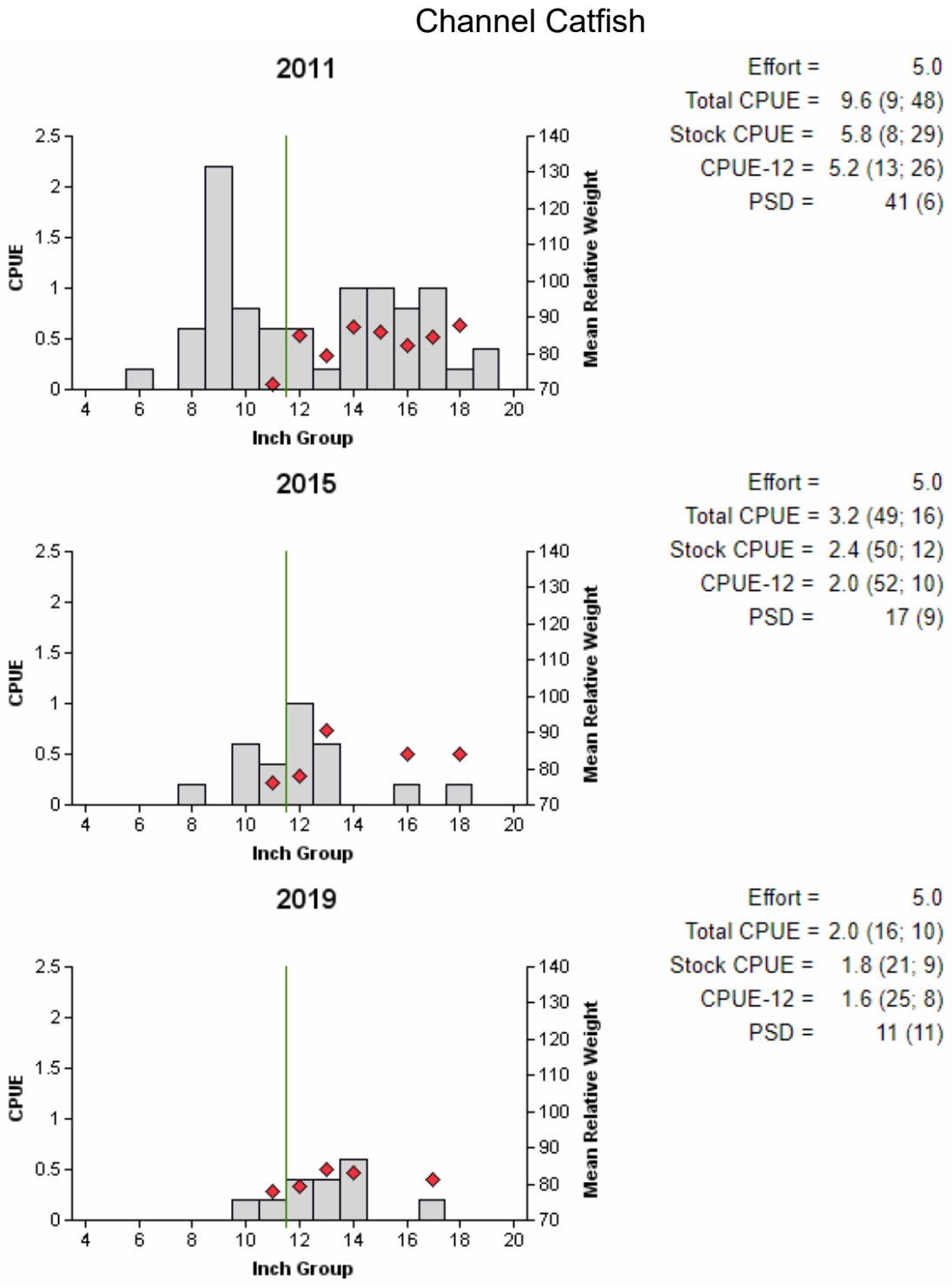


Figure 6. Number of Channel Catfish caught per net night (CPUE), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Worth Reservoir, Texas, 2011, 2015, and 2019. Solid vertical lines indicate minimum length limit at time of sampling.

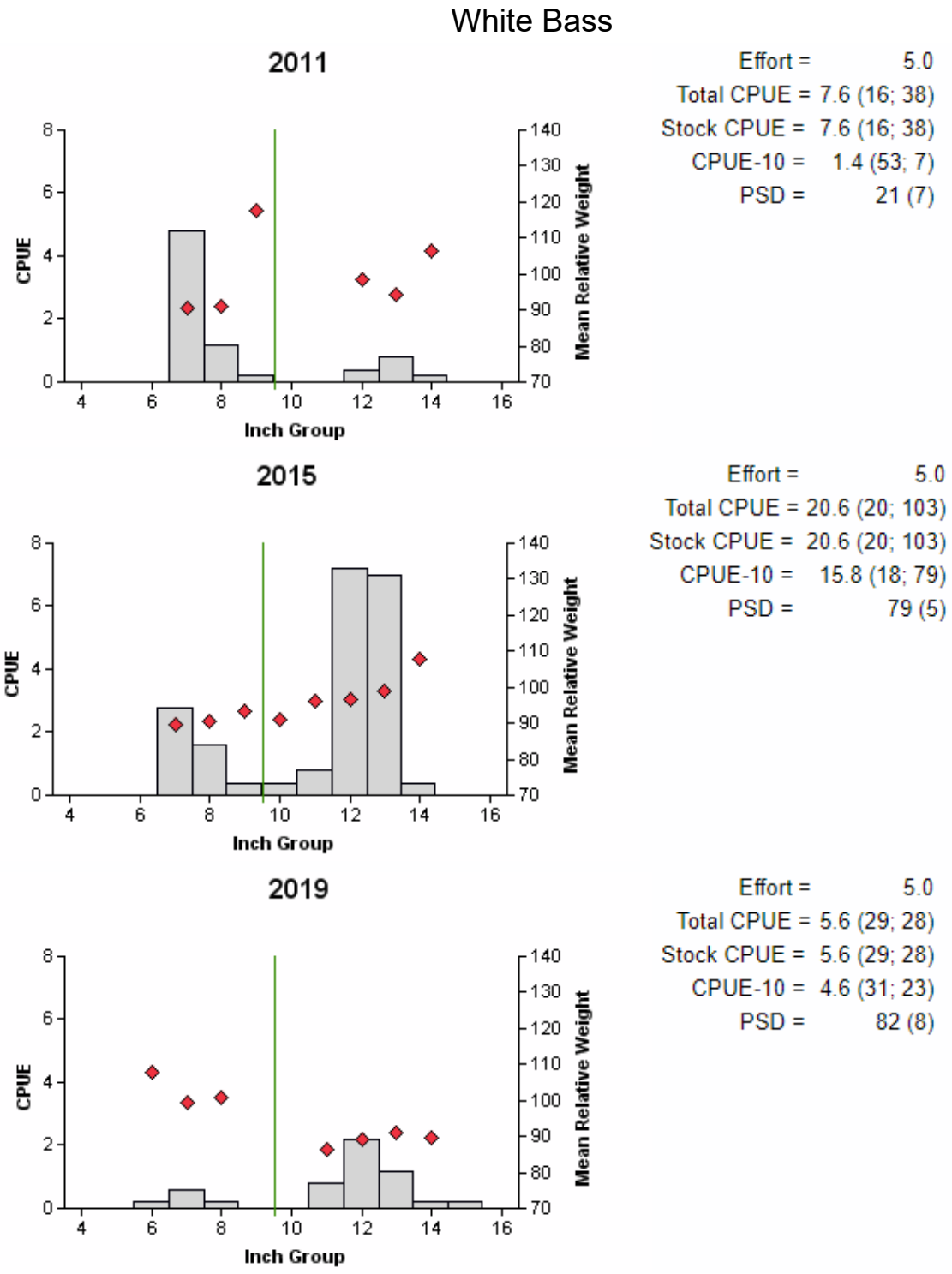


Figure 7. Number of White Bass caught per net night (CPUE), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Worth Reservoir, Texas, 2011, 2015, and 2019. Solid vertical lines indicate minimum length limit at time of sampling.

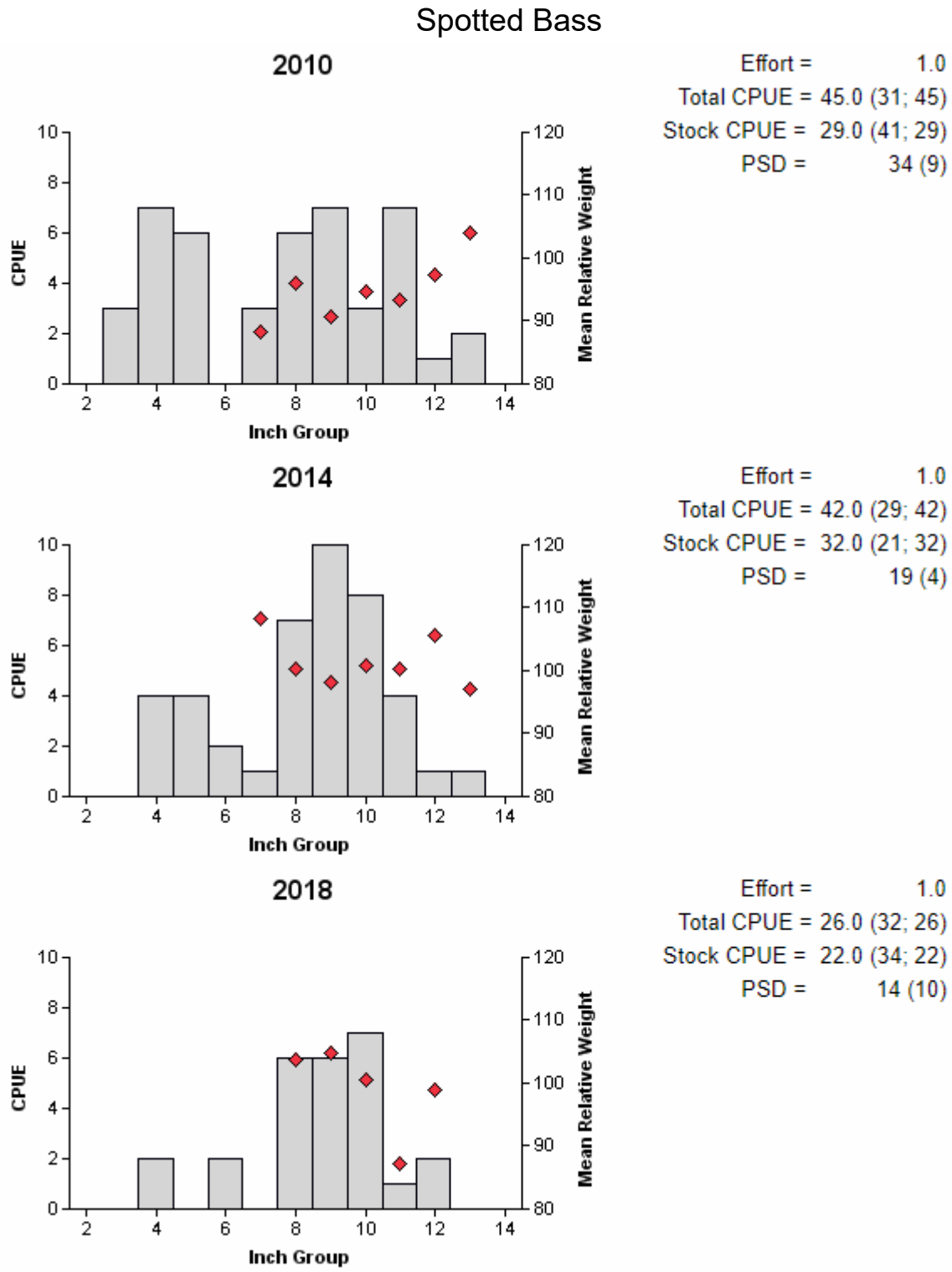


Figure 8. Number of Spotted Bass caught per hour (CPUE), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Worth Reservoir, Texas, 2010, 2014, and 2018.

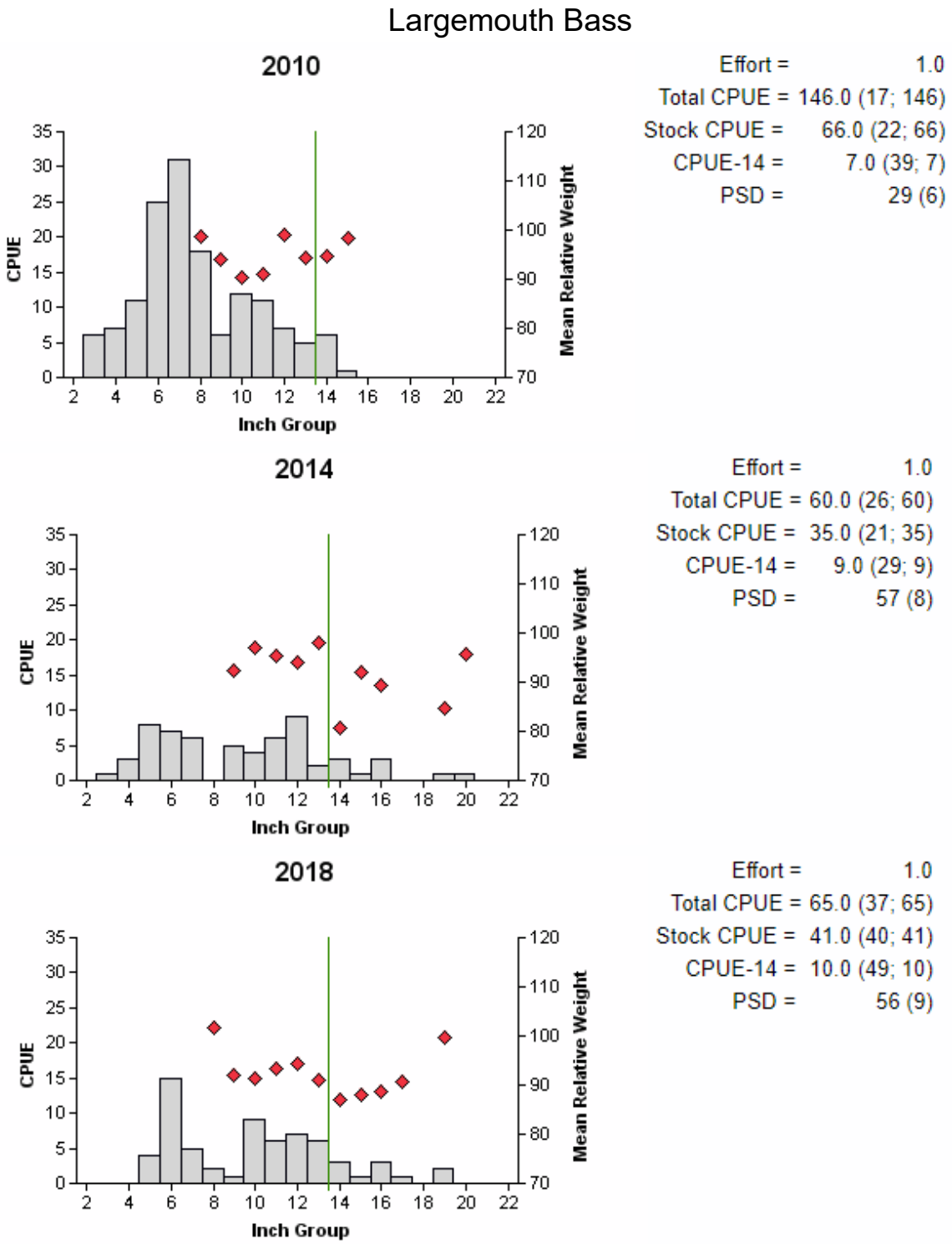


Figure 9. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Worth Reservoir, Texas, 2010, 2014, and 2018. Solid vertical lines indicate minimum length limit at time of sampling.

Table 6. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Worth Reservoir, Texas, 2010, 2014, and 2018. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB. Genetic composition was determined by micro-satellite DNA analysis.

		Number of fish				
Year	Sample size	FLMB	Intergrade	NLMB	% FLMB alleles	% FLMB
2010	30	0	26	4	24	0
2014	29	0	29	0	43	0
2018	30	1	27	2	40	3.3

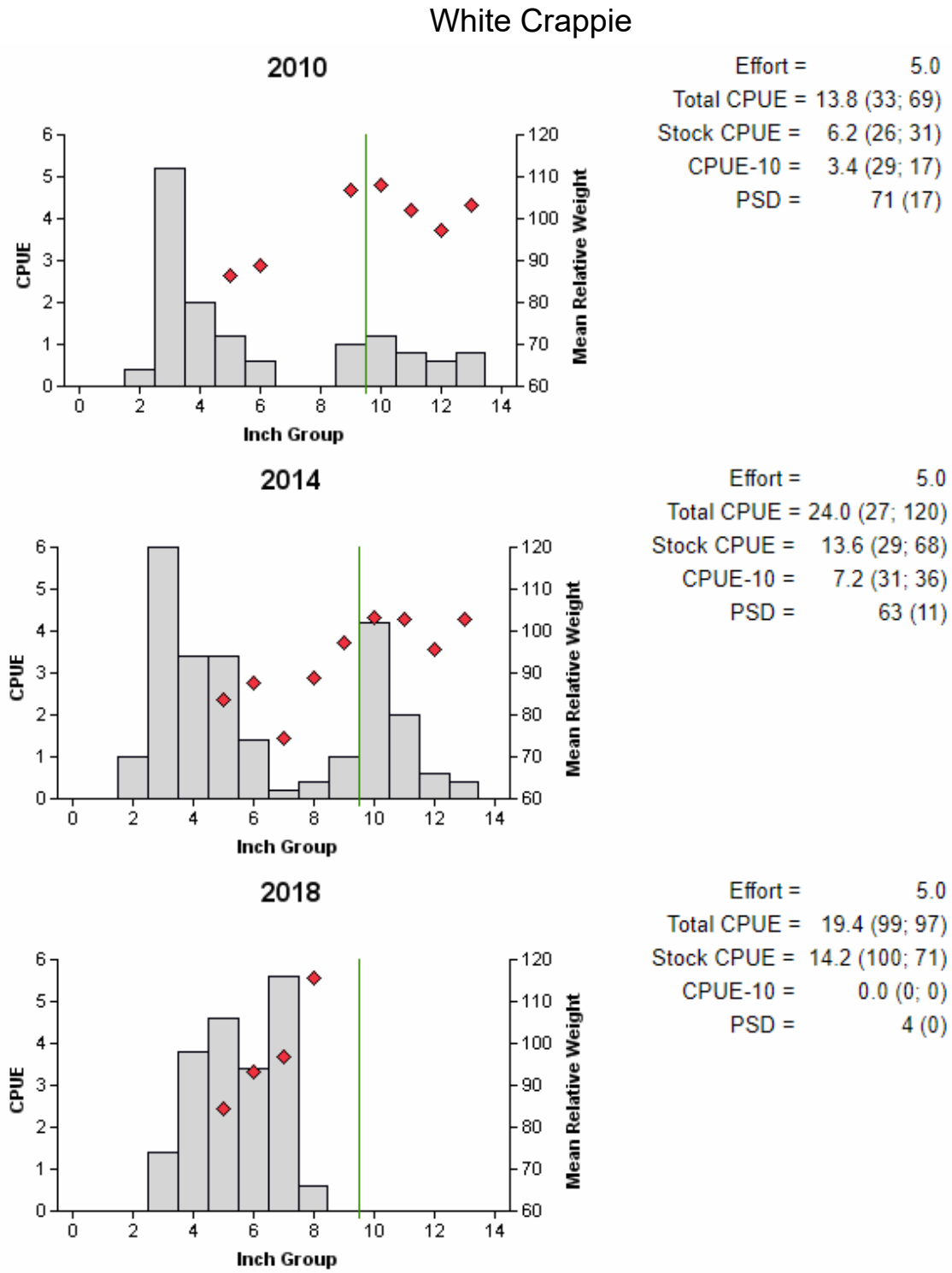


Figure 10. Number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Worth Reservoir, Texas, 2010, 2014, and 2018. Vertical line indicates minimum length limit.

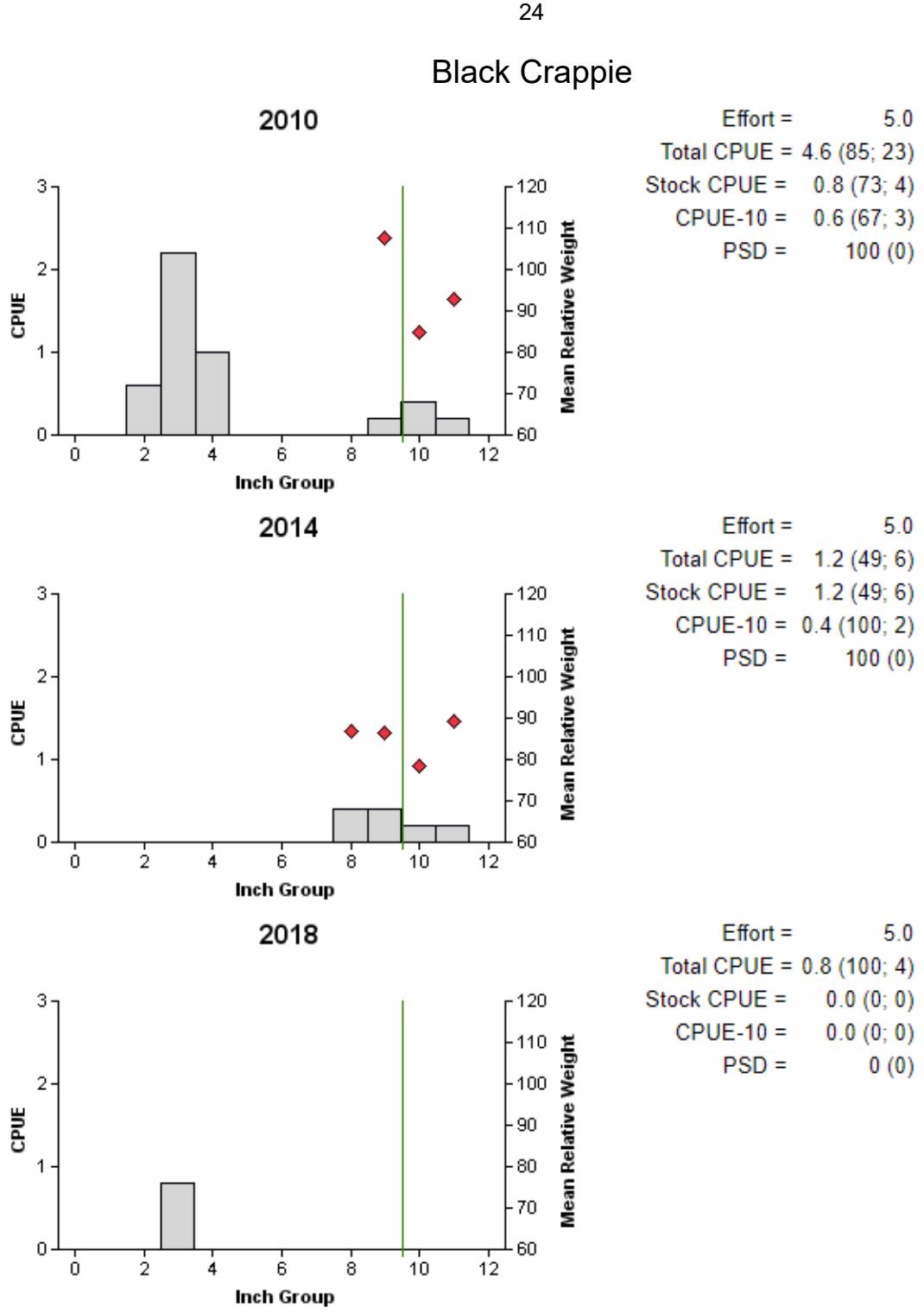


Figure 11. Number of Black Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Worth Reservoir, Texas, 2010, 2014, and 2018. Vertical line indicates minimum length limit.

Proposed Sampling Schedule

Table 7. Proposed sampling schedule for Worth Reservoir, Texas. Survey period is June through May. Gill netting surveys are conducted in the spring, while electrofishing and trap netting surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

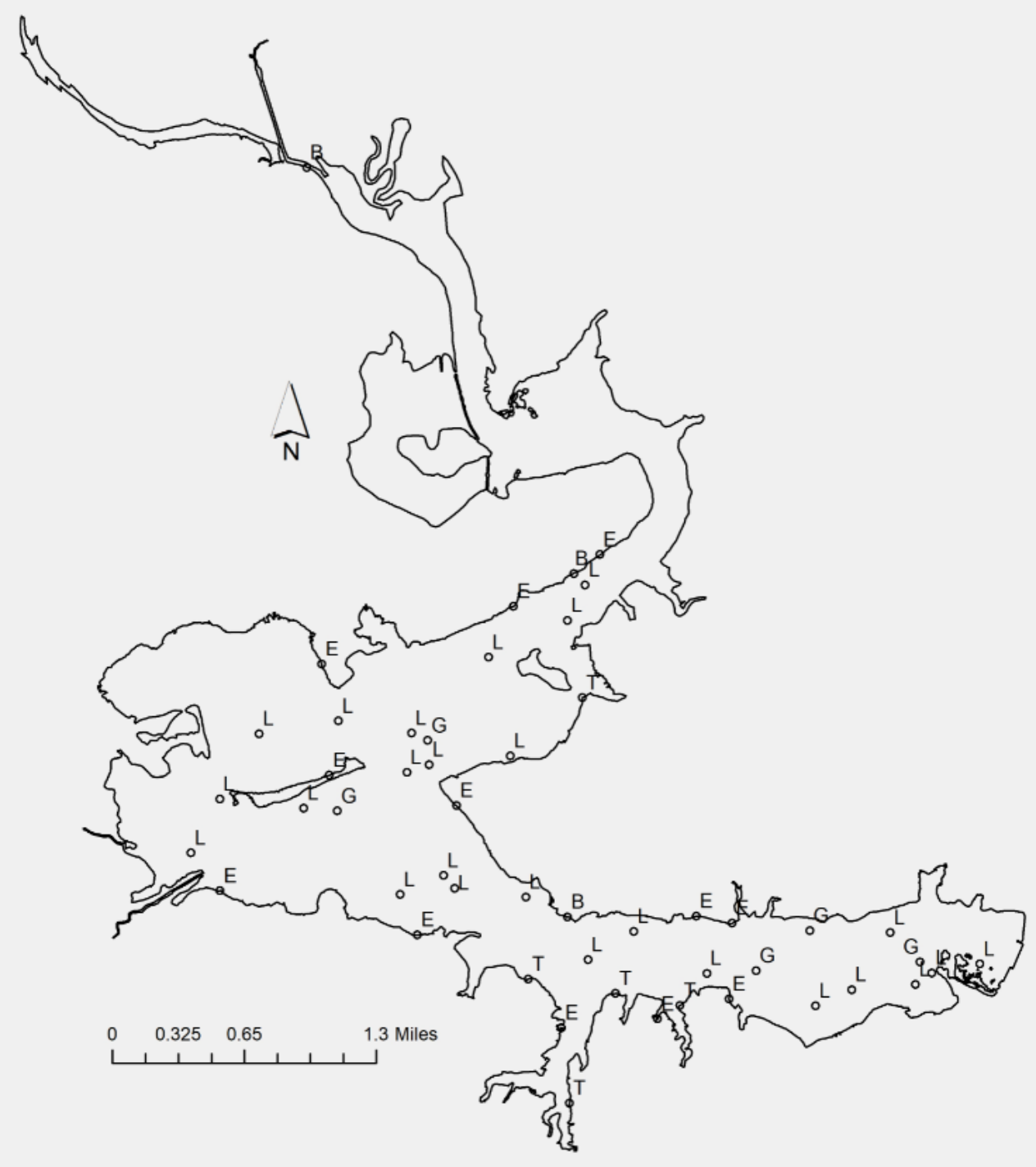
	Survey year			
	2019-2020	2020-2021	2021-2022	2022-2023
Angler Access				S
Vegetation				
Electrofishing – Fall				S
Electrofishing – Low frequency				A
Trap netting				S
Gill netting				
Creel survey				
Report				S

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

Number (N) and catch rate (CPUE; RSE in parentheses) of all target species collected from all gear types from Worth Reservoir, Texas, 2018-2019. Sampling effort was 5 net nights for gill netting, 5 net nights for trap netting, and 1 hour for electrofishing.

Species	Gill Netting		Trap Netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Gizzard Shad					491	419.0 (35)
Threadfin Shad					339	339.0 (46)
Channel Catfish	10	2.0 (16)				
Blue Catfish	42	8.4 (30)				
White Bass	28	5.6 (29)				
Redbreast Sunfish					26	26.0 (80)
Bluegill					201	201.0 (25)
Longear Sunfish					142	142.0 (35)
Redear Sunfish					12	12.0 (41)
Spotted Bass					26	26.0 (32)
Largemouth Bass					65	65.0 (37)
White Crappie			97	19.4 (99)		
Black Crappie			4	0.8 (100)		

APPENDIX B – Map of sampling locations



Location of sampling sites, Worth Reservoir, Texas, 2018-2019. Trap net, gill net, electrofishing, and low-frequency electrofishing stations are indicated by T, G, E, and L, respectively. Boat ramps are indicated with a B. Water level was near full pool at time of sampling.

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