# O.H. Ivie 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 O.H. Ivie Reservoir were surveyed in 2017 using electrofishing and trap netting and in 2018 using gill 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:** At conservation pool, O. H. Ivie Reservoir is a 19,200-acre impoundment and is located on the Colorado and Concho Rivers in Concho, Runnels, and Coleman counties, Texas, approximately 55 miles east of San Angelo. Water level fluctuations are common; the reservoir surface elevation ranged from 37 to 40 feet below conservation pool during the 2017-2018 sampling period. In May 2018, reservoir surface area totaled 5,034 acres. Habitat features consisted of standing timber, rocks, and flooded saltcedar.

**Management History**: Important sport fish include Largemouth Bass, White Bass, White Crappie, and catfishes. Annual electrofishing and creel surveys were conducted from 2001 to 2013 to evaluate the effectiveness of the 2001 Largemouth Bass length limit change (from 18-inch minimum length and 5-fish bag to a 5-fish bag, 2 of which may be <18 inches). The 18-inch MLL on Smallmouth Bass was removed in 2015 and replaced with statewide regulations. A variety of fish species have been stocked in the reservoir including Threadfin Shad; Bluegill; Channel, Blue and Flathead Catfishes; Florida Largemouth Bass; Smallmouth Bass; White Crappie; and Walleye. Walleye stockings were discontinued after failing to produce a fishery.

**Fish Community**

- **Prey species:** Threadfin Shad were present in the reservoir in low abundance. Electrofishing catch of Gizzard Shad was below average and Gizzard Shad IOV was poor. Electrofishing catch of Bluegill was higher than average with most fish measuring between 4 to 5 inches.
- **Catfishes:** Blue, Channel, and Flathead Catfish are all present in the reservoir, but gill net catch rates were too low to accurately assess the population.
- **White Bass:** White Bass were present in the reservoir in good abundance. Many legal size White Bass were present with fish up to 16 inches.
- **Largemouth Bass:** Stock size Largemouth Bass abundance was above average due to a strong year-class from 2016, while abundance of bass over 18 inches was near historical averages. Size structure continued to be poor with approximately 7% of catchable size bass over 15 inches.
- **White Crappie:** White Crappie catch rates in trap nets were low, but fish up to 13 inches were collected. Good numbers of small crappie indicate a successful year-class was produced in 2017.

**Management Strategies**: Continue to stock Florida Largemouth Bass contingent upon adequate water levels and habitat. Discontinue trap netting for White Crappie due to poor catch rates. Conduct additional electrofishing surveys in 2018, 2019, and 2020, and general monitoring surveys with gill nets and electrofishing surveys in 2021-2022. Additional vegetation surveys will be conducted in 2018, 2019, and 2020 to survey hydrilla coverage. Access and vegetation surveys will be conducted in 2021. Conduct year-long creel survey in 2019-2020. Water samples will be taken annually to monitor for golden alga cell counts and toxicity.

# Introduction

This document is a summary of fisheries data collected from O.H. Ivie Reservoir 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 fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2017-2018 data for comparison.

## Reservoir Description

At conservation pool, O. H. Ivie Reservoir is a 19,200-acre impoundment and was constructed in 1990 on the Colorado and Concho rivers. It is located in Concho, Runnels, and Coleman counties approximately 55 miles east of San Angelo and is operated and controlled by the Colorado River Municipal Water District (CRMWD). Primary water uses included municipal water supply and recreation. O. H. Ivie Reservoir was eutrophic with a mean TSI chl-*a* of 47.26 (Texas Commission on Environmental Quality 2011). Habitat at time of sampling consisted of rocks, native submersed vegetation, flooded timber, and saltcedars. Hydrilla, a non-native, was first discovered in O. H. Ivie Reservoir in 1997. The water level remained near conservation pool elevation from impoundment in 1990 through 1998, but declined 26 feet from May 1998 to November 2004. Rains in 2005 and 2007 improved water levels, but from 2008 to 2012 the reservoir dropped over 35 feet. Since 2013, the reservoir has fluctuated 8-12 feet annually, but has never exceeded 25% capacity over the past 5 years. The reservoir reached an all-time low in May 2014 (49 feet below conservation pool, 10.7% capacity). The reservoir surface elevation ranged from 37 to 40 feet below conservation pool (20.2 to 17.4% capacity) during the 2017-2018 sampling period (Figure 1) and surface area was between 5,699 and 5,034 acres. Other descriptive characteristics for O. H. Ivie Reservoir are in Table 1.

## Angler Access

Boat access consisted of four public boat ramps and several private boat ramps. The Concho (southwest) ramp has been unusable since 2010 due to low water levels. Extensions of these ramps are not feasible according to CRMWD. Additional boat ramp characteristics are in Table 2. Shoreline access is restricted to CRMWD parks.

## Management History

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

1. Change the minimum length limit on Smallmouth Bass to the statewide regulation of 14 inches.

   **Action:** The regulation was changed and statewide regulations on smallmouth went into effect September 1, 2015.

2. Collect additional data on Channel, Blue, and Flathead Catfish populations using non-traditional gears such as low-frequency electrofishing or jug-lines and collect data on passive-gear angling for catfish species at the reservoir with a special creel survey in 2017/2018.

   **Action:** Low-frequency electrofishing was unsuccessful in collecting catfish species. No additional special surveys were conducted for catfish species during the recent 4 year reporting period.

3. Cooperate with the CRMWD to post signage, educate the public about invasive species, and track existing and future inter-basin water transfers to facilitate potential invasive species responses.

**Action:** The San Angelo District continued to work with the CRMWD to post signage and to educate the public on invasive species threats through media outlets.

**Harvest regulation history:** From 1990 to 2001, Largemouth Bass were managed with an 18-inch minimum length limit (MLL). The MLL was changed in 2001 to no length limit, but only two <18 inches could be kept per day. The latter was implemented to alleviate stockpiling and improve growth of Largemouth Bass measuring 14 to 18 inches. Smallmouth Bass were managed with an 18-inch MLL from 1990 to 2015. The special Smallmouth Bass regulation was removed in 2015 and are currently managed with statewide regulations. Current regulations are in Table 3.

**Stocking history:** The majority of Florida Largemouth Bass stockings were conducted between 1989 and 2001 and between 2010 and 2017 (Table 4). Threadfin Shad; Blue, Channel, and Flathead Catfish; Bluegill; Smallmouth Bass; and White Crappie were introduced in 1990. Walleye were stocked 3 times from 1991 to 1994, but failed to produce a fishery. The complete stocking history is in Table 4.

**Vegetation/habitat management history:** O. H. Ivie Reservoir has supported a mix of aquatic vegetation species. From 2004 to 2017, native submersed vegetation ranged from 6.8 to 24.7% surface area coverage, however, no native vegetation was observed in 2012 or 2013 due to low water levels. Hydrilla was first discovered in O. H. Ivie Reservoir in 1997 and from 1999 to 2011 hydrilla coverage ranged from 400 to 3733 acres (average ~2300 acres, 21% surface area). Since 2012 hydrilla abundance has been low or non-existent due to falling water levels. In 2017 a small patch of hydrilla < 1 acre was discovered. Historically, no attempts have been made to control this invasive species since fluctuating water levels have kept it within an acceptable amount of coverage in most years, and it has never caused any boater access issues.

**Water transfer:** O. H. Ivie Reservoir is primarily used for municipal water supply for the cities of Midland, San Angelo, and Abilene, Texas as well as several smaller communities. Colorado River Municipal Water District is the controlling authority and supplier to these municipalities. Two permanent pump stations move water to the cities' treatment plants via pipeline. No interbasin water transfers are known to occur.

# Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for O.H. Ivie 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, sunfishes, Gizzard Shad, and Threadfin Shad were collected by electrofishing (2 hour at 24, 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 (20 net nights at 20 stations).  CPUE for trap netting was recorded as the number of fish caught per net night (fish/nn).  Ages for crappie were determined using otoliths from 13 randomly-selected fish (range 9.0 to 10.9 inches).

**Gill netting** – Blue Catfish, Channel Catfish, Flathead Catfish, and White Bass were collected by gill netting (15 net nights at 15 stations).  CPUE for gill netting was recorded as the number of fish caught per net night (fish/nn).

**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 CPUE.

**Habitat** –Vegetation surveys were conducted in 2014–2016 to monitor hydrilla and all aquatic plants in 2017.  Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

**Golden Alga** - Golden alga analyses were performed on water samples collected from O.H. Ivie Reservoir in 2017.  The samples were analyzed on site using handheld digital water quality meters, and then shipped overnight to the TPWD Fish Health Laboratory in San Marcos, Texas, where lab staff conducted cell counts and bioassay toxicity assessments using Fathead Minnows.

**Water level** – Source for water level data was the United States Geological Survey (USGS 2018).

# Results and Discussion

**Habitat:**  A structural habitat survey was last conducted in 2009 (Farooqi et al. 2010) and no significant human alterations have been made to the shoreline since that survey. Native submersed vegetation, primarily Illinois pondweed and sago pondweed, covered 9.7% of the reservoir's surface area (Table 6). This is the highest percent coverage of native submersed vegetation since 2011 (10.5%).   Trace amounts of Hydrilla was found in 2017 after not being observed the previous 4 years (Table 6). Historically, when water levels were higher, hydrilla surface area coverage averaged 21%.

**Golden Alga:** A golden alga bloom was documented in the upper portion of O.H. Ivie Reservoir from March through May 2017. Highly toxic (ichthyotoxicity units, ITU's ≥ 25) conditions were present in the Colorado River arm extending to the Abilene pump station on March 6th and 13th (29,000 cells/ml), April 17th in the Concho River arm (17,000 cells/ml), and peaking on or around May 10th (58,000 cells/ml). Samples taken May 31st showed toxicity and cell counts had dropped significantly (3,000 cells/ml, ITU's =

1). It was estimated 10% of the reservoir was affected by the bloom, however, fall electrofishing indicated no significant loss of Largemouth Bass or prey species as catch rates were near or above historical averages (Appendix C).

**Prey species:** Electrofishing catch rates of Bluegill and Gizzard Shad were 269.0/h and 96.0/h, respectively. Gizzard Shad IOV was poor, indicating that only 28% of Gizzard Shad were available to existing predators (Figure 2). Total CPUE of Gizzard Shad was below the historical average in 2017 (96.0/h) and 2015 (92.0/h). Total CPUE of Bluegill in 2017 (269.0/h) was much higher than previous surveys in 2015 (69.3/h) and 2013 (74.7/h), while size structure continued to be dominated by 4 to 5 inch fish (Figure 3). The increase in Bluegill catch rate may be attributed to the increase in native submersed vegetation, which had been lost due to falling water levels in previous years.

**Blue Catfish:** Blue Catfish continued to be present in the reservoir, but gill net total catch rates were low at 1.9/nn in 2018 (Figure 4). Most Blue Catfish collected ranged from 20 to 25 inches in 2018 with the largest collected at 35 inches (Figure 4). This was an improvement from 2014 when most fish ranged from 15-20 inches. Relative weights ranged from 100 to 110, indicating quality forage was available (Figure 4). Anecdotal evidence in the form of social media and fishing forum post show catches of large Blue Catfish, which suggest a good Blue Catfish population is present. However, gill nets have been ineffective at collecting sufficient numbers to adequately assess relative abundance and size structure.

**Channel Catfish:** Channel Catfish continued to be present, but catch rates were poor. Over the past 3 surveys, total catch rates have ranged from 0.6 to 1.4/nn (Figure 5). Most Channel Catfish collected in 2018 ranged from 9 to 18 inches. Relative weights were average with most inch groups above 90 (Figure 5).

**White Bass:** White Bass abundance was above average at 6.2/nn in 2018, but was slightly lower than the 8.0/nn in 2014. Size structure was excellent with many White Bass above the legal length limit. White Bass condition was variable among length groups, but overall were average with relative weights from 85 to 95 for most inch groups (Figure 6). Growth was good with White Bass; average age at 10 inches was 1.7 years (N = 9; range = 1 – 2 years).

**Largemouth Bass:** The electrofishing catch rate of stock-length Largemouth Bass was 62.0/h in 2017, higher than the 16.0/h in 2015 and 24.7/hr in 2013 (Figure 7). The catch rate of 62.0/h stock-length Largemouth Bass was the highest recorded since 1996 and nearly double the 22-year average (Appendix C). Catch rate of Largemouth Bass over 18 inches was close to historical averages (Appendix C). Size structure was poor as PSD was 27 and PSD-P was 7 in 2017 (Figure 7), which was below historical averages. The poor size structure and high catch rate of stock size bass can be attributed to high number of bass from 9 to 11 inches which are likely a strong year-class from 2016, when there was a 12 foot rise in water levels in the spring. Relative weight for Largemouth Bass was at or below 90 for nearly all size classes (Figure 7) which continued a long term trend in poor relative weights for most Largemouth Bass length groups. The condition of Largemouth Bass has been largely influenced by water level fluctuations with a positive relationship to increasing water levels. Regression analysis on data from 2001 to 2017 indicates 63% of the variation in Largemouth Bass condition is related to water level fluctuations (Appendix D). Increases in water levels lead to more flooded terrestrial vegetation and an increase in available food and shelter. Whereas, steady or falling water levels during the spring were associated with relative weights at or below 90 the following fall. Largemouth Bass in O. H. Ivie were highly influenced by Florida Largemouth Bass genetics with 76% Florida alleles while the percentage of pure Florida Largemouth Bass was 17% in 2017 (Table 7). Florida strain genetics have remained steady in O.H. Ivie; Florida alleles ranged from 76 to 86% from 2004 to 2017 (Table 7).

**Smallmouth Bass:** Smallmouth Bass were very low in abundance, but have persisted in the reservoir since their initial stockings in 1990. Total CPUE for Smallmouth Bass was 1.0/h in 2017, 0.7/h in 2015, and 1.5/h in 2010. Sizes of Smallmouth Bass collected since 2010 have ranged from 5 to 16 inches.

**Crappie:** Total catch rate of White Crappie was 1.4/nn in 2017, which was low, but similar to past surveys. White Crappie were observed up to 13 inches. Total catch rate of Black Crappie was 0.5/nn in

2017 and ranged from 4 to 9 inches. White Crappie have outnumbered Black Crappie about 10 to 1 over the past 3 surveys. Too few stock size crappie were collected to make any meaningful statements on size structure. Condition was good with relative weights over 100 for several inch classes (Figure 8). Only five White Crappie were collected for age and growth; average age at 10 inches was 1.4 years (N = 5; range = 1 – 2 years). Despite low and fluctuating water levels, recruitment appears to be relatively consistent with good numbers of young White Crappie collected each of the last 3 surveys (Figure 8). Historical creel survey data suggest a good crappie population persists in O.H. Ivie reservoir; however, trap nets have been ineffective for sampling crappie in this reservoir.

# Fisheries Management Plan for O.H. Ivie Reservoir, Texas

Prepared – July 2018

**ISSUE 1:** Largemouth Bass are the primary sportfish in O.H. Ivie Reservoir and historically the reservoir has produced many trophy bass. During January-April 2010, eleven Largemouth Bass over 13 lbs. were entered in the Sharelunker Program, including the lake record at 16.08 lbs. More recently in 2018, ten Largemouth Bass were entered for the Lunker Class Level (8+ lbs.) and two for the Elite Class Level (10+lbs.) in the Sharelunker Program. Continued monitoring and management of this important Largemouth Bass fishery is warranted.

MANAGEMENT STRATEGIES

1. Monitor the Largemouth Bass population and prey species with annual fall electrofishing surveys from 2018-2021.

2. Continue to request Florida Largemouth Bass stockings, pending adequate water levels and habitat, to enhance year-class strength and improve Florida genetics within the population.

3. Collect Largemouth Bass genetics in 2021.

4. Collect angler effort, catch rates, and harvest information during a full year creel survey from June 2019 to May 2020.

**ISSUE 2:** White Crappie are an important and popular sportfish in O.H. Ivie Reservoir. From 2006 to 2013 percent directed angler effort ranged from 1.6% to 10.1% and overall are the second most sought after species in the reservoir. However, trap nets have been ineffective at collecting quality data for crappie populations in O.H. Ivie Reservoir (Appendix C).

MANAGEMENT STRATEGIES

1. Discontinue trap netting in O.H. Ivie Reservoir due to poor catch rates.

2. Monitor the crappie populations through creel surveys. Collect angler effort, catch rate, and harvest information during a full year creel survey from June 2019 to May 2020.

**ISSUE 3:** A golden alga bloom occurred on the upper portion of O.H. Ivie Reservoir from March through May 2017 that affected approximately 10% of the reservoir and resulted in a fish kill. Golden alga had not previously been documented in this area. Monitoring of this reservoir for golden alga is warranted.

1. Add O.H. Ivie to the list of reservoirs to monitor for golden alga cell counts and toxicity.

2. Collect water samples in December and March annually to monitor for the present of golden alga.

**ISSUE 4:** 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.  Cooperate with the CRMWD to post appropriate signage at access points around the reservoir.

2.  Contact and educate marina owners about invasive species, and provide them with posters, literature, etc… so that they can in turn educate their customers.

3.  Educate the public about invasive species through the use of media and the internet.

4.  Make a speaking point about invasive species when presenting to constituent and user groups.

5.  Keep track of (i.e., map) existing and future inter-basin water transfers to facilitate potential invasive species responses.

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

Sport fish, forage fish, and other important fishes

Primary sport fishes in O.H. Ivie Reservoir include Largemouth Bass, Channel and Blue Catfish, Black and White Crappie, and White Bass. Known important forage species include Bluegill and Gizzard and Threadfin Shad.

Low-density fisheries

**Smallmouth Bass:** Smallmouth Bass are present in O.H. Ivie Reservoir, but electrofishing catch rates have been very low (< 2.0/h) and no directed angling effort has ever been documented. Sampling directed for Smallmouth Bass is not warranted, but fish encountered during sampling for other species will be recorded.

Survey objectives, fisheries metrics, and sampling objectives

**Largemouth Bass**: Largemouth Bass are the most popular sportfish in O.H. Ivie Reservoir. From 2006 to 2013 percent directed angler effort has ranged from 65.8% to 85.6% making them the most popular sportfish in the reservoir. O.H. Ivie has a history of producing Sharelunker bass and warrants significant sampling effort. Trend data on CPUE, size structure, and body condition have been collected annually from 1999-2013 and biennially since then with fall night-time electrofishing.  We will return to annual sampling in this reservoir with night electrofishing in the fall which will allow for determination of any large-scale changes in the Largemouth Bass population that may spur further investigation. Survey data from 2009 to 2017 indicates 16-50 stations would be needed to collect 50 stock size fish, while 12-30 stations would be needed to achieve an RSE ≤25 with 80% confidence. Sampling objectives for O.H. Ivie Reservoir are to collect 50 stock size fish and achieve a CPUE-Stock RSE ≤25. A minimum of 24 randomly selected 5-min electrofishing sites will be sampled in fall annually from 2018 to 2021. Exclusive of the original 24 random stations, another 12 random stations will be determined in the event some extra sampling is necessary.  A maximum of 36 stations will be sampled. Relative weight of Largemouth Bass ≥ 8 inches will be determined from their length/weight data. A genetic sample of 30 fish will be collected

during electrofishing in 2021. A creel survey in 2019-2020 will collect angler effort, catch rate, and harvest information.

**Crappie:** Black and White Crappie are both present in O.H. Ivie Reservoir. From 2006 to 2013 percent directed angler effort ranged from 1.6% to 10.1% making them the second most sought-after species in the reservoir. From 2003 to 2017 total trap net catch rates ranged from 1.8 to 10.1 fish/nn. Trap netting has been ineffective at collecting adequate numbers of crappie to assess trends in size structure or abundance. Trap netting will be discontinued in O.H. Ivie Reservoir, however, information on angler effort, catch rate, and harvest information for crappie will be collected during a creel survey in 2019-2020.

**White Bass:** White Bass are present in the reservoir and from 2006 to 2013 percent directed angler effort ranged from 1.2% to 10.6% making them the third most sought-after species in the reservoir. Gill net data from 2002 to 2018 indicate 13-66 stations would be needed to achieve an RSE ≤25, while 9-21 gill net stations would be needed to collect at least 50 stock size fish. Objectives for White Bass will be to collect 50 stock size fish to estimate size structure. We will set 15 gill net nights in spring 2022, but no additional sets will be made if objectives are not met in 15 nets. Relative weight of White Bass ≥ 5 inches will be determined from their length/weight data.

**Catfish:** Blue, Channel, and Flathead Catfish are all present in O.H. Ivie Reservoir. Collectively, catfish are the fourth most sought after species in the reservoir, ranging from 0.5 to 3.5% of the directed effort from 2006 to 2013. Several guide services targeting catfish operate on O.H. Ivie Reservoir and social media posts indicate large Blue and Flathead Catfish are caught regularly. However, gill nets have been ineffective at collecting sufficient numbers of fish for estimates of size structure and relative abundance. Past low-frequency electrofishing efforts have also been ineffective at collecting sufficient numbers of Blue and Flathead Catfish. The amount of sampling effort needed to achieve objectives for size structure and relative abundance is not reasonable. The sampling effort for White Bass, 15 gill net nights, will be sufficient to collect length and weight data on all catfish species encountered. However, no extra effort will be made to collect catfish species.

**Forage**: Sunfish, Gizzard Shad, and Threadfin Shad are important forage fish in O.H. Ivie Reservoir. From 2004 to 2017 total catch rates of Bluegill have ranged from 63.5 fish/h to 269.0 fish/h while Gizzard Shad have ranged from 66.0 fish/h to 269.3 fish/h. Threadfin Shad are present in lower abundance with 11.0/h in 2017, 12.7/h in 2013, and 15.5 fish/hr in 2009. Continuation of sampling, as per Largemouth Bass above, will allow for monitoring of large-scale changes in Bluegill 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 for size structure estimation (PSD; 50 fish minimum with 80% confidence) and relative abundance estimates (RSE < 25 of CPUE-Total). At the sampling effort needed to achieve sampling objectives for Largemouth Bass, the expected RSE for CPUE-T is < 20. If the target for Bluegill sampling is not attained, no additional effort will be expended to achieve an RSE≤25 for CPUE of Bluegill.

**Golden Alga**: Collect water samples in December and March as part of routine golden alga monitoring. Additional samples will be collected if initial samples indicate elevated cell counts, toxicity, or if fish kills are reported.

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# Tables and Figures
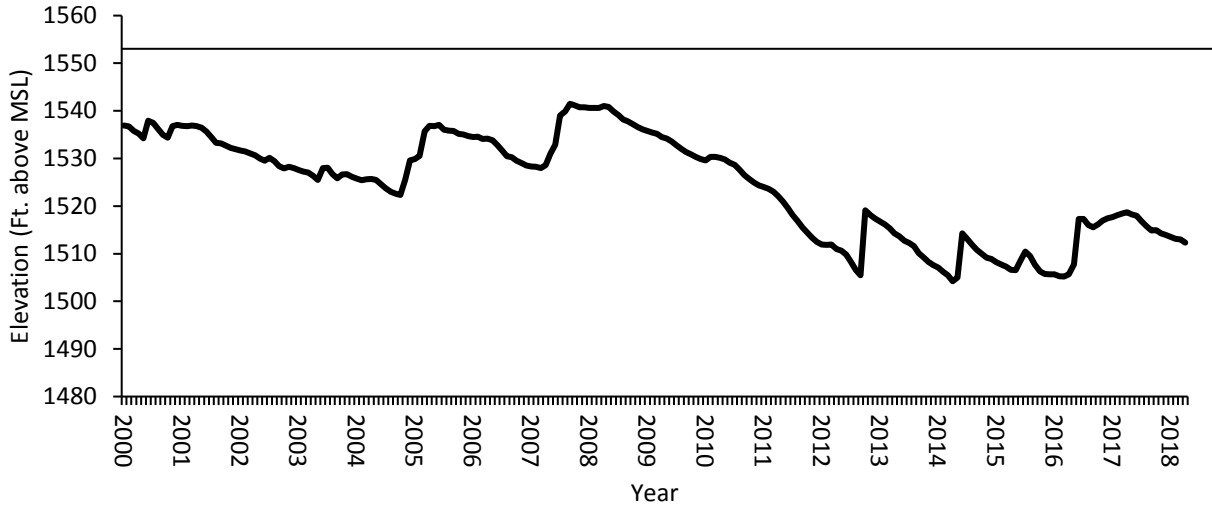


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for O.H. Ivie Reservoir, Texas. Horizontal line indicates conservation pool of 1551.5 feet above MSL.

Table 1. Characteristics of O.H. Ivie Reservoir, Texas.

| Characteristic | Description |
|---|---|
| Year constructed | 1990 |
| Controlling authority | Colorado River Municipal Water District |
| County | Concho, Runnels, and Coleman |
| Reservoir type | Main-stem of the Colorado and Concho Rivers |
| Shoreline Development Index | 10.6 |
| Conductivity | 1,500-2,000 µS/cm |

Table 2. Boat ramp characteristics for O.H. Ivie Reservoir, Texas, September, 2017.  Reservoir elevation at time of survey was 1,514 feet above mean sea level.

| Boat ramp | Latitude Longitude (dd) | Public | Parking capacity (N) | Elevation at end of boat ramp (ft) | Condition |
|---|---|---|---|---|---|
| Kennedy | 31.53118 -99.64046 | Y | 110 | 1,500 | Excellent, no access issues |
| Concho (west) | 31.55526 -99.71170 | Y | 110 | 1,505 | Excellent, no access issues |
| Concho (southwest) | 31.55405 -99.71131 | Y | (shared with Concho west) | 1,530 | Out of water. Extension is not feasible |
| Padgitt | 31.57672 -99.67858 | Y | 85 | 1,504 | Excellent, no access issues |

Table 3. Harvest regulations for O.H. Ivie Reservoir, 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, Smallmouth | 5 | 14-inch minimum |
| Bass, Largemouth | 5 (only 2 may be < 18 inches) | None |
| 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, Smallmouth Bass, Spotted Bass, and Guadalupe Bass = 5 fish in any combination.

Table 4. Stocking history of O.H. Ivie Reservoir, Texas.  FRY = fry; FGL = fingerling; ADL = adults.

| Species | Year | Number | Size |
|---|---|---|---|
| Threadfin Shad | 1990 | 300 | ADL |
| Coppernose Bluegill | 1990 | 332,548 | FGL |
| Bluegill | 1991 | 103,335 | FGL |
| | 2016 | 59,482 | FGL |
| | Species Total | 162,817 | |
| Blue Catfish | 1990 | 194,510 | FGL |
| | 1991 | 192,381 | FGL |
| | Species Total | 386,891 | |
| Channel Catfish | 1990 | 195,561 | FGL |
| | 1991 | 194,875 | FGL |
| | 1996 | 250 | ADL |
| | 1999 | 250 | ADL |
| | Species Total | 390,936 | |
| Flathead Catfish | 1990 | 3,013 | FRY |
| Smallmouth Bass | 1990 | 120,802 | FGL |
| Florida Largemouth Bass | 1989 | 3,610 | FGL |
| | 1990 | 495,845 | FRY |
| | 1991 | 1,920,593 | FGL |
| | 1991 | 633 | ADL |
| | 1992 | 50 | ADL |
| | 1999 | 31,496 | FGL |
| | 1999 | 250 | ADL |
| | 2001 | 19,968 | FGL |
| | 2010 | 267,201 | FGL |
| | 2014 | 383,483 | FGL |
| | 2016 | 193,113 | FGL |
| | 2017 | 185,701 | FGL |
| | Species Total | 2,694,168 | |
| Sharelunker Largemouth Bass | 2010 | 8,143 | FGL |
| | 2011 | 34,064 | FGL |
| | 2012 | 3,271 | FGL |
| | Species Total | 45,478 | |

Table 4. Stocking history. Continued.

| Species | Year | Number | Size |
|---|---|---|---|
| White Crappie | 1990 | 122,638 | FGL |
|  | 1991 | 183,661 | FGL |
|  | Species Total | 306,299 |  |
|  |  |  |  |
| Walleye | 1991 | 2,495,000 | FRY |
|  | 1992 | 860,000 | FRY |
|  | 1994 | 400,000 | FRY |
|  | Species Total | 3,755,000 |  |

Table 5. Objective-based sampling plan components for O.H. Ivie Reservoir, 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 |
| | 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 | PSD, length frequency | N ≥ 50 |
| | Prey availability | IOV | N ≥ 50 |
| *Gill Netting* | | | |
| Blue catfish | Size structure | Length frequency | N ≥ 50 stock |
| | Condition | $W_r$ | 10 fish/inch group (max) |
| Channel Catfish | Size structure | Length frequency | N ≥ 50 stock |
| | Condition | $W_r$ | 10 fish/inch group (max) |
| Flathead Catfish | Size structure | Length frequency | N ≥ 50 stock |
| | Condition | $W_r$ | 10 fish/inch group (max) |
| White Bass | Size structure | PSD, Length frequency | N ≥ 50 stock |
| | Condition | $W_r$ | 10 fish/inch group (max) |
| | Age-and-growth | Age at 10 inches | N = 13, 9.0 – 10.9 inches |
| *Trap netting* | | | |
| Crappie | Size structure | PSD, length frequency | N = 50 |
| | Age-and-growth | Age at 10 inches | N = 13, 9.0 – 10.9 inches |

[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 aquatic vegetation, O.H. Ivie Reservoir, Texas, 2014–2017.  Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

| Vegetation | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Native submersed | | | | 555.0 (9.7) |
| Native floating-leaved | | | | 0 (0) |
| Native emergent | | | | < 1.0 (0.1) |
| Non-native | | | | |
|    Hydrilla (Tier III)* | 0.0 | 0.0 | 0.0 | < 1.0 (0.1) |

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

# Gizzard Shad

## 2013

Effort = 1.5
Total CPUE = 269.3 (27; 404)
IOV = 71 (12)

## 2015

Effort = 1.5
Total CPUE = 92.0 (21; 138)
IOV = 54 (13)

## 2017

Effort = 2.0
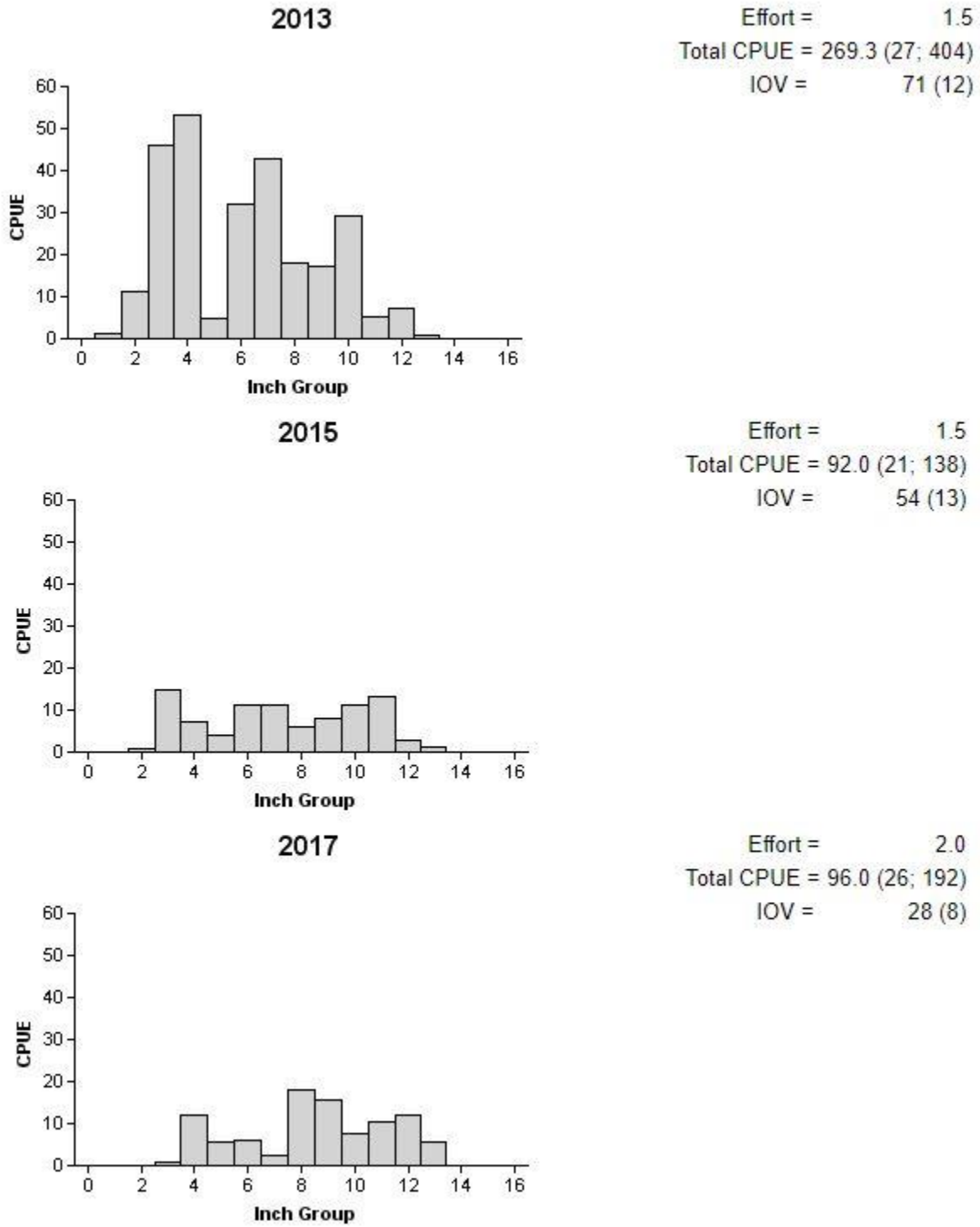Total CPUE = 96.0 (26; 192)
IOV = 28 (8)

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, O.H. Ivie Reservoir, Texas, 2013, 2015, and 2017.

# Bluegill

### 2013



Effort =                          1.5
Total CPUE = 74.7 (20; 112)
         PSD =                49 (8)

### 2015



Effort =                          1.5
Total CPUE = 69.3 (39; 104)
         PSD =                30 (7)

### 2017

Effort =                          2.0
Total CPUE = 269.0 (15; 538)
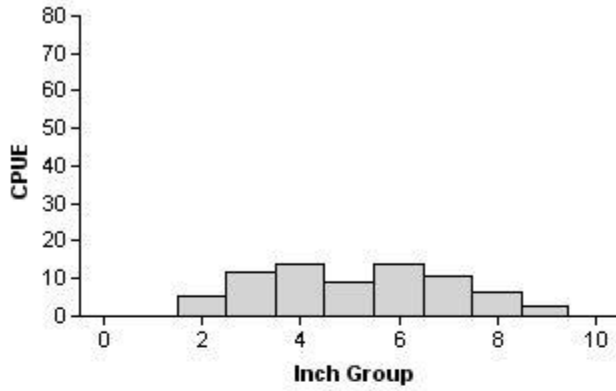         PSD =                22 (3)
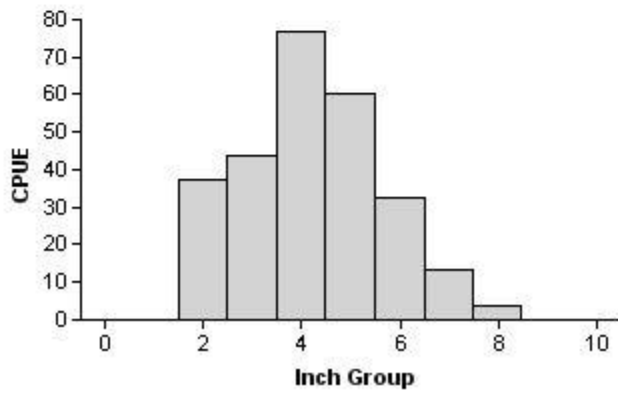


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, O.H. Ivie Reservoir, Texas, 2013, 2015, and 2017.
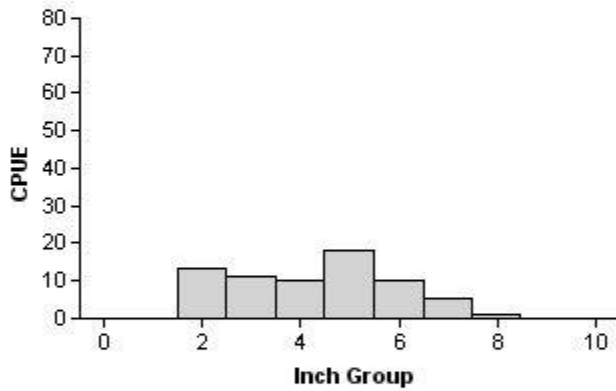
# Blue Catfish

### 2010

Effort = 15.0
Total CPUE = 0.6 (36; 9)
Stock CPUE = 0.6 (36; 9)



### 2014

Effort = 5.0
Total CPUE = 5.4 (22; 27)
Stock CPUE = 5.2 (25; 26)



### 2018

Effort = 15.0
Total CPUE = 1.9 (22; 28)
Stock CPUE = 1.9 (22; 28)



Figure 4. Number of Blue Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE are in parentheses) for spring gill net surveys, O.H. Ivie Reservoir, Texas, 2010, 2014, and 2018. Vertical line indicates minimum length limit.

# Channel Catfish

### 2010



Effort = 15.0
Total CPUE = 1.4 (37; 21)
Stock CPUE = 1.3 (40; 20)

### 2014



Effort = 5.0
Total CPUE = 0.6 (41; 3)
Stock CPUE = 0.6 (41; 3)

### 2018



Effort = 15.0
Total CPUE = 0.9 (34; 13)
Stock CPUE = 0.6 (39; 9)

Figure 5. Number of Channel Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE are in parentheses) for spring gill net surveys, O.H. Ivie Reservoir, Texas, 2010, 2014, and 2018. Vertical line indicates minimum length limit.

# White Bass

### 2010

Effort = 15.0
Total CPUE = 4.7 (20; 70)
CPUE-10 = 3.1 (21; 47)
PSD = 67 (7)
PSD-P = 37 (7)

### 2014

Effort = 5.0
Total CPUE = 8.0 (43; 40)
CPUE-10 = 6.8 (50; 34)
PSD = 88 (4)
PSD-P = 80 (5)

### 2018

Effort = 15.0
Total CPUE = 6.2 (22; 93)
CPUE-10 = 5.7 (23; 85)
PSD = 95 (2)
PSD-P = 59 (8)
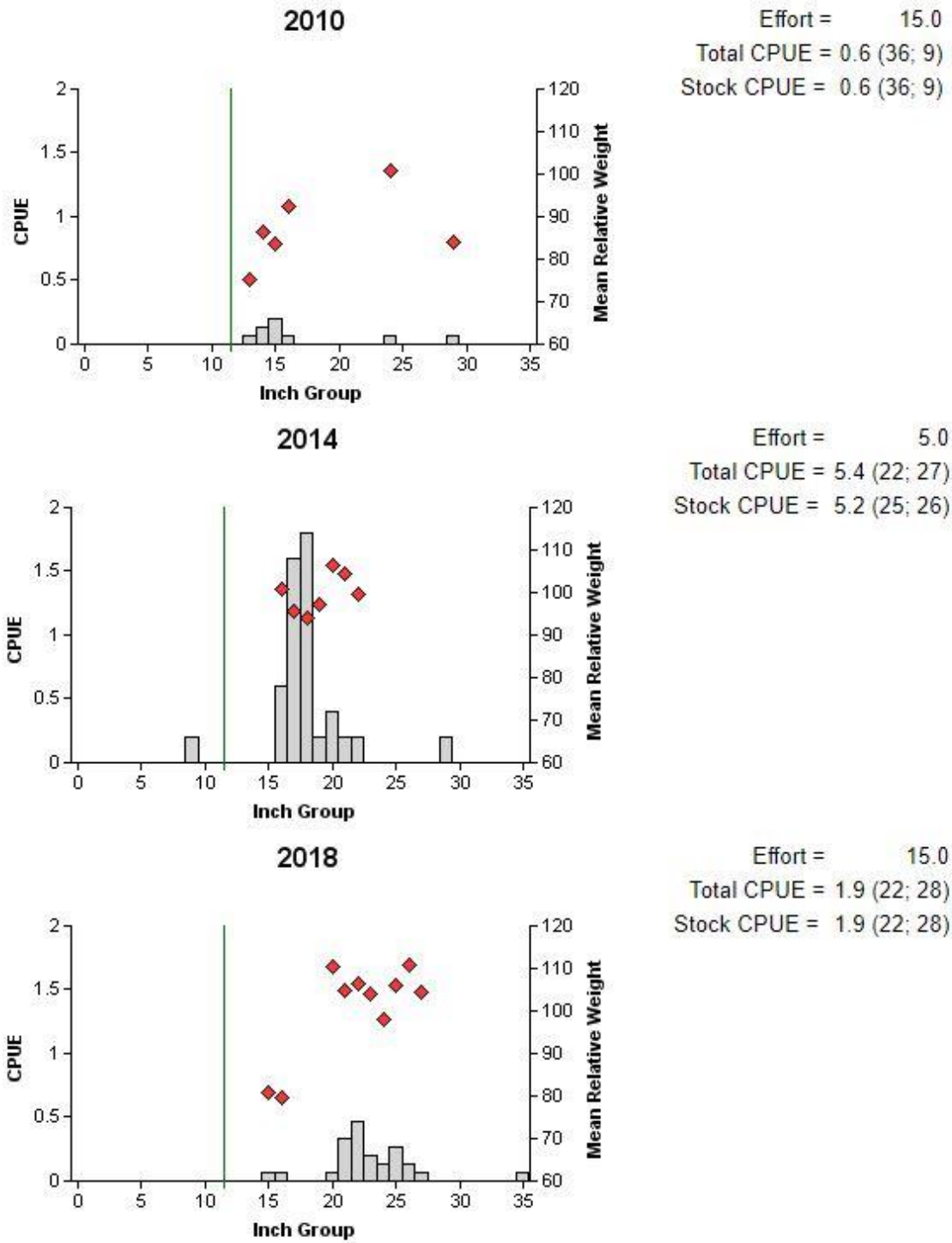
Figure 6. Number of White Bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, O.H. Ivie Reservoir, Texas, 2010, 2014, and 2018. Vertical line indicates minimum length limit.
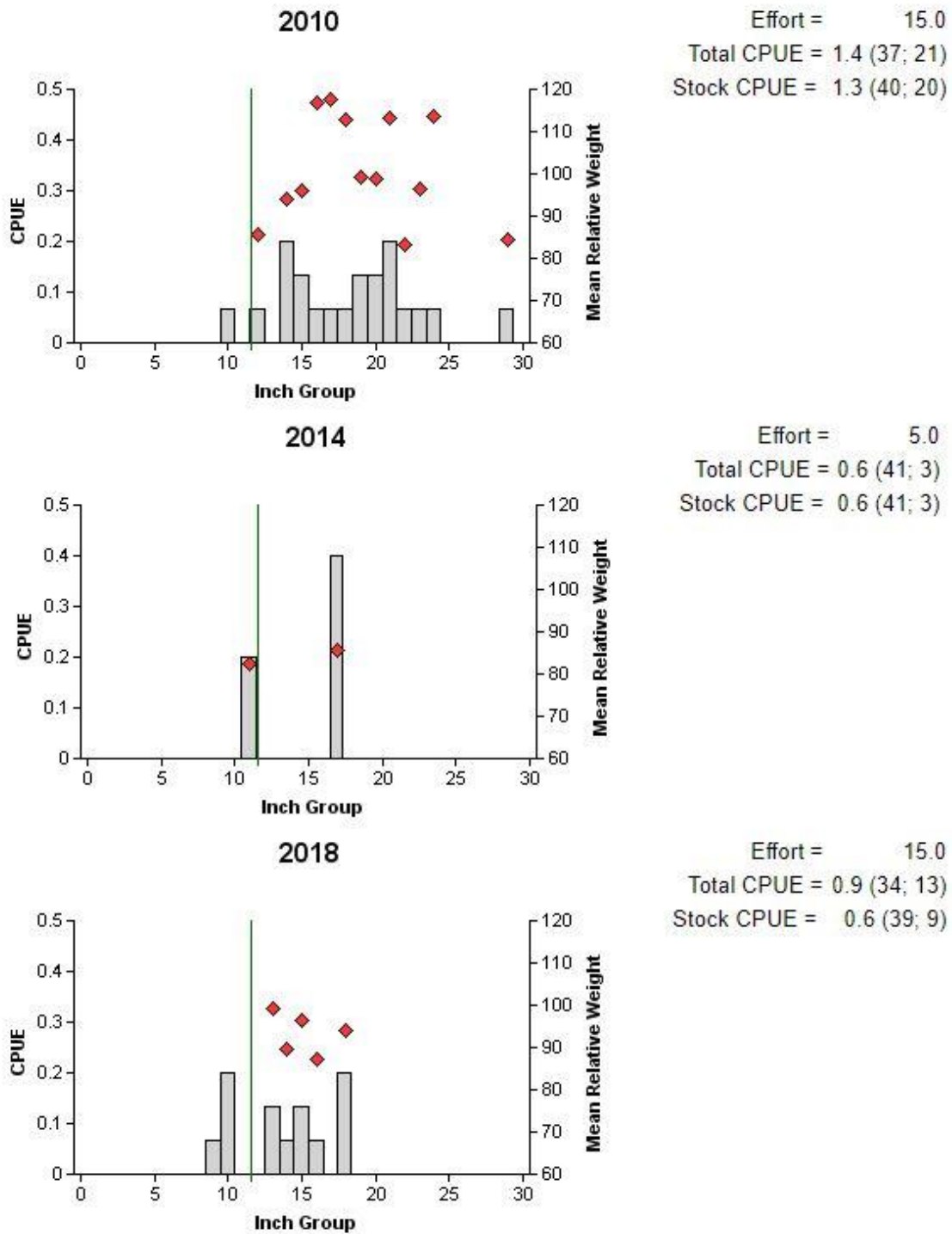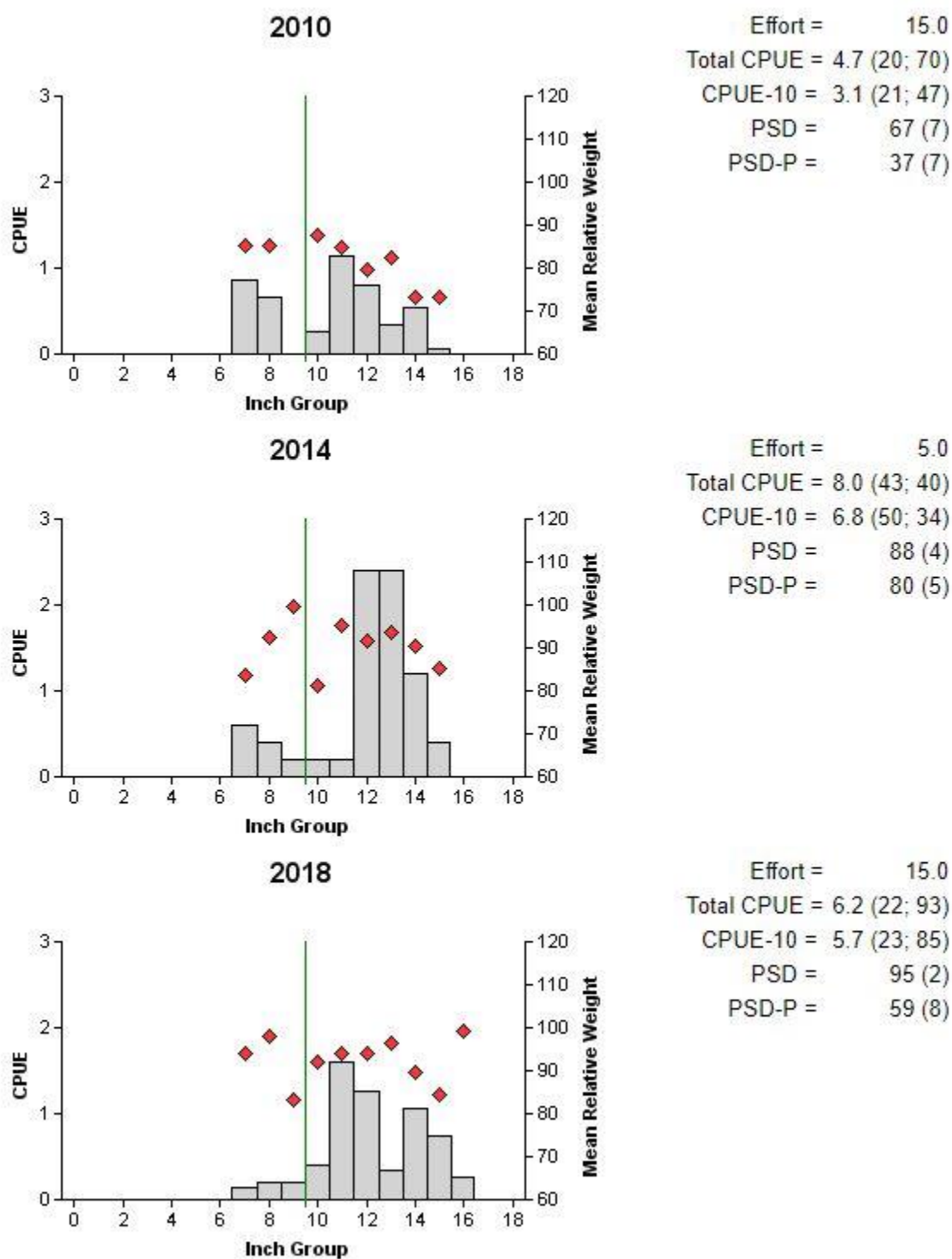
# Largemouth Bass

## 2013



Effort = 1.5
Total CPUE = 63.3 (20; 95)
Stock CPUE = 24.7 (19; 37)
CPUE-18 = 0.7 (100; 1)
PSD = 49 (8)
PSD-P = 22 (7)
PSD-M = 3 (3)

## 2015



Effort = 1.5
Total CPUE = 45.3 (28; 68)
Stock CPUE = 16.0 (30; 24)
CPUE-18 = 2.0 (54; 3)
PSD = 33 (9)
PSD-P = 12 (8)
PSD-M = 4 (4)

## 2017



Effort = 2.0
Total CPUE = 100.5 (12; 201)
Stock CPUE = 62.0 (11; 124)
CPUE-18 = 2.5 (50; 5)
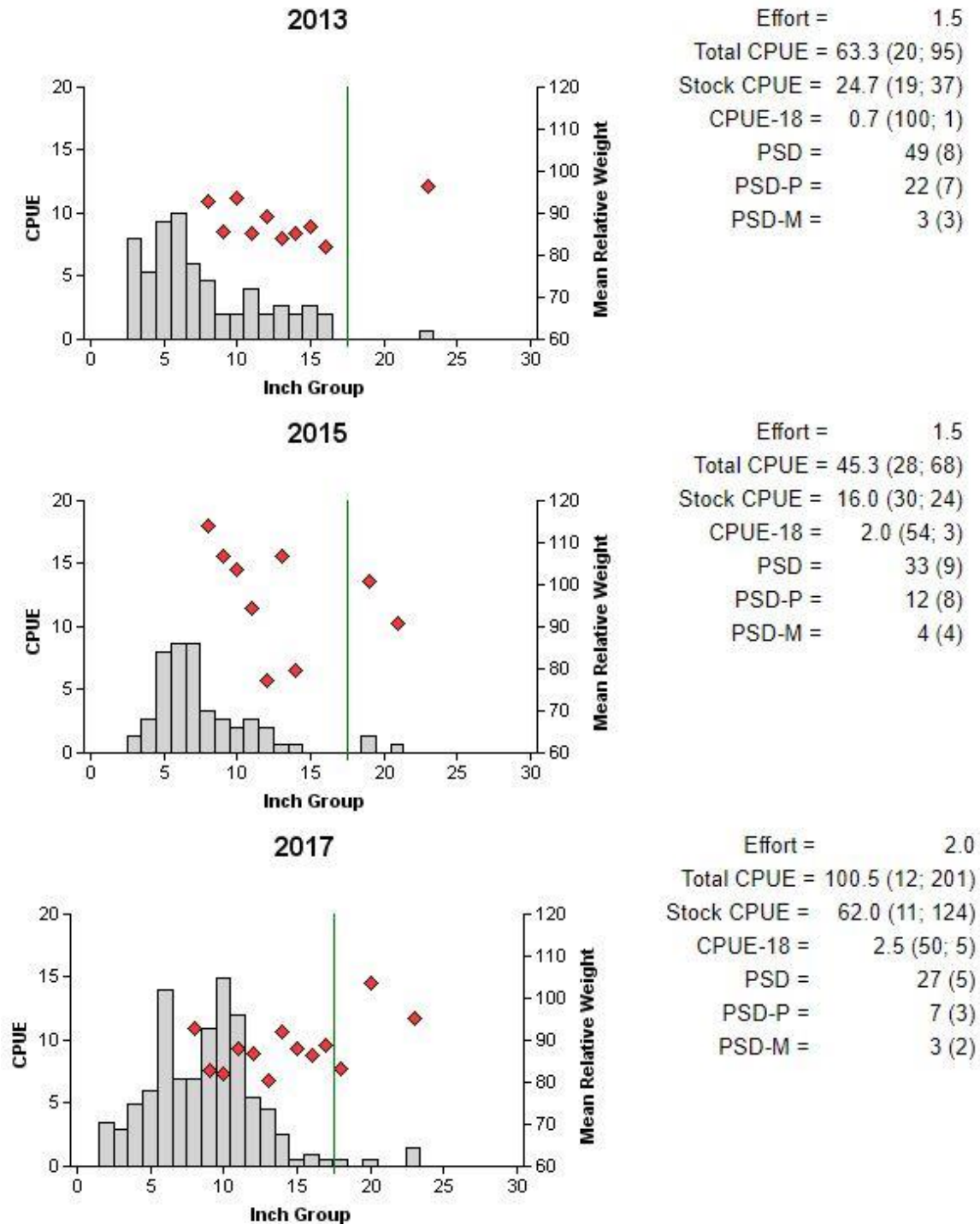PSD = 27 (5)
PSD-P = 7 (3)
PSD-M = 3 (2)

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, O.H. Ivie Reservoir, Texas, 2013, 2015, and 2017. Vertical line represents the length limit demarcation.

Table 7. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, O.H. Ivie Reservoir, Texas, 2004, 2005, 2013, and 2017.  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.

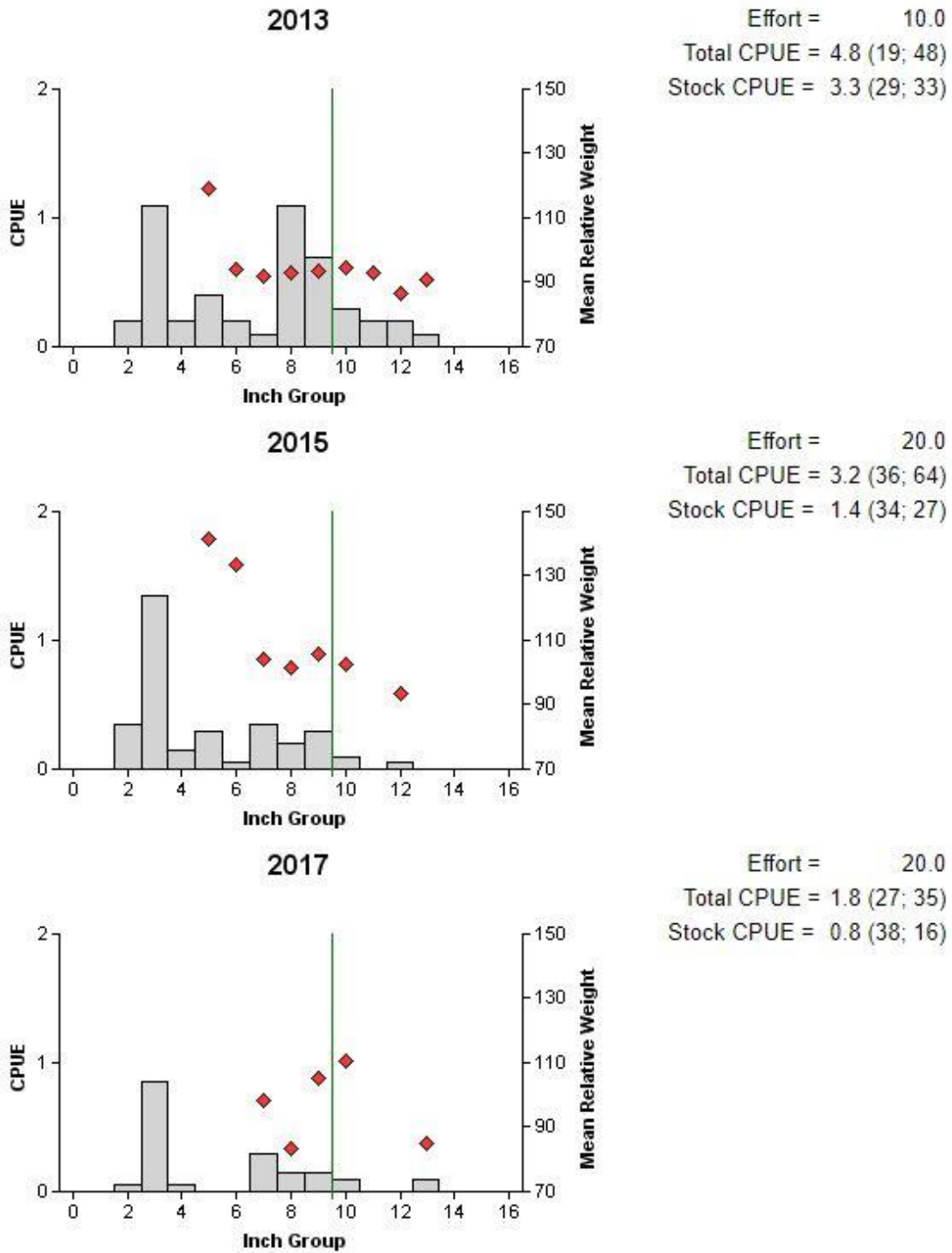| Year | Sample size | Number of fish | | | % FLMB alleles | % FLMB |
| | | FLMB | Intergrade | NLMB | | |
| --- | --- | --- | --- | --- | --- | --- |
| 2004 | 30 | 17 | 12 | 0 | 86 | 59 |
| 2005 | 95 | 23 | 72 | 0 | 76 | 24 |
| 2013 | 30 | 5 | 25 | 0 | 85 | 17 |
| 2017 | 30 | 5 | 24 | 1 | 76 | 17 |

# White Crappie

## 2013

## 2015

## 2017

Figure 8. Number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE are in parentheses) for fall trap netting surveys, O.H. Ivie Reservoir, Texas, 2013, 2015, and 2017.  Vertical line indicates minimum length limit.

# Proposed Sampling Schedule

Table 8.  Proposed sampling schedule for O.H. Ivie 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 | | | |
|---|---|---|---|---|
| | 2018-2019 | 2019-2020 | 2020-2021 | 2021-2022 |
| Angler Access | | | | S |
| Structural Habitat | | | | |
| Vegetation | A | A | A | S |
| Electrofishing – Fall | A | A | A | S |
| Electrofishing – Spring | | | | |
| Electrofishing – Low frequency | | | | |
| Trap netting | | | | |
| Gill netting | | | | S |
| Baited tandem hoop netting | | | | |
| 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 O.H. Ivie Reservoir, Texas, 2017-2018.  Sampling effort was 15 net nights for gill netting, 20 net nights for trap netting, and 2 hours for electrofishing.

| Species | Gill Netting | | Trap Netting | | Electrofishing | |
|---|---|---|---|---|---|---|
| | N | CPUE | N | CPUE | N | CPUE |
| Gizzard Shad | | | | | 192 | 96.0 (26) |
| Threadfin Shad | | | | | 22 | 11.0 (43) |
| Blue Catfish | 28 | 1.9 (22) | | | | |
| Channel Catfish | 13 | 0.9 (34) | | | | |
| Flathead Catfish | 2 | 0.1 (68) | | | | |
| White Bass | 93 | 6.2 (22) | | | | |
| Green Sunfish | | | | | 1 | 0.5 (100) |
| Warmouth | | | | | 31 | 15.5 (27) |
| Bluegill | | | | | 538 | 269.0 (15) |
| Longear Sunfish | | | | | 32 | 16.0 (35) |
| Redear Sunfish | | | | | 3 | 1.5 (55) |
| Smallmouth Bass | | | | | 2 | 1.0 (69) |
| Largemouth Bass | | | | | 201 | 100.5 (12) |
| White Crappie | | | 35 | 1.8 (27) | | |
| Black Crappie | | | 9 | 0.5 (34) | | |

# APPENDIX B – Map of sampling locations



Location of sampling sites, O.H. Ivie Reservoir, Texas, 2017-2018. Trap net, gill net, and electrofishing stations are indicated by T, G, and E, respectively. Water level was approx. 37 feet below full pool at time of sampling. Dashed line indicates water's edge at time of sampling.

# APPENDIX C – Historical catch rates and size structure

Largemouth Bass – Fall Electrofishing

|  | 1996 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2015 | 2017 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total CPUE | 44.0 | 94.5 | 72.5 | 61.5 | 70.0 | 17.0 | 66.8 | 82.4 | 59.5 | 132.0 | 67.0 | 46.0 | 146.5 | 60.0 | 22.7 | 63.3 | 45.3 | 100.5 | 69.5 |
| Stock CPUE | 37.5 | 35.5 | 40.2 | 32.0 | 21.0 | 8.5 | 17.3 | 47.6 | 40.0 | 31.9 | 43.0 | 24.5 | 45.5 | 28.7 | 14.0 | 24.7 | 16.0 | 62.0 | 31.7 |
| CPUE-18 | 2.0 | 2.5 | 3.1 | 1.5 | 0.5 | 0.5 | 0.8 | 2.0 | 1.0 | 1.9 | 5.5 | 3.0 | 4.5 | 2.7 | 3.3 | 0.7 | 2.0 | 2.5 | 2.2 |
| PSD | 79 | 69 | 64 | 64 | 67 | 65 | 50 | 33 | 55 | 46 | 56 | 80 | 55 | 60 | 86 | 49 | 33 | 27 | 57.7 |
| PSD-P | 20 | 32 | 30 | 22 | 19 | 35 | 24 | 9 | 21 | 29 | 33 | 29 | 31 | 30 | 43 | 22 | 12 | 7 | 24.9 |
| PSD-M | 4 | 3 | 1 | 2 | 2 | 0 | 0 | 3 | 2 | 0 | 2 | 4 | 3 | 2 | 24 | 3 | 4 | 3 | 3.4 |

Gizzard Shad – Fall Electrofishing

|  | 1996 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2015 | 2017 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total CPUE | 164.0 | 242.0 | 292.2 | 177.5 | 67.0 | 205.0 | 126.8 | 126.0 | 88.5 | 66.0 | 98.5 | 164.5 | 136.5 | 190.7 | 111.3 | 269.3 | 92.0 | 96.0 | 150.8 |
| IOV | 52 | 75 | 85 | 73 | 40 | 67 | 40 | 51 | 7 | 72 | 7 | 36 | 19 | 41 | 57 | 71 | 54 | 28 | 48.6 |

Bluegill – Fall Electrofishing

|  | 1996 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2015 | 2017 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total CPUE | 31.5 | 158.0 | 78.3 | 79.5 | 155.5 | 107.0 | 177.8 | 120.8 | 216.0 | 76.5 | 163.5 | 63.5 | 165.5 | 102.7 | 106.0 | 74.7 | 69.3 | 269.0 | 123.1 |
| PSD | 25 | 10 | 17 | 26 | 27 | 16 | 29 | 23 | 12 | 52 | 28 | 17 | 27 | 33 | 47 | 49 | 30 | 22 | 27.2 |

White Crappie – Fall Trap Netting

|  | 1996 | 1999 | 2001 | 2003 | 2005 | 2009 | 2011 | 2013 | 2015 | 2017 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Total CPUE | 2.0 | 3.1 | 7.3 | 7.9 | 10.7 | 1.9 | 4.0 | 4.8 | 3.2 | 1.8 | 4.7 |
| Stock CPUE | 1.3 | 1.9 | 4.8 | 2.3 | 0.8 | 1.1 | 2.4 | 3.3 | 1.4 | 0.8 | 2.0 |

Catfishes – Spring Gill Netting

|  | 1996 | 1999 | 2002 | 2006 | 2010 | 2014 | 2018 | Average |
|---|---|---|---|---|---|---|---|---|
| Blue Catfish - Total CPUE | 0.6 | 0.1 | 0.4 | 0.3 | 0.6 | 5.4 | 1.9 | 1.3 |
| Channel Catfish - Total CPUE | 2.6 | 1.1 | 0.5 | 1.2 | 1.4 | 0.6 | 0.9 | 1.2 |
| Flathead Catfish - Total CPUE | 0.7 | 0.5 | 0.3 | 0.1 | 0.2 | 0.6 | 0.1 | 0.4 |

White Bass – Spring Gill Netting

|  | 1996 | 1999 | 2002 | 2006 | 2010 | 2014 | 2018 | Average |
|---|---|---|---|---|---|---|---|---|
| Total CPUE | 4.0 | 3.7 | 7.3 | 3.3 | 4.7 | 8.0 | 6.2 | 5.3 |
| PSD | 73 | 79 | 72 | 66 | 67 | 88 | 95 | 77.1 |
| PSD-P | 62 | 25 | 45 | 40 | 37 | 80 | 59 | 49.7 |

# APPENDIX D – Relationship between water level fluctuations and Largemouth Bass relative weights
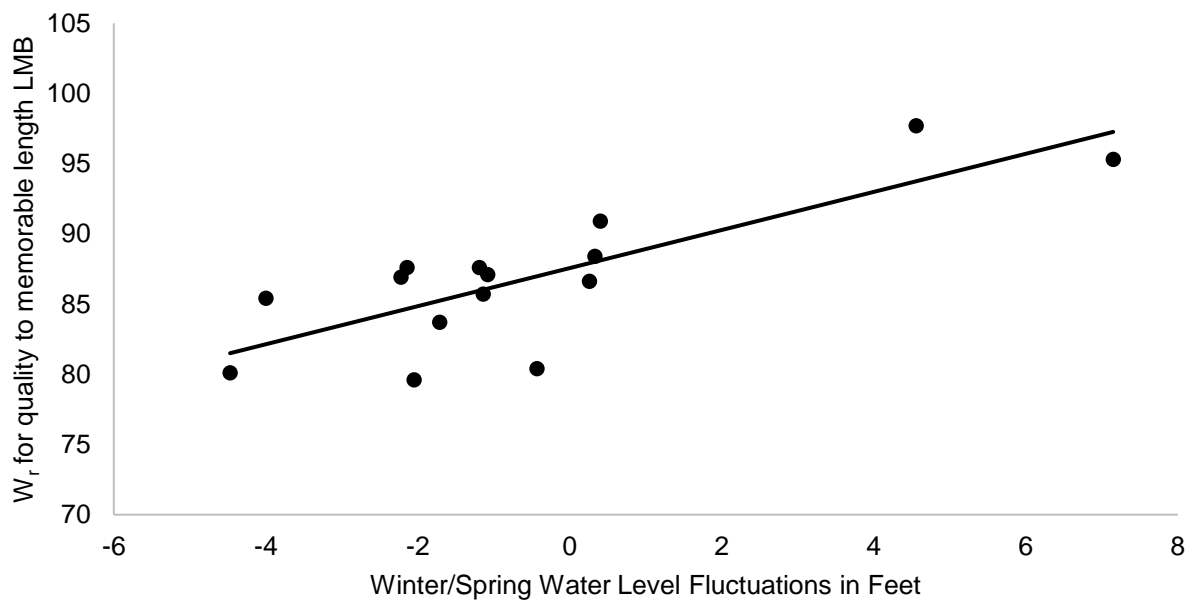


Relationship between winter/spring (January-June) water level fluctuations and mean relative weights ($W_r$) of Largemouth Bass from quality to memorable length (12 to 20 inches) in O.H. Ivie Reservoir collected during fall electrofishing from 2001-2017. ($P < 0.01$, $r^2 = 0.63$).

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