Highlands Reservoir

2023 Fisheries Management Survey Report

PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

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INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

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Survey and Management Summary

Fish populations in Highlands Reservoir were surveyed in 2024 using tandem hoop netting. Historical data are presented with the 2020-2024 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: Highlands Reservoir is a 498-acre impoundment and canal system located in Harris County east of Highlands, Texas. It lies on Goose Creek in the San Jacinto River Basin and is located approximately 1 mile upstream from McNair, Texas and two miles north of Interstate 10. The reservoir is used for water supply and was opened to public fishing in 2015. Highlands Reservoir has high turbidity. Habitat features consist of standing timber, riprap, and overhanging brush.

Management History: Highlands Reservoir was opened to the public for fishing in 2015. Prior to 2015 the San Jacinto River Authority (SJRA) managed the reservoir based on water supply needs. Important sport fish include Channel Catfish, Blue Catfish and White Crappie.

Fish Community

- **Prey species:** Prey species in Highlands Reservoir included Gizzard Shad, Bluegill, and Longear Sunfish.
- **Catfishes:** Blue and Channel Catfish are present in Highlands Reservoir; however, seemingly in low abundance,
- **Largemouth Bass:** Few Largemouth Bass have been collected during sampling, but those collected were in good condition.
- **White Crappie:** White Crappie were abundant with harvestable fish available to anglers.

Management Strategies: Highlands Reservoir has existing fisheries for White Crappie, Blue, and Channel Catfish. Due to lack of boat access, lack of aquatic fish habitat, shallow depths, and the primary function of the reservoir not being conducive to active fisheries management, Highlands Reservoir will be removed from the 4-year sampling rotation. Habitat improvements should be made to support production of Largemouth Bass, crappie, and sunfish. Exotic vegetation is present and will be monitored and controlled if necessary.

Introduction

This document is a summary of fisheries data collected from Highlands Reservoir from 2020-2024. The purpose of the document is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2020-2024 data for comparison.

Reservoir Description

Highlands Reservoir is a 498-acre impoundment east of Highlands, Texas in Harris County controlled by the San Jacinto River Authority (SJRA). Highlands reservoir was constructed by the Federal Works Agency in 1943. The reservoir is made up of 3 components: a lower section, an upper section, and a canal system that runs a total of 28 miles (Figure 1). The regularly inundated lower section is 498 acres, the upper section and lower section combined are 518 acres, which expands during highwater to 1,440 acres with a normal capacity of about 3,800 acre-feet. Only the lower section is accessible by boat and all fisheries data presented in this report were collected there. Water is primarily used for municipal and industrial water supply and the reservoir experiences high exchange rates of turbid water and regular fluctuations of water level. The reservoir was opened to the public in 2015 for recreational use. Habitat at time of sampling consisted of riprap, standing timber, and overhanging brush. Other descriptive characteristics for Highlands Reservoir are presented in Table 1.

Angler Access

Highlands Reservoir does not have a boat ramp, but non-motorized watercraft are allowed to launch from shore. Fishing is allowed from the shoreline, and the southern half has maintained shoreline access; the northern half has limited bank access.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Best and Ragan-Harbison 2020) included:

1. Promote the Highlands Reservoir crappie fishery using traditional and social media outlets.

   Action: The reservoir was closed to the public for canal repairs from March 2022-October 2023. These management efforts were not completed over the 2020-2024 sampling period.

2. Improve structural and vegetative habitat in the lower portion of Highlands Reservoir.

   Action: The reservoir was closed to the public for canal repairs from March 2022-October 2023. These management efforts were not completed over the 2020-2024 sampling period.

Harvest regulation history: There is no previous harvest regulation history. The reservoir is currently managed under statewide regulations (Table 2).

Stocking history: Grass Carp were stocked in 2008, 2011, and 2015 by SJRA to control hydrilla in the canal system. Bluegill were stocked in 2016 and Florida Largemouth Bass were stocked in 2016 and 2017 (Table 3).

Vegetation/habitat management history: Nuisance vegetation has been managed by SJRA with herbicide. The southern shoreline, composed primarily of riprap, has been treated for alligator weed as needed. A section of shoreline along the northern half of the reservoir is inaccessible and alligator weed is abundant along that edge. Triploid Grass Carp were stocked in 2008, 2011, and 2015 by SJRA for hydrilla control in the water supply canals. The controlling authority requires intensive vegetation management due to industrial and municipal water supply.

Water transfer: Highlands Reservoir is primarily used for municipal and industrial water supply within the San Jacinto River Basin. One permanent pumping station on Lake Houston supplies water to the canal system that feeds Highlands Reservoir. Control gates at the top of Highlands Reservoir control the amount of water flowing into the reservoir with another set of control gates at the bottom controlling the outflow to the rest of the canal system. The lower canals provide water for industrial customers.

Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Highlands Reservoir (Best and Ragan-Harbison 2020). Primary components of the OBS plan for 2023-2024 are listed in Table 4. All survey sites were randomly selected, and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2022).

Common names of fishes and their hybrids in this report are used following Page et al. (2023) with an exception for Largemouth Bass. While we recognize recent changes to black bass names, Texas reservoirs contain a mix of Florida Bass, Largemouth Bass, and their intergrade offspring. Therefore, Largemouth Bass is used in this report for simplicity as well as consistency with previous reports.

Tandem hoop nets – Channel Catfish were collected using 5 tandem hoop-net series at 5 stations. Nets were baited with soap and deployed for 2-night soak durations. CPUE for tandem hoop netting was recorded as the number of fish caught per tandem hoop net series (fish/series).

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 Neumann et al. (2012).

Habitat – Exotic vegetation surveys were conducted annually to monitor expansion of exotic vegetation and a complete vegetation survey was conducted in 2023. Vegetation was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2022).

Results and Discussion

Habitat: Due to no major changes to the reservoir, no structural habitat surveys were conducted between 2020-2023. Structural habitat was last evaluated in 2019 and littoral zone structural habitat consisted primarily of riprap and a mix of overhanging brush (Best and Ragan-Harbison 2020). Two acres of native emergent vegetation were observed in 2023. Non-native vegetation, including alligator weed and salvinia, covered less than 1% of the regularly inundated portion of the reservoir (Table 5). Historically, hydrilla has been present in the reservoir and connected canals, but none was observed in the reservoir in 2023. Triploid Grass Carp were stocked in 2015 and can move freely between the reservoir and canals. Due to SJRA's goal of maintaining unrestricted water flow, the presence of Triploid Grass Carp, and turbid water, opportunities for establishing beneficial aquatic habitat are limited.

Prey species: Forage species (e.g., shad and sunfish spp.) were not surveyed over this period. Per the 2019 OBS sampling plan, electrofishing surveys to monitor forage species will only be conducted if sunfish spawning habitat is added to Highlands Reservoir. Body conditions of Channel Catfish and White Crappie sampled in 2024 hoop net surveys were utilized to monitor for forage species presence, Channel Catfish had a mean relative weight of 91 while White Crappie had a mean relative weight on 97.1, indicating adequate forage is available.

Channel Catfish: Tandem hoop nets were used to collect Channel Catfish. The tandem hoop netting catch rate of Channel Catfish was 1.2/series in 2024. Five nets were set in water depth of 5 feet or more to reduce turtle mortality, no additional nets were set due to limited site availability with adequate water depth. The Channel Catfish population continued to have low relative abundance with an increase in the number of stock-sized fish in 2024 compared to the 2020 surveys (Figure 2).

White Crappie: Highlands Reservoir was not sampled for crappie using fall trap nets during the sampling period. White Crappie were collected during the 2024 and 2020 spring hoop net sampling and the data will be utilized for exploratory purposes. A total of 53 White Crappie were captured for a catch rate of 10.6/series, this is an increase compared to 6.2/series in 2020. CPUE-10 increased from 1.8/series in 2020 to 5.4/series in 2024, which indicates 51% of crappie sampled in 2024 were available for harvest compared to 29% in 2020. Relative weight was good for 2024 with an average of 97.1 for all the fish captured, the relative weight for fish 10 inches or larger was good with an average of 96 (Figure 3). White Crappie from sampling were not aged due sampling being conducted in the spring.

Fisheries Management Plan for Highlands Reservoir, Texas

Prepared – July 2024

ISSUE 1: Due to lack of boat access, lack of aquatic fish habitat, shallow depths, and the primary function of the reservoir not being conducive to active fisheries management, Highlands Reservoir will be removed from the 4-year sampling rotation.

MANAGEMENT STRATEGY

1. Meet with SJRA officials to discuss interest in developing proper boating access through the TPWD Boater Access Program.
2. Highlands Reservoir will remain open to the public for angling and paddling access; therefore, fisheries management activities will be revisited should conditions improve.

ISSUE 2: Highlands Reservoir represents a unique crappie fishery located in the Greater Houston area and does not require a watercraft to access the fish.

MANAGEMENT STRATEGY

1. Continue to promote crappie fishing opportunities at Highlands Reservoir through traditional and social media outlets.

ISSUE 3: Highlands Reservoir is habitat limited, likely reducing angler success and fish recruitment. Littoral habitat improvements would support consistent fish recruitment and angler catch rates.

MANAGEMENT STRATEGY

1. Work with SJRA to increase structural habitat in the lower portion of the lake within casting distance of shore to concentrate fish for anglers to target.

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 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 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 controlling authority to post appropriate signage at access points around the reservoir.
2. Educate the public about invasive species through the use of media and the internet.
3. Make a speaking point about invasive species when presenting to constituent and user groups.
4. Keep track of (i.e., map) existing and future interbasin water transfers to facilitate potential invasive species responses.

Objective-Based Sampling Plan and Schedule (2024–2028)

Sport fish, forage fish, and other important fishes

Sport fishes in Highlands Reservoir include Blue Catfish, Channel Catfish, and White Crappie. Forage species include Gizzard Shad, Bluegill, and Longear Sunfish.

Low-density fisheries

Largemouth Bass: Largemouth Bass are present in low abundance in Highlands Reservoir. The catch per unit effort for Largemouth Bass was 3.0/h in 2015 and 6.0/h in 2019. In 2016, a bass-only survey was conducted to determine Florida-strain influence in the Largemouth Bass population at Highlands Reservoir: the CPUE-Total was 8.0/h at biologist selected stations. Anecdotal information from anglers indicated few anglers target Largemouth Bass. Electrofishing surveys were discontinued in 2019 due to consistent low catch rates.

Temperate Bass: A single White Bass was collected in 2016 and Yellow Bass are present, but no other temperate bass species have been observed in Highlands Reservoir. There are no reports of anglers targeting temperate basses.

Survey objectives, fisheries metrics, and sampling objectives

Catfishes: Catfish are speculated to be the primary fishery at Highlands Reservoir, but angling pressure is unknown. Gill nets were used for initial catfish surveys in 2016, but depths were inadequate, mean depth ≤ 3 feet, so hoop nets were used in 2020 and 2024. Hoop net surveys of Blue and Channel Catfish in 2024 were not successful. No additional sampling is scheduled for this reservoir.

Crappies: White Crappie are common at Highlands Reservoir, but angling pressure is unknown. Bootstrap analysis of 2015 and 2019 trap net data indicate that 5 net nights at randomly selected stations will collect 50 stock-size White Crappie with 80% confidence which will be sufficient to determine the survey objectives of population size structure and growth rate. No additional sampling is scheduled for this reservoir.

Prey Species: Gizzard Shad, Bluegill, and Longear Sunfish are the primary forage fish at Highlands Reservoir and were surveyed in 2015 and 2019 by electrofishing. Bootstrap analysis of 2015 and 2019 prey species data estimate that 80% of the time, a minimum of 57 stations would be needed to obtain an RSE<25 for all three species. No effort will be expended to survey the prey species.

Habitat and Vegetation: Highlands Reservoir has a history of excess hydrilla growth impeding water supply. Salvina and alligator weed are also present. Exotic vegetation will be monitored to determine if control efforts are needed. Structural habitat is stringently maintained by SJRA and will be surveyed if major changes are made.

Literature Cited

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Tables and Figures

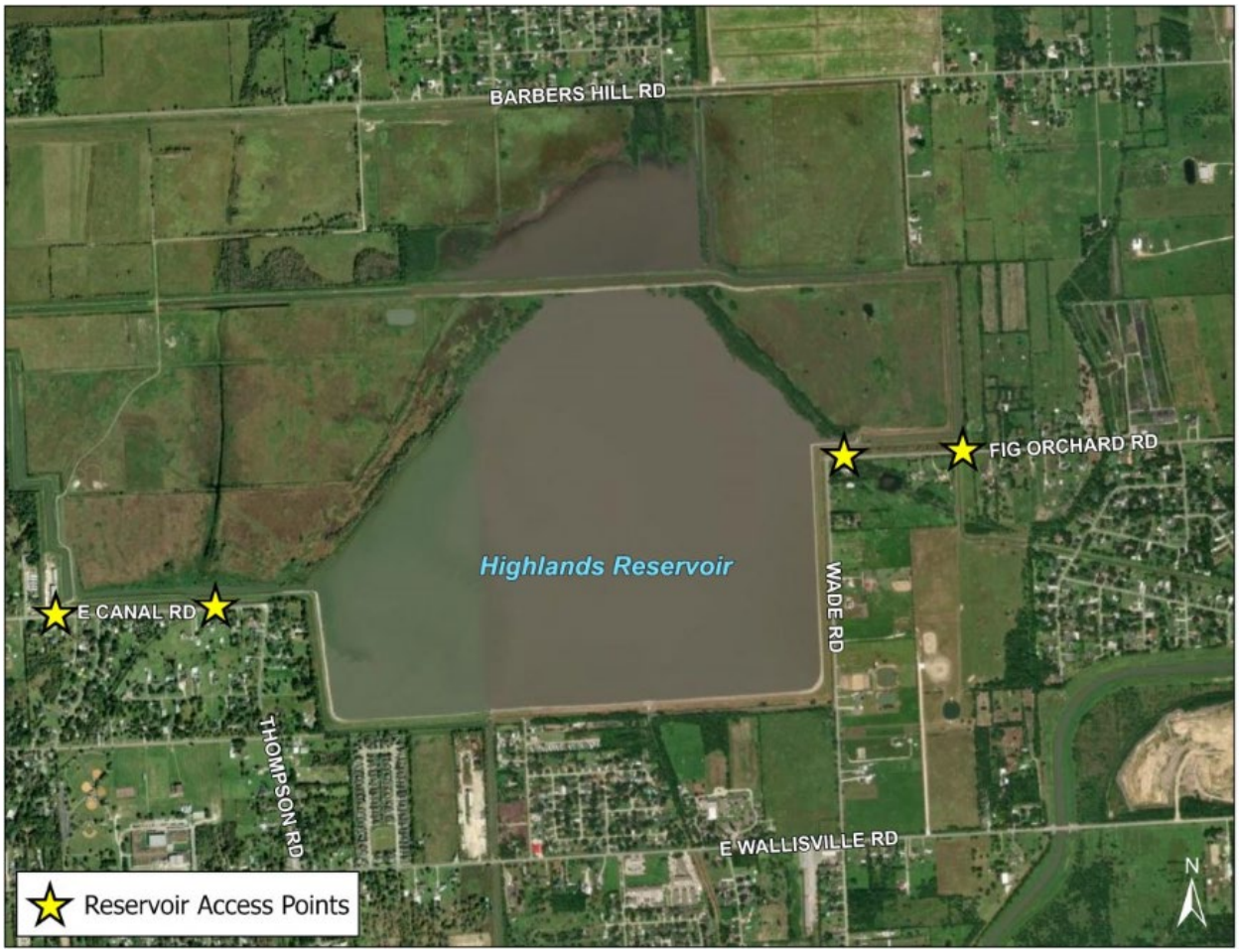


Figure 1. Map of Highlands Reservoir, Texas with associated San Jacinto River Authority access. The lower section of the reservoir is the only area accessible by boat for fisheries surveys.

Table 1. Characteristics of Highlands Reservoir, Texas.

Characteristic	Description
Year constructed	1943
Controlling authority	San Jacinto River Authority
County	Harris
Reservoir type	Water Supply
Conductivity	83 µS/cm
Lower section area	498 acres
Upper and Lower section area	518 acres
Total reservoir area	1,437 acres
Regularly managed area	498 acres
Main canal length [a]	11 miles
South canal length [a]	8 miles
East canal length [a]	9 miles
Total canal length [a]	28 miles

Table 2. Harvest regulations for Highlands Reservoir, Texas.

Species	Bag limit	Length limit
Catfish: Channel and Blue Catfish, their hybrids and subspecies	25 (only 10 ≥ 20 inches)	none
Catfish, Flathead	5	18-inch minimum
Bass, White	25	10-inch minimum
Bass, Largemouth	5	14-inch minimum
Crappie: White and Black Crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum

Table 3. Stocking history of Highlands Reservoir, Texas. FGL = fingerling, AFGL = advanced fingerling ADL = adult.

Species	Year	Number	Size
Grass Carp	2008	9,000	ADL
	2011	4,000	ADL
	2015	4,000	ADL
	Total	17,000	
Bluegill	2016	143,365	AFGL
Florida Largemouth Bass	2016	136,478	FGL
	2017	142,000	FGL
	Total	278,478	

Table 4. Objective-based sampling plan components for Highlands Reservoir, Texas 2023-2024.

Gear/target species	Survey objective	Metrics	Sampling objective
Electrofishing			
Bluegill and Longear Sunfish	Abundance	PSD, length frequency	12, 5-minute electrofishing stations
Gizzard Shad	Size structure		
	Presence/Absence		
Gill Netting			
Blue Catfish	Abundance	CPUE–stock	5 net nights
Channel Catfish	Size structure	Length frequency	
Trap netting			
Crappies	Size structure	PSD, length frequency	5 net nights
	Age-and-growth	Age at 10 inches	

Table 5. Survey of aquatic vegetation, Highlands Reservoir, Texas, 2020–2023. Surface area (acres) is listed with percent of the regularly inundated reservoir in parentheses.

Vegetation	2020	2021	2022	2023
Native submersed				<0.01 (<0.1)
Native floating-leaved				0.14 (<0.1)
Native emergent				1.94 (<0.1)
Non-native				
Salvinia (Tier III)*	0.02(<0.1)	1.06 (<0.1)	0.01 (<0.1)	0.16 (<0.1)
Alligator Weed (Tier III)*	0.08(<0.1)	1.36 (<0.1)	1.18 (<0.1)	0.37 (<0.1)
Water Hyacinth (Tier III)	0	<0.01	0	0

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

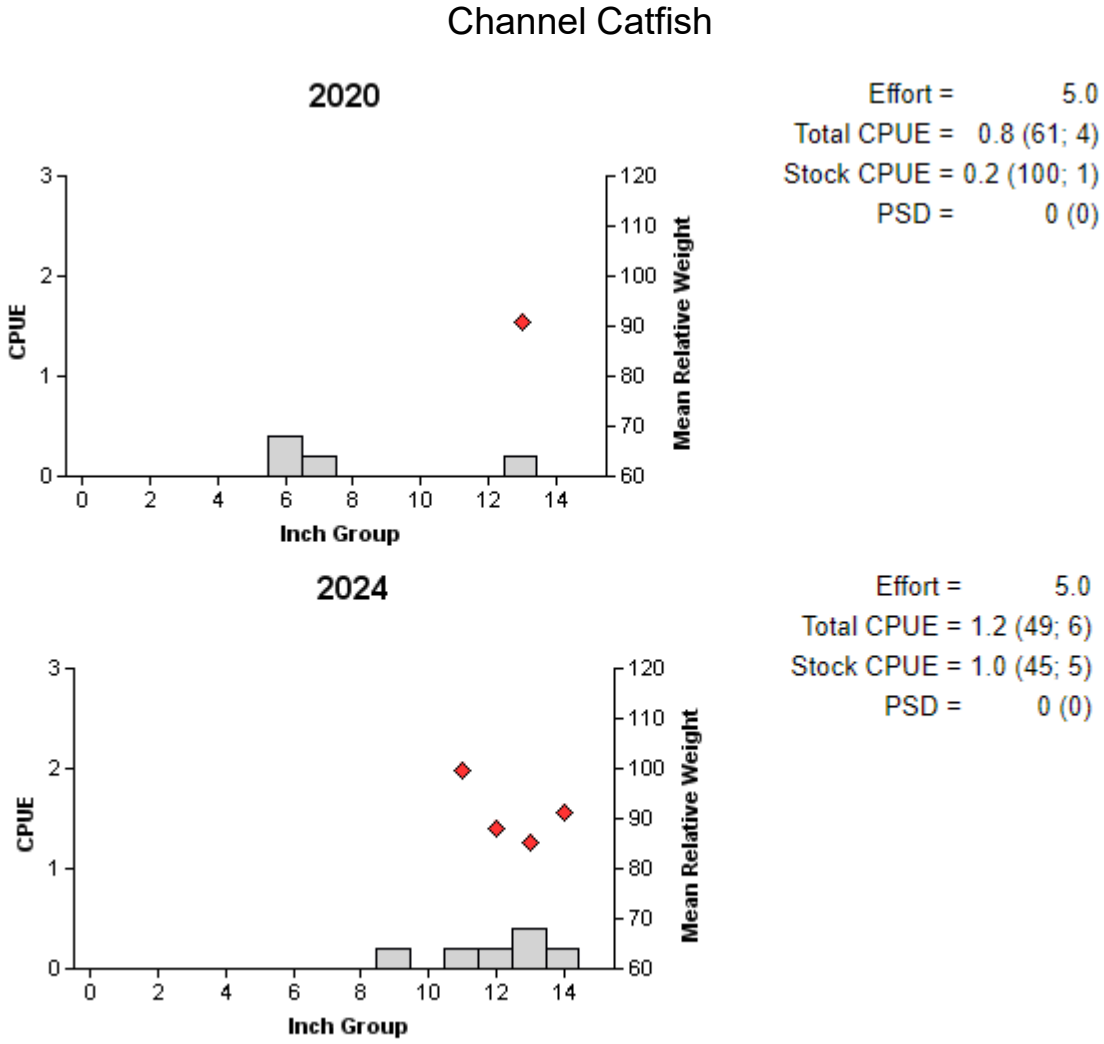


Figure 2. Number of Channel Catfish caught per net series (CPUE), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for the spring hoop net survey, Highlands Reservoir, Texas, 2020 and 2024.

White Crappie

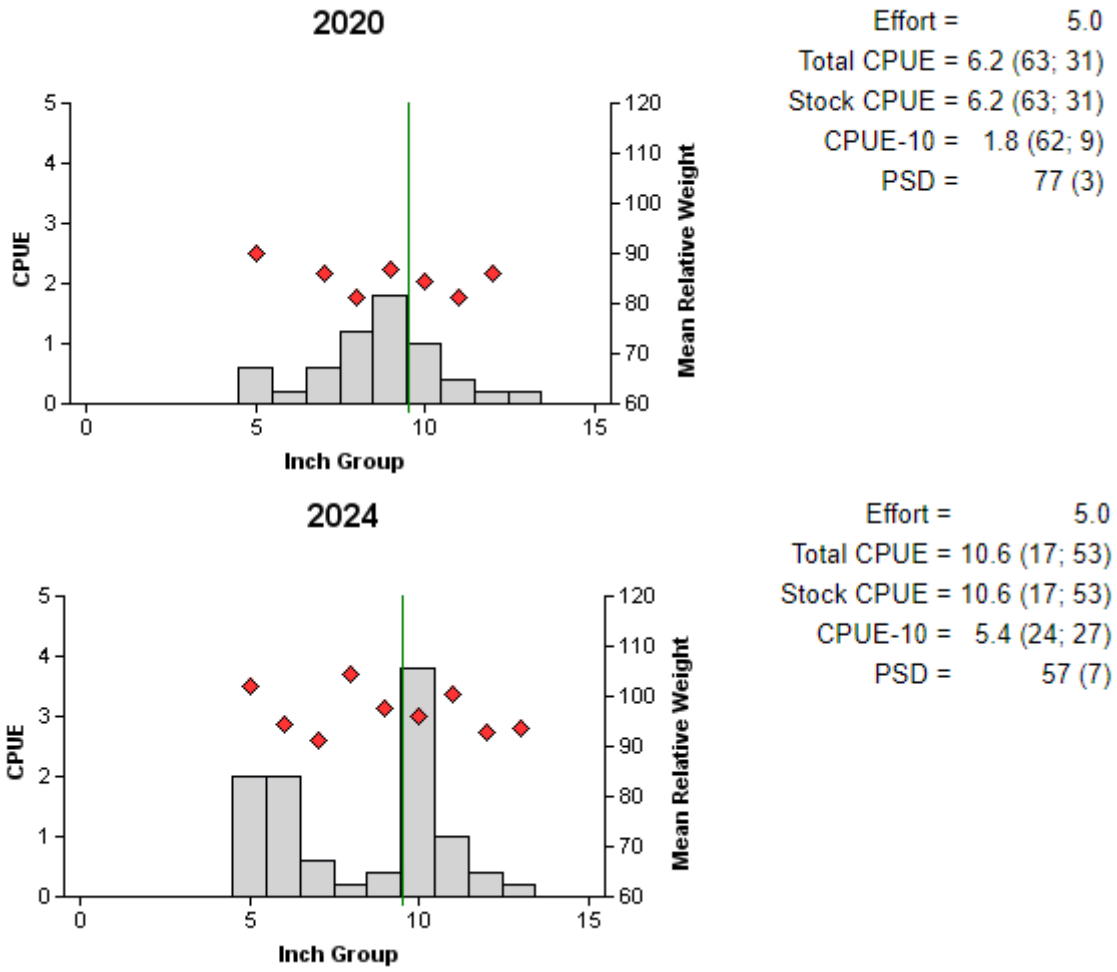


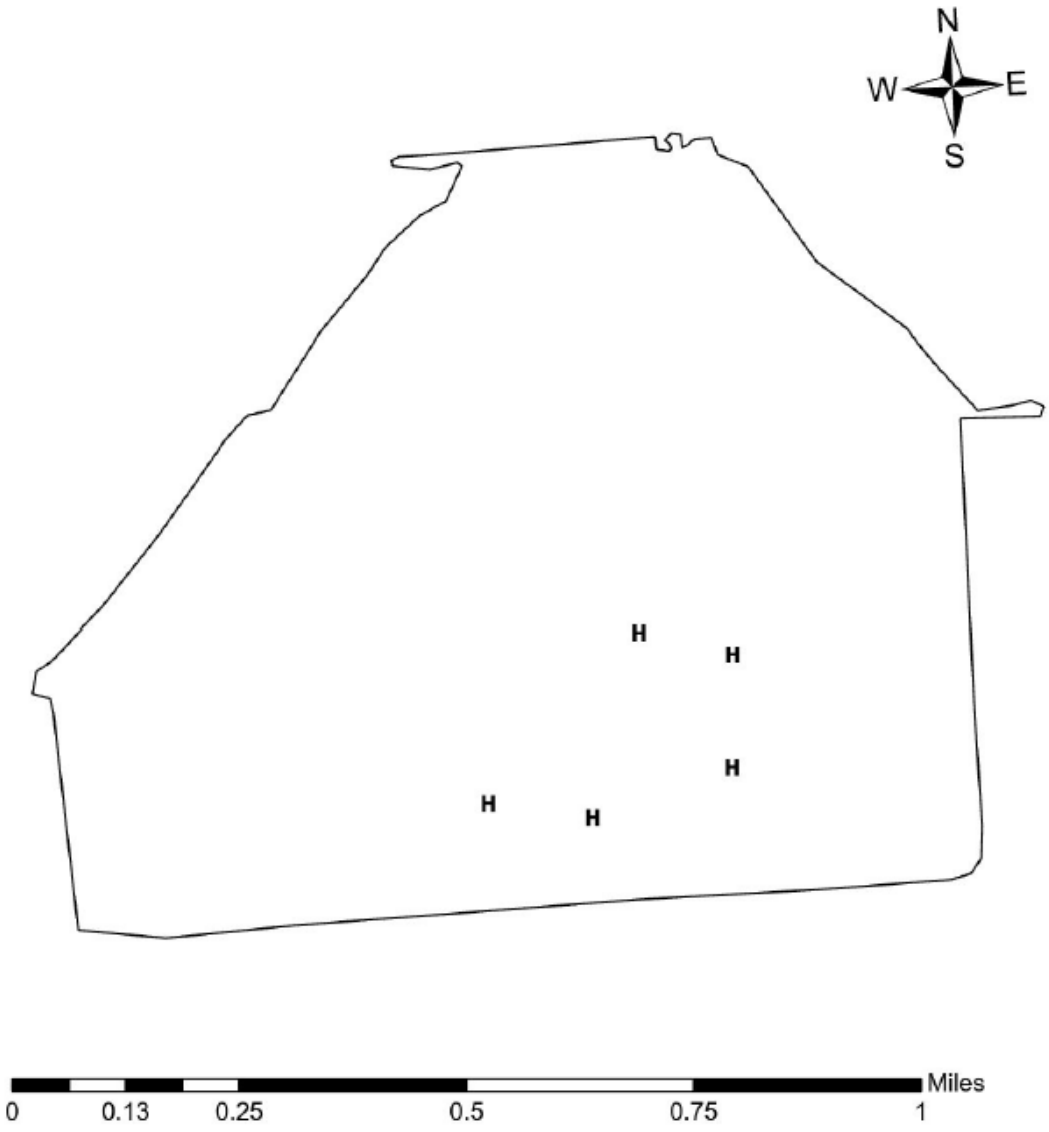
Figure 3. Number of White Crappie caught per net series (CPUE), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for the spring hoop net survey, Highlands Reservoir, Texas, 2020 and 2024.

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 Highlands Reservoir, Texas, 2023-2024. Sampling effort was 5 nets at 5 stations for 2 nights for baited tandem hoop netting.

Species	Hoop Netting	
	N	CPUE
Channel Catfish	6	1.2 (49)
Freshwater Drum	1	0.2 (100)
Spotted Gar	1	0.2 (100)
White Crappie	53	10.6 (17)

APPENDIX B – Map of sampling locations



Location of sampling sites, Highlands Reservoir, Texas, 2024. Baited tandem hoop net locations are indicated by the letter H. Water level was full pool at time of sampling.

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