# Lake Crook <br> 2022 Fisheries Management Survey Report <br> PERFORMANCE REPORT 

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-4

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

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## Survey and Management Summary

Fish populations in Lake Crook were surveyed in 2022 using electrofishing, low-frequency electrofishing, trap netting and in 2023 using gill netting. Historical data are presented with the 2022-2023 data for comparison. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

Reservoir Description: Lake Crook is a 1,060-acre impoundment located on Pine Creek in the Red River Basin approximately 2 miles north of Paris, Texas. Primary water uses included municipal water supply and recreation. Water level has remained within two feet of conservation pool since 2010. Lake Crook has high productivity. Habitat features consisted of natural shoreline and native vegetation (primarily American lotus).

Management History: Important sport fish include White Crappie and catfish. Blue Catfish were stocked in 2015 and Channel Catfish were stocked in 2018. The management plan from the 2018 survey report primarily focused on monitoring the sportfish and prey fish populations through a combination of standard electrofishing, low-frequency electrofishing and trap netting in 2022 and gill netting in 2023.

## Fish Community

- Prey species: Threadfin Shad were present in the reservoir and electrofishing catch rate was high. Electrofishing catch rate of Gizzard Shad was moderate and $67 \%$ were available as prey to most sport fish. Electrofishing catch of Bluegill was low and most were less than six inches long.
- Catfishes: Blue and Channel Catfish were present in the reservoir. Blue Catfish abundance remains fair and have the potential to provide angling opportunities.
- Largemouth Bass: Largemouth Bass were present in the reservoir in low densities and were primarily under 14 inches in length.
Crappie: White Crappie abundance was moderate. The number of legal-length crappie increased from the previous survey.

Management Strategies: Continue managing sportfish with statewide regulations. Reinstate trap nets as standard sampling for crappie. Inform the public about the negative impacts of aquatic invasive species.

## Introduction

This document is a summary of fisheries data collected from Lake Crook in 2022-2023. 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 2022-2023 data for comparison.

## Reservoir Description

Lake Crook is a 1,060-acre impoundment constructed in 1923 on Pine Creek, a tributary of the Red River. It is located in Lamar County approximately 2 miles North of Paris, Texas and is operated and controlled by the city of Paris. Primary water uses included municipal water supply and recreation. Lake Crook was eutrophic with a mean TSI chl-a of 57.6 and a mean secchi depth of 0.3 meters (Texas Commission on Environment Quality 2022). Trophic level and secchi depth have notably increased since 2016 (TSI chl-a =48.2, 0.2 m ) (Texas Commission on Environment Quality 2016). Habitat at time of sampling consisted of natural shoreline, native emergent vegetation, and native floating vegetation. Water level has remained within 2 feet of conservation pool since 2010 (Figure 1). Other descriptive characteristics for Lake Crook are in Table 1.

## Angler Access

Lake Crook has two public boat ramps and no private boat ramps. The West boat ramp is currently under construction and unavailable to public use. Additional boat ramp characteristics are in Table 2. Shoreline access is limited to the city park and public fishing pier.

## Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Norman and Cartabiano 2019) included:

1. Conduct genetic analysis for Largemouth bass.

Action: Electrofishing catch rate of Largemouth Bass was not adequate to conduct genetic analysis.
2. Monitor invasive species.

Action: Invasive species are not problematic. Monitoring and cooperation with the controlling authority will continue.

Harvest regulation history: Sport fish in Lake Crook are managed under statewide regulations (Table 3).

Stocking history: Lake Crook was stocked with White Bass in 1953, Blue Catfish in 2015 and Channel Catfish in 2018 (Table 4).

Water transfer: No interbasin transfers are known to exist.

## Methods

Surveys were conducted to achieve survey and sampling objectives in accordance with the objectivebased sampling (OBS) plan for Lake Crook (Norman and Cartabiano 2019). 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 2022).

Electrofishing - Largemouth Bass, sunfishes, Gizzard Shad, and Threadfin Shad were collected by electrofishing ( 1 hour at 12, $5-\mathrm{min}$ 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). 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, and White Bass were collected by gill netting (10 net nights at 10 stations). CPUE for gill netting was recorded as the number of fish caught per net night (fish/nn).

Low-frequency electrofishing - Blue Catfish were collected by low-frequency electrofishing (LFE) (0.7 hours) at 10 stations. The minimum duration of electrofishing at each station was 3 minutes. CPUE for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing.

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 ( $\mathrm{W}_{r}$ )] 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.

Habitat - An aquatic vegetation survey was conducted in 2022. Coverages were assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2022).

Water level - Source for water level data was the United States Geological Survey (USGS 2023).

## Results and Discussion

Habitat: Vegetation coverage has historically fluctuated, likely attributable to fluctuating water levels, high turbidity and poor substrate composition. Aquatic vegetation has increased in recent years, covering $23 \%$ of the reservoir in 2018 and approximately $40 \%$ in 2022. American lotus accounted for $37 \%$ ( 380 surface acres) of the total coverage (Table 6, Appendix C). Emergent species, including bulrush and cutgrass, covered approximately 3\% of the reservoir shoreline (26 acres).

Prey species: Electrofishing catch rates of Gizzard Shad and Bluegill were 121.0/h and 116.0/h, respectively. Index of Vulnerability (IOV) for Gizzard Shad was moderate, indicating that $67 \%$ of Gizzard Shad were available to existing predators, and was comparable to previous surveys conducted in 2014 ( $75 \%$ ) and 2018 ( $76 \%$; Figure 2). Total CPUE of Gizzard Shad was considerably lower in 2022 compared to the 2018 survey (Figure 2). Total CPUE of Bluegill was higher than total CPUE from surveys in 2018 (82.0/h) and 2014 ( $83.0 / \mathrm{h}$ ), and size structure continued to be dominated by small individuals (Figure 3). Threadfin shad were still abundant in the reservoir. The limnetic changes previously described (i.e., turbidity, chl-a) coupled with increased vegetation coverage is likely responsible for the shift in prey species composition in Lake Crook.

Catfish: Blue Catfish were first observed in the 2007 gill net survey, despite no previous stocking records in the waterbody. The gill net catch rate of Blue Catfish in 2023 (8.4/h) was lower than 2015 (19.2/h) and $2019(10.6 / \mathrm{h}$; Figure 4). A large range ( $6-42$ inches) of size classes were represented in survey. The total LFE catch rate for Blue Catfish was 108.8/h, however the catch rate for stock-size fish was poor (CPUE = 15.1; Figure 5). Both the 2022 LFE survey and 2023 gill net survey contained numerous fish $<8$ inches, suggesting natural reproduction is occurring; Blue Catfish were only stocked in 2015. Despite the poor
catch rate of stock-size fish, size structure estimates were the same (PSD = 40) for both the 2022 LFE survey and the 2023 gill net survey.
The Channel Catfish population continued to have low relative abundance; gill net catch rate of Channel Catfish was 2.8/nn in 2023 (Figure 6). The small size of the reservoir and abundance of forage suggest Channel Catfish would be an ideal candidate for additional stocking in future years.

Largemouth Bass: The daytime electrofishing catch rate of Largemouth Bass was 21.0/h in 2022, similar to 2018 (21.0/h) and higher than 2014 (7.0/h) (Figure 7). High turbidity and poor littoral habitat continue to result in a low-density Largemouth Bass population. The small sample size from recent surveys limits the merit of other population indices (PSD, W ${ }_{r}$, length-at-age). The combination of an observable limnetic and prey species composition shift and increasing littoral habitat support monitoring this population in future years.

Crappie: The trap net catch rate of White Crappie was $70.2 / \mathrm{nn}$ in 2022, similar to the survey conducted in 2014 ( $68.8 / n n$ ). The sampling objective for estimating relative abundance (RSE $\leq 25$ ) was not met in both 2022 (RSE = 33) and 2014 (RSE = 48). The catch rate of stock-size fish was considerably higher in 2022 (52.8/nn), than in 2014 ( $9.8 / \mathrm{nn}$ ) (Figure 8). Growth was moderate; average age at 10 inches ( 9.4 to 10.6 inches) was 2.4 years ( $\mathrm{N}=13$; range $=2-3$ years). The observed increases in the trophic state index and water clarity are likely contributing factors to the increased growth rate and size structure.

# Fisheries Management Plan for Lake Crook, Texas 

Prepared - July 2023


#### Abstract

ISSUE 1: 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 inter-basin water transfers to facilitate potential invasive species responses.

## Objective-Based Sampling Plan and Schedule (2023-2027)

Sport fish, forage fish, and other important fishes
Sport fish in Lake Crook include White Crappie, Blue Catfish, Channel Catfish, and Largemouth Bass. Important forage species include Gizzard and Threadfin Shad, and sunfishes.

## Low-density fisheries

Channel Catfish and White Bass have historically been present in the reservoir; gill net surveys have produced low and variable catch rates. The historical data suggests it would take $50+$ net nights to estimate size structure or relative abundance with $80 \%$ confidence. Therefore, Channel Catfish will be monitored for presence/absence during the low-frequency electrofishing survey, or the 2027 gill net survey if needed. No sampling will be conducted for White Bass.

Survey objectives, fisheries metrics, and sampling objectives
White Crappie: Historical trap net survey results suggested the crappie population was stunted and sampling was cancelled in 2014 due to poor size structure and suspected poor fishing quality. Trap netting was resumed in 2022 to assess the potential of this gear as a viable method of collecting a representative sample of the crappie population. The total CPUE for the 2022 and 2014 surveys were similar, however CPUE-Stock was considerably higher in 2022. The observed increases in the trophic state index and water clarity are likely contributing factors to increased growth rate and size structure. Trap net surveys will continue in the fall of 2026. Five randomly selected trap nets will be set to monitor crappie population indices (relative abundance and size structure). Historically high trap net catch rates suggest no additional effort will be required to collect an adequate sample size ( $N \geq 50$ ). No additional
effort will be given if survey precision does not meet the objective ( $R S E \leq 25$ ). Otoliths will be removed from 13 fish (9.0-10.9 inches), if available, during the 2026 survey for age and growth analysis.

Blue Catfish: It is unclear if the Blue Catfish population is still expanding, stable or decreasing. Historical data suggests over 15 net-nights may be necessary to estimate relative abundance, size structure and body condition with acceptable precision, however the limited importance of this fishery does not warrant intensive sampling (10+ net nights). Both gill net and LFE surveys produced similar estimates of stockedsized fish. Ultimately, the most important metric for this population is the presence of sub-stock fish, which would continue to indicate natural reproduction is occurring. The results from the 2022 LFE survey suggest sub-stock fish, as well as larger fish (i.e., $\geq 20$-inches) can be effectively monitored with LFE surveys. Therefore, in the summer of 2026 Blue Catfish will be surveyed with LFE. Fifteen randomly selected sites will be sampled for a minimum of 3 minutes each, with up to 5 more sites if necessary, to estimate relative abundance and size structure with acceptable precision. No additional electrofishing effort will be conducted if survey objectives are not met after a total sampling time of 1 hour. If the electrofishing produces poor results, Blue Catfish will be monitored with winter gill netting in 2027.

Largemouth Bass: Lake Crook has historically supported a low-density Largemouth Bass population; electrofishing catch rates have ranged from $0-1.0 / \mathrm{h}$ from previous nighttime electrofishing surveys and 7 $-21 / \mathrm{h}$ from recent daytime surveys. High turbidity has likely limited recruitment of bass within the reservoir. However, the recent increases in catch rate and vegetation coverage coupled with the shift in trophic state classification suggests the population merits monitoring. Twelve randomly selected daytime electrofishing sites will be sampled in the fall of 2026 to determine presence/absence of Largemouth Bass. No additional effort will be expended and the results of the 2026 survey will be used to determine future sampling efforts. If catch rates remain low, electrofishing will be discontinued after the 2026 survey.

## Literature Cited

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## Tables and Figures



Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Lake Crook, Texas, 2010-2023.

Table 1. Characteristics of Lake Crook, Texas.

| Characteristic | Description |  |
| :--- | :--- | :--- |
| Year constructed | 1923 |  |
| Controlling authority | City of Paris |  |
| County | Lamar |  |
| Reservoir type | Tributary |  |
| Shoreline Development Index | 3.4 |  |
| Conductivity | $111 \mu \mathrm{~S} / \mathrm{cm}$ |  |

Table 2. Boat ramp characteristics for Lake Crook, Texas, August 2022. Reservoir elevation at time of survey was 1,422 feet above mean sea level.

|  | Latitude <br> Longitude <br> (dd) | Public | Parking <br> capacity <br> $(\mathrm{N})$ | Elevation at <br> end of boat <br> ramp $(\mathrm{ft})$ | Condition |
| :--- | ---: | :--- | :--- | :--- | :--- |
| East Ramp | 33.72421 | Y | 20 | 474 | Shallow slope. Extension <br> not feasible |
| West Ramp | -95.57044 |  |  | 473 | Closed for reconstruction |
|  | -93.72113 | Y |  |  |  |

Table 3. Harvest regulations for Lake Crook, Texas.

| Species | Bag limit | Length limit |
| :--- | :---: | :---: |
| Catfish: Channel and Blue Catfish, <br> their hybrids and subspecies | (in any combination) | None ${ }^{\text {a }}$ |
| Catfish, Flathead | 5 | 18-inch minimum |
| Bass, White | 25 | 10-inch minimum |
| Bass, Largemouth | 5 | 14-inch minimum |
| Crappie: White and Black Crappie, <br> their hybrids and subspecies | (in any combination) | 10-inch minimum |

${ }^{\text {a }}$ Only 10 combined Blue and Channel Catfish $\geq 20$ inches may be retained per day.

Table 4. Stocking history of Lake Crook, Texas. FGL = fingerling.

| Species | Year | Number | Size |
| :--- | :--- | :--- | :--- |
| Blue Catfish | 2015 | 107,118 | FGL |
| Channel Catfish | 2018 | 2,091 | FGL |
| White Bass | 1953 | 2,000 | FGL |

Table 5. Objective-based sampling plan components for Lake Crook, Texas 2022-2023.

| Gear/target species | Survey objective | Metrics | Sampling objective |
| :---: | :---: | :---: | :---: |
| Electrofishing |  |  |  |
| Largemouth Bass | Relative Abundance <br> Size structure | CPUE-Stock <br> PSD, length frequency |  |
| Bluegill | Abundance <br> Size structure | CPUE-Total PSD, length frequency |  |
| Gizzard Shad | Abundance <br> Size structure <br> Prey availability | CPUE-Total <br> PSD, length frequency IOV |  |
| Gill netting |  |  |  |
| Blue Catfish | Relative Abundance Size structure | CPUE-stock PSD, length frequency |  |
| Channel Catfish | Relative Abundance <br> Size structure | CPUE-stock PSD, length frequency |  |
| Low-frequency electrofishing |  |  |  |
| Blue Catfish | Abundance <br> Size structure | CPUE-stock <br> Length frequency |  |
| Trap netting |  |  |  |
| Crappie | Relative Abundance | CPUE-Total | RSE $\leq 25$ |
|  | Size structure | PSD, length frequency | N > 50 |
|  | Age-and-growth | Age at 10 inches | $N=13,9.0-10.9$ inches |

Table 6. Survey of aquatic vegetation, Lake Crook, Texas, 2009-2022. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

| Vegetation | 2010 | 2014 | 2018 | 2022 |
| :--- | :---: | :---: | :---: | :---: |
| Native submersed |  |  | $<0.01(<0.01)$ |  |
| Native floating-leaved | $2.7(0.2)$ | $69.2(6.5)$ | $224.8(21.2)$ | $380.5(37.3)$ |
| Native emergent | $14.1(1.3)$ | $21.4(2.0)$ | $18.1(1.7)$ | $26.3(2.6)$ |

## 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 daytime electrofishing surveys, Lake Crook, Texas, 2014, 2018, and 2022.

## Bluegill

2014
Effort =

$$
1.0
$$

$$
\text { Total CPUE = } 83.0(31 ; 83)
$$



2018
Effort =
1.0

Total CPUE $=82.0(28 ; 82)$


2022


$$
\mathrm{PSD}=\quad 8(4)
$$

Effort =

$$
\text { Total CPUE = } 116.0(12 ; 116)
$$

PSD $=$
8 (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 daytime electrofishing surveys, Lake Crook, Texas, 2014, 2018, and 2022.

## Blue Catfish



Figure 4. Number of Blue Catfish caught per net night (CPUE), mean relative weight (squares) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Crook, Texas, 2015, 2019 and 2023.


Figure 5. Number of Blue Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall low frequency electrofishing survey, Lake Crook, Texas, 2022.

## Channel Catfish

2015


Effort = Total CPUE = Stock CPUE = PSD $=$

5
0.2 (100; 1) 0.2 (100; 1) 100 (0)

## 2019



Effort = Total CPUE = $2.2(27 ; 11)$ Stock CPUE = 1.8 (27; 9) PSD $=$ 44 (15)

## 2023



Effort =
5 Total CPUE =
$2.8(35 ; 14)$ Stock CPUE =
$2.6(35 ; 13)$ PSD $=$

85 (8)

Figure 6. Number of Channel Catfish caught per net night (CPUE), mean relative weight (squares) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Crook, Texas, 2015, 2019, and 2023.

## Largemouth Bass

2014


2018

Effort =
1 Total CPUE = Stock CPUE = $12(25 ; 12)$ PSD = 67 (12)


| Effort | $=$ |
| ---: | ---: |
| Total CPUE | $=$ |
| Stock CPUE | $=$ |
| PSD | $=$ |
|  | $10(22 ; 21)$ |
|  | $40(18)$ |

Figure 7. Number of Largemouth Bass caught per hour (CPUE), mean relative weight (squares), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall daytime electrofishing surveys, Lake Crook, Texas, 2014, 2018, and 2022.


Figure 8. 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, Lake Crook, Texas, 2014, and 2022. Vertical line indicates minimum length limit.

## Proposed Sampling Schedule

Table 7. Proposed sampling schedule for Lake Crook, Texas. Survey period is June through May. Electrofishing, low frequency electrofishing and trap netting surveys are conducted in the fall and gill netting is conducted in the spring.

|  | Survey year |  |  |
| :--- | :--- | :---: | :---: |
|  | $2023-2024$ | $2024-2025$ | $2025-2026$ |

## APPENDIX A - Catch rates for all species from all gear types

Number ( N ) and catch rate (CPUE) (RSE in parentheses) of all target species collected from all gear types from Lake Crook, Texas, 2022-2023. Sampling effort was 1 hour for electrofishing, 5 net nights for trap netting, 0.7 hours for low frequency electrofishing and 5 net nights for gill netting.

| Species | Trap Netting |  | Electrofishing |  | Low-Frequency Electrofishing |  | Gill Netting |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | N | CPUE | N | CPUE | N | CPUE | N | CPUE |
| Gizzard Shad | 121 | 121 (22) |  |  |  |  |  |  |
| Threadfin Shad | 1,585 | 1,585 (18) |  |  |  |  |  |  |
| Blue Catfish |  |  |  |  | 72 | 108.84 (29) | 42 | 8.4 (15) |
| Channel Catish |  |  |  |  |  |  | 14 | 2.8 (47) |
| White Bass |  |  |  |  |  |  | 1 | 0.2 (100) |
| Warmouth | 1 | 1(100) |  |  |  |  |  |  |
| Bluegill | 116 | 116 (12) |  |  |  |  |  |  |
| Longear Sunfish | 6 | 6 (58) |  |  |  |  |  |  |
| Redear Sunfish | 23 | 23 (44) |  |  |  |  |  |  |
| Largemouth Bass | 21 | 21 (22) |  |  |  |  |  |  |
| White Crappie |  |  | 351 | 70.2 (33) |  |  |  |  |
| Black Crappie |  |  | 5 | 1 (32) |  |  |  |  |

## APPENDIX B - Map of sampling locations

Location of sampling sites, Lake Crook, Texas, 2022-2023. Trap net, low-frequency electrofishing, and electrofishing stations are indicated by T, L, and E, respectively. Water level was near full pool at time of sampling.



## APPENDIX C - Vegetation survey




