# Electrofishing Study Results & Fishery Analysis

PROPERTY NAME: Springdale Estates
REPORT DATE: November 17, 2020
SUBMITTED TO: Van Cotter
SUBMITTED BY: Tyler Meighan

SAMPLING DATES: October 22, 2020
SIZE: 12.3 acres
AVERAGE DEPTH (Full Pool): 6 feet
MAX DEPTH (Full Pool): 22 feet

The electrofishing report is designed to provide an in-depth representation and analysis of the current state of the fishery. The results allow our biologists to make educated and precise decisions on any improvements that may be needed to meet your goals. The findings and their significance are followed by a discussion including management recommendations.

## Goals

Create a healthy family fishery with healthy water and healthy fish living in the lake. Desired species include Largemouth Bass, Bluegill, and Redear Sunfish. Keeping the lake clear of algae and vegetation is a priority.

## Methods (Approach)

A Midwest Lake Electrofishing System was used to collect all fish that were observed. Information was gathered on all fish collected during two sampling events. Length, weight, and abundance data were recorded and logged into a database. Relative weights were calculated for Largemouth Bass and Bluegill. Size classes for all species were determined to evaluate the health of the fishery.

## Relative Weights

Relative Weight (Wr) is the ratio of the actual weight of a fish to what a healthy fish of the same length should weigh, called standard weight. Fish with high relative weights are fat while those with low relative weights are thin. Comparing Wr is a preferred method of biologists to understand how a fishery is responding to management practices. Proper attention to Wr in relation to the time of year is important when drawing conclusions regarding a fishery. Relative weights of bass below 90 could be an indication of a lack of food resources or difficulty obtaining prey. A relative weight of 100 would indicate a bass of "normal weight" relative to its length and would be desired for a balanced fishery. Those desiring a trophy bass fishery should aim to maintain relative weights of 110 and above.

$$Wr = \frac{\text{Actual Weight of Captured Fish}}{\text{Standard Weight of Fish at Same Length}} \times 100$$

**Relative Weight Reference**

| Wr | Condition of Fish |
|---|---|
| 90 | Healthy |
| 100 | Quality |
| 110 | Trophy |

## Results & Discussion

### Relative Abundance

- We collected five species of fish: Bluegill (38), Largemouth Bass (42), Redear Sunfish (10), Black Crappie (3) and Koi (1). See the appendix at the end of this document for all fish descriptions.
- The predator to prey ratio is 'poor' with more predator fish collected than the lake can support.
- No minnow species such as Golden Shiner or Fathead Minnow were observed during sampling.
- Based on the goals, young-of-the-year Bluegill counts were 'fair' and adult numbers were 'common'.
- The Catch per Unit Effort (CPUE) for Largemouth Bass over 8 inches was 95 fish/ hour and for all bass was 107 fish/hr. Bluegill CPUE was 178 fish/hour, Black Crappie was 7.7 fish/ hour and Redear was 47 fish/ hour.

### Size Structure

- Largemouth Bass ranged in size from 4.3 to 24.2 inches and averaged 11.7. We collected 38 stock-size Largemouth Bass (over 8 inches) and their length distribution shows the majority of the population between 9-12 inches, with few individuals over 16 inches (Figure 1).
- Bluegill ranged in size from 4.7 to 9.5 inches with an average of 6.4. Their size class structure is representative of a balanced population (Figure 2).
- The ten Redear Sunfish collected ranged from 5.6 to 11.1 and averaged 8.1 inches. The three Black Crappie ranged between 5.2 to 10.5 and averaged 7.3 inches.

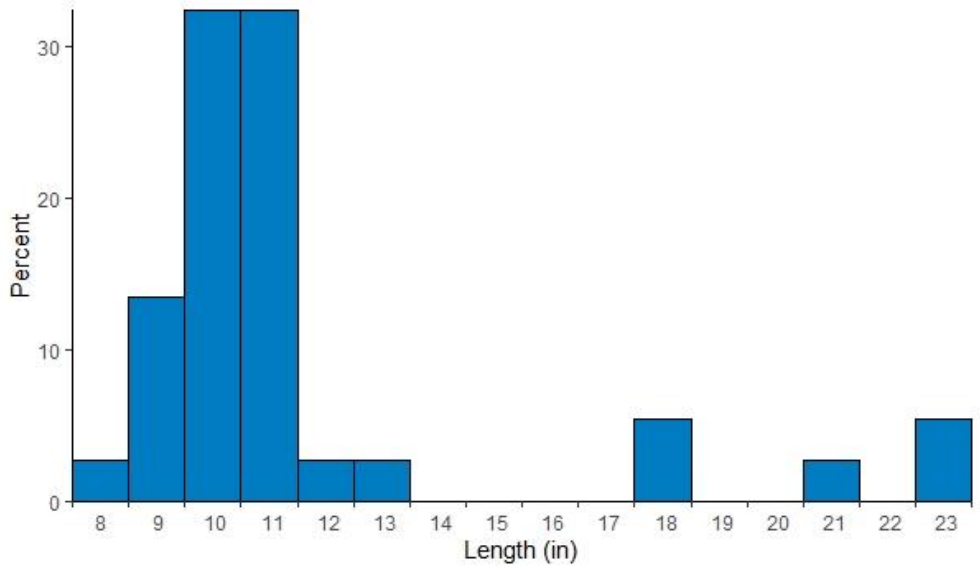


**Figure 1** – Largemouth Bass size distribution.

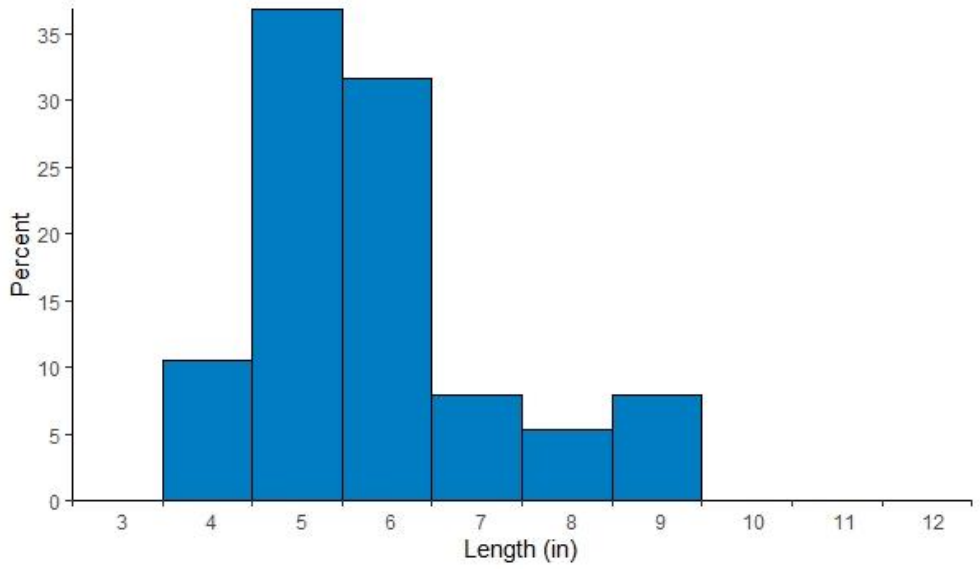


**Figure 2** – Bluegill size distribution.

## Relative Weight

Relative weights (Wr) of Largemouth Bass were 'poor' based on the goals set for the fishery. Wr ranged from 75 – 108 and averaged 93 (Figure 4). A decreasing trend existed as relative weight decreased with weight, suggesting that suitable forage is a problem for larger Largemouth Bass (Figure 5).

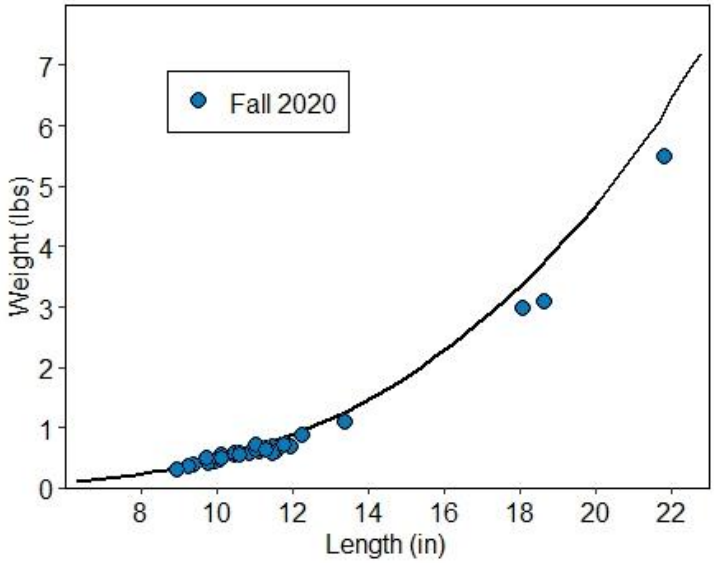


**Figure 4** – Largemouth Bass relative weights.

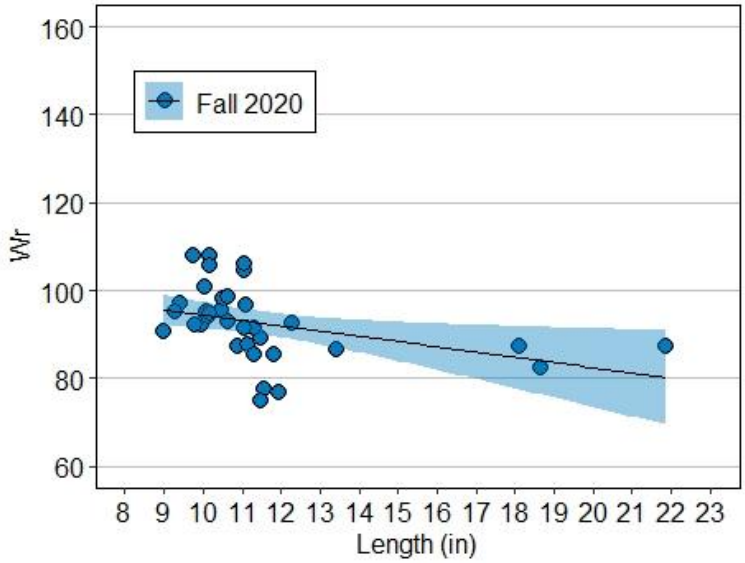


**Figure 5** – Largemouth Bass relative weights versus length.

Bluegill Wr ranged from 80 – 113 and averaged 97, below the goal set for the fishery (Figure 6).

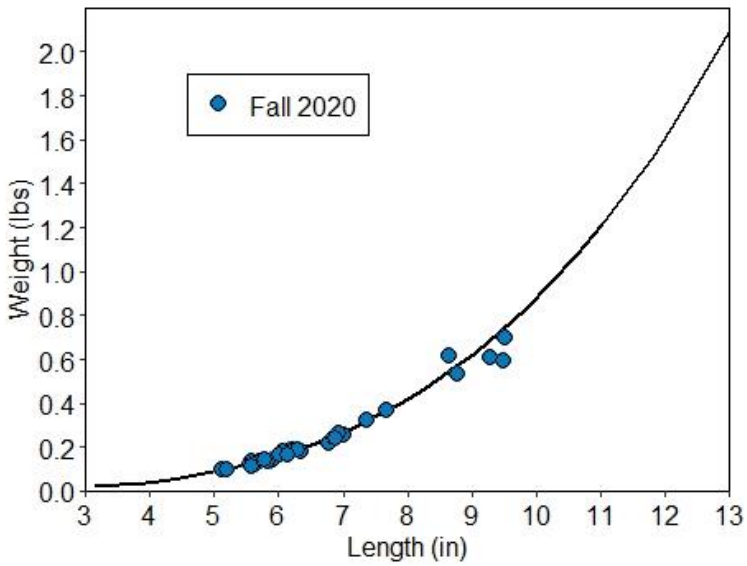


**Figure 6** – Bluegill relative weights.

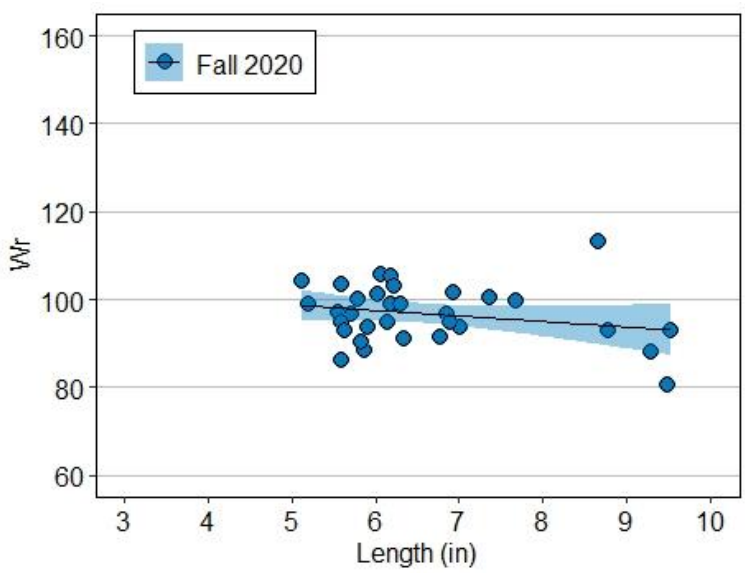


**Figure 7** – Bluegill relative weights versus length.

Due to the small sample size, Wr for Redear Sunfish and Black Crappie were not calculated.

## Fish Habitat

Dense cover required by forage fish is lacking and needs to be improved through the addition of beneficial aquatic vegetation. Large cover used to congregate predator fish and improve angling success is in good shape and does not need to be improved at this time. The overall fish habitat is rated as 'fair'.

## Water Quality

The water quality in the lake is currently in poor shape. A profile of the water column was recorded to better understand the lakes dissolved oxygen level (Table 1). During the day the lake has enough oxygen only in the top few feet of the water column to allow fish to survive. However below 9 feet the oxygen level is too low to support fish. It is normal to have a low reading just above the bottom due to the high amount of decomposition, a process that consumes oxygen. The poor dissolved oxygen readings observed throughout the water column are not ideal and are an indicator that the lake is in poor shape, putting stress on the fishery.

Water was also tested at the surface for multiple parameters (Table 2). The lake's nutrient levels (nitrites, nitrates and total phosphorous) are elevated and are contributing to the excess plant and algae growth. Encouraging beneficial vegetation to grow in shallow water around the perimeter and throughout the inflow area teamed with a dense upland buffer will help reduce the high phosphorous level.

Alkalinity is an important component of water quality when considering fish health. Alkalinity is the measure of the water's buffering capacity and the higher the alkalinity the more stable the pH will be. Having an alkalinity level >20 is critical to the success of a fishery, but an alkalinity level >50 ppm is an important component of a quality fishery. The alkalinity level of the lake is just above the recommended level to support quality fish growth. Increasing the alkalinity would help to improve the water quality and allow the fishery to become more productive. Adding agricultural limestone to the lake is the best way to improve alkalinity.

**Table 1** – Lake temperature and oxygen profile. October 22, 2020

| Water Depth (Feet) | Temperature (F) | Dissolved Oxygen (mg/l) |
|---|---|---|
| **Surface** | 73 | 12.3 |
| **3** | 70 | 12.1 |
| **6** | 70 | 10.6 |
| **9** | 68 | 12.4 |
| **12** | **65** | **1.6** |
| **15** | **65** | **0.1** |
| **18** | **62** | **0.1** |
| **21** | **59** | **0.1** |
| **Optimal Range** | **N/A** | **≥5** |

**Table 2** – Surface water quality. October 22, 2020

| Goal: Lake Aesthetics and Lake Health | | |
|---|---|---|
| **Parameter** | **Surface** | **Optimal Range** |
| **Turbidity (NTU)** | **10.3** | <10 |
| **Conductivity (us/cm)** | 81.6 | >50 |
| **Free Reactive Phosphorus (µg/L)** | 7.0 | <25 |
| **Dissolved Oxygen (mg/L)** | 7.6 | >5.0 |
| **Chlorophyll *a* (µg/L)** | **112.4** | <20 |
| **Total Phosphorus (µg/L)** | **70.0** | <25 |
| **Alkalinity (mg/L)** | 30.7 | >20 |
| **Hardness (mg/L as $CaCO_3$)** | **26.4** | >30 |
| **Total Nitrate & Nitrite (mg/L)** | <0.02 | <5 |
| **Nitrites (mg/L)** | <0.02 | <0.25 |
| **Nitrates (mg/L)** | <0.02 | <5.0 |
| **Total Kjeldahl Nitrogen (mg/L)** | 2.3 | <5 |
| **Total Nitrogen (mg/L)** | **2.3** | <1.0 |
| **pH** | 7.9 | 6.8-8.2 |

## Fishery Assessment

Results indicate poor water quality is having a negative impact on the fishery. Forage availability is also less than desired, and the Largemouth Bass (LMB) are on track to maintain slow growth rates since most bass are the same size and are competing for a limited amount of food. Bluegill are the base of the food chain and it is important that they have a well-established population.

Fisheries managers compute relative weight to assess fish condition. Our results indicate that Largemouth Bass relative weights are below optimal. If it is important that Largemouth Bass reach sizes greater than two pounds, managers should consider fisheries management strategies that promote growth in weight to improve fish condition. These strategies include, but are not limited to: improving water quality, fish feeding, forage fish stocking, habitat improvement (fish cover and beneficial vegetation), and continued harvest of Largemouth Bass.

Though not found in great abundance in the sample, Black Crappie may also be disrupting the recruitment success of Bluegill and other forage fish species, adding pressure to an insufficient forage base, and having a negative impact on bass growth.

## Recommendations

A summary of our recommendations are:
Habitat
- Dense cover required by the smaller fish should continually be improved in shallow water. As always, build up where you already have cover. Try to not spread the cover out too much.
- Structural cover needs to be improved for predator fish. Work to congregate predator fish in areas where angers fish from shore.
- Install beneficial emergent aquatic vegetation in water less than two feet deep.

Water Quality
- Bottom diffused aeration should be installed to improve the lake's water quality and overall health. If electric is not available or the cost to run electric to the lake is too expensive, the air can be piped to the lake from a current electrical source.
- Apply alum or another nutrient remediation product to decrease phosphorous levels in the lake
- Begin a regular maintenance program to proactively treat blue-green algae blooms.

Fish Stocking
- Stock 1,500 adult Bluegill 5.5 inches and greater to help improve their population.

Management
- Budget to electrofish the lake in 1-2 years to assess the success of fish stocking, selective harvest, and other recommended improvements.
- Creel recommendations:
    - 600 Largemouth Bass less than 12 inches should be harvested in 2021 and 2022 to help improve bass growth rates. Currently the lake has far too many bass less than 12 inches, and not nearly enough greater than 12 inches. Harvesting will help solve this imbalance.

Thank you,
SOLitude Lake Management
Fisheries Biologists
Tyler Meighan, David Beasley, and Aaron Cushing

# Appendix: Fish Pictures and Life History

**Largemouth Bass**
***Micropterus salmoides***

**Management Notes:** Largemouth Bass are the most popular warm water sport fish in North America. However more fish in a lake does not mean more big bass. They have a tendency to become overpopulated and often require active harvest or removal of intermediate sized fish to prevent size classes from becoming stunted. Under trophy management Largemouth Bass can exceed 12 pounds.

**Habitat and Biology**: Largemouth Bass occupy almost all aquatic habitats. They thrive in lakes, ponds, and reservoirs where they are more tolerant of turbidity and slack water current and are found in the weedy parts of the body of water. Spawning occurs in spring, when water temperatures reach the mid- 60's and takes place in deeper water than other sunfishes, usually1 to 4 feet. Males build and defend a nest. After spawning, the female leaves the nest although she, or another female, may return to spawn later. The eggs hatch in 3 to 4 days. Females produce 2000 to 7000 eggs per pound of body weight. Until they are 2 inches long, largemouth fry feed on plankton, insects and other invertebrates. Adult Largemouth Bass prey upon Bluegill and Redear Sunfish in stocked ponds and upon shad, minnows, smaller sunfishes, crayfishes, and amphibians in natural habitats. Average life span is from 10 to 12 years, although growth rates are extremely variable depending on the water body.

**Characteristics:** The back of the fish is olive green to brown, and the greenish sides are marked with a broad black band composed of somewhat oval blotches connected by shorter blotches. The belly is white, and between it and the lateral stripe are several rows of scales with darkened centers, giving the fish a striped appearance. The dorsal, caudal, and pectoral fins are varying shades of green and the pelvic and anal fins are clear to white. They typically grow 12 to 30 inches in length.

**Bluegill**
*Lepomis macrochirus*

**Management Notes**: Bluegill are the number one food source for Largemouth Bass. A healthy population with abundant small individuals is critical for ponds being managed as successful Largemouth Bass fisheries. They readily accept pelletized feed, which makes it very straightforward to grow large Bluegill for angling and lots of small fish to feed bass. Bluegill are not only stocked in ponds and lakes as the primary food source for Largemouth Bass, but are also a fun and easy sportfish for kids to catch. In addition to their catchability, they also help bring balance to the ecosystem by feeding on insect larvae, including mosquito larvae.

**Habitat and Biology**: Bluegill are warm water species that are well suited for the habitat found in ponds and lakes. Bluegill are colony nesters and begin spawning when the water temperatures reach 60°F. They have a protracted spawning season lasting from April to September. The long spawning season of Bluegill gives them tremendous reproductive potential. Bluegill nest in colonies and prefer sites with firm substrates such as gravel within water 1 to 3 feet deep with little to no vegetation or debris. They typically reach maturity at age 1 or 2. Bluegill feed during the day and most actively in the morning and afternoon. They eat a wide variety of organisms including significant amounts of plant material and insect larvae. Young Bluegill feed on plankton while larger individuals eat insects and other fish. They feed throughout the water column. Bluegill live for 5 to 6 years and grow 6 to 10 inches in length.

**Identification Characteristics:** The mouth on a Bluegill is small with the upper jaw not extending to the front of the eye. The flexible ear flap is always black and is small in juveniles while longer in adults. Juveniles and non-breeding adults are light olive to gray on the back and sides with several evenly spaced, darker vertical bands. The venter varies from pale yellow to white. All but small individuals have a distinct black spot toward the rear of the soft dorsal fin. Breeding males darken, with the black and sides becoming purple.

**Redear Sunfish (Shellcracker)**
*Lepomis microlophus*

**Management Notes:** Due to their preferred diet of snails and clams, redear play a vital role in reducing fish parasites such as black and yellow grub in a pond, which require a mollusk host to complete their life cycle. Redear are usually stocked into small ponds and lakes with Bluegill and Largemouth Bass. They grow quite well in these environments, and because of their diet, do not compete with Bluegill. Their reproduction is limited, however, and a supplemental stocking is recommended every few years to support their population.

**Habitat and Ecology**: This species occurs in moderate to large streams, rivers, reservoirs, lakes, swamps, and other standing-water habitats. Spawning occurs during May, June and July when water temperatures reach 70°F. They prefer water three to four feet deep, and a firm, shelly bottom, often near a dropoff. Nesting sites are often near aquatic vegetation such as water lilies, cattails, lizard's tail, and maidencane. Breeding behavior is similar to other sunfish, with the males doing the nest building and guarding the young. A female may lay between 15,000 to 30,000 eggs during a spawn. Redear sunfish have extensive molar surfaces on the pharyngeal arches and associated musculature that enables the fish to crack mollusk shells, hence the local name of shellcracker. Individuals live for six years and grow 8 - 11 inches in length.

**Characteristics**: The back on this species is light green to brown with scattered dark spots. The sides are light gray to silver. Lower surfaces of the head and venter are light yellow to white. Sides of the head are mottled with brown to dark orange spots. The dorsal fin is light gray while the anal fin is light yellow to white. The pectoral fin is long and pointed, its end reaching past the nostril when bent forward. The common name of this species is derived from the characteristic red or orange spot at the rear of the opercular flap.

**Black Crappie**
*Pomoxis nigromaculatus*

**Management Notes:** Crappie are a predator species and tend to become over populated, especially in smaller ponds. They compete heavily with Largemouth Bass for food and can quickly deplete the forage base. If managing for a balanced pond the crappie population should be kept small through regular harvest or removal. If a trophy Largemouth Bass fishery is the goal, as many crappie as possible should be removed or harvested.

**Characteristics:** The dorsal fin base on Black Crappie is equal to or slightly longer than the distance from the rear margin of the eye to the origin of the dorsal fin base. The back is usually light gray to light lime green. The sides and venter are lime green with a silvery sheen. Dark mottling is scattered across the body. The dorsal, caudal, and anal fins have several alternating light and dark wavy bands.

**Habitat and Biology:** Black Crappie are less tolerant of silt and turbidity than White Crappie and are more apt to be found in clear water where there is abundant vegetation. Spawning season is April to May when the water temperatures are higher than 68ºF. Before spawning, Black Crappie form schools and venture to feed into shallow water where they can be caught in large numbers. Nests are constructed in water 10 inches to 2 feet deep. They are usually built in sandy bottom in weedy areas. Eggs hatch in 3 to 5 days. Young crappie are plankton feeders but older fish feed on insects and fish. Considerable feeding takes place at night. They can live for eight years and grow 12 to 18 inches in length.

**Golden Shiner**
*Notemigonus crysoleucas*

**Management Notes**: Golden Shiners are a great supplemental forage fish for Largemouth Bass ponds. They reproduce several times a season, and routine stocking helps reduce the predation pressure on the Bluegill population. Golden Shiners compete with young Bluegill for food and are therefore best stocked in the fall.

**Habitat and Biology**: The Golden Shiner is a slow-water fish that thrives in ponds. It usually occurs where there is abundant vegetation and clear water and commonly avoids silty areas. Spawning occurs several times from April to July when water temperatures exceed 68° F. Females lay adhesive eggs in shallow water over vegetation, including filamentous algae and rooted aquatic plants. The eggs are usually broadcast with no nesting or parental care but some Golden Shiners have been reported to spawn over the nests of both Bluegills and Largemouth Bass. Growth is typically rapid and maturity is usually reached at age 2, although fast growing fish may spawn during their second summer. Zooplankton forms a large part of their diet. They are also known to feed on algae, insect larvae, and the eggs of other fish species.

**Characteristics:** The body of the Golden Shiner is deeply and laterally compressed, with a lateral line that curves toward the venter on the anterior part of the body. The venter has a sharp, fleshly keel extending from between the pelvic fins to the sickle-shaped anal fin. The head is small, with a small, upturned mouth. The back is light greenish olive to light orange; the sides are silvery, the venter white. They grow 2 to 9 inches in length.

**Threadfin Shad**
*Dorosoma petenense*

**Management Notes:** The Threadfin Shad is a favorite food for many game fishes including Largemouth Bass, Hybrid Striped Bass, Smallmouth Bass, and catfish. It is a warm water fish that requires annual spring stocking. This fish is widely introduced throughout the U.S. as a forage fish for game fish.

**Habitat and Biology**: This pelagic, plankton-feeding species occurs in large, often single-size schools and with Gizzard Shad. The greatest numbers occur in rivers, reservoirs, and large streams, where they can be seen rippling the surface at dawn and dusk. Spawning typically occurs from dawn to sunrise, when water temperatures reach 70ºF. The eggs adhere to submerged and floating objects. Females lay from 2,000 to 24,000 eggs. The young and adults feed on a variety of planktonic organisms and organic debris. This fish is very sensitive to changes in temperature and dissolved oxygen, and die offs are frequent in fall and late summer especially when water temperature reaches 42 °F. Threadfin Shad sometimes grow larger than their prey when this happens they tend to take up a large number of the biomass and a method of reduction is required. Life expectancy seldom exceeds 2 to 3 years and they grow 5 to 7 inches in length.

**Characteristics**: Like the Gizzard Shad, the Threadfin Shad has an elongated posterior dorsal ray, but its mouth is terminal and the lower margin of its upper jaw is not notched. The back is bluish gray with a persistent black or purple shoulder spot. The venter is silver to creamy white. The caudal fin is distinctly yellow (hence the local name "yellowtails). Other fins may be light yellow, dusky, or clear.