Abstract

Sooner Lake was surveyed using experimental gillnets to determine the status of the hybrid striped bass, saugeye, striped bass and white perch populations during the fall sampling seasons of 2022 and 2023.

Recommendations include gillnetting in fall 2024, spring black bass electrofishing with FLMB DNA samples in spring 2024 and a-year long creel survey beginning in 2024.

Introduction

Background

Sooner Lake impounds Greasy Creek, 15 miles south of Ponca City in Noble and Pawnee Counties, Oklahoma. The Greasy Creek basin is a small, prairie grass watershed. The silt load is light and is trapped on the West side of Highway 177. Overall water quality is very high due to the small size and quality of the watershed which results in very stable water levels even during heavy spring rain events. Sooner Lake covers 5,400 surface acres and was constructed in 1976 by the Oklahoma Gas and Electric Company to serve as a cooling reservoir. The thermal impact of the plant is limited to the west side of the lake which only covers about 25 percent of the total area of the lake, so the main body of Sooner Lake is thermally unaffected. Sooner Lake is located close to the Arkansas River and was initially filled and by pumping water from the Arkansas. Water levels are now maintained in the same way. Sooner Lake has a mean depth of 28 feet and a maximum depth of 89 feet, a shoreline development ratio of 5.2, a very low water exchange rate of 0.05 (inflow/storage capacity) and a secchi disc visibility of around 70 inches in the main pool in August; turbidity is primarily from plankton.

Fish habitat consists primarily of aquatic vegetation, primarily pondweed, water milfoil and cattails. Due to stable water levels and clear water, aquatic vegetation covers most shorelines and extends out to a depth of six feet. Standing timber is restricted to several coves south of Highway 15 and is not accessible by boat from the main body of the lake. Rip-rap habitat originally covered 9.7, miles but the more exposed stretches were concreted in to prevent further wave erosion. The remaining rip-rap areas are located behind the north and central dykes and covers 4.1 miles of shoreline. Substrates are largely clay with some limited areas of sandstone rock. The surrounding topography is open tall grass prairie which leaves the lake open to the prevailing winds.

Current Management Practices

Evaluate and Maintain Stocked Moronid and Percid Fish Populations

Hybridized fish species like hybrid striped bass and saugeye do not have the capability to reproduce and sustain their populations as other game fish can. These put and take fisheries are subject to greater control by fisheries managers who must request annual introductions to maintain their abundances in satisfactory levels for the angling public. Populations must be monitored closely to ensure this limited resource is used most efficiently. The Sooner Lake hybrid fishery is high profile and utilized regularly by fishing guides. The saugeye fishery at Sooner Lake is currently being evaluated as a method to control

invasive white perch. The maintenance of current data on these species is vital to gauging success of these management strategies and communicating about them with constituents.

White Perch Monitoring and Research

The aquatic nuisance species White Perch was first documented in Sooner Reservoir in 2006. Following introduction, managers observed increasing numbers, negative impacts on sport fish, and angler dissatisfaction. A year-long diet study was conducted to determine if a viable candidate for biological control of White Perch was present in the current species assemblage. The 2016 completion of that study found the foraging success of Saugeye to be significantly higher than that of the other predator species examined. Stocking Saugeye to control White Perch in Oklahoma is novel and no standard protocol currently exists for stocking rates and length limit regulations. A five year evaluation of this concept began in 2019 following two seasons of collecting baseline data. The plan included Sooner Reservoir maintaining an 18 inch minimum length limit on Saugeye, doubling Saugeye stocking rates to 40 fish per acre, and halving Striped Bass x White Bass Hybrid stockings to 5 per acre.

Monitoring of Heavily Utilized Black Bass Populations

Largemouth bass was the most sought after species in Oklahoma according to the most recent angler survey. Sooner Lake has a high profile largemouth bass fishery that is utilized by both recreational and tournament anglers. The introduction of Florida Largemouth Bass genetics into largemouth bass populations can be a valuable management tool to improve growth rates. The warm-water discharge at Sooner Lake has provided an opportunity to utilize this management strategy at the northernmost border of its viability. This black bass population requires monitoring for constituent interaction, evaluation of recent regulation changes, and evaluation of genetic contribution of FLMB.

Results

We sampled Sooner Lake using experimental gillnets. We sampled a total of 30 net nights in 2022 and 30 net nights in 2023. The minimum number of net nights was 18 per standard sampling procedures, but sampling didn't cease until CVs (CV ≤ .2) were met for all target species (Saugeye, Hybrid Striped Bass and White Perch). Otoliths were collected from and CPUE, mean length at age, and length frequencies were calculated for all target species.

2022

Hybrid Striped Bass:

        A total of 261 Hybrid Striped Bass were collected and otoliths were able to be collected and used from 259. Catch Per Unit Effort (CPUE) did not significantly change (Figure 1, Table 1). Mean length at age did not significantly change   compared to 2021 (Figure 2, Table 2). Proportional Size Distribution (PSD) significantly decrease from 2021 but not for the years prior (Figure 3).

Overall Hybrid Striped Bass did not see any significant change to the CPUE including 2017 and 2018, the years before stocking rates were reduced to 5 per acre from 10 per acre. These catch rates rank between the 50th and 75th percentile when compared to Hybrid fisheries statewide with 2019 and 2022 exceeding the 75th percentile. Mean Length at Age (MLA) for age 1, 2, and 3 did not significantly increase compared to any of the previous years including before reduced stocking with the exception for age 1 in 2018. Age 1 Hybrids are just over the 75th percentile for MLA but fall to the below the 50th percentile at age 2 and 3. PSD ranked in 25th to 50th percentile. While catch rates have not changed over time with reduced stocking neither has growth as one might expect with less interspecies competition. Hybrid anglers can expect good catch rates with moderate opportunity to catch quality sized Hybrids (410mm, 16in), reaching this size by age 2.

Saugeye:

A total of 104 Saugeye were collected, otoliths were able to be retrieved and used from 101. Catch Per Unit Effort (CPUE) was 3.67 significantly lower than in 2021 (Figure 4, Table 3). Mean Length at Age (MLA) significantly increased for age 2 and was not significantly different for age 1 and 3 (Figure 5, Table 4). Proportional Size Distributions (PSD) was not significantly different from 2021 (Figure 6) but PSD – P did significantly increase from 1 in 2021 to 17 in 2023.

Saugeye CPUE significantly decreased from a high of 12.19 in 2020 a year after doubling the stocking rate of Saugeye but still remained in about the 50th percentile of Saugeye fisheries catch rates statewide. The years since 2020 have had catch rate decrease to more closely resemble those years pre increased stocking. This suggests that increasing the stocking rate has not had the intended effect of increasing numbers of adult Saugeye in Sooner Lake to predate on White Perch. There are a few reasons why the intended effect was not seen, including net saturation and avoidance, increased angling pressure due to increased stocking amount, environmental factors, or simply caring capacity being reached. While MLA did increase for age 2 fish, no significant difference was observed between any age class and the years before the increased stocking rate was implemented. The same is seen with PSDs with no significant change being found between all sample years. Anglers should have better success with catching harvestable size Saugeye where about 1 in 5 is over 18in compared to 2021 where only 1 out of 100 was 18in.

White Perch:

A total of 368 White Perch were collected, otoliths were able to be retrieved and used from 361. Catch Per Unit Effort (CPUE) significantly increased from 2021 to 13.54 (Figure 7, Table 5). Mean Length at Age (MLA) significantly decreased for age 1 and was not significantly different for age 2 and 3 (Figure 8, Table 7). White Perch were collected in higher numbers than in the previous year (Table 6). Proportional Size Distributions (PSD) were significantly lower from 2021 (Figure 6). PSD – Preferred was 67 and not significantly different from 2021.

White Perch catch rate significantly increased compared to every year except 2017. This large increase in White Perch is concerning and may be a result of the significant decrease in Saugeye. The number of White Perch collected increased for ages 1 – 8 indicating it was not just a booming year class. This is odd

as older ages would have been present in the greater numbers earlier in years but was not reflected in the 2021 sample. A contributing factor may be the increased number of net nights sampled but catch rates were also significantly up. While MLA was significantly lower for age 1, age 2 White perch were the only year class that was significantly different from both pre-stocking increase samples. While PSD was significantly lower than in 2021 it was not significantly different from 2017 and 2018. Overall, it appears Saugeye are having a potential effect on White Perch. We do see a correlation where catch rates of White Perch increase as Saugeye catch rates decrease, and again in PSDs as Saugeye PSD increases White Perch decreases. This indicates that as a greater amount of Saugeye in the population are getting over quality size a smaller number of White Perch are getting as large. This could be due to predation of White Perch preventing as many smaller White Perch reaching larger sizes or a very large year class of age 1 White Perch. Continued monitoring is recommended to see if these trends continue.

2023

Hybrid Striped Bass:

A total of 246 Hybrid Striped Bass were collected and otoliths were able to be collected and used from 244. Catch Per Unit Effort (CPUE) did not significantly change (Figure 1, Table 1). Mean length at age increased significantly for age 1 and age 3 Hybrids compared to 2022 (Figure 2, Table 2). Proportional Size Distribution (PSD) significantly increased from 44 in 2022 to 67 in 2023 (Figure 3) and PSD – P reached 9 in 2023.

Overall Hybrid Striped Bass did not see any significant change to the CPUE including 2017 and 2018, the years before stocking rates were reduced to 5 per acre from 10 per acre. Catch rates fell in 2023 to below the 75th percentile of Hybrid fisheries statewide that was reached in 2022. Since catch rates of Hybrids have not significantly changed for the duration of the reduced stockings it is recommended that stocking rates remain 5 per acre after study of the White Perch population has concluded. Mean Length at Age (MLA) for age 1 and 3 significantly increase from 2022. Age 0, 1, 2, and 3 Hybrids are over the 75th percentile for MLA when compared to statewide Hybrid fisheries. PSD ranked between 50th to 75th percentile statewide while PSD – P 50th percentile. Since reduced stockings HSB Mean Length at Age has trended up for age 1, 2, and 3 year olds. Hybrid anglers should see no difference in the catch rates compared to the years before reduced stocking rates were implemented and while catching larger fish more often as Hybrids are reaching quality size (16in) by age 2.

Saugeye:

A total of 161 Saugeye were collected, and otoliths removed for aging. Catch Per Unit Effort (CPUE) was 5.64 not significantly different from 2022 and before the doubled stocking rate (Figure 4, Table 3). Mean Length at Age (MLA) increased significantly for age 1 and age 3 Saugeye from 2022 (Figure 5, Table 4). Proportional Size Distribution (PSD) was 92 and was not significantly different 2022 and from the years before increased stockings (Figure 6). PSD – Preferred was 35 and not significantly different from 2022.

Saugeye catch rates continued to be significantly smaller from the peak in 2020 but ranking above the 75th percentile of Saugeye catch rates statewide. The insignificant difference in catch rates from 2023 and the years pre increased stocking rate indicates that increased stockings of Saugeye have still failed to increase the number of adult Saugeye in Sooner Lake to control the White Perch population. Increased angling pressure may be a cause for catch rates not increasing. Anecdotal reports of anglers targeting Saugeye have increased throughout the study. A creel survey of Sooner Lake would help to answer the question of how many anglers are targeting Saugeye and how successful they are. While MLA increased from 2022 samples for age 1 and 3, all age group were not significantly different from pre stocking increases. It would be expected that increased stocking rates would slow growth and create stunting. PSD was not significantly different from pre stocking increases but was significantly larger than the 2019 and 2020 samples, the initial two years of stocking increases. PSP – P was not significantly different from pre stocking increases either, but anglers should have an increased opportunity to harvest Saugeye with close to 40% of Saugeye caught being over 18in.

White Perch:

A total of 212 White Perch were collected, otoliths were able to be retrieved and used from 205. Catch Per Unit Effort (CPUE) significantly decreased from 2022 to 7.34 (Figure 7, Table 5). Mean Length at Age (MLA) had no significant change for age 1 and 2. Age 3 White Perch were collected in too few in number to be used for analysis (Figure 8, Table 7). White Perch were collected in lower numbers than in the previous year except for age 2 which had almost double the amount in 2022 (Table 6). Proportional Size Distributions (PSD) were not significantly different from 2021 (Figure 6). PSD – Preferred was 27 and significantly lower from 2022.

While catch rates significantly dropped from 2021 they were not significantly different from 2017 and 2018 before increased stocking Saugeye took place. This indicates that Saugeye have failed to decrease the amount of White Perch in Sooner Lake. 80% of White Perch collected were age 1 or 2 indicating successful spawns with ample recruitment in 2021 and 2022. Age 0 White Perch appear to not recruit to the gear and thus continued monitoring will be able to discern if these are abnormally large year classes or a decrease in the abundance of older year classes. Age 2 White perch continued to be the only year class that was significantly different from both pre-stocking increase samples. This may be due to fewer age 3 White Perch in Sooner Lake allowed for better growth. PSD were insignificantly different from 2017 but were significantly different from 2018. The last three years of PSD indicate the fewer White Perch each year are reaching quality size. This is even more clear in preferred sized White Perch where significant decreases indicate larger fish are leaving the lake through natural or angling mortality and not being replaced. As 2023 was the last year for increased stockings of Saugeye continued monitoring in needed to see changes in White Perch and Saugeye as stocking numbers of Saugeye return to normal.

Evaluation of Saugeye as a control for White Perch

Overall, White Perch abundance has not significantly decreased in the long-term over the course of this evaluation (2017-2023). As this was the goal, we can say using Saugeye as a control for White Perch has not been successful in terms of abundance.

There appears to be an inverse relationship between the abundance of White Perch and the abundance of Saugeye in Sooner Lake. This relationship has not been tested for significance, but is visible in CPUE trend data over the last seven sampling seasons. However, we cannot rule out that this relationship may be an artifact of catchability of each species under certain environmental conditions. It will be important to continue regular sampling to monitor this relationship.

The abundance of Saugeye in Sooner Lake only temporarily increased over the course of this effort, despite a doubling of the stocking contribution for five years. Anecdotally, we think this may have to do with an increase in angling pressure do to public knowledge of the increased stockings, and subsequent word of mouth of great Saugeye angling opportunity at the lake. Saugeye length frequency histograms lead us to believe Saugeye are being harvested as soon as they reach legal size. We hope a creel survey in 2024 will shed more light on this dynamic.

It seems the effect of Saugeye on the White Perch population in Sooner Lake has been similar to what we see when using Saugeye to control stunted crappie populations. White Perch in their native range on the East Coast exhibit great reproductive potential that can cause overpopulation and stunting, similar to crappie in Oklahoma. In Maine, for example, for most waters the only management recommendation needed for white perch is unlimited harvest at current levels of fishing pressure. The increased stockings of Saugeye have seemed to increase the growth of White Perch in Sooner Lake. Mean length of Age-2 White Perch has increased significantly since the beginning of the modified Saugeye stockings.

If White Perch were not considered an invasive species, we would speak favorably of the White Perch population in Sooner Lake. Unlike other Oklahoma waters they have invaded, White Perch in Sooner regularly reach preferred, even memorable size. They are good table fare and customers of local fishing guides are requesting to target them on trips. Our 2024 creel will help us to quantify angler preferences and dial in our management efforts surrounding these species going forward.

RECOMMENDATIONS
1. Evaluate Hybrid Striped Bass and Saugeye and White Perch in 2024 using gill nets.
2. Continue stocking rates of 5 fish per acre for HSB.
3. Conduct a creel survey of Sooner Lake to look at harvest pressure of Saugeye and Moronid Spp.
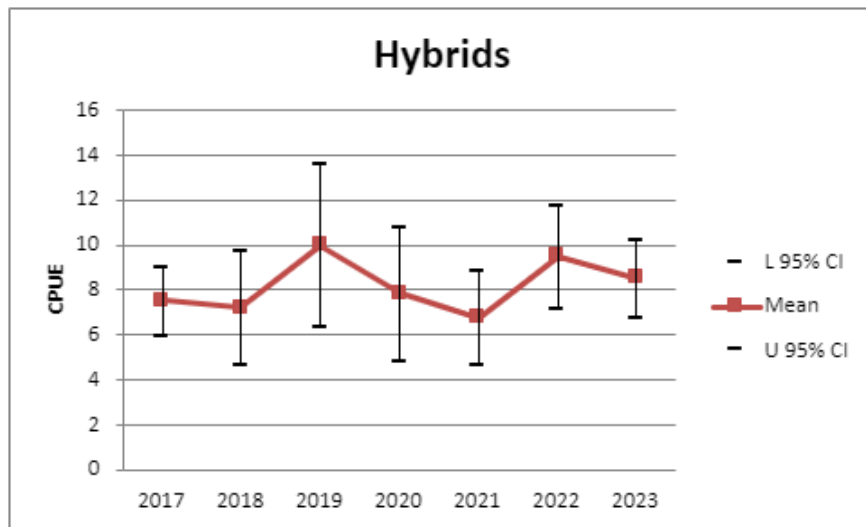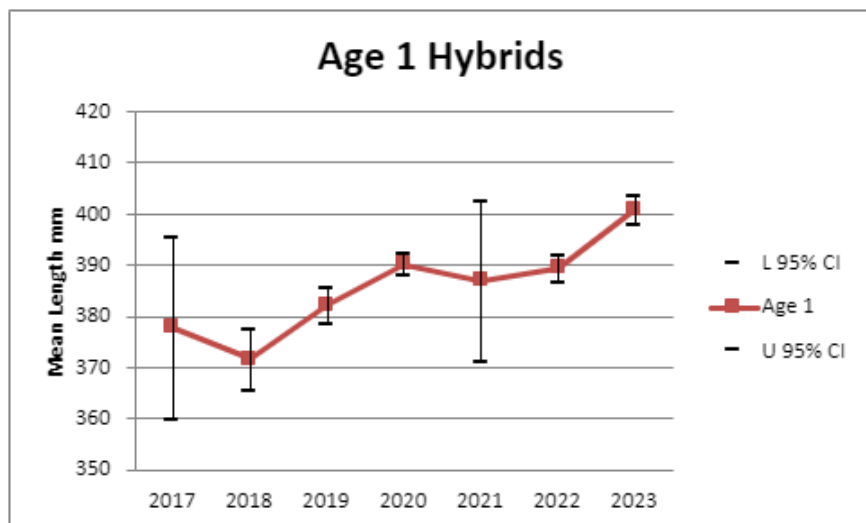
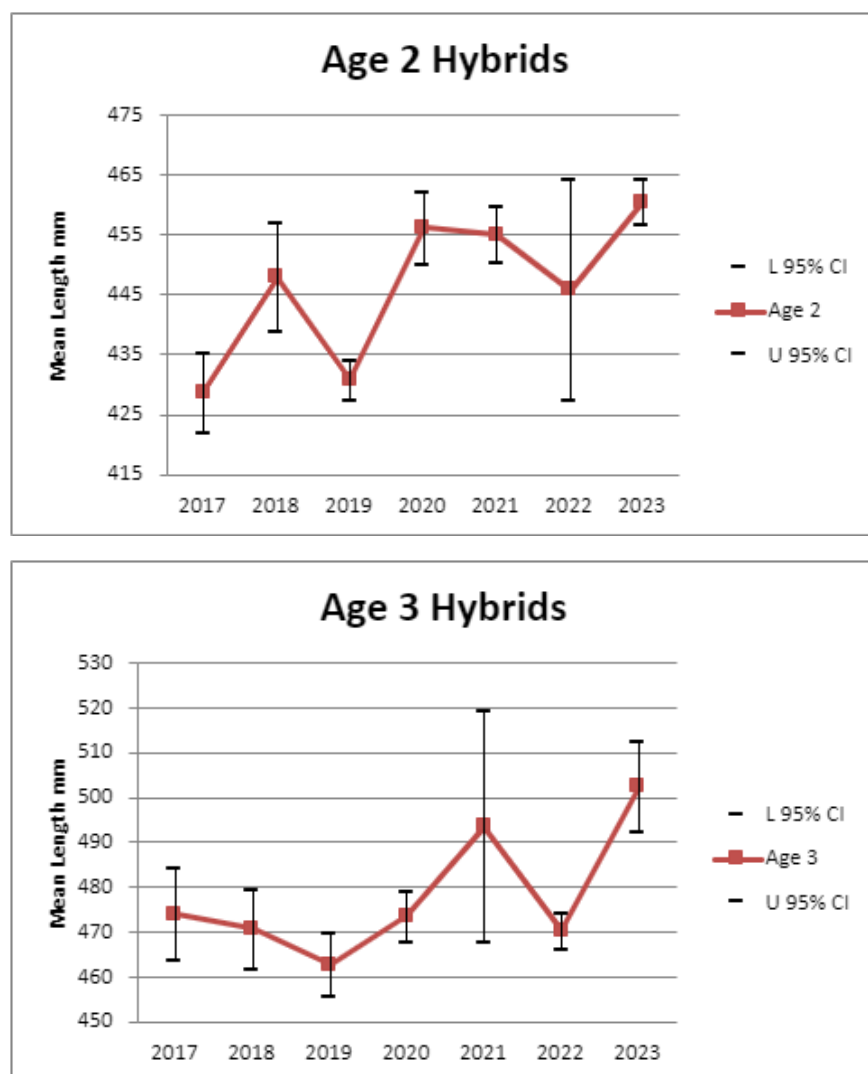Figure 1. Catch Per Unit Effort of Hybrid Striped Bass in Sooner Lake.

Figure 2. Mean Length at Age of Hybrid Striped Bass for age 1, 2, and 3 in Sooner Lake.
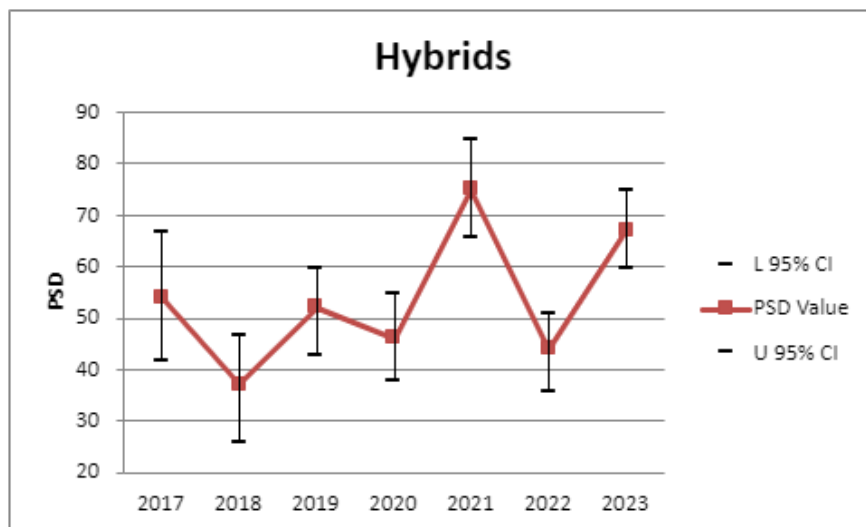
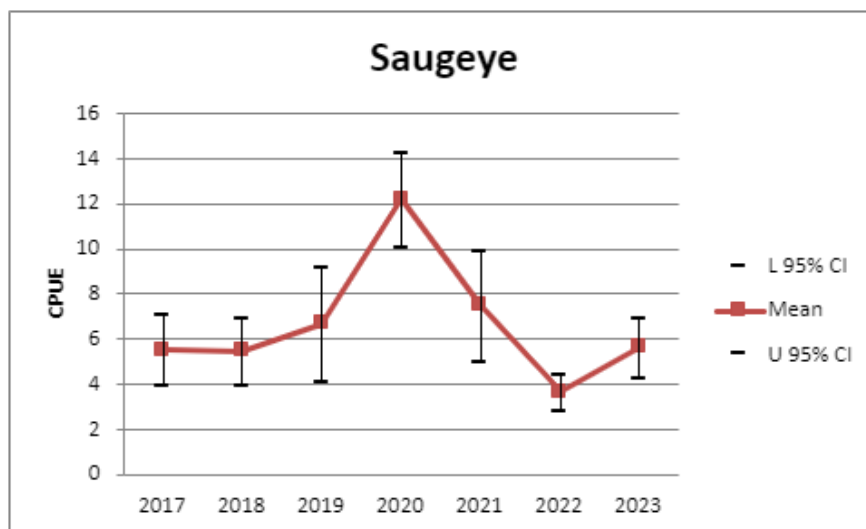Figure 3. Proportional Size Distributions of Hybrid Striped Bass in Sooner Lake.

Figure 4. Catch Per Unit Effort of Saugeye in Sooner Lake.
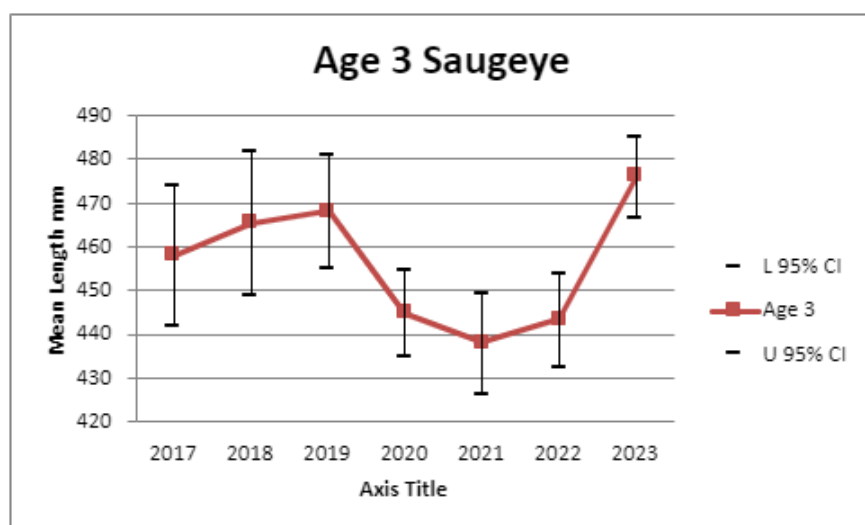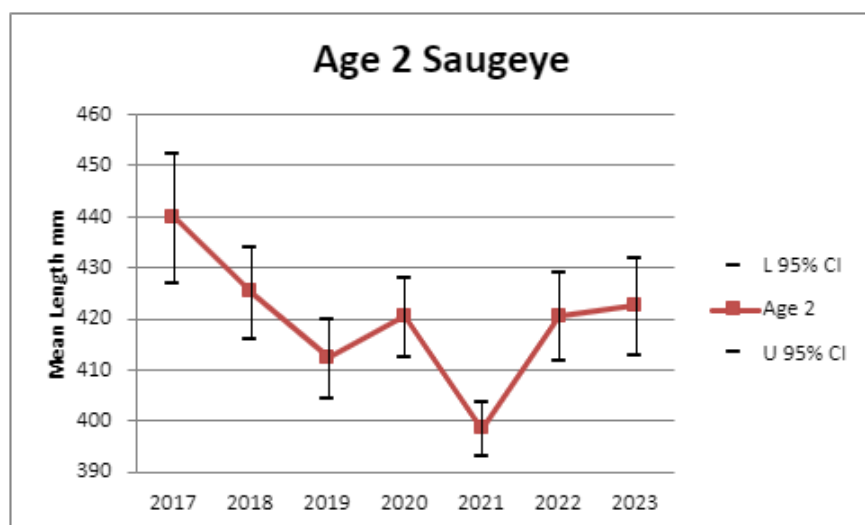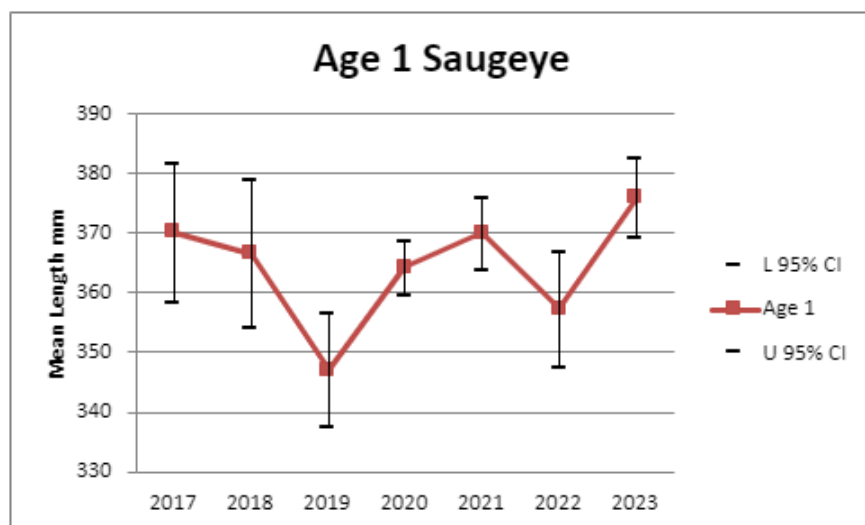
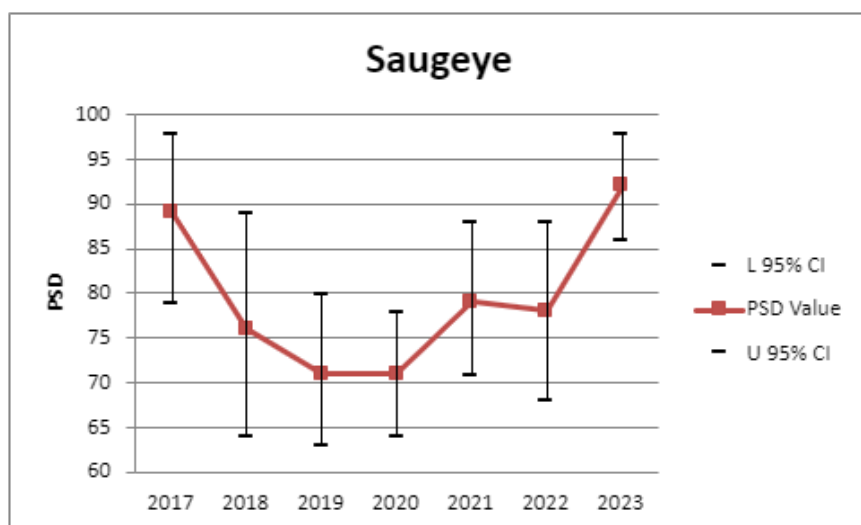Figure 5. Mean Length at Age of Saugeye for age 1, 2, and 3 in Sooner Lake.

Figure 6. Proportional Size Distributions of Saugeye in Sooner Lake.
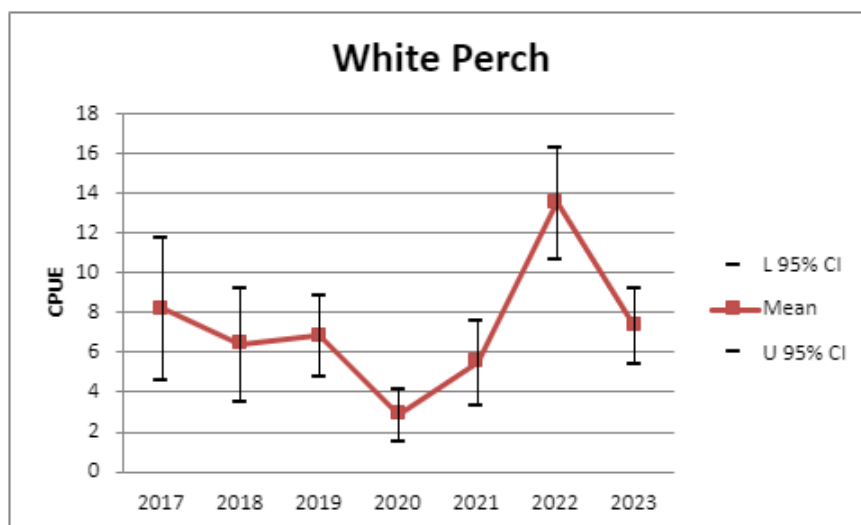
Figure 7. Catch Per Unit Effort of White Perch in Sooner Lake.

Age 1 White Perch
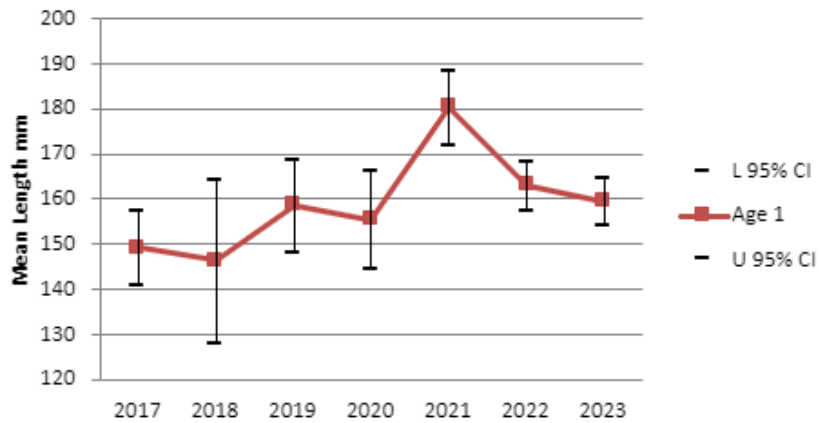
Age 2 White Perch
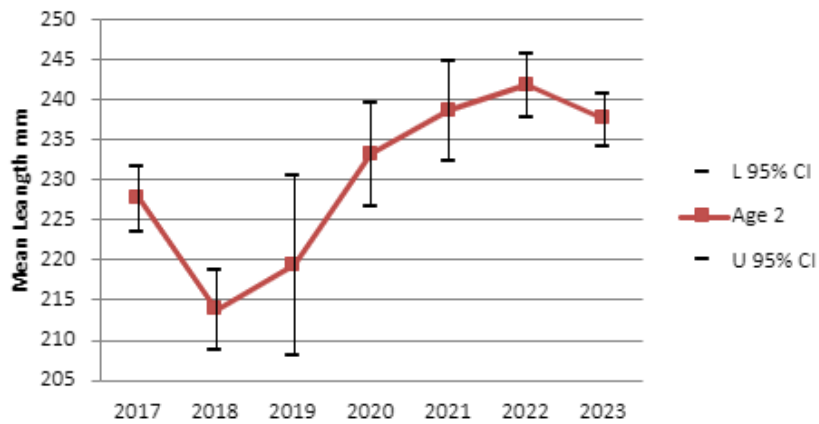
Age 3 White Perch
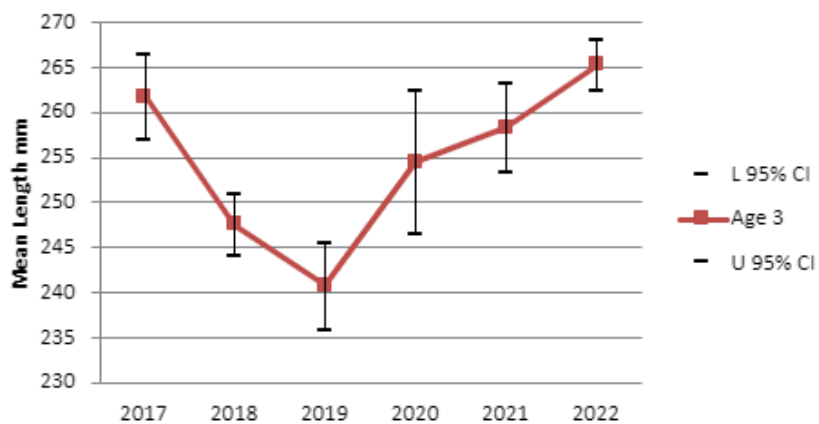
Figure 8. Mean Length at Age of White Perch for age 1, 2, and 3 in Sooner Lake.
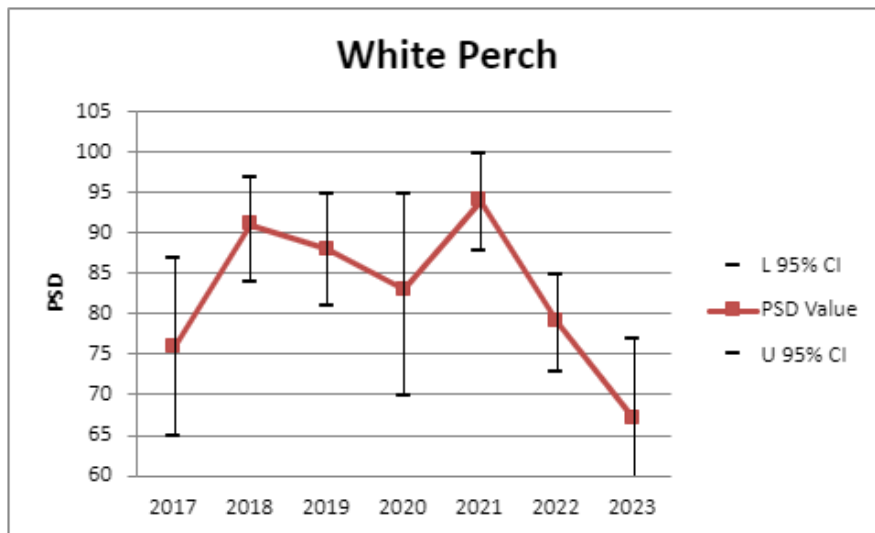
Figure 9. Proportional Size Distributions of White Perch in Sooner Lake.

Table 1. Catch per Unit Effort of Hybrid Striped Bass on Sooner Lake sampled with gillnets.

Lake	Year	Sample Size	Species	L 95% CI	CPUE	U 95% CI
Sooner	2017	15	Hybrid Striped Bass	5.99	7.52	9.05
Sooner	2018	19	Hybrid Striped Bass	4.68	7.21	9.75
Sooner	2019	25	Hybrid Striped Bass	6.38	10	13.61
Sooner	2020	29	Hybrid Striped Bass	4.85	7.83	10.81
Sooner	2021	20	Hybrid Striped Bass	4.66	6.77	8.87
Sooner	2022	30	Hybrid Striped Bass	7.19	9.49	11.79

Sooner	2023	30	Hybrid Striped Bass	6.81	8.53	10.26

Table 2. Mean length at age of Hybrid Striped Bass in Sooner Lake collected using gillnets over multiple years.

Lake	Species	Sample Size (N)	Age (0)	Age-1	Age-2	Age-3	Age-4
2017	Hybrid Striped Bass	119	246.8	377.7	428.6	474	499
2018	Hybrid Striped Bass	132	252.08	372.29	453.00	472.88	450.67
2019	Hybrid Striped Bass	243	254.5	382.97	430.81	461.88	488.67
2020	Hybrid Striped Bass	194	-	390.68	456.17	472.87	508.30
2021	Hybrid Striped Bass	134	245.2	386.9	455	493.5	487.1
2022	Hybrid Striped Bass	259	254.8	389.5	445.8	470.4	492.5
2023	Hybrid Striped Bass	246	269.33	400.85	460.46	502.43	496.61

Table 3. Catch per Unit Effort of Saugeye on Sooner Lake sampled with gillnets.

Lake	Year	Sample Size	Species	L 95% CI	CPUE	U 95% CI
Sooner	2017	15	Saugeye	3.93	5.52	7.11
Sooner	2018	19	Saugeye	3.94	5.45	6.97
Sooner	2019	25	Saugeye	4.14	6.68	9.22
Sooner	2020	29	Saugeye	10.06	12.19	14.31
Sooner	2021	20	Saugeye	5.04	7.48	9.92
Sooner	2022	30	Saugeye	2.86	3.67	4.48
Sooner	2023	30	Saugeye	4.32	5.64	6.97

Table 4. Mean length at age of Saugeye in Sooner Lake over multiple years.

Lake	Species	Sample Size (N)	Age (0)	Age-1	Age-2	Age-3	Age-4	Age-5

Year	Species							
2018	Saugeye	97	258.75	369.89	424.28	466.30	507.4	-
2019	Saugeye	160	265.53	344.63	410.56	465.26	465.25	-
2020	Saugeye	315	272.54	363.44	416.09	443.97	467.94	519.55
2021	Saugeye	141	265.6	369.9	398.5	438.2	-	-
2022	Saugeye	102	262.6	357.3	420.5	443.5	-	-
2023	Saugeye	161	240.47	375.97	422.62	476.09	472.29	-

Table 5. Catch Per Unit Effort of White Perch in Sooner Lake over multiple years collected using gillnets.

Lake	Year	Sample Size	Species	L 95% CI	CPUE	U 95% CI
Sooner	2017	15	White Perch	4.6	8.19	11.78
Sooner	2018	19	White Perch	3.59	6.42	9.26
Sooner	2019	25	White Perch	4.83	6.84	8.86
Sooner	2020	29	White Perch	1.57	2.88	4.2
Sooner	2021	20	White Perch	3.38	5.5	7.63
Sooner	2022	30	White Perch	10.74	13.54	16.33
Sooner	2023	30	White Perch	5.46	7.34	9.22

Table 6. Sooner Lake White Perch sampled by age.

Age	0	1	2	3	4	5	6	7	8	9	10	11	12	13
2013		1	3	18	10	4								
2014		2	3	4	7	2								
2017	3	56	38	14	2		2	5	2	2				
2018		3	48	47	8		2	3	7					
2019		19	16	42	58	17		2	1	2	5			
2020		12	35	6	6	11		1						
2021		6	32	39	6	7	9	3		1				

2022		91	47	57	83	12	35	21	14		1			
2023		78	92	2	9	6	5	7	3				2	1

Table 7. Mean Length at Age of White Perch in Sooner Lake over multiple years.

Gear	Year	(n)	0	1	2	3	4	5	6	7	8	9	10
Gill Net	2013	36	---	132	210	207	246	268	---	---	---	---	---
Gill Net	2014	18	---	163	213	219	238	250	---	---	---	---	---
Multiple	2017	124	107.8	148.4	218.2	263.8	279.5	---	274.5	284.5	299.5	304.5	---
Gill Net	2018	118	---	146.3	214.3	246.2	263.0	---	284	278.3	279.9	---	---
Gill Net	2019	163	---	161.7	220.9	241.9	263.2	279	---	290	280	299	294
Gill Net	2020	71	---	155.1	233.5	244.8	261.7	290.8	---	304	---	---	---
Gill Net	2021	104	---	180.3	238.6	258.3	273.8	284.7	287.6	307.7	---	---	---
Gill Net	2022	361	---	163	241.8	265.3	277.3	277.3	285.2	296.1	307.7		
Gill Net	2023	212	---	159	236.9	---	294	295.2	308.2	313	318		