SURVEY REPORT

OKLAHOMA DEPARTMENT OF WILDLIFE CONSERVATION

FISH MANAGEMENT SURVEY AND RECOMMENDATIONS

FOR

SHAWNEE TWIN LAKE #2

2022

SURVEY REPORT

State: Oklahoma

Project Title: Shawnee Lake #2 Fish Management Survey Report

Period Covered: Changes in ODWC standard reporting occurred since the 2007 Survey Report. This report discusses survey results from 2007-2022.

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Shawnee Lake #2

ABSTRACT

Shawnee Lake #2 was surveyed by spring electrofishing (2016, 2018, 2021), fall gill netting (2007, 2012, 2016, 2022), fall trap netting (2018), fall saugeye electrofishing (2008, 2009, 2012, 2015, 2016) and by summer catfish electrofishing (2020) techniques to monitor trends in fish populations. Largemouth Bass relative abundance increased to that of a quality fishery. Channel Catfish had moderate abundance and increased growth rates with the reduced stocking frequency. Saugeye abundance varied but appeared to have good growth with the change in stocking frequency from yearly to biannual. Saugeye grew to legal harvest size of 14 inches by age two. Blue Catfish and Flathead Catfish abundance remained low. Crappie and Gizzard Shad abundance varied but remained moderate to low.

INTRODUCTION

Shawnee Twin Lakes are located 7 miles west of Shawnee in Pottawatomie County, Oklahoma. These two lakes impound South Deer Creek and are connected by a 10 ft. deep canal. Shawnee Twin Lake #2 covers 1,100 surface acres and was constructed in 1960 by the City of Shawnee. Lake #2 has a mean depth of 16.4 ft. and a maximum depth of 45 ft., a shoreline development ratio of 3.8 and a secchi disc visibility of around 40 inches in the main pool in August; turbidity is primarily from suspended clay. Fish habitat consists primarily of aquatic vegetation (water willow).

Poor Largemouth Bass recruitment has been a chronic problem. Historically, Shawnee Twin #2 remains fairly turbid for extended periods of time following heavy rains; however, in recent years the lake has been clearer. Previous surveys indicated an established saugeye fishery. Shawnee Twin Lakes were confirmed positive with Zebra Mussels in 2022.

Early management objectives for this lake were to establish saugeye in order to provide an additional fishery and to improve the size structure of the Crappie population. A stocking of saugeye fry in 1994 proved to be unsuccessful, but subsequent fingerling stockings have been successful. Saugeye were unsuccessful with improving Crappie size structure. However, they have been successful in establishing a fishery.

Several stockings of other fish species have been made in past years (Appendix 1). Channel Catfish have been stocked frequently, but stocking frequency has been reduced to allow body conditions and growth rates to increase. Thirteen fish attractor habitat sites have been established in the lake and are maintained (Appendix 2). A fishing and boating access project consisting of extension of a boat ramp; installation of a boat dock and fishing dock; and renovation of the parking lot was completed in 1990. In 2000, the parking lot was asphalted, and a ramp repair was completed. In 2012, a new boat dock was installed. Other fish management activities have included implementing a 356 mm minimum length limit on Largemouth Bass on July 30, 1987. Currently Shawnee Twin Lakes follow all statewide fishing regulations. Statewide saugeye regulations changed in 2016 from an 18-inch minimum to a 14-inch minimum. Statewide Largemouth Bass fishing regulations changed in the fall of 2022 to: A creel limit of six (6) Largemouth Bass of which only one may be larger than 16 inches.

Shawnee Lake #2 was surveyed by spring electrofishing (2016, 2018, 2021), fall gill netting (2007, 2012, 2016, 2022), fall trap netting (2018), fall saugeye electrofishing (2008, 2009, 2012, 2015, 2016) and summer catfish electrofishing (2020) techniques to monitor trends in fish populations.

Largemouth Bass

Largemouth Bass (LMB) were surveyed in spring of 2016, 2018 and 2021 by means of boat electrofishing. Randomly selected shoreline units were sampled. A total of 24 units were sampled in 2016, 18 in 2018, and 18 in 2021. Overall LMB abundance, catch per unit of effort (CPUE) increased slightly for all three surveys in 2016 (CPUE = 31.0), 2018 (CPUE = 49.3), and 2021 (CPUE = 42.7) compared to the last survey reported in 2002 (CPUE = 25.3) (Table 1). Largemouth Bass relative abundance was considered low for 2016, but the 2018 and 2021 surveys exceeded a catch rate of 40 fish per hour, or the minimum considered as a quality fishery. While abundance varied between size classes and years surveyed, the most recent 2021 survey showed an increase in the preferred size class (CPUE = 10.3) compared to the previous surveys. Poor recruitment after 2016 can be observed in the lower than desired abundance of substock size fish in 2018 (CPUE = 6.3). However, relative abundance of substock size fish increased in 2021 (CPUE = 16.7) to a desirable amount, indicating an increase in recruitment from the 2020-year class. It is important to note that the standard sampling procedures (SSP) for Largemouth Bass electrofishing surveys changed from 15-minute to 10-minute units in 2015. While this change decreased the amount of time sampled per unit, it is unknown how that would have affected catch rates. CPUE's can vary based on habitat types sampled.

Body condition or relative weights (Wr) in 2021 for stock (Wr = 92), preferred (Wr = 90), and memorable (Wr = 96) size classes were at or above acceptable body conditions (Wr $\geq$ 90) (Table 1). The quality (Wr = 85) size class in 2021 was below that of acceptable body conditions. The 2021 length frequency histogram also showed an increase in preferred size fish (15-19 in) compared to the previous surveys (Figure 1). Proportional size distribution (PSD) values have increased considerably for both quality and preferred size classes. Indicating an increase in the proportion of larger fish (Table 2). The largest fish sampled was from the 2016 survey and measured 21.6 (in) in total length and 6.2 (lbs.) in weight.

Age data was collected on a subset of Largemouth Bass from the 2021 survey. Largemouth Bass growth was slow taking approximately three years to reach a mean length of 13.5 inches, and six years to reach a mean length of 18.6 inches (Table 3). The Von Bertalanffy growth curve (Figure 2) gives a visual representation of the predicted growth of Largemouth Bass for Shawnee Lake #2 and estimates the mean maximum length at 21.8 inches. The oldest LMB collected during the 2021 survey was aged to be six years old.

Overall abundance has varied slightly and ultimately increased since 2002. Since 2018, overall abundance has remained above acceptable values for a quality fishery. Body conditions were acceptable for most size classes while growth rates were slow.

Table 1. Total number (No.), catch per unit of effort (CPUE), and relative weights (Wr) by size groups of Largemouth Bass collected by spring electrofishing from Shawnee Lake #2. Acceptable Wr values are ≥90.

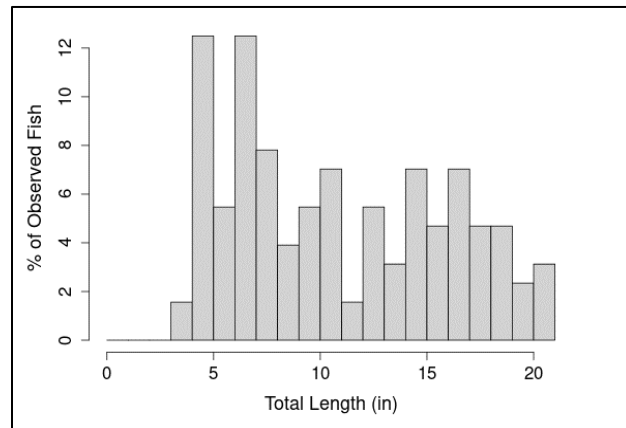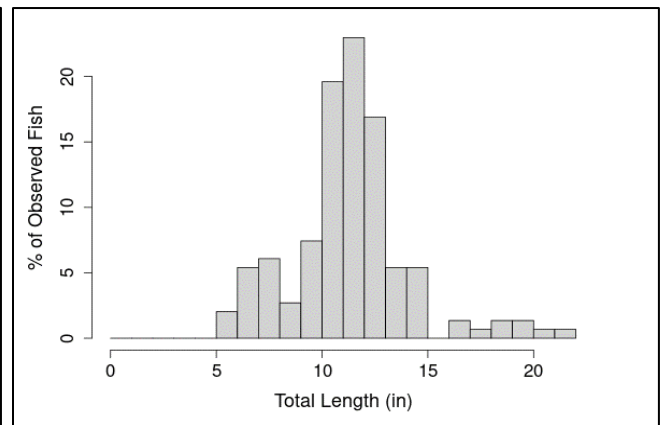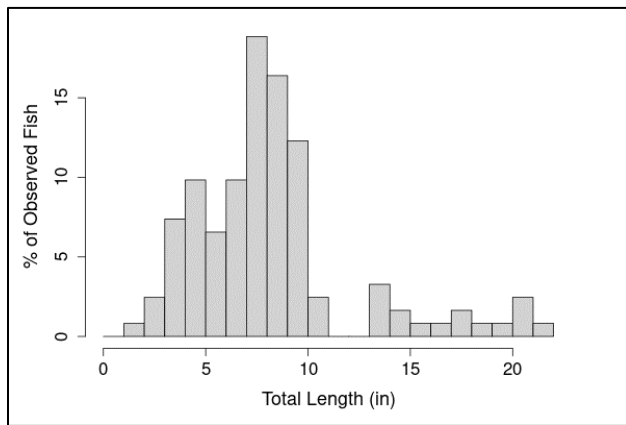|		Total CPUE	Substock 0-7.8 in	Stock 7.9 in		Quality 11.8 in		Preferred 15 in		Memorable 20.1 in		Trophy 24.8 in	
Year	No.	CPUE	CPUE	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr
2002	95	25.3	8.3	8.3	94	8.8	89	5.1	89	.	.	.	.
2016	124	31.0	16.0	10.5	88	1.3	91	1.8	103	1.0	102	.	.
2018	148	49.3	6.3	23.7	86	16.3	82	2.3	85	0.7	89	.	.
2021	128	42.7	16.7	8.0	92	6.3	85	10.3	90	1.3	96	.	.

Figure 1. 2016 (top left), 2018 (top right) 2021 (bottom) Largemouth Bass Length Frequencies for Shawnee Lake #2.

Table 2. Proportional Size Distribution (PSD) of Largemouth Bass. Quality (PSD-Q) preferred (PSD-P) and memorable (PSD-M) lengths. PSD values indicate the proportion of fish in or above the quality, preferred or memorable size classes.

Year Surveyed	PSD-Q (11.8 in)	PSD-P (15 in)	PSD-M (20.1 in)
2016	28	19	7
2018	45	7	2
2021	69	45	5

Table 3. Mean Total Length at age (inches) and L infinity (estimated mean maximum length) for Largemouth Bass from Shawnee Lake #2.

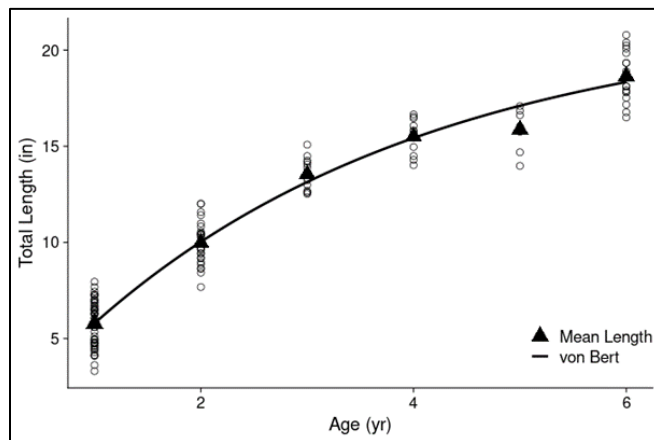| Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	L inf.
2021	5.8	10	13.5	15.5	15.9	18.6	.	.	.	.	.	.	21.8

Figure 2. 2021 Largemouth Bass Mean Length at Age: Von Bert Estimated Growth Curve. The Von Bert Growth Curve indicates the estimated growth rate of Largemouth Bass.
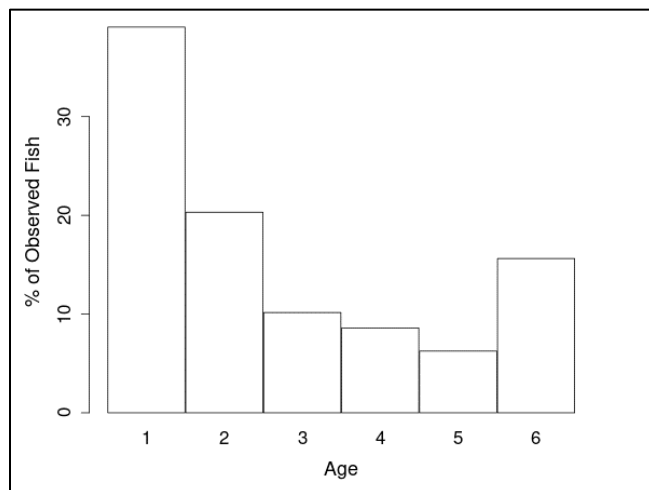

Figure 3. 2021 Age Frequency of Largemouth Bass.

Spotted Bass

Spotted Bass were surveyed in spring of 2016, 2018, and 2021 by means of boat electrofishing. Randomly selected shoreline units were sampled. A total of 24 units were sampled in 2016, 18 in 2018, and 18 in 2021. Overall Spotted Bass abundance increased during the 2016 (CPUE = 23.8) survey compared to 2002 (CPUE = 14.9), then slightly decreased during the 2018 (CPUE = 18.7) and 2021 (CPUE = 17.3) surveys. Spotted Bass abundance has been above acceptable values (CPUE < 10) since the 2002 survey. Relative abundance increased for all size classes during the 2021 survey except for quality (CPUE = 1.0) size fish compared to 2002 (Table 4). It is important to note that the standard sampling procedures (SSP) for Black Bass electrofishing surveys changed from 15-minute to 10-minute units in 2015. While this change decreased the amount of time sampled per unit, it is unknown how that would have affected catch rates. CPUE's can vary based on habitat types sampled.

Body condition or relative weights (Wr) were considered acceptable for all size classes during the 2016 survey; however, they fell below acceptable values and were considered poor for all size classes in the 2018 and 2021 surveys except for the quality (Wr = 91) size class in 2021 (Table 4). The 2018 and 2021 Spotted Bass length frequency histograms (Figure 3) indicate a decrease in the amount of 10-15 inch fish observed, but an increase in 7-10 inch fish compared to 2016. Proportional size distribution (PSD) values decreased for both the quality (PSD-Q =28) and preferred (PSD-P = 11) size classes compared to 2016 (PSD-Q = 95) (PSD-P = 34) (Table 5). The largest fish sampled was from the 2016 survey and measured 16.3 (in) in total length and 2.2 (lbs.) in weight.

Spotted Bass typically grow slower and obtain smaller sizes than Largemouth Bass and they compete for the same food source. For management reasons low abundance of Spotted Bass is preferred. Spotted Bass have no minimum length limit.

Table 4. Total number (No.), catch per unit of effort (CPUE), and relative weights (Wr) by size groups of Spotted Bass collected by spring electrofishing from Shawnee Lake #2. Acceptable Wr values are ≥90.

Year	No.	Total CPUE	Substock 0-7.0 in CPUE	Stock 7.1 in CPUE	Stock 7.1 in Wr	Quality 11 in CPUE	Quality 11 in Wr	Preferred 13.8 in CPUE	Preferred 13.8 in Wr	Memorable 16.9 in CPUE	Memorable 16.9 in Wr	Trophy 20.1 in CPUE	Trophy 20.1 in Wr
2002	56	14.9	6.4	3.2	97	5.3	88	.	.	.	.	.	.
2016	95	23.8	12.8	0.5	96	6.8	90	3.8	95	.	.	.	.
2018	56	18.7	9.3	5.3	86	1.7	78	2.3	77	.	.	.	.
2021	52	17.3	11.3	4.3	83	1.0	91	0.7	84	.	.	.	.

Table 5. Proportional Size Distribution (PSD) of Spotted Bass. Quality (PSD-Q) preferred (PSD-P) and memorable (PSD-M) lengths. PSD values indicate the proportion of fish in or above the quality, preferred or memorable size classes.

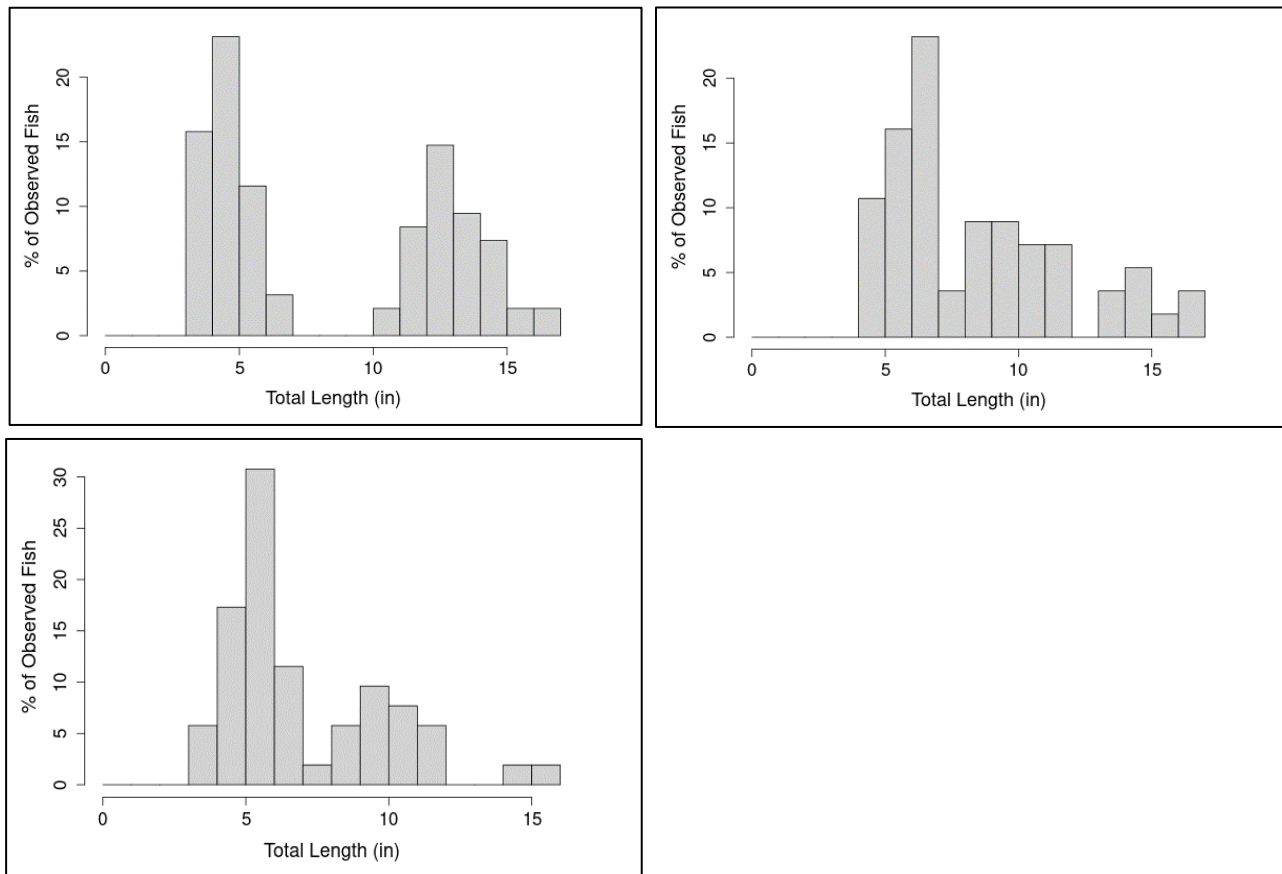| Year Surveyed	PSD-Q (11 in)	PSD-P (13.8 in)	PSD-M (16.9 in)
2016	95	34	.
2018	43	25	.
2021	28	11	.

Figure 4. 2016 (top left), 2018 (top right), 2021 (bottom) Spotted Bass Length Frequencies for Shawnee Lake #2.

Channel Catfish

Channel Catfish were surveyed in 2007, 2012, 2016, and 2022 using suspended gill nets. Standard sampling protocols for gill net lengths changed in 2009 to 80 foot nets. Gill net lengths and effort varied prior to 2009. Ten stations in both 2016 and 2022, nine stations in 2012 and five stations in 2007 were randomly sampled for a period of 24 hours during each survey. Relative abundance varied between years surveyed but was considered moderate for all surveys except 2016 (CPUE = 4.0) (Table 6). The 2012 and 2022 surveys were the only years preferred size fish were collected (CPUE = 0.1). Body

conditions were considered poor for all size classes in the 2007 and 2016 surveys, all size classes but preferred (Wr = 100) in the 2012 survey, and for the quality (Wr = 85) size class in the 2022 survey.

The 2022 Length frequency histogram (Figure 4) showed an increase in 20-25 inch fish, but a decrease in fish under 15 inches compared to the previous years surveyed. The proportional size distribution (PSD) values also indicated a size increase with an increase in PSD-Q = 94 compared to the previous years surveyed (Table 7). While PSD- Q values increased, too high PSD-Q values may indicate poor recruitment with few fish present in the smaller size classes. The largest fish sampled was from the 2012 survey and measured 26.3 (in) in total length and 7 (lbs.) in weight.

Age data was collected on a subset of Channel Catfish from the 2016 and 2022 surveys. Channel Catfish grew to a mean length of 17 inches by age four during both surveys. Channel Catfish grew to a mean length of 19.6 inches by age five in 2022 compared to 17.8 inches in 2016. Growth rates varied between years and ages surveyed (Table 8). However, the Von Bertalanffy growth curve (Figure 6) gives a visual representation of the predicted growth of Channel Catfish for Shawnee Lake #2 and estimates the mean maximum length at 20 inches in 2022, an increase compared to 19.3 inches in 2016.

The 2022 age frequency histogram indicates that the 2015 stocking of Channel Catfish had extremely high success rates (Figure 5). The most recent stocking occurred in 2016 (Appendix 1) and no Channel Catfish under four years of age were collected in the 2022 survey, indicating low natural recruitment is occurring.

Overall, Channel Catfish at Shawnee Twin Lake #2 had moderate abundance and mostly poor body conditions. However, growth rates increased with the reduction in stocking frequency. Natural reproduction has been verified, though poor recruitment was observed in the 2022 survey. The Channel Catfish stocking program is for the establishment of a self-sustaining population and deemed successful. No stockings are recommended at this time.

Table 6. Total number (No.), catch per unit of effort (CPUE), and relative weights (Wr) by size groups of Channel Catfish collected by fall gill netting from Shawnee Lake #2. Acceptable Wr values are ≥90.

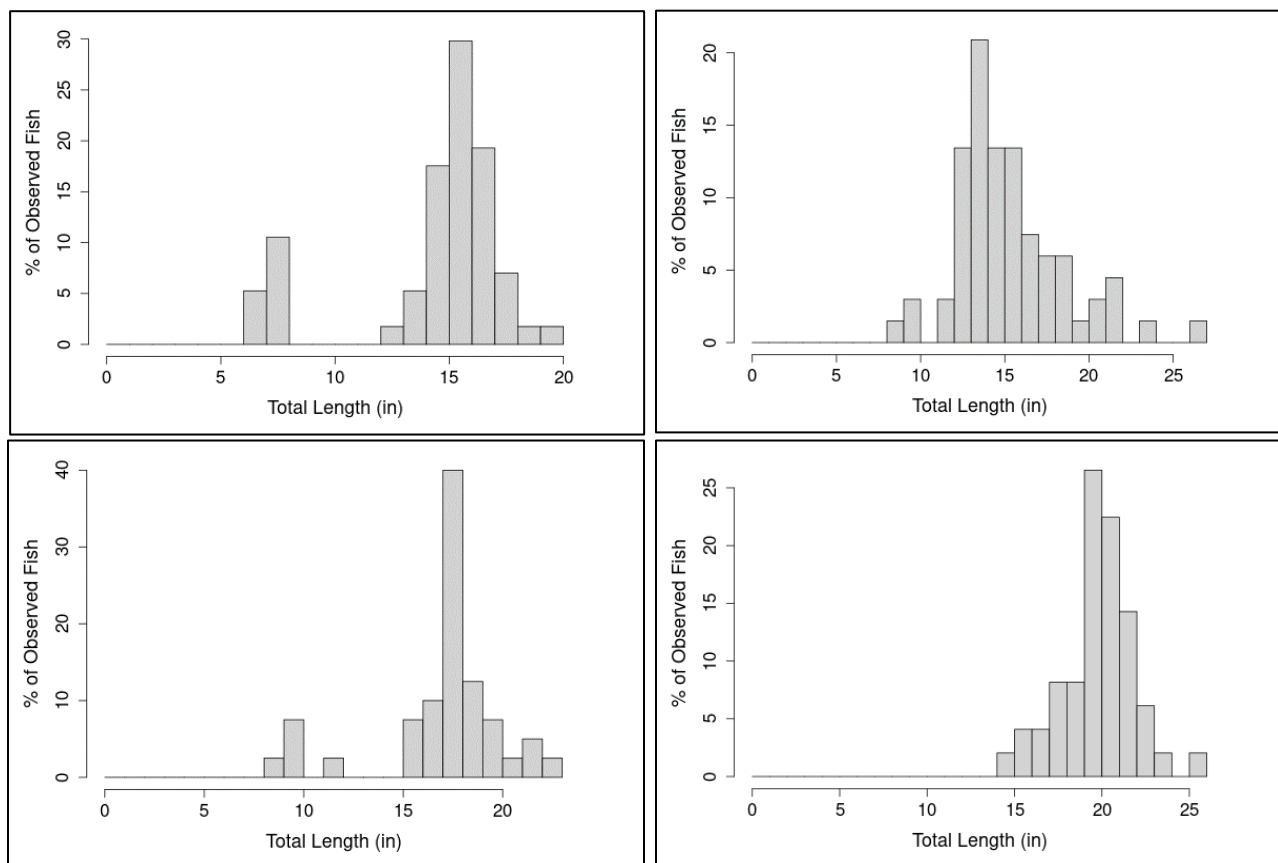|		Total CPUE	Stock 11 in		Quality 16.1 in		Preferred 24 in		Memorable 28 in		Trophy 35.8 in	
Year	No.	CPUE	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr
2007	57	5.6	3.2	79	1.5	78	.	.	.	.	.	.
2012	67	6.9	4.4	81	2.1	84	0.1	100	.	.	.	.
2016	40	4.0	0.4	83	3.2	83	.	.	.	.	.	.
2022	49	5.0	0.3	97	4.6	85	0.1	102	.	.	.	.

Figure 5. 2007 (top left), 2012 (top right), 2016 (bottom left), 2022 (bottom right) Channel Catfish Gill Net Length Frequency Histograms for Shawnee Lake #2.

Table 7. Proportional Size Distribution (PSD) of Channel Catfish. Quality (PSD-Q), preferred (PSD-P) and memorable (PSD-M) lengths. PSD values indicate the proportion of fish in or above the quality, preferred or memorable size classes.

Year Surveyed	PSD-Q (16.1 in)	PSD-P (24 in)	PSD-M (28 in)
2007	31	.	.
2012	33	2	.
2016	89	.	.
2022	94	2	.

Table 8. Mean Total Length at age (inches) for Channel Catfish from Shawnee Lake #2.

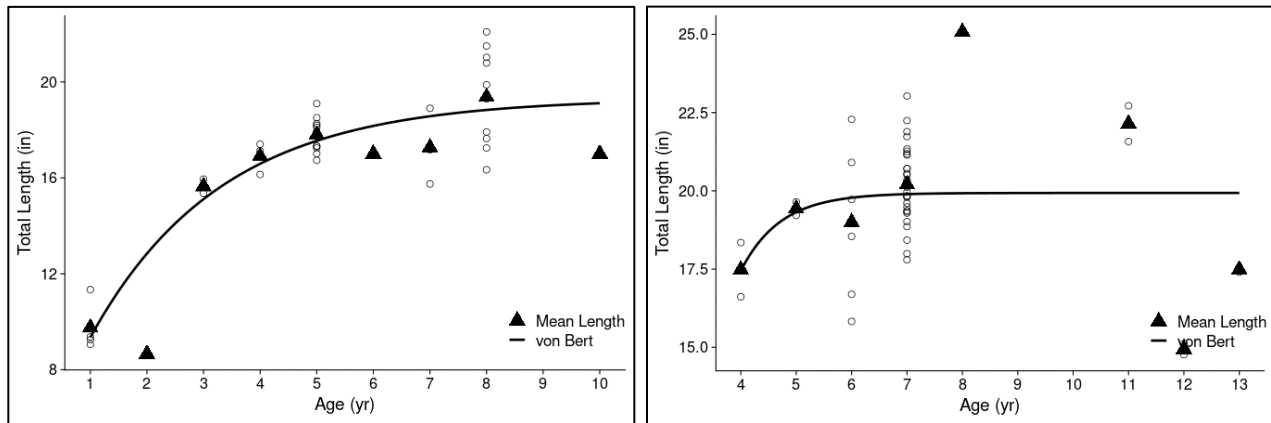|	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	L inf.
2016	9.8	8.7	15.7	17	17.8	17	17.3	19.4	.	17	.	.	19.3
2022	.	.	.	17	19.6	20.4	20.1	25.1	.	.	21.8	16.7	20

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Figure 6. 2016 (left) and 2022 (right) Channel Catfish Mean Length at Age: Von Bert Estimated Growth Curve. The Von Bert Growth Curve indicates the estimated growth rate of Channel Catfish.
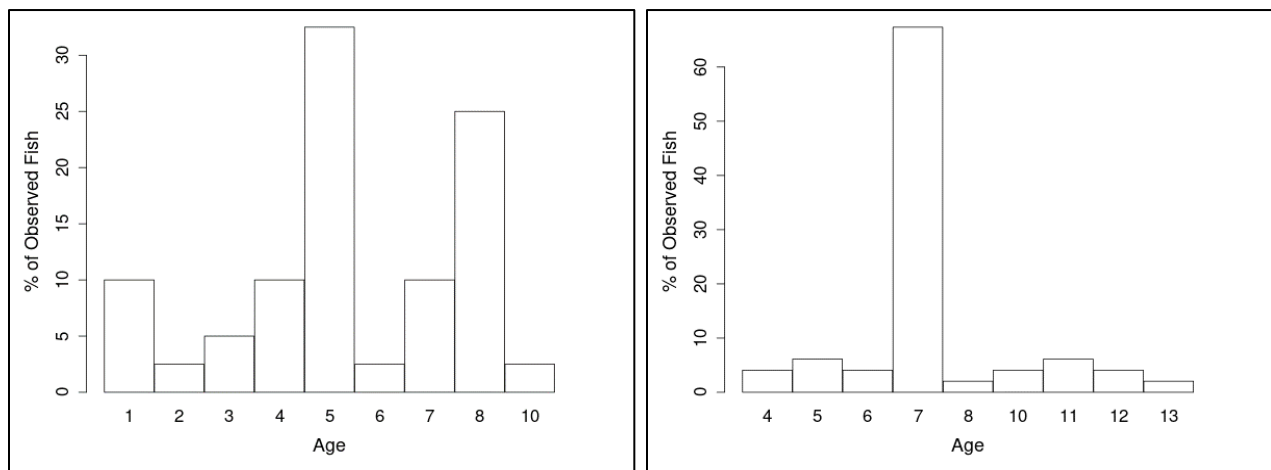

Figure 7. 2016 (left) and 2022 (right) Age Frequency of Channel Catfish.

Blue Catfish

Blue Catfish were surveyed in 2007, 2012, 2016, and 2022 using suspended gill nets. Standard sampling protocols for gill net lengths changed in 2009 to 80 foot nets. Gill net lengths and effort varied prior to 2009. Ten stations in both 2016 and 2022, nine stations in 2012 and five stations in 2007 were randomly sampled for a period of 24 hours during each survey. All four gill net surveys indicated a low abundance of Blue Catfish. However, only one Blue Catfish was collected in 2012 and no Blue Catfish were collected during the 2016 and 2022 surveys (Table 9). Body condition were considered acceptable for all size classes observed in the 2007 survey except for the quality (Wr = 89) size class. The largest fish sampled from the gill net surveys was from 2007 and measured 31.5 (in) in total length and 14.5 (lbs.) in weight.

Blue Catfish were also sampled in the summer of 2020 using electrofishing techniques. Eight randomly selected sites were surveyed for a total of 40 minutes of effort. Only one Blue Catfish was observed during the survey. Relative abundance was low (CPUE = 1.5) but body condition of the one fish sampled was considered acceptable (Table 10). The fish sampled measured 23.1 (in) in total length and 4.6 (lbs.) in weight.

Table 9. Total number (No.), catch per unit of effort (CPUE), and relative weights (Wr) by size groups of Blue Catfish collected by fall gill netting from Shawnee Lake #2. Acceptable Wr values are ≥90.

		Total CPUE	Stock 11.8 in		Quality 20.1 in		Preferred 29.9 in		Memorable 35 in		Trophy 44.9 in	
Year	No.	CPUE	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr
2007	14	1.3	0.4	91	0.9	89	0.1	103	.	.	.	.
2012	1	0.1	0.1	.	.	.	.	.	.	.	.	.
2016	0	.	.	.	.	.	.	.	.	.	.	.
2022	0	.	.	.	.	.	.	.	.	.	.	.

Table 10. Total number (No.), catch per unit of effort (CPUE), and relative weights (Wr) by size groups of Blue Catfish collected by Summer Electrofishing from Shawnee Lake #2. Acceptable Wr values are ≥90.

		Total CPUE	Stock 11.8 in		Quality 20.1 in		Preferred 29.9 in		Memorable 35 in		Trophy 44.9 in	
Year	No.	CPUE	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr
2020	1	1.5	.	.	1.5	93	.	.	.	.	.	.

Flathead Catfish

Flathead Catfish were surveyed in 2007, 2012, 2016, and 2022 using suspended gill nets. Standard sampling protocols for gill net lengths changed in 2009 to 80 foot nets. Gill net lengths and effort varied prior to 2009. Ten stations in both 2016 and 2022, nine stations in 2012 and five stations in 2007 were randomly sampled for a period of 24 hours during each survey. All four surveys indicated a low abundance of Flathead Catfish. Only one fish was collected in both 2007 and 2016 (CPUE = 0.1). No Flathead Catfish were sampled in the 2012 or 2022 surveys (Table 11). The fish observed in the 2016 survey was substock size and the fish observed in the 2007 survey was in the memorable size class and showed body conditions below what is considered acceptable. The largest fish sampled was from the 2007 survey and measured 35.4 (in) in total length 16.6 (lbs.) in weight.

Table 11. Total number (No.), catch per unit of effort (CPUE), and relative weights (Wr) by size groups of Flathead Catfish collected by fall gill netting from Shawnee Lake #2. Acceptable Wr values are ≥90.

		Total CPUE	Stock 13.8 in		Quality 20.1 in		Preferred 28 in		Memorable 33.9 in		Trophy 40.2 in	
Year	No.	CPUE	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr
2007	1	0.1	.	.	.	.	.	.	0.1	75	.	.
2012	0	0	.	.	.	.	.	.	.	.	.	.
2016	1	0.1	.	.	.	.	.	.	.	.	.	.
2022	0	0	.	.	.	.	.	.	.	.	.	.

Saugeye

Saugeye were surveyed in 2007, 2012, 2016 and 2022 using suspended gill nets. Standard sampling protocols for gill net lengths changed in 2009 to 80 foot nets. Gill net lengths and effort varied prior to 2009. Ten stations in both 2016 and 2022, nine stations in 2012 and five stations in 2007 were randomly sampled for a period of 24 hours during each survey. Relative abundance varied between size classes and years surveyed. Relative abundance was below what is considered acceptable for the most recent survey in 2022 (CPUE = 1.6). The 2012 survey had the highest total abundance (CPUE = 5.5), while the 2022 survey had the highest abundance of stock size fish (CPUE = 1.1) (Table 13). Body condition varied between size classes and years surveyed. Body conditions for the 2016 survey and the most recent 2022 survey, were below values considered acceptable (Wr $\geq$ 90) for all size fish. The 2022 length frequency histogram shows, nearly 70% of the saugeye sampled were between 11 and 14 inches (Figure 8). The largest fish sampled was from the 2022 survey and measured 24 (in) in total length and 4.3 (lbs.) in weight.

Fall nighttime electrofishing surveys for saugeye were conducted in 2008, 2009, 2012, 2015, and 2016. Six randomly selected shoreline units were sampled in both 2008 and 2009. Nine randomly selected shoreline units were sampled in 2012, 2015, and 2016. Overall saugeye abundance increased from 2008 (CPUE = 6) through 2016 (CPUE = 80.7) and was considered high. The most recent survey in 2016 indicated a decrease in preferred and memorable size fish compared to the previous three surveys (Table 13). Body condition varied between years but were generally considered poor for the larger size fish. In the most recent 2016 survey, body conditions were extremely poor for quality size fish (Wr = 68) (Table 13). The length frequency histogram (Figure 9) shows a decrease in overall size structure compared to the previous surveys. The largest fish sampled was from the 2015 survey and measured 23.6 (in) in total length and 4.2 (lbs.) in weight.

Age data was collected on a subset of Saugeye from the 2016 and 2022 surveys. Growth rates increased in 2022 compared to the 2016 survey. In the 2016 survey, saugeye grew to a legal harvest limit of 14 inches by age two or a mean length 15.3 inches (Table 14). No fish were aged to two years old in the 2022 survey but showed a mean length of 20 inches by age three. The legal harvest limit was changed from 18 inches to 14 inches statewide in 2016. The Von Bertalanffy growth curve (Figure 10) gives a visual representation of the predicted growth of Saugeye for Shawnee Lake #2 and estimates the mean maximum length at 25.4 inches, an increase from 2016's 17.8 inches.

Saugeye were first introduced to Shawnee Twin Lakes in 1994 and stocked periodically since, as an additional fishing opportunity. The most recent stocking occurred in 2023 (Appendix 1). Saugeye do not naturally reproduce, therefore, they must be stocked to maintain the fishery. To reduce overall competition and continue to increase growth rates and body conditions, it is recommended to maintain a biannual stocking rotation.

Table 12. Total number (No.), catch per unit of effort (CPUE), and relative weights (Wr) by size groups of Saugeye collected by fall gill netting from Shawnee Lake #2. Acceptable Wr values are ≥90.

		Total CPUE	Stock 9.1 in		Quality 13.8 in		Preferred 18.1 in		Memorable 22 in		Trophy 27.2 in	
Year	No.	CPUE	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr
2007	27	2.8	0.1	82	1.7	82	0.9	83	0.1	91	.	.
2012	54	5.5	0.8	95	0.5	83	3.6	83	0.3	80	.	.
2016	6	0.6	.	.	0.3	76	0.3	71	.	.	.	.
2022	16	1.6	1.1	86	.	.	0.4	83	0.1	.	.	.

Table 13. Total number (No.), catch per unit of effort (CPUE), and relative weights (Wr) by size groups of Saugeye collected by fall electrofishing from Shawnee Lake #2. Acceptable Wr values are ≥90.

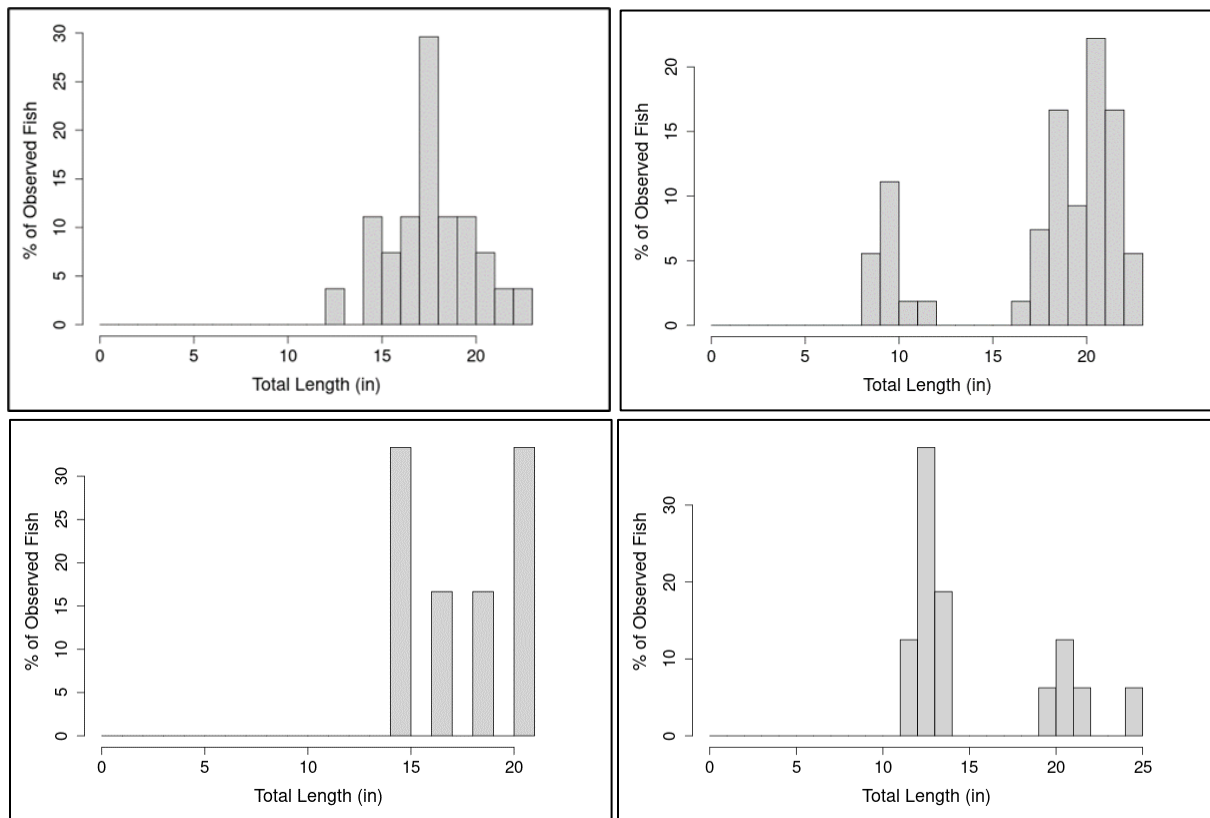|		Total CPUE	Stock 9.1 in		Quality 13.8 in		Preferred 18.1 in		Memorable 22 in		Trophy 27.2 in	
Year	No.	CPUE	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr
2008	3	6.0	6.0	97	.	.	.	.	.	.	.	.
2009	71	47.3	36.0	92	10	78	0.7	89	.	.	.	.
2012	84	56.0	33.3	87	0.7	68	2.7	73	.	.	.	.
2015	30	22.5	8.3	87	3.8	81	.	.	1.5	75	.	.
2016	121	80.7	42	89	5.3	68	.	.	.	.	.	.

Figure 8. Saugeye, Gill net Length Frequency Histograms 2007 (top left), 2012 (top right), 2016 (bottom left), 2022 (bottom right).
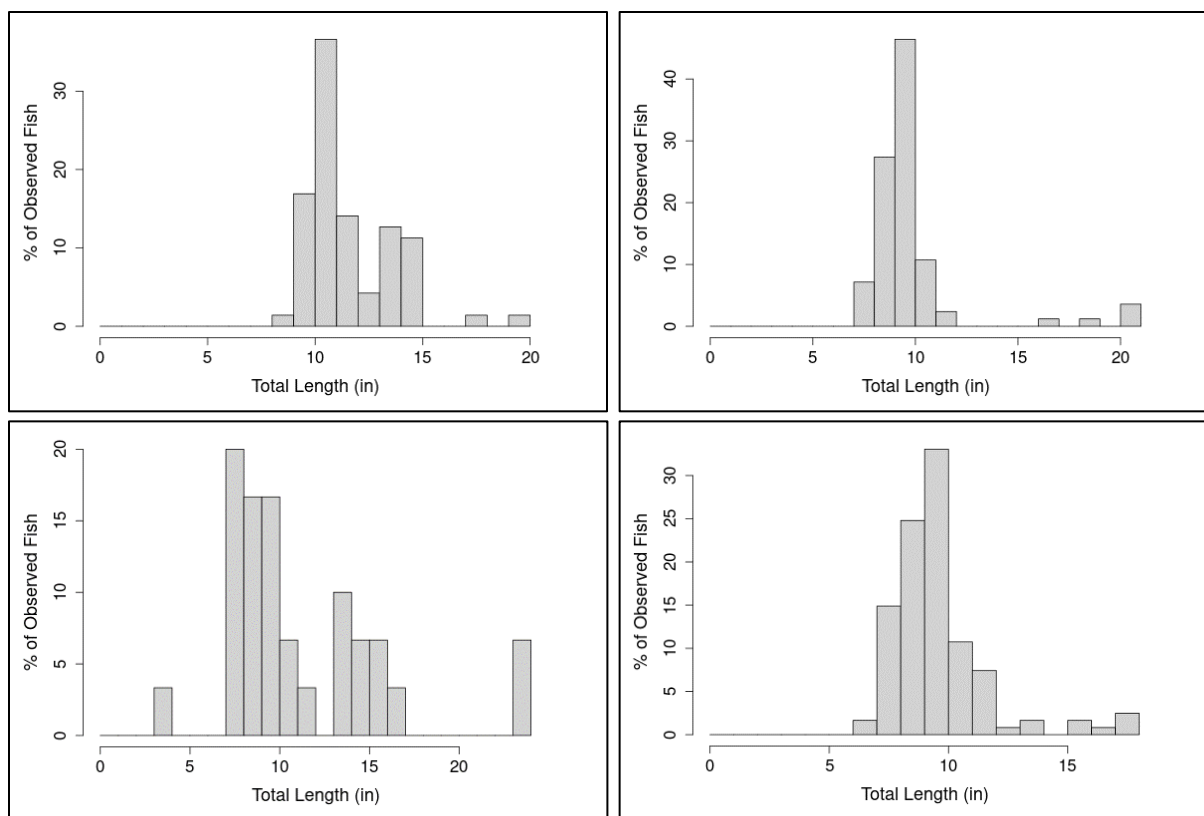
Figure 9. Saugeye, Electrofishing Length Frequency Histograms 2009 (top left), 2012 (top right), 2015 (bottom left), 2016 (bottom right).

Table 14. Mean Total Length at age (inches) and L infinity (estimated mean maximum length) for Saugeye from Shawnee Lake #2.

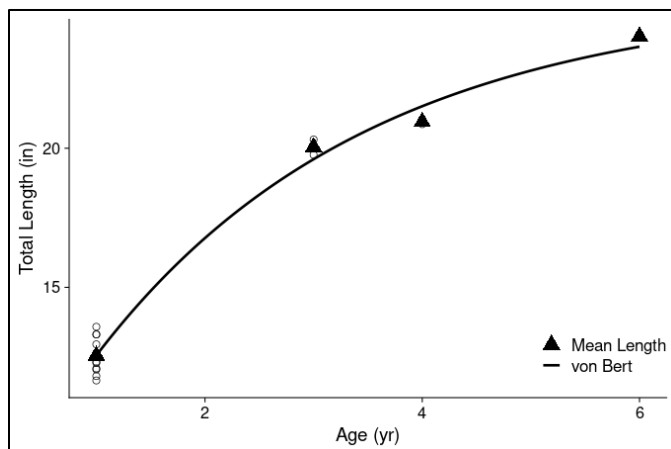| Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	L inf.
2016	9.1	15.3	14.1	.	.	.	.	17.8
2022	12.5	.	20	20.9	.	24	.	25.4

Figure 10. 2022 Saugeye Mean Length at Age: Von Bert Estimated Growth Curve. The Von Bert Growth Curve indicates the estimated growth rate of Saugeye.

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Crappie

Crappie were surveyed in 2007, 2012, 2016, and 2022 using suspended gill nets. Standard sampling protocols for gill net lengths changed in 2009 to 80 foot nets. Gill net lengths and effort varied prior to 2009. Ten stations in both 2016 and 2022, nine stations in 2012 and five stations in 2007 were randomly sampled for a period of 24 hours during each survey. Overall Crappie abundance was considered low for all years surveyed. A slight increase from 2007 (CPUE = 1.8) to 2016 (CPUE = 4.1) was observed, then again, decreased in 2022 (CPUE = 2.6) (Table 15). Abundance in 2022 decreased in stock and preferred size fish, increased in quality size fish, and stayed the same for memorable size fish (Table 15). Body conditions varied between years and size classes. Body conditions were considered poor for the stock (Wr = 88) and quality (Wr = 84) size classes in 2022 but were above acceptable values for preferred (Wr = 96) and memorable size (Wr = 100) fish. The largest fished sampled was from the 2012 survey and measured 13.4 (in) in total length and 1.1 (lbs.) in weight.

Trap nets were also used to sample the Crappie population in 2018. Trap nets are more efficient and typically catch more fish, which gives a greater accuracy due to higher number being sampled. A total of 30 randomly selected shoreline locations were surveyed. Trap nets are fished for a period of 24 hours. In 2018 (CPUE=33.3), relative abundance was above what is considered acceptable (Table 16). Body conditions were below accepted values (Wr $\geq$ 90) for stock (Wr = 86) and quality (Wr = 80) size fish, and above accepted values for preferred (Wr = 93) and memorable (Wr = 98) size fish. The 2018 length frequency indicates only 22% of the Crappie sampled were greater than eight inches and only 6% were ten inches or larger (Figure 11). The largest fish sampled from the trap net survey measured 13.4 (in) in total length and 1.3 (lbs.) in weight.

Age data was collected on a subset of Crappie from the 2012, 2016, 2018, and 2022 surveys. Growth rates varied but was considered slow for all ages and years surveyed and appears to have decreased slightly in 2022 compared to the previous surveys. However, only the 2018 trap net sample had sufficient numbers surveyed to be considered reliable. In 2018, Crappie grew to a mean length of 9.7 inches by age three and 10.3 inches by age four (Table 17). The 2018 age frequency indicated a strong 2017 (age one) year class with nearly 50% of the fish surveyed were aged to be one year old (Figure 12).

Crappie at Shawnee Twin Lake #2 have shown to have low relative abundance in fish under eight inches, and moderate relative abundance in fish over eight inches. Growth appears to be slow, and body conditions low. Saugeye introductions do not appear to be increasing growth rates of Crappie.

Table 15. Total number (No.), catch per unit of effort (CPUE), and relative weights (Wr) by size groups of Crappie collected by fall gill netting from Shawnee Lake #2. Acceptable Wr values are ≥90.

		Total CPUE	Stock 5.1 in		Quality 7.9 in		Preferred 9.8 in		Memorable 11.8 in		Trophy 15.0	
Year	No.	CPUE	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr
2007	19	1.8	1.0	83	0.2	87	0.2	101	0.2	101	.	.
2012	33	3.4	2.1	76	0.1	73	0.9	92	0.2	85	.	.
2016	41	4.1	2.3	102	0.9	91	0.4	101	0.1	88	.	.
2022	26	2.6	0.9	88	1.3	84	0.2	96	0.2	100	.	.

Table 16. Total number (No.), catch per unit of effort (CPUE), and relative weights (Wr) by size groups of Crappie collected by fall trap netting from Shawnee Lake #2. Acceptable Wr values are ≥90.

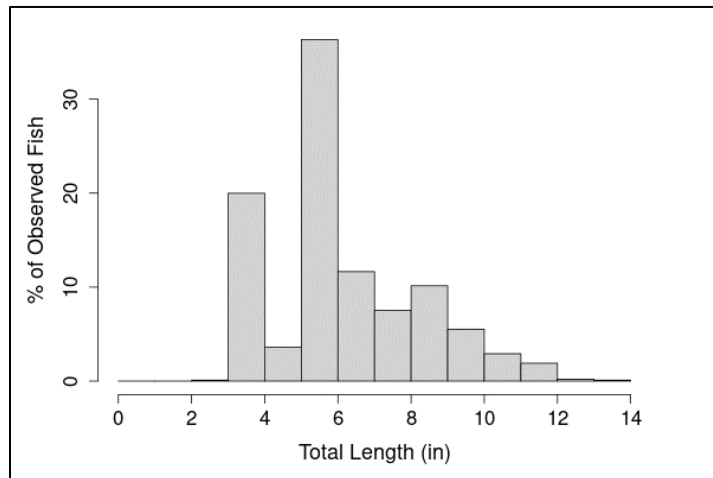|		Total CPUE	Stock 5.1 in		Quality 7.9 in		Preferred 9.8 in		Memorable 11.8 in		Trophy 15.0	
Year	No.	CPUE	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr
2018	996	33.3	14.6	85	5.5	80	1.7	93	0.2	98	.	.

Figure 11. Crappie, Trap Net Length Frequency Histogram 2018

Table 17. Mean Total Length at age (inches) and L infinity (estimated mean maximum length) for Crappie from Shawnee Lake #2.

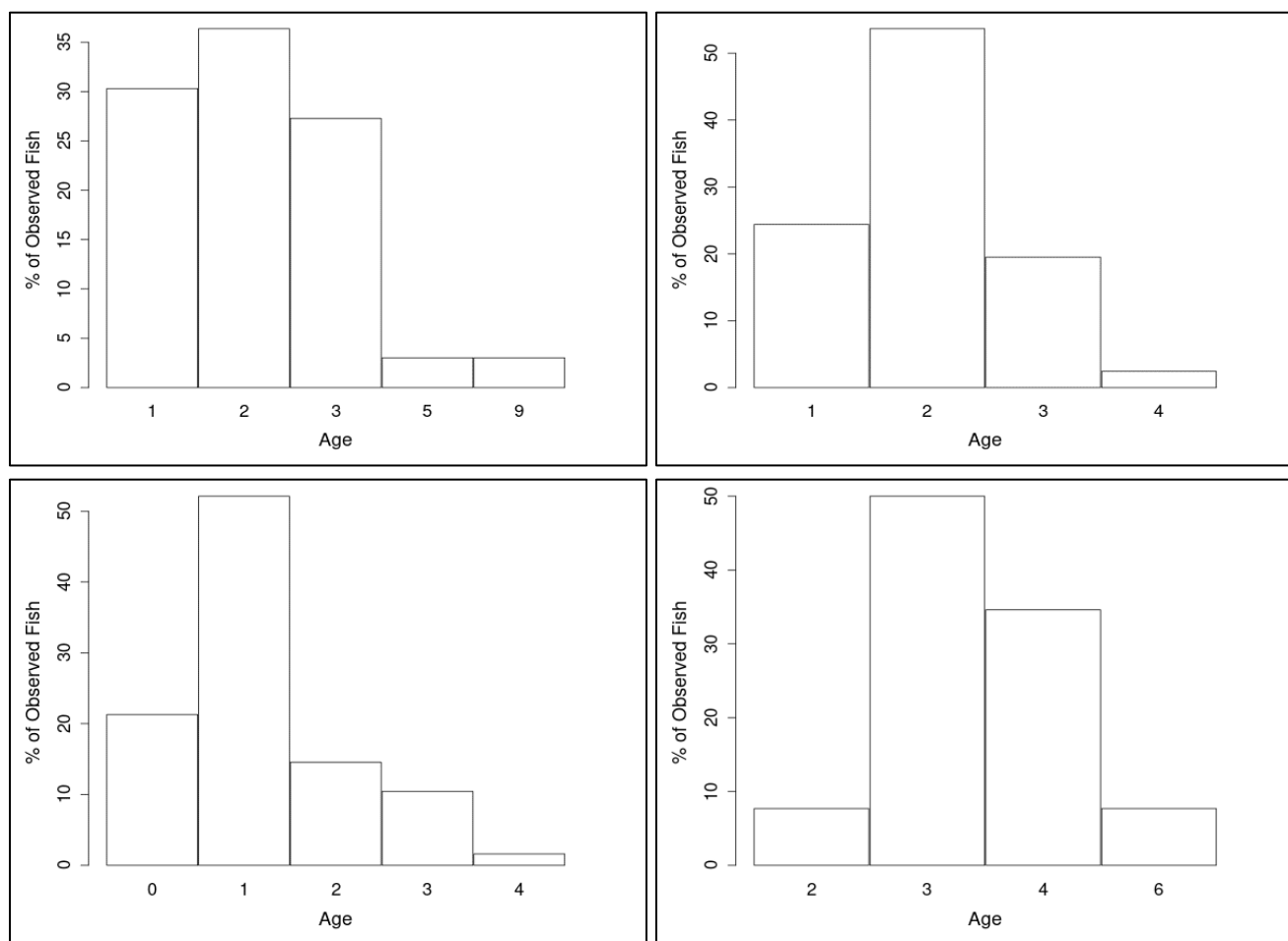| Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	L inf.
2012	5.5	7.1	11.2	.	11.4	.	.	.	14.6
2016	5.2	7.4	9.7	12.6	.	.	.	.	.
2018	5.8	8.3	9.7	10.3	.	.	.	.	21.4
2022	.	7.8	8.1	8.4	.	12.1	.	.	.

Figure 12. 2012 (top left), 2016 (top right), 2018 (bottom left), 2022 (bottom right) Crappie Age Length Frequencies.

White Bass

White Bass were surveyed in 2007, 2012, 2016, and 2022 using suspended gill nets. Standard sampling protocols for gill net lengths changed in 2009 to 80 foot nets. Gill net lengths and effort varied prior to 2009. Ten stations in both 2016 and 2022, nine stations in 2012 and five stations in 2007 were randomly sampled for a period of 24 hours during each survey. Relative abundance was considered high in 2007 (CPUE = 9.9) and 2016 (CPUE= 11.2), then ultimately decreased to low abundance in 2022 (CPUE= 1.2). Body conditions were below acceptable values (Wr $\geq$ 90) for all size classes since the 2012 survey except for stock size fish (Wr = 101) in 2016 (Table 18).

The 2022 Length frequency histogram (Figure 13) shows an overall reduction in size structure and a reduction in White Bass under five inches in total length. Age data was collected on White Bass from the 2022 survey and indicated they grew to a mean length of 10.1 inches by age one and 12.7 inches by age five (Table 19). The largest fish sampled was from the 2007 survey and measured 15.8(in) in total length and 1.9 (lbs.) in weight.

Table 18. Total number (No.), catch per unit of effort (CPUE), and relative weights (Wr) by size groups of White Bass collected by fall gillnet from Shawnee Lake #2. Acceptable Wr values are ≥90.

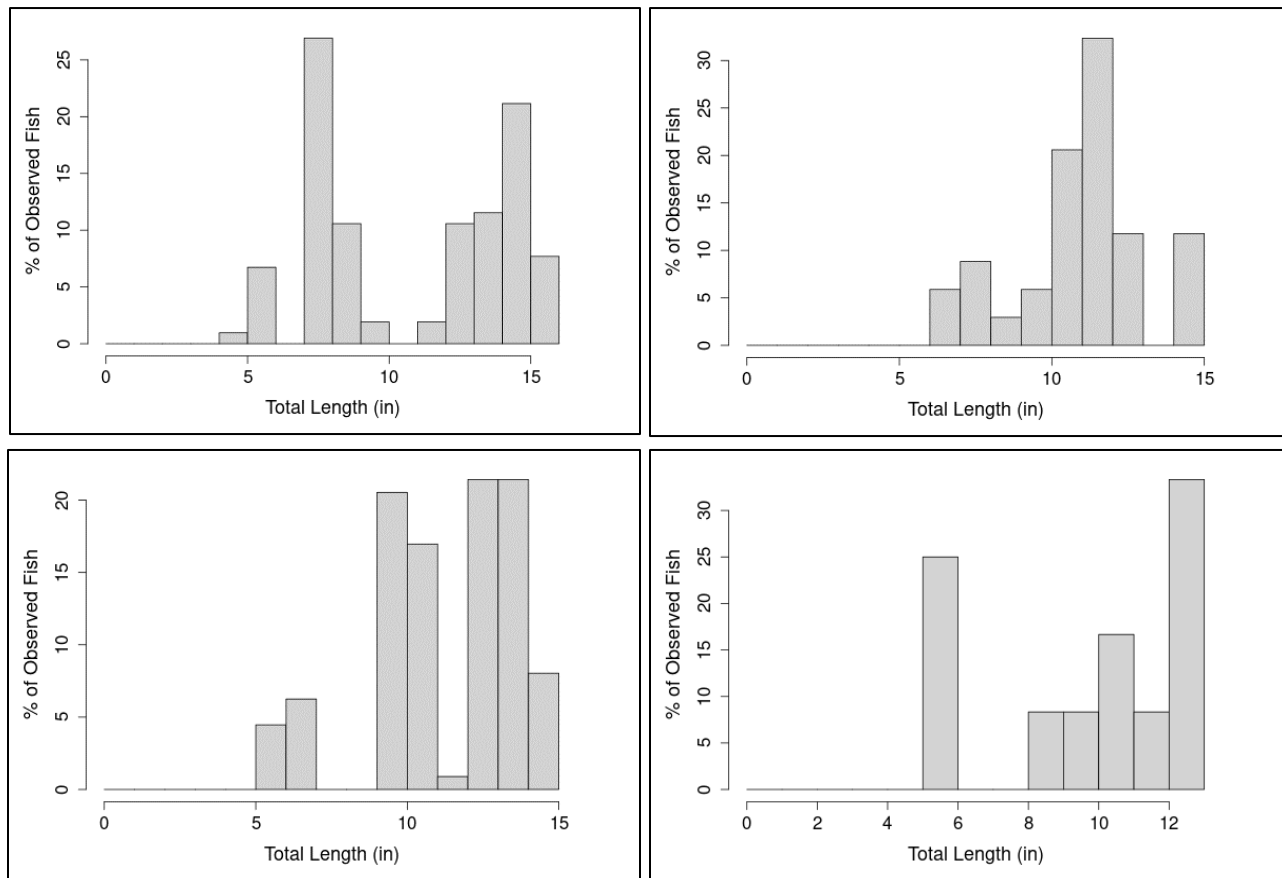| Year	No.	Total CPUE	Stock 5.9 in		Quality 9.1 in		Preferred 11.8 in		Memorable 15 in		Trophy 18.1 in	
		CPUE	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr	CPUE	Wr
2007	104	9.9	3.7	88	0.3	96	4.2	98	1	94	.	.
2012	34	3.5	0.6	89	1.9	80	1	76	.	.	.	.
2016	112	11.2	1.0	101	4.2	84	5.8	78	.	.	.	.
2022	12	1.2	0.1	82	0.3	82	0.5	82	.	.	.	.

Figure 13. White Bass Gill Net Length Frequency Histograms 2007 (top left), 2012 (top right), 2016 (bottom left), 2022 (bottom right).

Table 19. Mean Total Length at age (inches) and L infinity (estimated mean maximum length) for White Bass from Shawnee Twin Lake #2.

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	L inf.
2022	10.1	12.3	.	.	12.7	.	.	.	13.2

Shad

Gizzard Shad were sampled by suspended gill nets in 2007, 2012, 2016 and 2022. Standard sampling protocols for gill net lengths changed in 2009 to 80 foot nets. Gill net lengths and effort varied prior to 2009. Ten stations in both 2016 and 2022, nine stations in 2012 and five stations in 2007 were randomly sampled for a period of 24 hours during each survey. All surveys except the 2007 (CPUE = 0.9) survey showed moderate relative abundance of Gizzard Shad (Table 20). The length frequency histograms (Figure 14) indicated most of the shad for all surveys were larger than six inches in length, indicating that much of the shad population is above acceptable size for forage. Optimal forage size for most species is six inches or less.

Table 20. Total number (No.) and catch per unit of effort (CPUE) by size groups of Gizzard Shad collected by fall gill netting from Shawnee Lake #2.

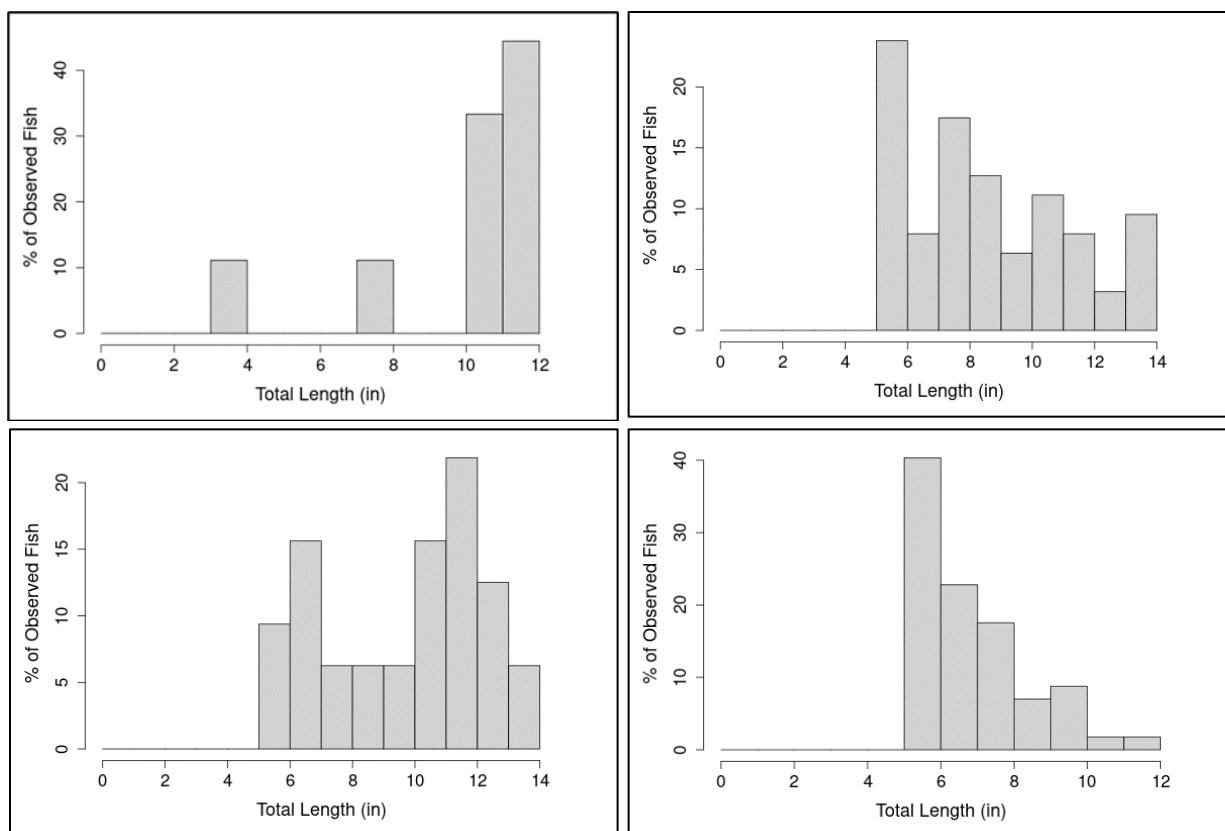| Gizzard Shad				
Year	No.	Total CPUE	<6 inches	≥6 inches
2007	9	0.9	.	0.8
2012	63	6.5	1.5	5
2016	64	6.4	0.6	5.8
2022	58	5.9	2.4	3.5

Figure 14. Gizzard Shad Length Frequency Histograms 2007 (top left), 2012 (top right), 2016 (bottom left), 2022 (bottom right).

Appendix 1. Species, number, and size of fish stocked in Shawnee Lake #2 since 2005.

Date	Species	Number	Size (inches)
2005	Saugeye	22,400	1.5
	Channel Catfish	22,013	7
2006	Saugeye	10,200	1.75
	Saugeye	12,500	2
	Channel Catfish	22,049	7
2007	Channel Catfish	22,000	7
2008	Saugeye	22,500	1.9
2009	Saugeye	12,285	2
	Channel Catfish	11,071	7
2011	Channel Catfish	11,900	7
2012	Saugeye	15,263	1.5
	Saugeye	7,800	2
	Channel Catfish	11,400	4.5
2013	Channel Catfish	11,070	6.75
	Saugeye	22,000	1.5
2014	Saugeye	29,580	1.5
2015	Saugeye	27,300	1.5
	Channel Catfish	11,196	6.75
2016	Saugeye	52,360	1.5
	Channel Catfish	11,000	7
2017	Saugeye	83,741	fry
2018	Saugeye	27,018	1.5
2019	Saugeye	26,720	1.5
2021	Saugeye	28,464	2
2023	Saugeye	26,936	1.7

Appendix 2. Shawnee Lake #2 Fish Attractor Locations

Fish Attractor Site Information for Shawnee Lake #2.

Site #	Latitude	Longitude	Marked	Habitat Type	Bank Access	Date
#1	35.351527	-97.072833	Y	Cedar Trees	N	3/9/2022
#2	35.353194	-97.082166	Y	Cedar Trees	N	3/9/2022
#3	35.355583	-97.086944	Y	Cedar Trees	N	3/9/2022
#4	35.353146	-97.069535	Y	Spider Blocks	Y	3/9/2022
#5	35.36124	-97.08946	Y	Cedar Trees	N	3/9/2022
#6	35.35569	-97.08201	Y	Cedar Trees	N	3/9/2022
#7	35.35488	-97.07309	Y	Cedar Trees	N	3/9/2022
#8	35.352283	-97.071783	Y	Starfish	N	3/9/2022
#9	35.364183	-97.0887	Y	Starfish	N	3/9/2022
#10	35.35895	-97.082083	Y	Starfish	N	3/9/2022
#11	35.359933	-97.071633	Y	Starfish	N	3/9/2022
#12	35.36018	-97.08763	N	Cedar Trees	N	3/9/2022
#13	35.36035	-97.07421	N	Cedar Trees	N	3/9/2022