Newsletter Date:
September 2017
Volume 7, Issue 2

Cedar Bluff District Fisheries

Kansas Department of Wildlife Parks and Tourism
Fisheries Division

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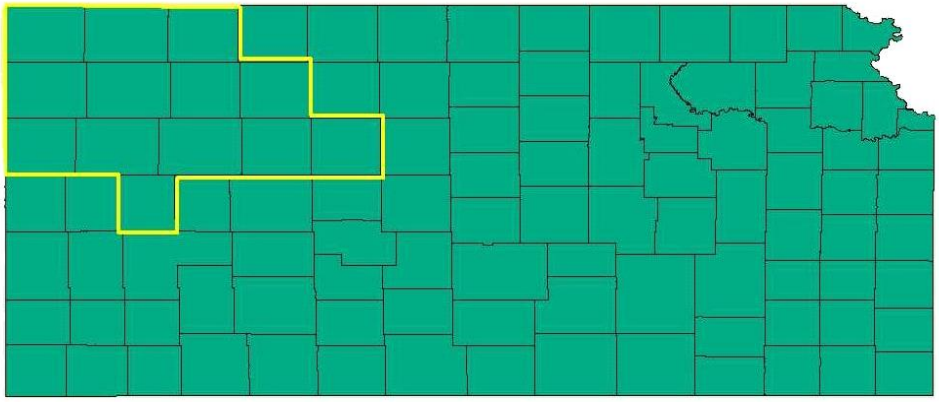

The above figure shows the 13 counties outlined in yellow that comprise the Cedar Bluff District

Sheridan SFL Common Carp Reduction

Quality sport fisheries don't exist by accident. For a fishery to consist of abundant, quality-sized sportfish, a balance must exist between desired gamefish and the available prey organisms to promote good sportfish growth while maintaining consistent forage production. Abiotic factors such as weather influence habitat availability, water quality, and food chain productivity. Factors involving competition for food or habitat amongst species are examples of biotic interactions that can dramatically affect this balance, ultimately characterizing the overall fishery dynamics.

Area of winter carp congregation at the upper end of Sheridan, note the snow

Recently Sheridan State Fishing Lake (SFL) has become an example of an unbalanced sport fishery that has resulted from biotic and abiotic changes. Since the early

2000s, common carp numbers have increased resulting in undesirable changes to sportfish populations. Bottom-feeding behavior of the carp disturb lake-bottom sediments, reduce water clarity, and limit the efficiency of sight-feeding sportfish like largemouth bass. Poor water clarity limits sunlight penetration, resulting in lower plankton production which means less food is available to small sportfish, as well as panfish of all sizes. It is also suspected that high carp densities may limit bluegill, largemouth bass, and crappie production due to nest disturbance and depredation by carp on their eggs and young.

With the rise in carp abundance at Sheridan SFL, several negative trends in sportfish dynamics were noted. Largemouth bass numbers have decreased and growth of individual bass has been poor with few individuals exceeding 15 inches in length. Bluegill abundance decreased to a lower level, and with the reduction, most predatory sportfish were forced to rely on abundant, small age-0 gizzard shad produced every year for food. The small shad have been optimal forage for small-gaped sportfish like crappie and small wiper, saugeye, and largemouth bass. But larger saugeye and largemouth bass forage more efficiently and exhibit better growth by foraging on larger prey fish. To promote better balance of the Sheridan fishery, increasing the abundance of bluegill to diversify the overall forage base was the objective. Based upon the theorized negative impacts of high common carp abundance on bluegill production, the decision was made to selectively reduce common carp in Sheridan SFL.

A larger Sheridan wiper exhibiting signs of starvation

Electrofishing during the cooler months was utilized to capture and remove the carp. Past observations indicated that carp congregate in the upper end of the lake during the winter months, especially when the irrigation well was on to supplement the lake's level. In addition, electrofishing is more efficient in colder water, making this technique more promising.

To evaluate effectiveness of the project, quantities and the weight of carp removed were documented. Knowing how many carp were removed was one piece of the puzzle, but to better understand effectiveness of the project, it was useful to have an estimate of the total size of the carp population to determine the magnitude of population reduction affected by selective removal operations. Population size estimation was accomplished by a mark/recapture method. To derive a statistically robust population size estimate, it was necessary to mark and release 400 carp and observe at least 700 fish for marks during subsequent selective removal efforts. Carp were marked by removing the left pelvic fin.

In addition to knowing the degree to which selective removal efforts reduce the carp population, collection of other data was necessary to quantify the effect of the project. As mentioned previously, it is

well known that carp degrade water clarity, thus measurements of water clarity were collected throughout the growing season and will continue to be collected in the future. With the goal of carp reduction being increased bluegill production and concomitant improvement in large-gaped sportfish growth, it will be necessary to continue to monitor trends in abundance and size structure of the bluegill population, and body condition exhibited by primarily larger largemouth bass and saugeye through standard sampling results in upcoming years.

Since this is an ongoing project, the purpose of this article is to provide background rationale and preliminary results of the project. Prior to instigation of the population size estimate, a single selective harvest effort was conducted on February 16, 2016 to assess whether capturing carp concentrated at the upper end of the lake during the cold-water time of year via electrofishing would prove worthwhile. Results of this single-day effort netted the removal of 639 common carp at a combined weight of 1,251 lbs. This initial effort deemed promising, thus efforts to mark common carp to facilitate estimation of the population size were instigated on September 20, 2016 and periodically conducted until December 1, 2016. Four, single-day mark and release efforts within the previously mentioned timeframe resulted in 404 marked carp in the population.

Once the fish marking goal had been achieved, effort shifted toward removal of carp. During removal efforts, all carp were observed for marks such that at least 700 fish had been observed and a ratio of marked versus unmarked carp could be established. Formal selective removal efforts commenced on February 14, 2017 and were periodically conducted until June 22, 2017. A total of five, single-day capture efforts resulted in the removal of 719 carp weighing a combined 1,746 lbs. The mark/recapture population size estimate indicated that the population was comprised of 2,858 carp at the start of selective removal efforts. Applying statistical methods with 95% certainty, the true carp population ranged in size from 2,483 to 3,443 individuals.

It is important to remember that prior to the mark/recapture population estimate, 639 carp had been removed. Thus, it was necessary to add these fish to the population estimate to enable determination of the full degree by which the population had been reduced. By simple addition, the starting population was estimated at 3,497 fish and with 95% certainty ranged from 3,122 to 4,082 fish. A total of six, single-day efforts removed 1,358 carp weighing a combined 2,997 lbs. from February 16, 2016 to June 22, 2017. Based on the estimated total population size, these efforts reduced the common carp population by 39%.

Harvested carp in the electrofishing boat

As mentioned, it was expected that reducing carp should result in increased water clarity. The past seven years, prior to selective carp removal, water clarity has averaged 3.2' and ranged from 1.3' to 4.3' in May, and averaged 1.1' and ranged from 0.8' to 1.5' in October. During May of 2017, water clarity was better than the past seven-year average at 3.7' but fell within the previously documented range. The single water clarity measurement made after carp reduction showed little to possibly no improvement.

No additional water clarity measurements or trend data – relative to bluegill population dynamics and largemouth bass and saugeye body condition indices – were available to evaluate changes in the fishery following selective removal of common carp. Although removal of approximately 40% of the carp population seemed significant, lacking data precludes much evaluation of potential positive results.

With October around the corner, standard fall sampling will begin to collect fish population data that may shed light on changes to the Sheridan fishery. Efforts to further reduce carp abundance may be conducted this winter. Sampling of the fish population and water clarity measurements over the next several years, combined with continued carp removal, will provide more insight into the degree to which a carp population must be reduced to realize improvements to the fishery.

Project Objective-a quality Sheridan largemouth bass

Despite a lack of immediate conclusive results, it's believed that reducing the carp density by roughly 40% helped to rebalance the Sheridan fishery. Ultimately, improved water quality and less disturbance of spawning bluegill and bass will lead to a more positive balance between forage and predators. This will result in better fishing at Sheridan SFL in the future.

Cedar Bluff District Stocking Report-2017

Lake	Stocking Date	Species	Size	# Stocked
Atwood Township Lake	4/11/2017	Saugeye	Fry	27,600
	9/14/2017	Channel Catfish	Intermediate	420
Cedar Bluff Reservoir	5/9/2017	Wiper	Fry	362,000
Colby-Villa High Lake	11/6/2016	Rainbow Trout	Adult	500
	2/26/2017	Rainbow Trout	Adult	500
	4/14/2017	Channel Catfish	Adult	347
	5/18/2017	Channel Catfish	Adult	172
	6/3/2017	Channel Catfish	Adult	267
	9/18/2017	Channel Catfish	Adult	267
Ellis City Lake	4/11/2017	Saugeye	Fry	90,000
	4/13/2017	Channel Catfish	Adult	240
	8/8/2017	Channel Catfish	Adult	140
	9/14/2017	Channel Catfish	Intermediate	750
Graham Co.-Antelope Lake	9/15/2017	Channel Catfish	Intermediate	2,000
Hays-Vineyard Park Pond	5/18/2017	Channel Catfish	Adult	75
	6/3/2017	Channel Catfish	Adult	76
	9/18/2017	Channel Catfish	Adult	76
Scott State Fishing Lake	4/11/2017	Saugeye	Fry	115,000
	10/3/2017	Channel Catfish	Intermediate	4,025
Scott State Park-Barrel Springs Pond	10/27/2016	Rainbow Trout	Adult	1,046
	11/27/2016	Rainbow Trout	Adult	1,240
	1/18/2017	Rainbow Trout	Adult	1,240
	2/27/2017	Rainbow Trout	Adult	1,240
Sheridan State Fishing Lake	9/19/2017	Channel Catfish	Intermediate	1,005
St. Francis-Keller Lake	9/14/2017	Channel Catfish	Intermediate	75
St. Francis WA North Pond	9/14/2017	Channel Catfish	Intermediate	25
St. Francis WA South Pond	9/14/2017	Channel Catfish	Intermediate	50
FISH TR Co.-Connor Ponds	9/14/2017	Channel Catfish	Intermediate	125
FISH GH Co.-Hofstetter Pond	9/14/2017	Channel Catfish	Intermediate	130
FISH RA Co.-Rippe Pond	9/14/2017	Channel Catfish	Intermediate	50
FISH GH Co.-Trexler Lake	4/11/2017	Walleye	Fry	129,000
	6/1/2017	Walleye	Fingerling	2,105
	9/14/2017	Channel Catfish	Intermediate	400

Cedar Bluff Walleye 21-inch Minimum Length Limit Proposed

There is no doubt that walleye are one of the most popular sportfish in Kansas. Recent events surrounding the Cedar Bluff walleye population have underscored this fact. Anecdotal evidence such as the dam covered by anglers in near shoulder-to-shoulder fashion during the spawn, to boat ramp parking lots overflowing with trucks and trailers during the post-spawn bite hint at the popularity. Quantitative information such as state park visitation, creel survey, and sampling data lends further credence to the assertion, as well. The overall popularity of walleye among anglers, coupled with other factors, have led to trends in the population at Cedar Bluff that necessitated a change in management direction to proactively head off potential negative consequences for the fish population in the future.

An age-0 Cedar Bluff walleye

This change in management direction has garnered a great degree of public comment further highlighting the popularity, and dare say, passion Cedar Bluff anglers have for the local walleye population. The stir really got started back in May and June 2017 when the final decision to submit a proposal to change the harvest regulation on Cedar Bluff walleye from an 18" minimum length limit (MLL) to a 21" MLL was becoming public knowledge. For some, it may seem like the MLL change was a sudden shift in walleye management philosophy, but the change was really prompted by longer term trends. Rationale for the length limit change centers on the observed reduction of larger walleye in the population.

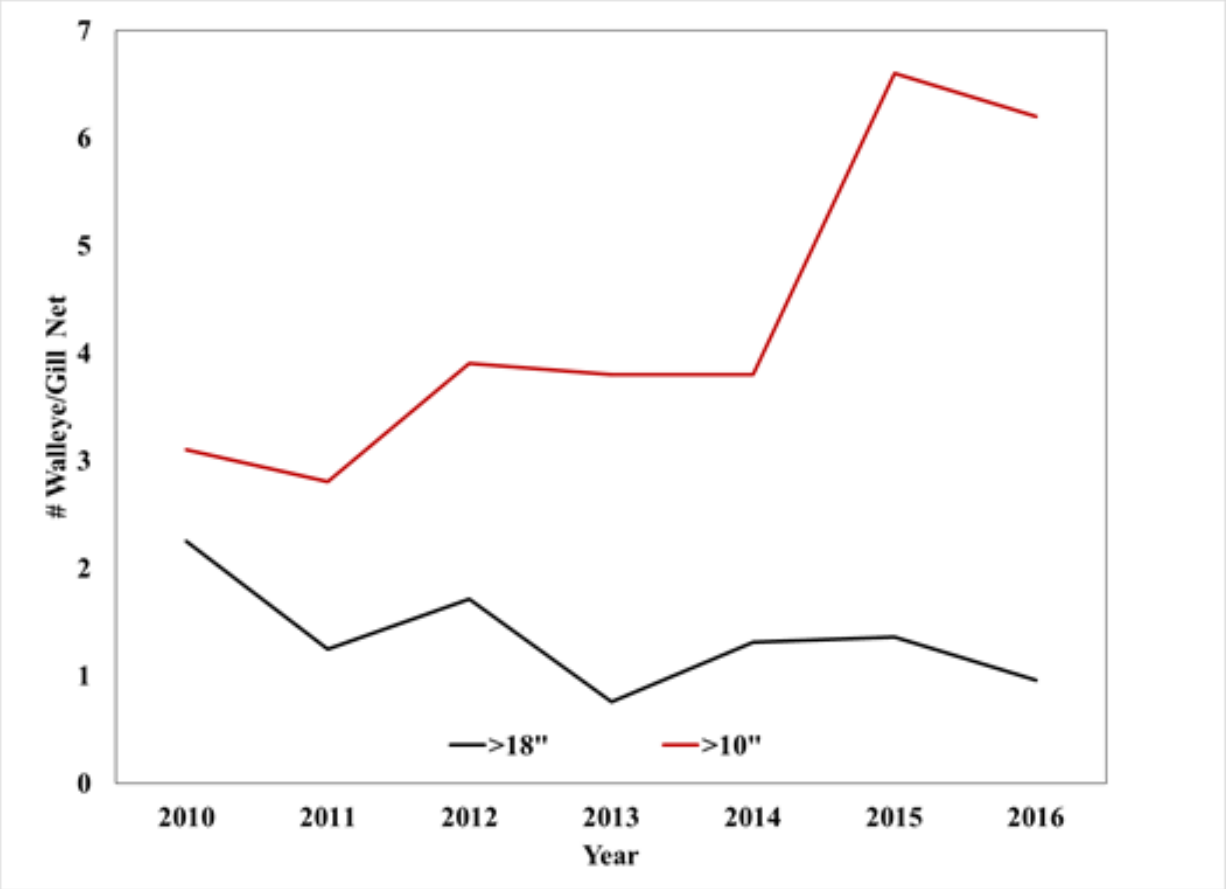

Figure 1. *Catch of walleye 10 inches and larger (red), and 18 inches and larger (black) at Cedar Bluff Reservoir in core panel gill nets in October from 2010 to 2016.*

KDWPT fisheries biologists sample fish populations in many public waters each fall to monitor trends in dynamics. At Cedar Bluff, KDWPT has been collecting walleye eggs for hatchery production purposes each year since 2006. Data collected during the spring spawning enables further evaluation of trends occurring within the adult segment of the population. Fall sampling results revealed overall walleye abundance has been increasing over the past several years, but the catch of fish over 18 inches has decreased. The population has become dominated by smaller, young fish. See **Figure 1**. Data from spring walleye spawning activities revealed a similar trend in dynamics as the prevalence of larger female walleye has been declining since 2013. As of spring 2017, the median length of walleye captured fell to the lowest value observed since egg collection efforts have been conducted at Cedar Bluff, again pointing to a population dominated by small, young fish. See **Figure 2**.

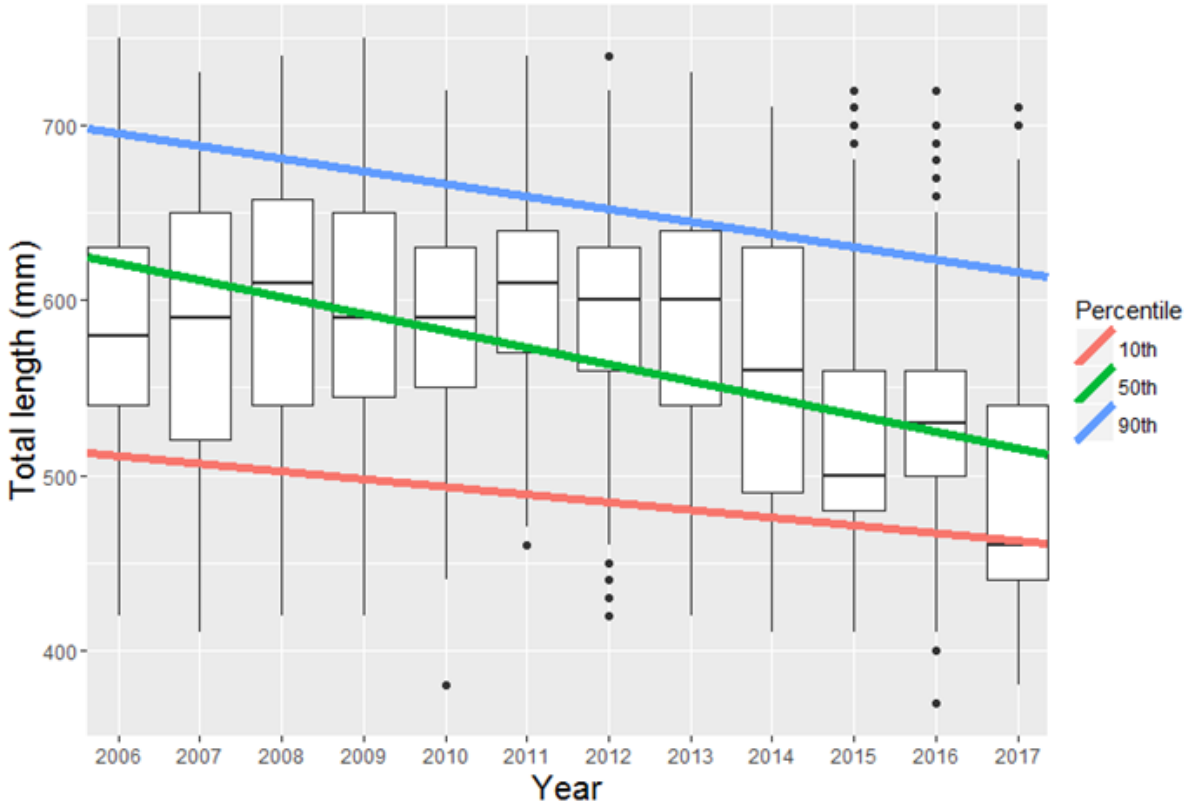

Figure 2. *Box and whisker plot of Cedar Bluff Reservoir female walleye length-frequency data collected during annual egg collection operations (summarized by percentiles). Walleye length distributions in millimeters are plotted for each year as: lower whisker=fish length at lower 5th percentile, lower bound of box=fish length at lower 25th percentile, mid-line in box=median (50th percentile) fish length, upper bound of box=fish length at upper 75th percentile, and upper whisker=fish length at upper 95th percentile. Colored linear regression lines of fish lengths at: lower 10th percentile (red), median (green), and upper 90th percentile (blue) depict trends in relative abundance of small, medium, and large female walleye, respectively. Black dots correspond to fish of total lengths that fell below the lower 5th and above the upper 95th percentiles.*

Walleye length-frequency data collected in the spring and fall both reveal a shift in the population towards younger fish. This trend was not a complete surprise, as the number of age-0 walleye captured in fall sampling nets has been especially high on an annual basis from 2013 to 2016, with an exceptionally strong 2014 year class documented. The notable increase in production of walleye observed since 2013 no doubt skewed length frequency data in favor of smaller, younger walleye, but good production since 2003 has not been sufficient to maintain or improve the abundance of larger fish. See **Figure 3**.

Development and maintenance of a fish population that exhibits stable abundance of a diverse size range of individuals is predicated on three factors: production, survival, and growth. To be present in the fishery, individuals must first be produced on a consistent basis. But for anglers to realize harvestable sized fish year in and year out, individuals must survive in sufficient numbers and grow fast enough to keep pace with harvest. Considering the dynamics of the Cedar Bluff walleye fishery presented so far, initial production is not the reason for declining numbers of larger fish.

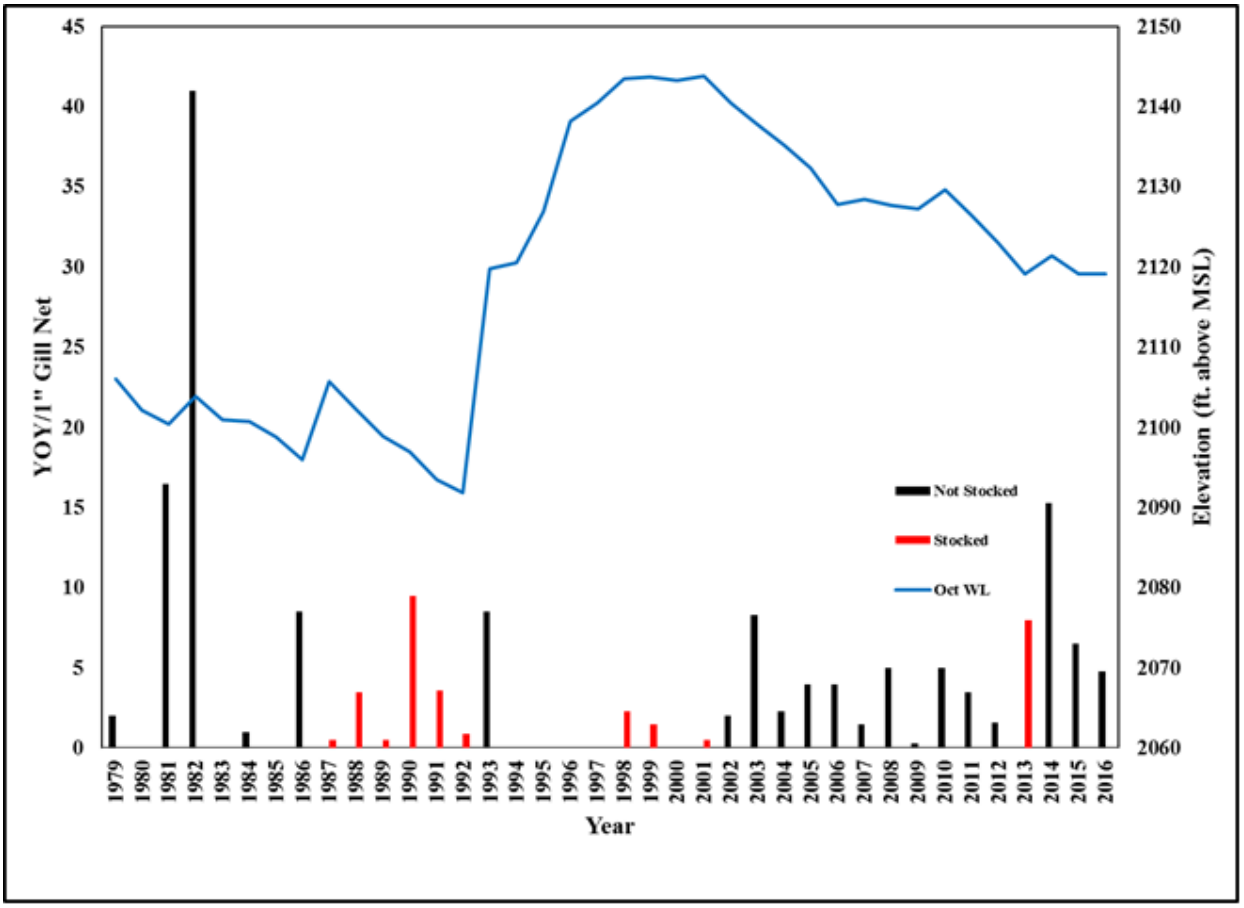

Figure 3. *Catch of age-0 walleye in 1" mesh gill nets at Cedar Bluff Reservoir from 1979 to 2016. Black bars indicate catch in years no walleye were stocked and red bars indicate catch in years that walleye were stocked. Blue line represents reservoir water level measured in feet above mean sea level at the end of October each year.*

To further elucidate the reasons for declines of larger walleye, growth information was collected in the spring of 2017 and compared to the same information collected in 2010 and 2011 to determine if growth had slowed. Analysis indicated that growth of both female and male walleye in 2017 was like that documented in 2010 and 2011, indicating that forage availability had been sufficient to maintain walleye growth despite increased walleye abundance. When growth of Cedar Bluff walleye was compared with average growth for Kansas walleye, Cedar Bluff fish generally grew slower. But, it is important to note that Kansas walleye populations generally exhibit some of the most rapid growth for the species across their North American range. Although Cedar Bluff walleye growth may be somewhat slow by Kansas standards, they grow relatively quick and can grow to and beyond harvestable sizes. See **Figure 4.**

To this point, it should be apparent that production and growth of Cedar Bluff walleye observed over the recent past should have produced an increasing trend in numbers of larger fish if survival of individuals was adequate. When biologists manage fisheries open to angler harvest (i.e. exploited), fish survival is viewed in the reciprocal sense as mortality, resulting from two sources: natural and fishing. Natural mortality is caused by, but not limited to, sources such as disease, predation, starvation, weather, etc. The rate with which mortality acts upon a population is variable in many ways and often differs based upon a given fishes age and on the year, too. Generally for walleye, mortality is extremely high for individuals in their first year of life (age-0) with the probability a fish will experience mortality decreasing once the given individual reaches its second year of life (age-1). Beyond age-1, walleye

experience increased probability of survival with natural mortality being a lesser factor. At this point, fishing mortality becomes the primary factor limiting walleye survival. Thus harvest regulations like a MLL must be included in the management of an exploited population if any semblance of quality size dynamics are to be achieved.

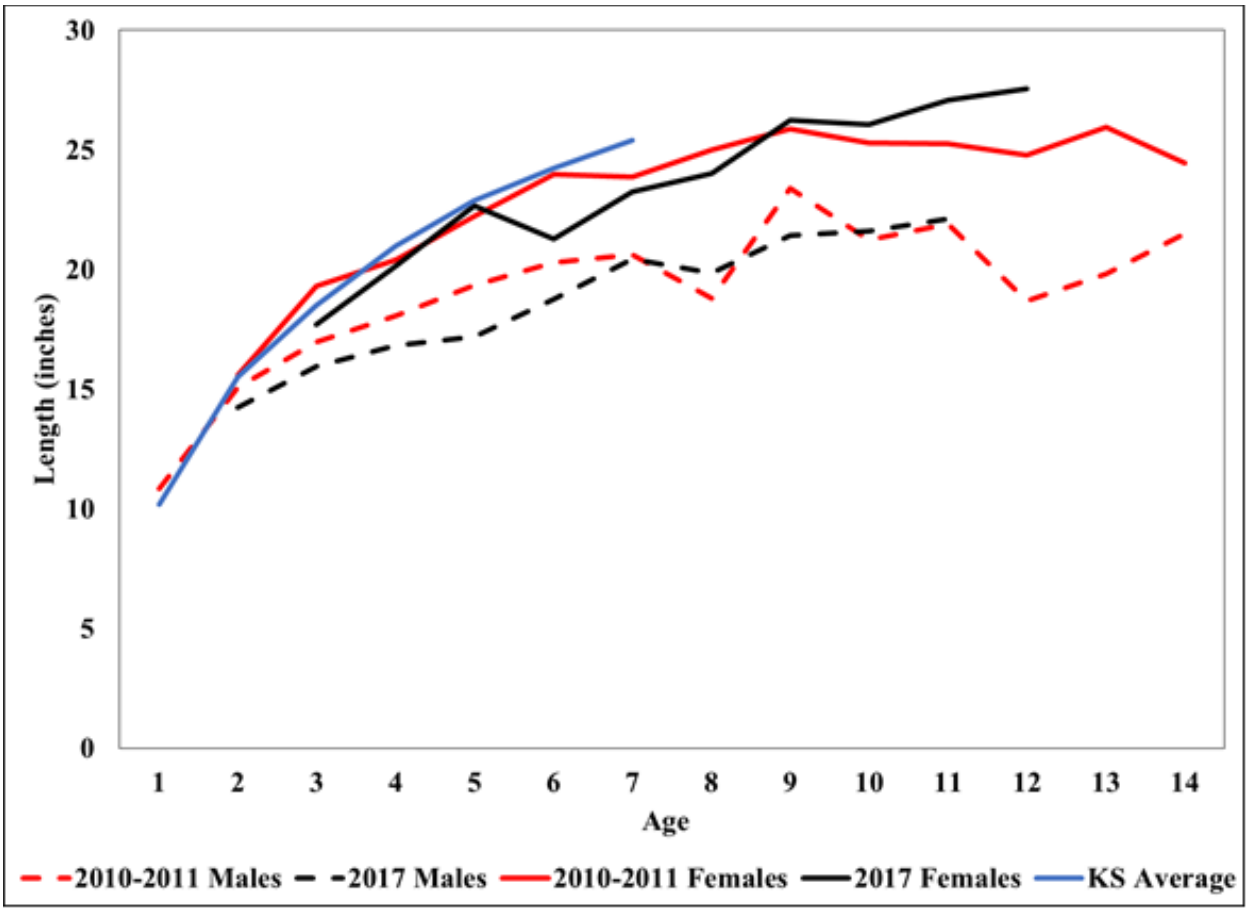

Figure 4. *Growth curves for male and female Cedar Bluff walleye and Kansas walleye sexes combined*

Cedar Bluff's reputation as a quality walleye fishery among anglers continues to grow, and as such, the reservoir has received a tremendous amount of walleye-specific pressure. In Kansas, most walleye specific pressure occurs from March to May during the walleye spawn and the subsequent, post-spawn recovery period. During this time, most walleye anglers at Cedar Bluff enter the state park to: use boat ramps, access shore fishing areas, and/or camp. Fortunately, state park staff maintain traffic counters at the entrances, enabling documentation of annual trends in visitation that are partially influenced by changes in angling pressure.

This annual visitation data was modified to serve as a surrogate for annual walleye angling pressure since no specific angling pressure data has been collected on an annual basis at Cedar Bluff. No doubt park visitation consists of users accessing the park for activities other than fishing, but drilling down to annual park visitation data specific to the timeframe of March to May focuses on a time of year when anglers fishing specifically for walleye make up a significant portion of state park visitors. Further, at Cedar Bluff, state park visitation often coincides with water level. Thus water level changes may obscure trends in park visitation, resulting from annual differences in walleye angling activity. Annual state park visitation data collected from 2010 to 2017 was standardized for changes in water level and

compared to trends in walleye sampling data. In summary, the data quantitatively showed that during the months of March through May, state park visitation/reservoir surface acres exhibited an increasing trend that corresponded well with increased walleye abundance in fall samples. This increasing trend in visitation, coupled with increased walleye abundance, eludes to how the reputation of Cedar Bluff as a walleye angling destination has resulted in high walleye angling pressure in recent years. See **Figure 5.**

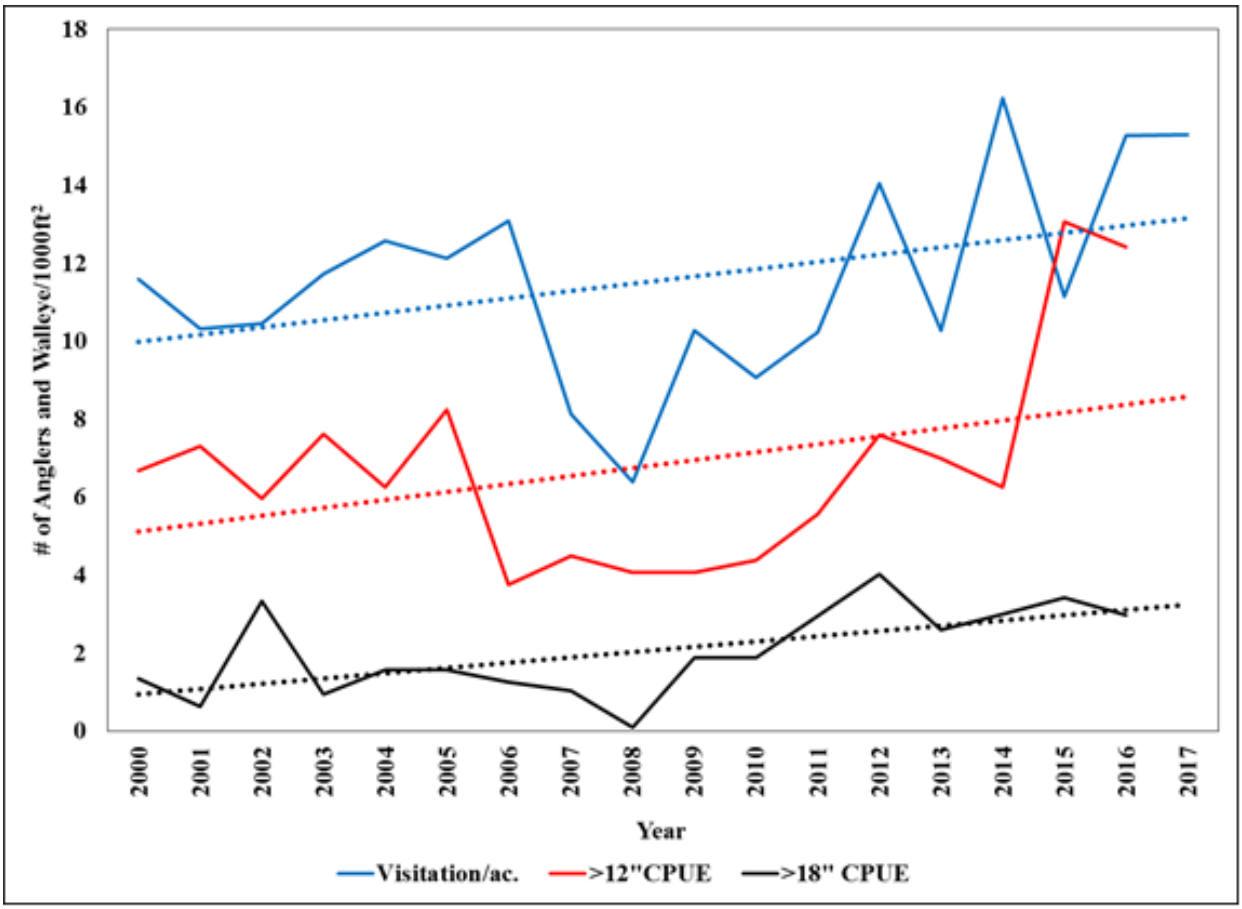

Figure 5. *Comparison of Cedar Bluff State Park annual visitation March to May/reservoir surface area (blue) with catch-per-unit effort (CPUE) of walleye 12-inches and larger (red), and CPUE of walleye 18-inches and larger (black) in fall gill nets*

While state park visitation data encompasses more variables than those specific to walleye angling, it does provide annual use data that reflects broad changes in walleye angling pressure. On the other hand, creel surveys provide more fishery-specific information, but are not always conducted every year. The most recent creel census conducted at Cedar Bluff (March thru October 2014) documented angler behavior, success, and harvest patterns. This survey showed that walleye were the most sought after species. It was estimated that 32,084 anglers fished at Cedar Bluff during the survey period, and of the 20,832 walleye caught, 5,620 were harvested. The 2014 survey also revealed that most walleye less than 18 inches in length were released. Conversely, walleye 18 inches or larger caught were harvested nearly 100% of the time.

Management goal: a nice Cedar Bluff female walleye from the spring 2017 spawn

The 2014 creel survey results revealed the total number of walleye harvested was high at 5,620 or 1.86 fish/reservoir surface acre. For comparison's sake, the average number of walleye harvested/ reservoir surface acre from other well-known Kansas walleye reservoirs documented by recent creel surveys was 0.53 fish/reservoir surface acre. The declining trend in larger walleye abundance – despite good annual production of young fish and reasonable fish growth – indicated that angler exploitation was outpacing the walleye population's ability to replace fish lost to harvest. Allowing fish to grow to larger sizes before they become legal for harvest is the most prudent step in allowing the abundance of larger walleye to recover.

Increasing the MLL on walleye at Cedar Bluff from 18 to 21 inches is intended to be a proactive step towards stemming the decline and improving the quality of walleye population dynamics. To better illustrate, it is important to understand some basics about Cedar Bluff walleye biology relative to the differences in growth and longevity observed between male and female walleye. Juvenile walleye of both sexes grow similarly and reach approximately 10 inches by age-1 and 15 inches by age-2. However, the similarity in sex-specific growth ends with increased age. Male walleye reach sexual maturity by age-2 and join the remainder of the adult population in spawning by their second spring. After reaching maturity, male walleye growth slows compared to that observed for female fish. Males on average attain lengths of 18 inches by age-4 and 21 inches by age-6. In contrast, female walleye reach sexual maturity at age-3 at an average length of 18 inches and attain 21 inches in length between age-4 and age-5.

Another difference between the sexes relative to age hinges on longevity. Walleye of both sexes have the potential to live a relatively long time in Cedar Bluff as fish up to age-14 have been documented. The difference between the sexes relates to longevity, or in other words, the probability a given fish will survive to reach a given age. For males, the probability of surviving from age-4 to age-5 appears to dramatically decrease. Some male walleye will attain and surpass 21 inches, but there will be relatively few of them. Longevity for female walleye is much different as individuals have a much greater probability of surviving to age-10 and age-12. Differential growth and longevity observed between the sexes, coupled with relatively consistent year-class production observed at Cedar Bluff, tends to result in a population comprised of an abundance of individuals less than 18 inches. All juveniles and most males fall into this group. The remainder of the population, consisting of individuals 18 inches and longer, is primarily comprised of adult female walleye.

Given female walleye grow faster and live longer, managing the Cedar Bluff walleye population with an 18- or 21-inch MLL primarily regulates harvest of adult female walleye. The benefit of the 21-inch MLL is that by promoting more female walleye to larger sizes, the abundance of larger fish will

increase and the yield to the angler will be significant, as the difference in weight between an 18- and a 21-inch walleye can be 2.1 and 3.5 lbs., respectively. Reducing mortality of walleye up to 21 inches will also greatly increase the probability that individuals will grow beyond 21 inches, maximizing the potential to improve the abundance of fish up to trophy sizes (+28 inches). Increasing the availability of larger female walleye ensures that more fish in their reproductive prime are present to promote desired walleye production into the future.

With the presence of the strong 2014 year class, a great opportunity exists to allow this population to begin to recover the loss of larger fish. Based upon length data collected this spring, 57% of females were 18 inches or larger, with most of the harvestable fish consisting of individuals from the 2014 year class that were right at 18 inches in length. Relatively few males will be available for harvest during 2017, as only 8% were 18 inches or longer. The proposed regulation would not take effect until January 1, 2018, so anglers would be able to harvest 18 inch and longer fish for the remainder of 2017. At the same time, many female walleye of the 2014 year class that escape harvest during the 2017 season should grow to or near 21 inches by the beginning of 2018, providing a seamless transition of harvest opportunities. The primary objective of the proposed change from an 18- to 21-inch minimum length limit is to promote the quality and future sustainability of this valuable walleye fishery for the benefit of Cedar Bluff anglers.