WISCONSIN DEPARTMENT OF NATURAL RESOURCES

2022 Comprehensive Summary Report
Cloverleaf Chain, Shawano County
299000

Introduction And Objectives

In 2022, the Wisconsin Department of Natural Resources (DNR) conducted a comprehensive fish survey of the Cloverleaf Chain in order to provide insight and direction for the future fisheries management of this system. Comprehensive fish surveys include both spring fyke netting and spring electrofishing surveys. The primary sampling objectives of these surveys are to characterize species composition, relative abundance and size structure. The following report is a brief summary of the activities conducted the general status of fish populations and future management options for the Cloverleaf Chain.

DNR Contact

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Lake Information

Combined Acres:334
Max. Depth: 52
Shoreline Miles: 4.8
Public Access: 1 Boat Landing

Regulations

Statewide regulations except special panfish regulation of 25 bag limit but five or fewer can be bluegill or pumpkinseed over 7 inches.

SURVEY INFORMATION						
Site Location	**Survey Dates**	**Water Temperature (°F)**	**Target Species**	**Gear**	**Number of Nets**	**Effort**
Cloverleaf Chain	4/14/2022 - 4/30/2022	38 - 48	Northern Pike Walleye	Fyke Net	8	116 net nights
Cloverleaf Chain	4/30/2022 – 5/09/2022	38 - 54	Muskellunge	Fyke Net	8	188 net nights
Cloverleaf Chain	5/23/2022	64	Bass/Panfish	Boomshocker	N/A	4.8 miles

Metric Descriptions

- **Catch per unit effort (CPUE) is an index used to measure fish population relative abundance**, which simply refers to the number of fish captured per unit of distance or time. For netting surveys, we typically quantify CPUE by the number and size of fish per net night. For electrofishing, we quantify CPUE as the number caught per mile of water electrofished. CPUE indexes are compared to statewide data by percentiles and within lake trends. For example, if a CPUE is in the 90th percentile, it is higher than 90% of the other CPUEs in the state.
- **Proportional Stock Density (PSD) is an index used to describe the size structure of fish populations.** It is calculated by dividing the number of quality-size fish by the number of stock-size fish for a given species. PSD values between 40 - 60 generally describe a balanced fish population.
- **Length frequency distribution (LFD) is a graphical representation of the number or percentage of fish captured by half-inch or one-inch size intervals.** Smaller fish (or younger age classes) may not always be represented in the length frequency due to different habitat usage or sampling gear limitations.
- **Mean age at length is an index used to assess fish growth.** Calcified structures (e.g., otoliths, spines or scales) are collected from a specified length bin of interest (e.g., 7.0-7.5 inches for bluegill). Mean age is compared to statewide data by percentile with growth characterized by the following benchmarks: slow (<33rd percentile); moderate (33rd to 66th percentile); and fast (>66th percentile).

Survey Method

- The Cloverleaf Chain was sampled according to spring netting I (SNI), spring netting II (SNII) and spring electrofishing II (SEII) protocols as outlined in DNR Fisheries Monitoring Protocols. The primary objective of the spring fyke netting I survey is to count and measure adult walleye and northern pike and mark adult walleyes to estimate walleye abundance. The primary objective of the spring netting II survey is to count, measure and mark adult muskellunge. The primary objective of the spring electrofishing II survey is to count and measure adult largemouth bass, smallmouth bass and panfish. Other species of fish may be sampled during each survey but are considered bycatch as part of that survey.
- Boom shockers were used to electrofish 4.8 miles of shoreline. Gamefish were collected and measured throughout, and panfish were collected and counted along 1.5 miles of shoreline.
- Fyke nets were deployed in areas of the lake that contained spawning habitat or were likely travel areas for northern pike, walleye and muskellunge. All newly captured individuals were marked with a fin clip or PIT tag. Aging structures (spines/otoliths) were taken from a sample of northern pike, bluegill and black crappie for age and growth analyses.

RELATIVE ABUNDANCE — CATCH PER UNIT EFFORT (CPUE)					
Species	**Protocol**	**Total Number Captured**	**CPUE**	**Units**	**Statewide Percentile**
Northern Pike	Spring Netting I	71	0.6	fish/net night	22nd
Walleye	Spring Netting I	120	1.0	fish/net night	26th
Muskellunge	Spring Netting II	21	0.1	fish/net night	9th
Largemouth Bass	Spring Electrofishing II	131	27.3	fish/mile	70th
Black Crappie	Spring Electrofishing II	21	14.0	fish/mile	72nd
Bluegill	Spring Electrofishing II	154	102.7	fish/mile	56th
Pumpkinseed	Spring Electrofishing II	57	38	fish/mile	89th

Northern Pike

- Northern Pike (*Esox lucius*) are a common predatory fish species found across many Wisconsin waterbodies. Northern pike spawn in areas of emergent vegetation at approximately 34-40°F water temperatures. Fyke netting is the preferred sampling gear for northern pike. All results presented for northern pike are from spring fyke netting surveys.

YEAR SIZE STRUCTURE METRICS

Total Number Measured	Average Length (inches)	Length Range (inches)	Stock and Quality Size (inches)	Stock Number	Quality Number	PSD	Percentile Rank	Size Rating
62	17.4	10.0 - 28.1	14.0 and 21.0	45	13	29	31st	Low-Moderate

RELATIVE ABUNDANCE (CPUE = NUMBER PER NET NIGHT)

Total Sampled	2013	2017	2022	Historical Median	2022 Statewide Percentile Rank	2022 Abundance Rating
71	2.5	1.3	0.6	1.3	22nd	Low

SIZE STRUCTURE (PSD) TRENDS

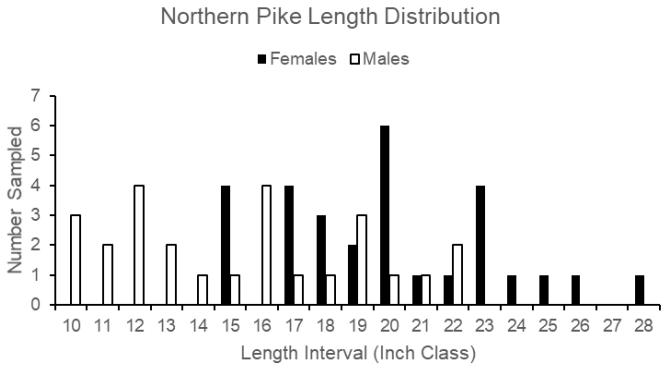
PSD by Year			Historical Median
2013	2017	2022	
10	15	29	15

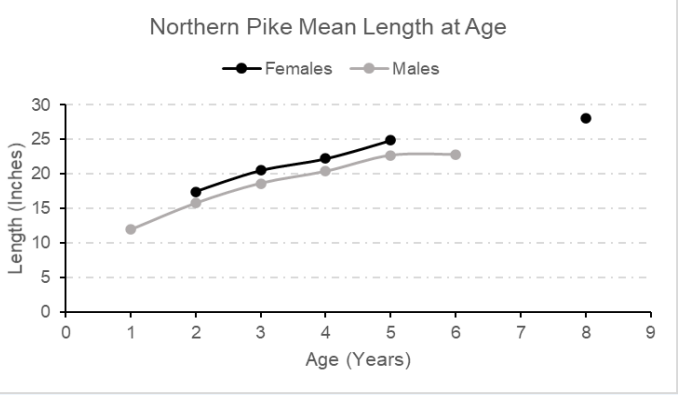
2022 GROWTH METRICS

Number Sampled	Length Bin (inches)	Sex	Mean Age	Age Range	Percentile Rank	Growth Rating
1	13.5-14.4	M	2	N/A	N/A	N/A
1	20.5-21.4	M	3.5	N/A	N/A	N/A
1	20.5-21.4	F	3	N/A	N/A	N/A
1	25.5-26.4	F	5	N/A	N/A	N/A

ADULT ABUNDANCE (POPULATION ESTIMATE)

Marked	Captured	Recaptures	Population Estimate (95% CI)	Number per Acre
62	71	9	453 (264 - 867)	1.4





Species Summary

- The Cloverleaf Chain supports a low density northern pike population with 2022 catch rates at 0.6 fish per net night. A catch rate of 0.6 per net night ranks in the 22nd percentile when compared to northern pike catch rates statewide. When compared to past surveys, the 2022 northern pike catch rates have decreased slightly.
- The size structure of northern pike in the 2022 survey was low to moderate with a PSD of 29 which ranks in the 31st percentile when compared to lakes statewide. The length ranges of male (10 - 22 inches) and female (15 - 28 inches) northern pike are within the ranges commonly found statewide; however, there were a number of individuals measuring in the lower end of the range that brought the overall PSD score down. Size structure trends over the last several surveys show a slight increase in northern pike size structure but overall has remained fairly stable.
- Although aging structures were collected from 50 individuals, too few samples were collected from the desired length bins used to compare growth rates statewide. However, the age and growth information collected was used to assess growth within the Cloverleaf Chain and can be used in analyses to compare the growth of northern pike among future surveys in the Cloverleaf Chain.


Photo Credit: DNR Staff

Walleye

- Walleye (*Sander vitreus*) are a predatory fish species found throughout many Wisconsin waterbodies. Typically walleye migrate to spawn in areas of rock or gravel substrate at approximately 40-50°F water temperatures. Fyke netting and electrofishing are both suitable gears for capturing walleye; however, electrofishing was not conducted during this survey and all results presented for walleye are from fyke netting surveys.

YEAR SIZE STRUCTURE METRICS

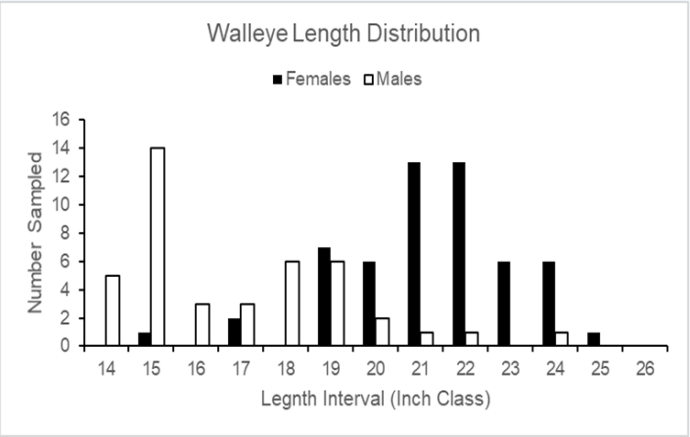
Total Number Measured	Average Length (inches)	Length Range (inches)	Stock and Quality Size (inches)	Stock Number	Quality Number	PSD	Percentile Rank	Size Rating
100	19.7	14.3 - 25.6	10.0 and 15.0	100	95	95	82nd	High

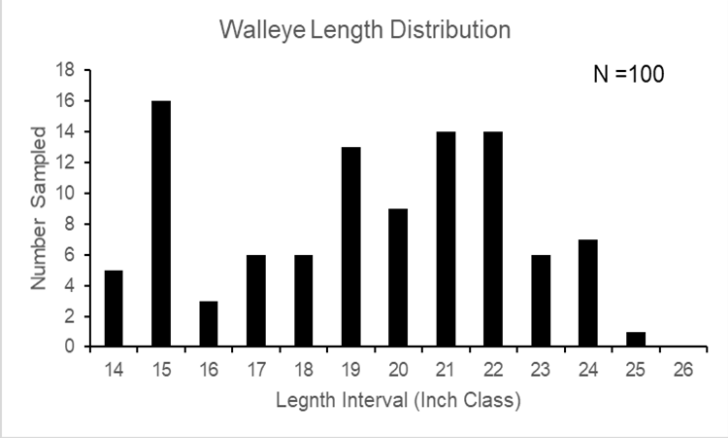
RELATIVE ABUNDANCE (CPUE = NUMBER PER NET NIGHT)

Total Sampled	2013	2017	2022	Historical Median	2022 Statewide Percentile Rank	2022 Abundance Rating
120	0.1	0.2	1.0	0.2	26th	Low

SIZE STRUCTURE (PSD) TRENDS

PSD by Year			Historical Median
2013	2017	2022	
100	31	95	95





Species Summary

- The Cloverleaf Chain supports a low density walleye population with catch rates of 1.0 fish per net night. A catch rate of 1.0 fish per net night ranks in the 26th percentile when compared to lakes throughout Wisconsin. Although catch rates remain low when compared to statewide rates, the Cloverleaf Chain walleye catch rates continue to slightly increase over time (CPUE of 0.1 and 0.2 in the 2013 and 2017 surveys, respectively).
- The size structure of walleye in the 2022 survey was high with a PSD of 95, which ranks in the 82nd percentile when compared to lakes statewide. The current walleye size structure found in the Cloverleaf Chain is similar to the 2013 survey but much improved from what was found in the 2017 survey.
- The walleye population on the Cloverleaf Chain consists primarily of a lower density of quality size (>15.0 inches) individuals which provides a unique harvest opportunity for anglers.

Muskellunge

- Muskellunge (*Esox masquinongy*) are a predatory fish species found across the three main drainage basins of Wisconsin but are historically more common in the northern half of the state. Muskellunge typically spawn in shallow nearshore areas at approximately 50-60°F water temperatures. Fyke netting is the preferred sampling gear for muskellunge. All results presented for muskellunge are from spring fyke netting surveys.

YEAR SIZE STRUCTURE METRICS

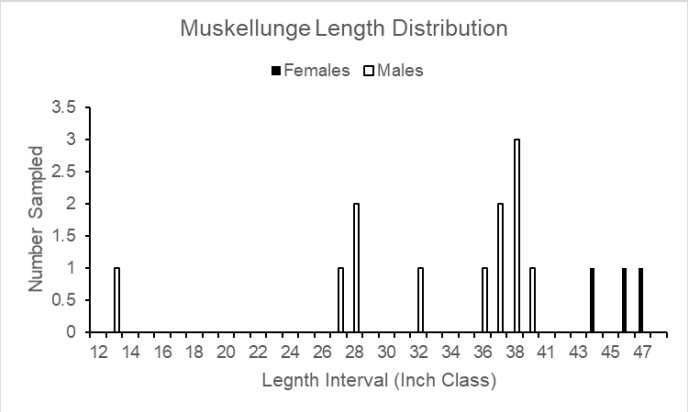
Total Number Measured	Average Length (inches)	Length Range (inches)	Stock and Quality Size (inches)	Stock Number	Quality Number	PSD	Percentile Rank	Size Rating
20	24.3	12.3 - 47.0	20.0 and 30.0	14	11	79	67th	Moderate-High

RELATIVE ABUNDANCE (CPUE = NUMBER PER NET NIGHT)

Total Sampled	2013	2017	2022	Historical Median	2022 Statewide Percentile Rank	2022 Abundance Rating
21	0.6	0.4	0.1	0.4	9th	Low

SIZE STRUCTURE (PSD) TRENDS

PSD by Year			Historical Median
2013	2017	2022	
43	91	79	79



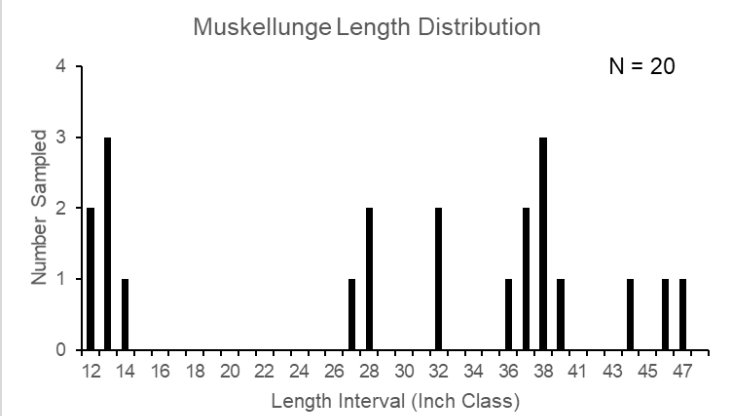



Photo Credit: DNR Staff

Species Summary

- The Cloverleaf Chain supports a low-density muskellunge population with a catch rate of 0.1 fish per net night. A catch rate of 0.1 fish per net night ranks in the 9th percentile when compared to muskellunge catch rates statewide. Relative abundance estimates have continued to slightly decrease when compared among recent surveys on the Cloverleaf Chain.
- The size structure of muskellunge in the 2022 Cloverleaf Chain survey was moderate-high with a PSD of 79, which ranks in the 67th percentile when compared to lakes statewide. This is a slight decrease from what was found in the 2017 survey but still up from what was reported in the 2013 survey.
- The Cloverleaf Chain muskellunge population can be characterized by a low number of larger individuals, resulting in a low-density but high-quality fishery. There were also a number of individuals from more recent stocking events represented in the sample that may supplement the adult population in the future.
- The 2022 muskellunge netting survey on the Cloverleaf Chain was planned to be year one (marking event) of a two-year survey protocol used to estimate adult muskellunge population numbers. However, too few newly captured individuals were handled in the 2022 survey to warrant a recapture sampling. Therefore, no population estimate was conducted for this survey cycle, and the population will be re-evaluated in 2026.

Largemouth Bass

- Largemouth bass (*Micropterus salmoides*) are a common predatory fish species found in many Wisconsin waterbodies. Largemouth bass typically spawn in shallow nearshore areas consisting of sand/mud or gravel substrate at approximately 60-70°F water temperatures. Electrofishing is the preferred sampling gear for largemouth bass. All results presented for largemouth bass are from spring electrofishing surveys.

YEAR SIZE STRUCTURE METRICS

Total Number Measured	Average Length (inches)	Length Range (inches)	Stock and Quality Size (inches)	Stock Number	Quality Number	PSD	Percentile Rank	Size Rating
131	11.0	5.0 - 21.0	8.0 and 12.0	100	66	66	60th	Moderate

2022 RELATIVE ABUNDANCE (CPUE = NUMBER PER MILE)

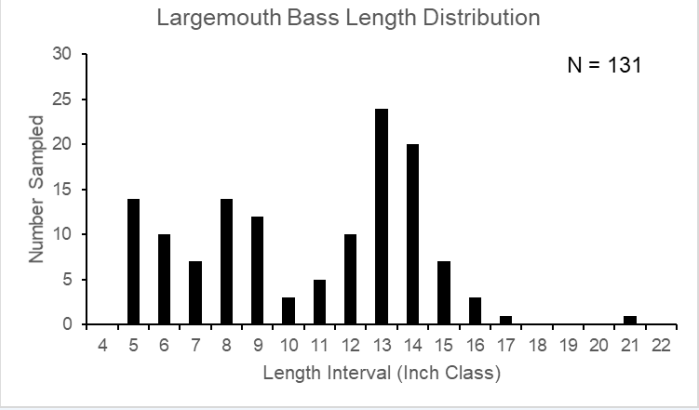
CPUE Total	Percentile Rank	Overall Abundance Rating	Length Index	Length Index CPUE	Length Index Percentile Rank	Length Index Abundance Rating
27.3	70th	Moderate - High	≥ 14.0 inches	6.7	75th	Moderate - High

SIZE STRUCTURE (PSD) TRENDS

PSD by Year			Historical Median
2013	2017	2022	
50	60	66	60

RELATIVE ABUNDANCE TRENDS (CPUE = NUMBER PER MILE)

CPUE by Year			Historical Median
2013	2017	2022	
26.4	41.1	27.3	27.3



Species Summary

- The Cloverleaf Chain supports a moderate - high density largemouth bass population with catch rates of 27.3 fish per mile of electrofishing. A catch rate of 27.3 fish per mile ranks in the 70th percentile among lakes throughout Wisconsin. Relative abundance comparisons among years indicate that CPUE was down slightly from the 2017 survey but similar to what was found in the 2013 survey. Further, the CPUE of largemouth bass greater than 14 inches was also moderate - high when compared to statewide values.
- The size structure of largemouth bass in the Cloverleaf Chain was moderate with a PSD value of 66, which ranks in the 60th percentile when compared to statewide values. When compared to recent surveys on the Cloverleaf Chain, largemouth bass PSD values have remained relatively stable, indicating that the size structure of largemouth bass has been fairly consistent over the last several years.
- The current status of the largemouth bass population on the Cloverleaf Chain looks to be positive. Moderate - high relative abundance and a moderate size structure results in angling opportunities to catch largemouth bass of all sizes.

Black Crappie

- Black crappie (*Pomoxis nigromaculatus*) are a common panfish species distributed widely across many Wisconsin waterbodies. Black crappie typically spawn in nearshore areas consisting of detritus, sand/mud or gravel substrate at approximately 58-68°F water temperatures. Electrofishing and fyke netting can be effective sampling gear for black crappie, and therefore, results from both gears are presented for black crappie.

2022 SIZE STRUCTURE METRICS

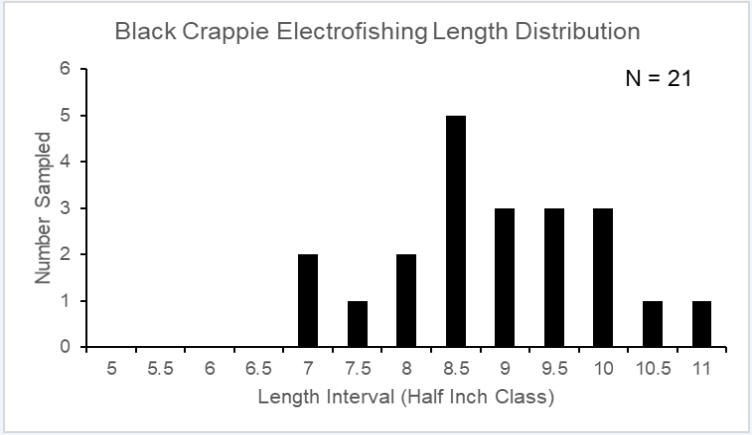
Gear	Number Measured	Average Length	Length Range	Stock and Quality Size	Stock	Quality	PSD	Percentile Rank	Size Rating
Fyke Netting	790	6.9	4.4 - 13.0	5.0 and 8.0	776	52	7	4th	Low
Electrofishing	21	9.1	7.3 - 11.2	5.0 and 8.0	21	18	86	84th	High

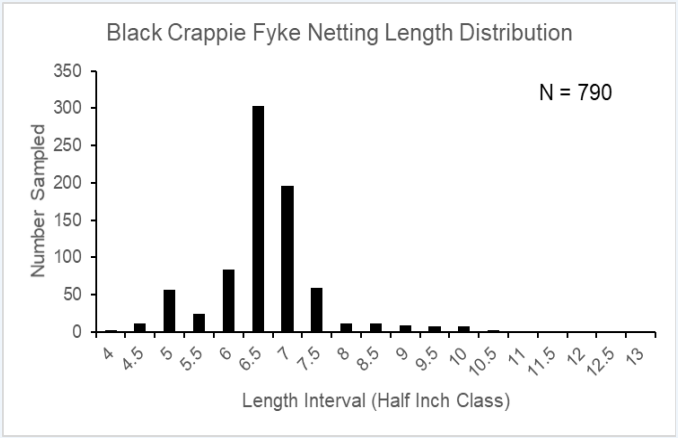
FYKE NETTING CPUE TRENDS (NUMBER PER NET NIGHT)

2022 Number Sampled	2013	2017	2022	Historical Median	2022 Statewide Percentile Rank	2022 Abundance Rating
805	23.0	7.8	6.9	7.8	65th	Moderate

SIZE STRUCTURE (PSD) TRENDS FYKE NETTING

PSD by Year			Historical Median
2013	2017	2022	
45	9	7	9





2022 GROWTH METRICS

Sample (n)	Length Bin	Sex	Mean	Age Range	Percentile	Growth Rating
14	7.5 – 8.4	M	3.1	3.0 - 4.0	84th	Fast
2	9.5 -10.4	M	8.5	8.0 – 9.0	12th	Slow
10	7.5 - 8.4	F	4.0	3.0 - 5.0	64th	Moderate
14	9.5 -10.4	F	8.8	5.0 - 12.0	12th	Slow

ELECTROFISHING CPUE (NUMBER PER MILE)

CPUE Total	Percentile Rank	Overall Abundance Rating	Length Index	Length Index CPUE	Length Index Percentile Rank	Length Index Abundance Rating
14.0	72nd	Moderate-High	≥ 8.0 inches	12.0	85th	High

ELECTROFISHING TRENDS CPUE (NUMBER PER MILE)

CPUE by Year			Historical Median
2013	2017	2022	
2.0	36.0	14.0	14.0

ELECTROFISHING SIZE STRUCTURE (PSD) TRENDS

PSD by Year			Historical Median
2013	2017	2022	
100	25	86	86

Species Summary

- The Cloverleaf Chain supports a moderate - high density black crappie population with catch rates of 6.9 fish per net night from the fyke netting survey and 14.0 fish per mile of electrofishing from the boom shocking survey. Catch rates of 6.9 per net night and 14.0 per mile rank in the 65th and 72nd percentiles, respectively.
- The size structure of black crappie in the Cloverleaf Chain differed by gear. In the fyke netting survey, most individuals captured ranged from 6-8 inches in length, whereas in the electrofishing survey, the majority of individuals captured were from the 8.5 - 10 inch range. This provides a great example of why it can be informative to use results from both gears to assess the population status. Length data from the fyke netting survey resulted in a PSD value of 7 which is in the 4th percentile when compared to fyke netting data statewide. Length data collected from the electrofishing survey resulted in a PSD value of 86, which is in the 84th percentile when compared to statewide values.
- Population trends from previous electrofishing surveys on the Cloverleaf Chain indicate that the size structure has improved from the 2017 survey and is similar to the 2013 survey. Moreover, relative abundance estimates have improved from the 2013 survey but have decreased slightly from the 2017 survey.
- Growth metrics calculated from age estimates indicate that black crappie in the Cloverleaf Chain grow moderate - fast for both male and female individuals up to 8.4 inches. Growth is slow compared to statewide metrics for both males and females in the 9.5 - 10.4 inch bin.

Bluegill

- Bluegill (*Lepomis macrochirus*) is a very common panfish species distributed widely across many Wisconsin waterbodies. Bluegill typically spawn in nearshore areas consisting of sand/mud or gravel substrate at approximately 67-80°F water temperatures. Electrofishing and fyke netting can be effective sampling gear for bluegill, and therefore, results from both gears are presented for bluegill.

2022 SIZE STRUCTURE METRICS

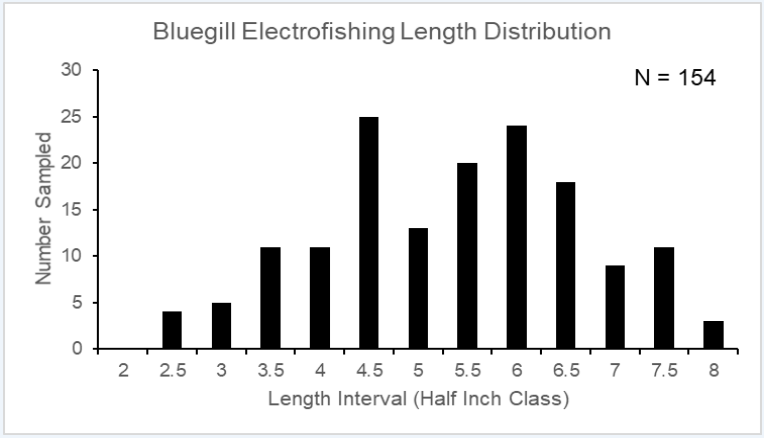
Gear	Number Measured	Average Length	Length Range	Stock and Quality Size	Stock	Quality	PSD	Percentile Rank	Size Rating
Fyke Netting	621	5.7	3.8 - 8.6	3.0 and 6.0	621	208	33	23rd	Low
Electrofishing	154	5.6	2.6 - 8.2	3.0 and 6.0	150	65	43	61st	Moderate

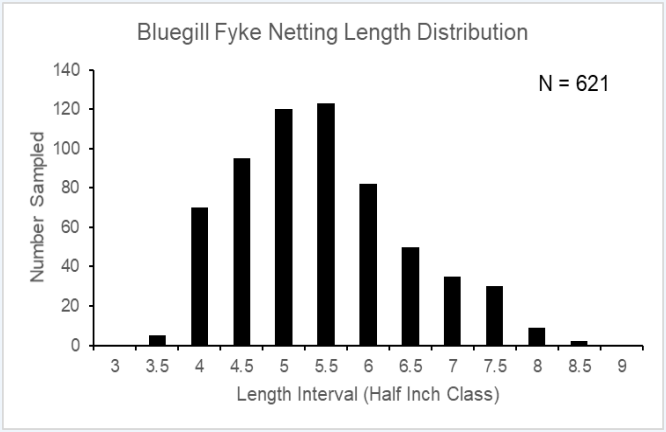
FYKE NETTING CPUE TRENDS (NUMBER PER NET NIGHT)

2022 Number Sampled	2013	2017	2022	Historical Median	2022 Statewide Percentile Rank	2022 Abundance Rating
621	30.5	15.3	5.4	15.3	45th	Moderate - Low

SIZE STRUCTURE (PSD) TRENDS FYKE NETTING

PSD by Year			Historical Median
2013	2017	2022	
40	48	33	40





2022 GROWTH METRICS

Sample (n)	Length Bin	Sex	Mean	Age Range	Percentile	Growth Rating
12	5.5 – 6.4	M	4.2	3.0 - 6.0	58th	Moderate
11	6.5 – 7.4	M	5.1	3.0 – 7.0	60th	Moderate
14	5.5 - 6.4	F	4.1	4.0 - 5.0	60th	Moderate
10	6.5 – 7.4	F	4.9	4.0 - 6.0	65th	Moderate

ELECTROFISHING CPUE (NUMBER PER MILE)

CPUE Total	Percentile Rank	Overall Abundance Rating	Length Index	Length Index CPUE	Length Index Percentile Rank	Length Index Abundance Rating
102.7	56th	Moderate	≥ 7.0 inches	15.3	71st	Moderate-High

ELECTROFISHING TRENDS CPUE (NUMBER PER MILE)

CPUE by Year			Historical Median
2013	2017	2022	
130.0	107.0	102.7	107.0

ELECTROFISHING SIZE STRUCTURE (PSD) TRENDS

PSD by Year			Historical Median
2013	2017	2022	
42	52	43	43

Species Summary

- The Cloverleaf Chain supports a moderate density bluegill population with catch rates of 5.4 fish per net night from the fyke netting survey and 102.7 fish per mile of electrofishing from the boom shocking survey. Catch rates of 5.4 per net night and 102.7 per mile rank in the 45th and 56th percentiles, respectively. Catch rates of bluegills greater than 7 inches in the electrofishing survey was 15.3 per mile, which ranks in the 71st percentile and is moderate - high when compared to lakes statewide.
- The size structure of bluegills in the Cloverleaf Chain was characterized as low based on the fyke netting survey and moderate based on data from the electrofishing survey. Length data from the fyke netting survey resulted in a PSD value of 33, which is in the 23rd percentile when compared to bluegill fyke netting data statewide. Length data collected from the electrofishing survey resulted in a PSD value of 43, which is in the 61st percentile when compared to statewide values.
- Population trends from previous electrofishing surveys on the Cloverleaf Chain indicate that size structure has generally remained similar over recent surveys. Moreover, relative abundance estimates have also remained relatively similar when compared among past surveys with a slight decrease from the 2013 survey.
- Growth metrics calculated from age estimates indicate that bluegill in the Cloverleaf Chain have moderate growth when compared to growth rates from bluegill populations across the state. Growth metrics were in the moderate rating for all compared length bins and for both male and female sexes.

Pumpkinseed

- Pumpkinseed (*Lepomis gibbosus*) is a common panfish species distributed widely across many Wisconsin waterbodies. Pumpkinseeds typically spawn in nearshore areas consisting of sand or gravel substrate at approximately 60-70°F water temperatures. Electrofishing and fyke netting can be effective sampling gear for pumpkinseed, and therefore, results from both gears are presented for pumpkinseed.

2022 SIZE STRUCTURE METRICS

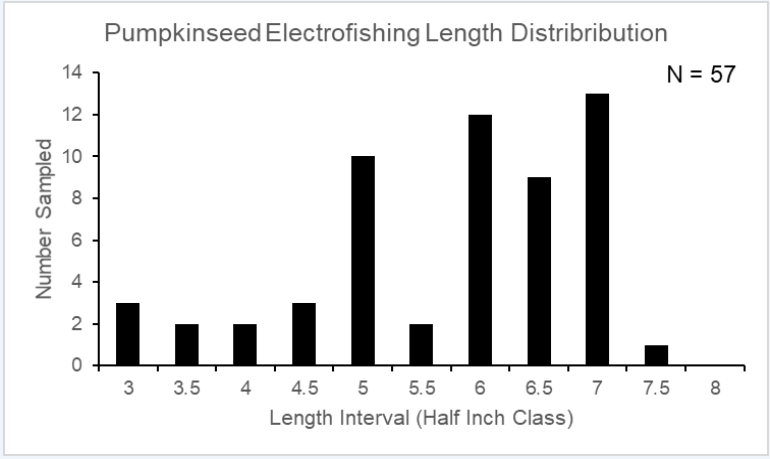
Gear	Number Measured	Average Length	Length Range	Stock and Quality Size	Stock	Quality	PSD	Percentile Rank	Size Rating
Fyke Netting	166	6.0	3.6 - 9.0	3.0 and 6.0	166	106	64	78th	Moderate-High
Electrofishing	57	5.9	3.2 - 7.9	3.0 and 6.0	57	35	61	76th	Moderate-High

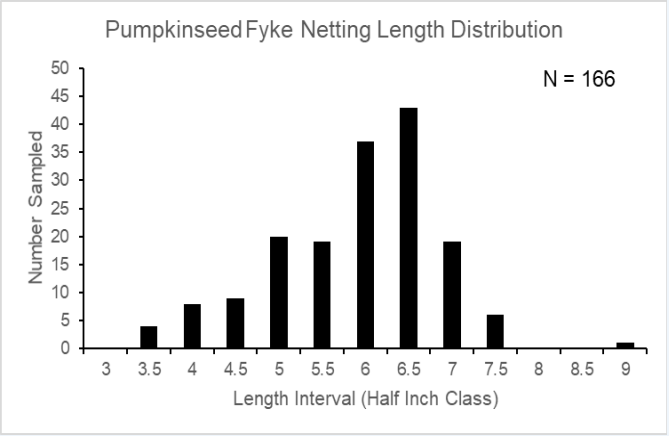
FYKE NETTING CPUE TRENDS (NUMBER PER NET NIGHT)

2022 Number Sampled	2013	2017	2022	Historical Median	2022 Statewide Percentile Rank	2022 Abundance Rating
166	3.2	3.5	1.4	3.2	62nd	Moderate

SIZE STRUCTURE (PSD) TRENDS FYKE NETTING

PSD by Year			Historical Median
2013	2017	2022	
16	21	64	21





ELECTROFISHING CPUE (NUMBER PER MILE)

CPUE Total	Percentile Rank	Overall Abundance Rating	Length Index	Length Index CPUE	Length Index Percentile Rank	Length Index Abundance Rating
38.0	89th	High	≥ 7.0 inches	9.3	95th	High

ELECTROFISHING TRENDS CPUE (NUMBER PER MILE)

CPUE by Year			Historical Median
2013	2017	2022	
15.0	30.1	38.0	30.1

ELECTROFISHING SIZE STRUCTURE (PSD) TRENDS

PSD by Year			Historical Median
2013	2017	2022	
47	53	61	53

Species Summary

- The Cloverleaf Chain supports a high-density pumpkinseed population with catch rates of 1.4 fish per net night from the fyke netting survey and 38.0 fish per mile of electrofishing from the boom shocking survey. Catch rates of 1.4 per net night and 38.0 per mile rank in the 62nd and 89th percentiles, respectively. Catch rates of pumpkinseed greater than 7 inches in the electrofishing survey was 9.3 per mile which ranks in the 95th percentile and is high when compared to lakes statewide.
- The size structure of pumpkinseed in the Cloverleaf Chain was characterized as moderate - high based on data from both the fyke netting survey and electrofishing survey. Length data from the fyke netting survey resulted in a PSD value of 64, which is in the 78th percentile when compared to pumpkinseed fyke netting data statewide. Length data collected from the electrofishing survey resulted in a PSD value of 61, which is in the 76th percentile when compared to statewide values.
- Population trends from previous electrofishing surveys on the Cloverleaf Chain indicate that size structure has increased dramatically over recent fyke netting surveys and increased slightly over recent electrofishing surveys. Relative abundance has slightly decreased based on data from the fyke netting survey whereas electrofishing survey data indicate relative abundance has remained generally similar with a slight increase from the 2017 survey.

Full Summary

Northern Pike

The Cloverleaf Chain supports a low-density northern pike population with a low - moderate size structure. Although there were individuals captured up to 28 inches, the majority of the sample consisted of 15 - 20 inch fish. Results from age and growth analyses were impacted by a small sample size but growth appears to be slow - average for northern pike. Future age and growth work is warranted to corroborate 2022 findings. Lack of suitable habitat could be one potential factor affecting northern pike in the Cloverleaf Chain. Areas that have existing emergent vegetation should be enhanced or undisturbed, and interested landowners should consider promoting emergent vegetation within the littoral zone.

Walleye

Data from the 2022 Cloverleaf Chain survey indicates that the walleye population has improved from the 2017 survey. Although relative abundance is considered low when compared to walleye populations statewide, the Cloverleaf Chain has seen a vast improvement. Moreover, the PSD value of 95 indicates a high size structure rating. The 2022 netting survey resulted in one of the highest total catches of walleye recorded on the Cloverleaf Chain. However. a population estimate was not conducted due to the inability to use electrofishing equipment on the required waterbodies. A fall electrofishing survey was conducted in an attempt to capture young of the year walleye and document reproduction, but no individuals were captured. The Cloverleaf Chain walleye population has seen a positive response from stocking efforts, and stocking should continue to benefit the walleye population.

Muskellunge

The muskellunge population in the Cloverleaf Chain is a low-density population with a moderate - high size structure of individuals. The 2022 survey was the first netting survey of a planned two-year mark-recapture survey to estimate the number of adult muskellunge in the Cloverleaf Chain. However, too few new individuals were marked to effectively conduct a mark-recapture survey. There were also several smaller fish captured that were from recent stocking cohorts that have yet to recruit to the adult population. These individuals should recruit to the adult population in the coming years. The 2022 survey results indicate that the Cloverleaf Chain adult muskellunge population is composed primarily of a low density of large, old individuals that has decreased over the past several surveys. A discussion with the local stakeholders should be held to determine a direction to pursue for the muskellunge population.

Largemouth Bass

The Cloverleaf Chain largemouth bass population has remained relatively consistent over the past several surveys, maintaining a moderate - high density and a moderate size structure. Overall, the largemouth bass population is healthy, with optimal numbers of individuals to maintain positive population characteristics and help keep panfish populations from becoming overabundant through predation. The largemouth bass population provides a high-action fishery with an above-average proportion of 14-inch or greater fish available for anglers. Population levels should be maintained for largemouth bass; however, pending the next survey, regulation changes may be considered. A larger sample of largemouth bass age structures would benefit this determination.

Black Crappie

The black crappie population in the Cloverleaf Chain is healthy and should provide an excellent angling opportunity. The 2022 survey results indicate that black crappie population levels were moderate - high when compared to waterbodies throughout Wisconsin. Further, the catch rate of black crappie greater than 8.0 inches was high compared to black crappie catch rates statewide. In addition to the high relative abundance of larger black crappie, the 2022 survey results also indicate a strong year class of 6.5 –7.5 inch fish that should recruit to desired lengths for harvest in the near future. The moderate - high relative abundance, along with the current high abundance of target size (> 8-inch) individuals and strong year classes of smaller fish, should promote a healthy black crappie fishery on the Cloverleaf Chain for the next several years.

Bluegill

Bluegill population characteristics quantified in the 2022 Cloverleaf Chain survey appear to have remained relatively similar to past surveys. Relative abundance and size structure metrics have both remained moderate. Growth was assessed on bluegill using age estimates from otolith cross sections, and results indicate bluegills have average growth in the Cloverleaf Chain compared to waterbodies statewide. It is likely still too early post-regulation to determine potential impact of the regulation change on the bluegill population but 2022 survey results did indicate that the catch rate of bluegills > 7-inches was moderate - high when compared to bluegill populations statewide. Although size structure of bluegill could still improve, the Cloverleaf Chain does provide a high-action bluegill fishery with a good number of > 7-inch individuals. Nearshore habitat is lacking around a majority of the Cloverleaf Chain and interested landowners should consider adding fish sticks/tree drops in the littoral zone or leaving timber that naturally recruits to the lake undisturbed.

Pumpkinseed

The Cloverleaf Chain pumpkinseed population has seen a positive improvement compared to previous surveys, with a high relative abundance and high size structure rating observed in the 2022 survey. Further, the number of > 7-inch size individuals was exceptionally high when compared to statewide pumpkinseed populations. Similar to the bluegill population, it is too soon to attribute positive or negative population impacts to the regulation change. However, recent survey data indicate the pumpkinseed population is trending positively in the Cloverleaf Chain. Improvements to nearshore habitat, such as the addition of tree drops or fish sticks, could benefit both panfish and predatory species in the Cloverleaf Chain.