

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

2023 Lake Winnebago Bottom Trawling

Assessment Report

Waterbody Code 131100



Photo 1. Calumet Research Vessel (RV) at the dock in Asylum Bay. Photo credit: Michael Cooney



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DNR Senior Fisheries Biologist
Dec. 20, 2023

Introduction

The Lake Winnebago bottom trawl survey is one of the most insightful fisheries assessments on the system. The survey, in its modern capacity, dates back to 1986, providing a lengthy time series of catch data for comparison over the years. This allows readers to compare species abundance of the past and present, as well as the outlook for future years through the comparison of annual year class strengths. The main objectives of this report include the assessment of year class strength for gamefish, non-gamefish and panfish species, relative abundance of forage fish species, and general population trends of adult gamefish and non-gamefish species. The 2023 trawl survey was completed utilizing a team of fisheries management and operations staff as well as our typical volunteer assistance. We had 33 different volunteers out on the RV Calumet this year. Volunteers throughout the surrounding area continue to be a major asset to the Wisconsin Department of Natural Resources' (DNR) Oshkosh fisheries crew in the completion of this survey.



Photo 2. Fisheries staff and volunteers on the Calumet measuring game and panfish captured in the trawl survey. Photo credit: Michael Cooney.

Methods

The Lake Winnebago bottom trawling assessment has been conducted with the same standardized method for the last 38 years. This involves a total of 138 net pulls split up into three sampling events. We conduct 46 net pulls during the first week of August, September and October. An average day on the trawl consists of 10-12 net pulls (about 8 hours on the boat). The 27-foot-wide trawl net is deployed behind the boat and pulled along the bottom of the lake at 4 miles per hour (mph) for 5 minutes. When the net is pulled in, the fish are emptied onto the counting table, and the trawling crew counts the fish and



Photo 3. Fisheries operations technician Kyle Olson tossing the trawl float off the back of the Calumet. Photo credit: WI DNR.

separates the gamefish and panfish into a holding tank where they get measured and released. The long-term data set from the survey allows for the comparison of year class strength and adult fish relative abundance over the past 37 years, giving fisheries managers and interested anglers insight on the status of the Winnebago fishery.

Results

We captured a total of 126,332 fish in the 2023 survey, representing 20 different species. We separate this total catch into young-of-year (YOY) of fish hatched in 2023 and adult fish for age 1+ fish. For the purpose of this survey, fish in the adult category may or may not be sexually mature. The total adult fish catch was 47,357, with 19 different species present. Most notable adult fish catch rates include record-setting walleye, the fourth highest yellow perch, persistence of the 2021 sauger year class, the sixth consecutive year of below-average freshwater drum, low white bass and record bluegill. The total YOY catch was 78,975 with nine species present.

Most notable YOY catch rates include the third highest yellow perch, above-average crappie, measurable but relatively low walleye, low white bass, the fourth highest trout perch, low gizzard shad and low freshwater drum. The most exciting results from this year's survey are the excellent recruitment of the near-record walleye year class of 2022, resulting in the record adult walleye catch and the continuation of high catch rates for both YOY and adult yellow perch. These species are among the most targeted on the system and results indicate a prosperous fishing forecast in the years to come. While YOY freshwater drum and gizzard shad came in low numbers, trout perch continue to be near record highs, which should provide good forage for our relatively high gamefish populations.

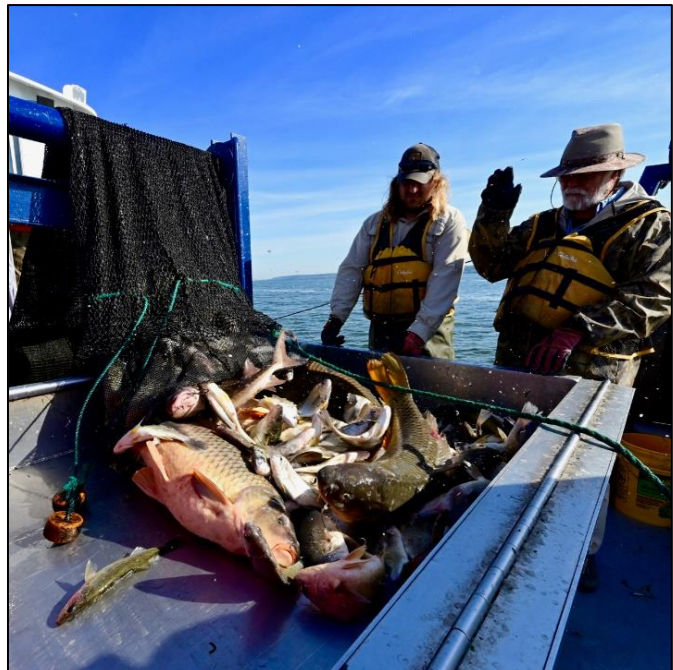


Photo 4. Fisheries technician Nate Schimanski and volunteer Mike Arrowwood at the fish counting table as the net comes in. Photo credit: Michael Cooney.

WALLEYE

High spring water levels on the Wolf River led to high hopes for walleye spawning success among those familiar with the Winnebago System, but 2023 trawling results indicate a relatively low, though measurable, year class. YOY walleye catch in the 2023 survey was 2.8 YOY/trawl, which is below the long-time average of 4.9 YOY/trawl (Figure 1). This being said, it is positive to see at least some measurable result of the 2023 spawn. While spring water levels were high on the Wolf River, there are several other considerations for the success of the spawn and subsequent development and survival of eggs and larval fish.



Photo 5. High yearling walleye catch in a spring (2023) electrofishing survey on the south shore of Lake Poygan. Photo credit WI DNR.

A gauge height of 7 feet in New London is the general benchmark for adequate water flows in the Wolf River marshes. Higher flows can allow for increased spawning habitat access as well as more favorable conditions for developing eggs and fry. The gauge height at New London first reached 7 feet on March 31 (Appendix 1). The water continued to rise rapidly, peaking just over 9.8 feet on April 9. Following the peak, the water gradually fell, remaining above 7 feet until May 19. The high and consistent water levels on the Wolf River are typical of previously observed successful spawns, though trawling results show a relatively weak year

class in 2023. Another environmental factor believed to play a role are spring water temperatures.

While we had favorable water levels on the Wolf River this spring, we also experienced a very erratic temperature swing directly after the peak walleye spawning period (Appendix 2). Our spring stock assessment on the Wolf River took place from April 4-11. Between April 4-7, recorded temperatures in survey sites ranged from 35-39° F, and only 3% of all female fish captured were observed to produce eggs. From April 8-9, recorded marsh temperatures



Photo 6. Fisheries biologist Angelo Cozzola and volunteer with two female walleye captured in the spring walleye assessment on the Wolf River. Photo credit: WI DNR

ranged from 41-43° F, and females producing eggs increased to 11%. Temperatures on April 10-11 started to quickly rise with observations ranging from 46-53° F, and the percentage of females producing eggs rose to 21%. At this point, our tagging objective for the spring survey was met and the survey was concluded. Four days after our survey was complete, water temperatures at the New London gauge peaked at 64° F on April 15. Considering this rapid warm-up and our observations towards the end of the spring assessment, the peak walleye spawning

period on the Wolf River in 2023 was estimated to be in between April 10 – 15. Following the peak spawning period, temperatures quickly decreased to 46° F on April 20, equating to a 17.6° F temperature swing over a 6-day period. Water temperatures remained between 44-51° F until May 4. While other factors, in addition to water levels and temperatures, can affect the success of the spawn, the dramatic and persistent temperature decrease experienced this past spring is a standout observation and may be related to the below-average year class observed in 2023.

While the 2023 walleye hatch was underwhelming, we did observe great recruitment of the near-record year class of 2022 (Photo 7), resulting in a record-setting catch of adult walleye. Yearling catch was the second highest on record at 10.6/trawl, and the total adult walleye catch was a record 15.7/trawl (Figure 1). High yearling catch was also noted in our 2023 spring fyke net surveys on Lake Winnebago near Fond Du Lac, as well as spring shoreline electrofishing on Lake Poygan (Photo 5). In addition to the recruitment of the 2022-year class, the system has had several strong year classes over the last seven years, with most years in between coming in at above average. While the adult walleye catch is at a record high, the total adult catch is typically largely comprised of yearling-sized fish. It will be interesting to follow how the earlier year classes persist in the population and where the adult catch lands next year with the weaker year class of 2023. Looking forward, anglers can expect good opportunity to catch Winnebago System walleye with fish present from multiple strong year classes over the last seven years.



Photo 7. A net full of yearling (fish hatched in 2022) sized walleye captured in the 2023 trawl survey. Photo credit: WI

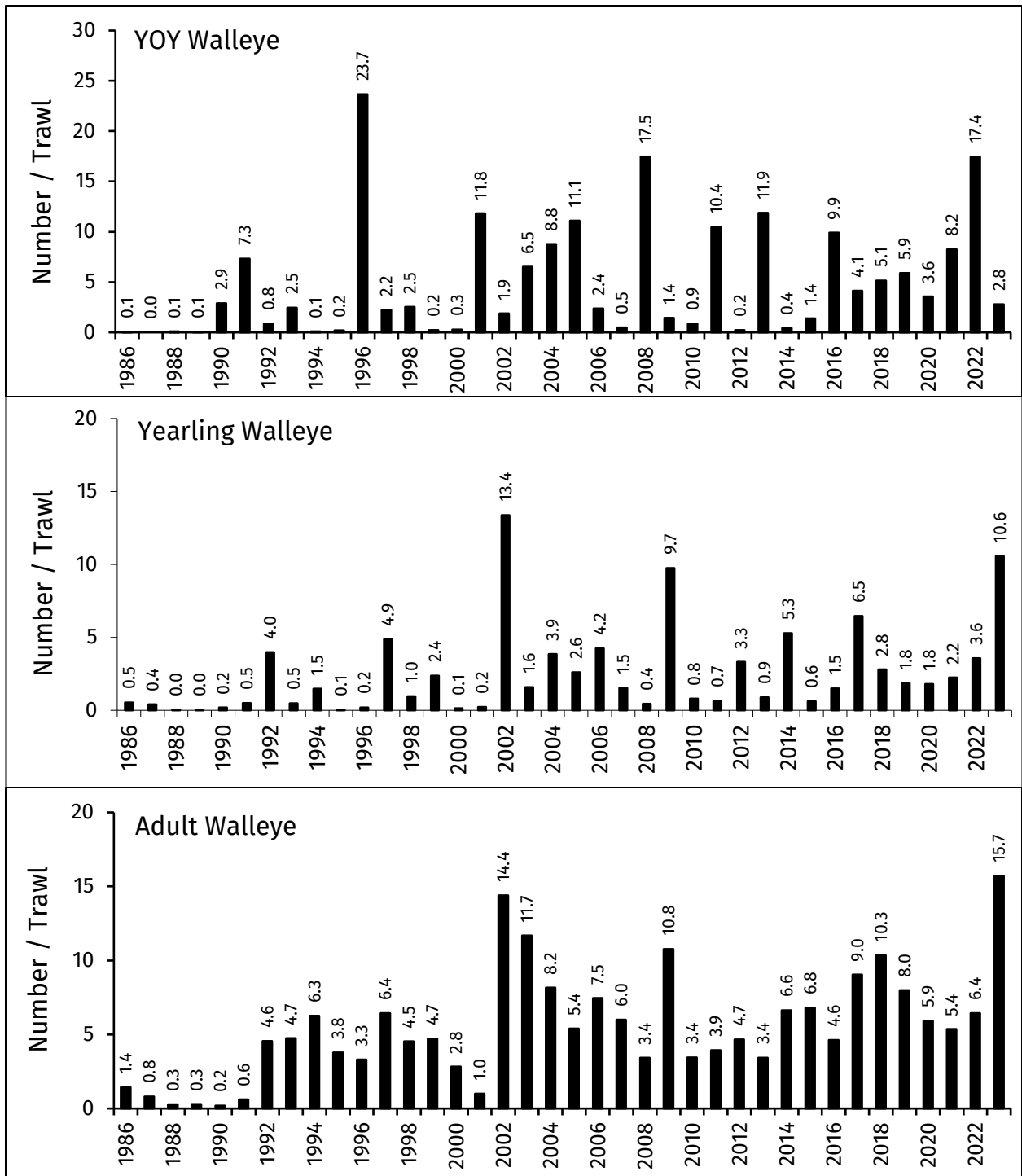


Figure 1. The average number of YOY, yearling and adult walleyes captured per trawl during the Lake Winnebago trawling assessment from 1986-2023.

YELLOW PERCH

YOY yellow perch catch was 9.6/trawl. This is the third highest yellow perch year class on record and the two years that rank higher occurred within the last four surveys. Another near-record year class in 2023 provides a promising outlook for one of the system's most targeted species. Adult yellow perch catch was also high, coming in at 13.4/trawl, the fourth highest catch on record. The strong adult catch shows good recruitment of the recent strong year classes. The length of non-YOY yellow perch captured in 2023 ranged from 3.1 to 12.2 inches with an average length of 6.9 inches. Fish between 4.0 and 6.5 inches dominated the size distribution, accounting for 57% of all fish captured. Based on previously established growth rates of yellow perch in the system, these fish are likely from both the record year class of 2022 as well as the above-average class of 2021. The catch remained strong for larger fish, with 34% of all fish captured measuring over 8 inches in length (Figure 2). The amount of large yellow perch captured in the 2023 trawl was impressive (Photo 9), with the catch per unit of effort (CPE) for fish over 9 inches in length at an all-time high of 2.7/trawl (Figure 2). The high catch rates of larger fish shows the persistence of fish from earlier year classes in the population, which is good to see for this highly targeted and harvested species. Anglers on the system have reported good levels of success in regard to both numbers and size this last season, and anglers can look forward to good opportunities on the ice this winter.



Photo 8. A 10.5-inch yellow perch captured in the 2023 trawl survey. Photo credit: WI DNR.



Photo 9. A net full of larger sized perch captured in the 2023 trawl survey. Photo credit: WI DNR.

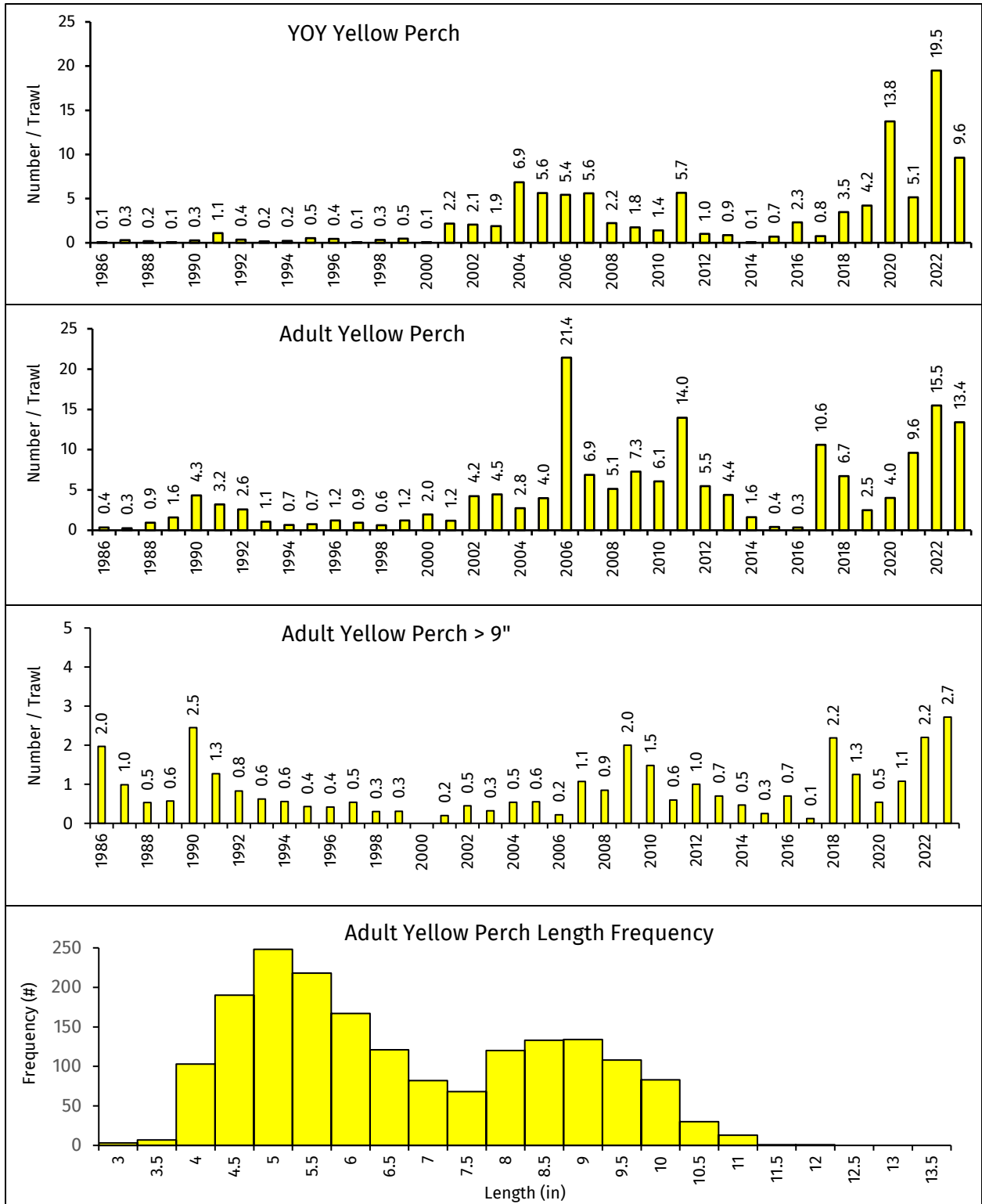


Figure 2. The average number of YOY, adult and adult yellow perch > 9 inches captured per trawl during the Lake Winnebago trawling assessment from 1986-2023. Adult yellow perch length frequency of trawl captured fish in 2023.

SAUGER

There were zero YOY saugers captured for the second straight year as natural reproduction on the system continues to be limited. There was a total of 81 adult saugers captured in the 2023 trawl resulting in a catch rate of 0.6/trawl, the same catch rate observed in

2022. While the Winnebago sauger population remains relatively low density, the catch rates in 2022 and 2023 do show a slight increase from most recent years (Figure 3). 2022 was the first year to show an increase (greater than 0.1) in adult catch since the conclusion of the sauger rehabilitation program in 2010. The recent increase is likely related to the measurable year class of 2021. Adult saugers in the trawl ranged in length

from 11.7 to 17.7 inches. The majority of fish captured are sub-14-inches, representing 64% of the total catch. These smaller fish are likely a result of the 2021 year, though larger individuals continue to persist and appear to measure in two size classes of 15-16 inches and 17-18 inches (Figure 3), indicating multiple year classes present in the population.

The sauger genetic study evaluating the contribution of Winnebago captured sauger from the Walleyes for Tomorrow (WFT) portable hatchery effort on the upper Fox River in Berlin failed to detect a genetic match. The larger year class of 2021 was of interest to those involved in the study, but following genetic analysis, the sauger year class of 2021 appears to be the result of natural reproduction.



Photo 10. Fisheries technician Nate Schimanski with a sauger captured in the 2023 trawl. Photo credit: WI DNR.

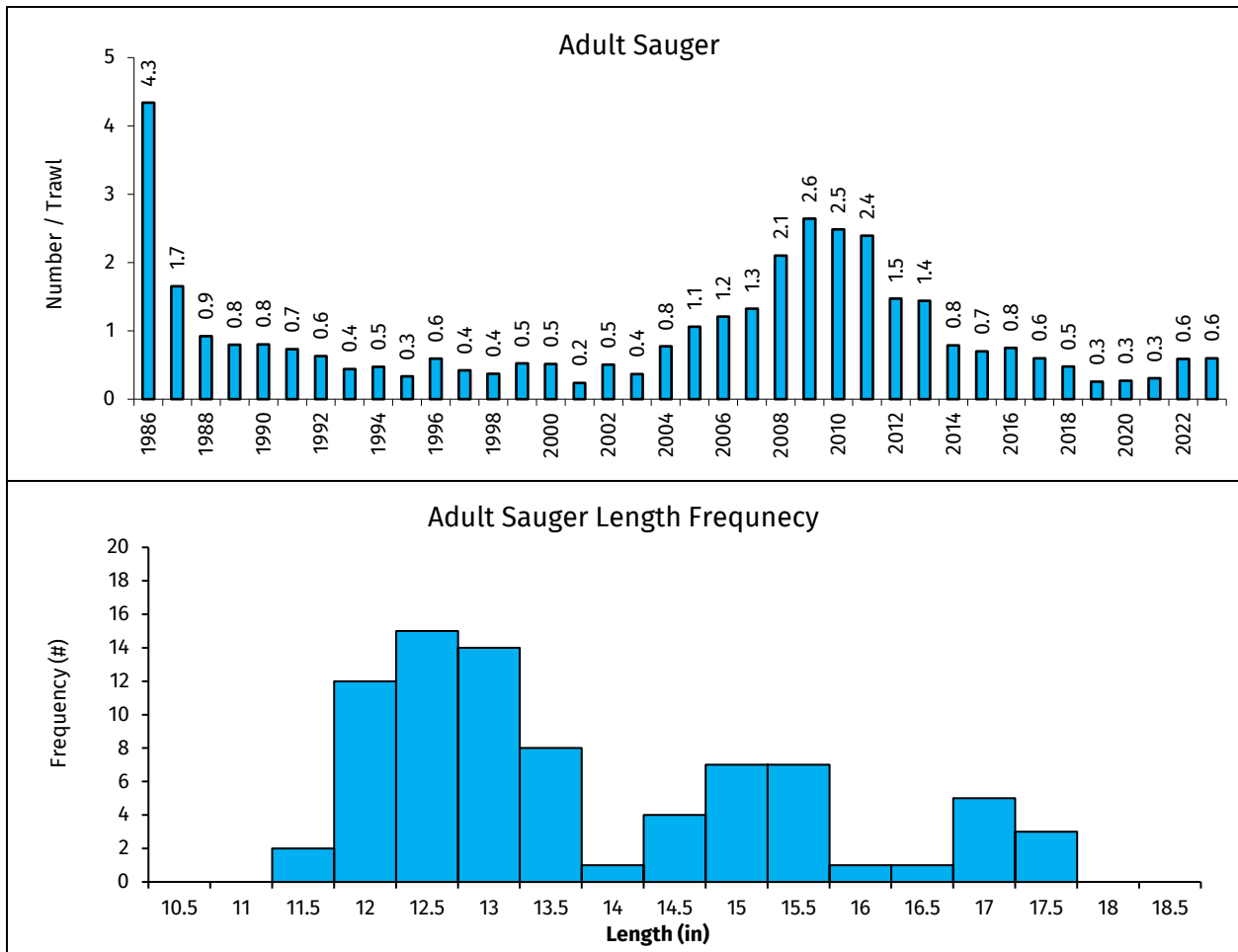


Figure 3. Average number of adult saugers captured per trawl in the Lake Winnebago trawl survey from 1986-2023 and adult saugers length frequency for trawl captured fish in 2023.

WHITE BASS

White bass catch rates in the trawl survey have been relatively low over the last 12 years for both adult and YOY fish. 2023 adult and YOY catch were well below the long-term averages, with catch rates of 3.8/trawl and 1.0/trawl, respectively (Figure 4). The last substantial year class was in 2011, and adult populations have shown slight fluctuation in the years since then but have been in a general downward trend. White bass continue to be a highly targeted and valued species on the Winnebago System. While angler experiences tend to vary, many have voiced concern over the status of the white bass population. There are several instances found in the trawling data that show Winnebago System fish of several species being capable of pulling off large year classes and rebounding population abundances following periods of low populations. A similar occurrence is most likely possible for white bass, though the

prolonged periods of decreased trawl catch are notable. In general, Winnebago System white bass have been shown to display boom and bust populations cycles, so this period of lower catch rates is not far from typical trends, but the persistence and magnitude of these lower catch rates have raised interest for establishing a bag limit on white bass, as there is currently no limit. White bass exploitation on the system has not been formally assessed, and a future assessment of exploitation could provide justification for this regulation change. Regardless, every year in the trawl survey, there is at least a measurable catch of adult and YOY white bass, and angling opportunities continue to exist. Future years of trawl data and the potential assessment of exploitation will provide insight.

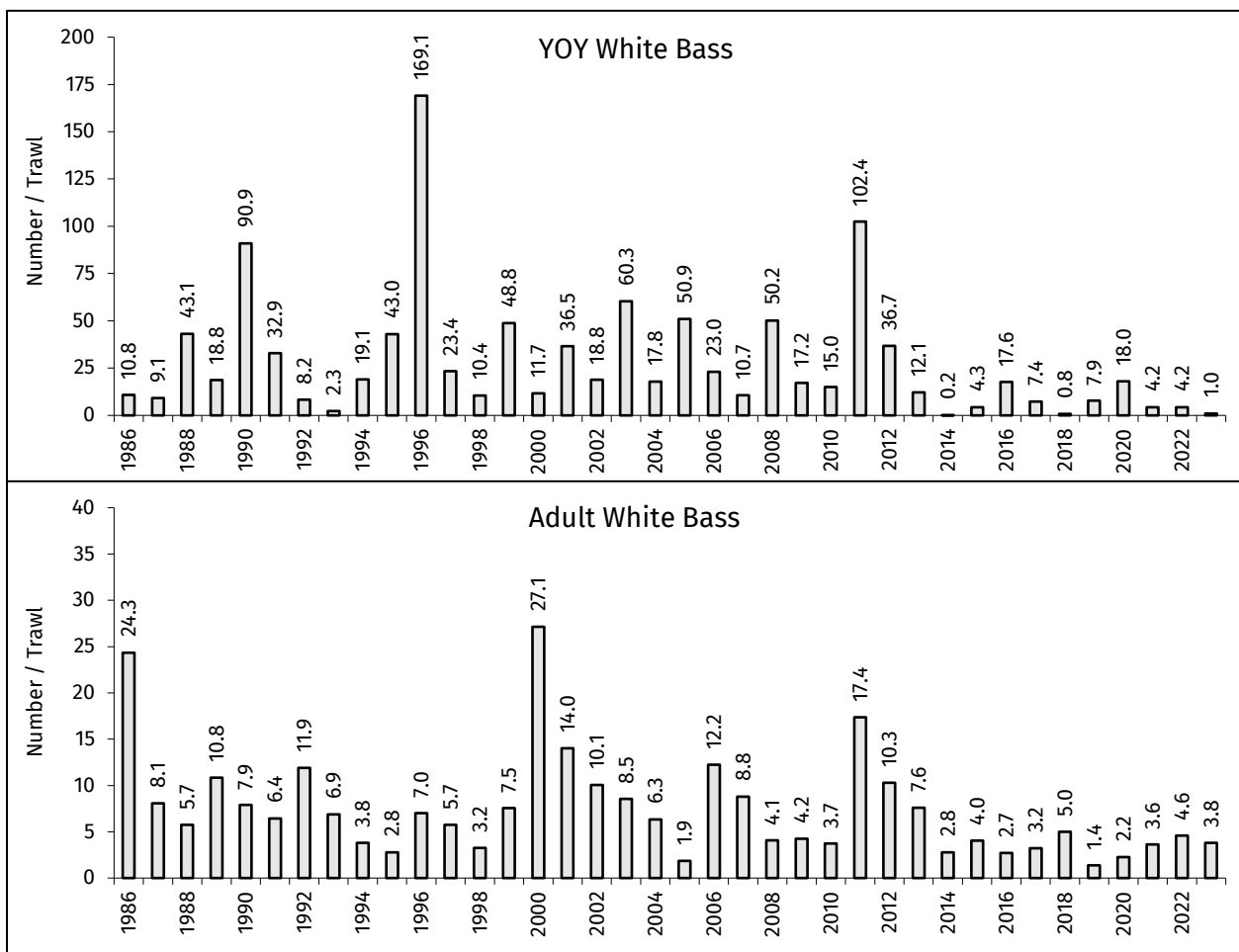


Figure 4. Average number of YOY and adult white bass captured per trawl in the Lake Winnebago trawl survey from 1986-2023.

CRAPPIE

YOY crappie catch in the 2023 survey was 4.7/trawl, solidly above the long-term average of 3.4/trawl. Over the last four surveys, there has only been one year with below-average catches, and 2020 and 2021 had substantial catches, ranking second and fourth since the survey began in 1986. The fish from these high-ranking year classes will be ending their third and fourth growing season moving into the winter of 2023/2024 and should provide angling opportunities for larger fish. Crappie catch in the trawl can be somewhat erratic, so it is good to see consistent year classes showing up over the last four surveys. While crappies do not compare to the level of targeted effort of Winnebago System walleye and perch, anglers around the system do have success with this species. Adult crappies are not well recruited in the trawl survey due to habitat preference and location of trawl efforts, though a measurable number of adults are typically captured. Length frequency of adult fish captured shows two distinct size classes, likely from the 2020- and 2021-year classes, as well as the persistence of some larger individuals (Figure 5, Photo 11).



Photo 11. Fisheries technician Jason Kohls with a 13-inch crappie captured in the 2023 trawl survey. Photo credit: WI DNR.

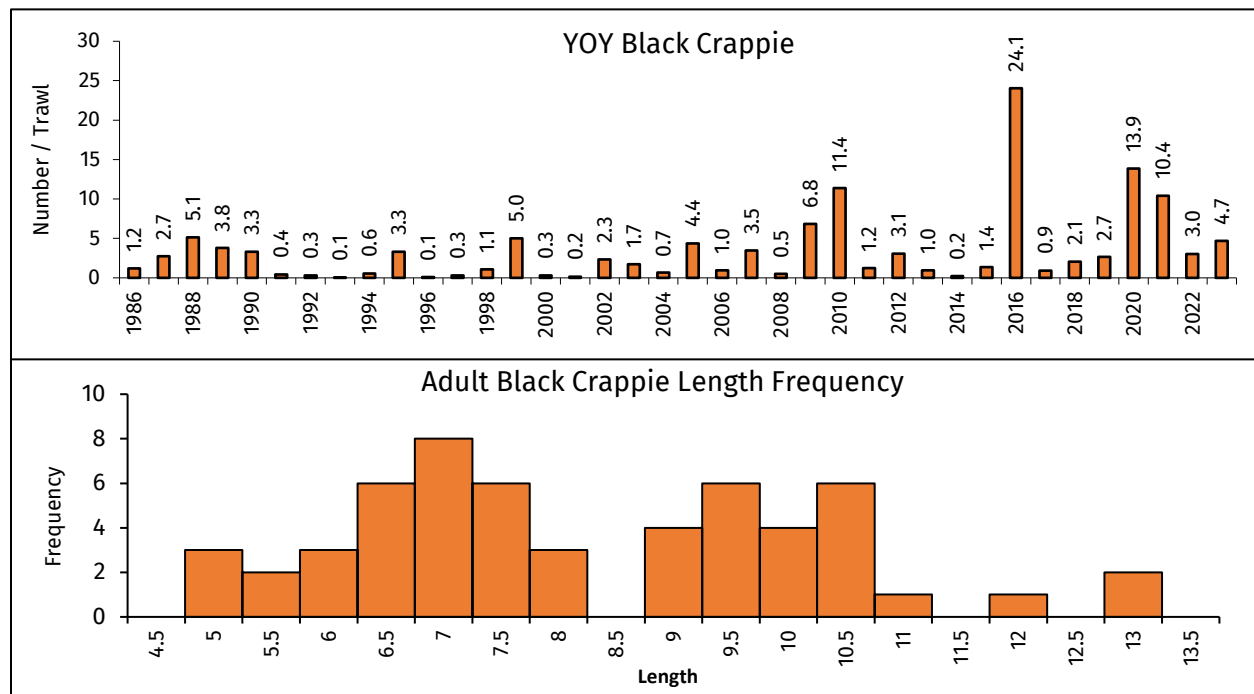


Figure 5. Average number of YOY black crappie captured per trawl in the Winnebago trawl survey from 1986-2023 and length frequency of adult black crappies captured in the 2023 survey.

BLUEGILL

Similar to crappies, bluegills are not well recruited by the trawl survey due to habitat preference. This being said, when bluegill catch in the trawl is high, it is most likely representative of other areas around the system not covered by the survey. Adult bluegill catch in 2023 came in at a record 3.1/trawl (Figure 6). This is approximately 1.5 times the previous record, and it is preceded by the fourth and fifth highest adult catch rates in 2021 and 2022, respectively. Bluegills are most likely to reside in areas containing a healthy amount of aquatic vegetation, which they use for cover, foraging and nursery habitat for young. An aquatic plant index sampling effort that has been occurring around the system since 2017 reports an uptrend in aquatic plant presence and rooting depth over the last three years. The increase in bluegill catch observed in the trawl survey in recent years may be related to the increase in aquatic plants. While they are not the most targeted species on the system, bluegills do receive a fair amount of attention among anglers. Many anglers have luck in early to late spring near the mouths of or within smaller tributaries, residential channels, and shallow bays. In the spring of 2023, a fyke net survey in the mouth of Van Dyne Creek (VDC) produced good catch rates of bluegills with a solid size structure. CPE ((CPE) = #/net night) in VDC was 26.8, with a mean length of 7.5 inches (max length = 10 in). There was also notable bluegill catch at netting sites in Lighthouse Harbor (Fond du Lac).



Photo 12. A 10-inch bluegill captured in Van Dyne Creek fyke net survey in spring 2023. Photo credit WI DNR.

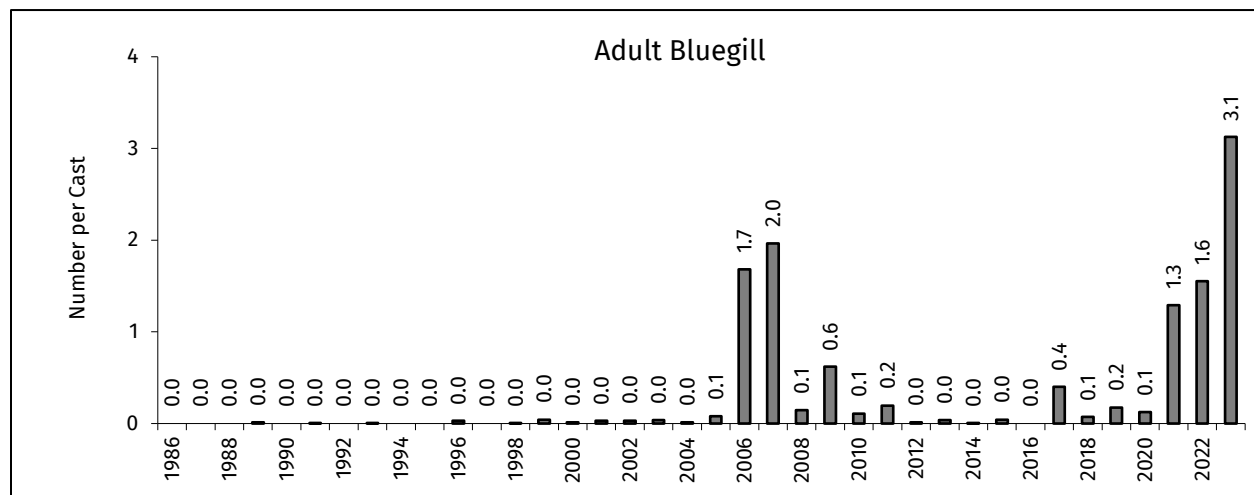


Figure 6. Average number of adult bluegills captured per trawl in the Lake Winnebago trawling survey from 1986-2023.

Forage Species

TROUT PERCH

YOY trout perch had a third consecutive year of near-record catch rates, with 532.3/trawl in 2023 (Figure 7). This is good news for Winnebago System gamefish, as trout perch are a highly utilized forage fish on the system. Over the last three years, trout perch have dominated the total forage catch on the trawl, as other forage on the system, such as YOY freshwater drum and gizzard shad, have been relatively low (Figures 9 & 10). The continuation of high trout perch catch in the trawl will benefit the system’s gamefish populations, providing forage, but they may moderate angler catch due to their abundance. High abundance of trout perch and other forage species in the lake can make gamefish less likely to bite on angler baits, leading to lower catch rates.



Photo 13. A pile of trout perch on the fish counting table captured in the 2023 trawl survey. Photo credit: WI DNR.

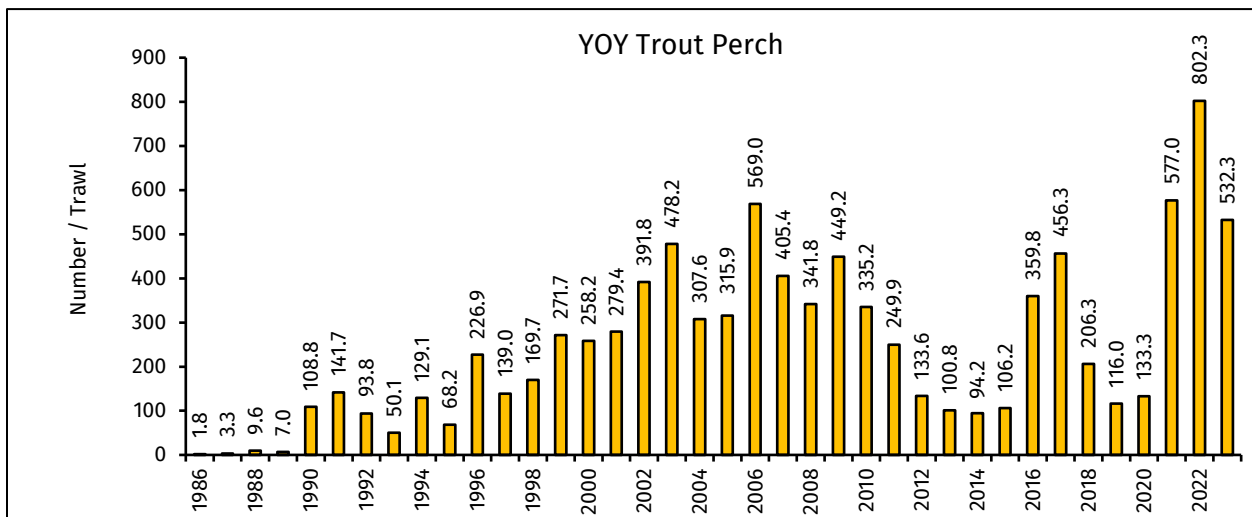


Figure 7. Average number of trout perch captured per trawl in the Lake Winnebago trawl survey from 1986-2023.

EMERALD SHINERS

Compared to other forage fish in the system, emerald shiners are typically caught in lower numbers, with an average YOY catch of 1.3/trawl and an average adult catch of 2.0/trawl (Figure 8). In 2023, the YOY catch was 1.2/trawl and the adult catch was 1.5/trawl. While adult catch is still below average, it is the second highest catch

recorded over the last 12 years of the survey. The increase is likely related to the strong year class observed in the 2022 survey.

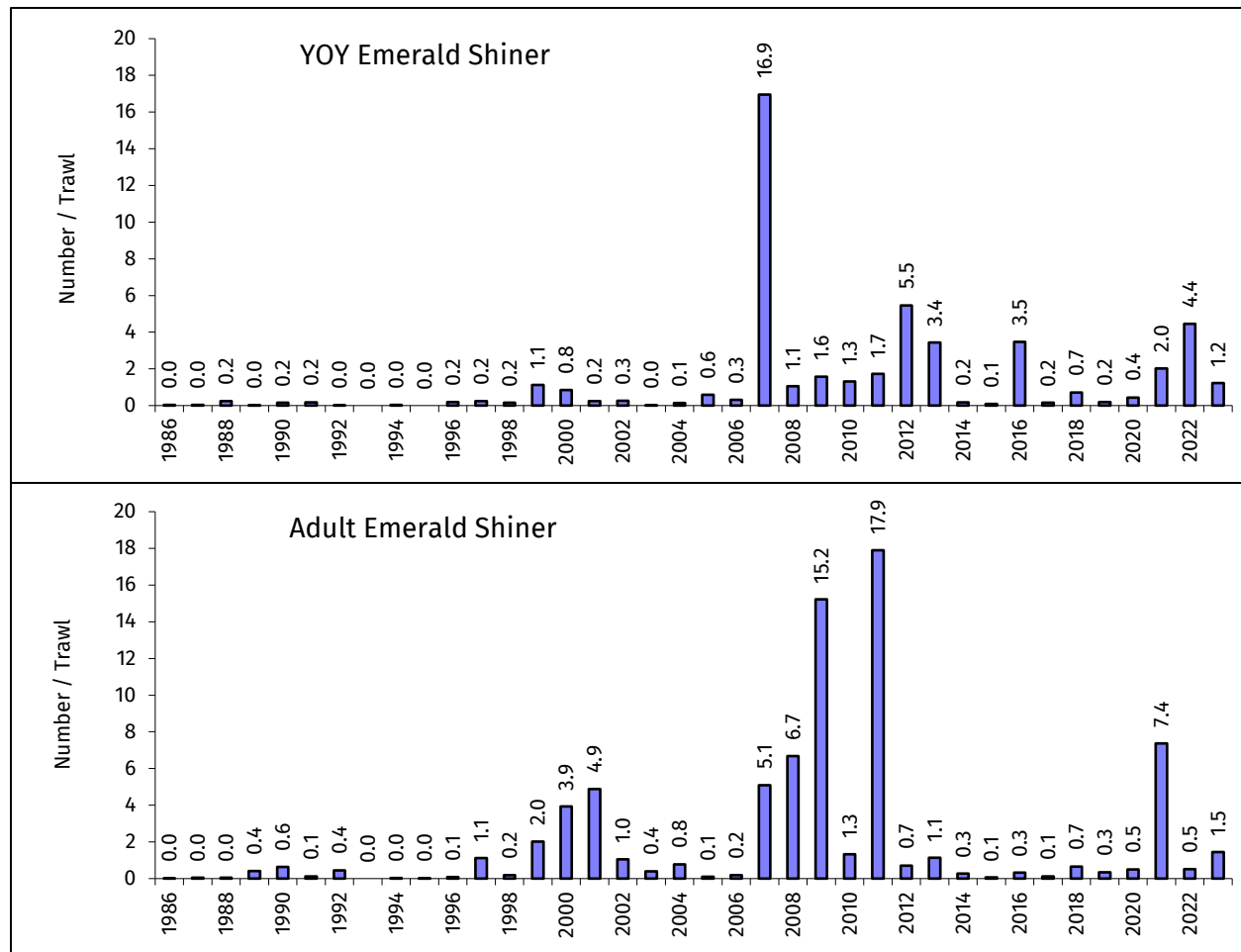


Figure 8. Average number of YOY and adult emerald shiners per trawl in the Lake Winnebago trawl survey from 1986-2023.

FRESHWATER DRUM

Freshwater drum dominate the adult catch numbers and total biomass in the trawl survey each year, and even though adult numbers remained well below average for the sixth consecutive year, freshwater drum remain abundant. The 2023 YOY catch was 25.4/trawl, ranking the ninth lowest in the survey (Figure 9). Adult freshwater drum catch in 2023 was 305.3/trawl. This is well below the long-time average 463.1/trawl and is the sixth-consecutive year of below-average catch following a Viral Hemorrhagic Septicemia (VHS) kill in 2018. Since 2018, freshwater drum have had two substantial year classes, including a record year class in 2020, though the adult population numbers have yet to rebound to their pre-2018 levels. Considering adult survival is high, and they have shown the ability to pull off large year classes following 2018, it is likely a matter of time until adult catch returns to its normal

higher level. Regardless, adult freshwater drum remain very abundant in the system and are very often reported as by-catch by anglers targeting perch and other species.

Due to their high abundance and occurrences of by-catch by anglers, freshwater drum are often viewed negatively as a rough fish competing for resources and angling opportunities with more highly valued gamefish species. Freshwater drum are a native species that serve multiple ecological functions. YOY freshwater drum can provide abundant forage opportunities for our gamefish species. In addition to their ecological value, drum also provide plentiful angling opportunities, with multiple rough fish tournaments occurring on the system annually, including a tournament for kids. Freshwater drum provide a good angling opportunity for beginner and youth anglers, as they are plentiful in the system, can be caught on a variety of baits/gears and put up a good fight. Surprisingly to some, drum also make for good table fair, especially when prepared correctly. Some of the most important factors for preparation include cutting out any red or darker-colored portions of flesh and getting the fish on ice and bleeding quickly. Freshwater drum are often by-catch for anglers targeting species such as walleye or perch, and I encourage anglers to try their drum catch alongside their usual favorites to see how they compare.

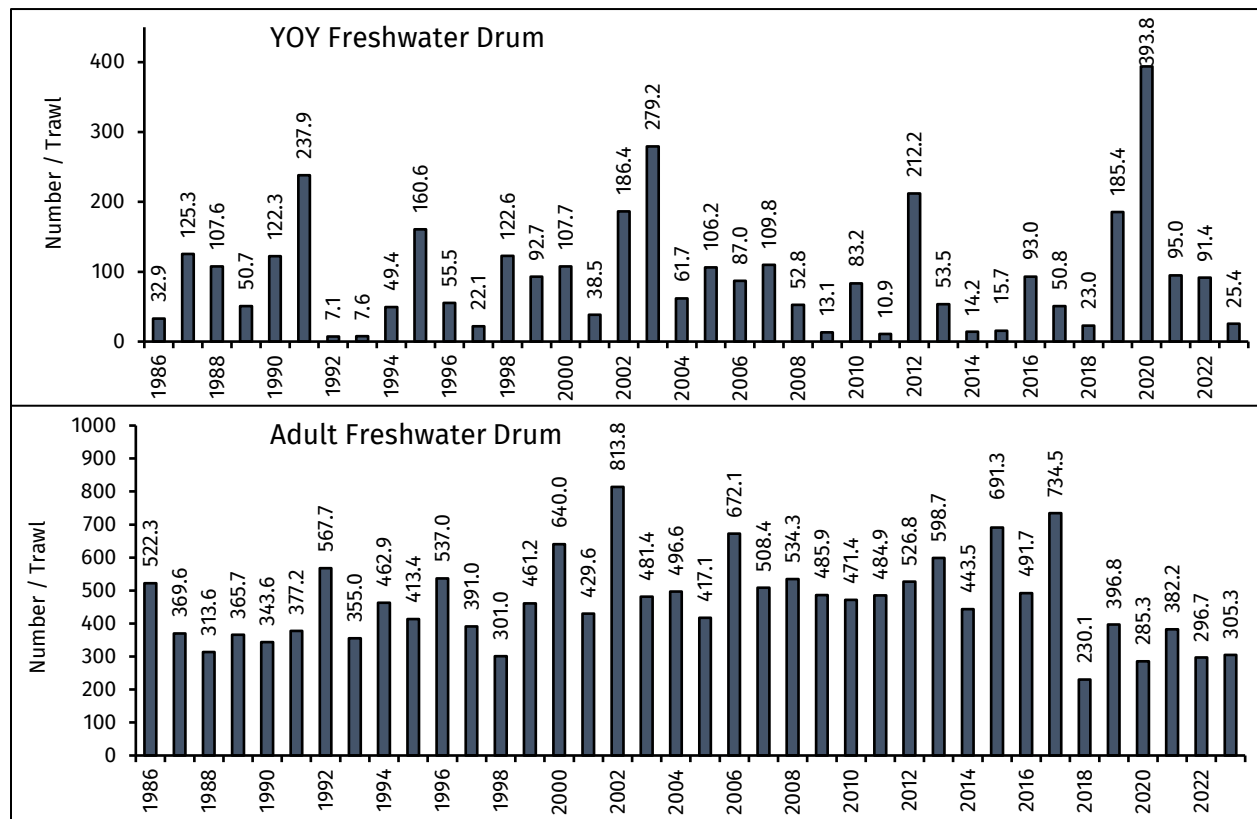


Figure 9. Average number of YOY and adult freshwater drum captured per trawl in the Lake Winnebago trawl survey from 1986-2023.

GIZZARD SHAD

The 2023 trawl results indicate another “bust” year for gizzard shad in Lake Winnebago with a YOY catch rate of 2.9/trawl (Figure 10). The last “boom” year was in 2016 with 102.4/trawl, and numbers have remained close to zero since then. This being said, gizzard shad populations have shown the ability to pull off “boom” years following years of “busts” several times throughout the years of the trawl survey. It is likely a matter of time until environmental conditions line up for gizzard shad and their populations take off once again.

Gizzard shad are one of the most inquired about species in the trawl survey. There is good reason for this as the gizzard shad population in Lake Winnebago follows a “boom” or “bust” recruitment cycle, and the year class strength of this forage fish has many implications for the rest of the fishery. For example, when there is a “boom” year class, gizzard shad are found in very high densities, and this can result in an abundance of natural forage for gamefish, which can lead to less angler success. Alternatively, when there is a “bust” year class and other forage in the system are relatively low, such as trout perch and freshwater drum, anglers tend to have higher success. This can lead to increases in gamefish exploitation, specifically our walleye harvest estimates the year following a gizzard shad “boom” year. Sturgeon spearers are also interested in the gizzard shad catch as winter die-off of gizzard shad is common resulting in an abundant food source for sturgeon, resulting in heavier fish coming in on the spear.

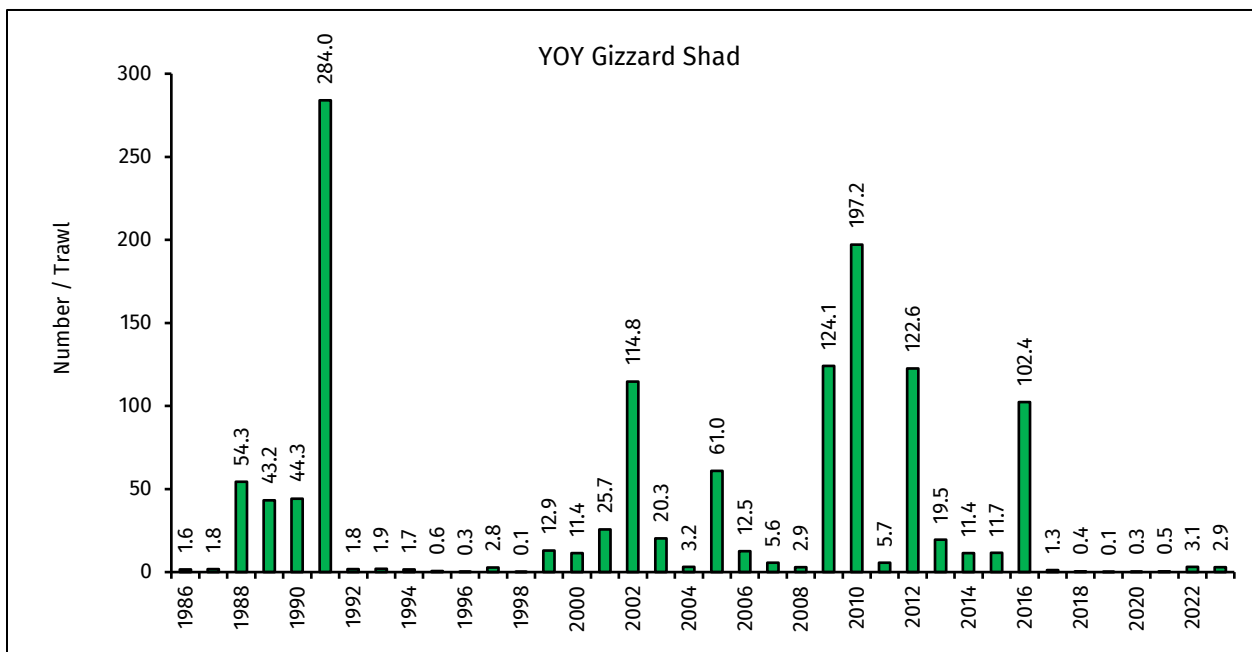


Figure 10. Average number of YOY gizzard shad captured per trawl in the Lake Winnebago trawl survey from 1986-2023.

Summary

This year's trawl survey had some exciting results, most notably the good recruitment of the significant 2022 walleye year class indicated by a high yearling catch. This recruitment, along with other recent strong year classes, has resulted in a record high adult walleye catch. This is good news for one of the system's most targeted species. We will hope to have environmental conditions line up for a successful walleye spawn in 2027-2028 when the large year classes of 2021 and 2022 are fully mature, hopefully providing the system with another substantial hatch. Another high note from the survey is the continued high catch of both YOY and adult yellow perch. Size structure present in the adult population is also very favorable, with an all-time high adult yellow perch catch of fish over 9 inches being observed in 2023. These abundant populations should have good forage availability with another year of near-record trout perch catch. Resource managers and anglers alike will be looking forward to seeing how the numbers for these species, as well as the many others in this report, come out in 2024. Current results indicate a prosperous fishing outlook for the Winnebago System.

The Winnebago trawl survey is the single largest survey effort on the system. It provides highly anticipated insight into the fish community composition and the current status of many species. It takes an impressive amount of time, people and resources in order to conduct this survey and summarize the results. This large task is made much more manageable through the utilization of our dedicated volunteers. I would like to extend one final thank you to everyone who came out on the RV Calumet with us this season. Your time is very appreciated. Thank you! I would also like to acknowledge the fisheries operations staff at Asylum Bay. The Asylum Bay crew's operation and maintenance of the equipment needed for this survey is critical to its completion.

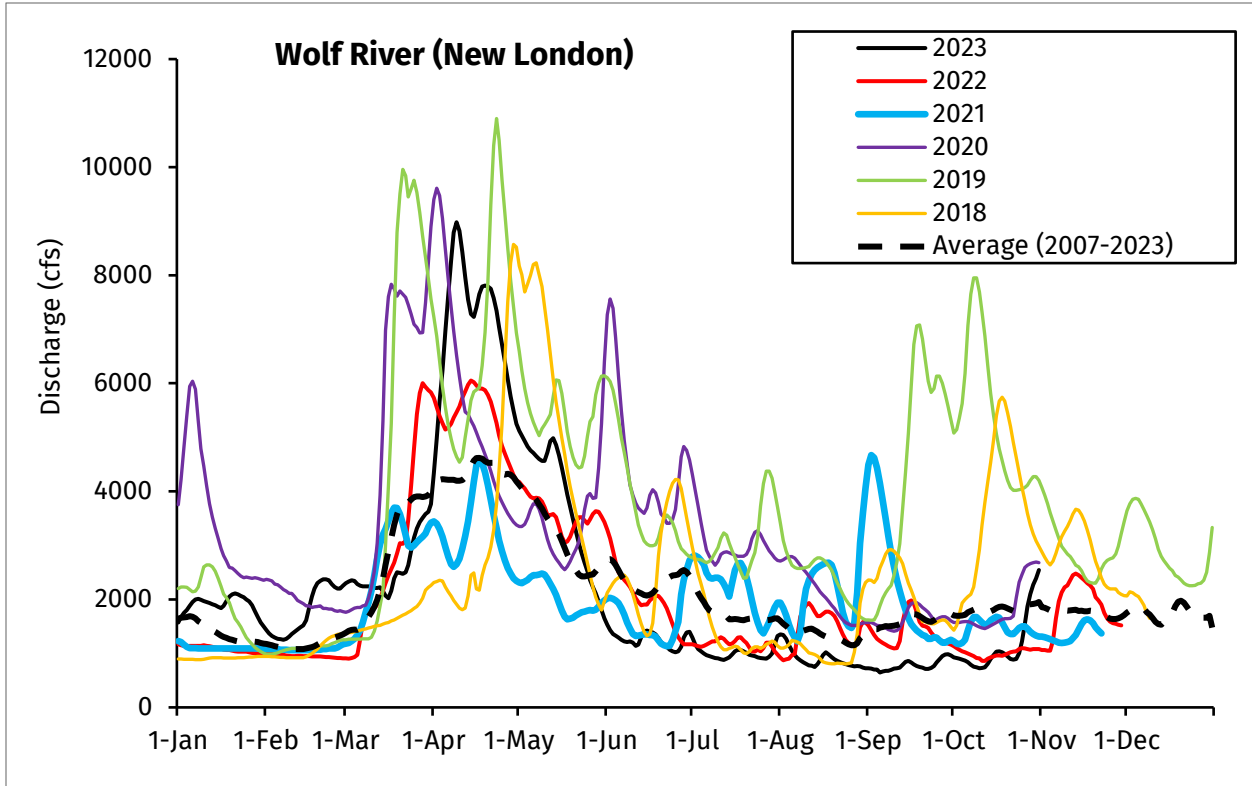
I hope you enjoyed reading the 2023 Winnebago Trawling Report. If you are interested in becoming a trawl volunteer, please contact myself at the number or email below or Fisheries Technician Jason Kohls at (920) 420-9943 or Jason.Kohls@wisconsin.gov for more information. Best of luck to all Winnebago System anglers in 2024!

Sincerely,

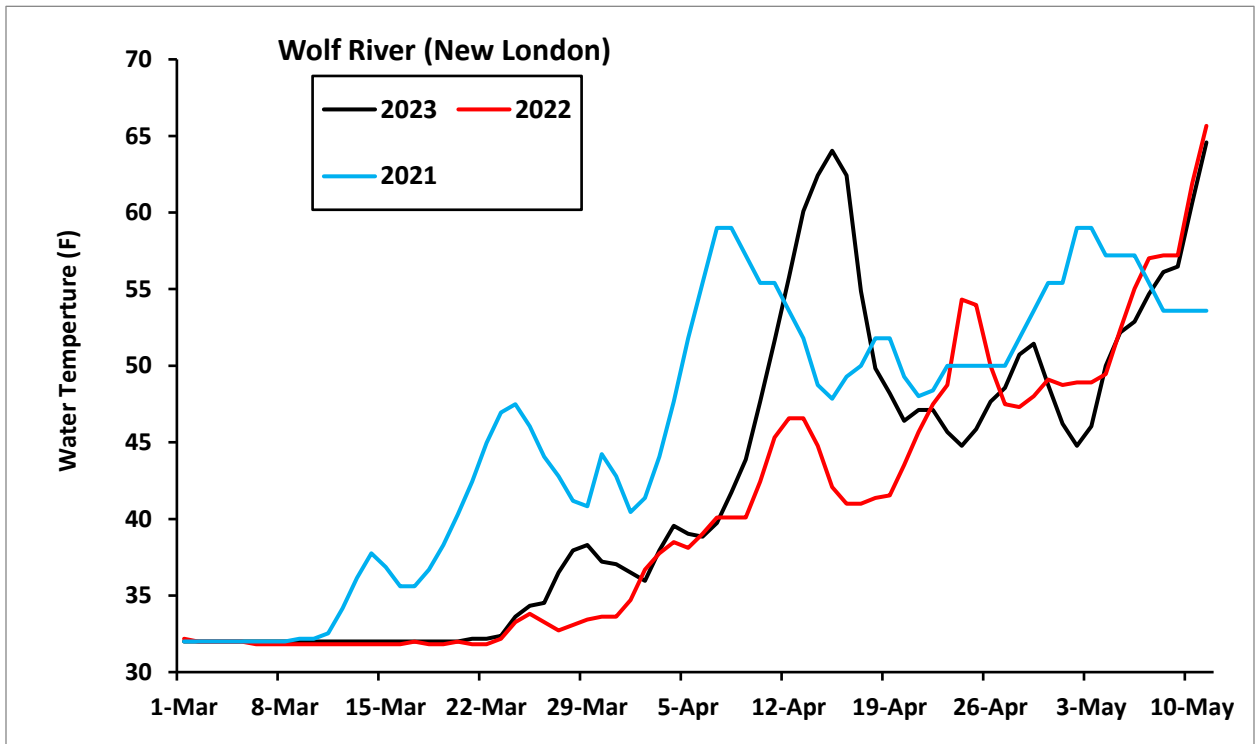
Angelo Cozzola

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Appendix 1. Wolf River hydrograph (average daily discharge) for 2018-2023 and average discharge (dashed line) from 2007-2023.



Appendix 2. Mean daily water temperatures (F) on the Wolf River at the New London gauge from March 1st-May 11 in 2021-2023.



Appendix 3. List of trawling records (number/trawl) for adult fish species with the top ten catch rates in the Lake Winnebago trawl survey.

Year	Freshwater Drum	Yellow Perch	Emerald Shiner	Walleye	White Bass	White Sucker	Channel Catfish	Common Carp	Bluegill	Quillback
1986	522.3	0.4	0.0	1.4	24.3	1.6	0.3	1.1	0.0	0.4
1987	369.6	0.3	0.0	0.8	8.1	1.5	0.1	0.8	0.0	0.4
1988	313.6	0.9	0.0	0.3	5.7	1.2	0.3	0.9	0.0	0.3
1989	365.7	1.6	0.4	0.3	10.8	1.2	0.4	1.3	0.0	0.9
1990	343.6	4.3	0.6	0.2	7.9	1.4	0.3	0.8	0.0	0.8
1991	377.2	3.2	0.1	0.6	6.4	1.1	0.5	0.7	0.0	0.3
1992	567.7	2.6	0.4	4.6	11.9	1.8	0.6	1.2	0.0	0.4
1993	355.0	1.1	0.0	4.7	6.9	2.2	0.4	1.6	0.0	0.6
1994	462.9	0.7	0.0	6.3	3.8	1.6	0.5	2.3	0.0	0.5
1995	413.4	0.7	0.0	3.8	2.8	1.2	0.4	1.4	0.0	0.3
1996	537.0	1.2	0.1	3.3	7.0	2.0	0.3	0.8	0.0	0.6
1997	391.0	0.9	1.1	6.4	5.7	1.7	0.6	0.9	0.0	1.0
1998	301.0	0.6	0.2	4.5	3.2	2.0	0.6	1.5	0.0	1.3
1999	461.2	1.2	2.0	4.7	7.5	2.0	0.6	1.9	0.0	1.4
2000	640.0	2.0	3.9	2.8	27.1	2.2	0.9	1.9	0.0	1.0
2001	429.6	1.2	4.9	1.0	14.0	1.6	0.7	1.1	0.0	1.0
2002	813.8	4.2	1.0	14.4	10.1	2.9	0.9	1.0	0.0	1.6
2003	481.4	4.5	0.4	11.7	8.5	2.1	1.4	1.4	0.0	0.8
2004	496.6	2.8	0.8	8.2	6.3	1.2	0.8	1.8	0.0	0.7
2005	417.1	4.0	0.1	5.4	1.9	1.8	0.6	1.4	0.1	0.3
2006	672.1	21.4	0.2	7.5	12.2	1.4	0.8	2.3	1.7	0.5
2007	508.4	6.9	5.1	6.0	8.8	2.7	0.7	2.4	2.0	1.0
2008	534.3	5.1	6.7	3.4	4.1	2.0	0.8	3.4	0.1	0.5
2009	485.9	7.3	15.2	10.8	4.2	2.3	0.9	2.2	0.6	1.3
2010	471.4	6.1	1.3	3.4	3.7	2.0	0.8	2.7	0.1	1.0
2011	484.9	14.0	17.9	3.9	17.4	5.1	1.3	3.6	0.2	1.0
2012	526.8	5.5	0.7	4.7	10.3	5.4	2.2	1.9	0.0	0.8
2013	598.7	4.4	1.1	3.4	7.6	4.0	3.3	2.0	0.0	0.5
2014	443.5	1.6	0.3	6.6	2.8	4.6	1.7	1.6	0.0	0.3
2015	691.3	0.4	0.1	6.8	4.0	4.4	1.5	1.8	0.0	0.8
2016	491.7	0.3	0.3	4.6	2.7	3.6	1.7	0.8	0.0	0.6
2017	734.5	10.6	0.1	9.0	3.2	3.0	1.5	1.3	0.4	0.6
2018	230.1	6.7	0.7	10.3	5.0	3.2	1.4	1.6	0.1	0.9
2019	396.8	2.5	0.3	8.0	1.4	4.4	1.7	2.3	0.2	1.1
2020	285.3	4.0	0.5	5.9	2.2	2.9	1.4	2.1	0.1	1.1
2021	382.2	9.6	7.4	5.4	3.6	2.7	1.9	1.8	1.4	1.2
2022	296.7	15.5	0.5	6.4	4.6	1.9	1.3	1.4	1.6	0.8
2023	305.3	13.4	1.5	15.7	3.8	2.5	1.4	0.9	3.1	0.8
Average	463.1	4.6	2.0	5.5	7.4	2.4	1.0	1.6	0.3	0.8

Appendix 4. List of trawling records (number/rawl) for YOY fish species with the top ten catch rates in the Lake Winnebago trawl survey.

Year	Trout Perch	Freshwater Drum	B. Crappie	Walleye	Yellow Perch	White Bass	Emerald Shiner	G. Shad	Sauger	Bluegill
1986	1.8	32.9	1.2	0.1	0.1	10.8	0.0	1.6	0.0	0.0
1987	3.3	125.3	2.7	0.0	0.3	9.1	0.0	1.8	0.0	0.0
1988	9.6	107.6	5.1	0.1	0.2	43.1	0.2	54.3	0.1	0.0
1989	7.0	50.7	3.8	0.1	0.1	18.8	0.0	43.2	0.0	0.0
1990	108.8	122.3	3.3	2.9	0.3	90.9	0.2	44.3	0.4	0.0
1991	141.7	237.9	0.4	7.3	1.1	32.9	0.2	284.0	0.0	0.0
1992	93.8	7.1	0.3	0.8	0.4	8.2	0.0	1.8	0.0	0.0
1993	50.1	7.6	0.1	2.5	0.2	2.3	0.0	1.9	0.0	0.0
1994	129.1	49.4	0.6	0.1	0.2	19.1	0.0	1.7	0.0	0.0
1995	68.2	160.6	3.3	0.2	0.5	43.0	0.0	0.6	0.1	0.1
1996	226.9	55.5	0.1	23.7	0.4	169.1	0.2	0.3	0.0	0.0
1997	139.0	22.1	0.3	2.2	0.1	23.4	0.2	2.8	0.0	0.0
1998	169.7	122.6	1.1	2.5	0.3	10.4	0.2	0.1	0.0	0.1
1999	271.7	92.7	5.0	0.2	0.5	48.8	1.1	12.9	0.0	0.0
2000	258.2	107.7	0.3	0.3	0.1	11.7	0.8	11.4	0.0	0.0
2001	279.4	38.5	0.2	11.8	2.2	36.5	0.2	25.7	0.0	0.0
2002	391.8	186.4	2.3	1.9	2.1	18.8	0.3	114.8	0.1	0.0
2003	478.2	279.2	1.7	6.5	1.9	60.3	0.0	20.3	0.3	0.0
2004	307.6	61.7	0.7	8.8	6.9	17.8	0.1	3.2	0.4	0.0
2005	315.9	106.2	4.4	11.1	5.6	50.9	0.6	61.0	0.1	0.1
2006	569.0	87.0	1.0	2.4	5.4	23.0	0.3	12.5	0.1	0.0
2007	405.4	109.8	3.5	0.5	5.6	10.7	16.9	5.6	0.9	0.1
2008	341.8	52.8	0.5	17.5	2.2	50.2	1.1	2.9	0.4	0.0
2009	449.2	13.1	6.8	1.4	1.8	17.2	1.6	124.1	0.3	0.0
2010	335.2	83.2	11.4	0.9	1.4	15.0	1.3	197.2	0.2	0.4
2011	249.9	10.9	1.2	10.4	5.7	102.4	1.7	5.7	0.0	0.0
2012	133.6	212.2	3.1	0.2	1.0	36.7	5.5	122.6	0.0	0.4
2013	100.8	53.5	1.0	11.9	0.9	12.1	3.4	19.5	0.0	0.0
2014	94.2	14.2	0.2	0.4	0.1	0.2	0.2	11.4	0.0	0.0
2015	106.2	15.7	1.4	1.4	0.7	4.3	0.1	11.7	0.1	0.0
2016	359.8	93.0	24.1	9.9	2.3	17.6	3.5	102.4	0.0	0.0
2017	456.3	50.8	0.9	4.1	0.8	7.4	0.2	1.3	0.0	0.0
2018	206.3	23.0	2.1	5.1	3.5	0.8	0.7	0.4	0.0	0.1
2019	116.0	185.4	2.7	5.9	4.2	7.9	0.2	0.1	0.0	0.0
2020	133.3	393.8	13.9	3.6	13.8	18.0	0.4	0.3	0.0	1.3
2021	577.0	95.0	10.4	8.2	5.1	4.2	2.0	0.5	0.3	0.1
2022	802.3	91.4	3.0	17.4	19.5	4.2	4.4	3.1	0.0	0.1
2023	532.3	25.4	4.7	2.8	9.6	1.0	1.2	2.9	0.0	0.3
Average	247.9	94.3	3.4	4.9	2.8	27.9	1.3	34.5	0.1	0.1