WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Lower St. Croix River Catfish Survey Report

2020-2024

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Photo Credit: Kasey Yallaly

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Executive Summary

The Lower St. Croix River from the St. Croix Falls dam downstream to its confluence with the Mississippi River at Prescott, WI contains a diverse fishery that receives heavy fishing pressure due to its proximity to the Twin Cities metropolitan and surrounding areas. Impacts of anthropogenic stressors coupled with environmental influences including altered flow regimes, invasive species and changes in habitat due to the nature of large rivers can result in alterations in fish communities. Therefore, consistent monitoring of populations is essential to effectively and sustainably manage species. To monitor catfish populations in this portion of river, we conducted a hoop net survey targeting both flathead and channel catfish during late summer in 2020, 2022 and 2024 using both baited and non-baited nets. Catch rates of both species were relatively low but comparable to other similar river systems and size structure was high. Baited nets were more effective in capturing channel catfish while non-baited nets outperformed baited nets for capturing flathead catfish. Growth rates of both species appeared average when compared to other river systems. This data serves as a baseline in future evaluations of regulations and impacts of angler harvest on these popular sport fish populations.

Introduction

The Lower St. Croix River is a large, fine substrate river located in northwestern Wisconsin and is a boundary water between the states of Wisconsin and Minnesota. It originates in Douglas County and joins the Mississippi River near Prescott, Wisconsin. The downstream 52 miles below the St. Croix Falls dam are referred to as the Lower St. Croix River. The Lower St. Croix River can be further defined as a free-flowing river from the St. Croix Falls dam downstream for 27 miles. The remaining 25 miles are deep and wide; a natural water body forming Lake St. Croix from Stillwater, Minnesota to Prescott.

Channel and flathead catfish exist within the free-flowing portion of the lower St. Croix River in low densities but exhibit excellent size structure. However, little information exists regarding population dynamics, juvenile habitat use and recruitment sources. Recent angling method regulation changes now allow for the harvest of catfish by bowfishing, spearing and hand-grabbing. Fishing regulations were recently changed in the spring of 2024 and featured a change from a 10 fish bag limit (species combined) to five channel catfish per day and only one can be over 24 inches and a bag limit of two flathead catfish and only one may be over 24 inches. However, even with reductions in bag limits, additional methods of take allowed coupled with low-density populations, the potential for over-harvest may be elevated. Information regarding catfish population demographics is limited except for a study conducted from 2011 to 2015. This survey used baited hoop nets during a four-year sampling timeframe and catch rates of flathead catfish were low and the sample size was too small for analysis. Therefore, to gain an understanding of baseline population demographics of flathead catfish and to obtain current demographic information to assess the status of channel catfish, we conducted a non-baited hoop net survey in 2020 and a non-baited and baited hoop net survey in 2022 and 2024 on the Lower St. Croix River.

Methods

SURVEY EFFORT

The Lower St. Croix River from the St. Croix Falls dam downstream to Lake St. Croix at Boomsite was sampled for 4 weeks in August of 2020, 2022 and 2024 using 12 Wisconsin standard 3ft hoop nets with 1 ¼ inch bar mesh. Nets were set for a total of 82 net nights in 2020, 109 net nights in 2022 and 131 net nights in 2024. The river was divided into five sections which were sampled for a minimum of 10 net nights each week. Sections included Boomsite to Arcola High Bridge, Arcola High Bridge to Marine, Marine to Swingbridge, Swingbridge to Osceola and Osceola to Interstate Park.

To evaluate the effect of bait on hoop net catch rates of both species in the St. Croix River, a total of 14 net nights in 2022 and 57 net nights in 2024 were baited with soy-cake and ran simultaneously with non-baited nets during the survey period. All nets were set for 24 hours overnight using the predator sampling strategy in various habitat types to attempt to target channel and flathead catfish. Fish were measured, weighed and pectoral fin rays were removed for age and growth analysis.

ANALYSIS

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, CPUE is quantified by the number and size of fish per net night. CPUE indexes are compared to statewide data by percentiles. 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 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.

Relative weight is an index used to assess the plumpness (i.e., condition) of fish. It is calculated by comparing the observed weight of a fish to the standard weight (i.e., predicted average weight) of that fish, given its length. A relative weight of 93 means it has average plumpness/weight compared to other fish of the same length. Relative weights above 93 mean it is plumper than average.

Recruitment was evaluated through residual analysis where the sign and magnitude of residuals from a catch-curve regression indicate relative year-class strength. Larger, positive residuals indicate years of higher recruitment and zero or negative residuals indicate years of poorer recruitment.

Mean length at age 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).

Growth rates were calculated using the von Bertalanffy growth model in Fishery Analysis and Modeling Simulator software (FAMS; Slipke and Maceina 2010) and mean length at age for each species was compared to the median mean length at age in other river systems. **Total annual mortality** was estimated with the formula $1 - e^{(-Z)}$ and instantaneous mortality (Z) was calculated from the slope of the regression from the descending right limb of the age-frequency distribution.

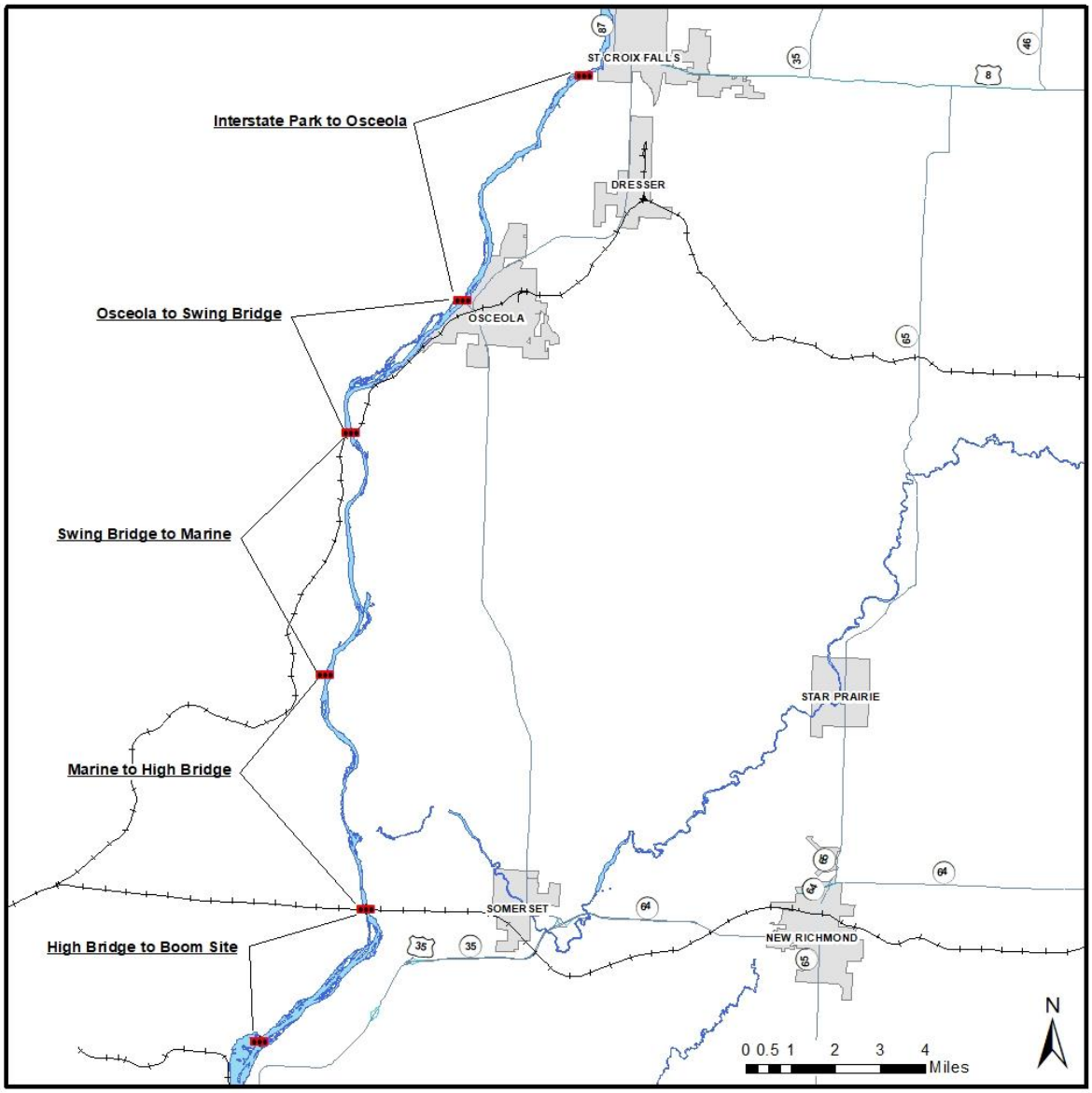

Figure 1. Surveyed sections of river for catfish hoop net surveys in the Lower St. Croix River.

Results

In 2020, a total of 41 channel catfish were captured which resulted in CPUE of 0.5 fish per net-night (Figure 4). Channel catfish relative abundance was highest in the Marine to Swingbridge section of river followed by Swingbridge to Osceola, Osceola to Interstate Park,

Highbridge to Marine and Boomsite to Highbridge (Figure 2). Lengths ranged from 13.9 to 34 inches with a mean length of 24 inches (Table 1; Figure 6). PSD was 95 and condition of fish as measured by relative weight was 87 (Table 1). A total of 25 flathead catfish were sampled for a CPUE of 0.3 fish per net-night (Table 1; Figure 5). Relative abundance of flathead catfish was also highest in the Marine to Swingbridge section followed by Osceola to Interstate Park, Boomsite to Highbridge, Swingbridge to Osceola and Highbridge to Marine (Figure 3). Lengths ranged from 22 to 47 inches with a mean length of 34 inches (Table 2; Figure 7). PSD was 100. Mean relative weight of flathead catfish was slightly poor at 87.

The 2022 survey resulted in 51 channel catfish and 20 flathead catfish sampled for total catch rates of 0.5 per net night and 0.2 per net night, respectively (Tables 1 & 2; Figures 4 & 5). Channel catfish CPE in baited nets was 1.7 per net night while CPE in non-baited nets was 0.3 per net night (Figure 4). Channel catfish were most abundant in the Highbridge to Marine section of river, followed by Marine to Swingbridge, Boomsite to Highbridge, Osceola to Interstate Park and Swingbridge to Osceola (Figure 2). Channel catfish ranged in length from 11 to 30.4 inches with a mean length of 20.5 inches (Table 1; Figure 6). PSD of channel catfish was 78. Flathead catfish were most abundant in the Swingbridge to Osceola section, followed by Boomsite to Highbridge and Marine to Swingbridge (Figure 3). No flathead catfish were captured in the Highbridge to Marine and Osceola to Interstate Park sections. Flathead catfish ranged in length from 21 to 47 inches with a mean length of 32 inches (Table 2; Figure 7). Relative weight of channel catfish was 88 and relative weight of flathead catfish was 93. PSD of flathead catfish was 100 and RSD-P was 74 (Table 2).

The 2024 survey resulted in 146 channel catfish and 40 flathead catfish sampled for a total catch rate of 1.9 fish per net night and 0.4 fish per net night, respectively (Tables 1 & 2). Similar to 2022, channel catfish catch rates were considerably higher in baited nets (1.7 per net night) than in non-baited nets (0.5 per net night; Figure 4). The Boomsite to Highbridge section of river held the highest densities of channel catfish followed by the Swingbridge to Osceola section (Figure 2). Channel catfish ranged in length from 11.8 to 32.2 inches with a mean length of 19.6 inches (Figure 6 and Table 1). RSD-P of channel catfish was 30 and condition of was similar to previous surveys (Table 1). Flathead catfish densities were highest in 2024 with a mean catch rate of 0.4 fish per net night in non-baited hoopnets. Non-baited hoopnets catch rates (0.35 per net night) were higher than baited hoopnet catch rates (0.25 per net night) in 2024. Flatheads were most abundant in the Boomsite to Highbridge section of river in 2024 followed by the Marine to Swingbridge section (Figure 3). Catch rates of flathead catfish in 2024 were similar to catch rates in prior years, except for the Boomsite to Highbridge section (Figure 3). Lengths of flathead catfish in 2024 ranged from 14 to 47.7 inches with a mean length of 28.4 inches (Figure 7; Table 2). Relative weight of flathead catfish was highest in 2024 at 95 and RSD-P was 59 (Table 2).

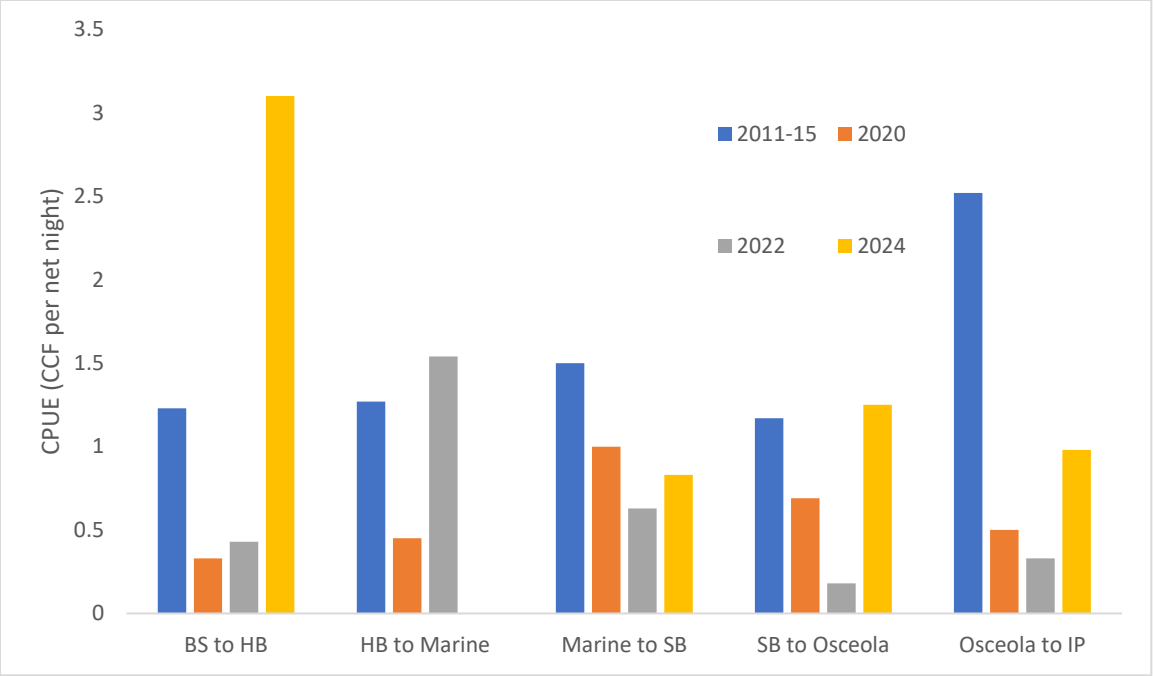

Figure 2. Relative abundance of channel catfish in five sections of the Lower St. Croix River (BS-Boomsite, HB-Highbridge, SB-Swingbridge, IP-Interstate Park).

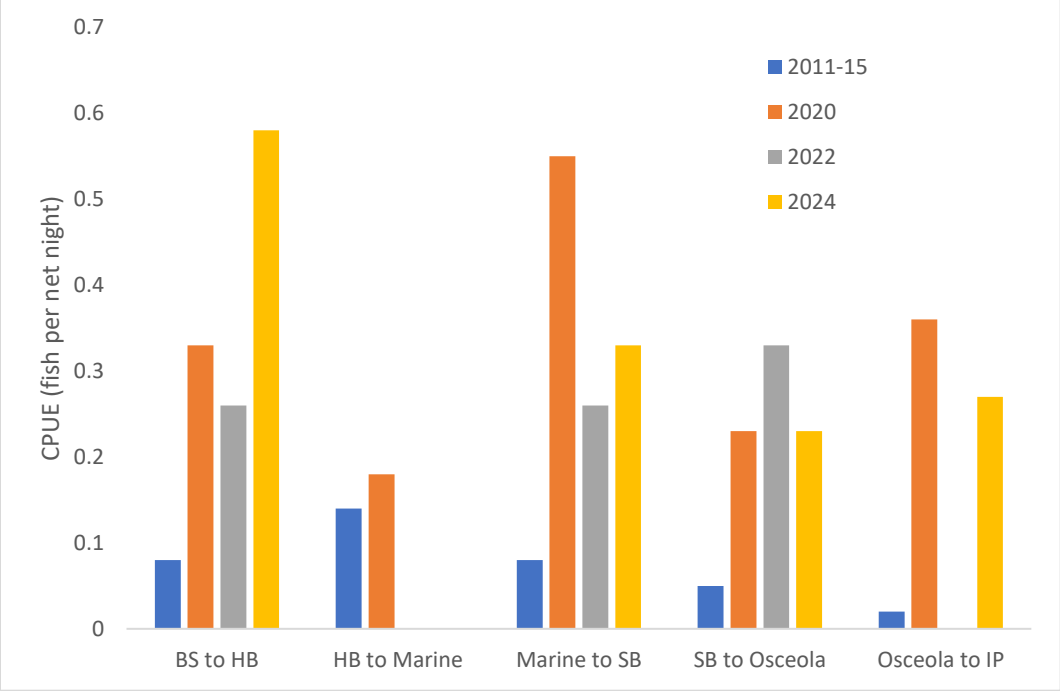

Figure 3. Relative abundance of flathead catfish in five sections of the Lower St. Croix River (BS-Boomsite, HB-Highbridge, SB-Swingbridge, IP-Interstate Park). Only baited hoopnets were used in 2011-2015 and non-baited hoopnets were used in 2020, 2022 and 2024.

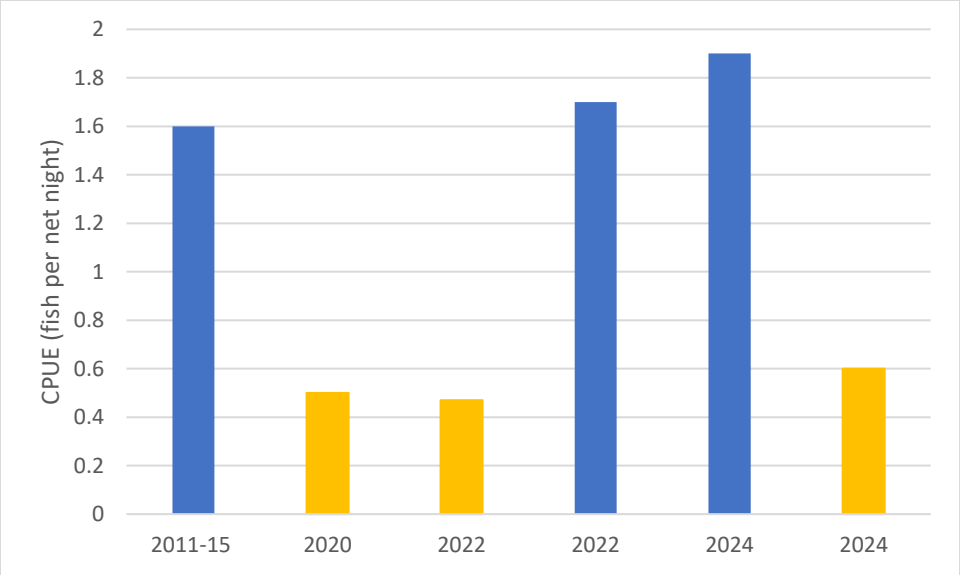

Figure 4. Hoop net catch rates of channel catfish on the Lower St. Croix River using bait (blue) and non-baited nets (yellow).

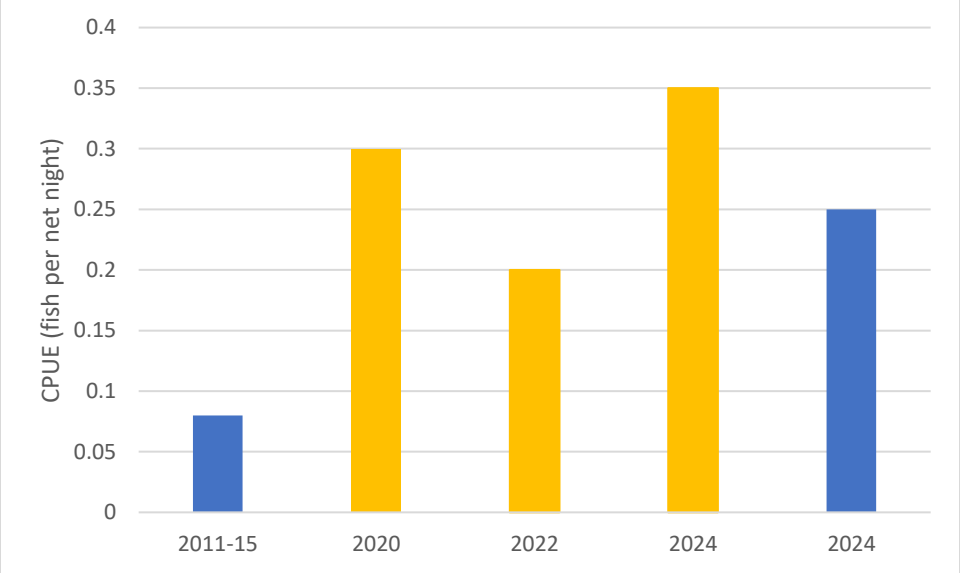

Figure 5. Hoop net catch rates of flathead catfish on the Lower St. Croix River using bait (blue) and non-baited nets (yellow).

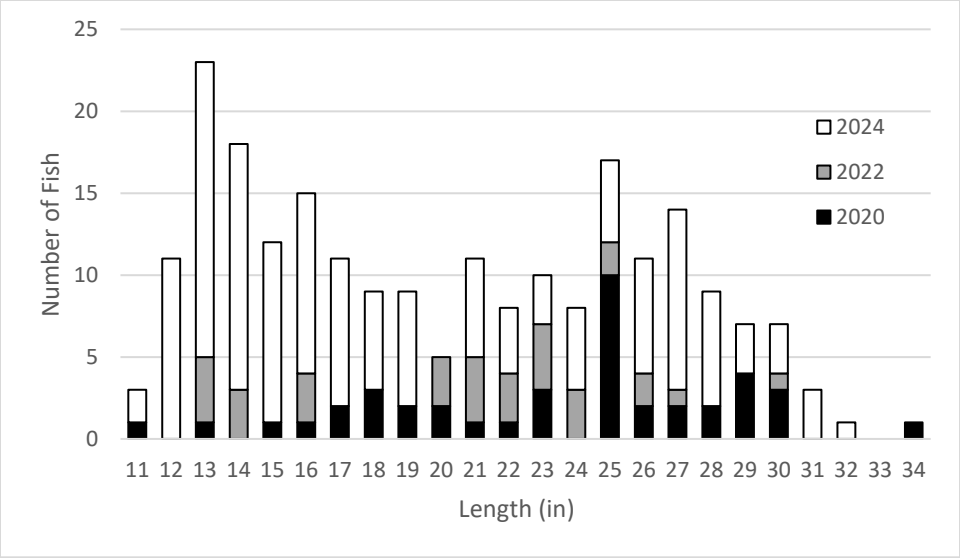

Figure 6. Length distribution of channel catfish collected from the lower St. Croix River (St. Croix Falls dam downstream to Lake St. Croix) in August 2020, 2022 and 2024.

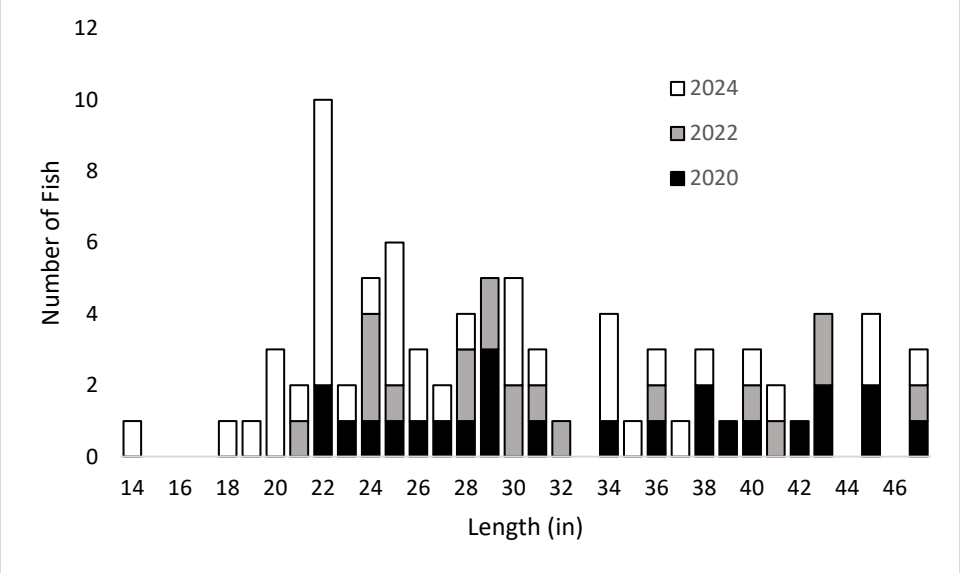

Figure 7. Length distribution of flathead catfish collected from the lower St. Croix River (St. Croix Falls dam downstream to Lake St. Croix) in August 2020, 2022 and 2024.

Recruitment of both species appeared erratic based on age frequency and residual analysis from the catch curve. For channel catfish, an exceptionally weak year class was present in 2017 while strong year classes were present in 2011-2013. Maximum age of channel catfish was 16 while mean age was 8.3 years old. In terms of growth, channel catfish reached 24 inches in 10 years (Figure 8) and mean annual growth increments averaged 1.5 inches per year and ranged from 0.8 to 5.9 inches. Growth coefficients estimated by the von Bertalanffy growth model described mean length at age (L_{inf}= 760, K= 0.17, t_0=-0.439, n=79, P < 0.0001, r^2= 0.90*).* Total annual mortality was 10.5% (r^2=0.38, n=72, P=0.0001). For flathead catfish, the sample size of each age class was too low to adequately calculate recruitment or mortality from a catch curve. However, ages of flathead catfish ranged from

age-3 (16.6 inches) to age-25 (45.1 inches) with a mean age of 13.6 (Figure 11). On average, flatheads reached 24 inches in approximately 8 years.

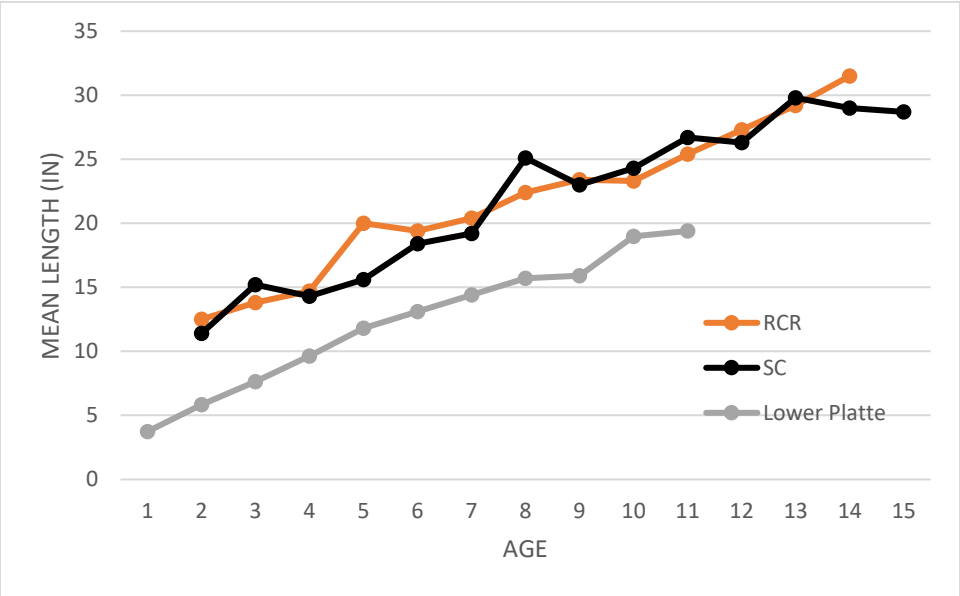

*Figure 8. Mean length at age of channel catfish in the Lower St. Croix and Lower Red Cedar Rivers from 2019 (Red Cedar River) and 2020 and 2022 (St. Croix River). *Lower Platte River data from Holland and Peters 1992.*

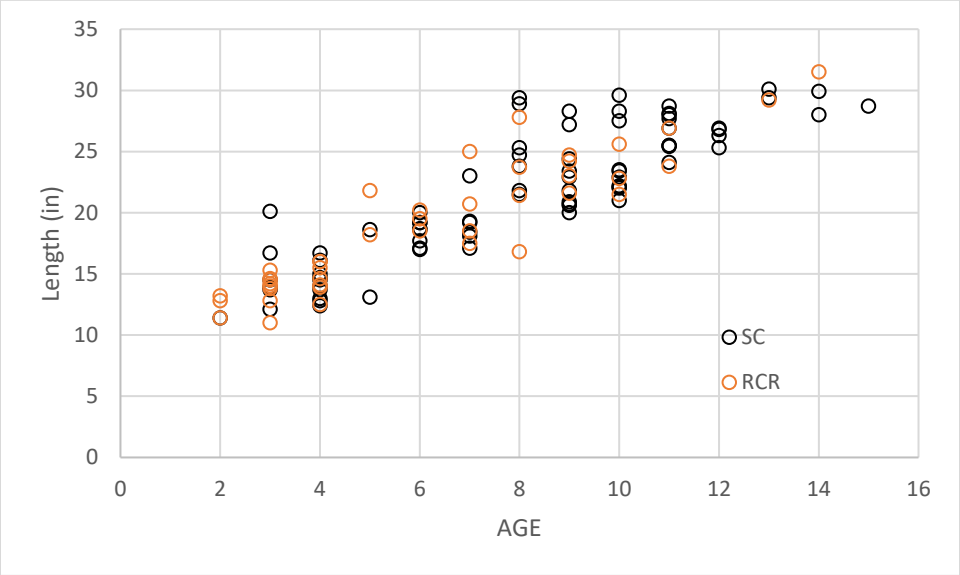

Figure 9. Length at age of channel catfish in the Lower St. Croix and Lower Red Cedar Rivers from 2019 (Red Cedar River) and 2020 and 2022 (St. Croix River).

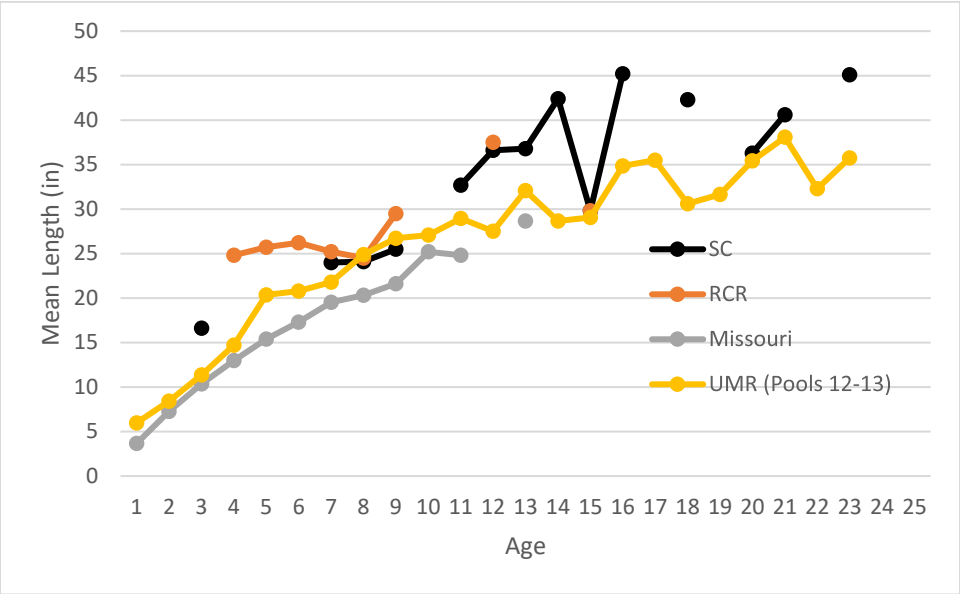

Figure 10. Mean length at age of channel catfish in the Lower St. Croix and Lower Red Cedar rivers from 2019 (Red Cedar River) and 2020 and 2022 (St. Croix River). Missouri River data from Porter et al. 2011 and UMR (Pools 12-13) data from Steuck and Schnitzler 2011.

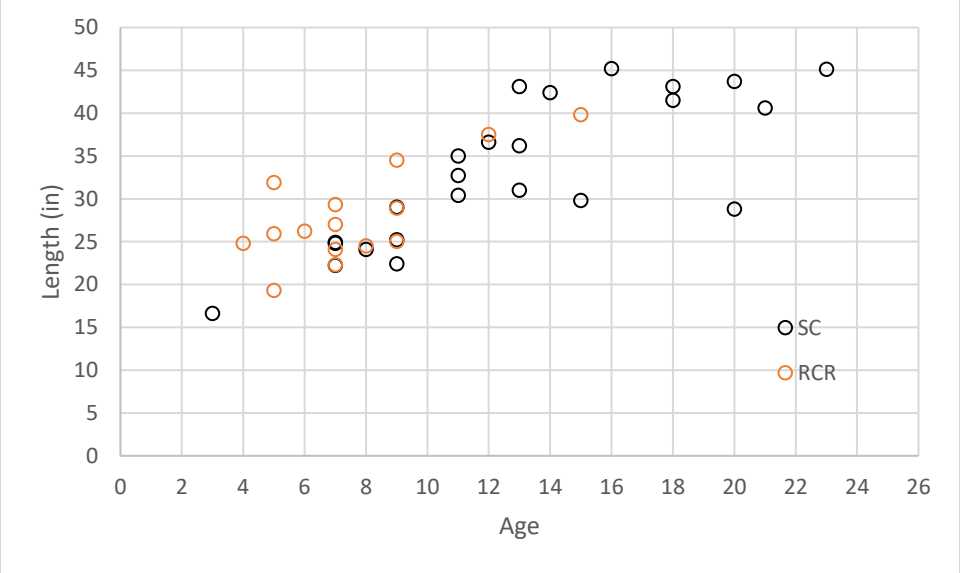

Figure 11. Length at age of flathead catfish in the Lower St. Croix and Lower Red Cedar Rivers from 2019 (Red Cedar River) and 2020 and 2022 (St. Croix River).

*Table 1. Channel catfish populations demographics in the lower St. Croix River collected with baited hoopnets. *Only non-baited nets were used in 2020.*

SURVEY YEAR	N	CPUE (# PER NET NIGHT)	MINIMUM LENGTH (IN)	MEAN LENGTH (IN)	MAXIMUM LENGTH (IN)	PSD	RSD-P	WR
2011-2015	757	1.6	7.0	18.4	34.4	61	15	88
2020	41	0.5*	13.9	24.0	34.0	95	59	87
2022	51	1.7	11.0	20.5	30.4	78	28	88
2024	146	1.9	11.8	19.6	32.2	66	30	88

*Table 2. Flathead catfish populations demographics in the lower St. Croix River using non-baited hoopnets. *Only baited nets were used in 2011-2015.*

SURVEY YEAR	N	CPUE (# PER NET NIGHT)	MINIMUM LENGTH (IN)	MEAN LENGTH (IN)	MAXIMUM LENGTH (IN)	PSD	RSD-P	WR
2011-2015	37	0.1*	2.3	30.2	43.8	86	49	90
2020	25	0.3	22	34	47	100	72	87
2022	20	0.2	21	32	47	100	74	93
2024	40	0.4	14	28.4	47.7	100	59	95

Discussion

Channel and flathead catfish in the Lower St. Croix River were found in low densities during all years of sampling. Size structure was excellent for both species. No trophy sized channel catfish were captured; however, multiple trophy sized flathead catfish were captured with 32% of the sample comprised of trophy size fish (> 40 inches) in 2020, 25% in 2022 and 20% in 2024. Catch rates were much higher for flathead catfish compared to the previous survey in 2011-2015 when CPUE of flathead catfish was 0.08 fish per net night and catch rates of channel catfish was 1.55 fish per net night. This is likely due to the use of non-baited hoop nets during the 2020-2024 surveys which generally exhibit higher catch rates for flathead catfish, while baited hoop nets tend to more effectively target and capture channel catfish (Pierce et al. 1981). A recent study completed in the Minnesota River evaluating the use of unbaited hoop nets for both species determined that at least 68 net nights were needed to achieve precision of catch rate estimates and adequate statistitcal power (Sindt 2018). Sindt (2018) also documented higher catch rates of both channel and flathead catfish relative to this study with catch rates of 2.1 fish per net night for channel catfish and 0.8 fish per net-night for flathead catfish. Based on results from the 2020-2024 surveys, the St. Croix River catfish population exists in lower abundance relative to the Minnesota River population. Catch rates of flathead catfish were similar to hoop net catch rates in the Grand, Lamine and Upper Mississippi River (Pools 20-22) in 2006 (Ford et al. 2011). The Grand and Lamine rivers are likely similar to the St. Croix in dominant substrate type, habitat and size. When compared to the nearby Lower Red Cedar River in Dunn county, channel catfish CPUE in the St. Croix was higher than the Lower Red Cedar in 2019 (0.83 fish per net night) and flathead catfish CPUE was similar to the Lower Red Cedar (0.32 fish per net night; Yallaly and Schurrer 2025). In addition to higher catch rates, a much wider size range of flathead catfish were captured during the current surveys with non-baited nets than in the previous survey using baited nets. PSD of flathead catfish is high an indicates a unbalanced population dominated by large individuals with relatively few smaller individuals. Other studies have found that relative abundance of flathead catfish larger than 40 cm was higher in hoopnets compared to electrofishing (Ford et al. 2011). A combination of gears may be needed in the future to effectively target all size ranges of flatheads (Pugibet and Jackson 1989; Stauffer and Koenen 1999; Vokoun and Rabeni 1999). Baited hoop nets used in 2022 and 2024 were substantially more effective in catching channel catfish than non-baited hoop nets. Catch rates of channel catfish in baited hoop nets in 2022 were higher than catch rates during the 2011-2015 survey in one of the river sections but exhibited similar catch rates to the previous survey in the remaining sections of river.

Across all years from 2020-2024, average channel catfish relative abundance was highest in the downstream-most sections surveyed including Boomsite to Marine. When compared to the 2011-2015 survey, catch rates declined in the Marine to Interstate Park sections and remained similar in the Boomsite to Marine sections. Catch rates of flathead catfish were consistently highest in the Marine to Osceola sections of river followed by the Boomsite to Highbridge section. Catch rates of flathead catfish were considerably higher in the current survey than during the 2011-2015 survey in all sections and catch rates remained relativley stable in all river sections and between all sampling years (2020-2024) but this was likely due to the use of non baited nets during the current survey. Catch rates of flathead catfish were also low during the 1999-2000 baseline monitoring survey of the Lower St. Croix River) with electrofishing gear (Benike and Michalek 2001). Anecdotally, the sections of river with higher catch rates likely contain the highest amount of large woody debris habitat in the form of fallen trees and log jams, coupled with the small pools or holes, although this has not been evaluated. During low water years, sampling becomes more difficult as the depth of pools becomes shallower and previously adequate habitats become unavilable to fish and may become unsamplable. Relativley low catch rates in 2022 were likely influenced by low water levels during the month of August when sampling occurred. The average discharge rate in August 2022 was 2200 cubic feet per second (cfs), 4919 cfs in August 2020 and was 3450 cfs in 2024. Because of the lack of and distance between pool habitats that contained adequate overhead cover during 2022, catfish may have sought refuge in upstream or downstream areas near Interstate Park or Lake St. Croix.

Growth of channel catfish varied among individuals but length explained 78% of the variability in ages. Length at age of channel catfish was similar to that of the Lower Red Cedar River in 2019 (Yallaly and Schurrer 2025). Channel catfish exhibited fast growth compared to the Lower Platte River in Nebraska for ages 1-11 (Holland and Peters 1992) and was similar to the Red River population in Manitoba which is managed as a trophy fishery (Siddons et al. 2016). Flathead catfish can exhibit fast growth rates (Jackson 1999). Growth of flatheads in the St. Croix River appeared moderate and similar to growth in the Lower Red Cedar River (Yallaly and Schurrer 2025). Growth was faster in the St. Croix compared to the Missouri River in Nebraska which was considered relatively slow (Morris et al. 1971; Porter et al. 2011) and in Pools 12-13 in the Upper Mississippi River (Steuck and Schnitzler 2011). However, sample sizes of flathead catfish aging structures from the St. Croix River was small and interpretation should therefore be limited.

Harvest of catfish may be relatively high in the St. Croix River based on a Minnesota DNR tagging study (Stiras 2013). The study found higher rates of harvest of both catfish species in the St. Croix River when compared to Mississippi River Pool 2, with 21% of tagged flatheads caught by anglers and 5% of tagged fish were harvested (Stiras 2013). A total of 5% of tagged channel catfish were caught by anglers and 2% of tagged fish were harvested (Stiras 2013). A significant proportion of tagged catfish of both species were larger than 24 inches in length. With catfish exploitation rates higher in the St. Croix River compared to Pool 2, coupled with lower densities and historically few harvest restrictions, the potential for overharvest may be high. Vulnerability of both species of catfish to new methods of take in Wisconsin, including bowfishing, hand-grabbing and spearing is likely high. Therefore, more conservative fishing regulations were needed to prevent over-harvest and future potential

negative impacts to the populations. The regulation prior to 2024 combined channel and flathead catfish for a 10 fish bag limit with no size restriction. Wisconsin and Minnesota DNR's simultaneously proposed several changes to the current catfish regulations in the Lower St. Croix River in 2023 and these changes went into effect in Wisconsin in April 2024. The new regulations separated the species, reduced bag limits and imposed a length restriction. The new regulation for channel catfish is a five fish bag limit and only one over 24 inches may be kept while the flathead catfish regulation is a two fish bag limit and only one over 24 inches may be kept. This regulation should limit overall harvest and offer more protection for preferred size fish.

It is recommended that future efforts focus on identification of abundance of preferred habitats within each of the five sections of river to further understand catfish habitat use and availability during varying water levels. Additional collection of flathead catfish age and growth information is recommended to further understand population dynamics of the species in the Lower St. Croix River. Standard catfish hoop net surveys should continue on a rotational basis to continue monitoring of relative abundance, size structure and age and growth in light of changing regulations. Utilizing a mixture of baited and un-baited hoop nets is recommended to effectively target both species.

Recommendations

1. Continue sampling on a rotational basis with a combination of gears to evaluate effects of regulation changes and monitor populations.
2. Continue to collect age and growth information for flathead catfish to improve understanding of vital rate functions (recruitment, growth and mortality).
3. Conduct surveys using baited and non baited hoop nets to effectively target both species.
4. Consider use of trot lines and electrofishing to increase sample sizes.
5. Conduct experimental bottom trawl surveys to evaluate juvenile catfish habitat use and identify spawning and nursery habitats within the lower St. Croix River.

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