Project II: Evaluation of new recreational and commercial regulations on catfish in the Ohio River

Project Objectives:

1. Determine abundance (CPUE), size structure, and condition of blue catfish, channel catfish, and flathead catfish in the Ohio River, and evaluate the effects of new regulations on blue, channel, and flathead catfish in the Ohio River, particularly trophy-size catfish.
2. Quantify age, growth, and mortality of the three species in each reach, and compare to previous data to determine if any changes have occurred over time.

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Trotline Surveys

During summer 2020, between July 7 and August 26, trotlines (50 hooks/line) baited with fresh cut rough fish (primarily smallmouth buffalo and silver carp) were used to sample blue catfish. KDFWR crews completed sampling in the Meldahl, Cannelton, and Smithland pools of the Ohio River, and Indiana Department of Natural Resources sampled the JT Myers Pool. One-hundred twenty seven total trotlines were fished throughout those pools: 36 in Meldahl Pool, 36 in Cannelton Pool, 32 in JT Myers Pool, and 23 in Smithland Pool (Table 1). CPUE of blue catfish decreased slightly from 2019 sampling (Table 2). Blue catfish CPUE (5.4 fish/line) in 2020 was higher than the historical average (2.9 fish/line).

Blue catfish collected with trotlines ranged from 12.2 – 49.7 in with a mean length of 27.7 in (Table 3). Trophy blue catfish were captured in all pools sampled during trotline sampling and accounted for 13.1% of the total sample. Trotline catch rates for different size groups of each species of catfish were also examined (Table 4). Due to the change in trotline methods in 2018, comparisons with previously collected data should be made with caution. Overall, blue catfish CPUE in 2020 the third highest on record and the second highest since trotlining sample sites became standardized in 2011. The 20.0 – 29.9 in and larger size groups were all above the historical averages; however, all size groups had small decreases in CPUE from 2019.

Trotline CPUE and size structure of blue catfish in the JT Myers and Smithland pools was lower than expected based on findings in the Meldahl and Cannelton pools. The Meldhal and Cannelton pools have displayed consistently higher CPUE (total and trophy fish) than the JT Myers and Smithland pools since 2017. The majority of commercial harvest occurs on the trophy permit section, and invasive Asian carp biomass is rapidly increasing in this part of the river. Both of these factors could play a role in lower catch rates.

Electrofishing Surveys

Low-pulse DC electrofishing was conducted in seven pools in June 2020: Meldahl, Markland, McAlpine, Cannelton, Newburgh, JT Myers, and Smithland. A total of 35.0 hr of electrofishing effort was conducted resulting in a total catch of 705 blue catfish and 2,087 flathead catfish (Table 5). Overall CPUE of blue catfish was 20.1 fish/hr and above the historical average of 17.1 fish/hr (Table 6). Overall flathead catfish CPUE was a record high 59.6 fish/hr and well above the historical average (35.1 fish/hr).

Blue catfish collected with electrofishing ranged from 3.2 – 48.5 in with a mean length of 20.5 in (Table 7). Electrofishing catch rates were also examined for different size groups of blue catfish. CPUE of <10.0 in and 12.0 – 19.9 in fish decreased for the second consecutive year and were below the historical average. CPUE of all other size groups were above the historical average (Table 8). Trophy blue catfish were observed in all pools except the Cannelton Pool.

Flathead catfish lengths ranged from 3.0 – 51.0 in with a mean length of 13.5 in (Table 7). Electofishing CPUE for all size groups examined were all above their historical averages, and all size groups also increased from the 2019 sample with the exception of 30.0 -34.9 in size group (Table 9). Trophy flathead

catfish were observed in all pools sampled except McAlpine, and CPUE of trophy flathead catfish was a record high 1.3 fish/hr.

Three secondary tributaries to the Ohio River (Barren River, Rough River, and Pond River) that allow commercial fishing were also sampled with electrofishing (Table 10). With the exception of Pond River, all tributaries sampled had lower catch rates of blue catfish and flathead catfish than the Ohio River in 2020. Additionally, trophy blue catfish and flathead catfish were not as common as in the main stem Ohio River, and were only captured in Pond River (Table 11).

Relative Weight

Relative weight (Wr) was also calculated for each species of catfish. Fish collected from all sampling methods used in 2020 were combined to provide a more representative estimate for the entire populations of each catfish species. Overall Wr of blue catfish (N=1,250) in 2020 was 107 (Table 12). Flathead catfish (N=1,504) overall relative weight was also 107. Overall, blue catfish and flathead catfish appear to be in great condition throughout the river.

Age, Growth, and Mortality

In spring 2017, otoliths (up to 5 per inch class for fish <30.0 in and up to 3 per inch class for fish ≥30.0 in) were taken from blue catfish, channel catfish, and flathead catfish to assess growth rates for each species. Separate samples were taken from the upper and trophy permit sections. Von Bertalanffy growth equations were calculated for each species (Table 13). Male blue catfish seemed to grow faster in the upper section, but the opposite was observed in the trophy permit section. On average, it took blue catfish 17.7 years to reach trophy size (≥35.0 in; Table 14). Channel catfish exhibited slightly faster growth in the upper section of the Ohio River, but no large differences were seen in growth between sexes. Overall, channel catfish reached trophy size (28.0 in) at 20.0 years (Table 15). There was no noticeable difference in growth rates of flathead catfish between sexes; however, flathead catfish exhibited faster growth in the trophy permit section of the Ohio River. On average a flathead catfish in the upper section reached trophy size (35.0 in) at 20.6 years, while flathead catfish in the trophy permit section reached trophy size nearly three years quicker at 17.7 years. Overall, flathead catfish reached trophy size at 20.1 years (Table 16). Growth of all three species of catfish sampled was extremely variable, particularly as fish grew older and larger, with some fish growing much slower than the Von-Bertalannfy model described and some growing much faster.

Total annual mortality estimates were made on all three species of catfish based off length-at-age of capture data from otoliths and paired with unaged catfish collected with multiple sampling techniques in 2017. Length frequency data from 2020 was paired with the 2017 age-length key to provide mortality estimates for 2020. Using Fishery Analysis and Modeling Simulator (FAMS), a separate weighted catch-curve regression was run on each species of catfish for each sampling method to calculate a range of total annual mortality estimates. As a precautionary step, the highest mortality estimate calculated for each species is reported to avoid underestimates and potentially masking problems in the populations. In 2020, river-wide total annual mortality for blue catfish was 26.6%. Flathead catfish total annual mortality was 19.5% (Table 17). This is highest estimate of both blue catfish and flathead catfish mortality since the project began.

Commercial Fishing Industry

Commercial fishing for catfish has long been present in the Ohio River, but concerns of potential overharvest have warranted further investigations. Harvest of blue catfish began increasing from 2004 to 2005 and has remained near 200,000 lbs through 2018 with the exception of large peaks in 2012 as well as in 2016, 2017, and 2019 (Figure 1). Channel catfish harvest has fluctuated, but generally increased from 2007 – 2012 and has gradually declined since 2012. Channel catfish harvest was around 150,000

lbs for each of the years from 2014 – 2017, and saw a decline to approximately 100,000 lbs in 2019 and 2020. Flathead catfish trends are similar to channel catfish; however, harvest has been below average the past six years. Unfortunately, commercial fish harvest reports do not include detailed information about gear (number of net nights, baited vs. unbaited, length of gillnet, etc.); however, the number of hooks fished for trotlines as well as number of hoop nets fished is required to be reported. Although trotline and hoop net harvest should not be considered indicative of the entire commercial catfish harvest, it is the best available method to analyze trends in commercial catfish harvest rates. Effort (number of hooks for trotlines and number of nets for hoop nets) and pounds harvested by method were examined to determine if harvest rates varied over the years. Trotlines are more effective at capturing blue catfish, while hoop nets are more effective when targeting flathead catfish according to commercial harvest data. Channel catfish appear to be captured efficiently by both trotlines and hoop nets. Each species was examined according to the most effective gear. The harvest rate of blue catfish increased sharply from 2004 to 2005, then increased gradually from 2005 – 2019. Harvest rate reached an all-time high in 2019 followed by the second highest harvest rate in 2020 (Figure 2). Recent decreases in total pounds of catfish harvested in 2013, 2014, and 2018 described above are likely not a result of decreased harvest rates, but rather a decrease in effort. Channel catfish trotline harvest rates has been extremely consistent since 2004, but reached a historical high in 2020 (Figure 2). Channel catfish and flathead catfish harvest in commercial nets have both remained between 5 – 15 pounds/net; however, a drastic spike in harvest occurred in 2012 and 2013 (Figure 3). Reasons for this extreme peak in harvest are not known, but could be a result of prolonged favorable fishing conditions or demand for fish.

Table 1. CPUE (fish/line) of blue catfish collected during trotline surveys on the Ohio River in summer 2020. Standard errors are in parentheses.

Pool	No. of trotlines	No. of Blue Catfish	CPUE
Meldahl	36	222	6.2 (0.5)
Cannelton	36	294	8.2 (0.5)
JT Myers	32	106	3.3 (0.4)
Smithland	23	59	2.6 (0.5)
Total	127	681	5.4 (0.3)

Table 2. CPUE (fish/line) of blue catfish collected during trotline surveys on the Ohio River during summer from 2004 - 2020. Standard errors are in parentheses.

Year	CPUE
2004	1.5 (0.3)
2005	1.5 (0.4)
2006	6.6 (1.2)
2007	2.4 (0.5)
2008	5.9 (0.7)
2010	4.0 (0.4)
2011	3.9 (0.6)
2012	3.0 (0.8)
2013	1.2 (0.2)
2014	1.3 (0.1)
2015	1.6 (0.2)
2016	2.8 (0.2)
2017	2.0 (0.2)
2018*	5.2 (0.4)
2019*	5.9 (0.4)
2020*	5.4 (0.3)
Mean**	2.9 (0.5)

*New methods were adopted for trotlining including changes in bait and style of dropper lines.
**Mean calculated from 2004 - 2017 data prior to changing methods.

Table 3. Length frequency and CPUE (fish/line) of blue catfish collected during trotline surveys on Ohio River in summer 2020. Standard errors are in parentheses.

Pool	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	Total	CPUE
Meldahl		1	2			1	1	4	1	8	16	22	25	32	23	19	9	9	3	7	2	5	2	4	3	6	4	5	4	1		1			1	1			222	6.2 (0.5)
Cannelton	1		1		1		1	4	8	18	27	32	34	25	21	16	15	10	12	4	9	8	4	5	3	3	4	5	2	5	5	1	1	3	2		2	2	294	8.2 (0.5)
JT Myers									1	4	1	9	18	17	11	9	6	4	5	5	4	1	2	3	3	1				1	1								106	3.3 (0.4)
Smithland						1			1	1	2		2	6	5	7	7	8	6	1	2	1	2	1	2		1	2		1									59	2.6 (0.5)
Total	1	1	3		1	2	2	8	11	31	46	63	79	80	60	51	37	31	26	17	17	15	10	13	11	10	9	12	6	8	6	2	1	3	3	1	2	2	681	5.4 (0.3)

Table 4. CPUE (fish/line) by size group of blue catfish collected during trotline surveys on the Ohio River during summer from 2004 - 2020. Standard errors are in parentheses.

	Size group (in)					
Year	<12.0	12.0 - 19.9	20.0 - 29.9	30.0 - 34.9	≥35.0	Total
2004	0.0	0.3 (0.2)	0.9 (0.2)	0.3 (0.2)	0.1 (0.1)	1.5 (0.3)
2005	0.0	<0.1 (<0.1)	1.0 (0.6)	0.2 (0.1)	0.2 (0.1)	1.5 (0.4)
2006	<0.1 (<0.1)	0.8 (0.2)	5.0 (1.0)	0.6 (0.2)	0.2 (0.1)	6.6 (1.2)
2007	0.0	0.3 (0.1)	1.5 (0.4)	0.5 (0.2)	0.1 (<0.1)	2.4 (0.5)
2008	0.0	0.6 (0.2)	4.1 (0.8)	1.0 (0.1)	0.1 (0.1)	5.9 (0.7)
2010	0.0	0.2 (<0.1)	1.9 (0.3)	1.1 (0.3)	0.7 (0.2)	4.0 (0.4)
2011	0.0	0.2 (0.1)	2.7 (0.5)	0.9 (0.3)	0.3 (0.1)	3.9 (0.6)
2012	0.1 (<0.1)	0.7 (0.3)	1.7 (0.3)	0.3 (0.2)	0.2 (0.1)	3.0 (0.8)
2013	0.1 (<0.1)	0.3 (0.1)	0.6 (0.1)	0.1 (<0.1)	<0.1 (<0.1)	1.2 (0.2)
2014	<0.1 (<0.1)	0.5 (0.1)	0.5 (0.1)	0.2 (<0.1)	0.1 (0.1)	1.3 (0.1)
2015	<0.1 (<0.1)	0.5 (0.2)	0.7 (0.2)	0.3 (0.1)	0.1 (<0.1)	1.6 (0.2)
2016	<0.1 (<0.1)	0.7 (0.2)	1.5 (0.4)	0.5 (0.2)	0.1 (<0.1)	2.8 (0.2)
2017	0.0	0.3 (0.1)	1.4 (0.1)	0.2 (<0.1)	0.1 (<0.1)	2.0 (0.2)
2018*	<0.1 (<0.1)	0.3 (0.1)	3.2 (0.3)	0.9 (0.1)	0.8 (0.1)	5.2 (0.4)
2019*	<0.1 (<0.1)	0.2 (<0.1)	4.2 (0.3)	0.9 (0.1)	0.6 (0.1)	5.9 (0.4)
2020*	0.0	0.1 (<0.1)	3.9 (0.2)	0.7 (0.1)	0.7 (0.1)	5.4 (0.3)
Mean**	<0.1 (<0.1)	0.4 (0.1)	1.8 (0.4)	0.5 (0.1)	0.2 (<0.1)	2.9 (0.5)

*New methods were adopted for trotlining including changes in bait and style of dropper lines.

**Mean calculated from 2004 - 2017 data prior to changing methods.

Table 5. Effort and CPUE (fish/hr) of blue catfish and flathead catfish collected during electrofishing surveys on the Ohio River in June 2020. Standard errors are in parentheses.

Pool	No. of transects	Effort (hr)	No. of Blue Catfish	CPUE	No. of Flathead	CPUE
Meldahl	20	5.0	59	11.8 (2.1)	340	68.0 (8.3)
Markland	20	5.0	105	21.0 (8.3)	227	45.4 (5.7)
McAlpine	20	5.0	39	7.8 (2.7)	286	57.2 (6.3)
Cannelton	20	5.0	43	8.6 (2.4)	274	54.8 (4.9)
Newburgh	20	5.0	143	28.6 (7.3)	279	55.8 (5.8)
JT Myers	20	5.0	171	34.2 (7.6)	405	81.0 (9.2)
Smithland	20	5.0	145	29.0 (8.2)	276	55.2 (11.4)
Total	140	35.0	705	20.1 (2.4)	2087	59.6 (3.0)

Table 6. CPUE (fish/hr) of blue catfish and flathead catfish collected during electrofishing surveys on the Ohio River from 2004 - 2020. Standard errors are in parentheses.

	Species	
Year	Blue catfish	Flathead catfish
2004	0.0	14.5 (4.1)
2009	1.6 (0.8)	15.5 (4.1)
2010	11.9 (4.0)	17.1 (3.3)
2013	11.4 (4.8)	38.9 (5.1)
2014	19.3 (3.2)	32.8 (2.6)
2015	19.0 (3.8)	37.6 (3.6)
2016	17.5 (2.7)	35.5 (2.2)
2017	25.2 (2.7)	40.6 (2.1)
2018	39.8 (5.7)	54.0 (4.7)
2019*	22.2 (2.6)	40.2 (2.4)
2020	20.1 (2.4)	59.6 (3.0)
Mean	17.1 (3.3)	35.1 (4.4)

*Incomplete sample due to high water

Table 7. Length frequency and CPUE (fish/hr) of blue catfish and flathead catfish collected during electrofishing surveys in June 2020 on the Ohio River. Standard errors are in parentheses.

		Inch class																																																		
Pool	Species	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	Total	CPUE
Meldahl	Blue catfish									1	3	5	3	5	2	1		1	5	2	6	11	5	1	2	3				1													1	1							59	11.8 (2.1)
	Flathead catfish	5	24	14	13	16	32	21	13	10	14	10	14	7	10	15	12	11	14	7	10	5	10	9	5	7	4	1	3	1	6		2	3	5	1	2	1		1	2										340	68.0 (8.3)
Markland	Blue catfish	3	4			3	7	2	2	7	6	10	4	4	2	4	4	4	5	7	13	7	4	1				1							1																105	21.0 (8.3)
	Flathead catfish	4	13	12	11	17	19	17	17	16	2	2	9	2	6	7	12	4	4	5	11	6	5	3	9	1	3	1		2	1	2	1			1						1		1							227	45.4 (5.7)
McAlpine	Blue catfish	1	4	1		1	1							1		1	1		5	7	5	2	2	1	1	1	1													1							2				39	7.8 (2.7)
	Flathead catfish	15	28	33	14	17	28	26	10	20	13	7	9	7	5	5	5	7	2	12	7	5	1	2	3	2		1	2																						286	57.2 (6.3)
Cannelton	Blue catfish								1				2		1	2	5	6	5	4	5	3	3	1	2		3																								43	8.6 (2.4)
	Flathead catfish	6	15	10	22	30	28	35	16	21	11	9	6	8	5	8	5	1	3	4	5	2	4	4	2	2		4	1	2			1	1	1					1	1										274	54.8 (4.9)
Newburgh	Blue catfish	2	8				1	2	4	2	2	6	6	2	6	2		4	6	14	15	20	9	12	2	4	2	3	1	2		1	1	2		1		1													143	28.6 (7.3)
	Flathead catfish	7	13	11	12	23	40	24	19	7	7	10	4	8	5	6	3	7	9	10	7	6	8	3	5	4	2	5		2	1	1	1	1	4		3			1											279	55.8 (5.8)
JT Myers	Blue catfish	1	1	1	1		2	4	8	1	2	1	3	9	4	5	2	4	5	10	20	19	18	13	10	10	7			2	2	2	1	1				1			1										171	34.2 (7.6)
	Flathead catfish	14	35	18	24	41	32	21	26	11	18	23	3	11	6	14	9	14	9	8	11	5	10	12	5	5	6	2		3	1	1		1				2			1			2			1				405	81.0 (9.2)
Smithland	Blue catfish	2			1		6	7	5	3	3		1	6	3	6	4	3	8	11	8	9	7	9	11	6	4	4	5	5		3				2					3										145	29.0 (8.2)
	Flathead catfish	7	7	12	18	23	27	14	12	13	11	7	14	7	5	6	10	10	14	4	8	11	11	3	5	1	4	1	1	2	2				1		2	1			1									1	276	55.2 (11.4)
Total	Blue catfish	9	17	2	2	4	17	15	20	14	16	22	19	27	18	21	16	22	39	55	72	71	48	38	28	24	17	8	6	10	2	6	2	3	1	3		2		1	4		1	1			2				705	20.1 (2.4)
	Flathead catfish	58	135	110	114	167	206	158	113	98	76	68	59	50	42	61	56	54	55	50	59	40	49	36	34	22	19	15	7	12	11	4	5	6	11	2	7	4		3	5	1		3			1			1	2087	59.6 (3.0)

Table 8. CPUE (fish/hr) by size group of blue catfish collected during electrofishing surveys on the Ohio River from 2004 - 2020. Standard errors are in parentheses.

	Size group (in)					
Year	<12.0	12.0 - 19.9	20.0 - 29.9	30.0 - 34.9	≥35.0	Total
2004	0.0	0.0	0.0	0.0	0.0	0.0
2009	0.1 (<0.1)	1.0 (0.1)	0.4 (<0.1)	0.1 (<0.1)	0.0	1.6 (0.8)
2010	8.8 (2.3)	1.0 (0.1)	1.4 (0.1)	0.7 (<0.1)	0.0	11.9 (4.0)
2013	9.2 (2.5)	1.8 (0.9)	0.3 (0.1)	0.0	0.0	11.4 (4.8)
2014	6.8 (0.6)	10.1 (1.2)	2.1 (0.2)	0.2 (0.1)	0.1 (0.1)	19.3 (3.2)
2015	0.8 (0.4)	14.3 (3.0)	3.5 (0.5)	0.2 (<0.1)	0.2 (0.1)	19.0 (3.8)
2016	0.7 (0.4)	11.1 (2.8)	4.9 (0.9)	0.3 (0.1)	0.5 (0.2)	17.5 (2.7)
2017	3.5 (0.7)	12.8 (1.7)	7.8 (1.0)	0.5 (0.2)	0.5 (0.1)	25.2 (2.7)
2018	6.2 (1.8)	15.1 (3.4)	17.3 (6.8)	0.6 (0.2)	0.6 (0.2)	39.8 (5.7)
2019*	4.9 (1.0)	7.4 (1.0)	8.6 (1.3)	0.9 (0.2)	0.5 (0.1)	22.2 (2.6)
2020	2.9 (0.5)	4.6 (0.7)	11.4 (1.7)	0.7 (0.2)	0.5 (0.1)	20.1 (2.4)
Mean	4.0 (1.0)	7.2 (1.7)	5.2 (1.7)	0.4 (0.1)	0.3 (0.1)	17.1 (3.3)

*Incomplete sample due to high water

Table 9. CPUE (fish/hr) by size group of flathead catfish collected during electrofishing surveys on the Ohio River from 2004 - 2020. Standard errors are in parentheses.

	Size group (in)					
Year	<12.0	12.0 - 19.9	20.0 - 29.9	30.0 - 34.9	≥35.0	Total
2004	9.3 (4.2)	5.0 (1.1)	0.3 (0.3)	0.0	0.0	14.5 (4.1)
2009	8.4 (1.7)	4.3 (0.2)	2.6 (0.2)	0.0	0.3 (<0.1)	15.5 (4.1)
2010	8.8 (1.9)	6.0 (2.1)	2.1 (0.5)	0.2 (<0.1)	0.0	17.1 (3.3)
2013	14.9 (4.5)	17.2 (1.1)	6.3 (1.8)	0.3 (0.1)	0.2 (0.2)	38.9 (5.1)
2014	12.3 (2.6)	15.9 (3.7)	4.3 (0.2)	0.3 (0.1)	0.1 (<0.1)	32.8 (2.6)
2015	15.8 (2.1)	14.6 (4.2)	5.6 (0.9)	0.9 (0.4)	0.7 (0.3)	37.6 (3.6)
2016	10.9 (1.6)	16.0 (4.2)	7.2 (1.3)	0.8 (0.3)	0.6 (0.3)	35.5 (2.2)
2017	12.5 (1.1)	15.5 (1.0)	10.7 (0.9)	1.1 (0.2)	0.8 (0.2)	40.6 (2.1)
2018	22.0 (2.8)	15.3 (1.0)	13.5 (1.2)	1.9 (0.3)	1.2 (0.2)	54.0 (4.7)
2019*	15.0 (1.8)	12.9 (0.9)	10.1 (0.8)	1.4 (0.3)	0.8 (0.2)	40.2 (2.4)
2020	33.1 (2.4)	13.3 (0.9)	10.8 (0.8)	1.1 (0.2)	1.3 (0.2)	59.6 (3.0)
Mean	14.8 (2.2)	12.4 (1.5)	6.7 (1.3)	0.7 (0.2)	0.5 (0.1)	35.1 (4.4)

*Incomplete sample due to high water

Table 10. Effort and CPUE (fish/hr) of blue catfish and flathead catfish collected during electrofishing surveys on commercially fishable tributaries of the Ohio River in June 2020. Standard errors are in parentheses.

Tributary	No. of transects	Effort (hr)	No. of blue catfish	CPUE	No. of flathead catfish	CPUE
Barren River	8	2.0	0	0.0	16	8.0 (3.4)
Rough River	8	2.0	2	1.0 (0.7)	18	9.0 (2.7)
Pond River	6	1.5	20	13.3 (5.1)	54	36.0 (6.4)

Table 11. Length frequency, CPUE (fish/hr), and relative weight (Wr) of blue catfish and flathead catfish collected during electrofishing surveys in June 2020 on commercially fishable tributaries of the Ohio

		Inch class																																		
Tributary	Species	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	…	40	41	Total	CPUE	Wr
Barren River	Blue catfish																																	0	0.0	
	Flathead catfish	2	1	1	2		1	2	1	3		1		1				1																16	8.0 (3.4)	107
Rough River	Blue catfish						1	1																										2	1.0 (0.7)	90
	Flathead catfish		1		3	1	1	1	1	1				1		1	1	1	1		2			1						1				18	9.0 (2.7)	93
Pond River	Blue catfish	1			6	6							2	2			1	1														1		20	13.3 (5.1)	101
	Flathead catfish		8	9	4	7	7	4	1				1		1		2		1	1		2	1			2		1	1			1		54	6.0 (2.0)	115

Table 12. Relative weight (Wr) of blue catfish, channel catfish, and flathead catfish collected from the Ohio River using trotlines, hoop nets, electrofishing and catfish tournaments from 2013 - 2020.

	Species		
Year	Blue catfish	Channel catfish	Flathead catfish
2013	112	100	99
2014	105	97	92
2015	109	100	98
2016	107	97	106
2017	106	89	107
2018	104	90	101
2019	99	86	99
2020	107		107
Mean	106	94	101

Table 14. von Bertalanffy growth parameters used to estimate length-at age for blue catfish, channel catfish, and flathead catfish collected from the Ohio River in 2017 where $L\infty$= theoretical maximum length, K=body growth coefficient, and t_0=time coefficient.

Parameter	Blue catfish	Channel catfish	Flathead catfish
$L\infty$ (in)	55.0	35.0	55.0
K	0.051	0.074	0.040
t_0	-2.086	-1.783	-4.556

Table 14. Mean length (in) at age calculated with the von Bertalanffy growth equation based on otoliths taken from blue catfish from the Ohio River in spring and summer of 2017.

		Age																			
Section	Sex	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Upper	Male	7.2	9.9	12.4	14.8	17.1	19.3	21.3	23.2	25.0	26.7	28.3	29.8	31.2	32.6	33.8	35.0	36.2	37.2	38.2	39.2
	Female	9.7	11.6	13.5	15.2	16.9	18.5	20.0	21.5	22.9	24.3	25.6	26.8	28.0	29.2	30.2	31.3	32.3	33.3	34.2	35.1
	Total	7.6	10.0	12.4	14.6	16.7	18.6	20.5	22.3	24.0	25.6	27.1	28.6	29.9	31.2	32.5	33.6	34.8	35.8	36.8	37.7
Trophy permit	Male	9.0	11.2	13.4	15.4	17.3	19.2	20.9	22.6	24.2	25.7	27.1	28.5	29.8	31.0	32.2	33.3	34.4	35.4	36.4	37.3
	Female	7.3	9.9	12.4	14.7	16.9	19.0	20.9	22.8	24.6	26.2	27.8	29.3	30.7	32.0	33.3	34.5	35.6	36.7	37.7	38.6
	Total	8.3	10.6	12.8	14.9	16.9	18.8	20.6	22.3	24.0	25.5	27.0	28.4	29.7	31.0	32.2	33.3	34.4	35.4	36.4	37.3
Overall	Male	8.7	11.1	13.3	15.4	17.4	19.4	21.2	22.9	24.5	26.1	27.5	28.9	30.3	31.5	32.7	33.9	34.9	36.0	36.9	37.9
	Female	11.9	13.4	15.0	16.4	17.8	19.2	20.5	21.7	23.0	24.1	25.3	26.3	27.4	28.4	29.4	30.3	31.2	32.1	32.9	33.7
	Total	8.0	10.4	12.6	14.7	16.7	18.6	20.4	22.2	23.8	25.4	26.8	28.2	29.6	30.9	32.1	33.2	34.3	35.3	36.3	37.2

Table 15. Mean length (in) at age calculated with the von Bertalanffy growth equation based on otoliths taken from channel catfish from the Ohio River in spring and summer of 2017.

		Age																			
Section	Sex	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Upper	Male	6.6	9.1	11.5	13.6	15.6	17.3	18.9	20.4	21.7	22.9	24.0	25.0	25.9	26.7	27.5	28.2	28.8	29.3	29.9	30.3
	Female	5.7	8.7	11.5	13.9	16.1	18.1	19.8	21.4	22.8	24.1	25.2	26.3	27.2	28.0	28.7	29.4	30.0	30.5	30.9	31.4
	Total	6.4	8.9	11.1	13.2	15.0	16.8	18.3	19.8	21.1	22.3	23.4	24.4	25.3	26.1	26.9	27.6	28.2	28.8	29.3	29.8
Trophy permit	Male	7.8	9.5	11.1	12.6	14.0	15.3	16.5	17.6	18.7	19.7	20.7	21.6	22.4	23.2	23.9	24.6	25.2	25.8	26.4	26.9
	Female	8.0	9.7	11.2	12.7	14.1	15.5	16.7	17.8	18.9	19.9	20.9	21.8	22.6	23.4	24.1	24.8	25.4	26.0	26.6	27.1
	Total	7.6	9.4	11.1	12.7	14.1	15.5	16.8	18.0	19.1	20.1	21.1	22.0	22.9	23.7	24.4	25.1	25.8	26.4	26.9	27.5
Overall	Male	7.4	9.5	11.4	13.2	14.9	16.4	17.8	19.1	20.3	21.4	22.5	23.4	24.3	25.1	25.9	26.6	27.2	27.8	28.3	28.8
	Female	7.8	9.6	11.3	12.9	14.4	15.8	17.1	18.3	19.4	20.5	21.5	22.4	23.2	24.0	24.8	25.5	26.1	26.7	27.3	27.8
	Total	6.5	8.5	10.4	12.2	13.8	15.3	16.7	18.0	19.2	20.4	21.4	22.4	23.3	24.1	24.9	25.6	26.3	26.9	27.5	28.0

Table 16. Mean length (in) at age calculated with von Bertalanffy growth equation based on otoliths taken from flathead catfish from the Ohio River in spring and summer of 2017.

		Age																																
Section	Sex	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Upper	Male	9.4	11.3	13.0	14.7	16.3	17.9	19.4	20.8	22.2	23.5	24.8	26.0	27.2	28.3	29.4	30.4	31.4	32.4	33.3	34.2	35.0	35.8	36.6	37.3	38.0	38.7	39.4	40.0	40.6	41.2	41.8	42.3	42.8
	Female	11.3	13.1	14.8	16.4	18.0	19.5	20.9	22.3	23.6	24.9	26.1	27.2	28.4	29.4	30.5	31.5	32.4	33.3	34.2	35.0	35.8	36.6	37.4	38.1	38.8	39.4	40.0	40.6	41.2	41.8	42.3	42.8	43.3
	Total	11.0	12.7	14.4	16.0	17.5	19.0	20.4	21.8	23.1	24.3	25.5	26.7	27.8	28.9	29.9	30.9	31.8	32.8	33.6	34.5	35.3	36.1	36.8	37.5	38.2	38.9	39.5	40.1	40.7	41.3	41.8	42.3	42.8
Trophy permit	Male	5.7	8.3	10.8	13.1	15.3	17.4	19.4	21.3	23.1	24.7	26.3	27.8	29.3	30.6	31.9	33.1	34.3	35.4	36.4	37.4	38.3	39.2	40.1	40.9	41.6	42.3	43.0	43.6	44.2	44.8	45.3	45.9	46.3
	Female	5.2	7.8	10.4	12.8	15.0	17.2	19.2	21.1	22.9	24.7	26.3	27.8	29.3	30.7	32.0	33.2	34.4	35.5	36.6	37.5	38.5	39.4	40.2	41.0	41.8	42.5	43.2	43.8	44.4	45.0	45.5	46.0	46.5
	Total	5.6	8.2	10.7	13.0	15.2	17.3	19.3	21.2	23.0	24.7	26.3	27.8	29.2	30.6	31.9	33.1	34.2	35.3	36.4	37.4	38.3	39.2	40.0	40.8	41.6	42.3	43.0	43.6	44.2	44.8	45.3	45.8	46.3
Overall	Male	8.8	10.7	12.6	14.3	16.0	17.6	19.2	20.6	22.0	23.4	24.7	26.0	27.2	28.3	29.4	30.5	31.5	32.5	33.4	34.3	35.1	36.0	36.8	37.5	38.2	38.9	39.6	40.2	40.8	41.4	42.0	42.5	43.0
	Female	9.3	11.3	13.2	15.0	16.7	18.3	19.9	21.4	22.9	24.3	25.6	26.9	28.1	29.3	30.4	31.4	32.5	33.4	34.4	35.3	36.1	36.9	37.7	38.5	39.2	39.9	40.5	41.2	41.8	42.3	42.9	43.4	43.9
	Total	7.6	9.6	11.6	13.6	15.4	17.1	18.8	20.4	21.9	23.4	24.8	26.1	27.4	28.6	29.8	30.9	32.0	33.0	34.0	34.9	35.8	36.6	37.4	38.2	39.0	39.7	40.4	41.0	41.6	42.2	42.8	43.3	43.8

Table 17. Maximum total annual mortality rates of blue catfish, channel catfish, and flathead catfish collected from the Ohio River using trotlines, hoopnets, and electrofishing from 2013 - 2020.

	Species		
Year	Blue catfish	Channel catfish	Flathead catfish
2013	18.7	32.2	18.8
2014	24.7	26.8	18.7
2015	20.0	20.6	15.9
2016	17.4	16.8	16.0
2017	18.9	27.9	18.2
2018	19.8	28.0	18.0
2019	17.3	23.3	17.1
2020	26.6		19.5
Mean	20.4	25.1	17.8

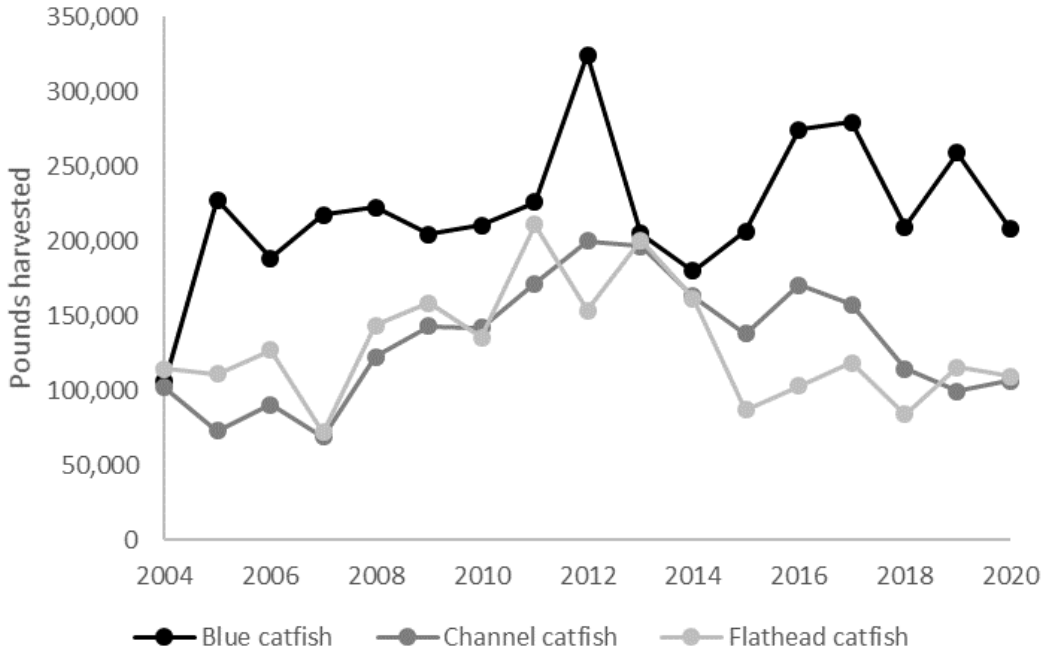

Figure 1. Total pounds of blue catfish, channel catfish, and flathead catfish harvested by commercial fishermen from the Ohio River from 2004 – 2020.

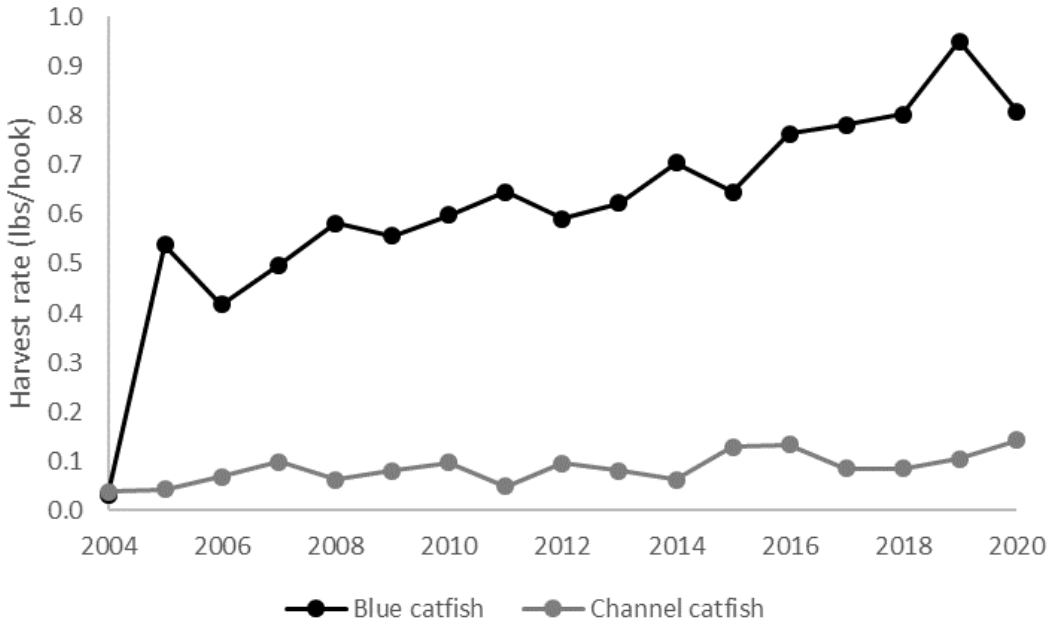

Figure 2. Harvest rate (lbs/hook) of blue catfish and channel catfish harvested with trotlines by commercial fishermen from the Ohio River from 2004 – 2020.

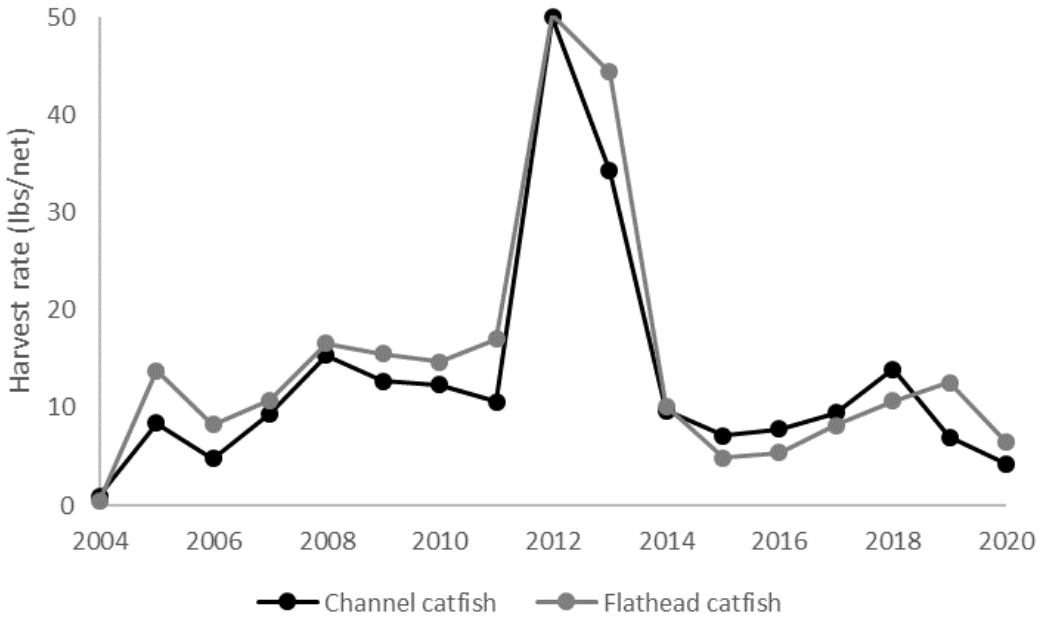

Figure 3. Harvest rate (lbs/net) of channel catfish and flathead catfish harvested with hoop nets by commercial fishermen from the Ohio River from 2004 – 2020.