

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

Carthage, Miner County

MJA-Lake-598-000

2023

Lake Information

Name: Carthage

County: Miner

Surface Area: 211 Acres

Surveys and Investigations

Survey methods used by gear type, date, and effort.

Gear	Date	Effort
AFS std gill net	Jun 06, 2023	4 net-nights
frame net (std 3/4 in)	Jun 06, 2023	5 net-nights

Common Fish Species Present

Black Bullhead

Black Crappie

Common Carp

White Sucker

Channel Catfish

Walleye

Yellow Perch

Sunfish Hybrid

Northern Pike

Terminology

Catch per unit effort (**CPUE**) refers to the relative abundance of a species. It is defined as the number of fish captured per unit of effort (i.e., number of fish captured per net-night or number of fish captured per hour electrofishing). In this report CPUE is typically given for only stock-length fish (see length categories table for stock lengths).

A statewide effort to help make netting efforts comparable to all waters sampled across the state, occurred in 2017, with a switch to American Fisheries Society gill nets. Past gill netting efforts were completed with different style/types of nets and are not comparable side by side.

- **AFS std gill net** – 80 ft experimental gill net containing eight panels (10 ft each) of varying monofilament meshes of 0.75, 1.00, 1.25, 1.50, 1.75, 2.00, 2.25 and 2.50 inches.
- **std experimental gill net for non-Missouri River waters** - 150 ft experimental gill net containing six panels (25 ft each) of varying monofilament meshes of 0.5, 0.75, 1.00, 1.25, 1.50 and 2.00 inches.
- **std experimental gill net for Missouri River reservoirs** – 300 ft experimental gill net containing six panels (50 ft each) of varying multifilament meshes of 0.5, 0.75, 1.00, 1.25, 1.50 and 2.00 inches.

$$CPUE = \frac{\text{number of fish}}{\text{effort}}$$

Population size structure is quantified using the indices proportional size distribution of quality-length fish (**PSD**) and proportional size distribution of preferred-length fish (**PSD-P**). These indices indicate the proportion of stock-length fish that are equal to or greater than a given length. Minimum lengths for stock, quality and preferred length fish are given in the length categories table.

$$PSD = \left(\frac{\text{number of fish} \geq \text{quality length}}{\text{number of fish} \geq \text{stock length}} \right) \times 100$$

$$PSD - P = \left(\frac{\text{number of fish} \geq \text{preferred length}}{\text{number of fish} \geq \text{stock length}} \right) \times 100$$

Relative weight (**Wr**) is used to quantify fish plumpness. Relative weight is the ratio of what a fish weighs (**W**) compared to a length-specific standard weight (**Ws**) multiplied by 100. Relative weight values of 95-105 are commonly cited as optimum values, but values in the 80s are common during summer sampling in South Dakota.

$$Wr = \left(\frac{W}{W_s} \right) \times 100$$

Confidence intervals (CI) are provided for many of the estimates calculated in this report. The confidence interval provides a range in which the true mean is expected to fall. For example, with an 80% CI we are 80% confident that the interval contains the true value.

Length categories include stock (S), quality (Q), preferred (P), memorable (M) and trophy (T). Length categories for most species have been defined based on a percentage of the world record length for that species. Some species mentioned in this report do not have defined length categories. Length categories for species used in this report are provided in the following table. Measurements are the minimum total length for each category and are reported in inches (in) and centimeters (cm).

Species Name	Stock		Quality		Preferred		Memorable		Trophy	
	(in)	(cm)	(in)	(cm)	(in)	(cm)	(in)	(cm)	(in)	(cm)
Black Bullhead	6	15	9	23	12	30	15	38	18	46
Black Crappie	5	13	8	20	10	25	12	30	15	38
Bluegill	3	8	6	15	8	20	10	25	12	30
Brown Trout	8	20	12	30	16	40	20	50	18	46
Channel Catfish	11	28	16	41	24	61	28	71	36	91
Freshwater Drum	8	20	12	30	15	38	20	51	25	63
Lake Trout	12	30	20	50	26	65	31	80	39	100
Largemouth Bass	8	20	12	30	15	38	20	51	25	63
Muskellunge	20	51	30	76	38	97	42	107	50	127
Northern Pike	14	35	21	53	28	71	34	86	44	112
Pumpkinseed	3	8	6	15	8	20	10	25	12	30
Rainbow Trout	10	25	16	40	20	50	26	65	31	80
Rudd	6	15	10	25	12	30	15	38	19	48
Sauger	8	20	12	30	15	38	20	51	25	63
Smallmouth Bass	7	18	11	28	14	35	17	43	20	51
Walleye	10	25	15	38	20	51	25	63	30	76
White Bass	6	15	9	23	12	30	15	38	18	46
White Crappie	5	13	8	20	10	25	12	30	15	38
Yellow Bullhead	4	10	7	18	9	23	11	28	14	36
Yellow Perch	5	13	8	20	10	25	12	30	15	38

Catch Summary of Stock Length Fish

Catch per unit effort (CPUE), proportional size distribution (PSD), proportional size distribution of preferred length fish (PSD-P), and relative weight (Wr) for species sampled in survey with 80% confidence interval (CI-80).

* **Methods/Species that ignore stock length**

Gear	Species	Sample Size (n)	Abundance		Stock Density Indices			Condition		
			CPUE	CI-80	PSD	CI-80	PSD-P	CI-80	Wr	CI-80
AFS std gill net	Black Bullhead	68	17.0	10.2	22	7	0			
	Channel Catfish	32	6.5	2.2	58	15	4	93	3	
	Common Carp	42	10.3	4.6	66	11	2			
	Northern Pike	1	0.3	0.4	100		0	89		
	Walleye	4	1.0	1.2	100		0	87	3	
	White Sucker	34	8.5	4.7	100		100			
	Yellow Perch	3	0.8	0.8	67		0	98	4	
frame net (std 3/4 in)	Black Bullhead	184	36.6	22.2	13	4	0			
	Black Crappie	148	29.6	26.0	30	5	19	5	114	4
	Channel Catfish	9	1.2	1.1	83		33		95	10
	Common Carp	7	1.4	1.0	100		14			
	Northern Pike	1	0.2	0.3	100		0		80	
	Sunfish Hybrid	3	0.6	0.4	0		0		109	9
	Walleye	11	2.0	2.4	30		20		81	4
White Sucker	40	8.0	7.3	100		100				

10-Year Catch Per Unit Effort by Gear and Species

Catch per unit effort (CPUE) and average (Avg) of species across 10 years using different gear types.

* Methods/Species that ignore stock length

Gear	Species	CPUE										Avg	
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		
AFS std frame net	Black Bullhead				18.4								18.40
	Black Crappie				7.8								7.80
	Bluegill				1.4								1.40
	Channel Catfish				0.2								0.20
	Common Carp				2.4								2.40
	Gizzard Shad				0.6								0.60
	Northern Pike				0.4								0.40
	Orangespotted Sunfish				0.0								0.00
	Pumpkinseed				0.4								0.40
	Sunfish Hybrid				0.8								0.80
	Walleye				2.0								2.00
White Sucker				4.4								4.40	
AFS std gill net	Black Bullhead				80.8	55.2	13.3		51.7		17.0		43.60
	Black Crappie				0.8	0.2	0.0		0.2		0.0		0.24
	Channel Catfish				12.3	6.2	9.5		10.7		6.5		9.04
	Common Carp				4.5	2.3	3.0		9.3		10.3		5.88
	Gizzard Shad				2.3	0.0	0.0		0.0		0.0		0.46
	Northern Pike				0.3	0.0	0.0		0.2		0.3		0.16
	Walleye				5.5	0.2	0.7		0.8		1.0		1.64
	White Sucker				7.5	3.8	5.5		10.0		8.5		7.06
	Yellow Perch				0.3	0.7	3.3		0.5		0.8		1.12
frame net (std 3/4 in)	Black Bullhead	100.4	377.4	1,495.6		576.0	35.5		97.5		36.6		388.43
	Black Crappie	2.6	6.0	9.4		6.8	14.0		14.8		29.6		11.89
	Bluegill	1.0	0.8	1.4		0.0	1.5		2.0		0.0		0.96
	Channel Catfish	3.8	0.4	6.2		1.6	0.5		1.3		1.2		2.14
	Common Carp	1.8	0.8	3.8		0.0	0.0		15.5		1.4		3.33
	Green Sunfish	0.0	0.2	0.0		0.0	0.5		0.0		0.0		0.10
	Northern Pike	2.0	3.0	3.4		0.0	0.0		4.8		0.2		1.91
	Orangespotted Sunfish	0.0	0.0	0.0		0.0	0.0		0.0		0.0		0.00
	Pumpkinseed	0.0	0.0	0.0		0.0	0.0		0.3		0.0		0.04
	Sunfish Hybrid	0.0	0.0	0.0		0.0	3.5		0.8		0.6		0.70
	Walleye	0.2	1.4	0.6		0.0	0.3		1.3		2.0		0.83
White Sucker	38.0	7.8	5.4		14.6	6.0		26.8		8.0		15.23	

		CPUE										
Gear	Species	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Avg
frame net (std 3/4 in)	Yellow Perch	0.0	0.0	0.2		0.0	3.0		5.3		0.0	1.21
std exp gill net	Black Bullhead	189.3	148.3	249.7								195.77
	Black Crappie	0.0	3.0	1.7								1.57
	Channel Catfish	6.3	5.0	17.3								9.53
	Common Carp	5.3	9.0	1.7								5.33
	Northern Pike	1.7	2.0	1.7								1.80
	Walleye	12.0	7.3	3.3								7.53
	White Sucker	2.0	1.7	10.3								4.67
	Yellow Perch	1.0	0.7	0.0								0.57

10-Year Size Structure and Condition Statistics by Gear and Species

Species proportional size distribution (PSD), proportional size distribution of preferred length fish (PSD-P), and relative weight (Wr) collected by different gear types across 10 years.

Gear	Species	Index	Year											
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		
AFS std frame net	Black Bullhead	PSD				1								
		PSD-P				0								
	Black Crappie	PSD				85								
		PSD-P				13								
		Wr				98								
	Channel Catfish	PSD				100								
		PSD-P				0								
		Wr				107								
	Common Carp	PSD				92								
		PSD-P				75								
		Wr												
	Northern Pike	PSD				100								
		PSD-P				50								
		Wr				88								
	Walleye	PSD				30								
		PSD-P				0								
		Wr				80								
White Sucker	PSD				100									
	PSD-P				100									
	Wr													
AFS std gill net	Black Bullhead	PSD				0	5	14		8			22	
		PSD-P				0	0	0		0			0	
		Wr												
	Black Crappie	PSD				100	100				100			
		PSD-P				0	0				0			
		Wr				102	92				121			
	Channel Catfish	PSD				31	73	70			81		58	
		PSD-P				2	0	2			11		4	
		Wr				94	95	96			88		93	
	Common Carp	PSD				56	79	78			14		66	
		PSD-P				11	7	56			5		2	
		Wr												
	Northern Pike	PSD				100					100		100	
		PSD-P				100					0		0	
		Wr				78					71		89	
	Walleye	PSD				59	100	75			60		100	
		PSD-P				0	100	75			20		0	
		Wr												

Gear	Species	Index	Year										
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
AFS std gill net	Walleye	Wr				85	103	94		87		87	
	White Sucker	PSD				100	96	100		100		100	
		PSD-P				100	96	94		75		100	
	Yellow Perch	PSD				100	25	25		100		67	
		PSD-P				0	0	0		0		0	
		Wr				84	99	110		90		98	
frame net (std 3/4 in)	Black Bullhead	PSD	23	2	0		7	11		11		13	
		PSD-P	0	0	0		1	0		0		0	
	Black Crappie	PSD	46	73	83		59	63		76		30	
		PSD-P	31	20	15		9	34		25		19	
		Wr	122	108	96		110	103		101		114	
	Channel Catfish	PSD	11	0	0		38	100		80		83	
		PSD-P	5	0	0		0	0		0		33	
		Wr	84	72	83		86	105		93		95	
	Common Carp	PSD	100	50	95					35		100	
		PSD-P	33	50	42					15		14	
	Northern Pike	PSD	90	80	88					42		100	
		PSD-P	10	27	47					0		0	
		Wr	90	77	78					82		80	
	Walleye	PSD	0	57	67				100	20		30	
		PSD-P	0	0	0				100	0		20	
		Wr	83	78	67				105	87		81	
	White Sucker	PSD	100	97	100		100	100		100		100	
		PSD-P	100	90	100		100	96		94		100	
	Yellow Perch	PSD			100				25	81			
		PSD-P			0				0	0			
		Wr			87				104	96			
	std exp gill net	Black Bullhead	PSD	23	11	0							
			PSD-P	0	0	0							
		Black Crappie	PSD		33	100							
PSD-P				0	0								
Wr				102	98								
Channel Catfish		PSD	42	13	17								
		PSD-P	5	0	0								
		Wr	85	80	92								
Common Carp		PSD	81	48	100								

Gear	Species	Index	Year									
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
std exp gill net	Common Carp	PSD-P	25	7	20							
		PSD	80	83	80							
	Northern Pike	PSD-P	20	0	40							
		Wr	93	82	81							
		PSD	0	32	70							
		PSD-P	0	0	0							
	Walleye	Wr	94	81	78							
		PSD	100	100	100							
		PSD-P	83	60	61							
	White Sucker	PSD	100	100	100							
		PSD-P	83	60	61							
	Yellow Perch	PSD	100	50								
PSD-P		100	50									
Wr		94	87									

Length at Capture

Mean length at capture by age across years sampled, sample size (N).

Species: Black Crappie

Mean Length (expanded sample number) at capture by age											
Year	N	1	2	3	4	5	6	7	8	9	10+
2021	52		186 (14)	230 (30)	286 (2)		275 (2)		296 (4)		
2018	39	107 (5)	175 (14)	228 (6)	235 (6)	241 (8)					

Species: Walleye

Mean Length (expanded sample number) at capture by age											
Year	N	1	2	3	4	5	6	7	8	9	10+
2018	1								662 (1)		

Species: Yellow Perch

Mean Length (expanded sample number) at capture by age											
Year	N	1	2	3	4	5	6	7	8	9	10+
2018	4		195 (4)								

Fish Condition

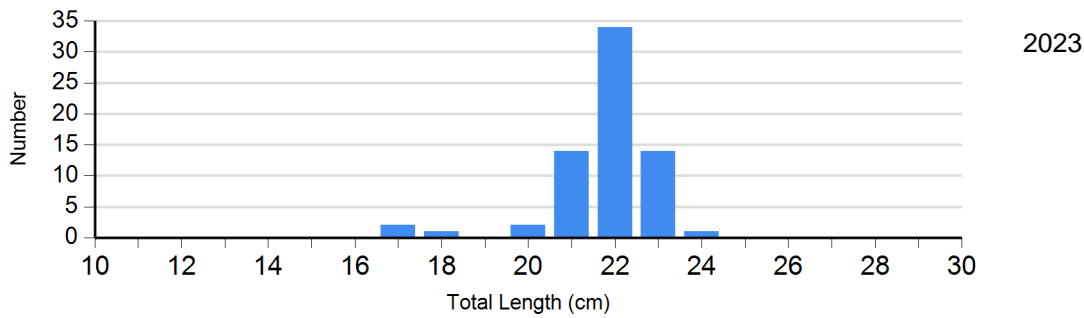
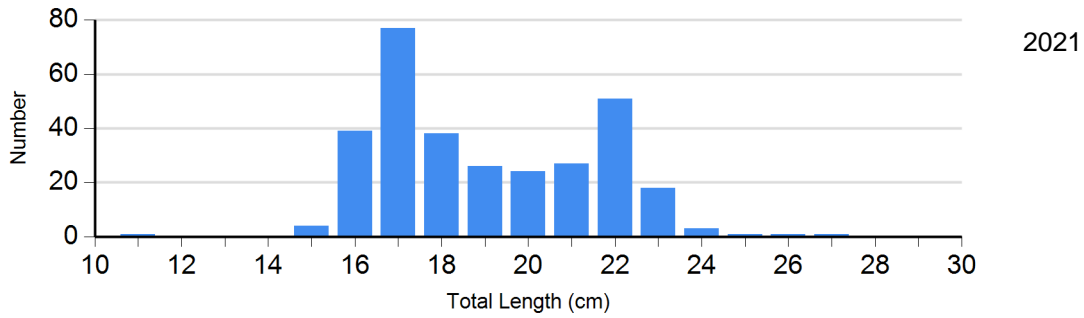
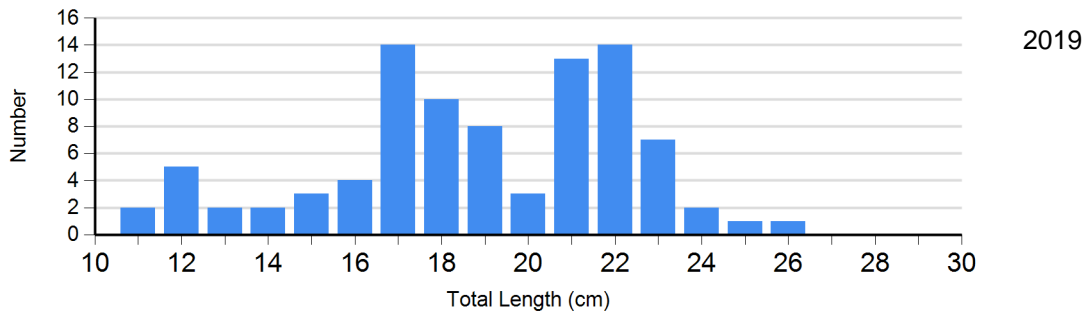
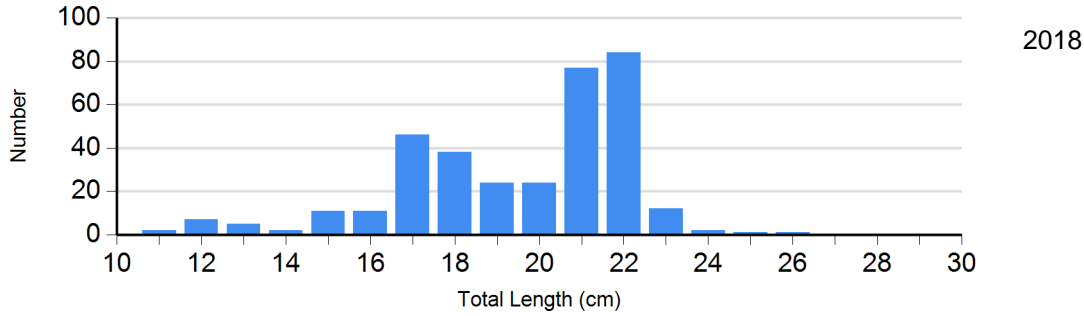
Mean relative weight (Wr) by sample size (N), length category stock to quality (S-Q), quality to preferred (Q-P), preferred to memorable (P-M), and memorable (M) for species collected across survey years with standard error (SE).

Species	Year	Length Groups							
		S-Q		Q-P		P-M		M	
		N	Wr (SE)	N	Wr (SE)	N	Wr (SE)	N	Wr (SE)
Black Crappie Frame Net	2019	21	114 (2.4)	16	100 (4.8)	19	94 (1.5)	0	
	2021	14	111 (3.5)	30	100 (2.0)	10	94 (2.1)	5	86 (1.7)
	2023	103	121 (4.1)	17	110 (8.0)	19	92 (1.2)	9	88 (6.3)
Channel Catfish Gill Net	2019	17	93 (2.1)	39	97 (2.2)	1		0	
	2021	12	82 (3.2)	45	90 (2.6)	7	91 (1.4)	0	
	2023	11	85 (2.3)	14	98 (2.5)	1	117	0	
Northern Pike Gill Net	2021	0		1	71	0		0	
	2023	0		1	89	0		0	
Walleye Gill Net	2019	1		0		3	94 (2.4)	0	
	2021	2	88 (8.2)	2	89 (1.3)	1	81	0	
	2023	0		4	87 (2.3)	0		0	
Yellow Perch Gill Net	2019	15	114 (2.1)	5	98 (4.1)	0		0	
	2021	0		3	90 (4.0)	0		0	
	2023	1	100	2	97 (5.8)	0		0	

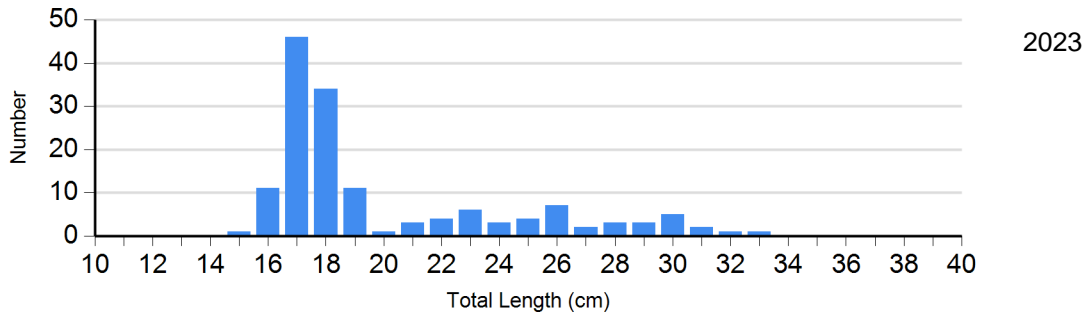
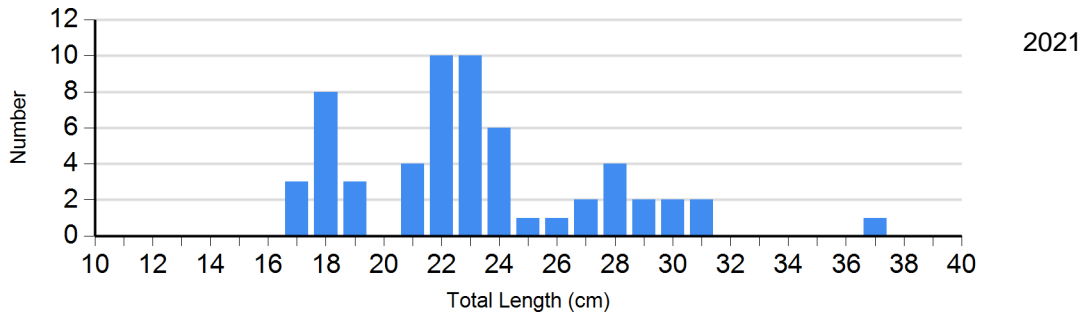
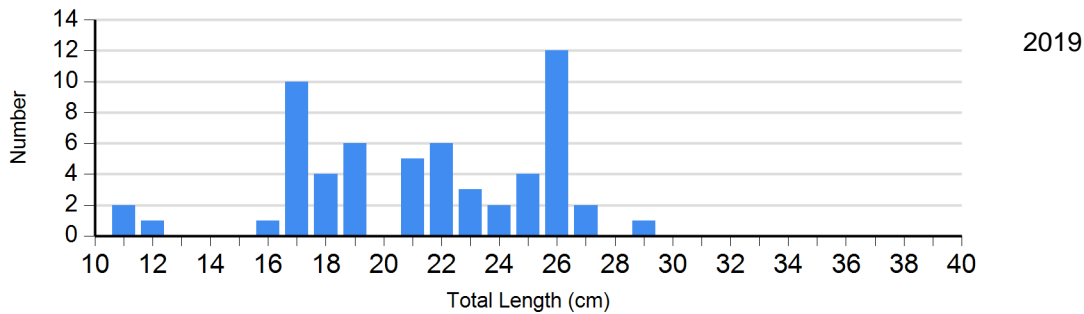
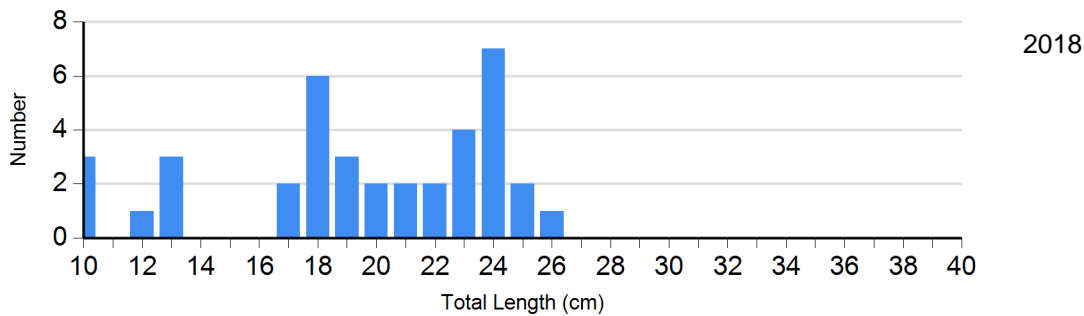
Length Frequency Distribution

Length frequency histogram of species sampled by year.

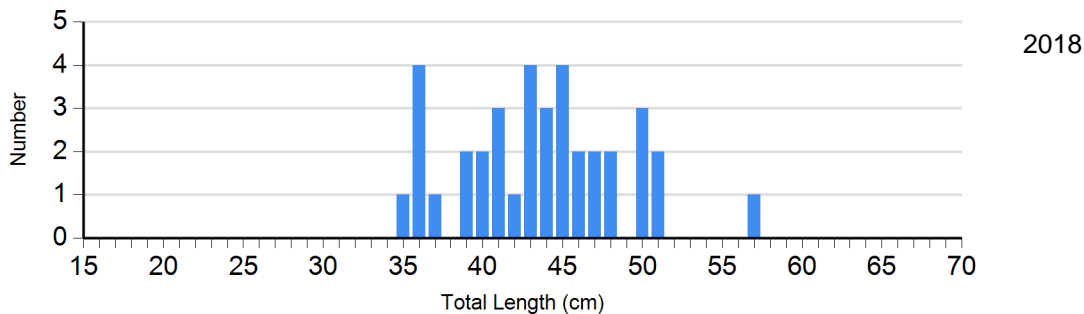
Species: Black Bullhead
Gear: AFS std gill net

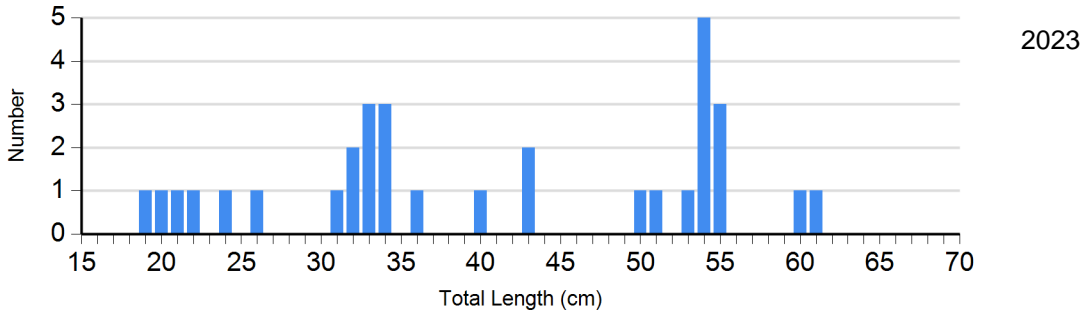
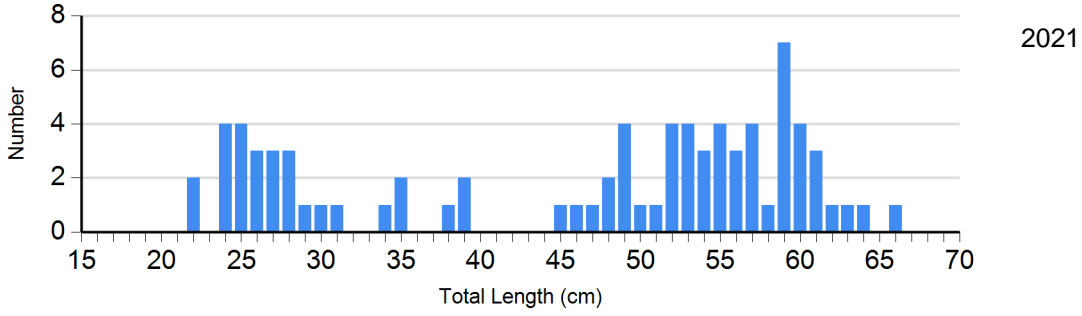
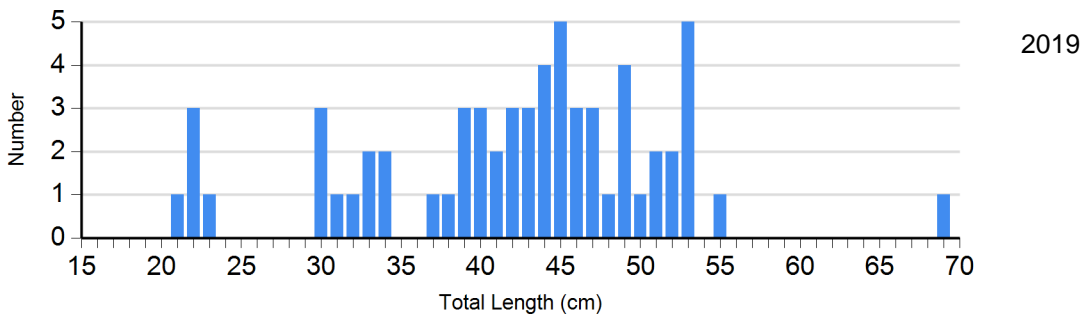


Species: Black Crappie
 Gear: frame net (std 3/4 in)

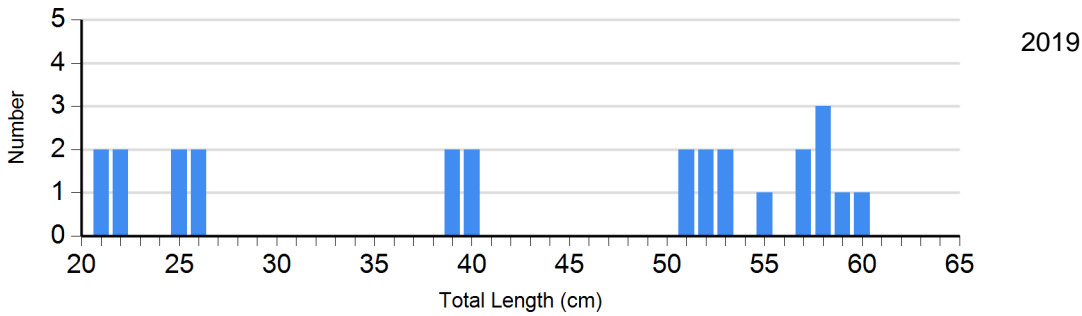
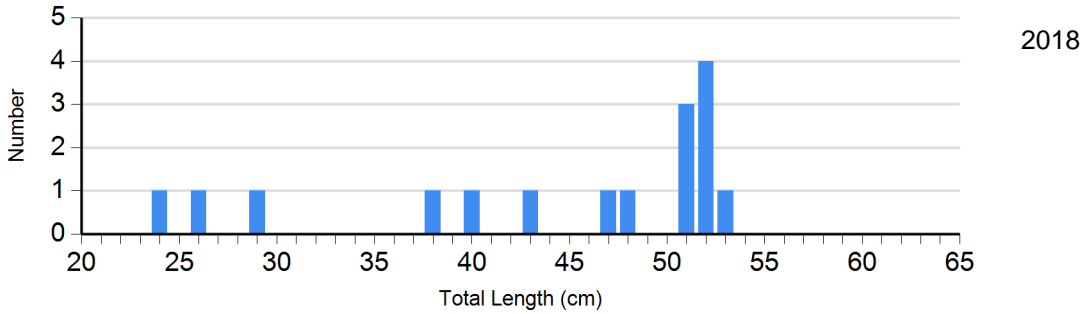


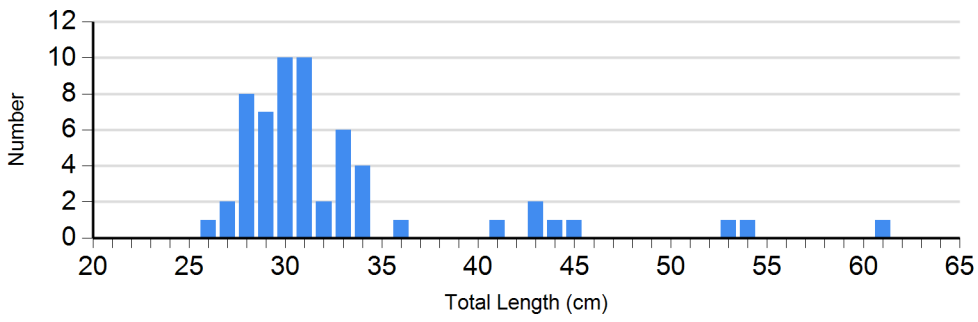
Species: Channel Catfish
 Gear: AFS std gill net



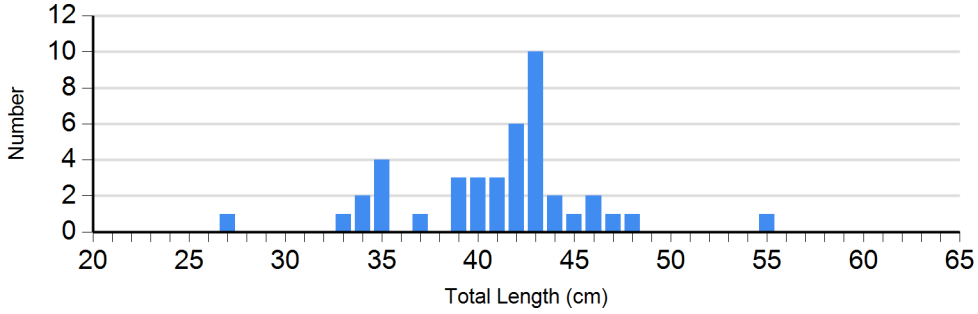


Species: Common Carp
 Gear: AFS std gill net



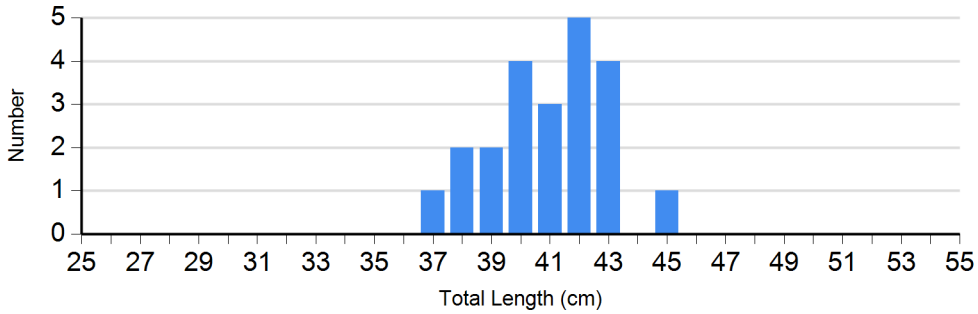


2021

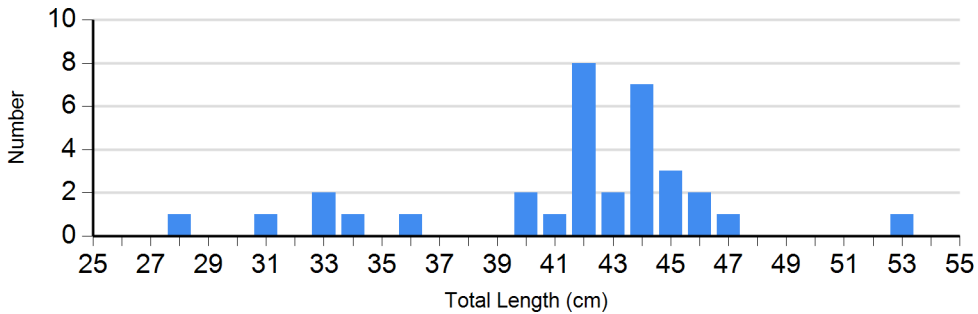


2023

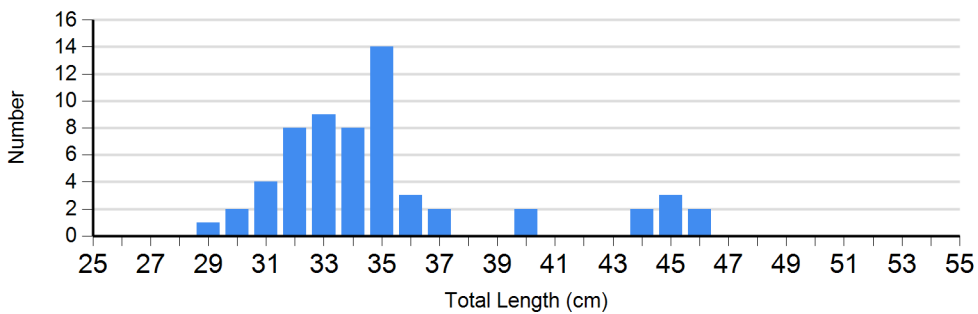
Species: White Sucker
Gear: AFS std gill net



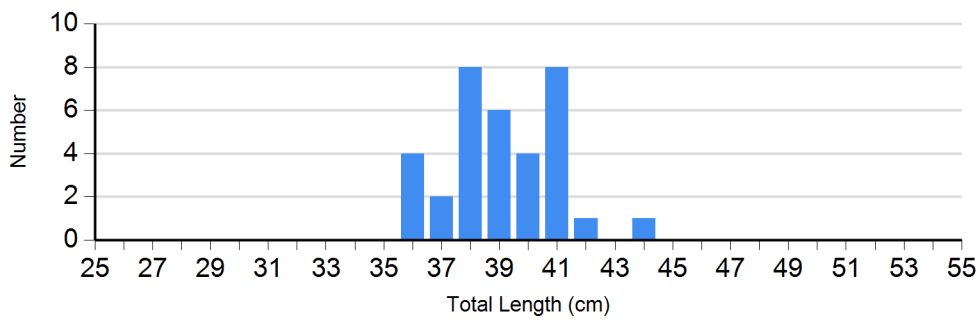
2018



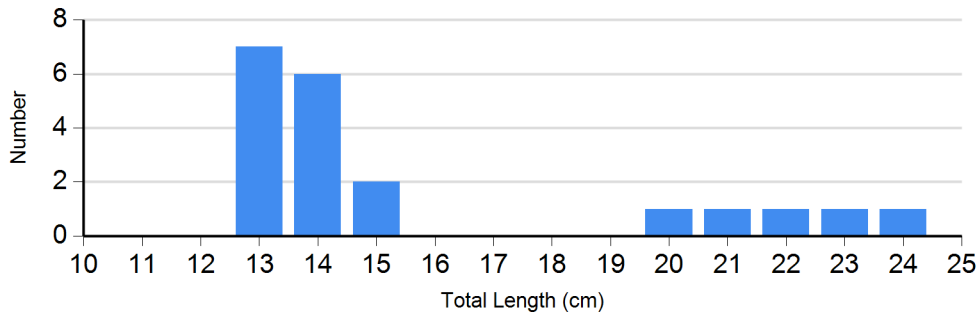
2019



2021



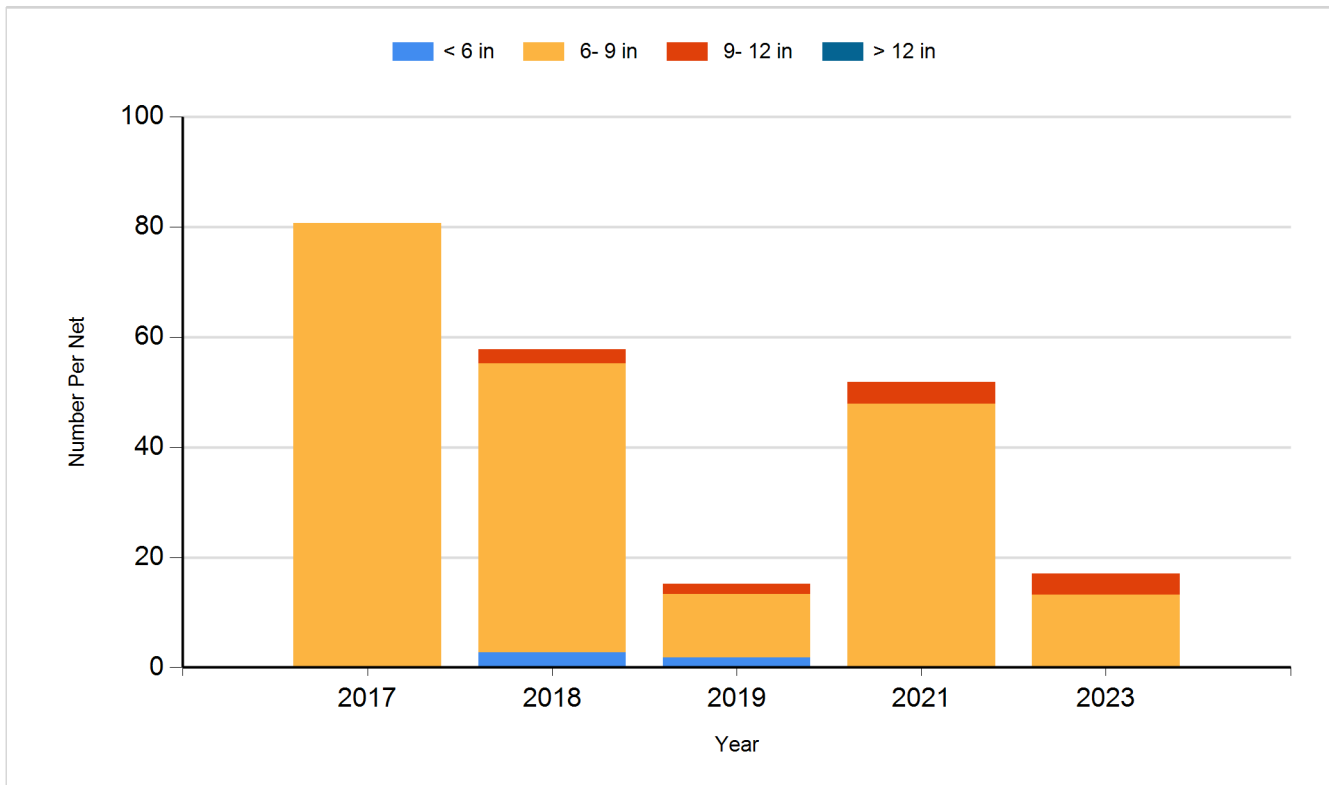
Species: Yellow Perch
 Gear: AFS std gill net



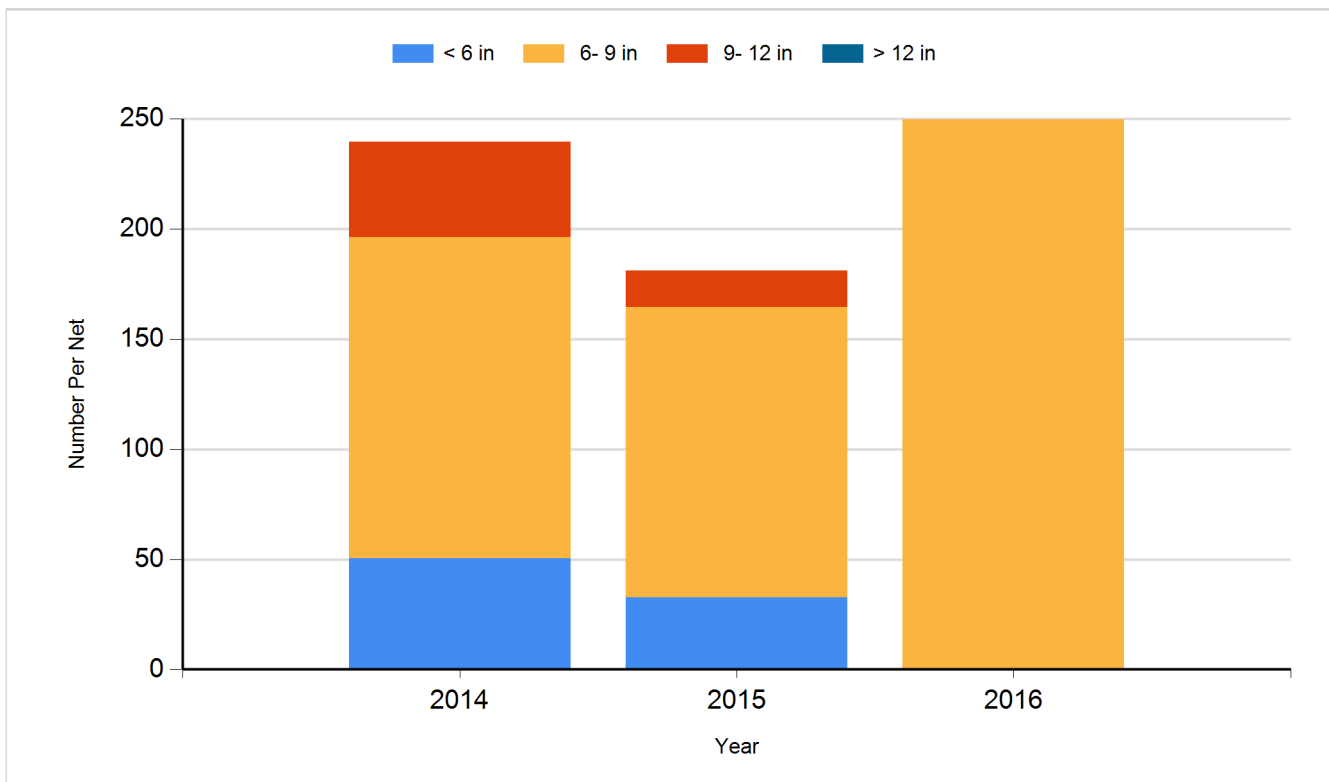
Historic Fish Sizes and Relative Abundance

Size distribution per net by color for species sampled by year.

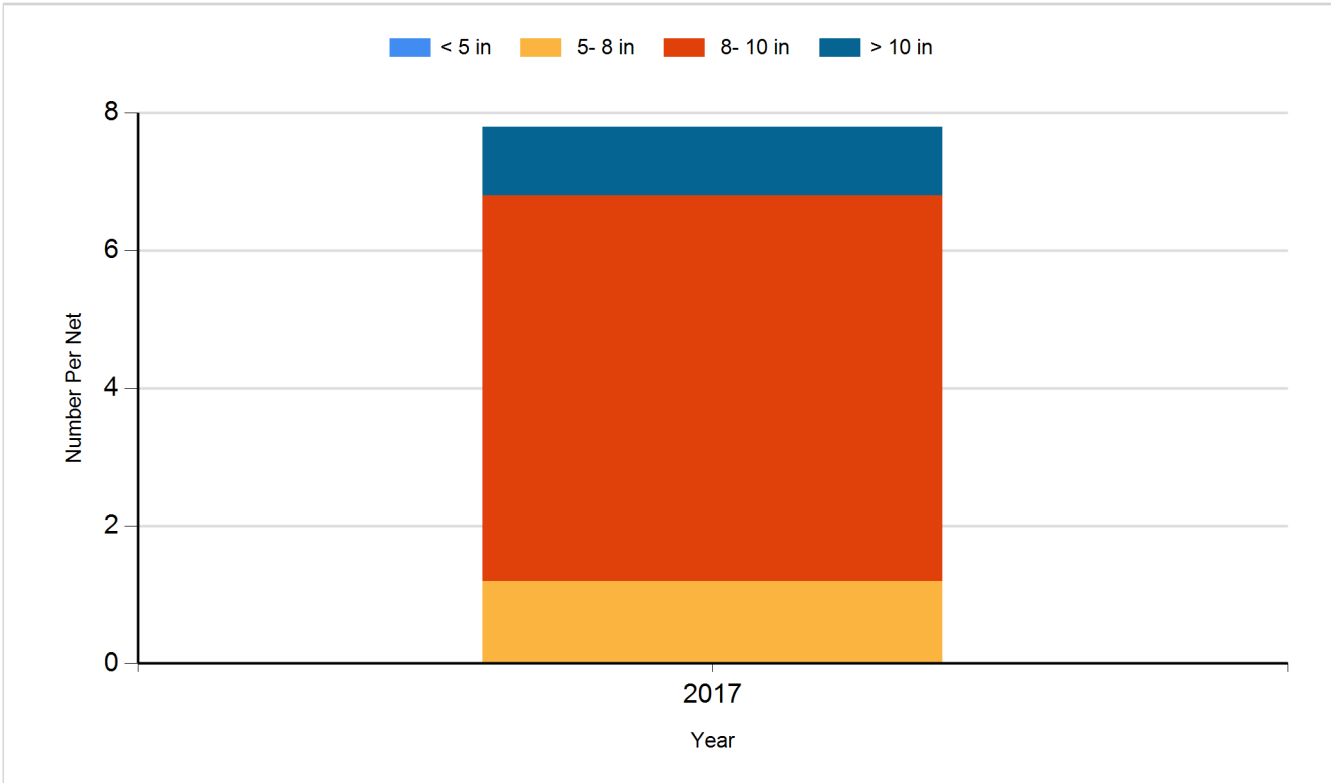
Species: Black Bullhead
Gear: AFS std gill net



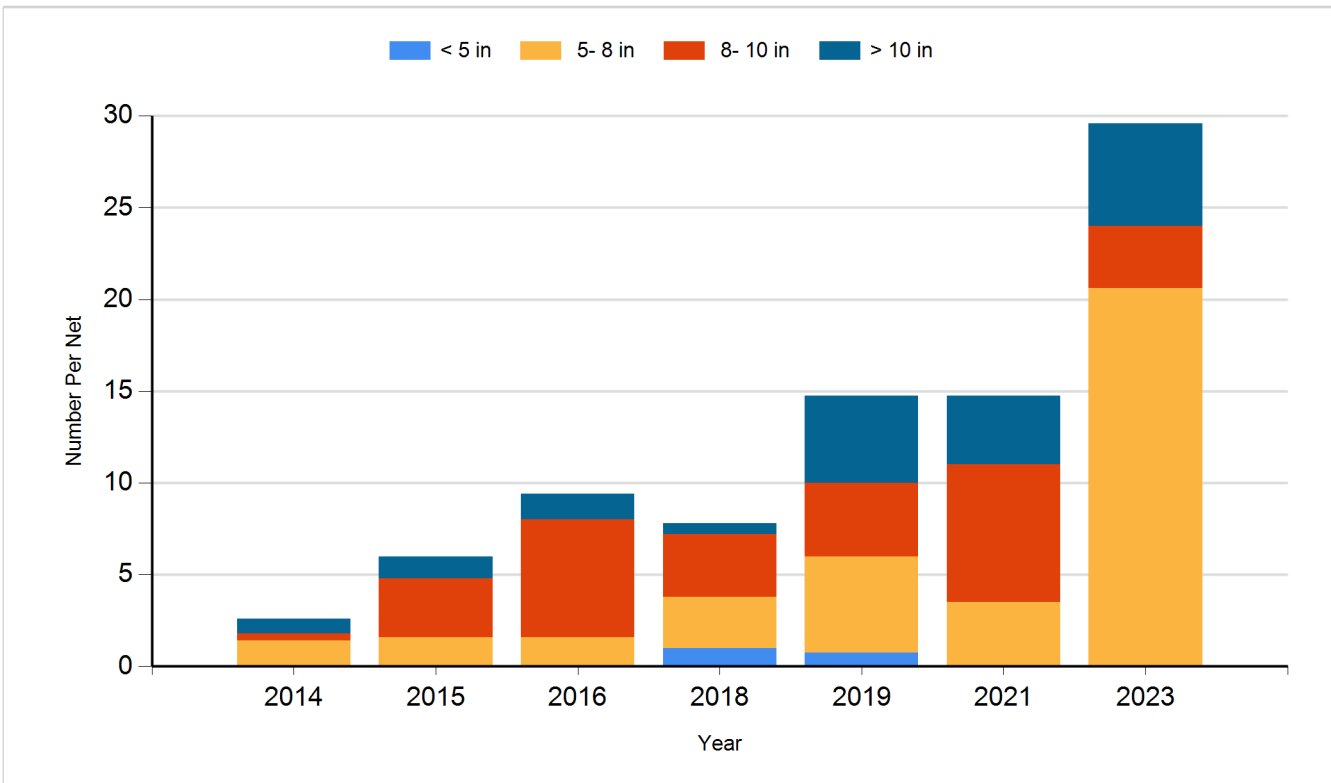
Species: Black Bullhead
Gear: std exp gill net



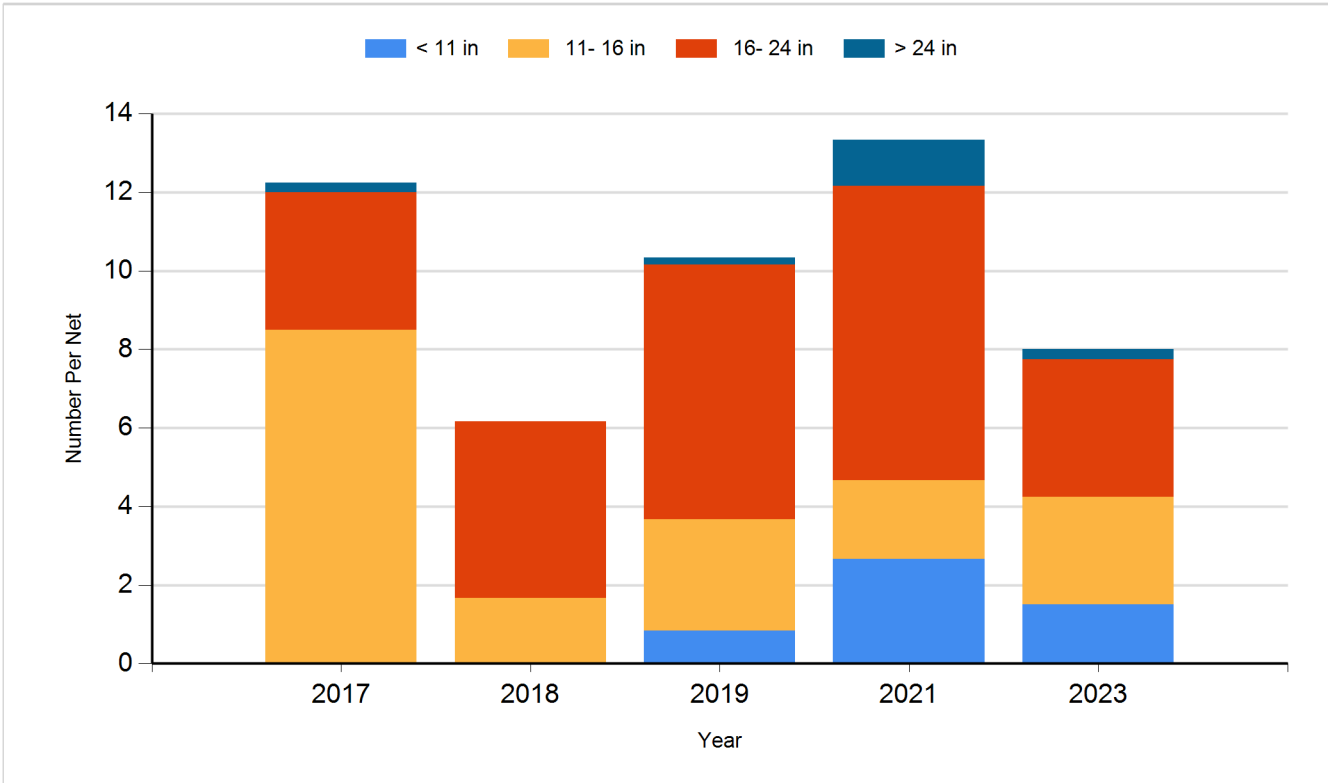
Species: Black Crappie
Gear: AFS std frame net



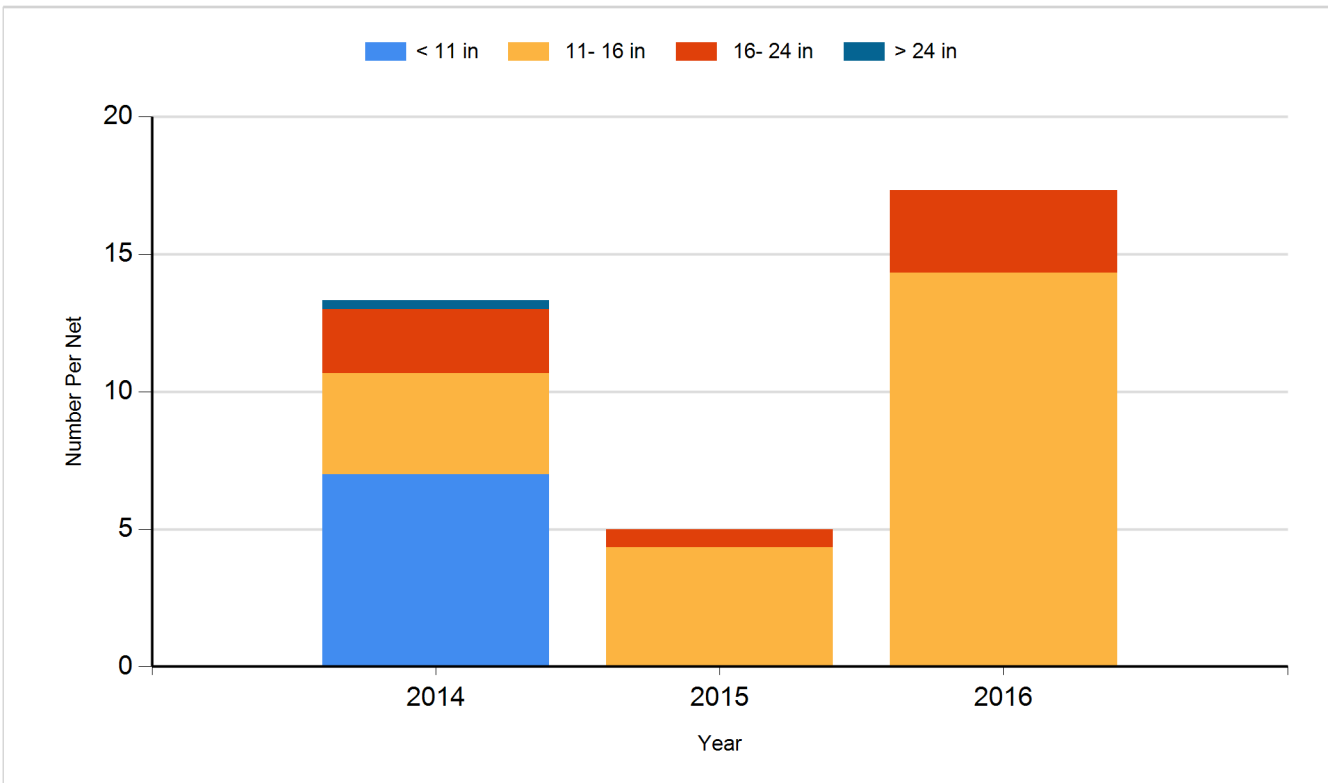
Species: Black Crappie
Gear: frame net (std 3/4 in)



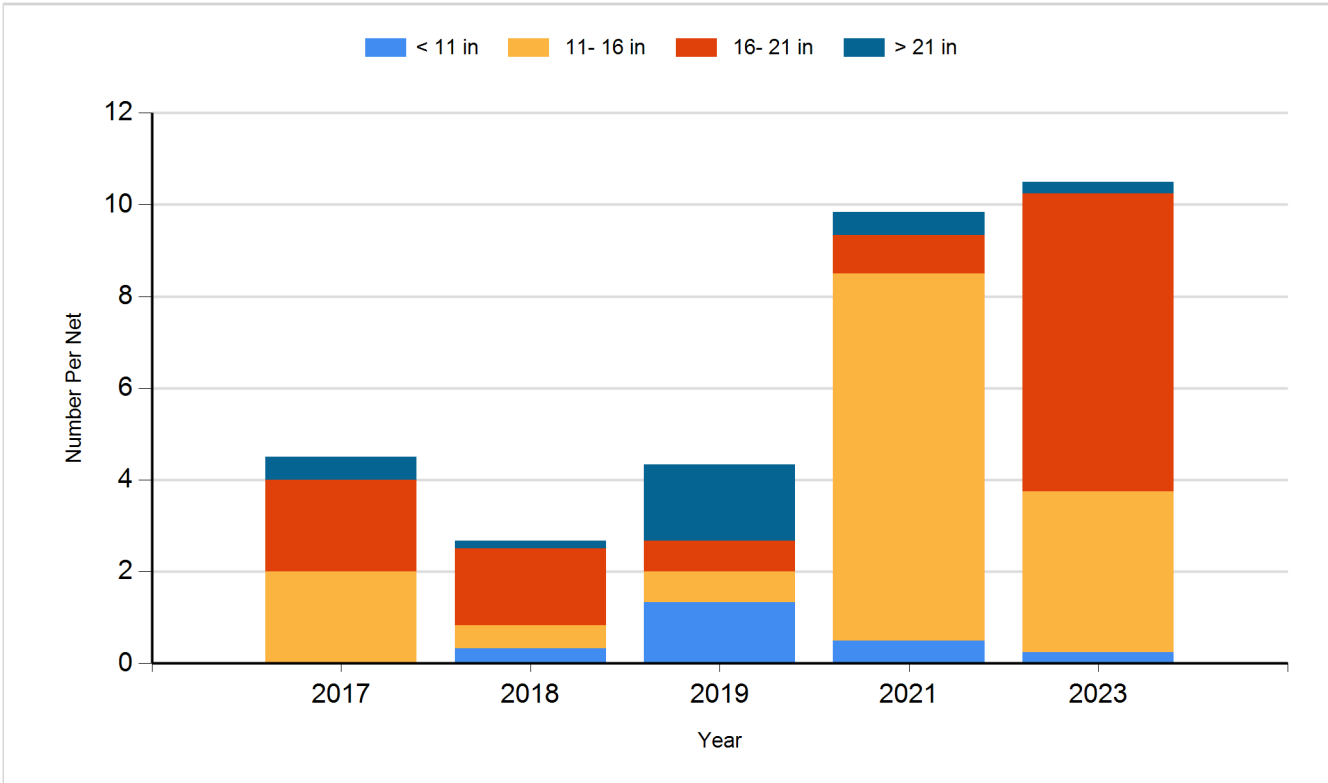
Species: Channel Catfish
Gear: AFS std gill net



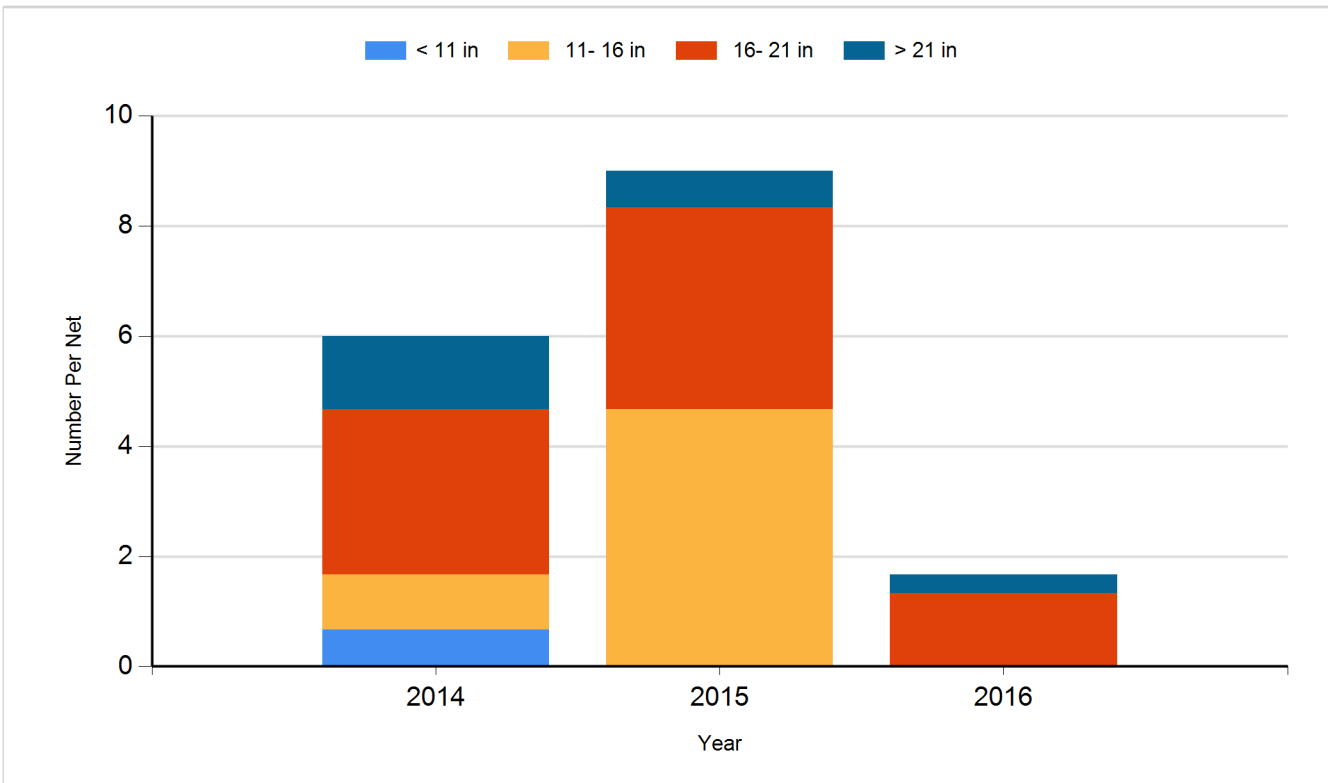
Species: Channel Catfish
Gear: std exp gill net



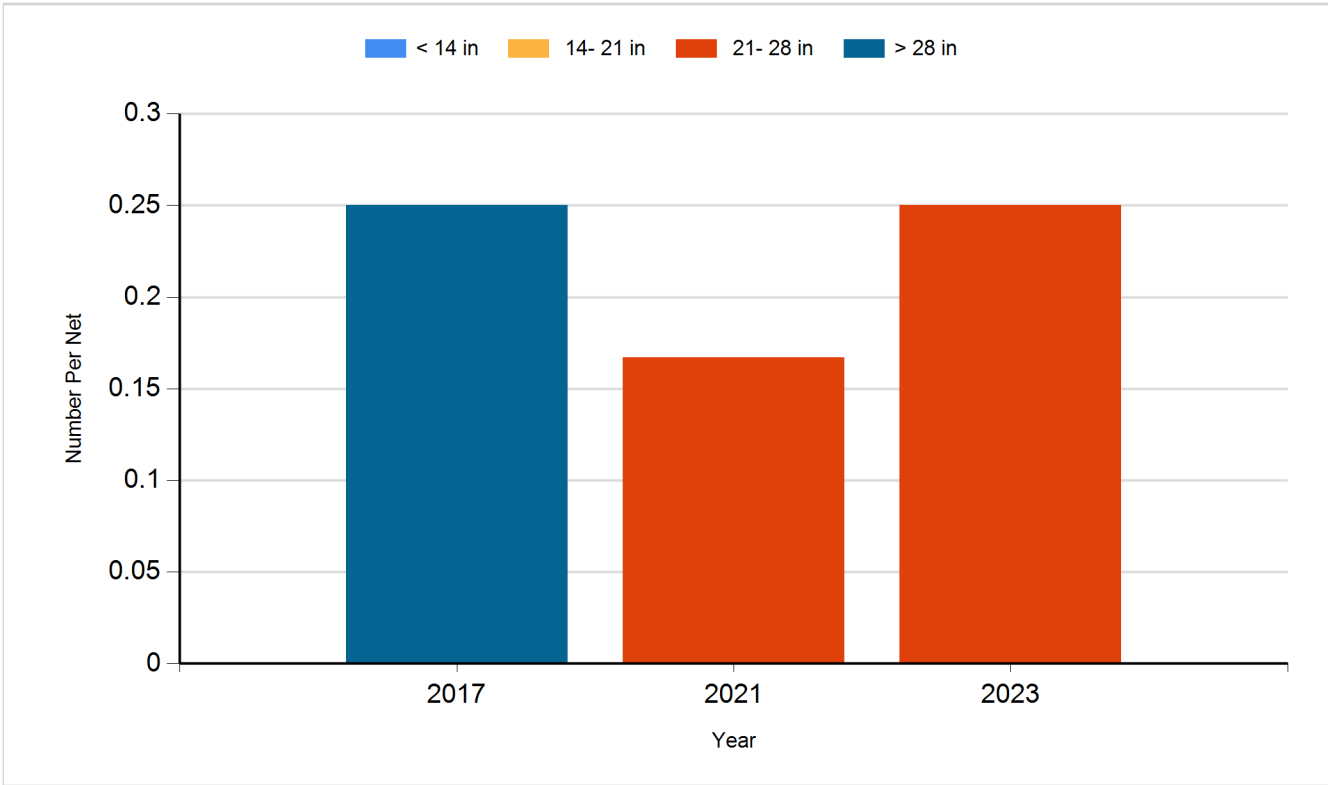
Species: Common Carp
Gear: AFS std gill net



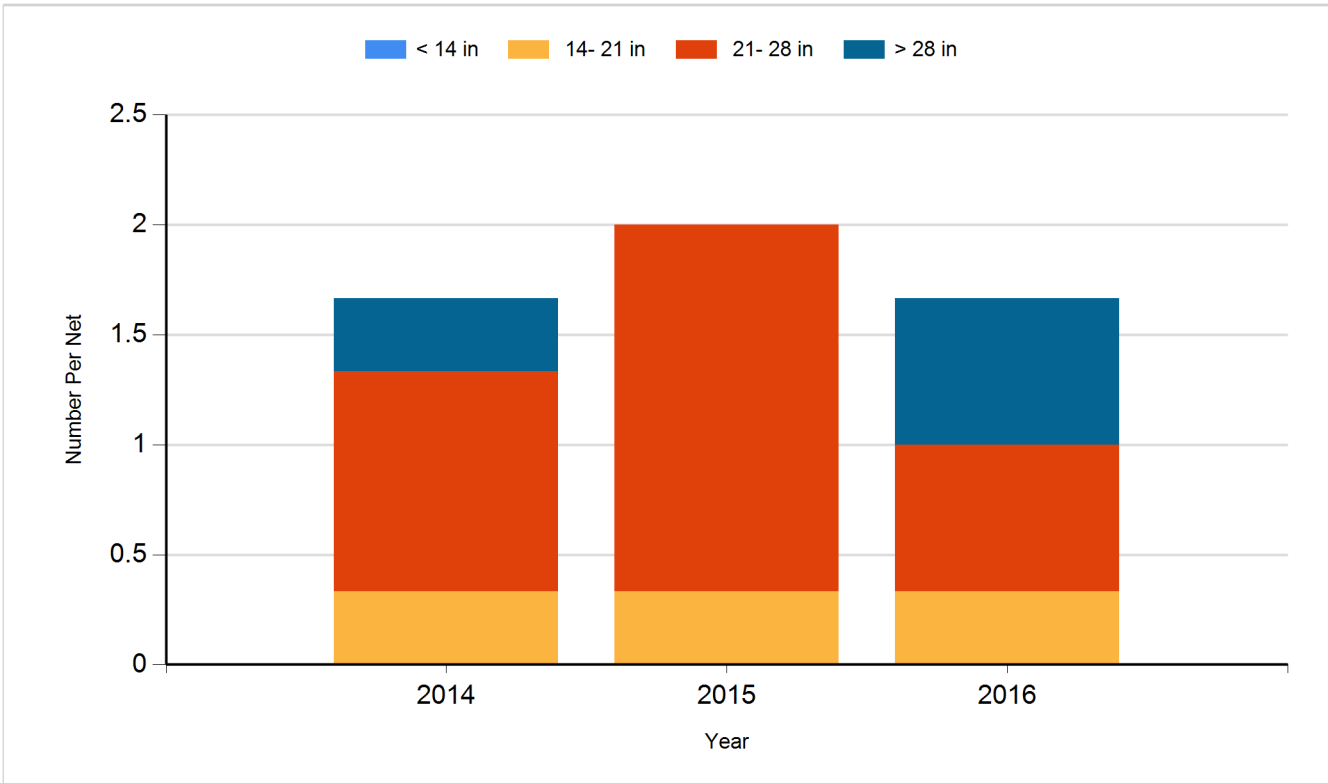
Species: Common Carp
Gear: std exp gill net



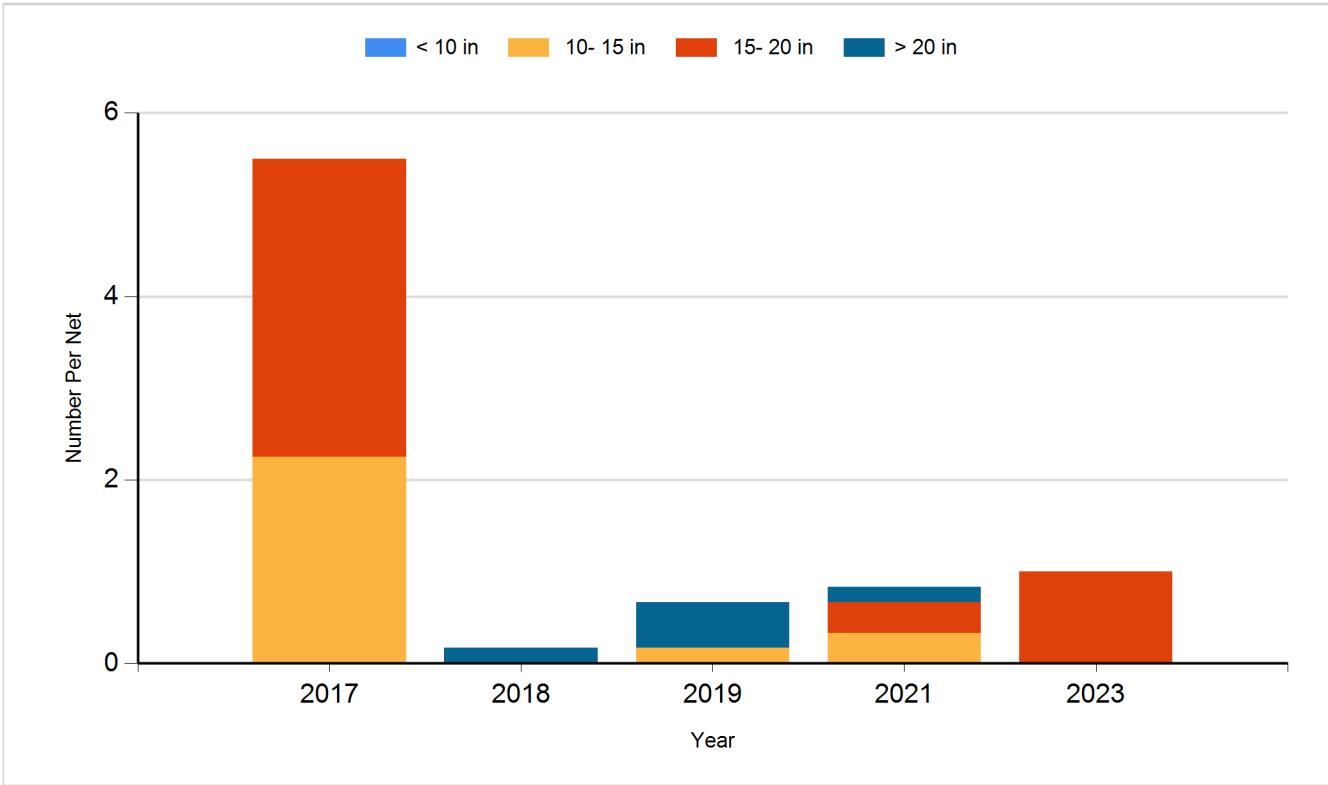
Species: Northern Pike
Gear: AFS std gill net



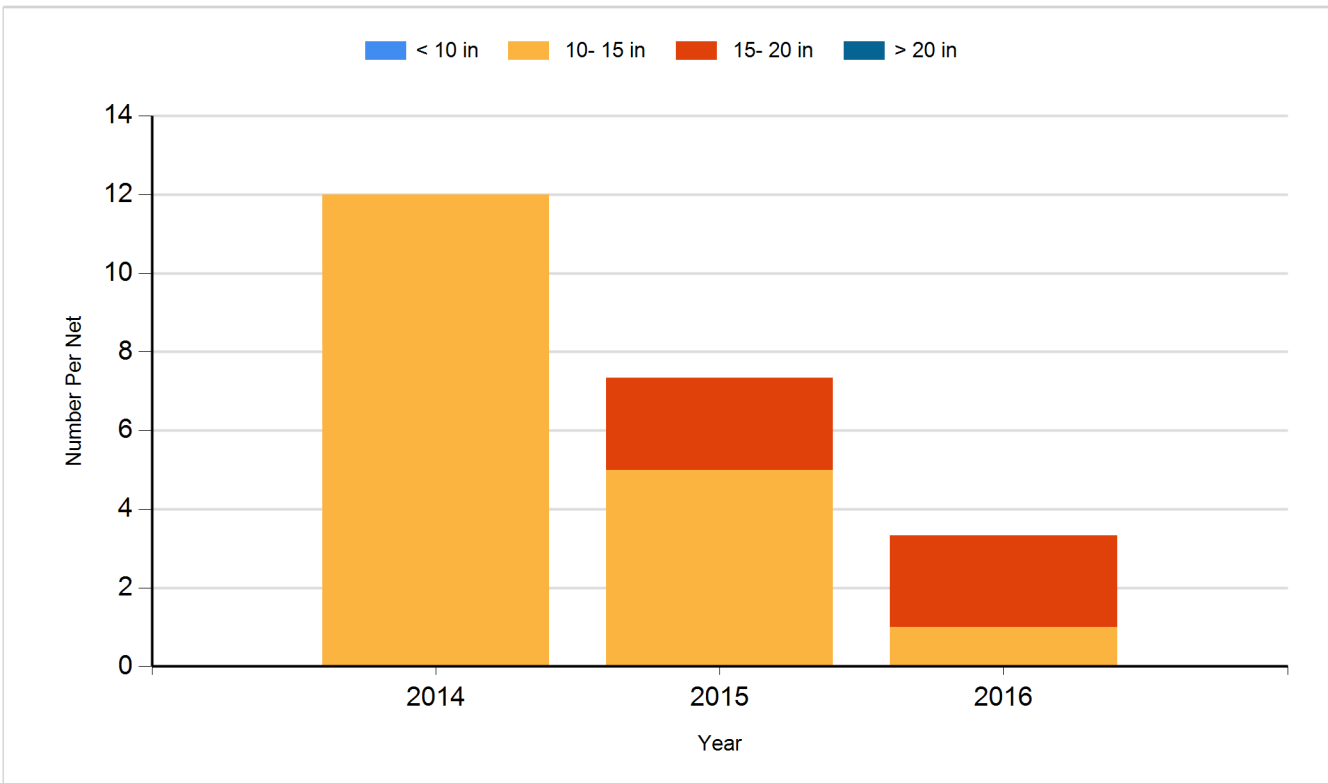
Species: Northern Pike
Gear: std exp gill net



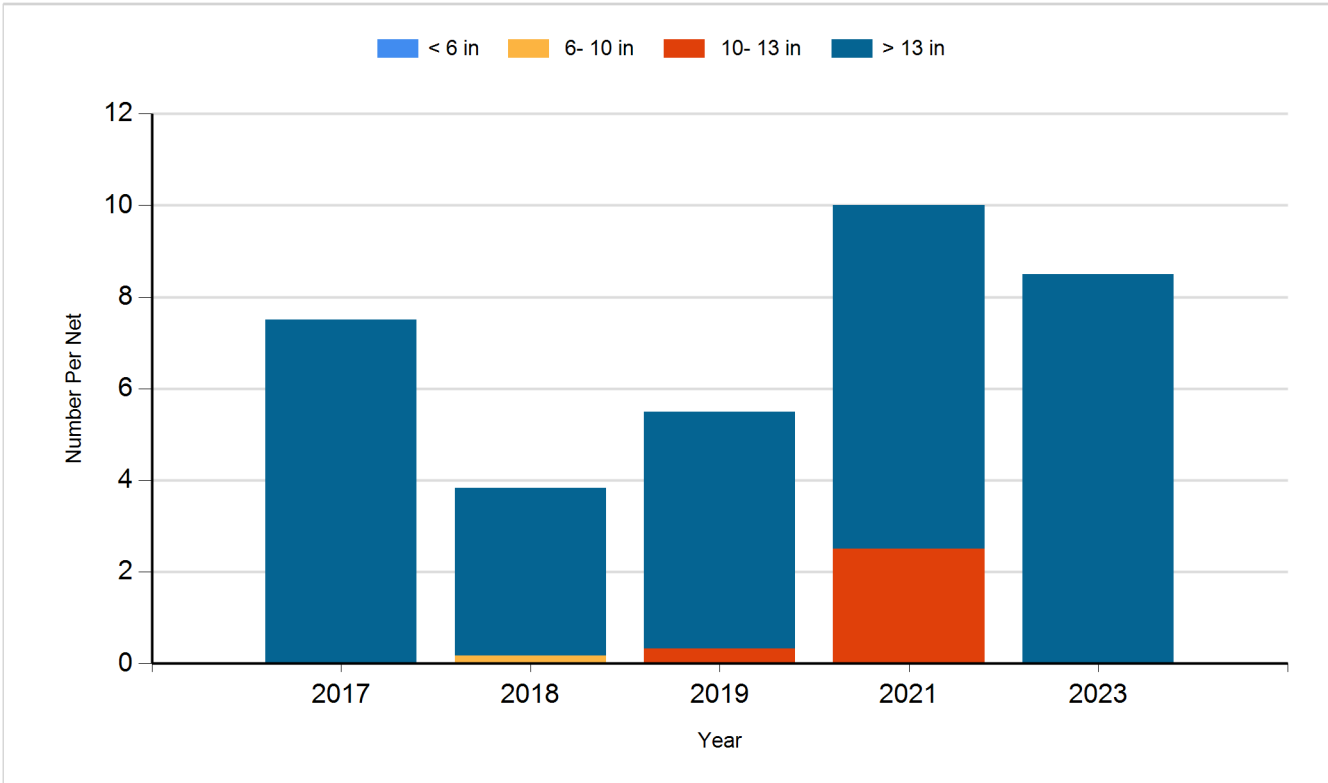
Species: Walleye
Gear: AFS std gill net



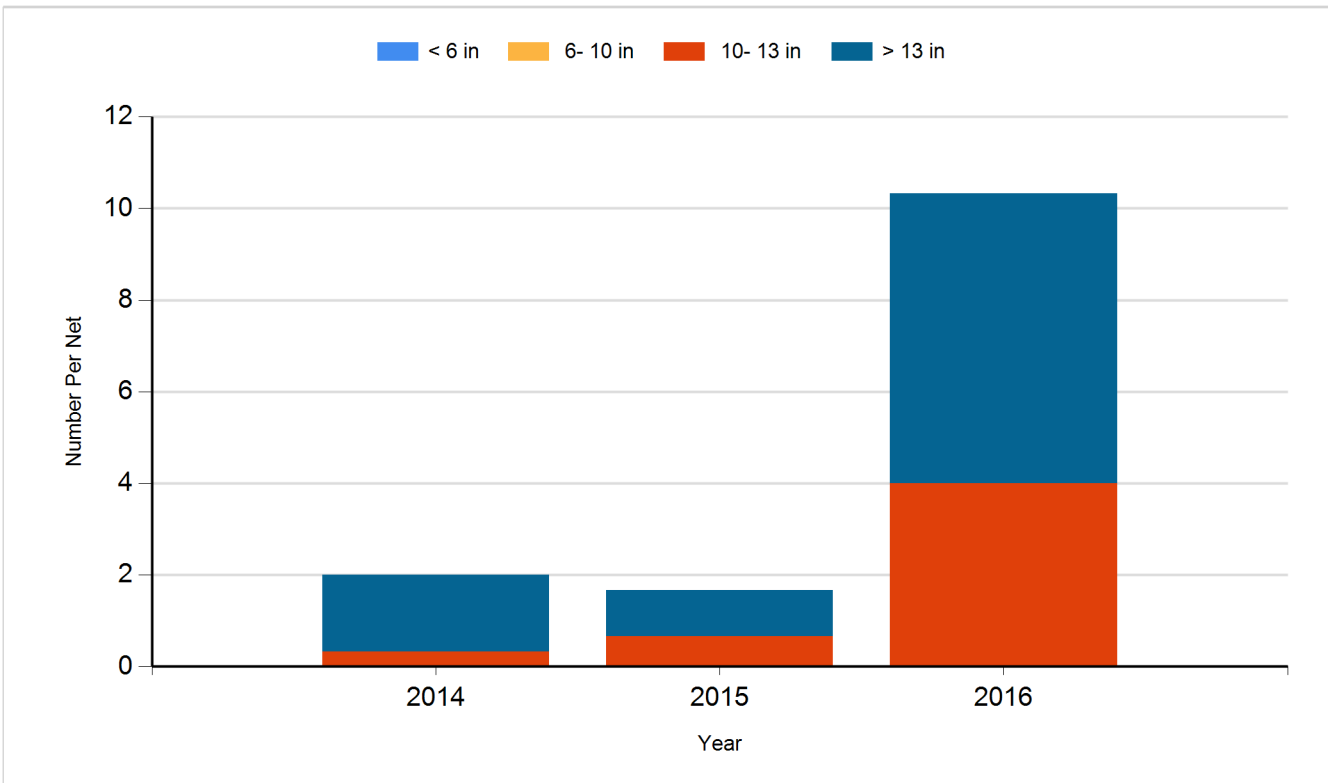
Species: Walleye
Gear: std exp gill net



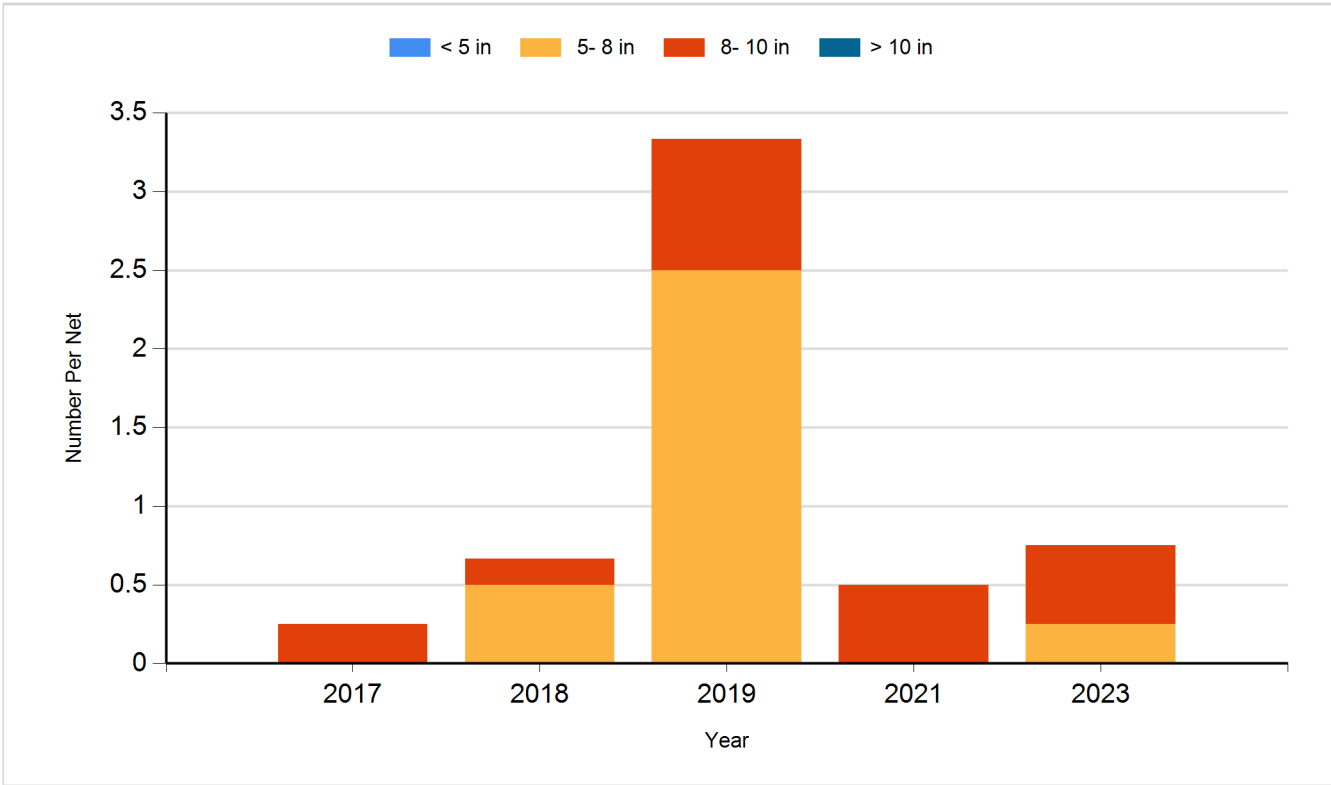
Species: White Sucker
Gear: AFS std gill net



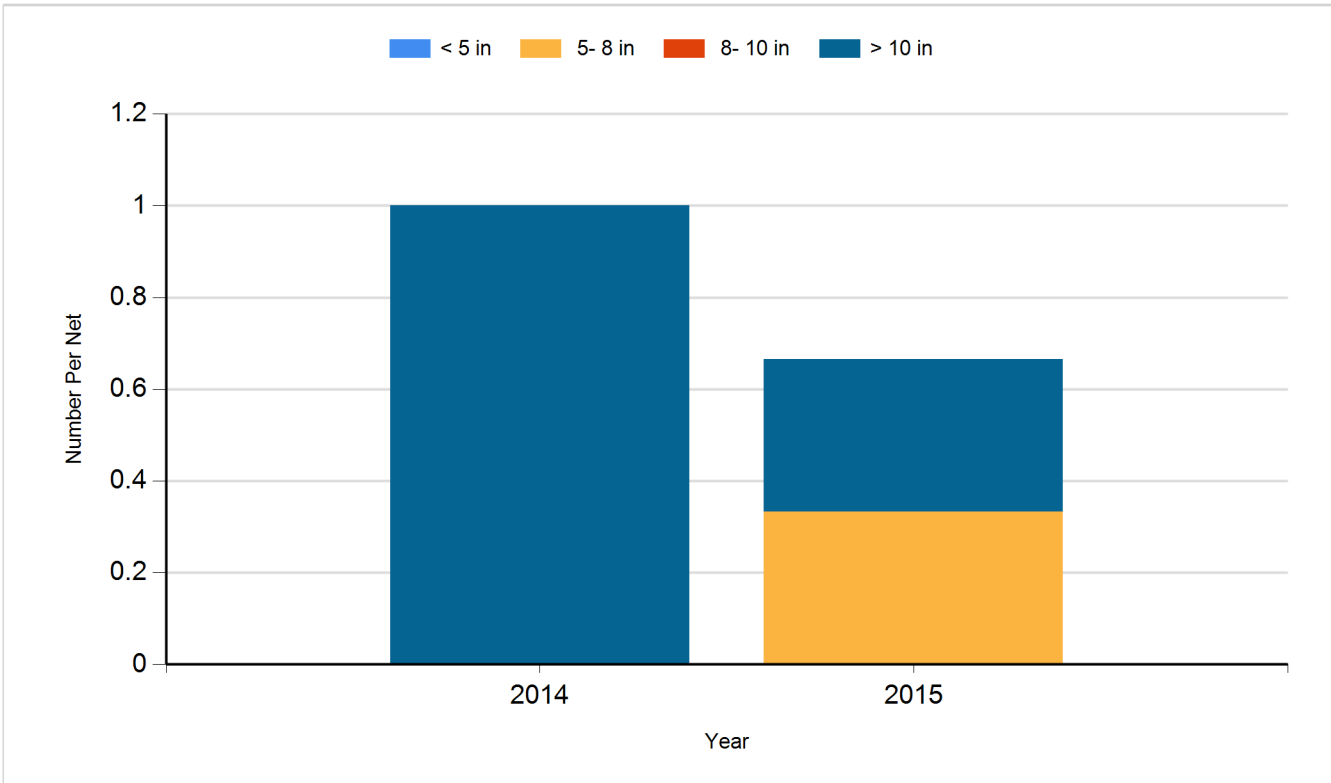
Species: White Sucker
Gear: std exp gill net



Species: Yellow Perch
Gear: AFS std gill net



Species: Yellow Perch
Gear: std exp gill net



Fish Stocking

Number of fish stocked by year, species, and size.

Year	Species	Size	Number
2012	Largemouth Bass	Juvenile	1,739
2015	Walleye	Small Fingerling	14,080
2016	Gizzard Shad	Adult	437
2016	Walleye	Fingerling	680
2016	Walleye	Juvenile	467
2017	Yellow Perch	Adult	6,953
2019	Walleye	Small Fingerling	15,680
2021	Gizzard Shad	Adult	135
2021	Walleye	Juvenile	18,300
2021	Yellow Perch	Small Fingerling	44,551
2023	Saugeye	Juvenile	14,960