

# SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

Carthage, Miner County

MJA-Lake-598-000

2021

## 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 08, 2021	6 net-nights
frame net (std 3/4 in)	Jun 08, 2021	4 net-nights

## **Common Fish Species Present**

Black Bullhead

White Sucker

Common Carp

Black Crappie

Channel Catfish

Yellow Perch

Northern Pike

Bluegill

Walleye

Pumpkinseed

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## 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	317	52.3	12.8	4	2	0			
	Black Crappie	1	0.2	0.2	100		0		121	
	Channel Catfish	80	10.7	2.6	81	7	11	6	88	3
	Common Carp	59	9.3	4.9	14	7	5			
	Northern Pike	1	0.2	0.2	100		0		71	
	Walleye	5	0.8	0.6	60		20		87	4
	White Sucker	60	10.0	5.3	100		75	8		
	Yellow Perch	3	0.5	0.3	100		0		90	5
frame net (std 3/4 in)	Black Bullhead	400	96.0	96.5	6	2	0			
	Black Crappie	59	14.8	9.5	76	8	25	8	101	2
	Bluegill	8	2.0	3.3	88		25		125	6
	Channel Catfish	12	1.3	1.0	80		0		93	9
	Common Carp	65	15.5	9.2	35	9	15	7		
	Northern Pike	19	4.8	4.0	42	18	0		82	2
	Pumpkinseed	1	0.3	0.4	0		0			
	Sunfish Hybrid	3	0.0	0.0						
	Walleye	5	1.3	1.6	20		0		87	2
	White Sucker	113	28.3	31.0	100		91	4		
	Yellow Perch	21	5.3	4.6	81		0		96	3

## 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	
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021		
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						0.0						0.00
	Walleye						2.0						2.00
White Sucker						4.4						4.40	
AFS std gill net	Black Bullhead						80.8	55.2	13.3		52.3		50.40
	Black Crappie						0.8	0.2	0.0		0.2		0.30
	Channel Catfish						12.3	6.2	9.5		10.7		9.68
	Common Carp						4.5	2.3	3.0		9.3		4.78
	Gizzard Shad						2.3	0.0	0.0		0.0		0.58
	Northern Pike						0.3	0.0	0.0		0.2		0.13
	Walleye						5.5	0.2	0.7		0.8		1.80
	White Sucker						7.5	3.8	5.5		10.0		6.70
	Yellow Perch						0.3	0.7	3.3		0.5		1.20
frame net (std 3/4 in)	Black Bullhead	810.6	100.4	377.4	1,495.6			576.0	35.5		96.0		498.79
	Black Crappie	0.1	2.6	6.0	9.4			6.8	14.0		14.8		7.67
	Bluegill	0.0	1.0	0.8	1.4			0.0	1.5		2.0		0.96
	Channel Catfish	0.7	3.8	0.4	6.2			1.6	0.5		1.3		2.07
	Common Carp	1.5	1.8	0.8	3.8			0.0	0.0		15.5		3.34
	Green Sunfish	0.0	0.0	0.2	0.0			0.0	0.5		0.0		0.10
	Northern Pike	0.4	2.0	3.0	3.4			0.0	0.0		4.8		1.94
	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	0.0		0.3		0.04
	Sunfish Hybrid	0.0	0.0	0.0	0.0			0.0	0.0		0.0		0.00
	Walleye	0.0	0.2	1.4	0.6			0.0	0.3		1.3		0.54
White Sucker	8.4	38.0	7.8	5.4			14.6	6.0		28.3		15.50	

		CPUE										
Gear	Species	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Avg
frame net (std	Yellow Perch		0.1	0.0	0.0	0.2		0.0	3.0		5.3	1.23
std exp gill net	Black Bullhead			189.3	148.3	249.7						195.7 7
	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												
			2012	2013	2014	2015	2016	2017	2018	2019	2020	2021			
AFS std frame net	Black Bullhead	PSD								1					
		PSD-P								0					
	Black Crappie	PSD								85					
		PSD-P								13					
		Wr								98					
	Bluegill	PSD								14					
		PSD-P								0					
		Wr								122					
	Channel Catfish	PSD								100					
		PSD-P								0					
		Wr								107					
	Common Carp	PSD								92					
		PSD-P								75					
	Northern Pike	PSD								100					
		PSD-P								50					
		Wr								88					
	Walleye	PSD								30					
		PSD-P								0					
		Wr								80					
	White Sucker	PSD								100					
PSD-P									100						
AFS std gill net	Black Bullhead	PSD								0	5	14			4
		PSD-P								0	0	0			0
	Black Crappie	PSD								100	100				100
		PSD-P								0	0				0
		Wr								102	92				121
	Channel Catfish	PSD								31	73	70			81
		PSD-P								2	0	2			11
		Wr								94	95	96			88
	Common Carp	PSD								56	79	78			14
		PSD-P								11	7	56			5
	Northern Pike	PSD								100					100
		PSD-P								100					0



Gear	Species	Index	Year										
			2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
AFS std gill net	Northern Pike	Wr							78				71
		PSD							59	100	75		60
		PSD-P							0	100	75		20
		Wr							85	103	94		87
	White Sucker	PSD							100	96	100		100
		PSD-P							100	96	94		75
	Yellow Perch	PSD							100	25	25		100
		PSD-P							0	0	0		0
		Wr							84	99	110		90
frame net (std 3/4 in)	Black Bullhead	PSD		8	23	2	0			7	11		6
		PSD-P		0	0	0	0			1	0		0
		Wr		87									
	Black Crappie	PSD		100	46	73	83			59	63		76
		PSD-P		0	31	20	15			9	34		25
		Wr		126	122	108	96			110	103		101
	Bluegill	PSD			80	25	100					17	88
		PSD-P			20	0	29					0	25
		Wr			95	102	103					137	125
	Channel Catfish	PSD		14	11	0	0			38	100		80
		PSD-P		0	5	0	0			0	0		0
		Wr		87	84	72	83			86	105		93
	Common Carp	PSD		47	100	50	95						35
		PSD-P		13	33	50	42						15
		Wr		85									
	Northern Pike	PSD		100	90	80	88						42
		PSD-P		50	10	27	47						0
		Wr		78	90	77	78						82
	Walleye	PSD			0	57	67					100	20
		PSD-P			0	0	0					100	0
		Wr			83	78	67					105	87
	White Sucker	PSD		100	100	97	100			100	100		100
		PSD-P		99	100	90	100			100	96		91
		Wr		95									
	Yellow Perch	PSD		100			100					25	81
		PSD-P		0			0					0	0
		Wr		115			87					104	96

Gear	Species	Index	Year									
			2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
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					
		PSD-P			25	7	20					
		Wr										
	Northern Pike	PSD			80	83	80					
		PSD-P			20	0	40					
		Wr			93	82	81					
	Walleye	PSD			0	32	70					
		PSD-P			0	0	0					
		Wr			94	81	78					
	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)					
2013	1				241 (1)						

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**

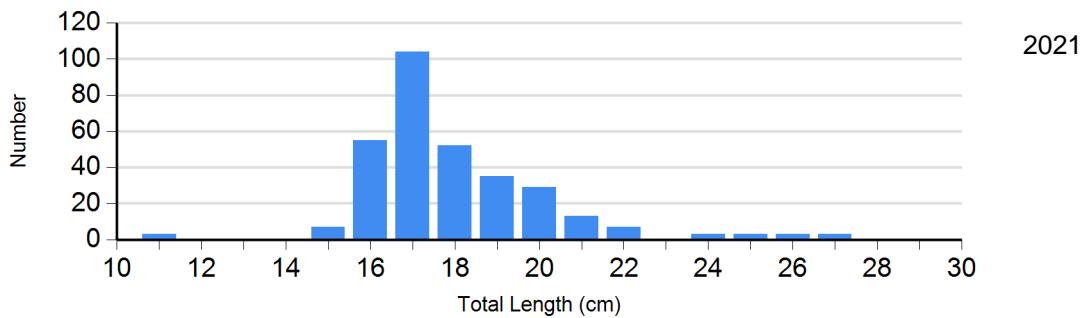
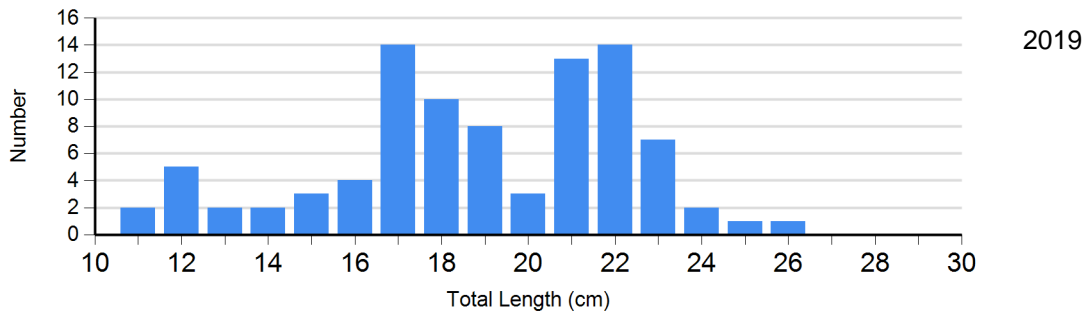
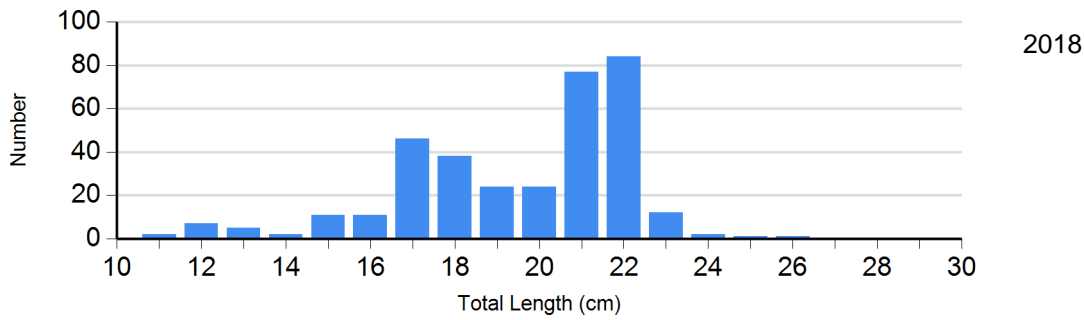
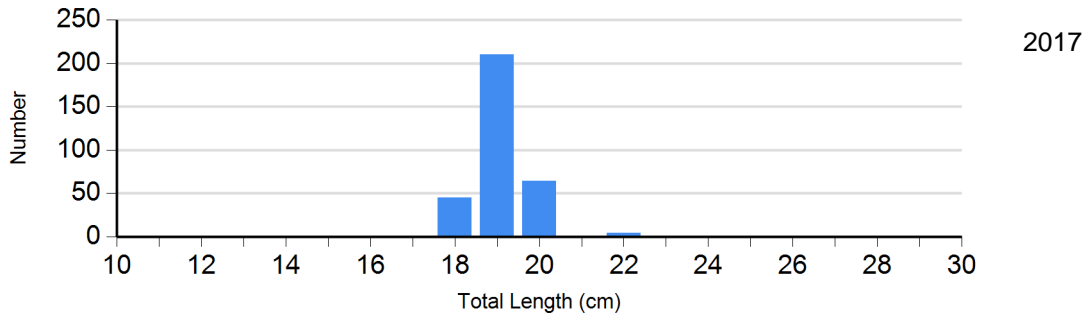
Mean relative weight (Wr) by sample size (N), length category stock to quality (S-Q), quality to preferred (Q-P), preferred to memorable (P-M), and memorable (M) for species collected across survey years with standard error (SE).

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	2017	6	107 (1.4)	28	98 (1.5)	5	87 (7.0)	0	
	2018	14	118 (1.6)	17	104 (1.7)	3	103 (3.0)	0	
	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)
Bluegill Frame Net	2017	6	127 (6.0)	1	104	0		0	
	2019	5	138 (6.6)	1	131	0		0	
	2021	1	153	5	123 (2.8)	2	117 (5.9)	0	
Channel Catfish Gill Net	2017	34	95 (2.0)	14	95 (3.2)	1	83	0	
	2018	10	91 (3.1)	27	96 (1.8)	0		0	
	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	
Northern Pike Gill Net	2017	0		0		1	78	0	
	2021	0		1	71	0		0	
Walleye Gill Net	2017	9	82 (2.0)	13	87 (1.5)	0		0	
	2018	0		0		0		1	103
	2019	1		0		3	94 (2.4)	0	
	2021	2	88 (8.2)	2	89 (1.3)	1	81	0	
Yellow Perch Gill Net	2017	0		1	84	0		0	
	2018	3	102 (2.2)	1	91	0		0	
	2019	15	114 (2.1)	5	98 (4.1)	0		0	
	2021	0		3	90 (4.0)	0		0	

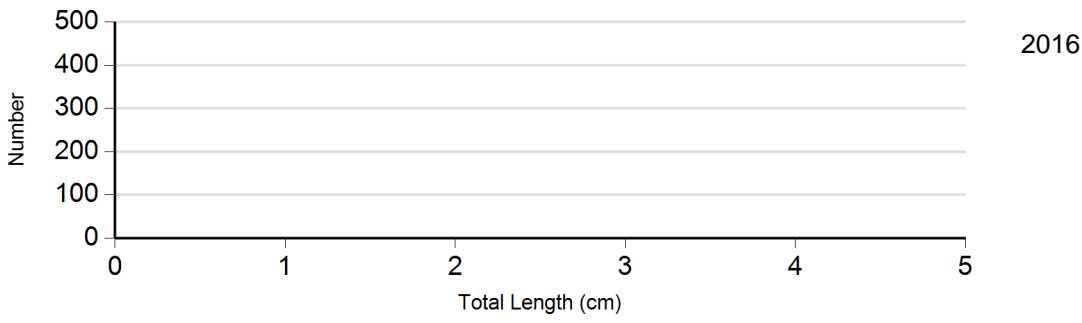
## Length Frequency Distribution

Length frequency histogram of species sampled by year.

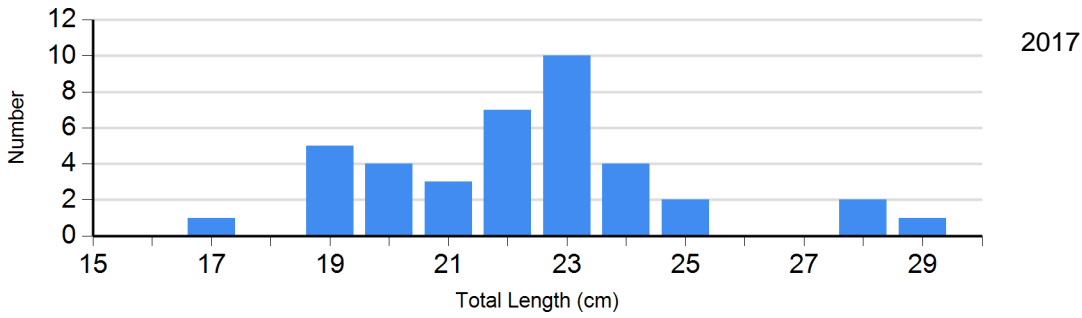
Species: Black Bullhead  
Gear: AFS std gill net



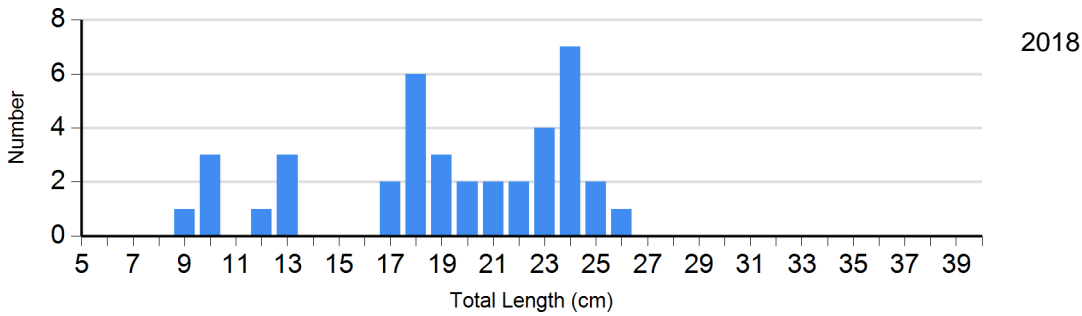
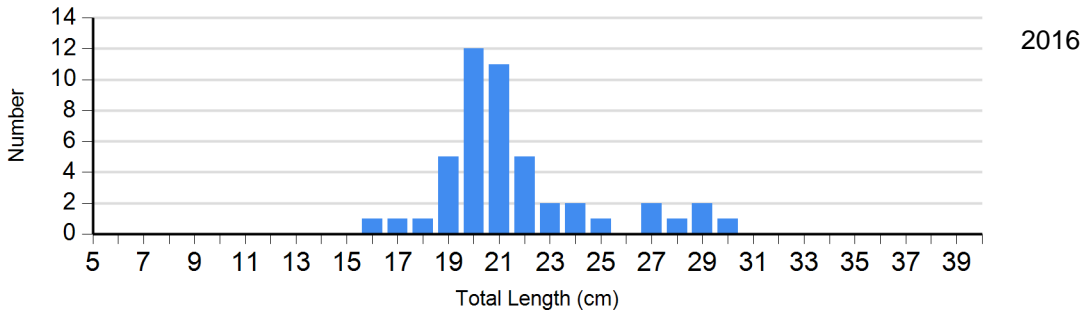
Species: Black Bullhead  
 Gear: std exp gill net

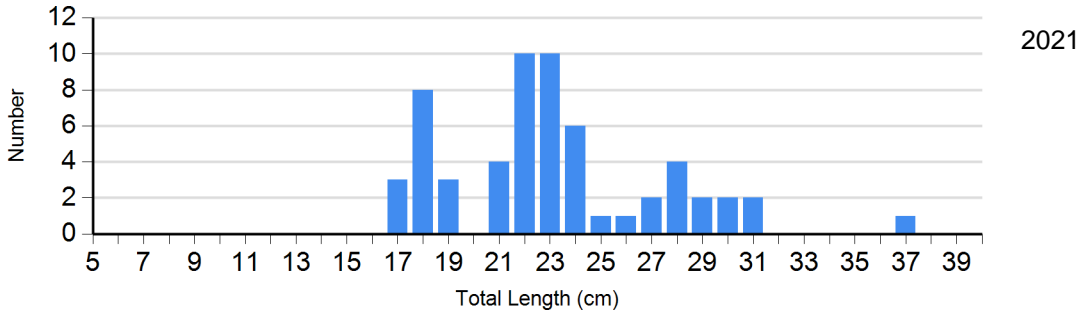
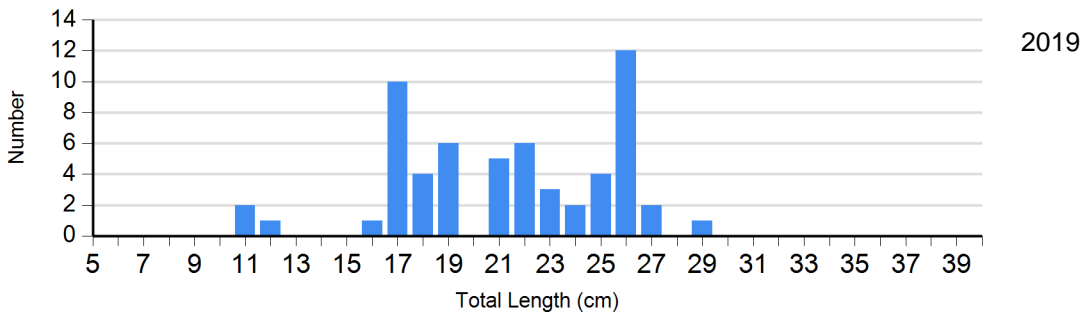


Species: Black Crappie  
 Gear: AFS std frame net

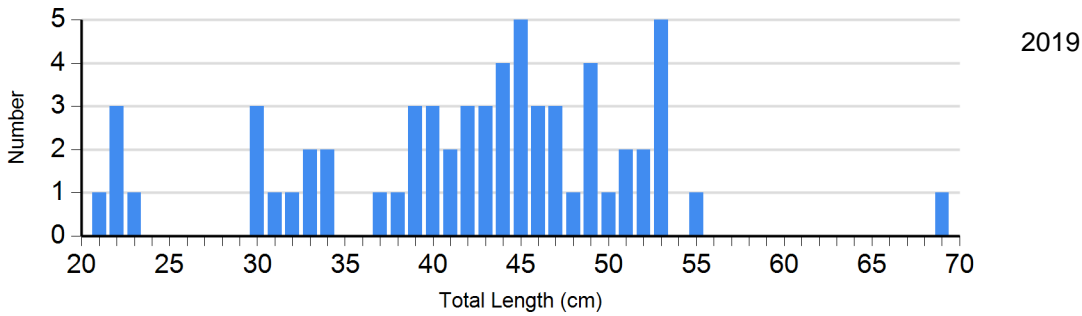
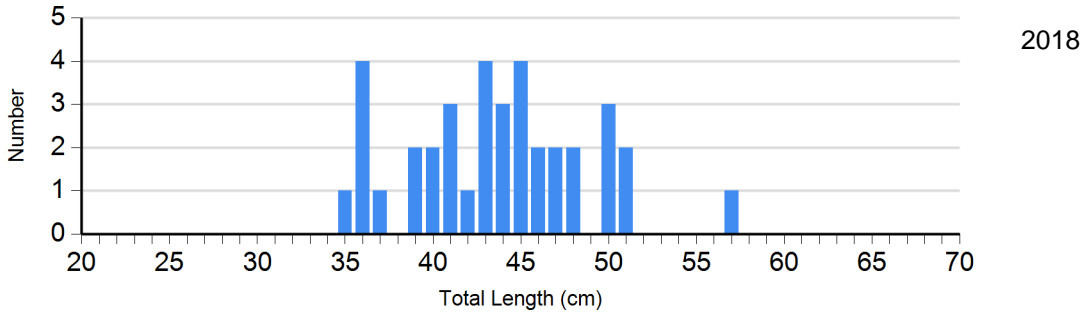
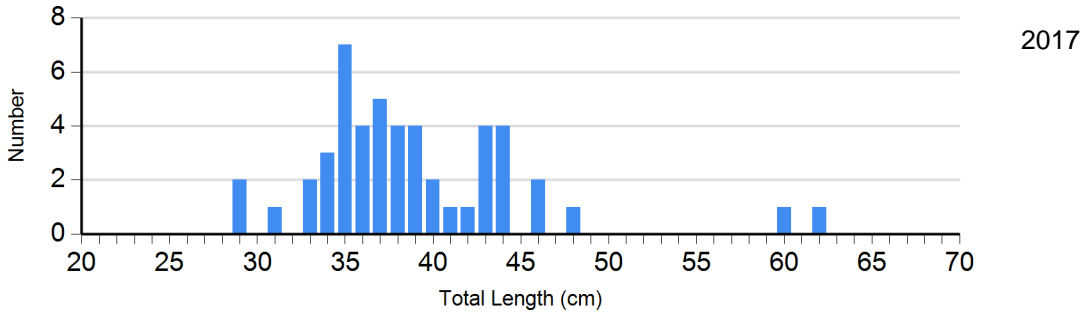


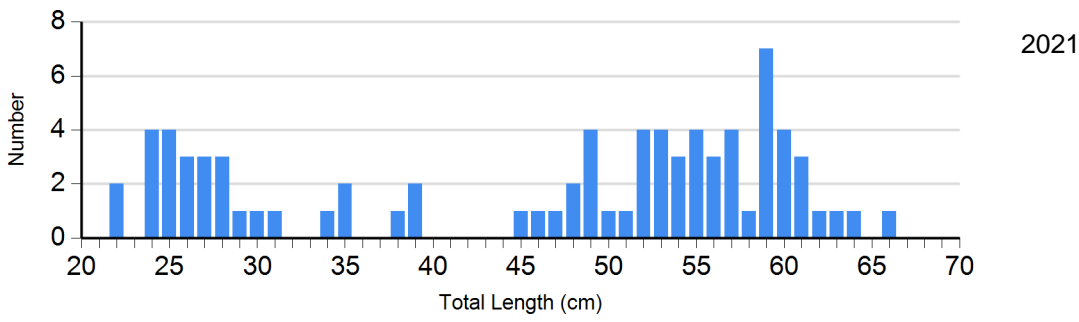
Species: Black Crappie  
 Gear: frame net (std 3/4 in)



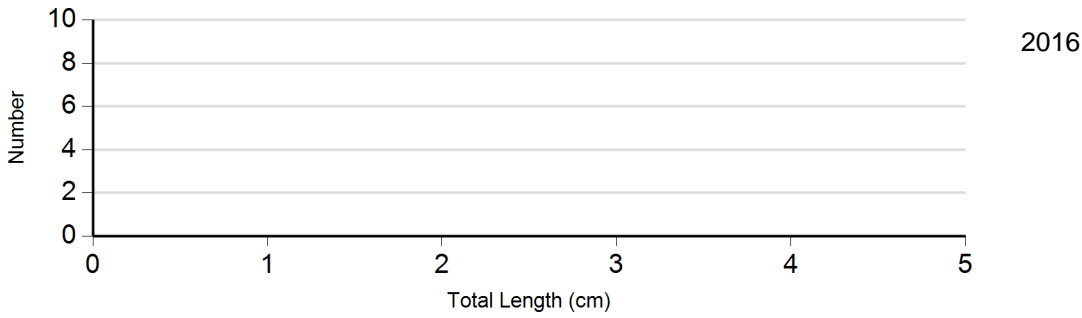


Species: Channel Catfish  
 Gear: AFS std gill net

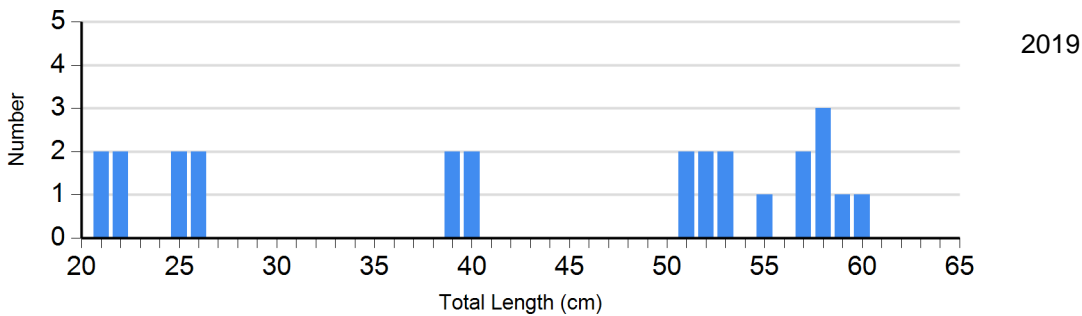
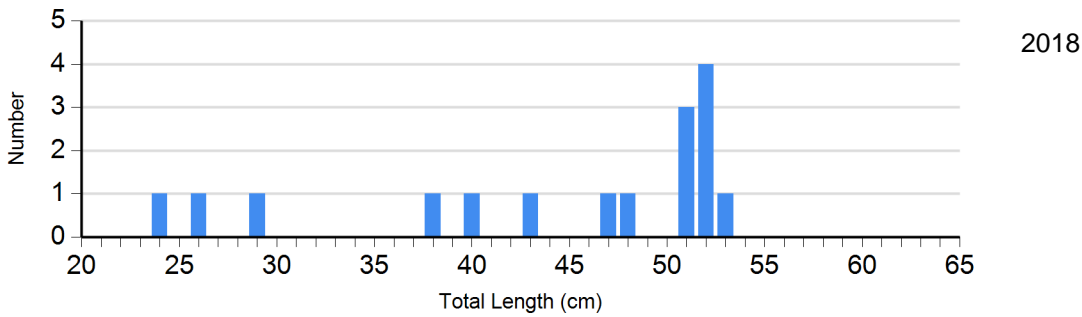
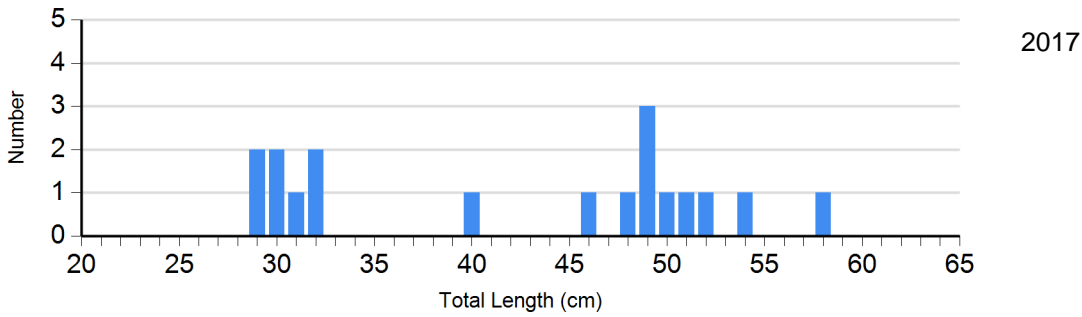




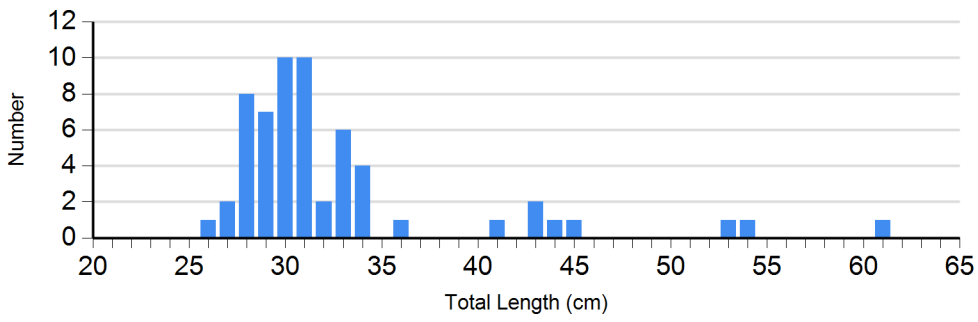
Species: Channel Catfish  
 Gear: std exp gill net



Species: Common Carp  
 Gear: AFS std gill net

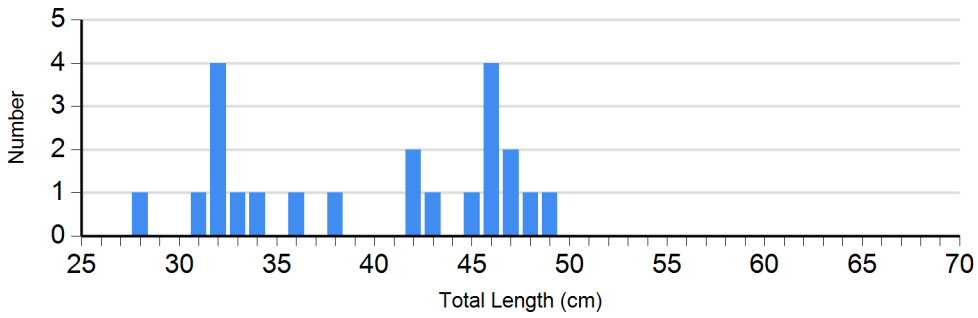






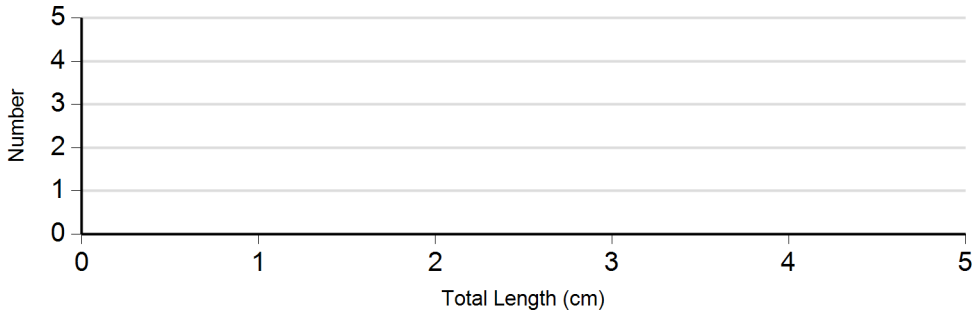
2021

Species: Walleye  
Gear: AFS std gill net



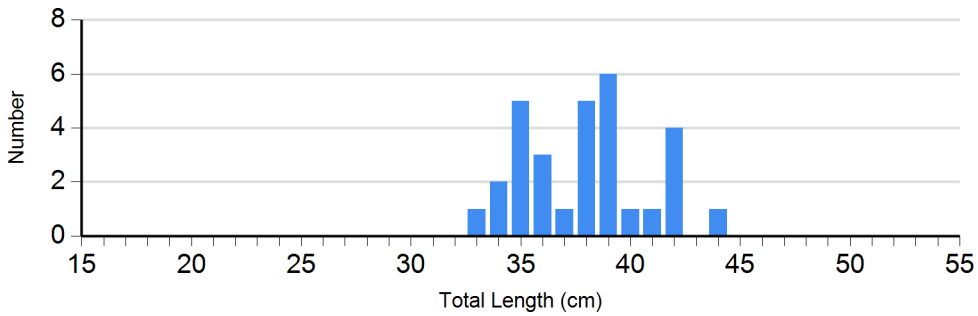
2017

Species: Walleye  
Gear: std exp gill net

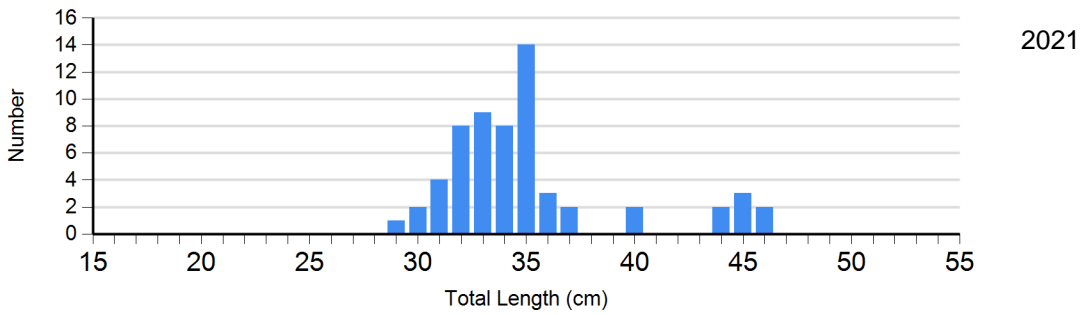
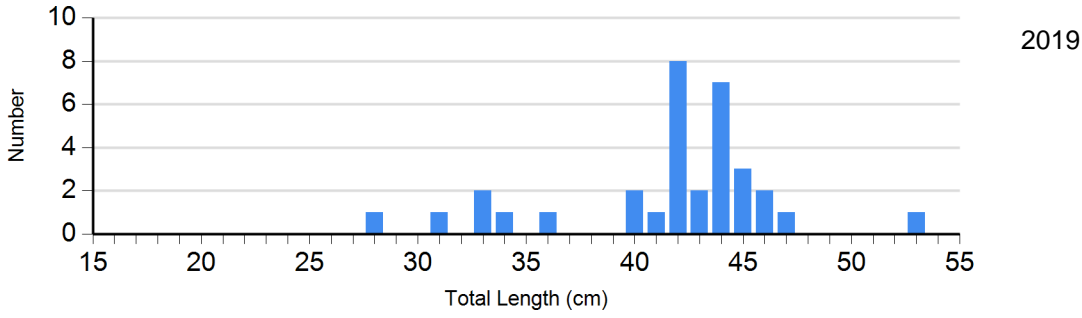
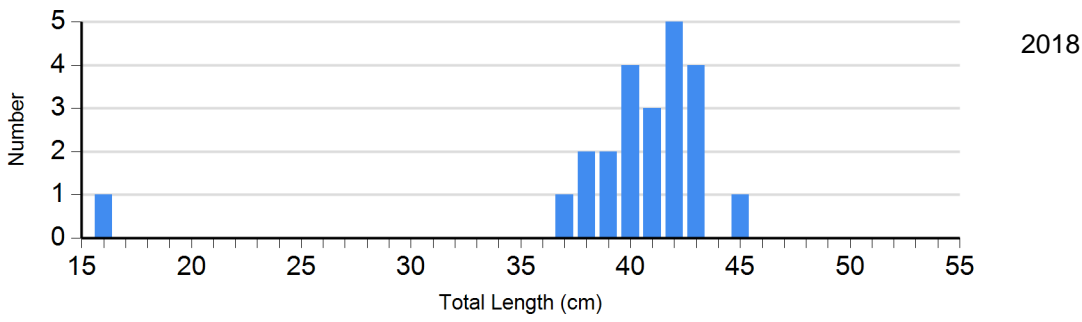


2016

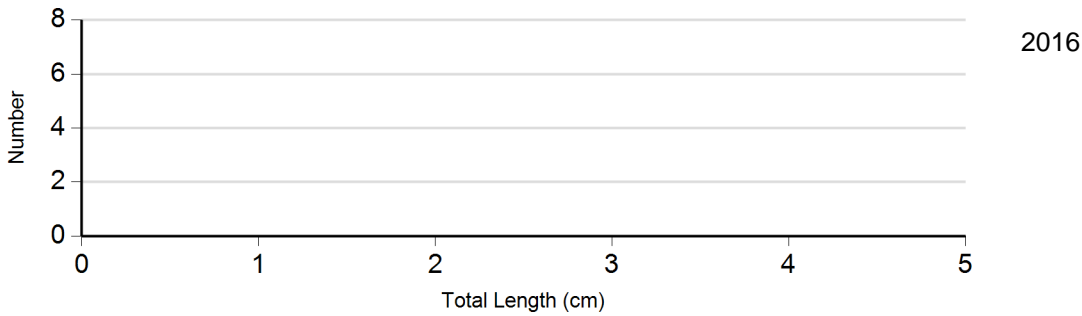
Species: White Sucker  
Gear: AFS std gill net



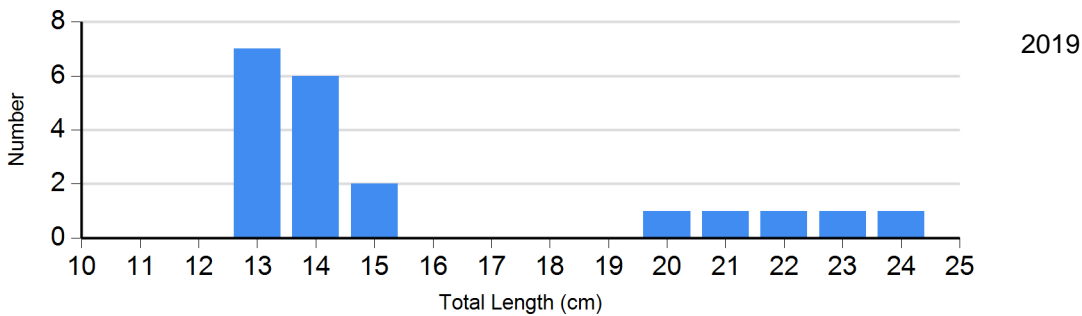
2017



Species: White Sucker  
 Gear: std exp gill net



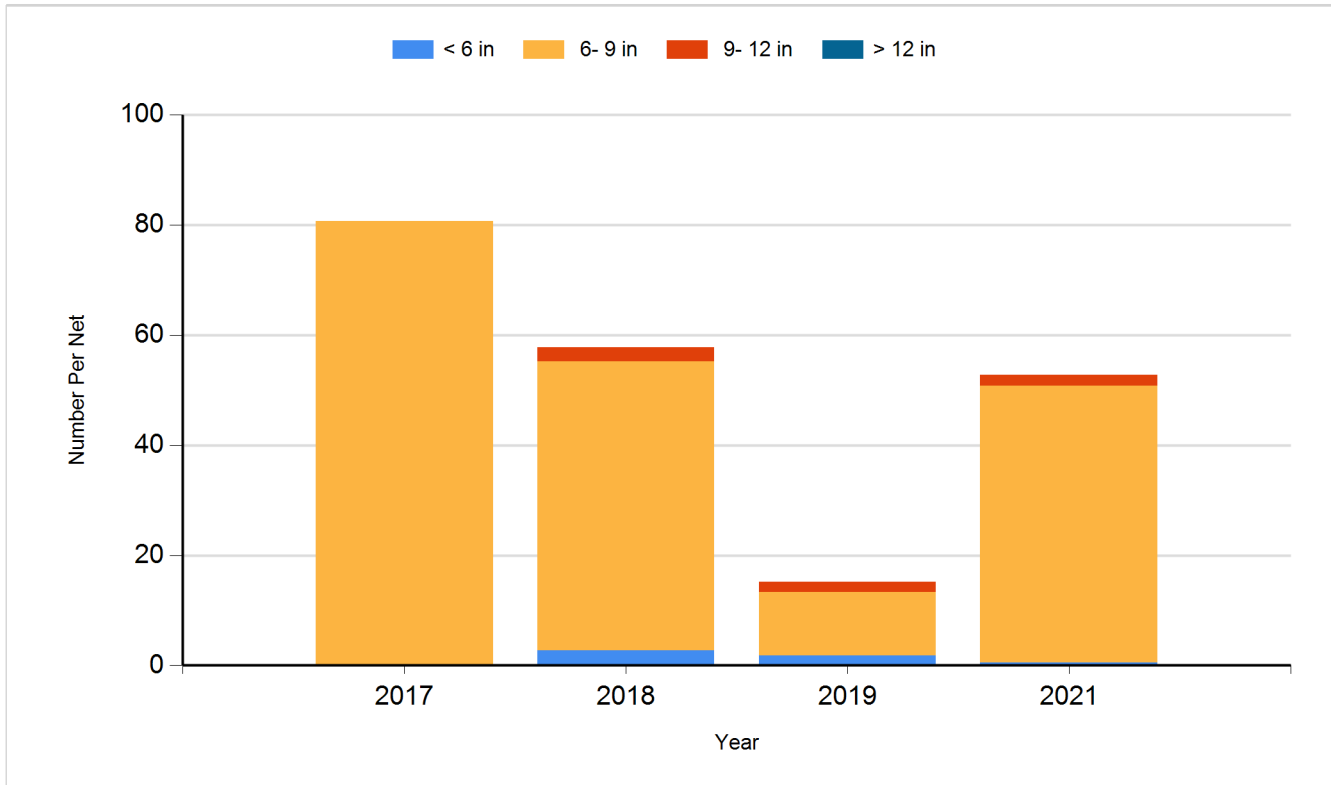
Species: Yellow Perch  
 Gear: AFS std gill net



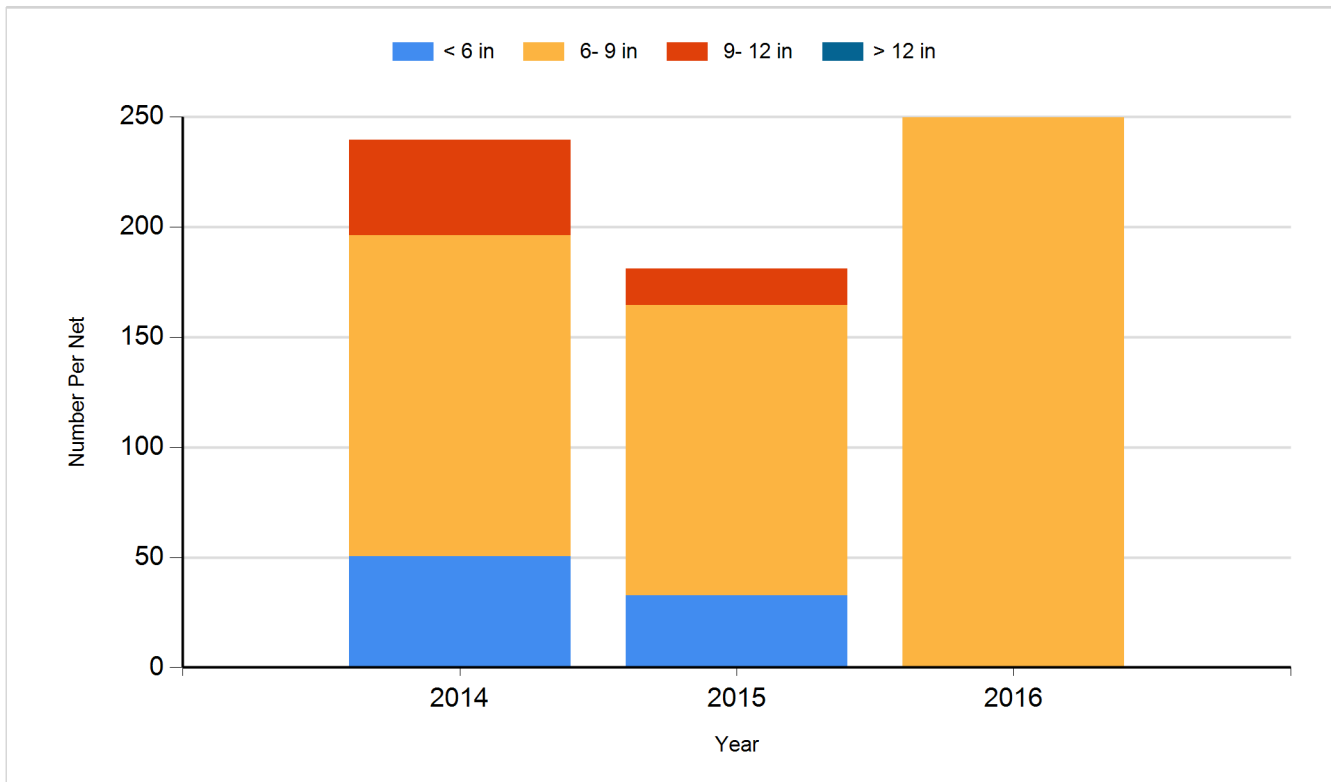
## Historic Fish Sizes and Relative Abundance

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

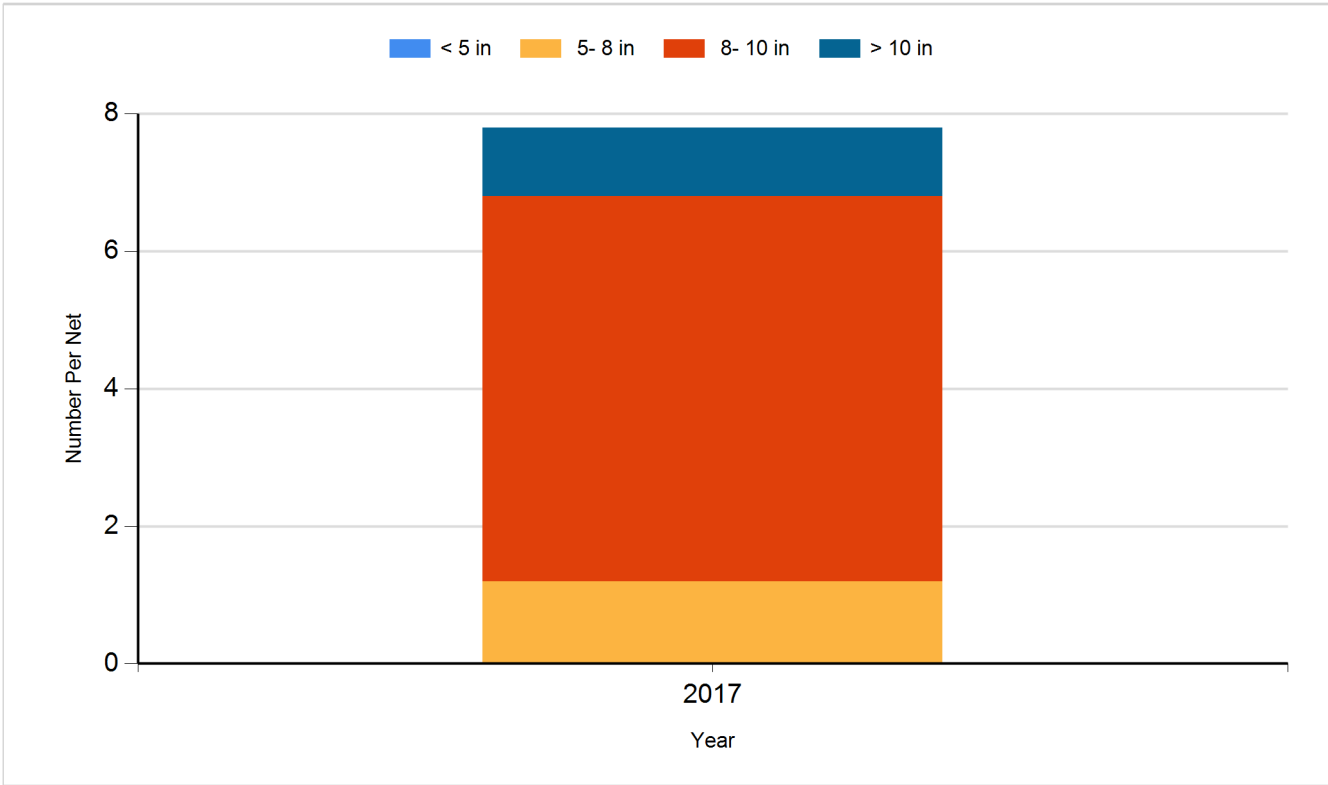
Species: Black Bullhead  
Gear: AFS std gill net



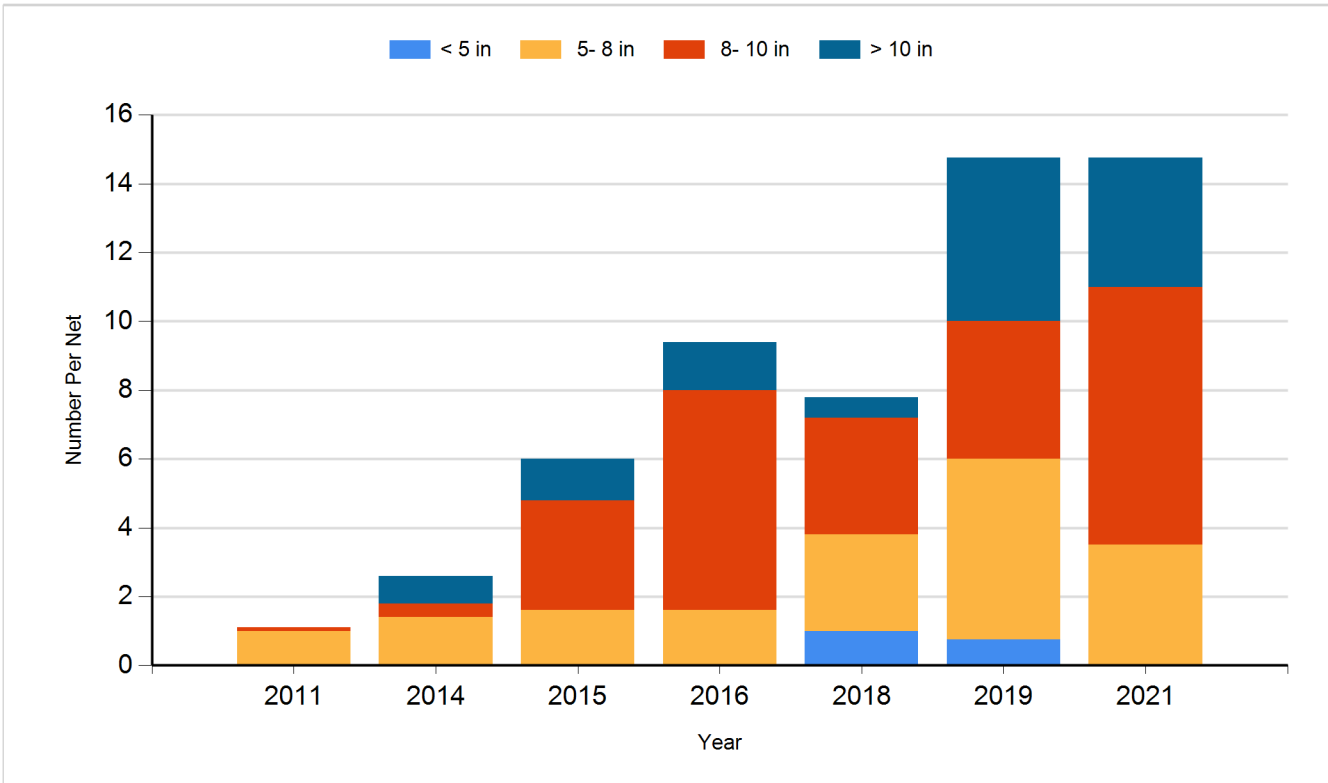
Species: Black Bullhead  
Gear: std exp gill net



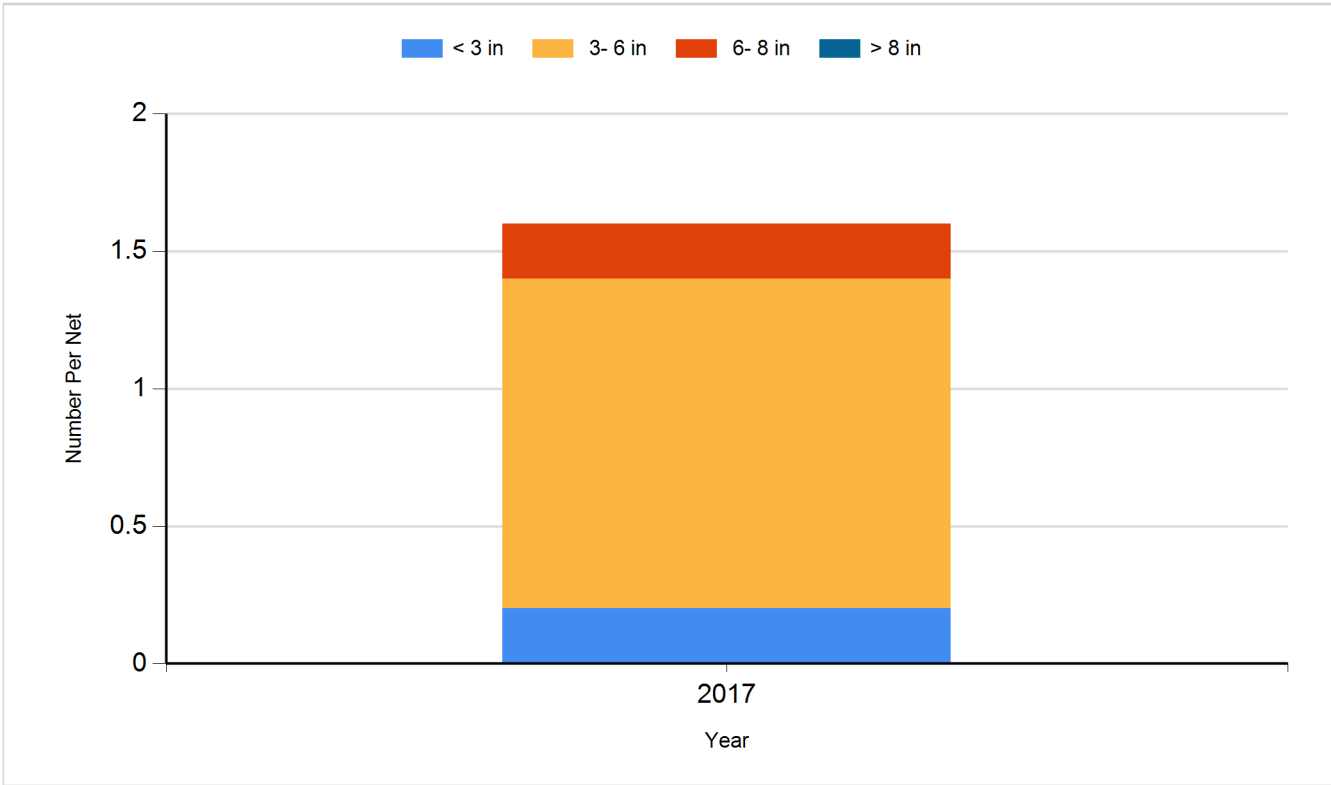
Species: Black Crappie  
Gear: AFS std frame net



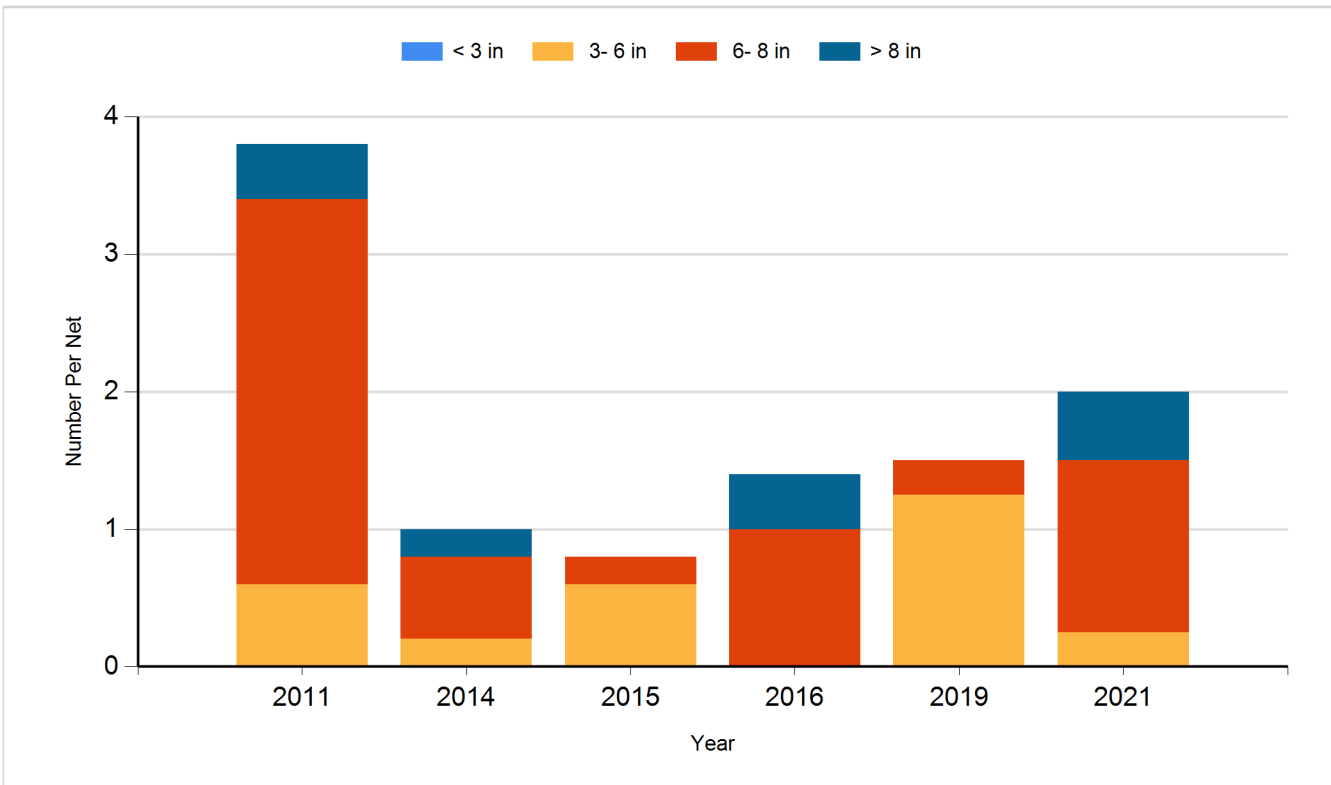
Species: Black Crappie  
Gear: frame net (std 3/4 in)



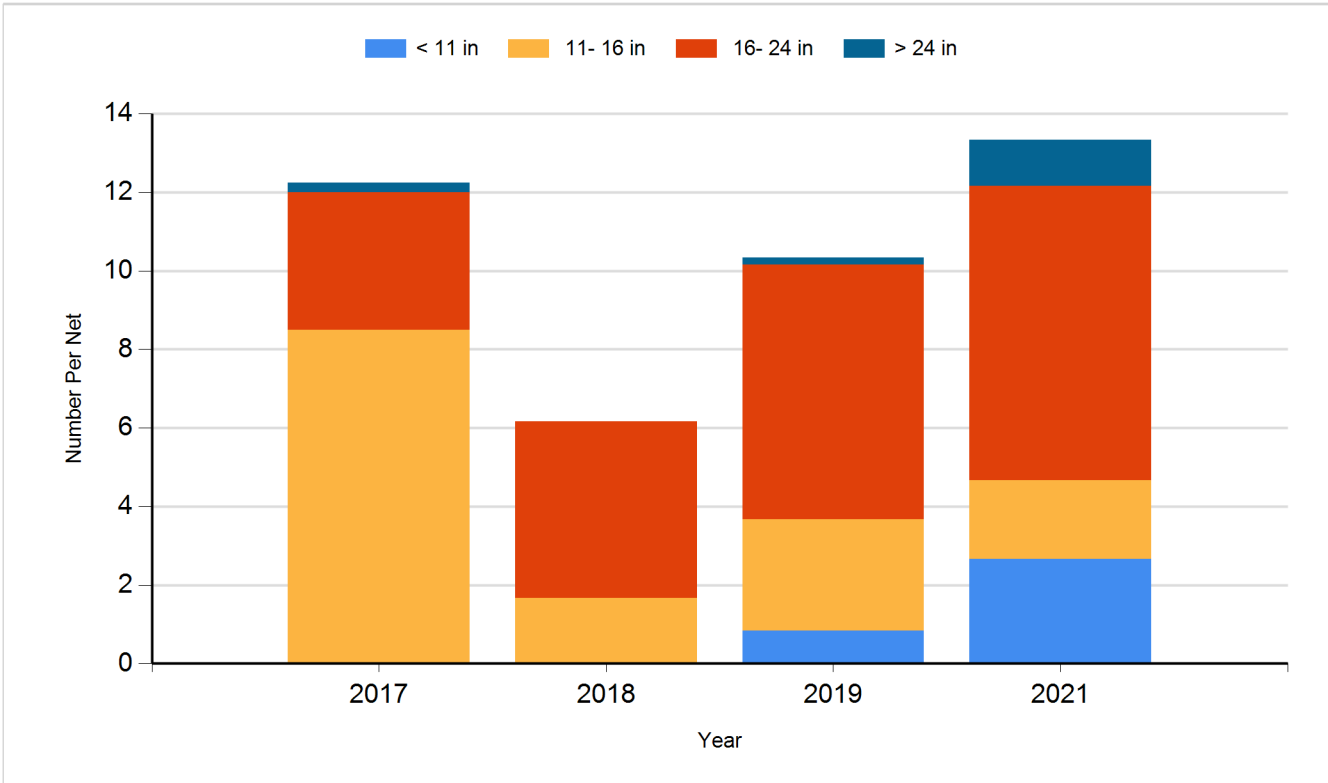
Species: Bluegill  
Gear: AFS std frame net



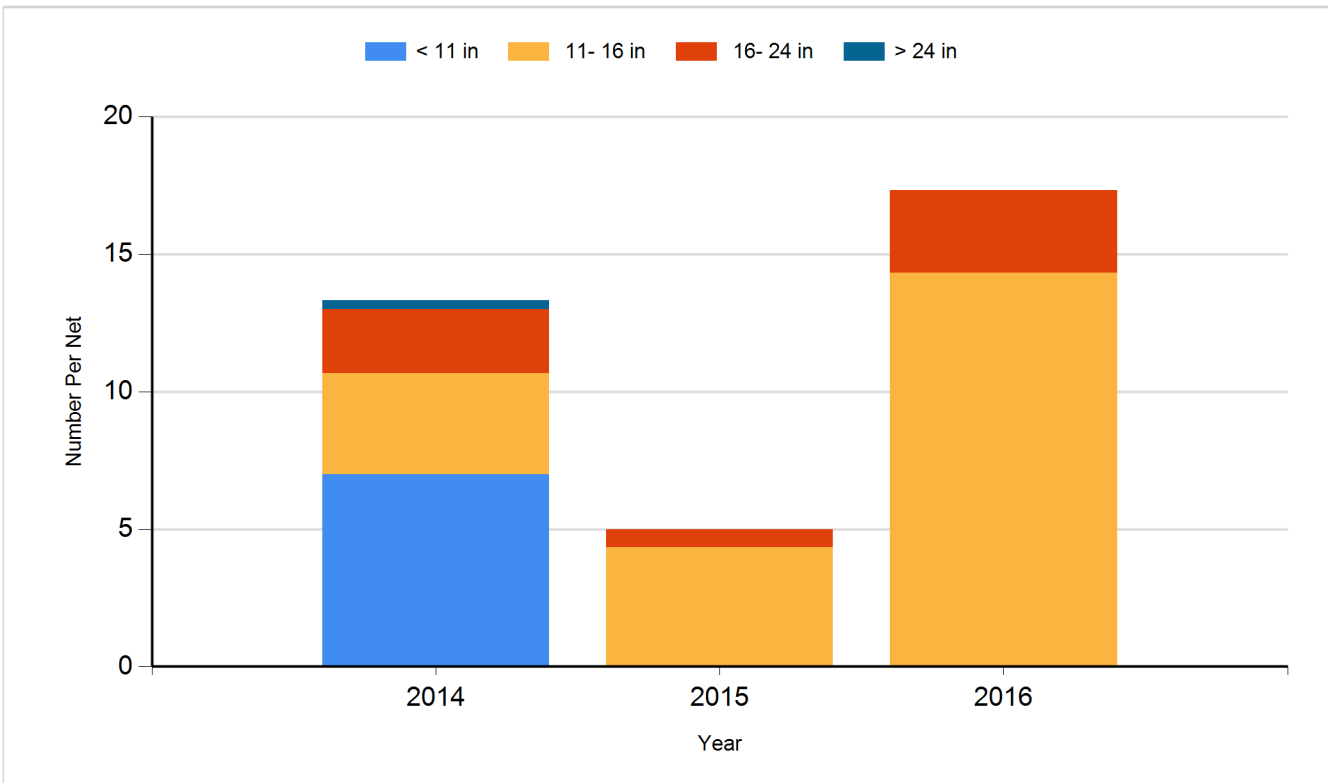
Species: Bluegill  
Gear: frame net (std 3/4 in)



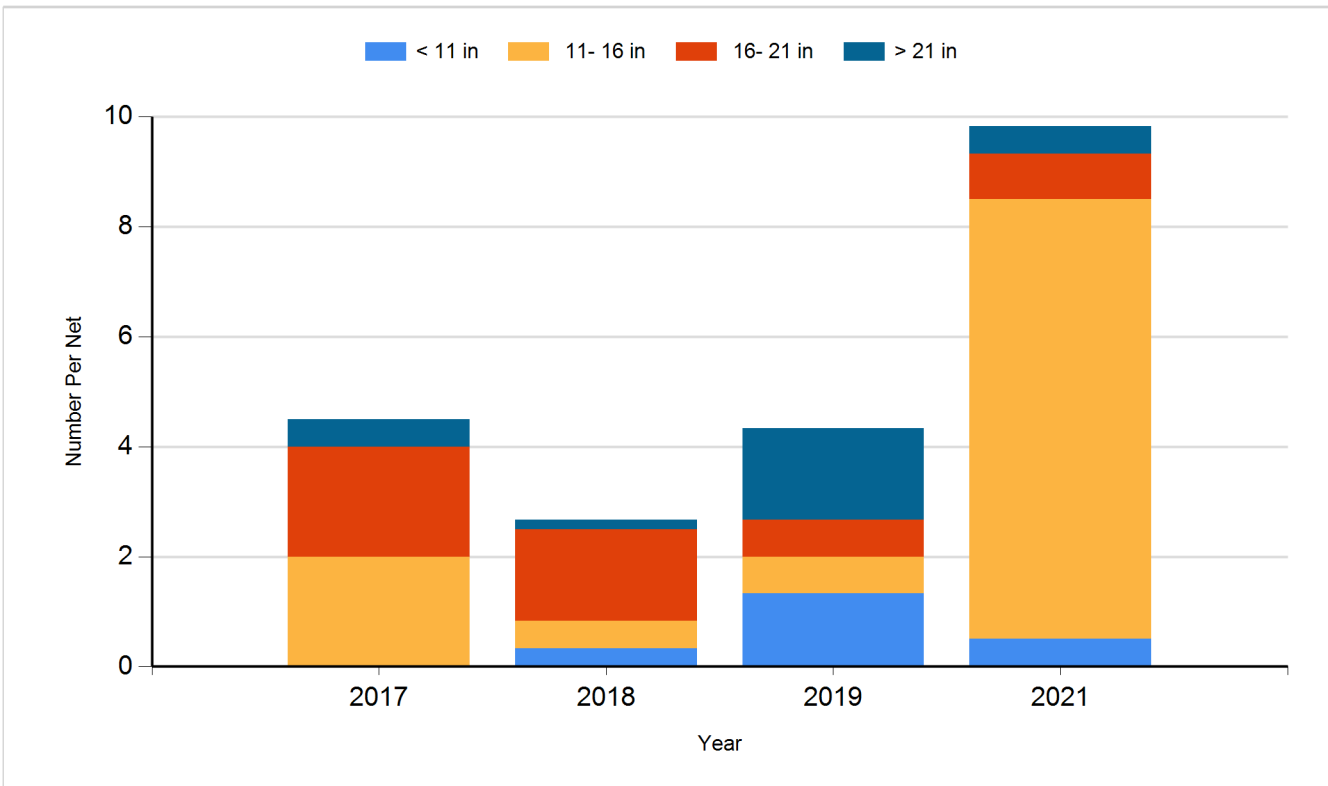
Species: Channel Catfish  
Gear: AFS std gill net



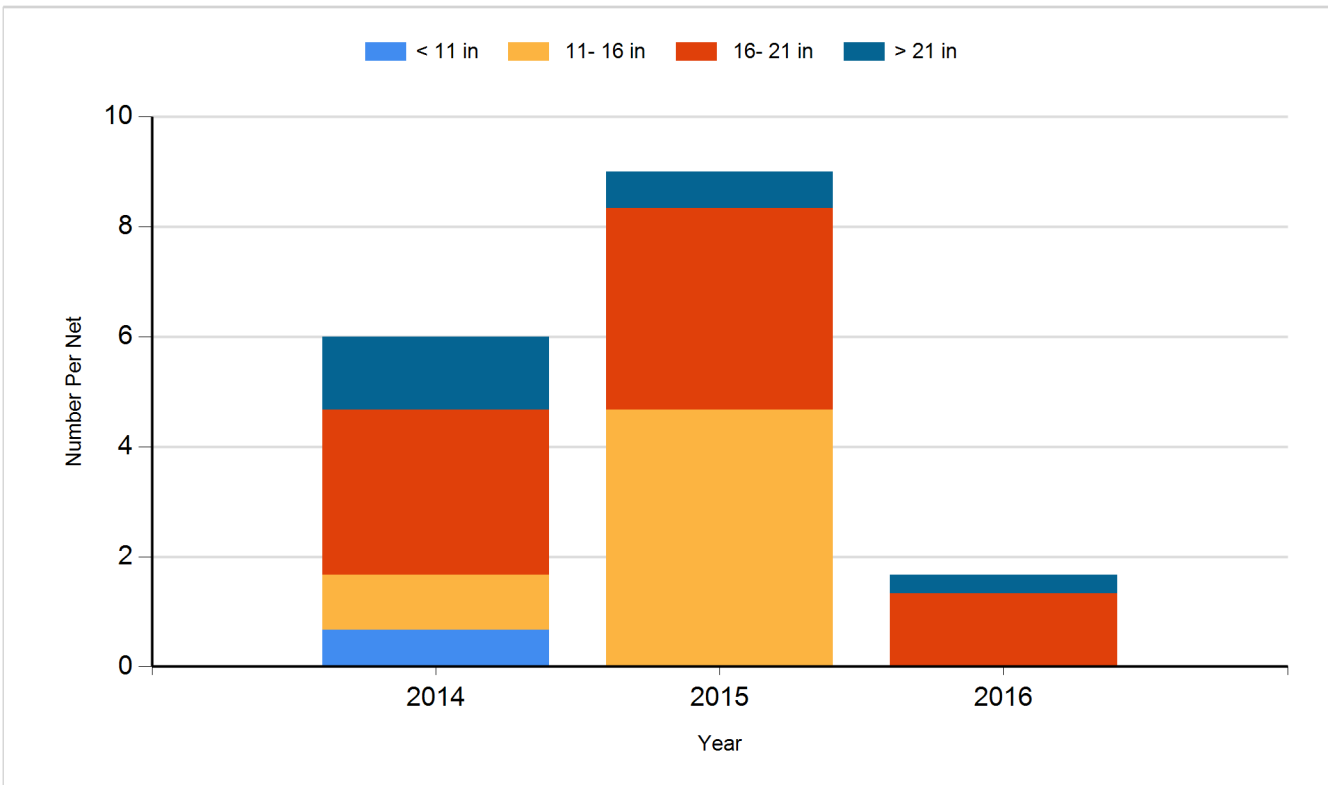
Species: Channel Catfish  
Gear: std exp gill net



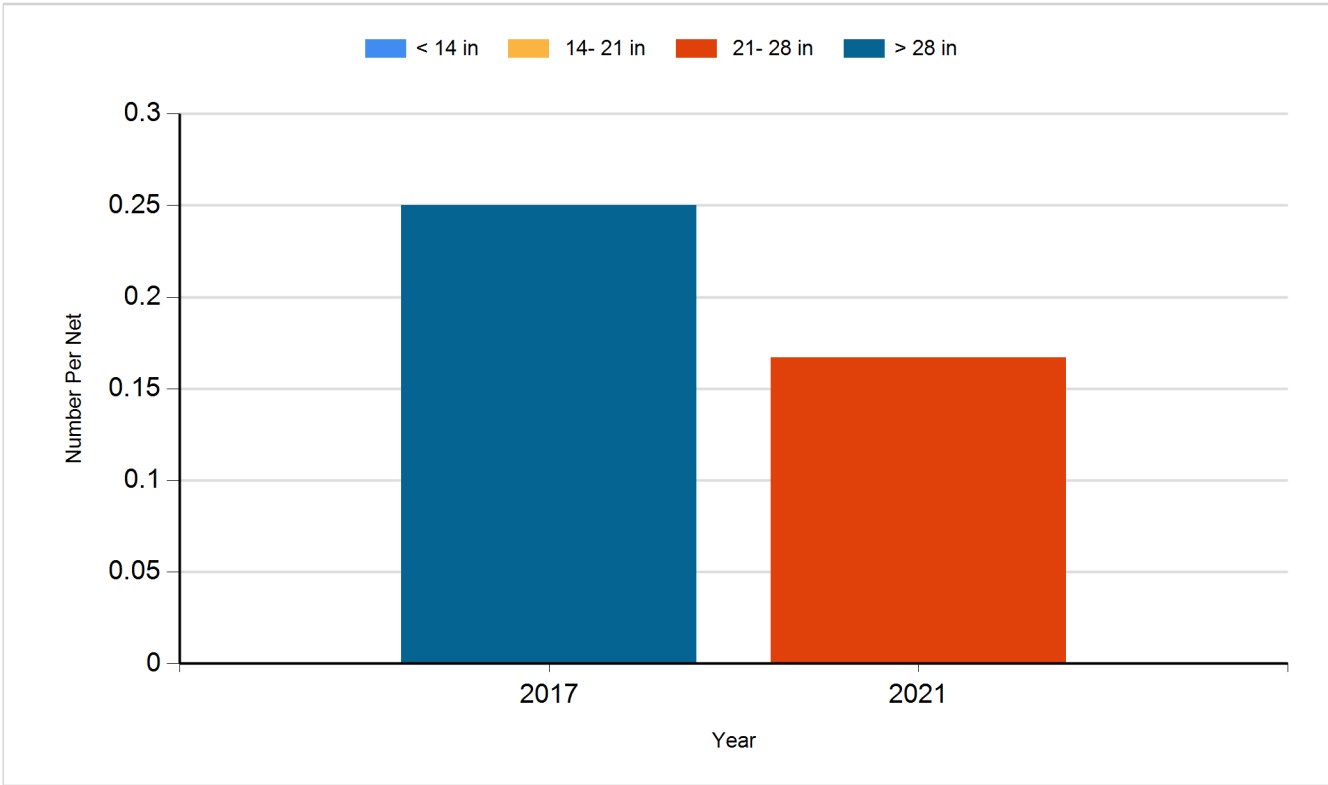
Species: Common Carp  
Gear: AFS std gill net



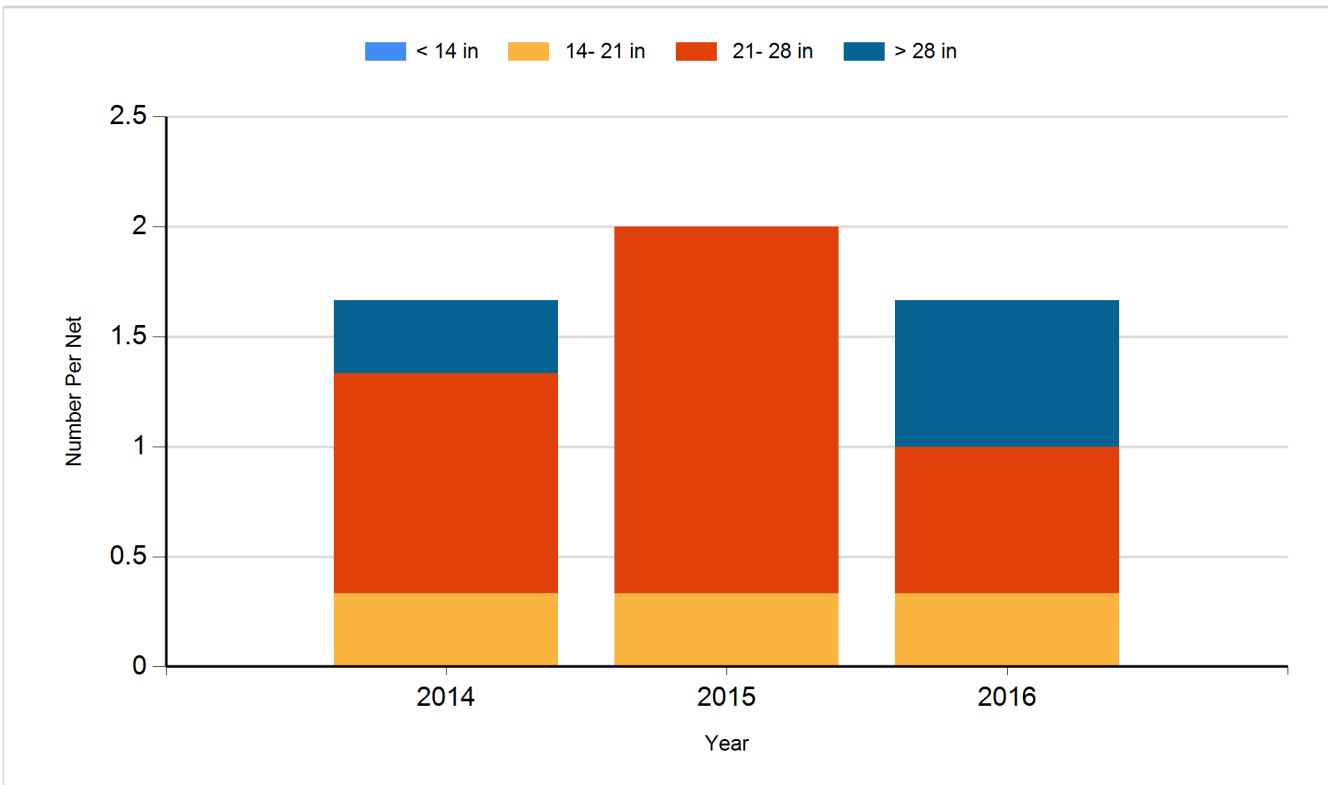
Species: Common Carp  
Gear: std exp gill net



Species: Northern Pike  
Gear: AFS std gill net

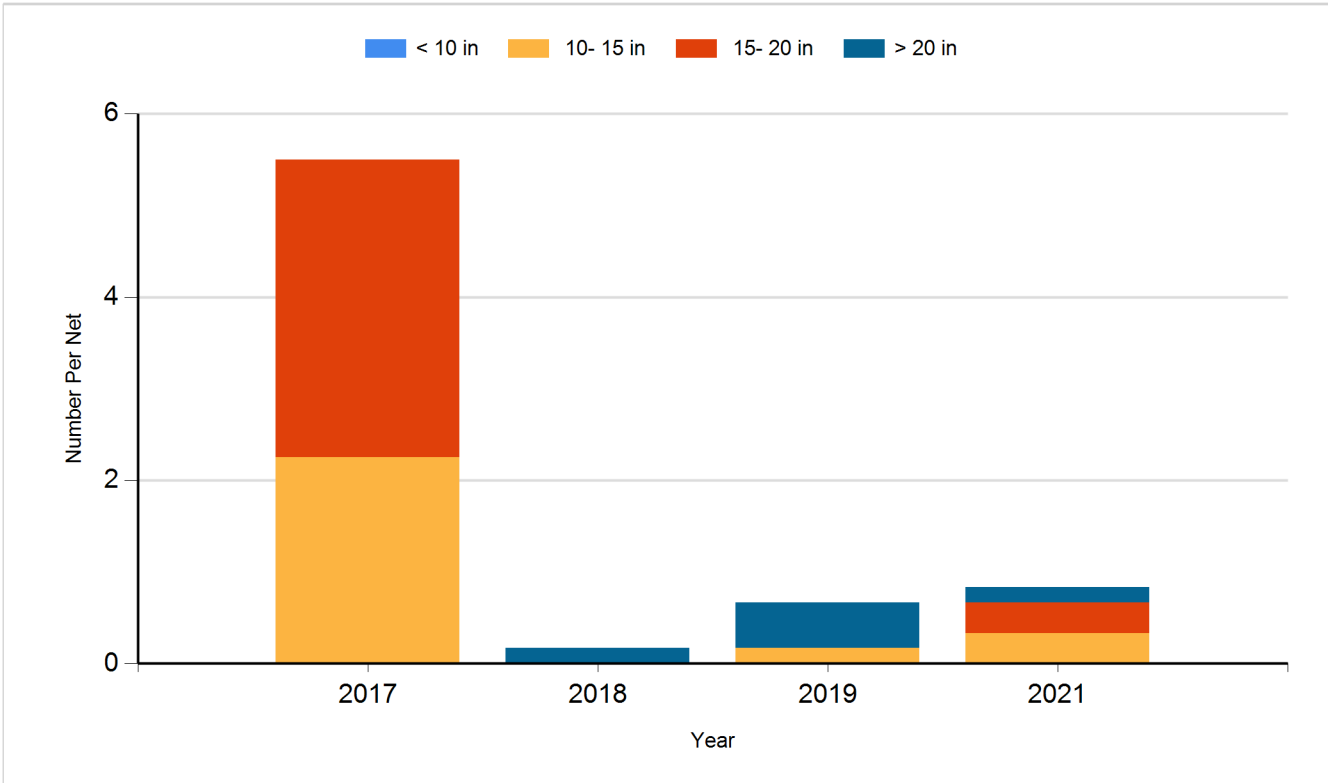


Species: Northern Pike  
Gear: std exp gill net

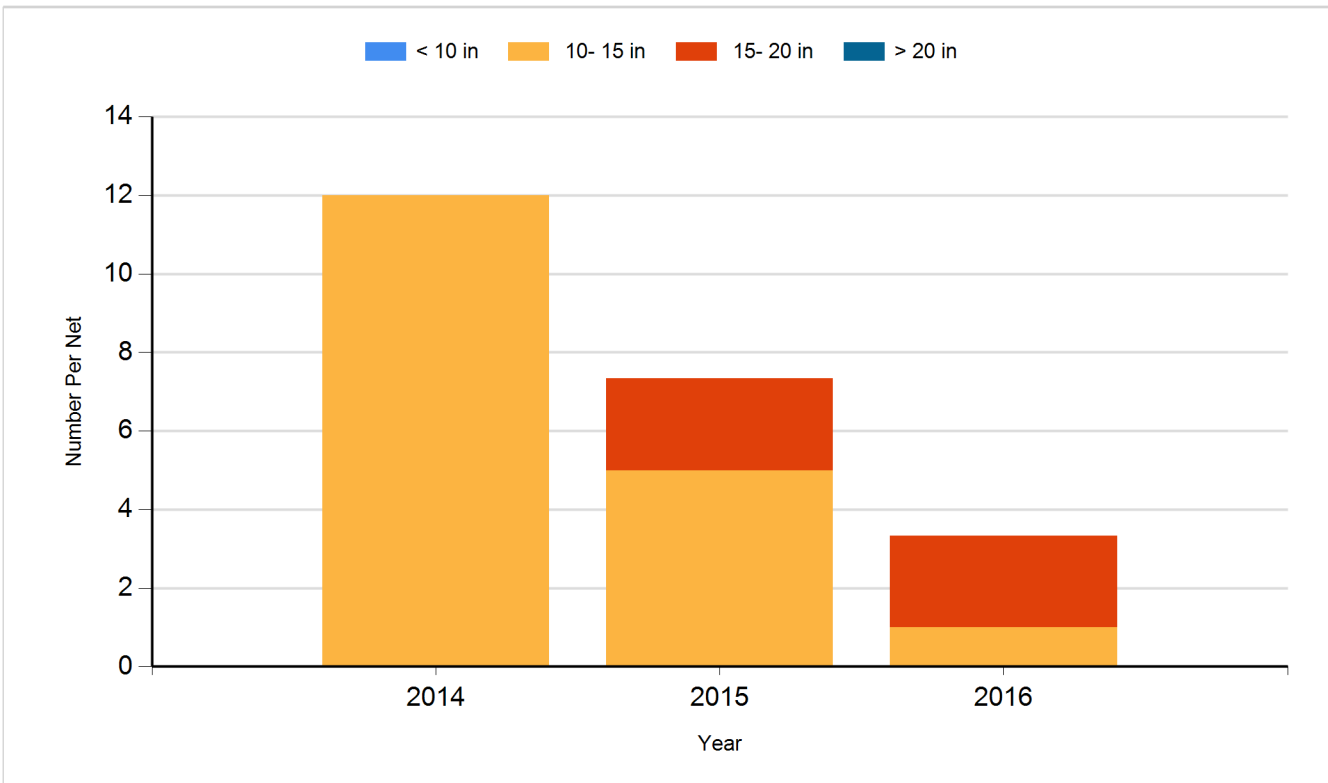




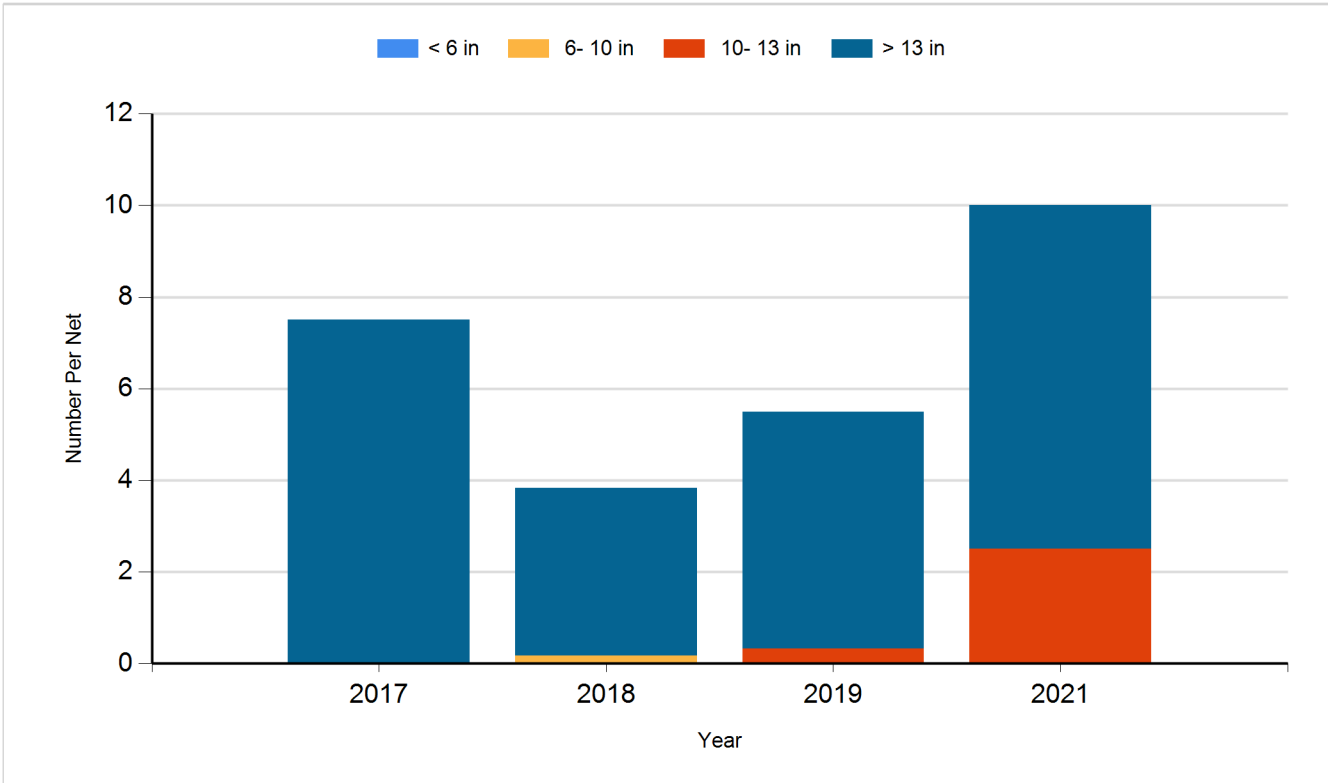
Species: Walleye  
Gear: AFS std gill net



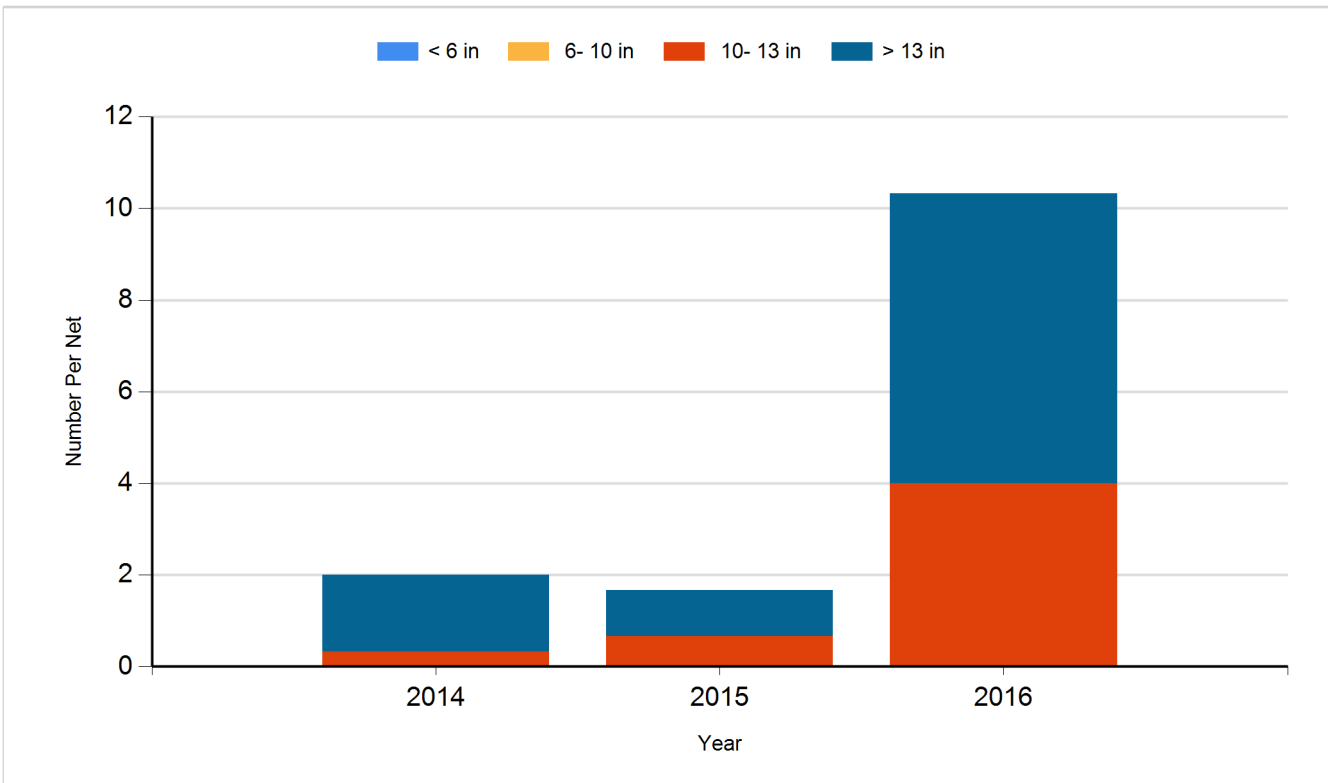
Species: Walleye  
Gear: std exp gill net



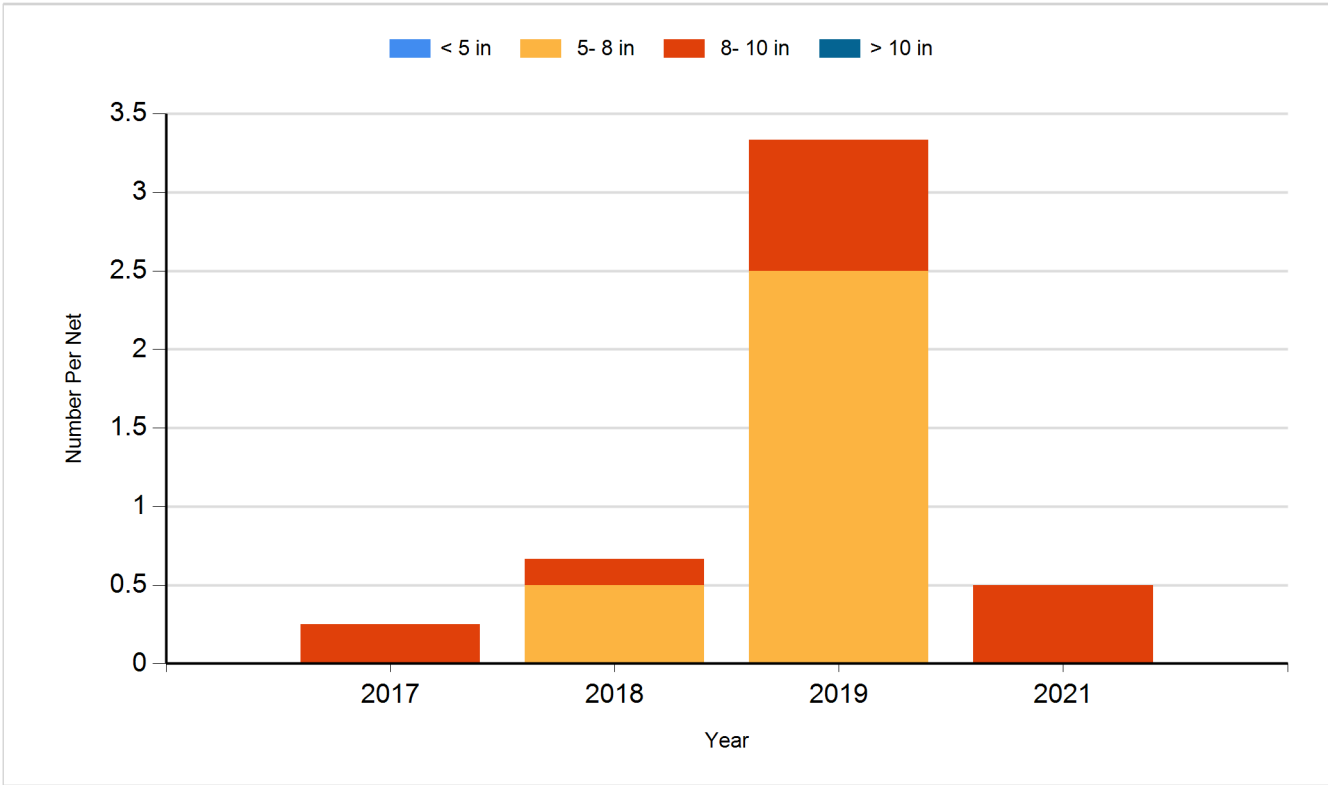
Species: White Sucker  
Gear: AFS std gill net



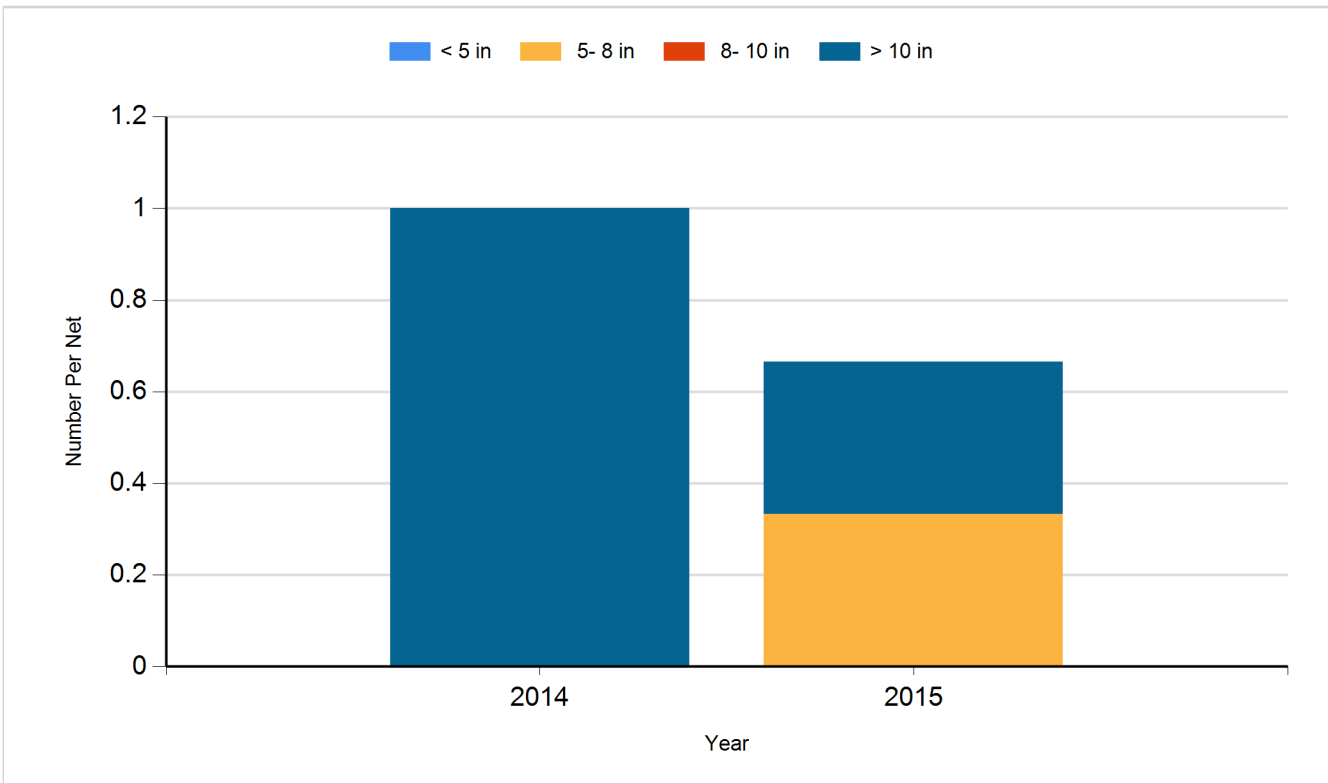
Species: White Sucker  
Gear: std exp gill net



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
2011	Largemouth Bass	Fingerling	2,890
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