SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

Carthage, Miner County

MJA-Lake-598-000

2019

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 17, 2019	6 net-nights
frame net (std 3/4 in)	Jun 17, 2019	4 net-nights

Common Fish Species Present

Black Bullhead

Black Crappie

Channel Catfish

White Sucker

Yellow Perch

Common Carp

Bluegill

Walleye

Green Sunfish

Sunfish Hybrid

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.
- s**td 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.

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

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.

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

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

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.

$$Wr = \left(\frac{W}{Ws}\right) \text{x } 100$$

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).

	Stock		Quality		Preferred		Memorable		Trophy	
Species Name	(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**

			Abundance		Stock Density Indices				Condition	
Gear	Species	Sample Size (n)	CPUE	CI-80	PSD	CI-80	PSD-P	CI-80	Wr	CI-80
AFS std gill net	Black Bullhead	91	13.3	7.2	14	6	0			
	Channel Catfish	62	9.5	2.6	70	9	2		96	2
	Common Carp	26	3.0	1.9	78		56	19		
	Walleye	4	0.7	0.7	75		75		94	3
	White Sucker	33	5.5	1.7	100		94			
	Yellow Perch	20	3.3	2.5	25	16	0		110	3
frame net (std 3/4 in)	Black Bullhead	178	35.5	45.7	11	4	0			
	Black Crappie	59	14.0	18.6	63	9	34	9	103	3
	Bluegill	6	1.5	1.1	17		0		137	7
	Channel Catfish	2	0.5	0.8	100		0		105	15
	Green Sunfish	2	0.5	0.5	0		0		125	22
	Orangespotted Sunfish	5	0.0	0.0						
	Sunfish Hybrid	14	0.0	0.0						
	Walleye	1	0.3	0.4	100		100		105	
	White Sucker	24	6.0	3.5	100		96			
	Yellow Perch	13	3.0	2.8	25		0		104	11

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.

		CPUE										
Gear	Species	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Avg
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	49.77
	Black Crappie								0.8	0.2	0.0	0.33
	Channel Catfish								12.3	6.2	9.5	9.33
	Common Carp								4.5	2.3	3.0	3.27
	Gizzard Shad								2.3	0.0	0.0	0.77
	Northern Pike								0.3	0.0	0.0	0.10
	Walleye								5.5	0.2	0.7	2.13
	White Sucker								7.5	3.8	5.5	5.60
	Yellow Perch								0.3	0.7	3.3	1.43
boat shocker (night)	Largemouth Bass		6.0									6.00
frame net (std 3/4 in)	Black Bullhead		441.7		810.6	100.4	377.4	1,495.6		576.0	35.5	548.17
	Black Crappie		1.1		0.1	2.6	6.0	9.4		6.8	14.0	5.71
	Bluegill		3.8		0.0	1.0	0.8	1.4		0.0	1.5	1.21
	Channel Catfish		2.8		0.7	3.8	0.4	6.2		1.6	0.5	2.29
	Common Carp		20.0		1.5	1.8	0.8	3.8		0.0	0.0	3.99
	Green Sunfish		0.0		0.0	0.0	0.2	0.0		0.0	0.5	0.10
	Northern Pike		3.0		0.4	2.0	3.0	3.4		0.0	0.0	1.69
	Orangespotted Sunfish		0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.00
	Sunfish Hybrid		0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.00
	Walleye		0.1		0.0	0.2	1.4	0.6		0.0	0.3	0.37
	White Sucker		3.1		8.4	38.0	7.8	5.4		14.6	6.0	11.90

		CPUE										
Gear	Species	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Avg
frame net (std	Yellow Perch		0.2		0.1	0.0	0.0	0.2		0.0	3.0	0.50
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.

			Year									
Gear	Species	Index	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
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		
	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
		PSD-P								0	0	0
	Black Crappie	PSD								100	100	
		PSD-P								0	0	
		Wr								102	92	
	Channel Catfish	PSD								31	73	70
		PSD-P								2	0	2
		Wr								94	95	96
	Common Carp	PSD								56	79	78
		PSD-P								11	7	56
	Walleye	PSD								59	100	75
		PSD-P								0	100	75
		Wr								85	103	94
	White Sucker	PSD								100	96	100
		PSD-P								100	96	94

			Year									
Gear	Species	Index	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AFS std gill net	Yellow Perch	PSD								100	25	25
		PSD-P								0	0	0
		Wr								84	99	110
frame net (std 3/4 in)	Black Bullhead	PSD		5		8	23	2	0		7	11
		PSD-P		0		0	0	0	0		1	0
		Wr		85		87						
	Black Crappie	PSD		9		100	46	73	83		59	63
		PSD-P		0		0	31	20	15		9	34
		Wr		116		126	122	108	96		110	103
	Bluegill	PSD		84			80	25	100			17
		PSD-P		11			20	0	29			0
		Wr		111			95	102	103			137
	Channel Catfish	PSD		36		14	11	0	0		38	100
		PSD-P		7		0	5	0	0		0	0
		Wr		84		87	84	72	83		86	105
	Common Carp	PSD		2		47	100	50	95			
		PSD-P		2		13	33	50	42			
		Wr		92		85						
	Green Sunfish	PSD						0				0
		PSD-P						0				0
		Wr						130				125
	Walleye	PSD		100			0	57	67			100
		PSD-P		0			0	0	0			100
		Wr		87			83	78	67			105
	White Sucker	PSD		100		100	100	97	100		100	100
		PSD-P		81		99	100	90	100		100	96
		Wr		92		95						
	Yellow Perch	PSD		100		100			100			25
		PSD-P		0		0			0			0
		Wr		87		115			87			104
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			

			Year									
Gear	Species	Index	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
std exp gill net	Channel Catfish	PSD-P					5	0	0			
		Wr					85	80	92			
	Common Carp	PSD					81	48	100			
		PSD-P					25	7	20			
	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+
2018	39	107 (5)	175 (14)	228 (6)	235 (6)	241 (8)					
2013	1				241 (1)						
2011	11	154 (10)		246 (1)							

Species: Bluegill

		Mean Length (expanded sample number) at capture by age									
Year	N	1	2	3	4	5	6	7	8	9	10+
2011	37	140 (6)	159 (4)	181 (20)	194 (5)	200 (2)					

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

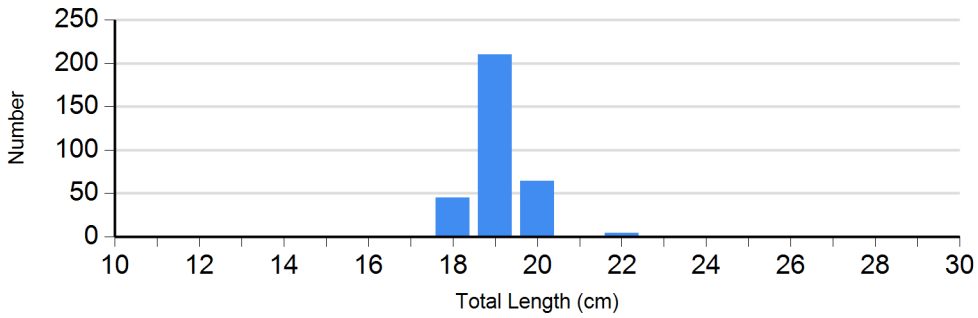
Mean relative weight (Wr) by sample size (N), length category stock to quality (S-Q), quality to preferred (Q-P), preferred to memorable (P-M), and memorable (M) for species collected across survey years with standard error (SE).

		Length Groups							
		S-Q		Q-P		P-M		M	
Species	Year	N	Wr (SE)	N	Wr (SE)	N	Wr (SE)	N	Wr (SE)
Black Crappie Frame Net	2015	8	121 (7.6)	16	106 (1.5)	6	98 (3.2)	0	
	2016	8	102 (2.9)	32	97 (1.8)	6	89 (2.1)	1	73
	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	
Bluegill Frame Net	2015	3	103 (6.0)	1	98	0		0	
	2016	0		5	106 (4.6)	2	95 (4.5)	0	
	2017	6	127 (6.0)	1	104	0		0	
	2019	5	138 (6.6)	1	131	0		0	
Channel Catfish Gill Net	2015	13	79 (1.8)	2	85 (2.7)	0		0	
	2016	43	93 (4.0)	9	88 (4.2)	0		0	
	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	
Walleye Gill Net	2015	15	80 (1.5)	7	82 (2.1)	0		0	
	2016	3	81 (2.6)	7	76 (2.1)	0		0	
	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	
Yellow Perch Gill Net	2015	1	98	0		1	75	0	
	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	

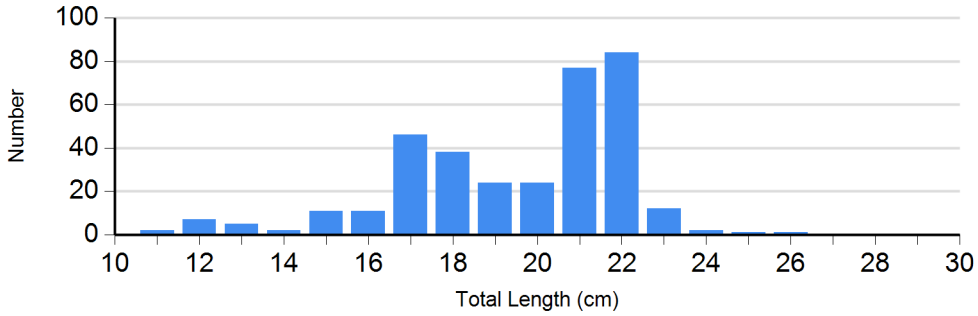
Length Frequency Distribution

Length frequency histogram of species sampled by year.

Species: Black Bullhead
Gear: AFS std gill net



2017



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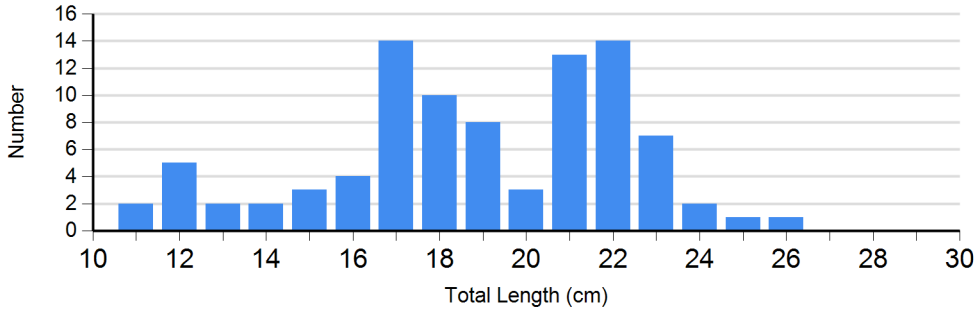

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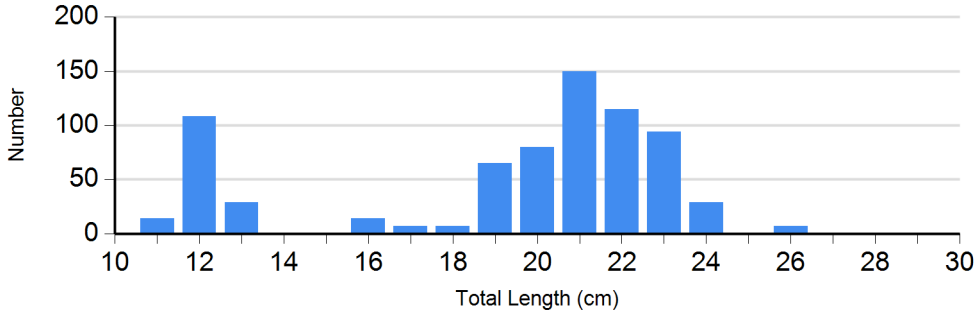
Species: Black Bullhead
Gear: std exp gill net



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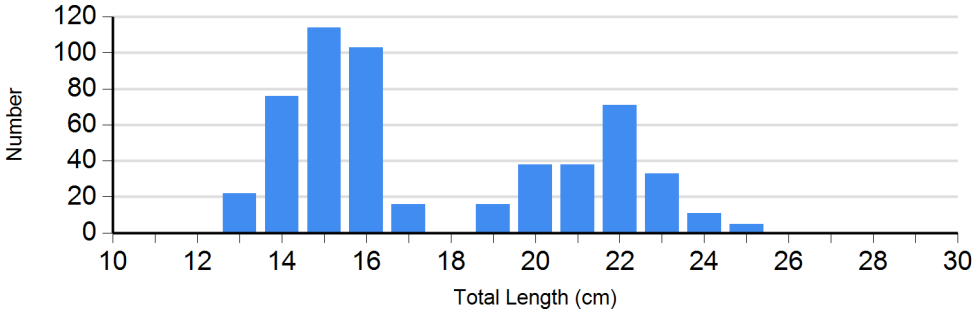

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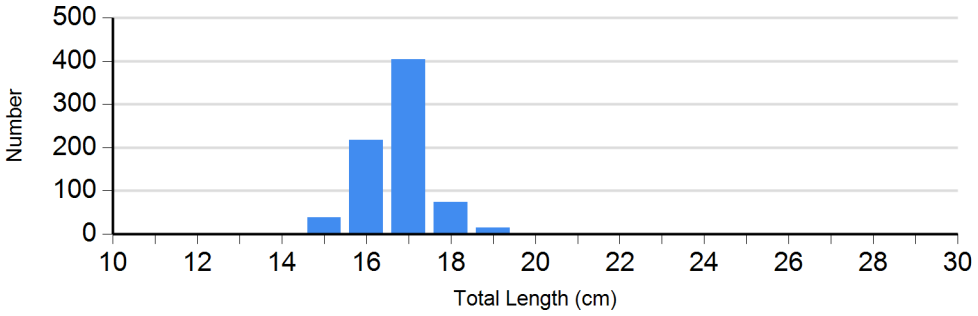
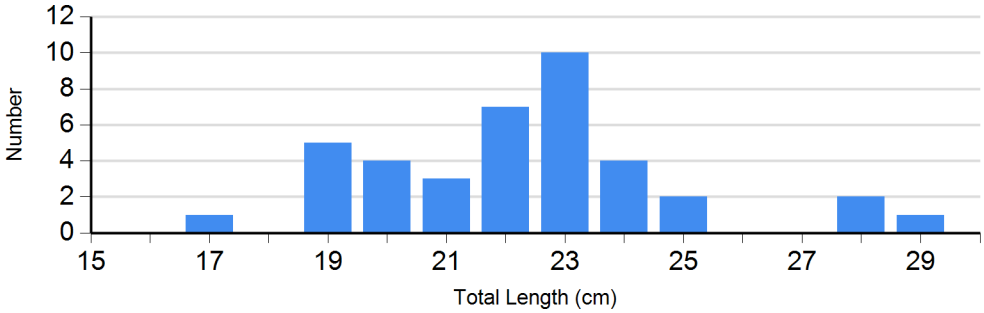


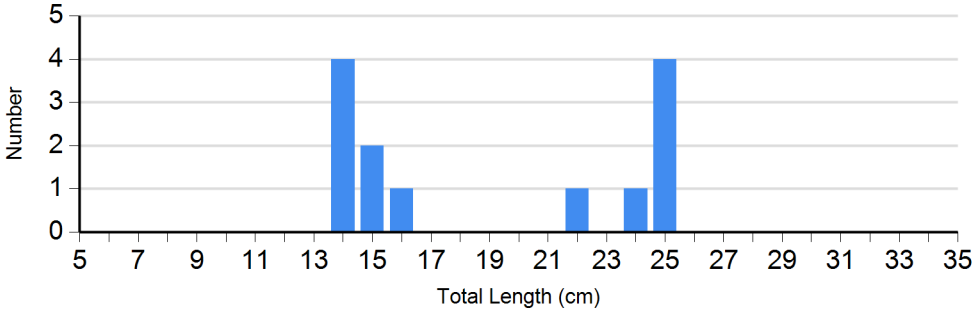
2016

Species: Black Crappie
Gear: AFS std frame net



2017

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



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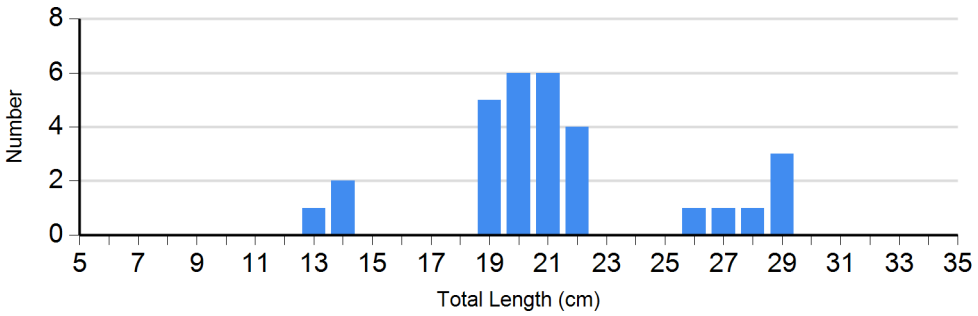

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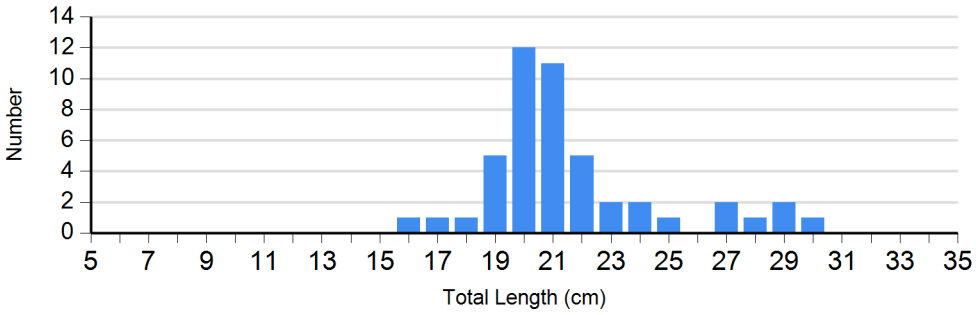

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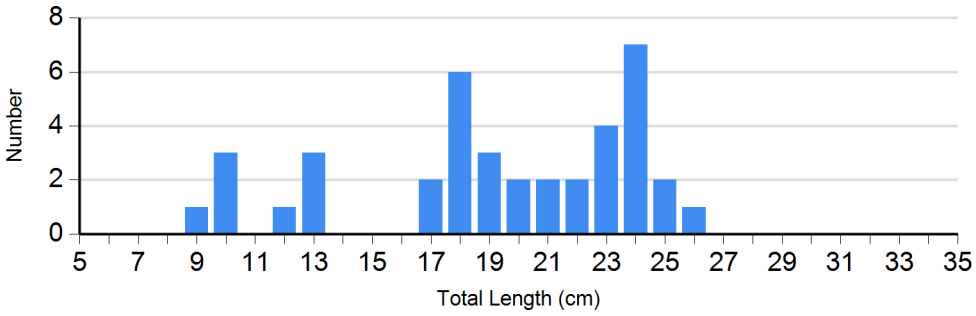
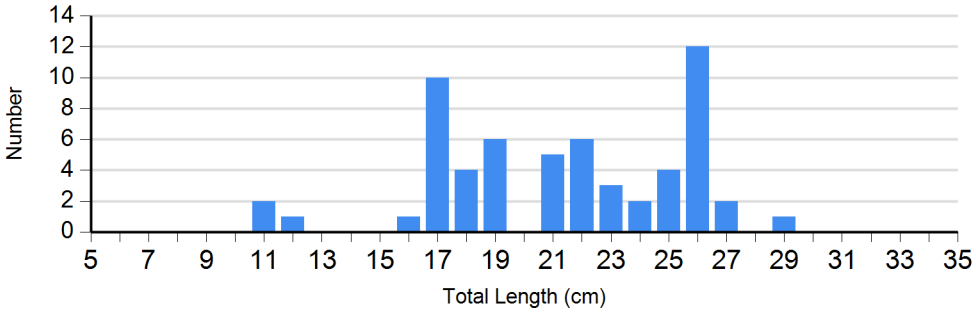
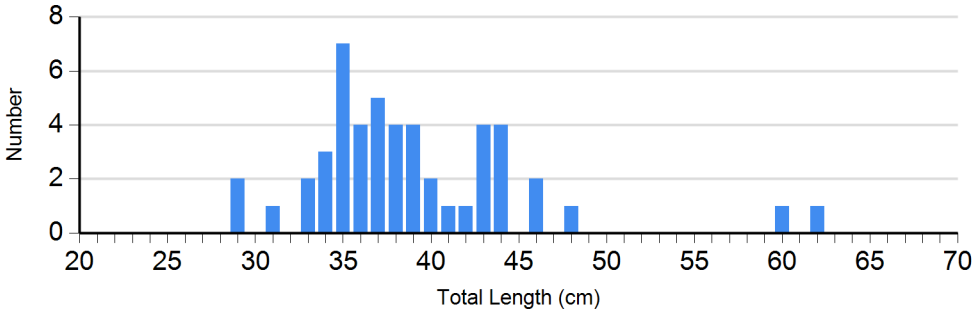


2018

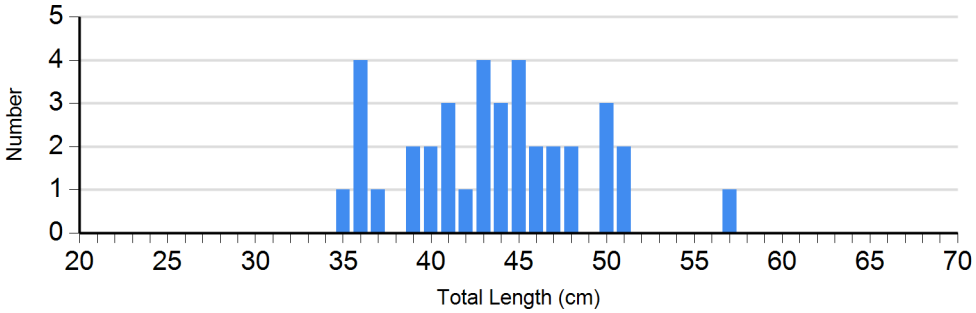


2019

Species: Channel Catfish
Gear: AFS std gill net



2017



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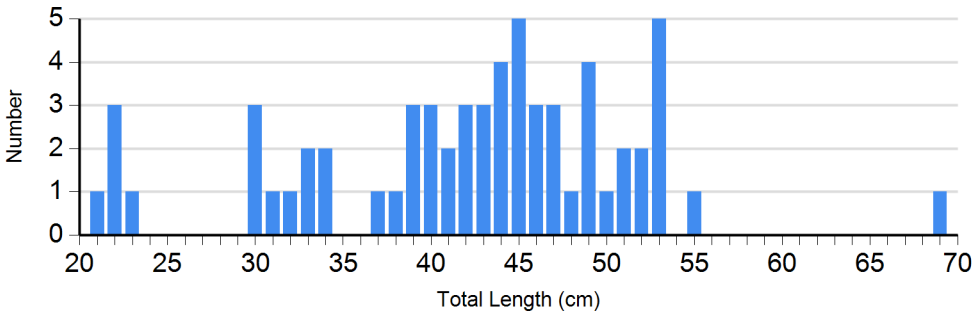
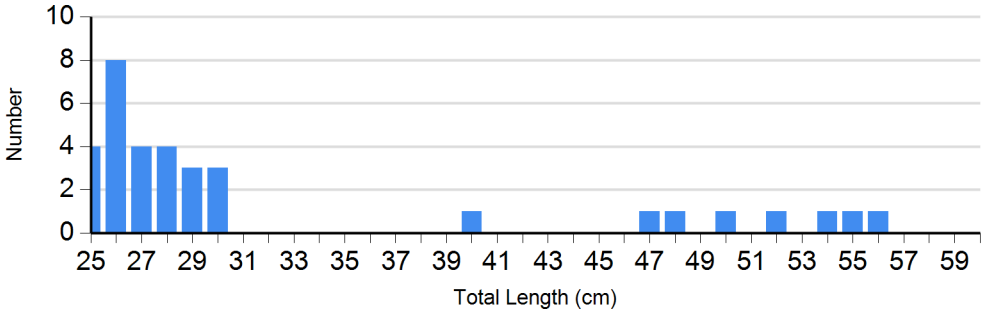
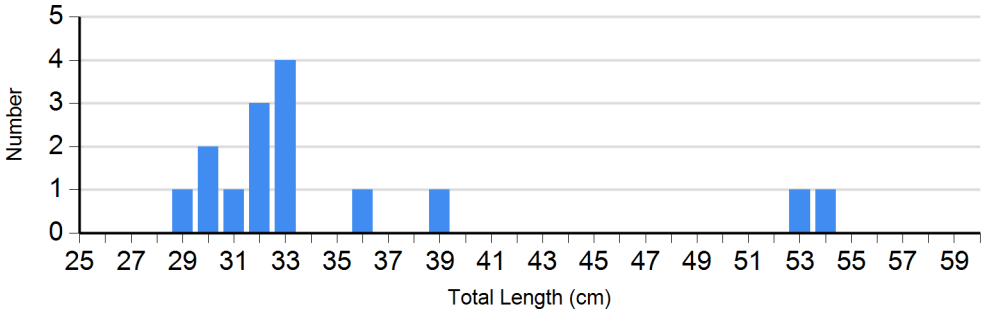


2019

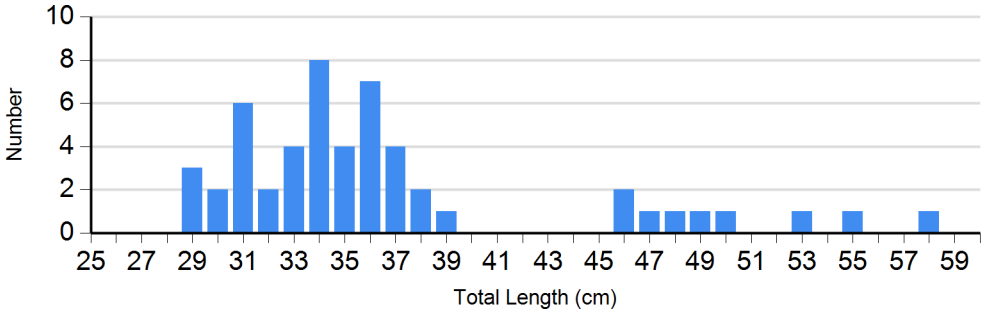
Species: Channel Catfish
Gear: std exp gill net



2014

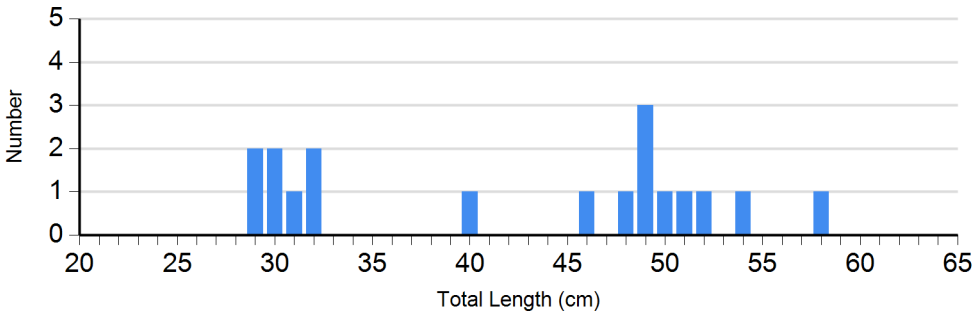


2015

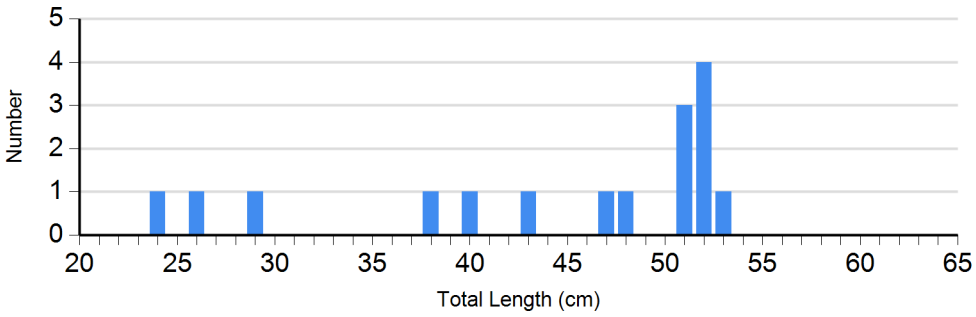


2016

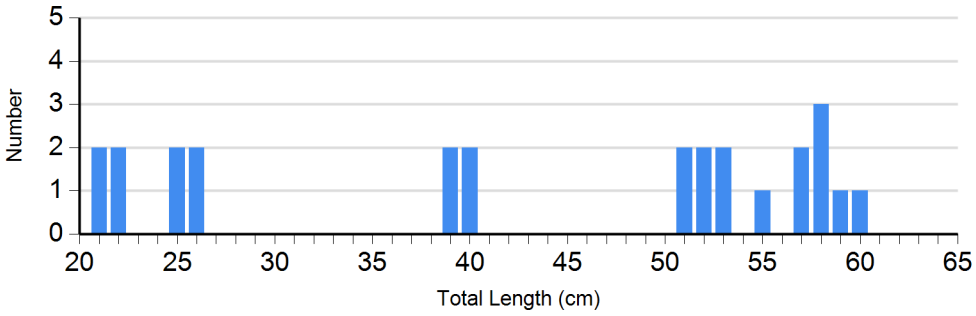
Species: Common Carp
Gear: AFS std gill net



2017

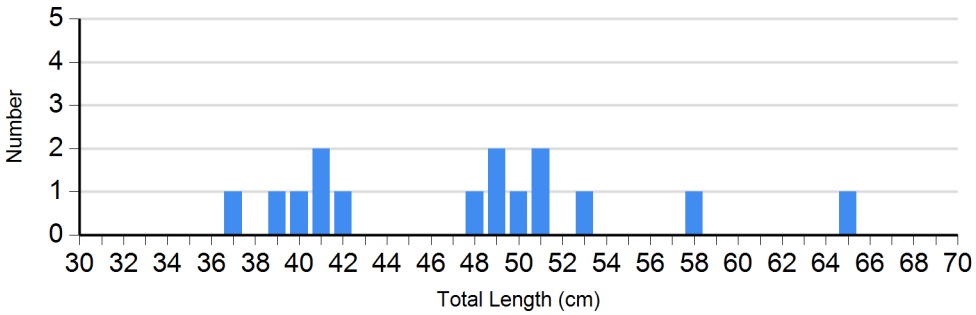


2018

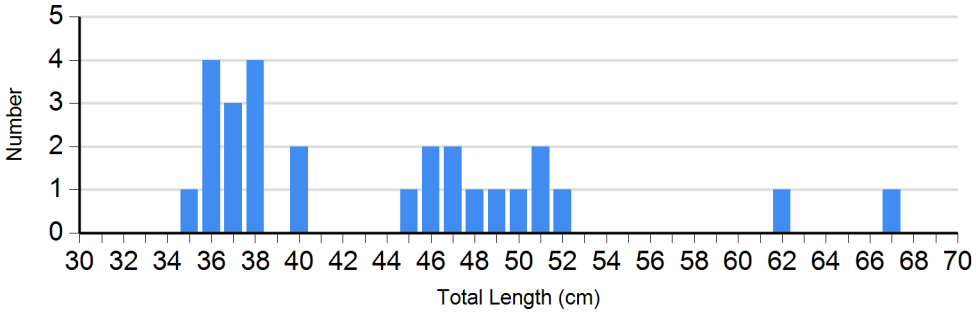


2019

Species: Common Carp
Gear: std exp gill net

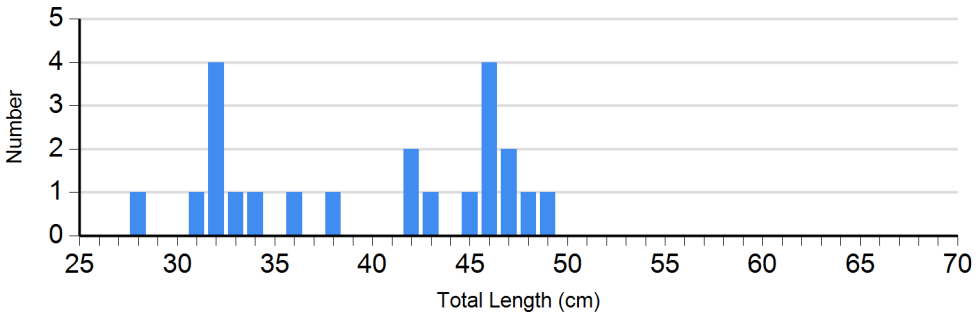


2014



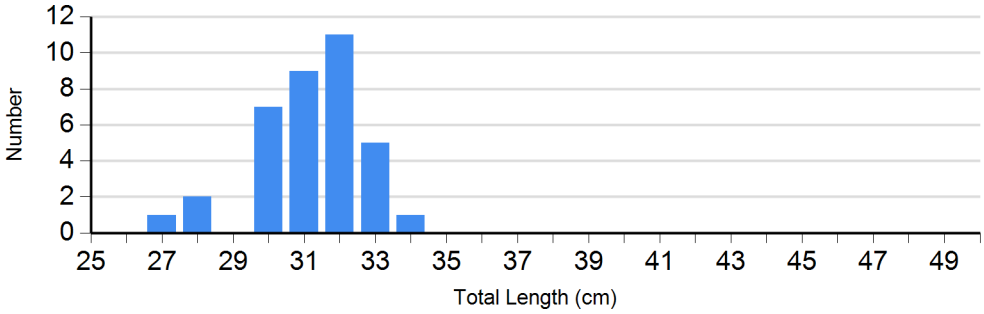
2015

Species: Walleye
Gear: AFS std gill net

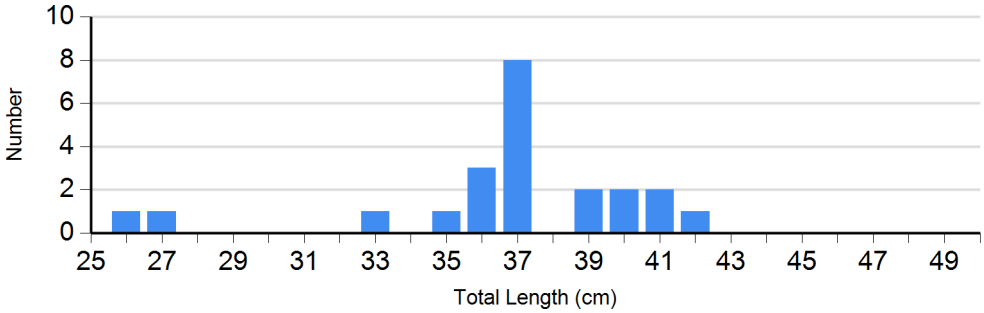


2017

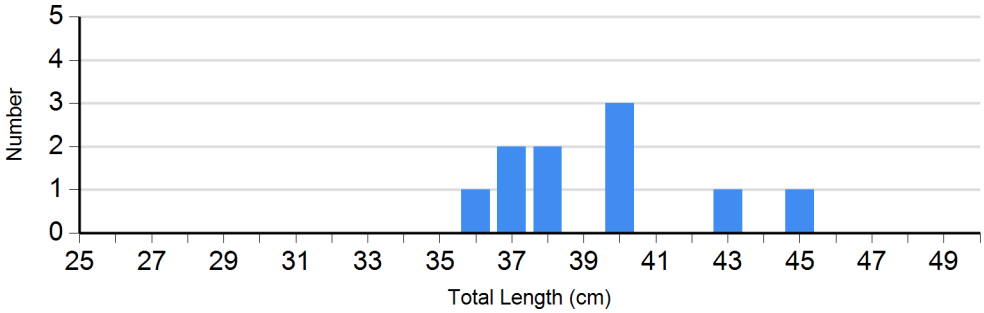
Species: Walleye
Gear: std exp gill net



2014

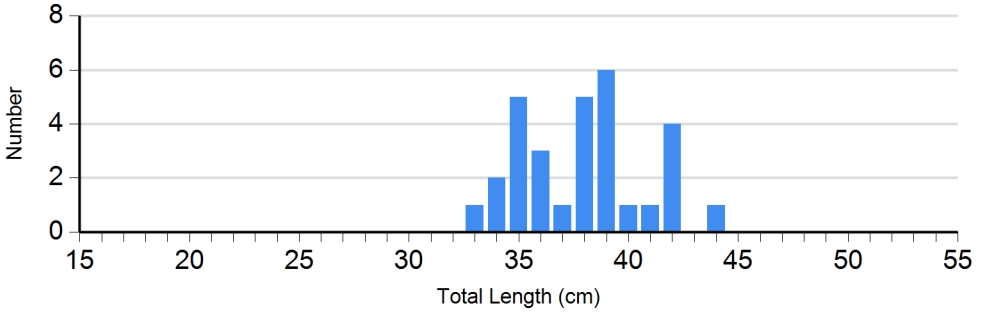


2015

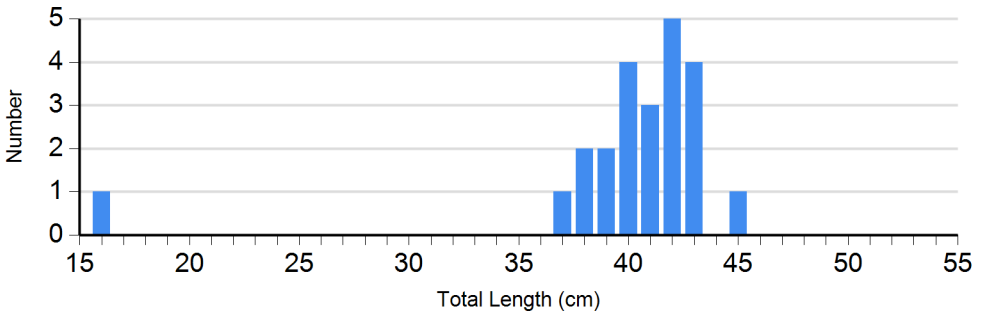


2016

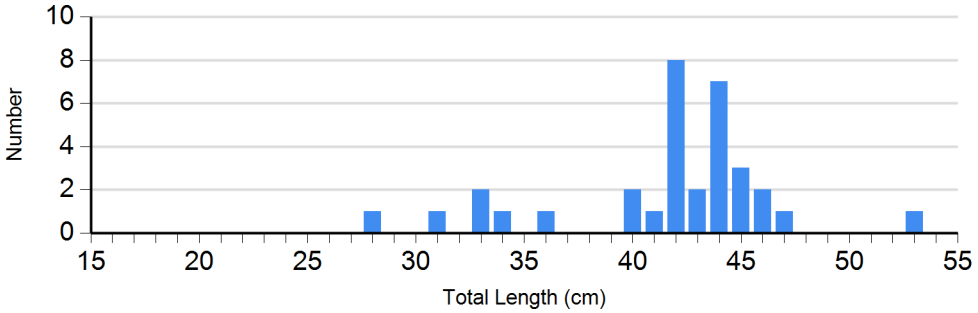
Species: White Sucker
Gear: AFS std gill net



2017

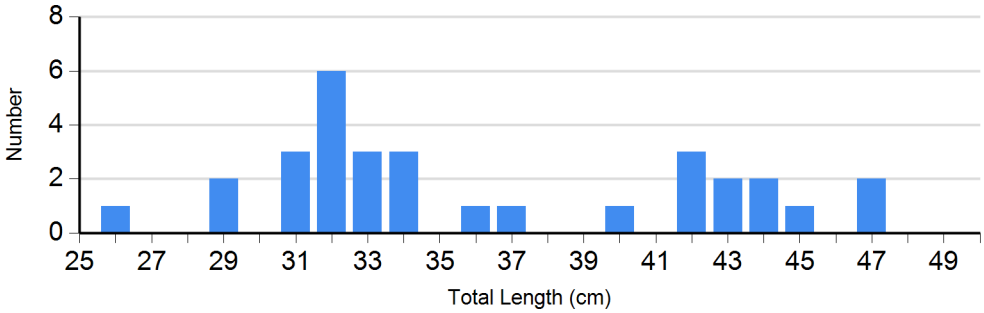


2018



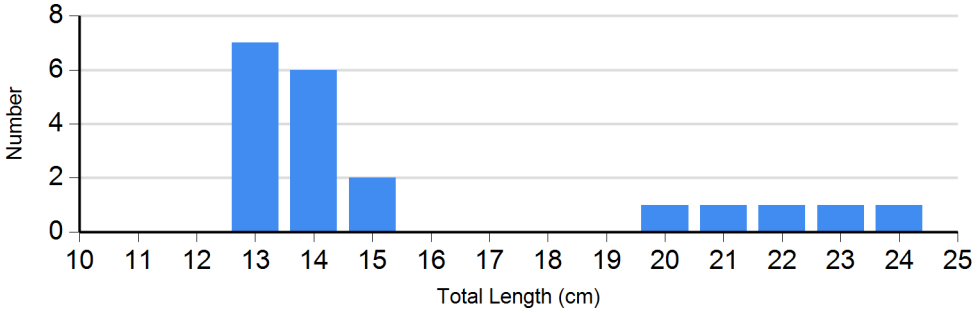
2019

Species: White Sucker
Gear: std exp gill net



2016

Species: Yellow Perch
Gear: AFS std gill net

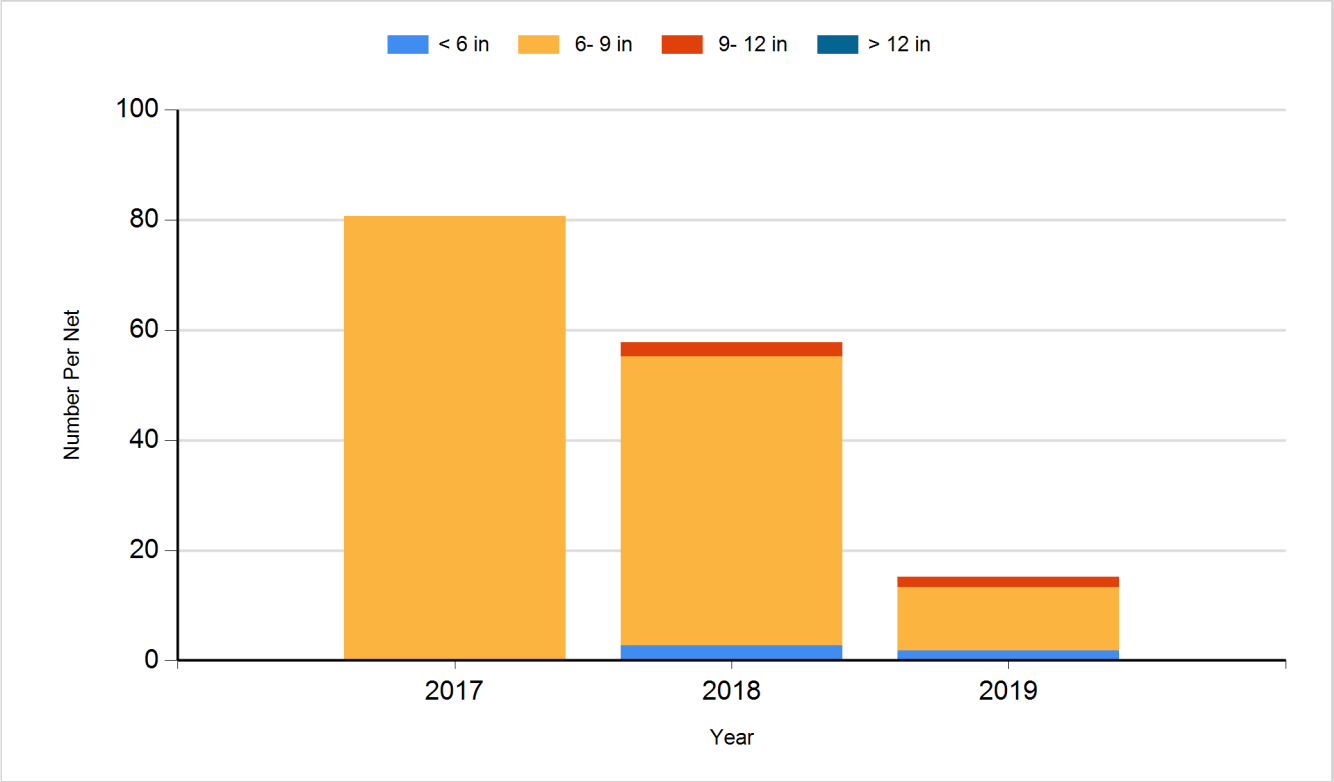


2019

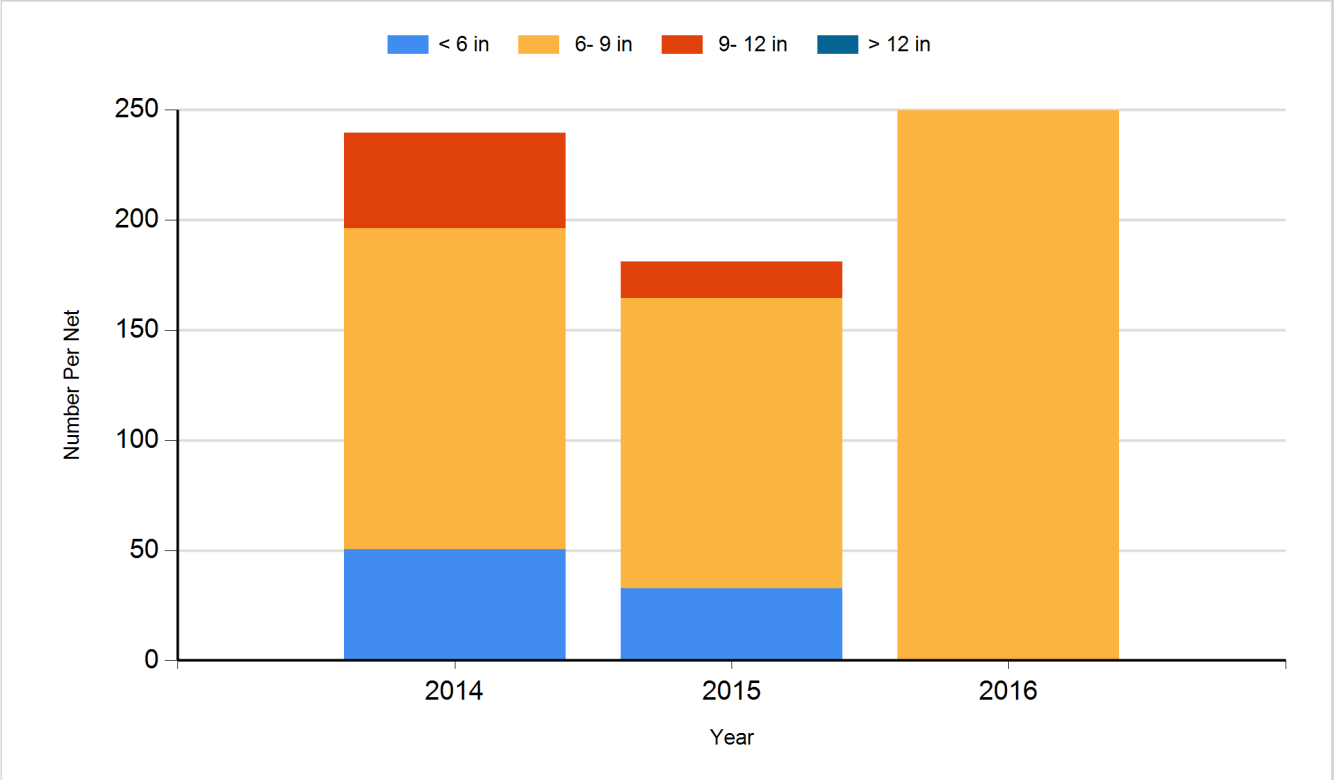
Historic Fish Sizes and Relative Abundance

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

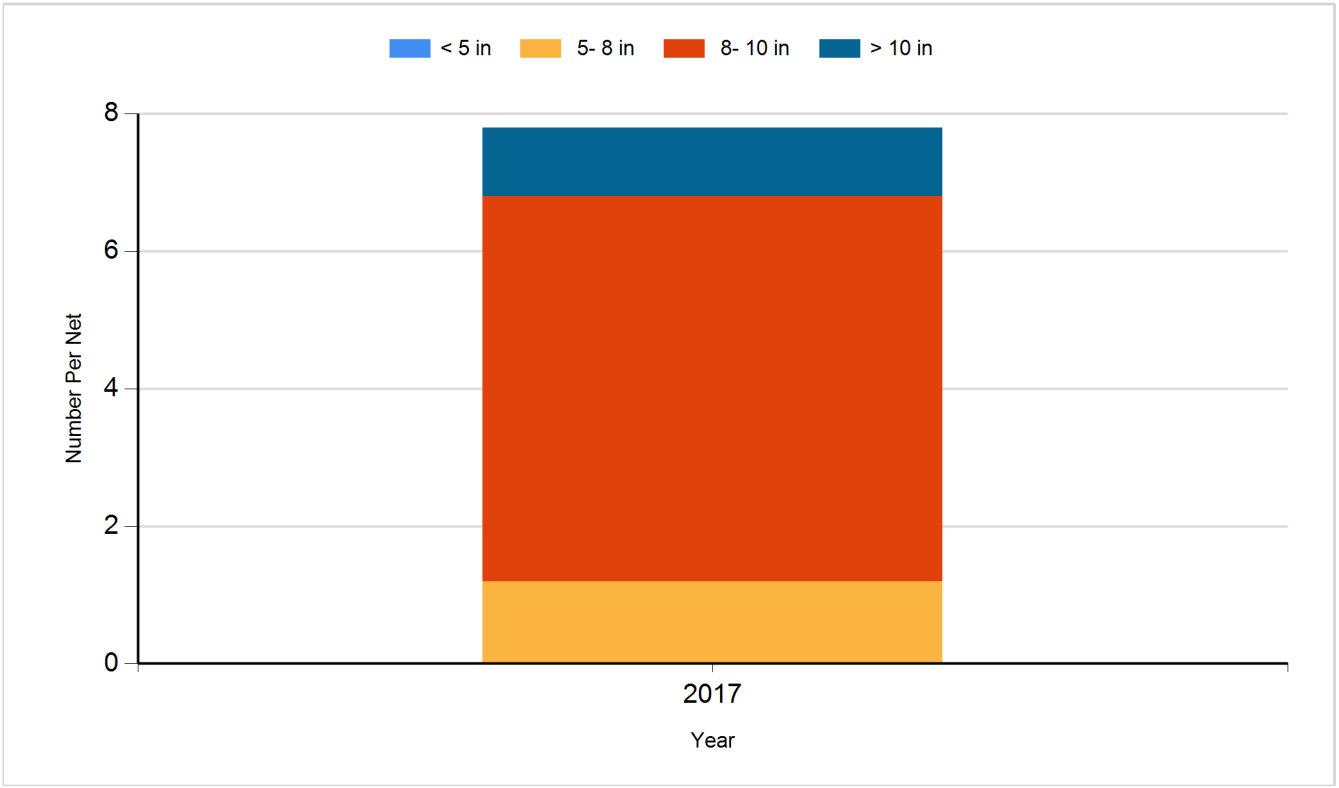
Species: Black Bullhead
Gear: AFS std gill net



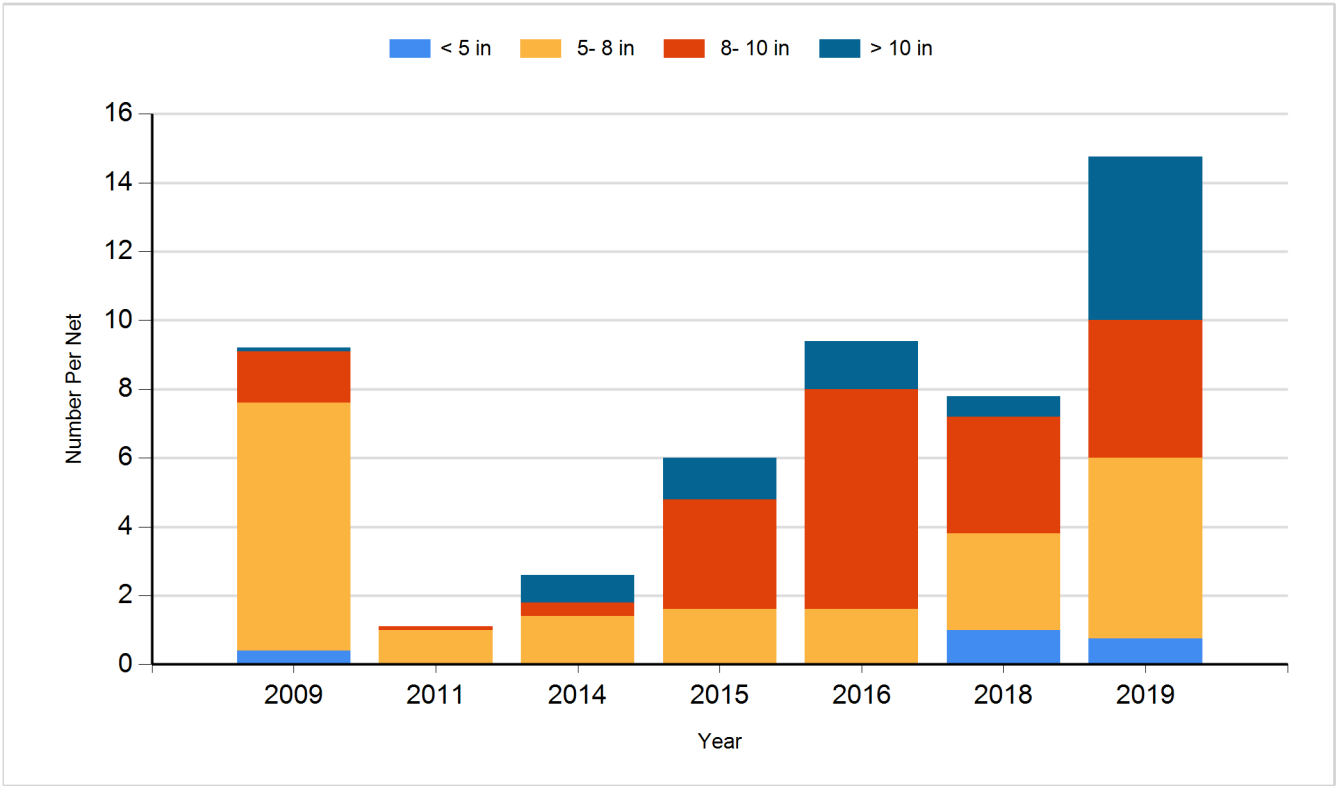
Species: Black Bullhead
Gear: std exp gill net



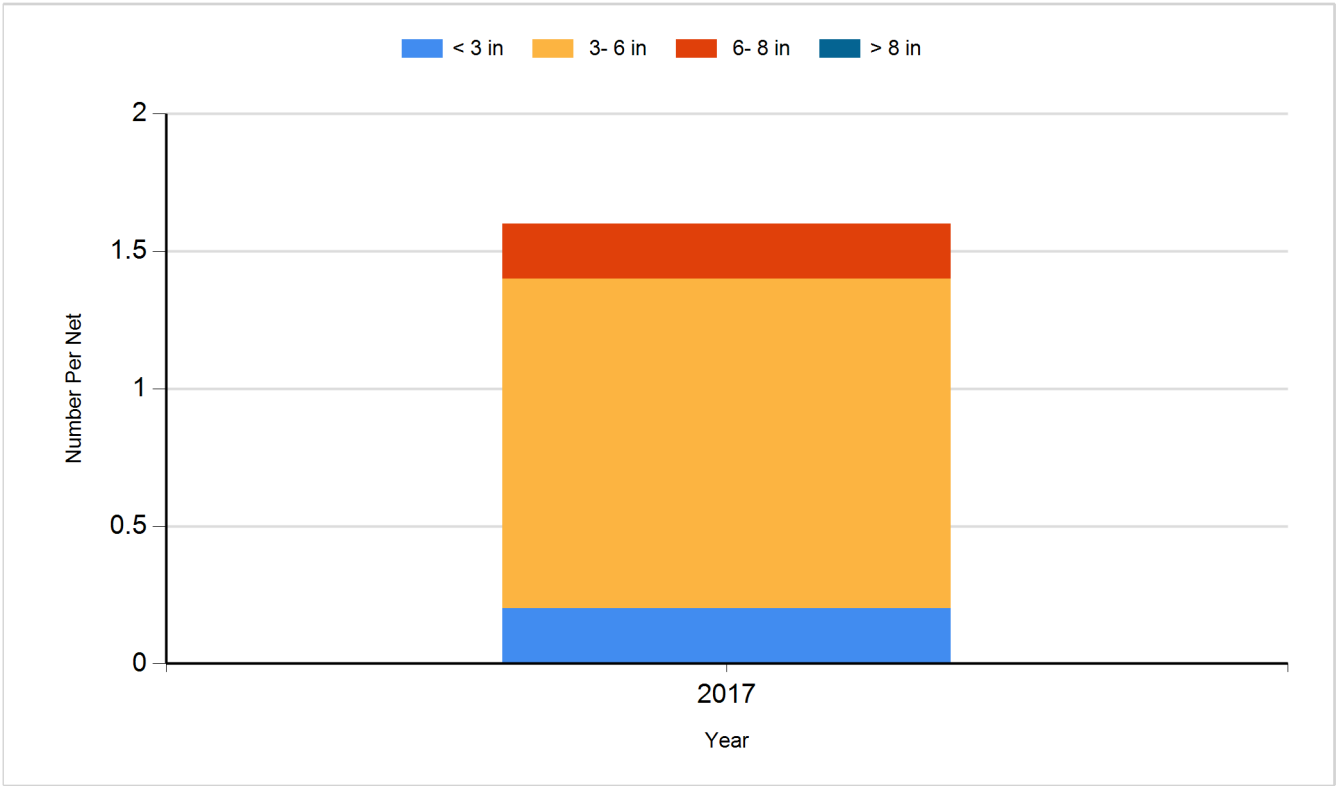
Species: Black Crappie
Gear: AFS std frame net



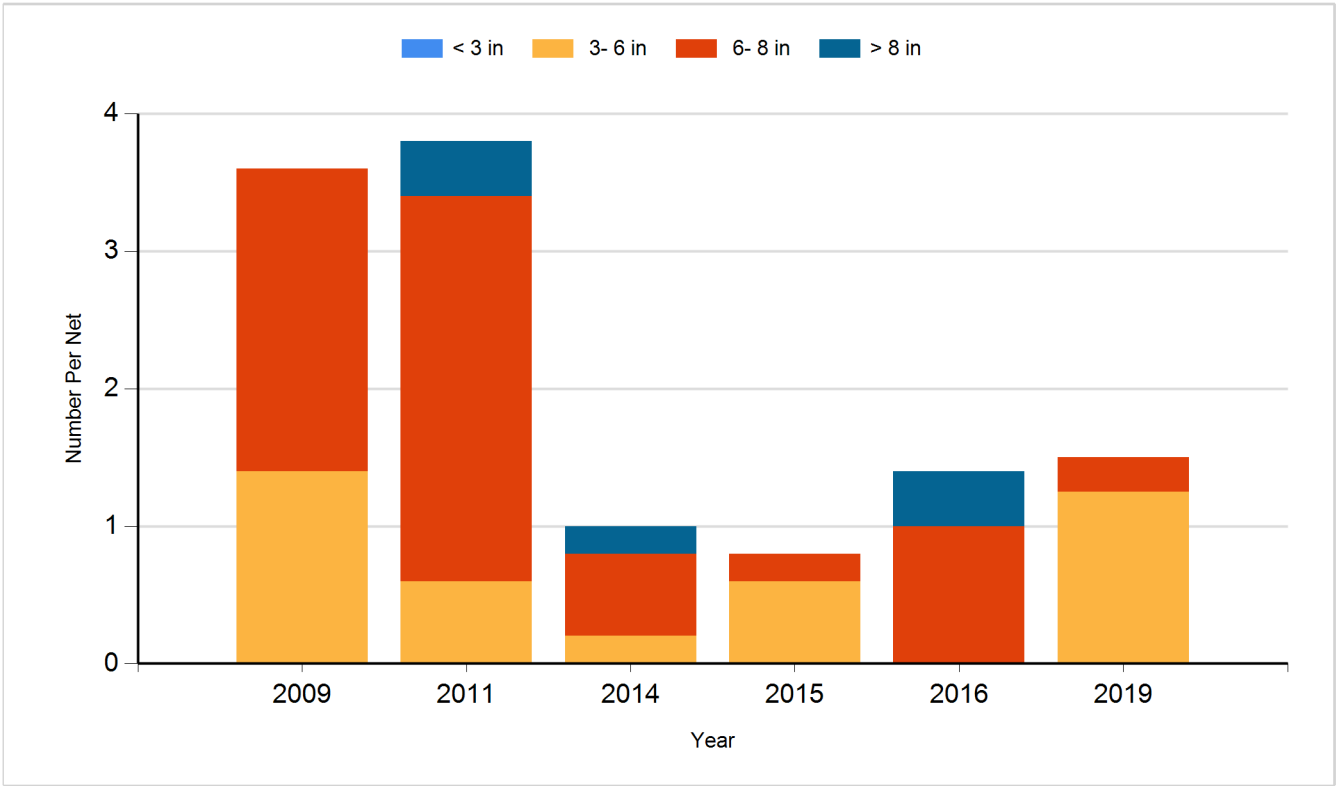
Species: Black Crappie
Gear: frame net (std 3/4 in)



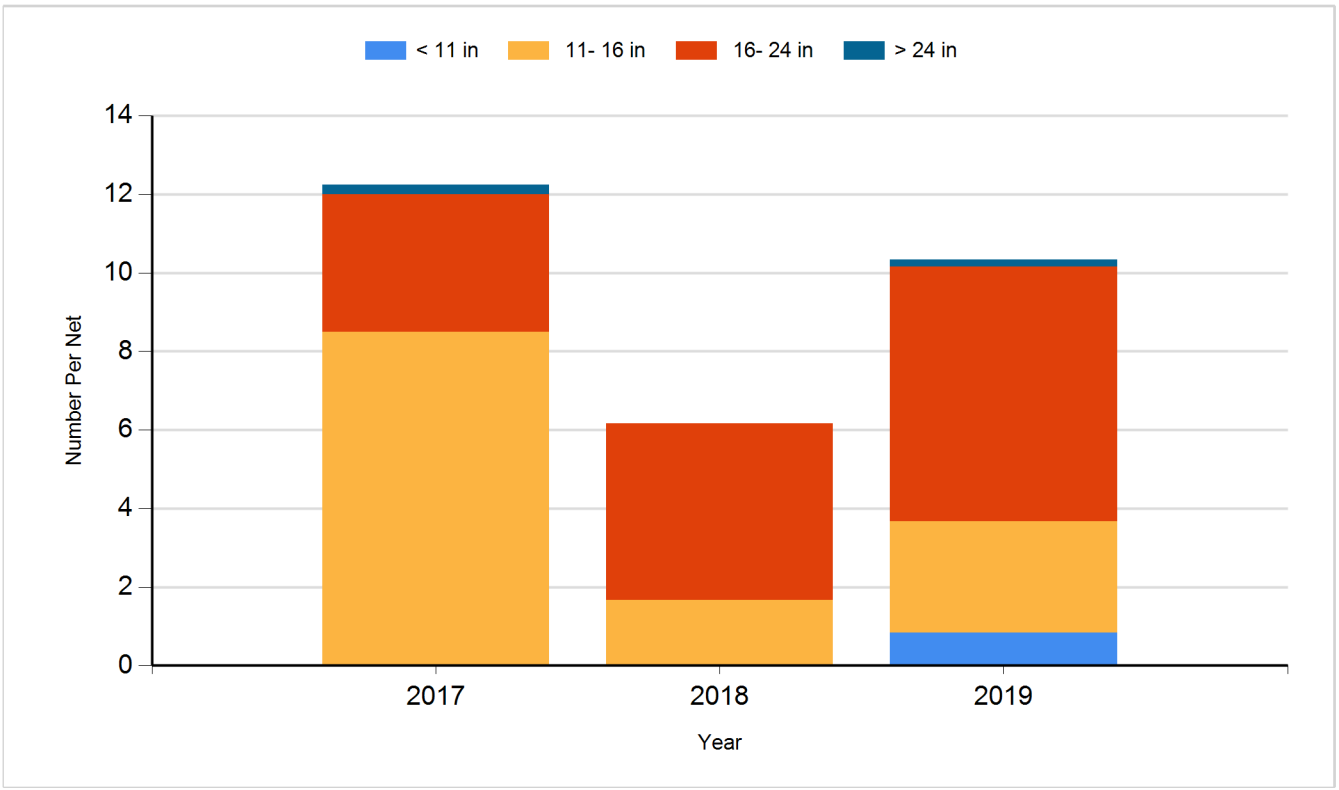
Species: Bluegill
Gear: AFS std frame net



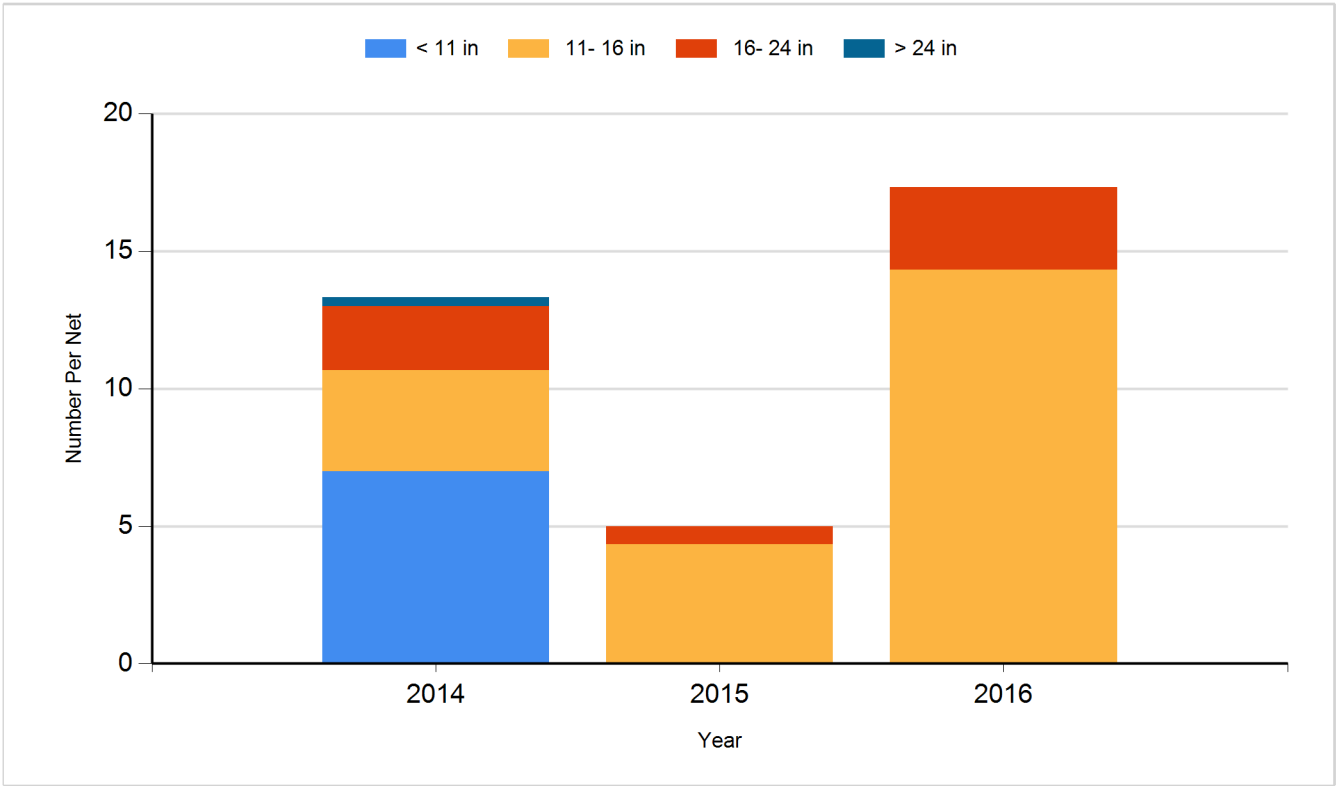
Species: Bluegill
Gear: frame net (std 3/4 in)



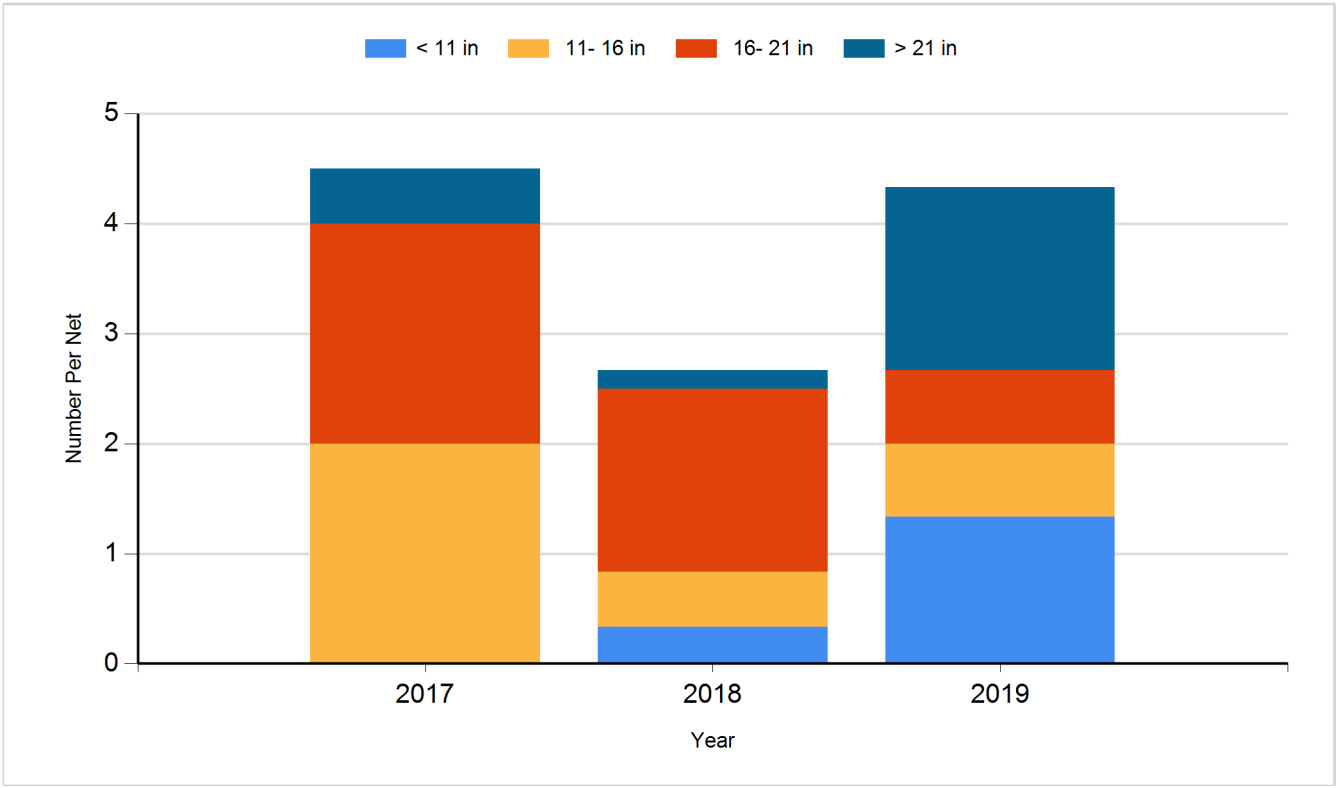
Species: Channel Catfish
Gear: AFS std gill net



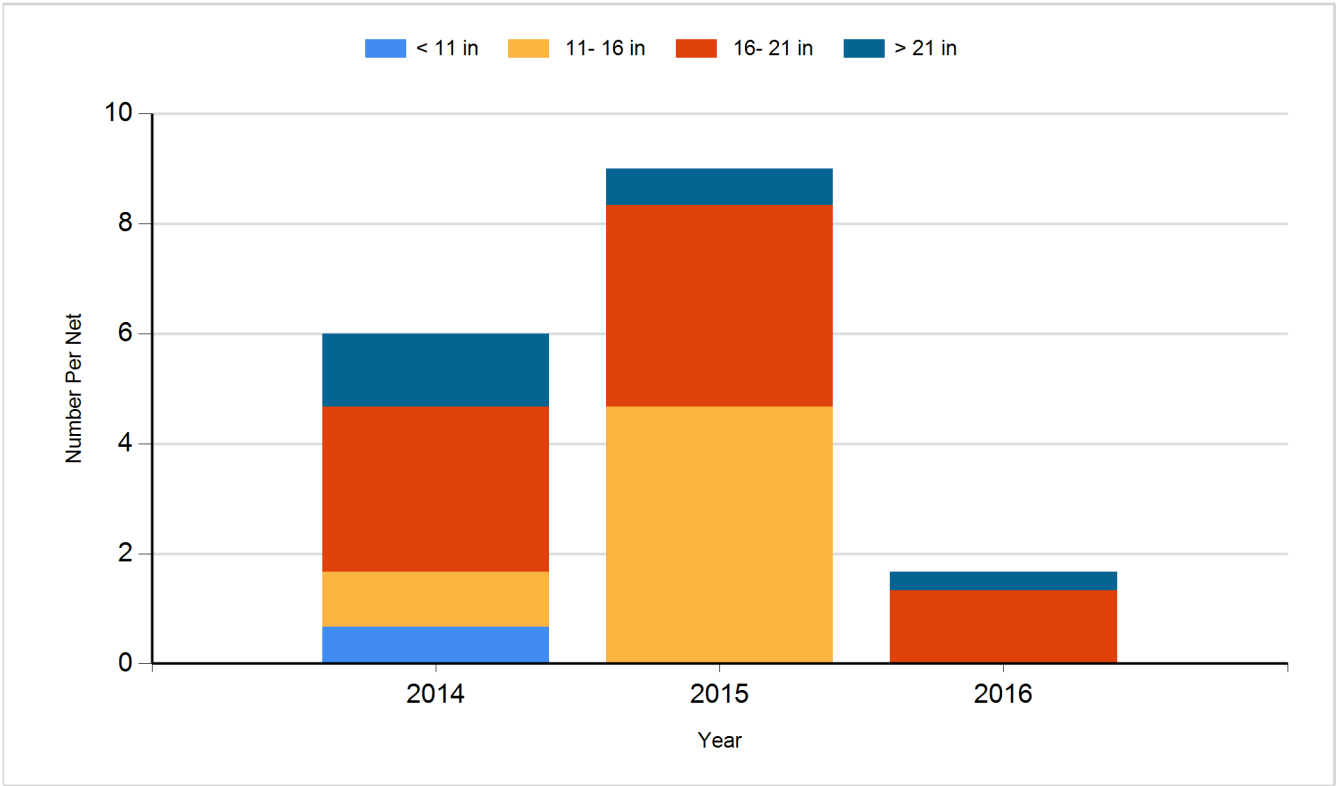
Species: Channel Catfish
Gear: std exp gill net



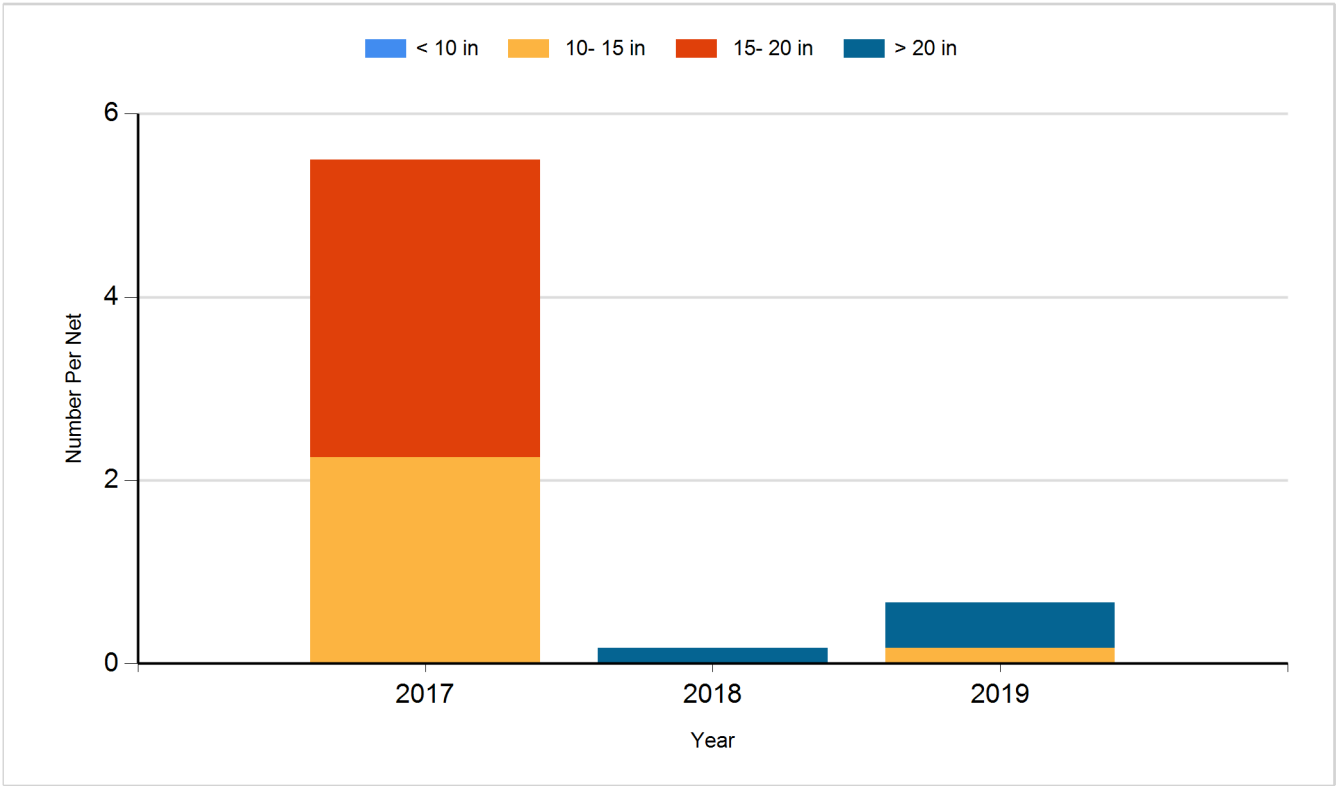
Species: Common Carp
Gear: AFS std gill net



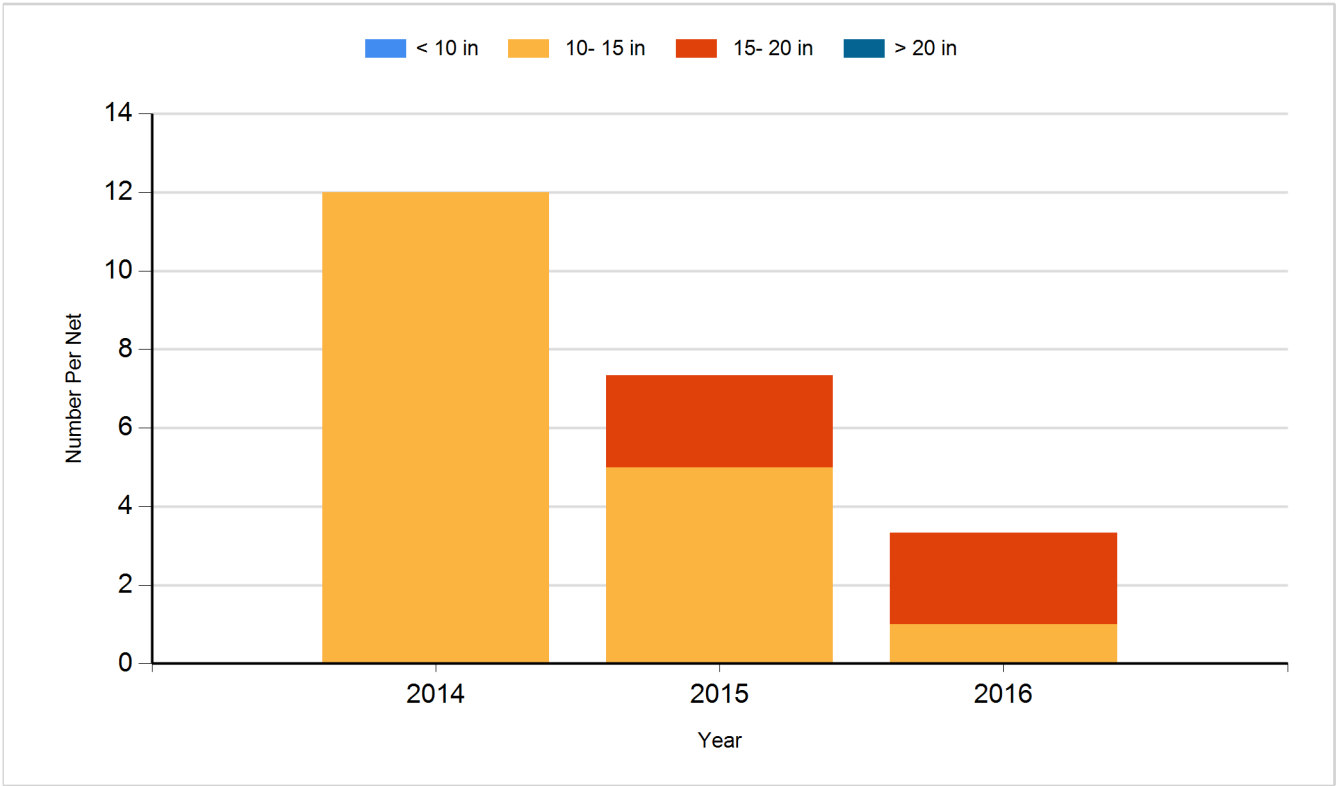
Species: Common Carp
Gear: std exp gill net



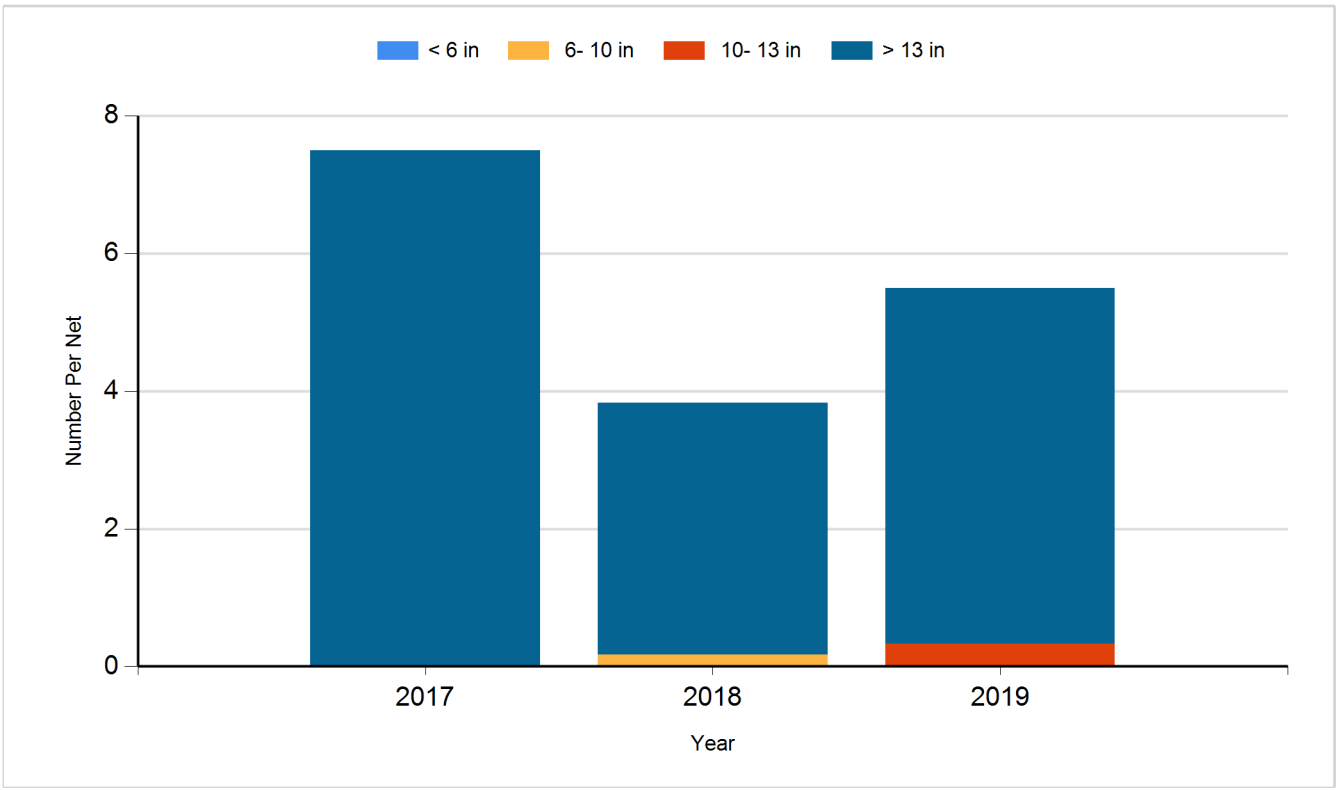
Species: Walleye
Gear: AFS std gill net



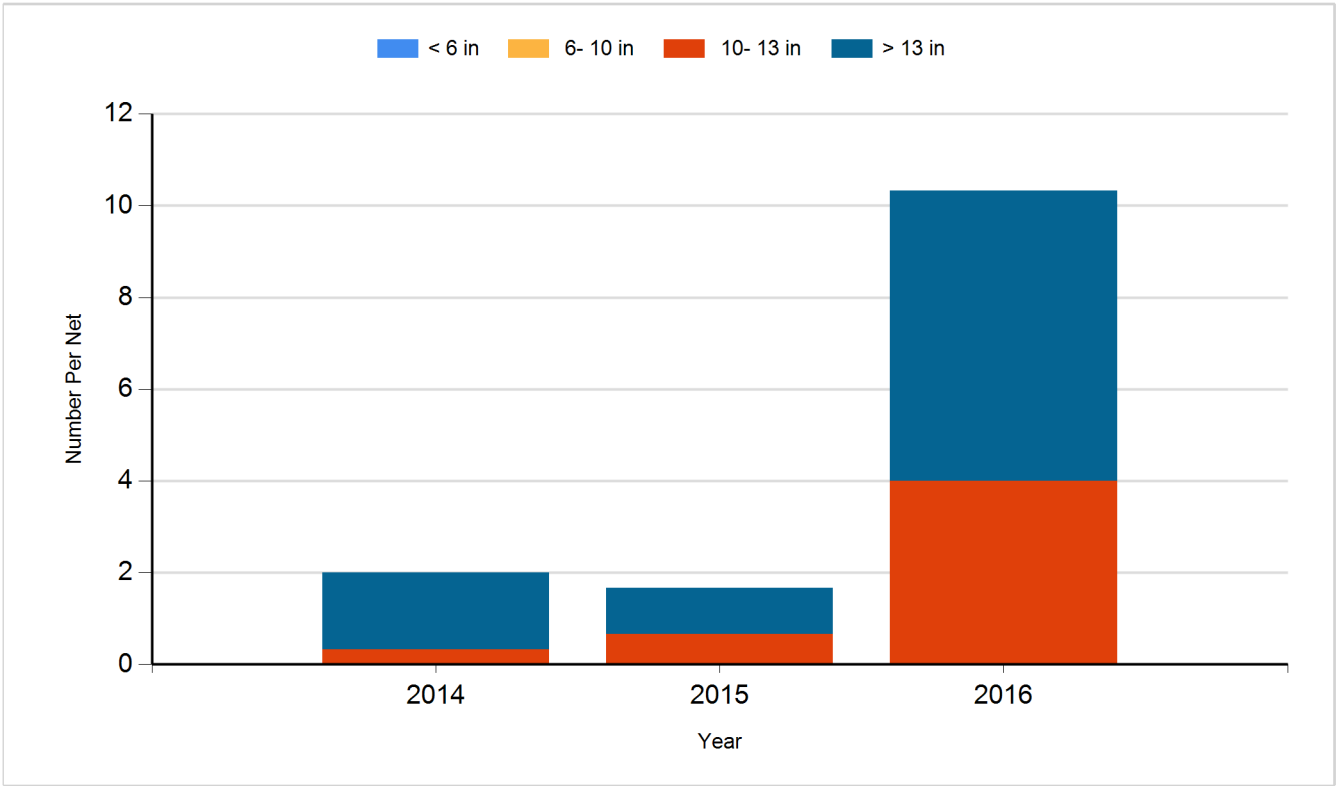
Species: Walleye
Gear: std exp gill net



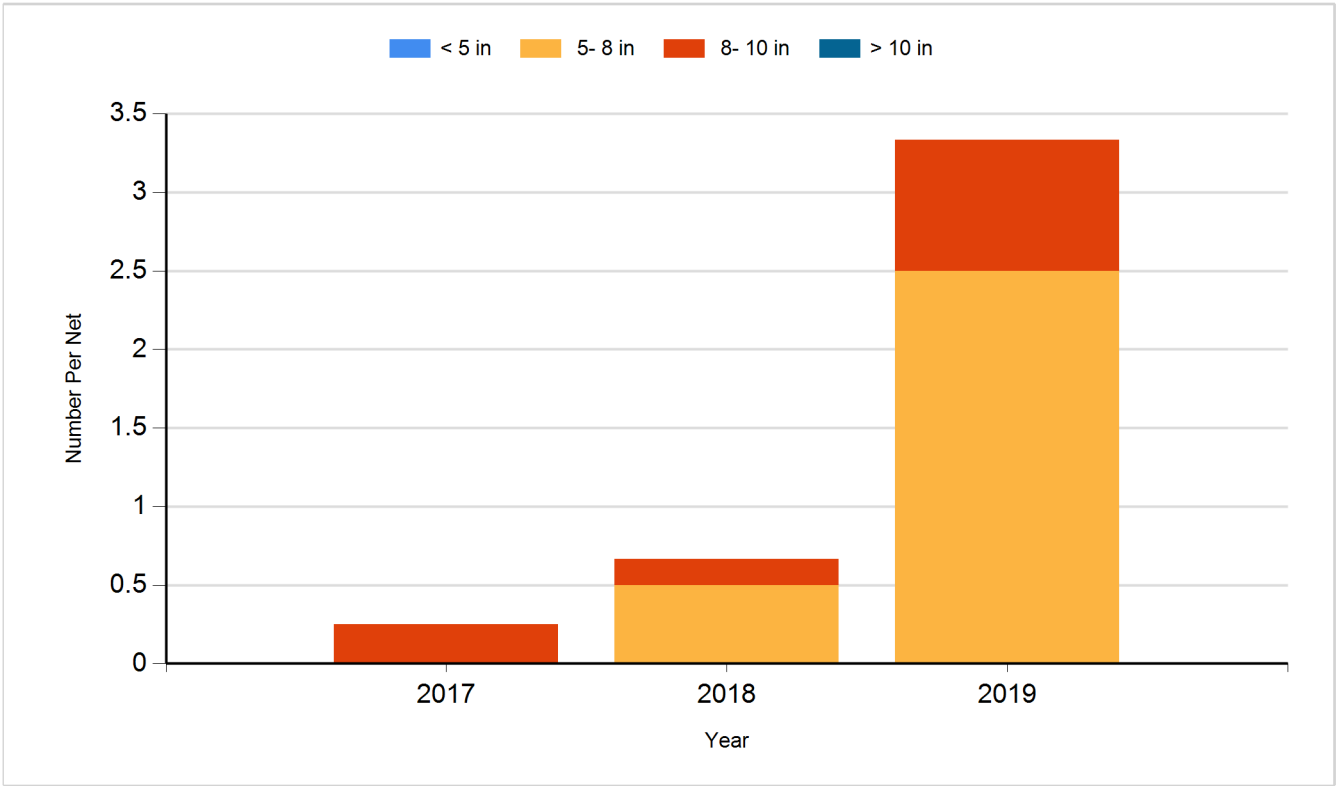
Species: White Sucker
Gear: AFS std gill net



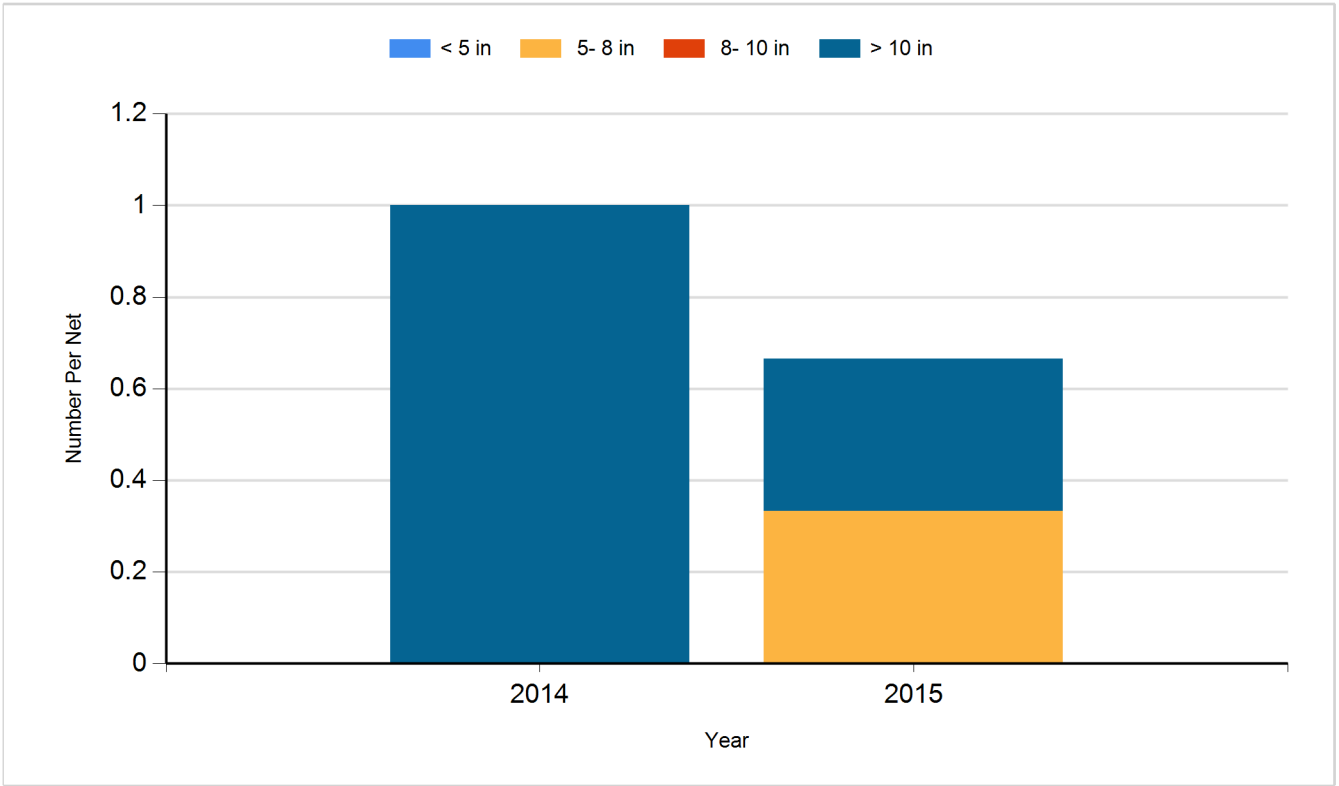
Species: White Sucker
Gear: std exp gill net



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