SOUTH DAKOTA STATEWIDE FISHERIES SURVEY
Madison, Lake County
LBS-Lake-135-000
2019

Lake Information

Name: Madison

County: Lake

Legal Description: T106-R51,52-Sec. 21-23, 25-27, 29, 30-32

OHWM Elevation: 1,604

Surface Area: 2,703 Acres

Outlet Elevation: 1,603

Surveys and Investigations

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

Gear	Date	Effort
AFS std gill net	Jul 16, 2019	6 net-nights
AFS std gill net	Jul 17, 2019	4 net-nights
frame net (std 3/4 in)	Jul 16, 2019	10 net-nights

Common Fish Species Present

Walleye

White Bass

Yellow Perch

Smallmouth Bass

Common Carp

Black Bullhead

Bluegill

White Sucker

Bigmouth Buffalo

Green Sunfish

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	Bigmouth Buffalo	18	1.1	1.2	0		0			
	Black Bullhead	17	1.7	0.8	76		59	20		
	Common Carp	16	1.6	0.9	94		88			
	Walleye	30	2.9	0.9	21	12	3		85	2
	White Bass	95	9.5	2.0	92	4	80	6	87	1
	White Sucker	22	2.2	1.1	95		91			
	Yellow Perch	84	8.2	2.4	40	8	33	7	109	2
frame net (std 3/4 in)	Bigmouth Buffalo	18	1.8	1.1	83		33	18		
	Black Bullhead	48	4.8	1.7	98		88	7		
	Black Crappie	6	0.6	0.4	100		83		101	4
	Bluegill	23	2.3	0.7	100		78	14	118	3
	Common Carp	61	6.1	3.5	98		90	6		
	Green Sunfish	7	0.7	0.5	100		29		112	
	Northern Pike	3	0.3	0.2	67		33		83	1
	Smallmouth Bass	64	6.3	2.6	57	9	13	6	90	2
	Walleye	3	0.3	0.3	33		0		80	1
	White Bass	22	2.2	1.6	100		73	15	89	2
	White Sucker	0	0.0	0.0	0		0			
	Yellow Perch	4	0.4	0.3	50		25		106	2

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	Bigmouth Buffalo								1.2			1.20
	Black Bullhead								2.9			2.90
	Black Crappie								1.4			1.40
	Bluegill								0.5			0.50
	Common Carp								3.1			3.10
	Northern Pike								0.4			0.40
	Smallmouth Bass								1.9			1.90
	Sunfish Hybrid								0.0			0.00
	Walleye								0.9			0.90
	White Bass								1.5			1.50
	White Sucker								0.7			0.70
AFS std gill net	Bigmouth Buffalo								1.1	0.7	1.1	0.97
	Black Bullhead								4.9	3.7	1.7	3.43
	Black Crappie								0.0	0.2	0.0	0.07
	Bluegill								0.3	0.1	0.0	0.13
	Common Carp								3.6	2.0	1.6	2.40
	Northern Pike								0.0	0.1	0.0	0.03
	Smallmouth Bass								0.3	0.5	0.0	0.27
	Walleye								3.3	2.7	2.9	2.97
	White Bass								6.6	9.8	9.5	8.63
	White Sucker								8.5	3.7	2.2	4.80
	Yellow Perch								9.4	11.4	8.2	9.67
fall night EF-WAE	Walleye	710.0	28.0	2.5	113.5	31.0	10.0					149.17
	Yellow Perch	0.0	0.0	0.0	0.0	0.0	0.0					0.00
frame net (std 3/4 in)	Bigmouth Buffalo	4.0	4.3	5.7	3.6	8.0	9.3	9.1		6.2	1.8	5.78
	Black Bullhead	28.4	74.2	73.9	24.0	301.9	61.0	21.5		14.0	4.8	67.08
	Black Crappie	7.1	26.6	8.3	0.1	2.1	1.7	3.6		4.1	0.6	6.02
	Bluegill	7.7	3.9	1.4	0.7	8.6	1.7	3.8		2.7	2.3	3.64
	Channel Catfish	0.0	0.1	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.01
	Common Carp	2.0	2.2	8.2	6.3	16.6	14.2	7.6		12.6	6.1	8.42
	Green Sunfish	5.5	2.5	0.0	0.2	0.4	0.2	0.1		0.0	0.7	1.07
	Northern Pike	0.0	0.5	0.9	0.4	0.2	0.3	0.1		0.4	0.3	0.34
	Smallmouth Bass	0.2	0.2	0.1	0.1	3.5	0.9	2.4		5.3	6.3	2.11
	Sunfish Hybrid	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.00

		CPUE										
Gear	Species	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Avg
frame net (std 3/4 in)	Walleye	0.5	1.9	16.8	0.2	0.2	0.7	1.7		0.8	0.3	2.57
	White Bass	0.1	0.3	5.1	0.2	0.0	0.5	4.8		0.8	2.2	1.56
	White Sucker	0.2	2.3	5.6	2.2	0.8	3.4	2.5		0.4	0.0	1.93
	Yellow Perch	165.9	100.9	5.5	0.6	2.2	0.4	0.8		1.9	0.4	30.96
std exp gill net	Bigmouth Buffalo	0.0	0.0	1.0	0.0	0.8	0.8	0.0				0.37
	Black Bullhead	6.3	26.8	19.7	15.8	63.4	91.0	7.8				32.97
	Black Crappie	2.3	10.8	0.0	0.0	0.2	0.3	0.0				1.94
	Bluegill	0.3	1.0	0.3	0.0	0.0	0.5	0.0				0.30
	Channel Catfish	0.0	0.0	0.0	0.0	0.2	0.3	0.2				0.10
	Common Carp	0.0	2.5	0.3	0.0	1.4	3.5	2.2				1.41
	Green Sunfish	0.0	0.3	0.0	0.0	0.0	0.0	0.0				0.04
	Northern Pike	0.0	0.3	0.7	0.0	0.2	0.0	0.2				0.20
	Smallmouth Bass	0.0	0.0	0.0	0.0	0.6	0.0	0.0				0.09
	Spottail Shiner	0.0	0.0	0.0	0.0	0.0	0.0	0.0				0.00
	Walleye	19.0	12.8	23.7	9.6	7.0	7.3	17.8				13.89
	White Bass	0.0	1.5	0.0	1.2	0.8	0.8	0.8				0.73
	White Sucker	9.0	15.8	14.7	11.6	20.0	11.0	13.6				13.67
	Yellow Bullhead	0.0	0.3	0.0	0.0	0.0	0.0	0.0				0.04
	Yellow Perch	162.3	265.8	130.0	6.0	24.2	8.3	15.6				87.46

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	Bigmouth Buffalo	PSD								83		
		PSD-P								8		
	Black Bullhead	PSD								100		
		PSD-P								79		
	Bluegill	PSD								80		
		PSD-P								20		
		Wr								144		
	Common Carp	PSD								100		
		PSD-P								32		
	Smallmouth Bass	PSD								53		
		PSD-P								16		
		Wr								89		
	Walleye	PSD								44		
		PSD-P								0		
		Wr								76		
	White Bass	PSD								87		
		PSD-P								73		
		Wr								85		
	White Sucker	PSD								100		
		PSD-P								100		
AFS std gill net	Bigmouth Buffalo	PSD								27	57	0
		PSD-P								0	14	0
	Black Bullhead	PSD								98	100	76
		PSD-P								80	95	59
	Bluegill	PSD								100	100	
		PSD-P								33	100	
		Wr								119	118	
	Common Carp	PSD								100	100	94
		PSD-P								22	90	88
	Smallmouth Bass	PSD								0	20	
		PSD-P								0	20	
		Wr								94	90	
	Walleye	PSD								52	30	21

			Year									
Gear	Species	Index	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AFS std gill net	Walleye	PSD-P								9	19	3
		Wr								80	83	85
	White Bass	PSD								86	100	92
		PSD-P								35	97	80
		Wr								93	87	87
	White Sucker	PSD								98	78	95
		PSD-P								94	78	91
	Yellow Perch	PSD								44	75	40
		PSD-P								26	48	33
		Wr								105	107	109
fall night EF-WAE	Walleye	Wr	95	100	105	83	98	92				
frame net (std 3/4 in)	Bigmouth Buffalo	PSD	65	98	40	31	66	13	84		90	83
		PSD-P	20	12	12	3	10	3	8		18	33
		Wr	100	97	89	104						
	Black Bullhead	PSD	77	24	95	99	25	90	97		97	98
		PSD-P	6	3	24	31	16	16	30		91	88
		Wr	99	93	90	103						
	Bluegill	PSD	9	97	64	83	6	100	97		100	100
		PSD-P	6	0	43	83	2	6	97		48	78
		Wr	132	120	95	110	125	118	115		111	118
	Common Carp	PSD	100	50	98	100	8	85	87		99	98
		PSD-P	85	9	20	72	7	4	37		84	90
		Wr	102	93	101	100						
	Green Sunfish	PSD	24	52		0	25	100	100			100
		PSD-P	4	4		0	0	0	100			29
		Wr	112	104		91		132	111			112
	Smallmouth Bass	PSD	0	0	100	100	0	0	38		32	57
		PSD-P	0	0	0	100	0	0	0		8	13
		Wr	119	109	88	102	100	97	97		88	90
	Walleye	PSD	20	16	2	0	50	29	0		50	33
		PSD-P	0	0	2	0	0	14	0		13	0
		Wr	92	90	86	97	83	79	81		84	80
	White Bass	PSD	100	67	100	100		60	98		100	100
		PSD-P	0	33	84	100		20	38		100	73
		Wr	100	96	84	100		92	92		84	89
	White Sucker	PSD	50	87	100	100	50	100	100		100	0

			Year									
Gear	Species	Index	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
frame net (std 3/4 in)	White Sucker	PSD-P	50	48	86	95	50	91	100		100	0
		Wr	95	100	84	103						
	Yellow Perch	PSD	8	4	96	0	9	100	13		63	50
		PSD-P	5	1	24	0	0	75	13		32	25
		Wr	99	101	90	123	93	98	97		108	106
std exp gill net	Bigmouth Buffalo	PSD	0		33		0	0				
		PSD-P	0		0		0	0				
		Wr			92							
	Black Bullhead	PSD	68	33	97	91	22	88	97			
		PSD-P	5	5	3	29	11	1	8			
		Wr	109	111	89	107						
	Bluegill	PSD	0	100	100			100				
		PSD-P	0	0	0			100				
		Wr	124	114	98			110				
	Common Carp	PSD		30	100	0	0	100	91			
		PSD-P		10	0	0	0	14	73			
		Wr		98	85		58					
	Green Sunfish	PSD		0		0						
		PSD-P		0		0						
		Wr		104								
	Smallmouth Bass	PSD					33					
		PSD-P					33					
		Wr					99					
	Walleye	PSD	39	49	6	48	89	0	1			
		PSD-P	0	10	3	0	11	0	0			
		Wr	91	87	77	100	85	86	86			
	White Bass	PSD		100	0	100	100	0	100			
		PSD-P		17	0	50	100	0	25			
		Wr		102		106	91	98	97			
	White Sucker	PSD	74	98	98	93	38	98	94			
		PSD-P	70	65	77	90	26	64	91			
		Wr	98	101	87	113						
	Yellow Perch	PSD	34	18	87	17	3	82	37			
		PSD-P	25	3	12	3	2	24	36			
		Wr	106	102	91	112	106	110	108			

Length at Capture

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

Species: Bluegill

		Mean Length (expanded sample number) at capture by age									
Year	N	1	2	3	4	5	6	7	8	9	10+
2012	14	107 (5)		181 (1)	197 (1)	203 (6)	233 (1)				

Species: Walleye

		Mean Length (expanded sample number) at capture by age									
Year	N	1	2	3	4	5	6	7	8	9	10+
2019	30	224 (1)	304 (19)	369 (5)		425 (3)	541 (2)				
2018	44	243 (27)	328 (6)	343 (1)	388 (4)	383 (1)		564 (1)			651 (4)
2017	34	254 (4)	255 (2)	373 (10)	397 (15)				669 (1)		645 (2)
2016	90	238 (1)	284 (56)	314 (32)	425 (1)						
2015	101	196 (48)	254 (53)								
2014	68	206 (37)	415 (1)	436 (8)	462 (19)	496 (1)	558 (2)				
2013	48		334 (7)	386 (41)							
2012	74	250 (8)	303 (63)		515 (2)	536 (1)					
2011	98	245 (73)	401 (6)	448 (8)	494 (11)						
2010	57	312 (12)	370 (37)	423 (7)		470 (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+
2017	94	171 (53)	247 (28)	275 (1)	281 (12)						
2015	33	166 (6)	240 (27)								
2014	121	173 (119)	251 (1)		318 (1)						
2013	30	165 (25)	233 (3)	256 (2)							
2012	390	155 (35)	231 (347)	263 (4)		325 (4)					
2011	1063	180 (938)	242 (125)								
2010	487	178 (355)	259 (16)	281 (112)	304 (6)						

Fish Condition

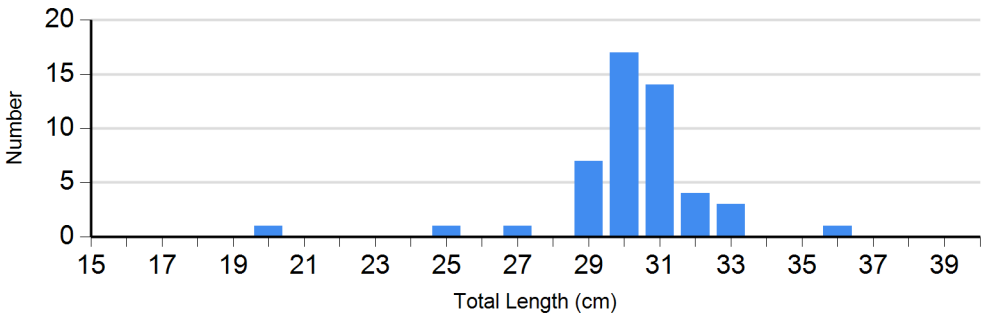
Mean relative weight (Wr) by sample size (N), length category stock to quality (S-Q), quality to preferred (Q-P), preferred to memorable (P-M), and memorable (M) for species collected across survey years with standard error (SE).

		Length Groups							
		S-Q		Q-P		P-M		M	
Species	Year	N	Wr (SE)	N	Wr (SE)	N	Wr (SE)	N	Wr (SE)
Bluegill Frame Net	2015	0		16	115 (2.2)	1	171	0	
	2016	1	117	0		37	115 (1.6)	0	
	2017	1	133	3	117 (3.7)	1	234	0	
	2018	0		14	116 (3.0)	10	104 (3.1)	3	106 (4.7)
	2019	0		5	132 (7.0)	17	115 (2.0)	1	104
Walleye Gill Net	2015	29	86 (0.8)	0		0		0	
	2016	88	86 (0.6)	1	85	0		0	
	2017	16	80 (0.8)	14	80 (1.2)	0		3	82 (6.6)
	2018	19	84 (1.4)	3	71 (0.4)	2	79 (2.9)	3	86 (3.4)
	2019	23	82 (0.9)	5	95 (6.6)	1	90	0	
White Bass Gill Net	2015	3	98 (1.9)	0		0		0	
	2016	0		3	98 (1.7)	0		1	97
	2017	9	98 (3.2)	34	94 (1.0)	23	91 (1.0)	0	
	2018	0		3	93 (1.3)	94	87 (0.4)	1	
	2019	8	96	11	95 (3.2)	75	87 (0.7)	1	85
Yellow Perch Gill Net	2015	6	104 (1.1)	19	111 (2.0)	8	113 (3.0)	0	
	2016	49	111 (1.2)	1	101	28	106 (1.2)	0	
	2017	53	108 (1.0)	17	107 (2.6)	20	100 (2.7)	4	95 (2.7)
	2018	28	107 (1.9)	31	109 (1.2)	49	108 (1.0)	6	95 (3.1)
	2019	49	107 (2.6)	6	118 (4.1)	19	112 (1.5)	8	100 (3.9)

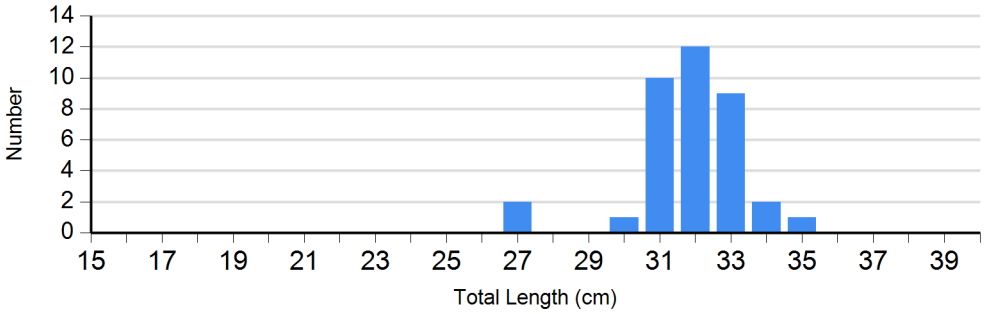
Length Frequency Distribution

Length frequency histogram of species sampled by year.

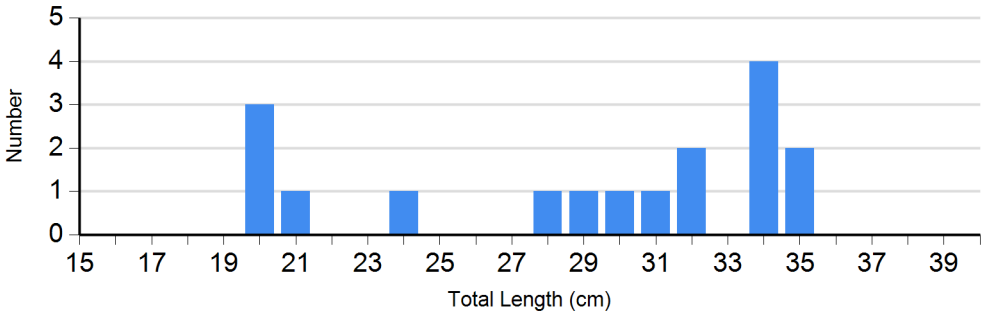
Species: Black Bullhead
Gear: AFS std gill net



2017

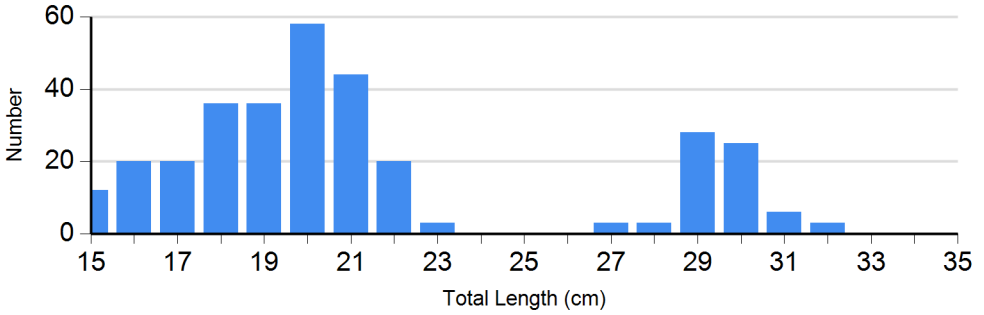


2018

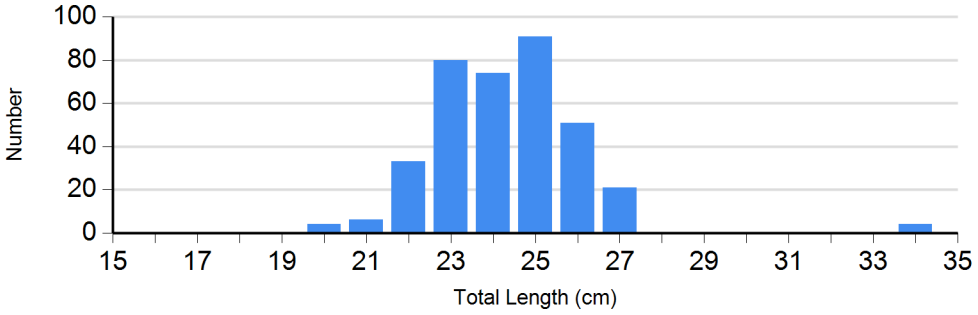


2019

Species: Black Bullhead
Gear: std exp gill net



2014



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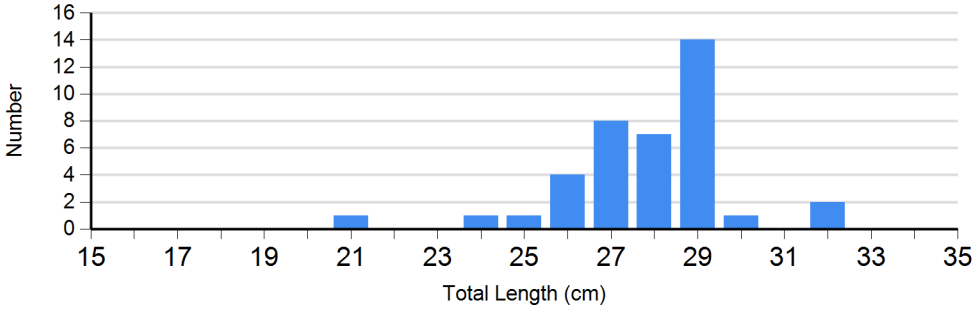
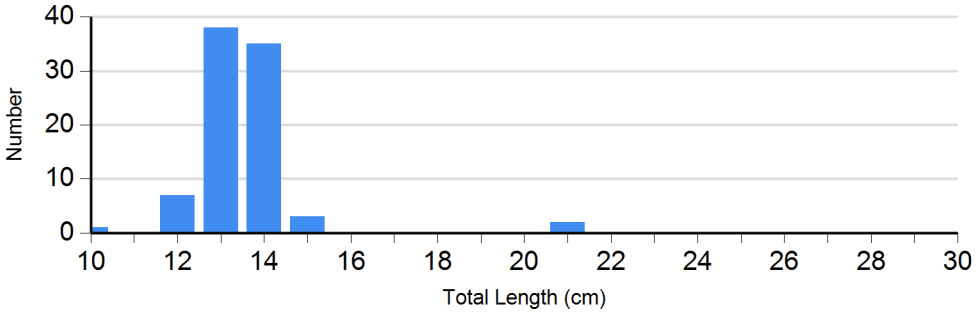
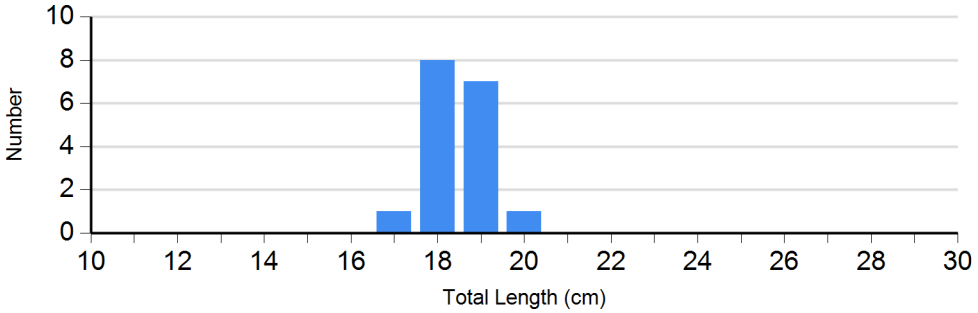


2016

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



2014



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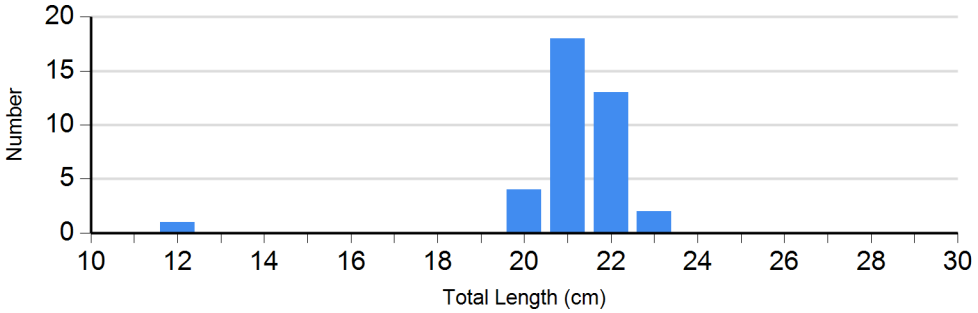

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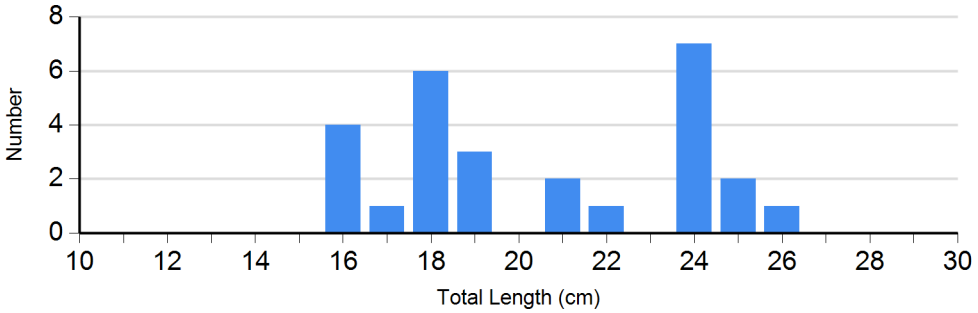
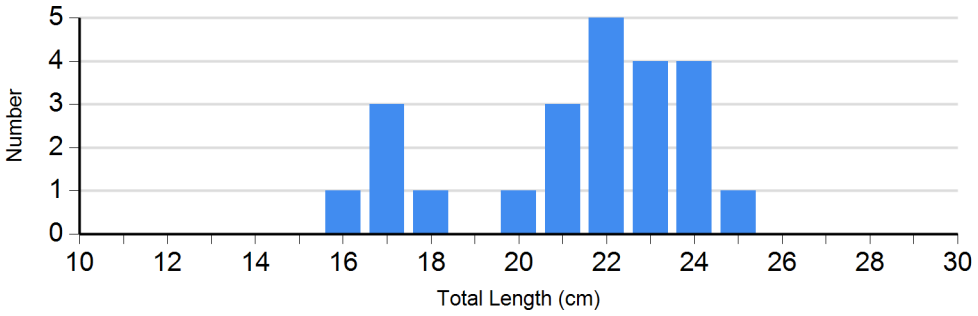
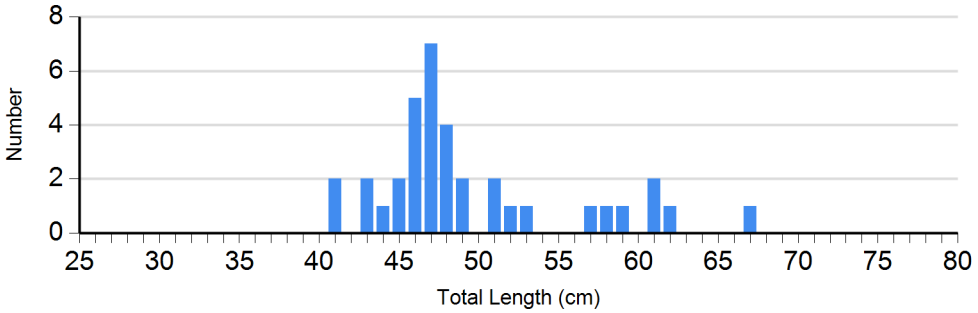


2018



2019

Species: Common Carp
Gear: AFS std gill net



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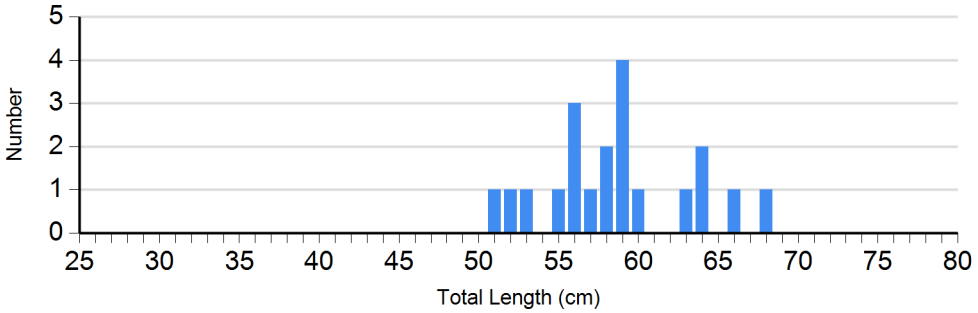
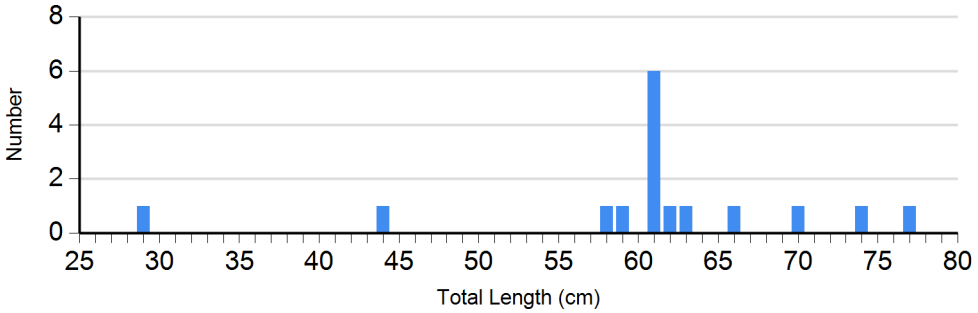
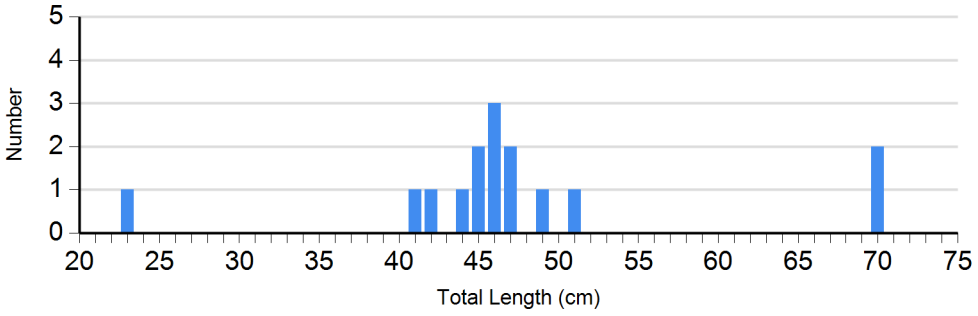


2018

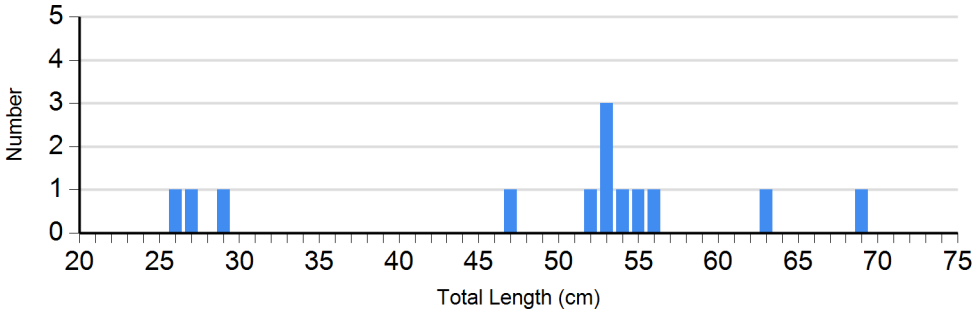


2019

Species: Common Carp
Gear: std exp gill net

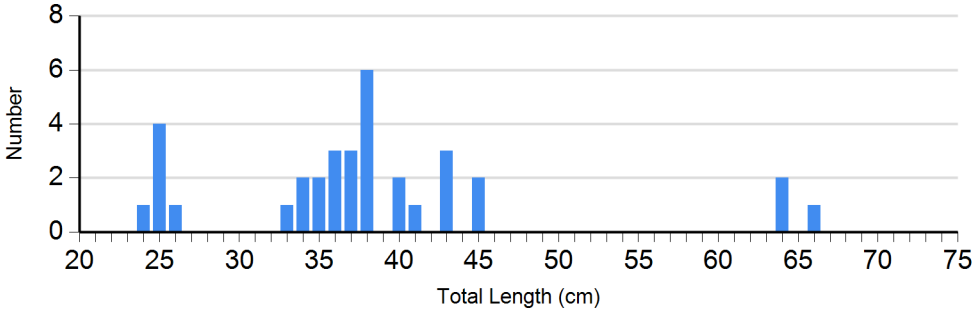


2015

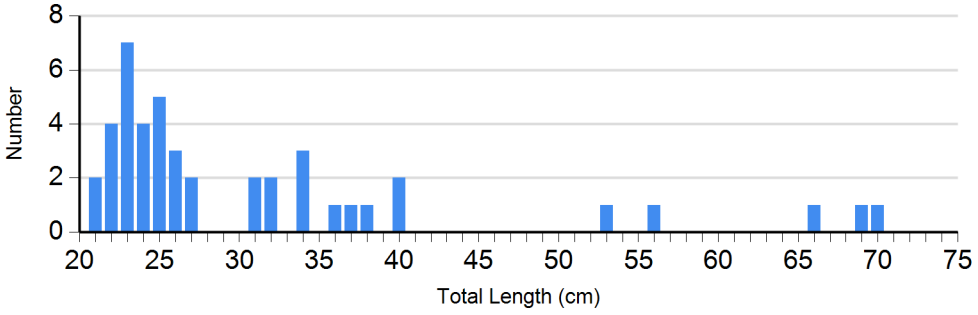


2016

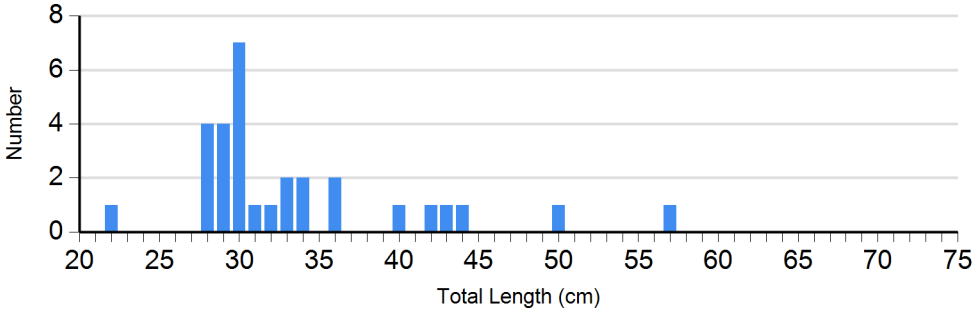
Species: Walleye
Gear: AFS std gill net



2017

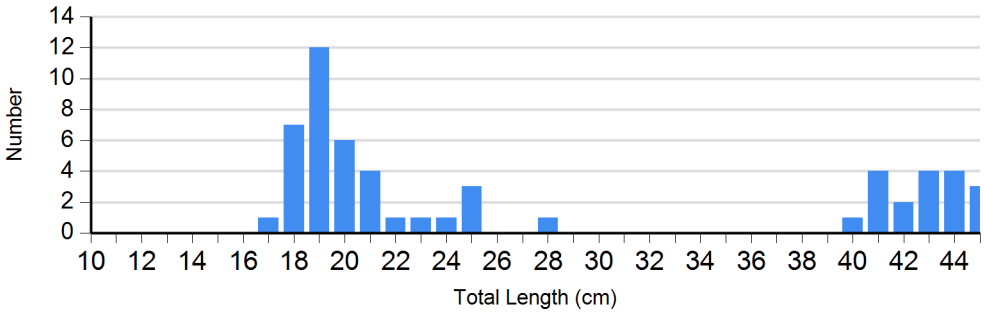


2018

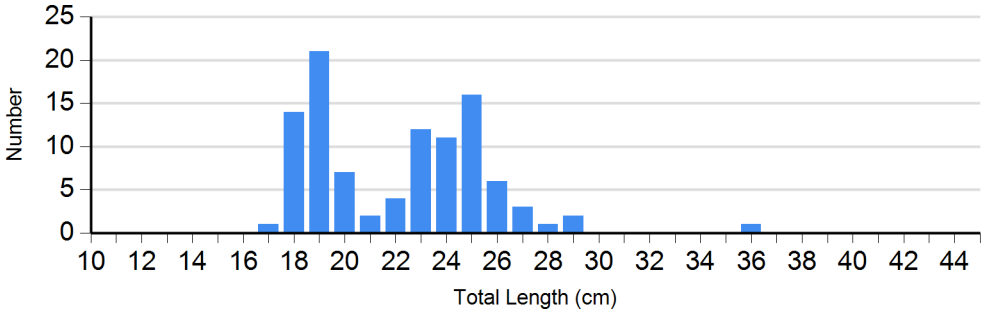


2019

Species: Walleye
Gear: std exp gill net



2014



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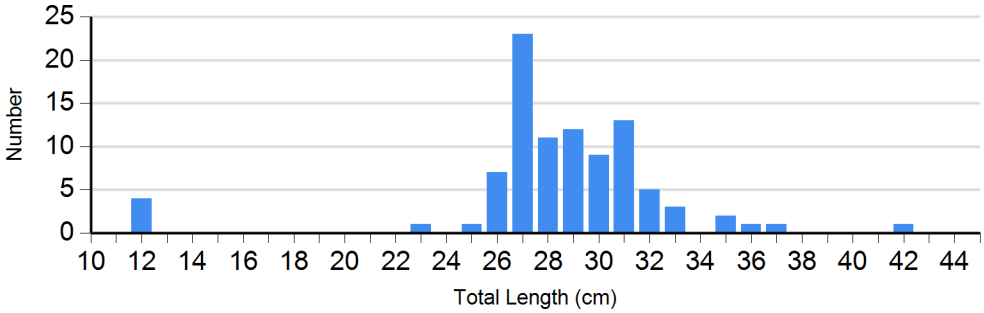
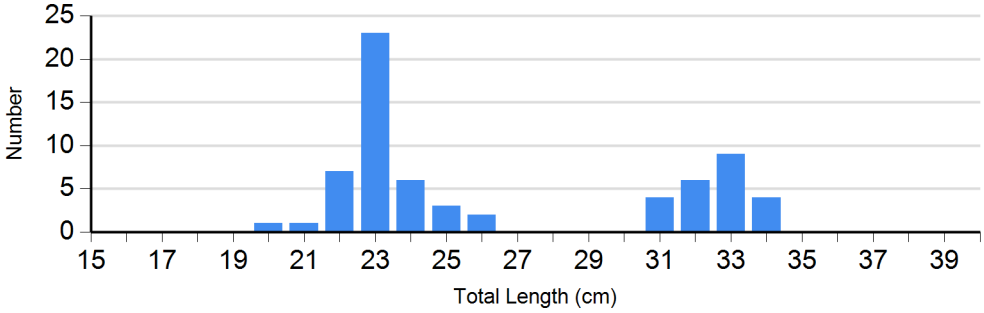
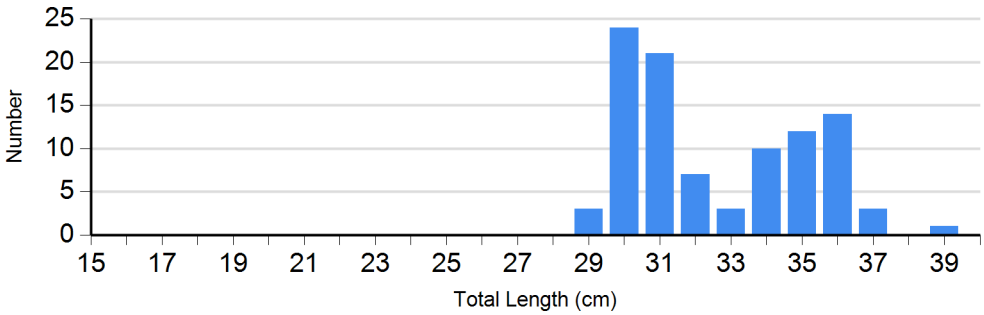


2016

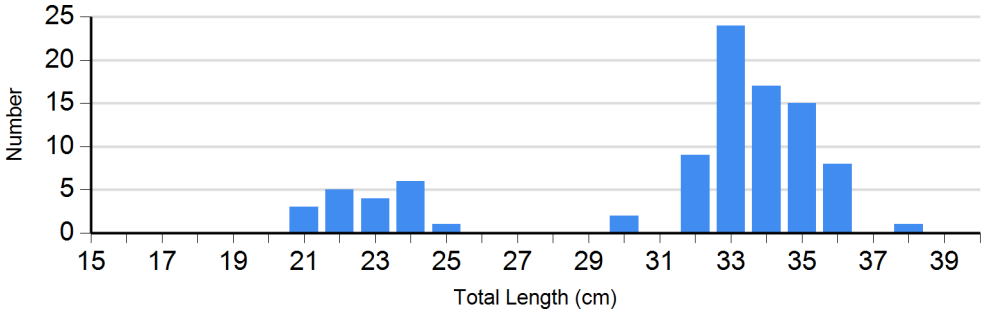
Species: White Bass
Gear: AFS std gill net



2017

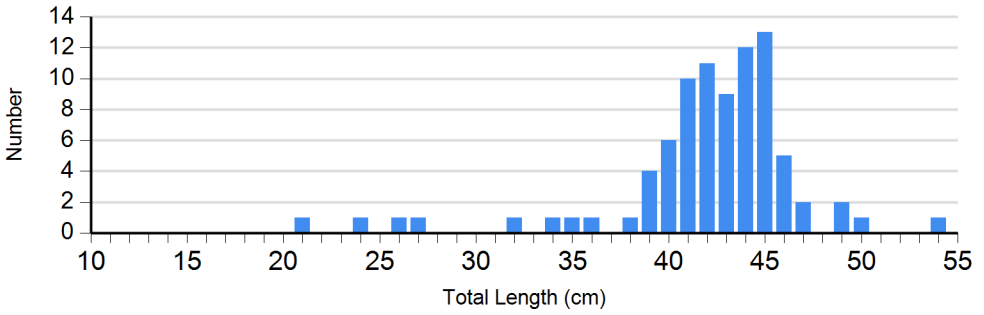


2018

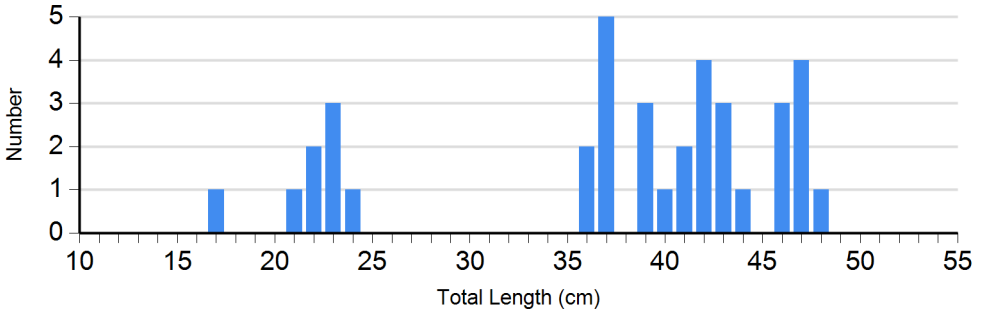


2019

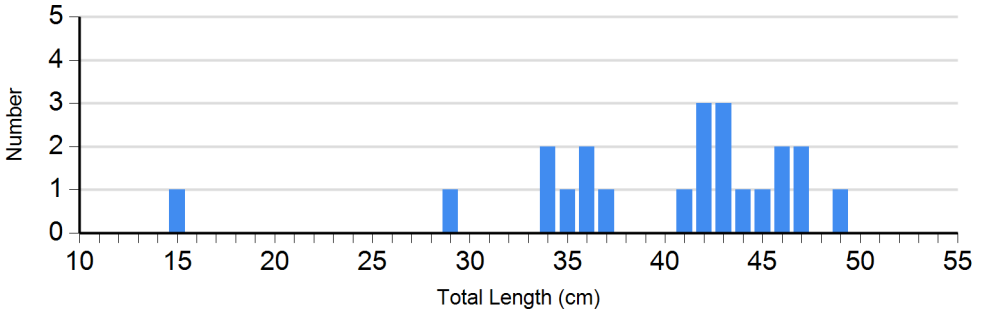
Species: White Sucker
Gear: AFS std gill net



2017

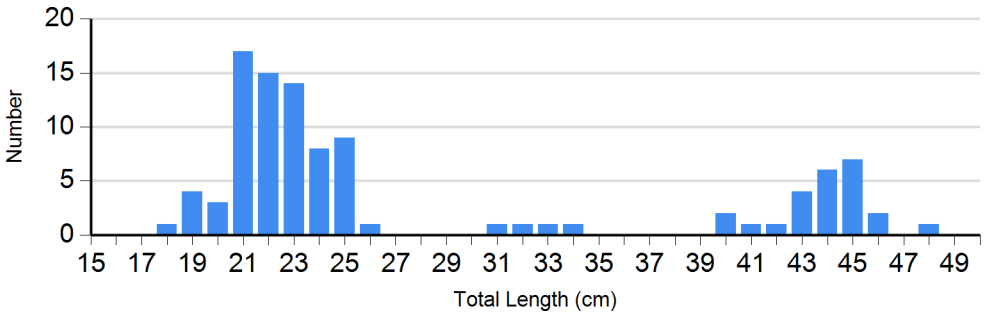


2018

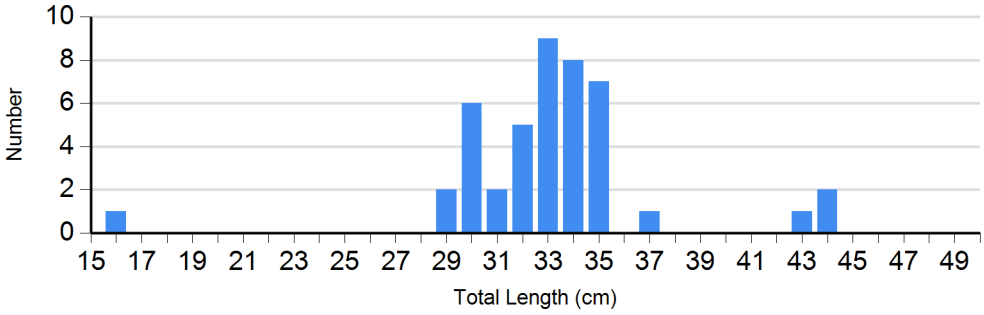


2019

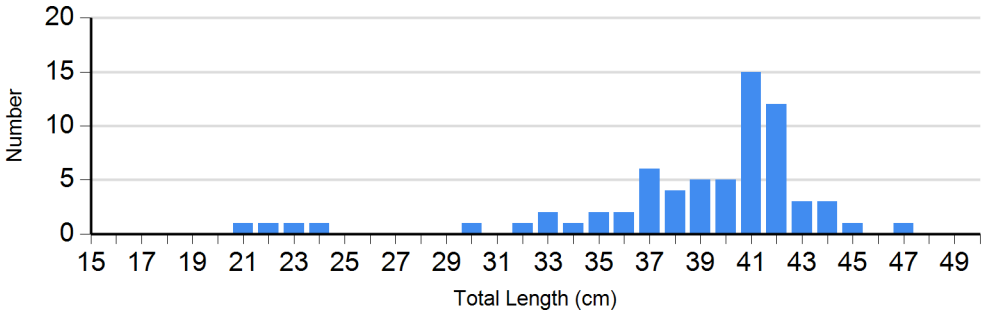
Species: White Sucker
Gear: std exp gill net



2014

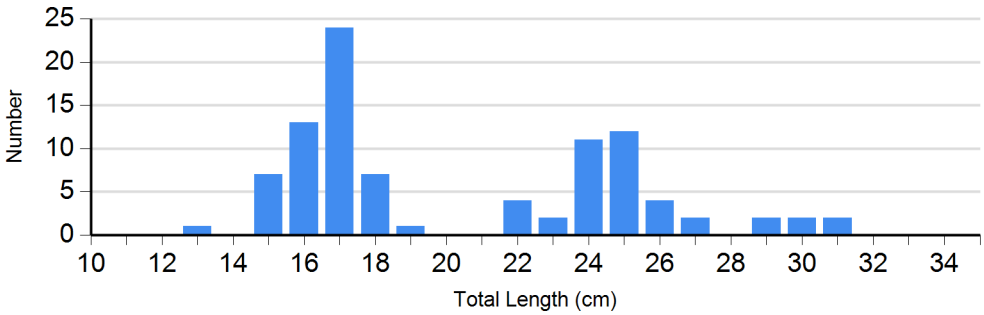


2015

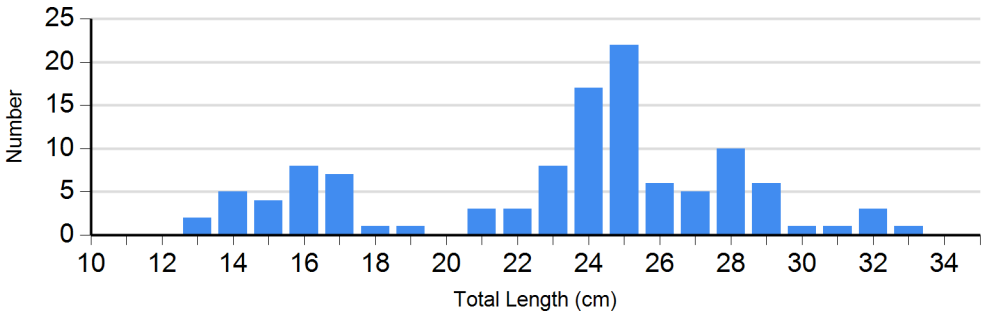


2016

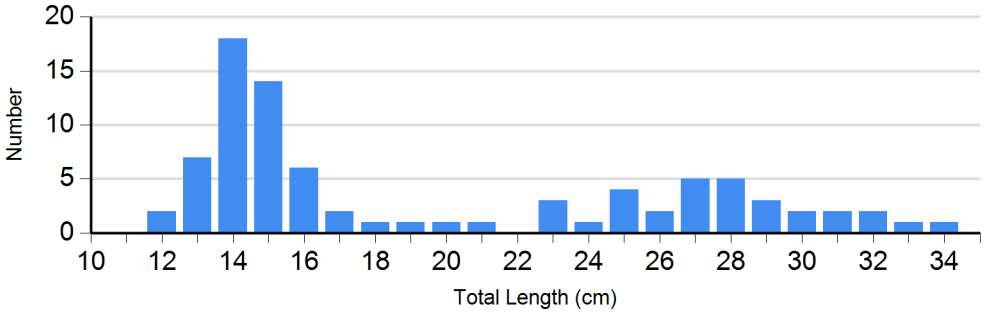
Species: Yellow Perch
Gear: AFS std gill net



2017

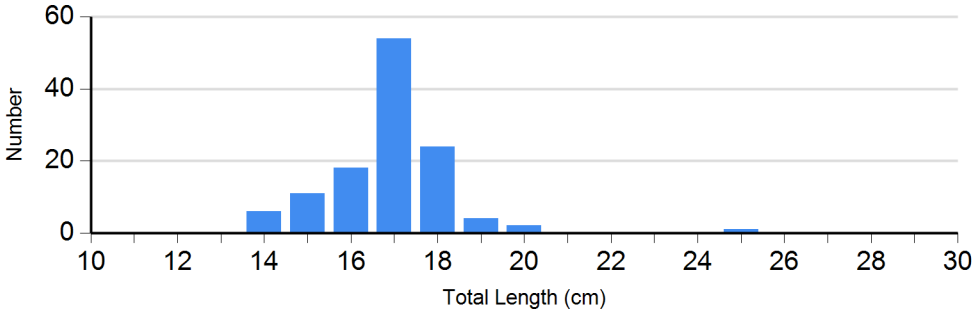


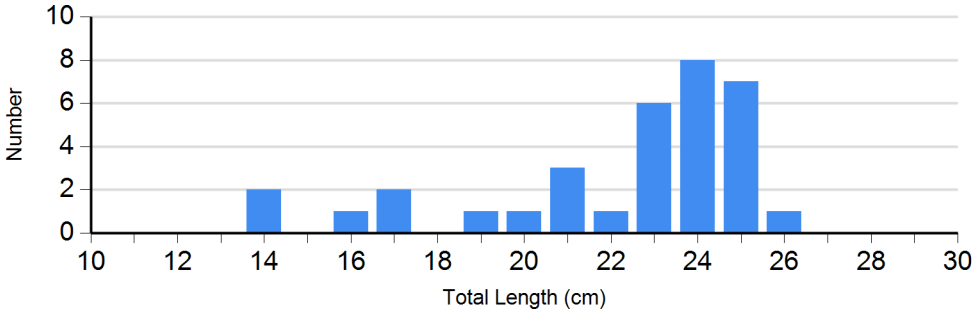
2018

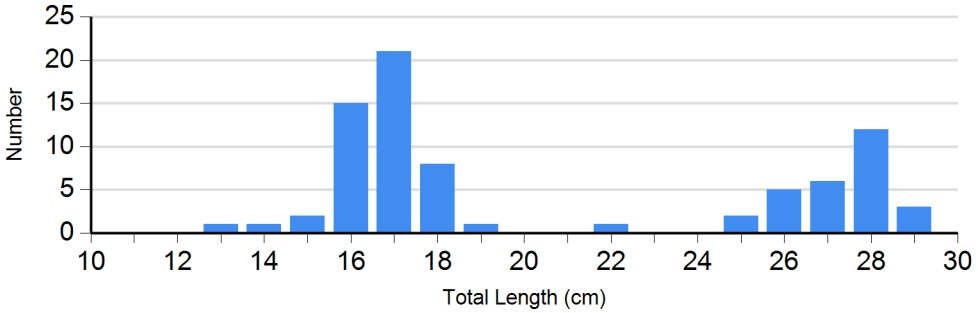


2019

Species: Yellow Perch
Gear: std exp gill net



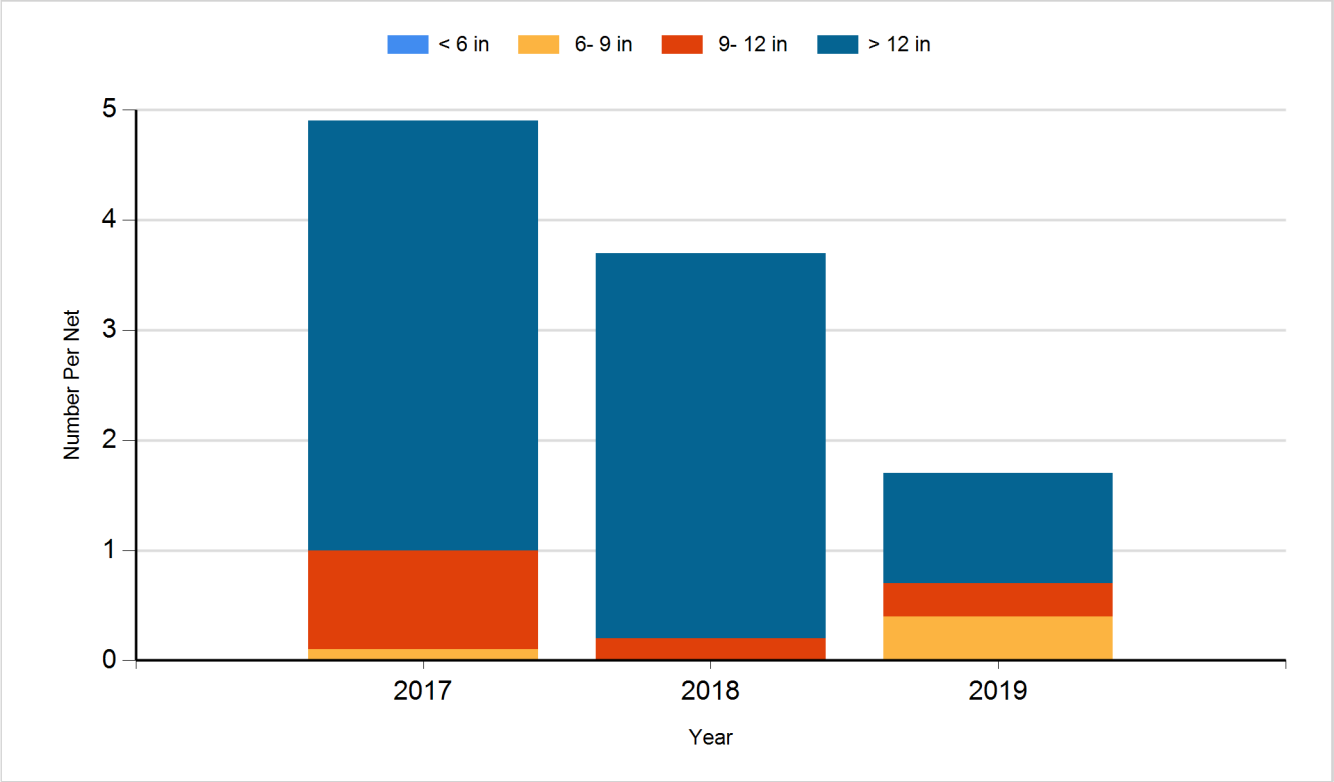




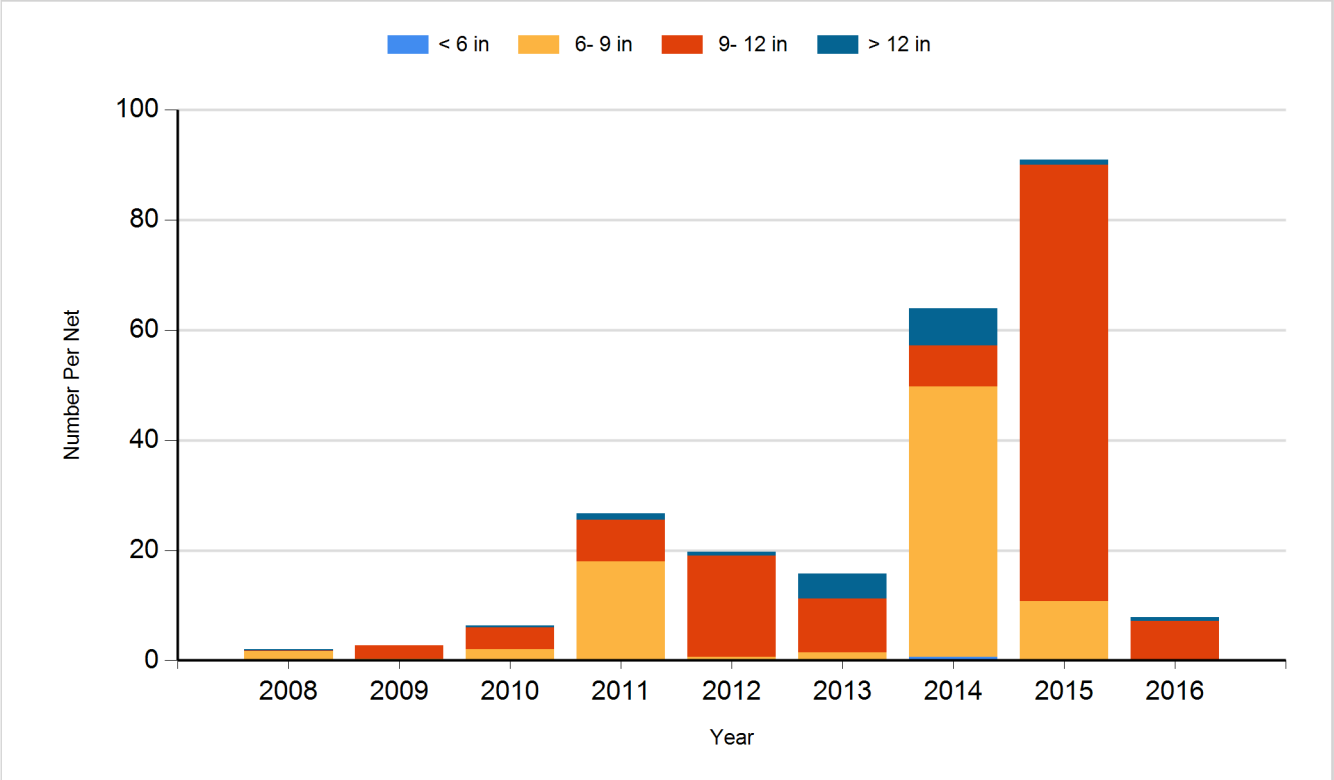
Historic Fish Sizes and Relative Abundance

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

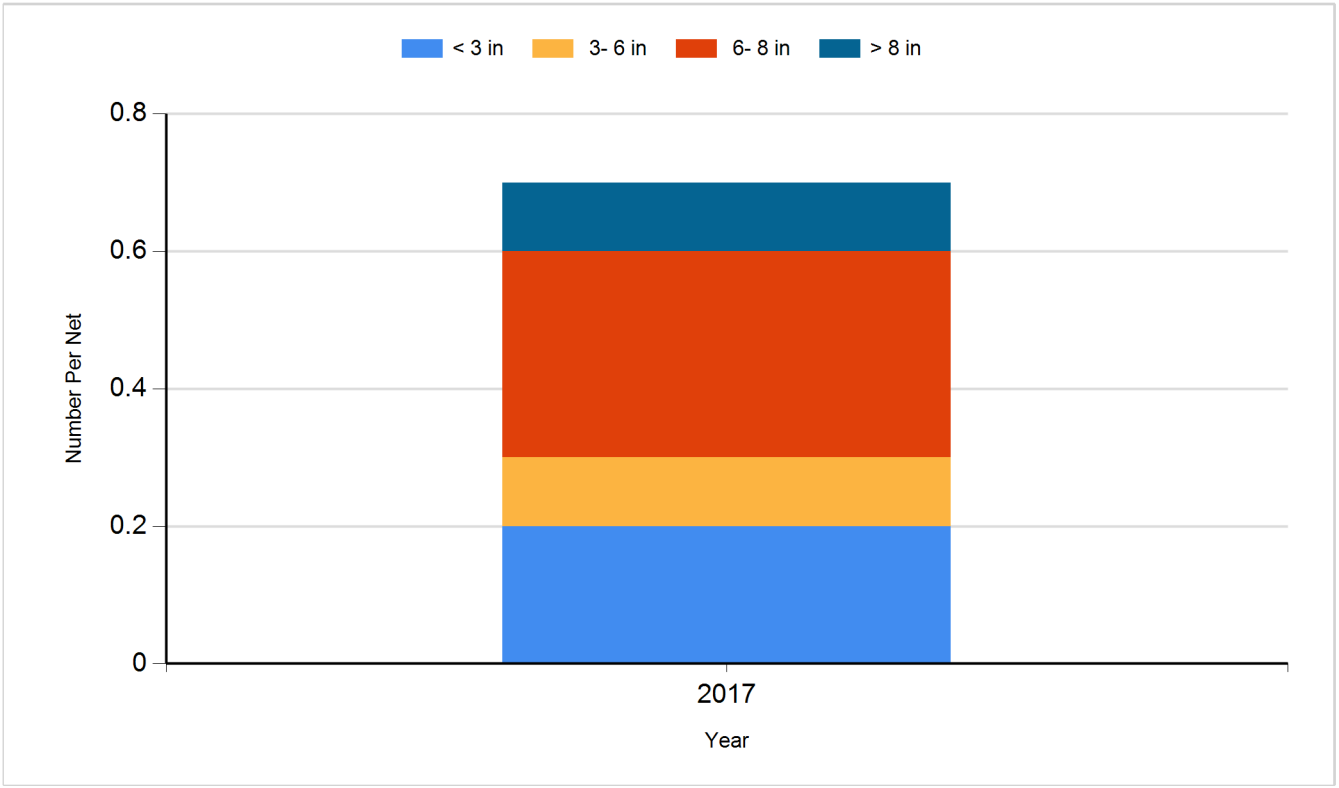
Species: Black Bullhead
Gear: AFS std gill net



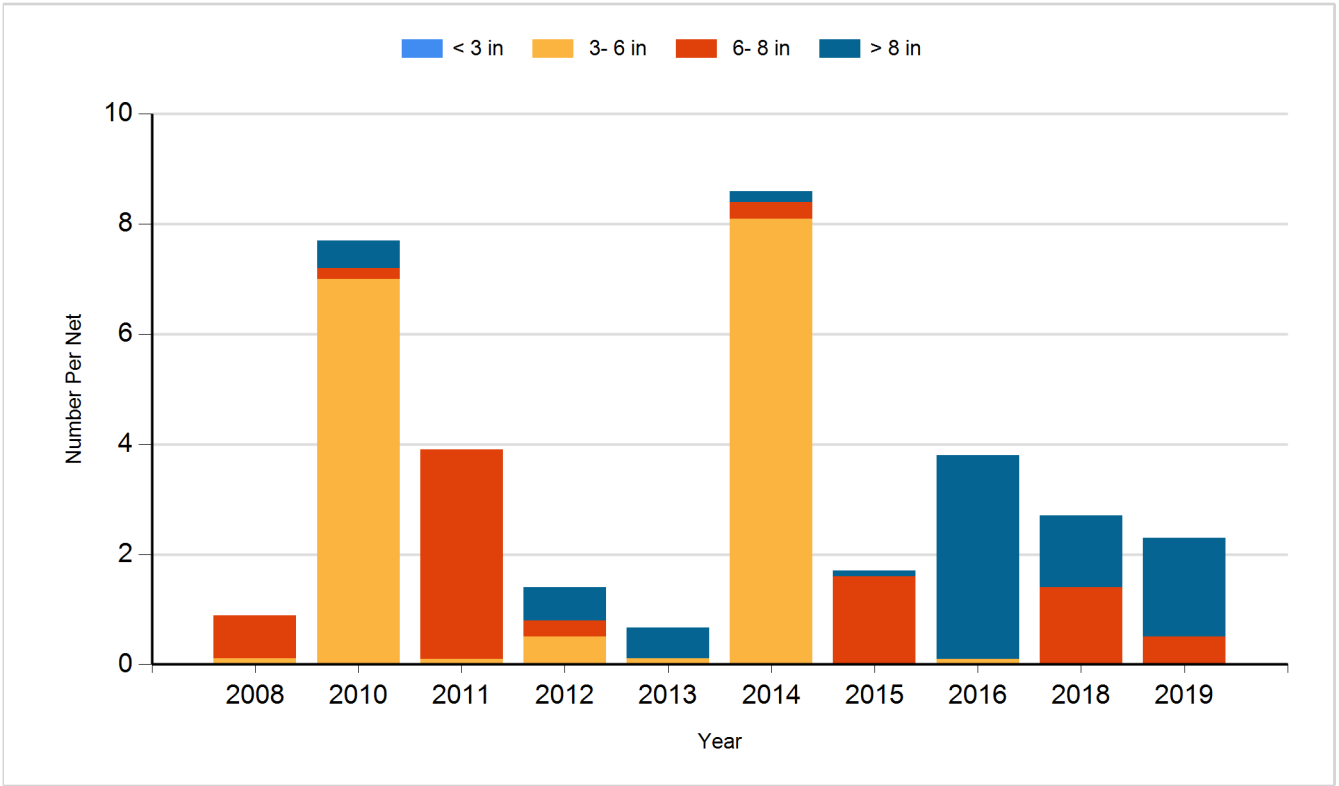
Species: Black Bullhead
Gear: std exp gill net



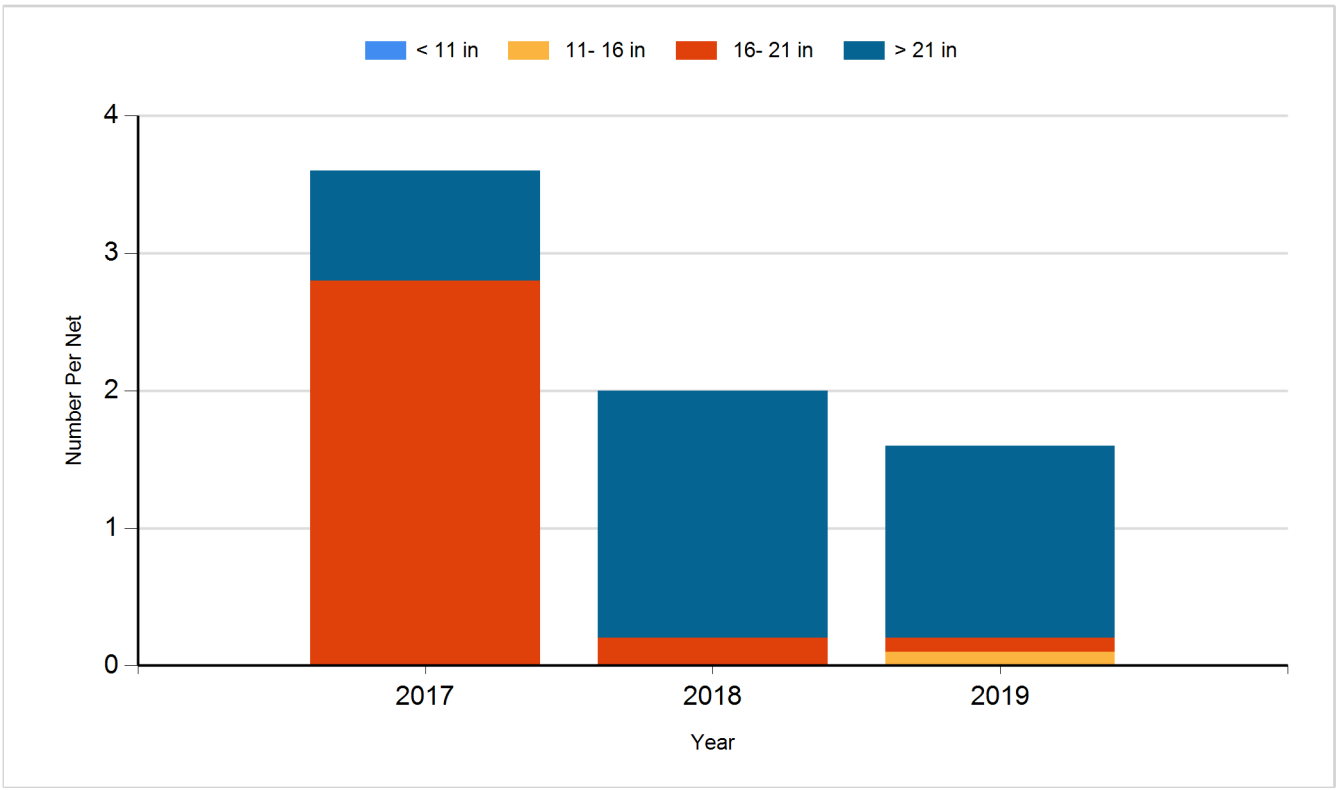
Species: Bluegill
Gear: AFS std frame net



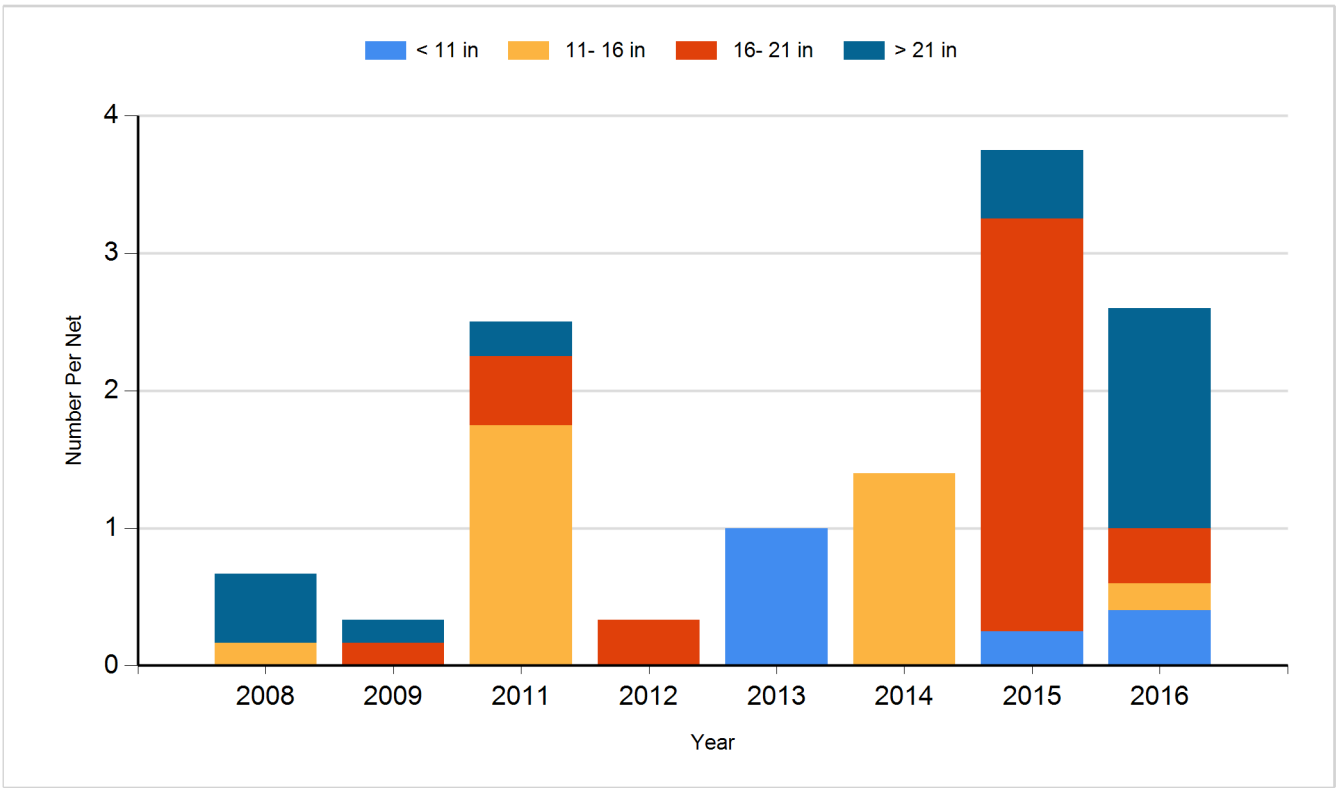
Species: Bluegill
Gear: frame net (std 3/4 in)



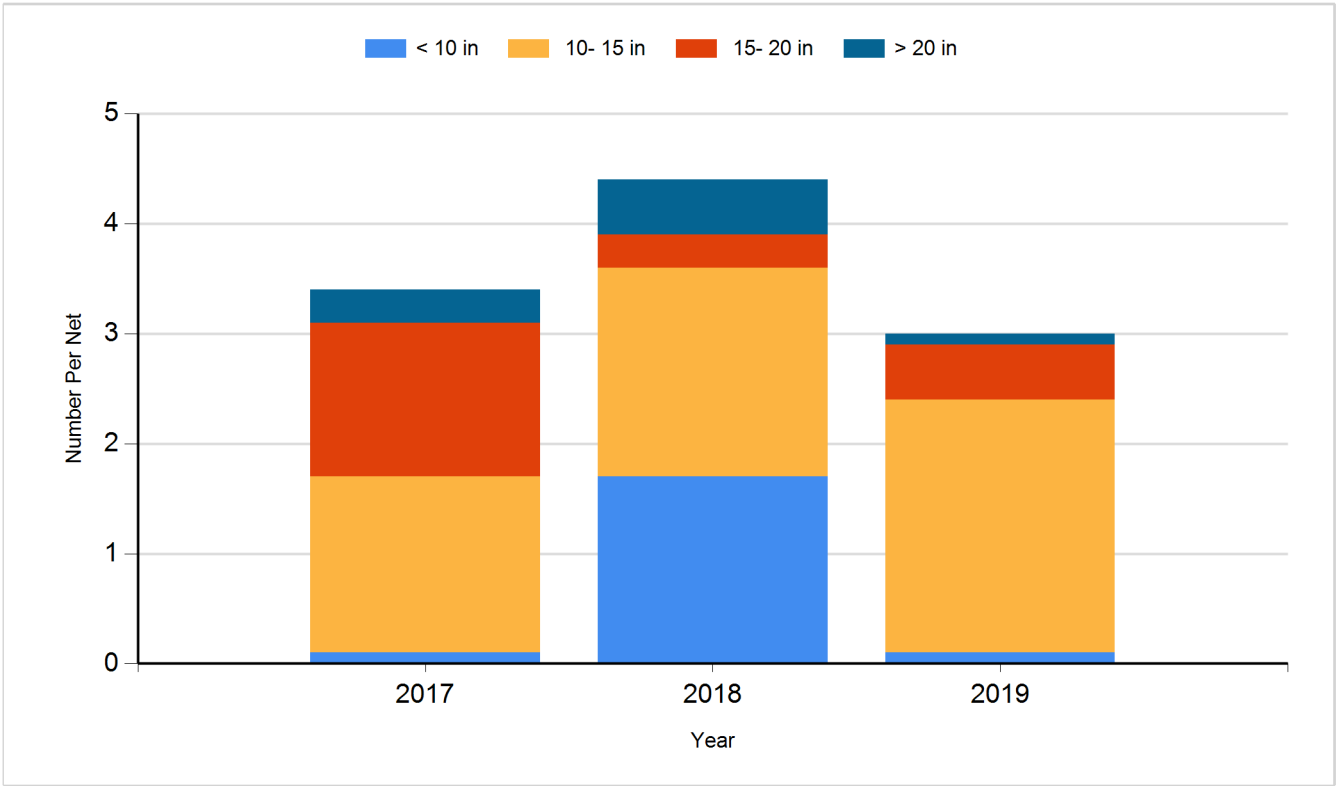
Species: Common Carp
Gear: AFS std gill net



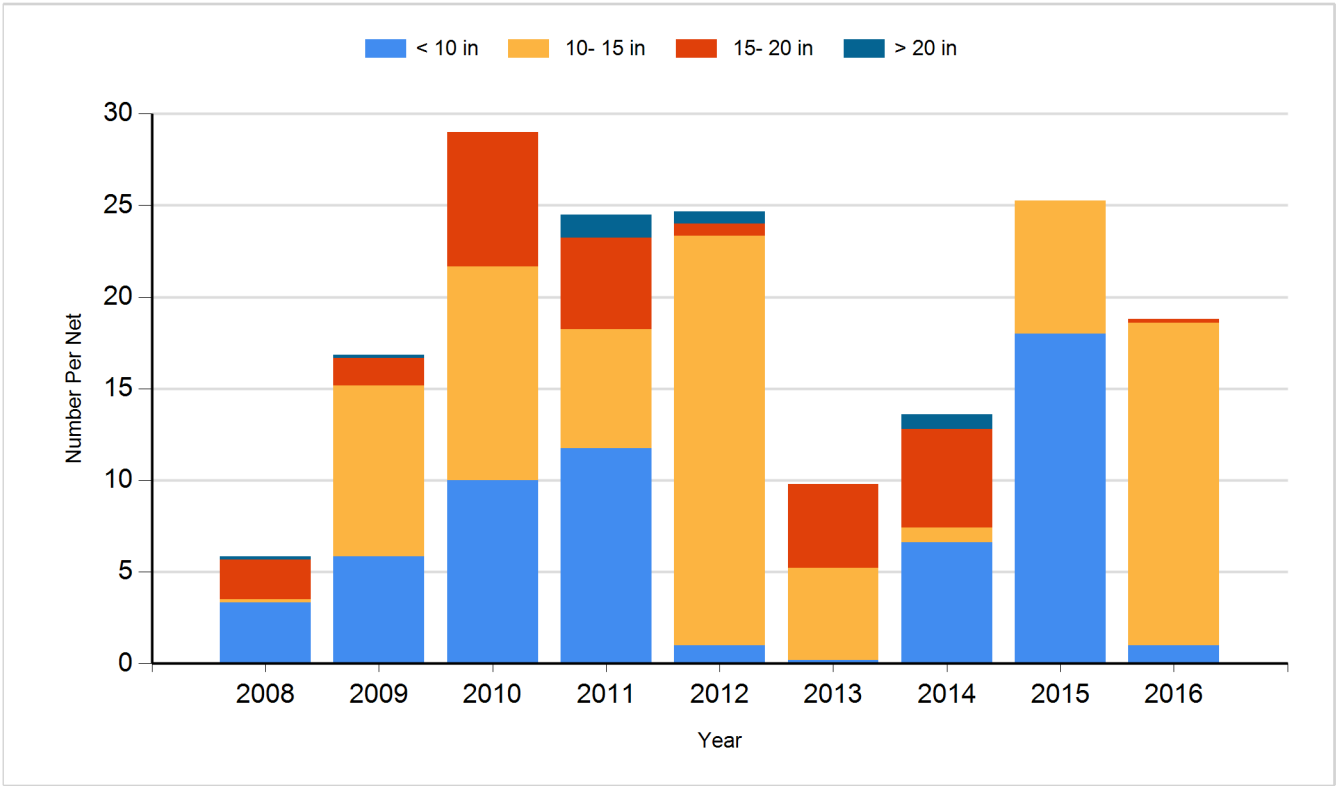
Species: Common Carp
Gear: std exp gill net



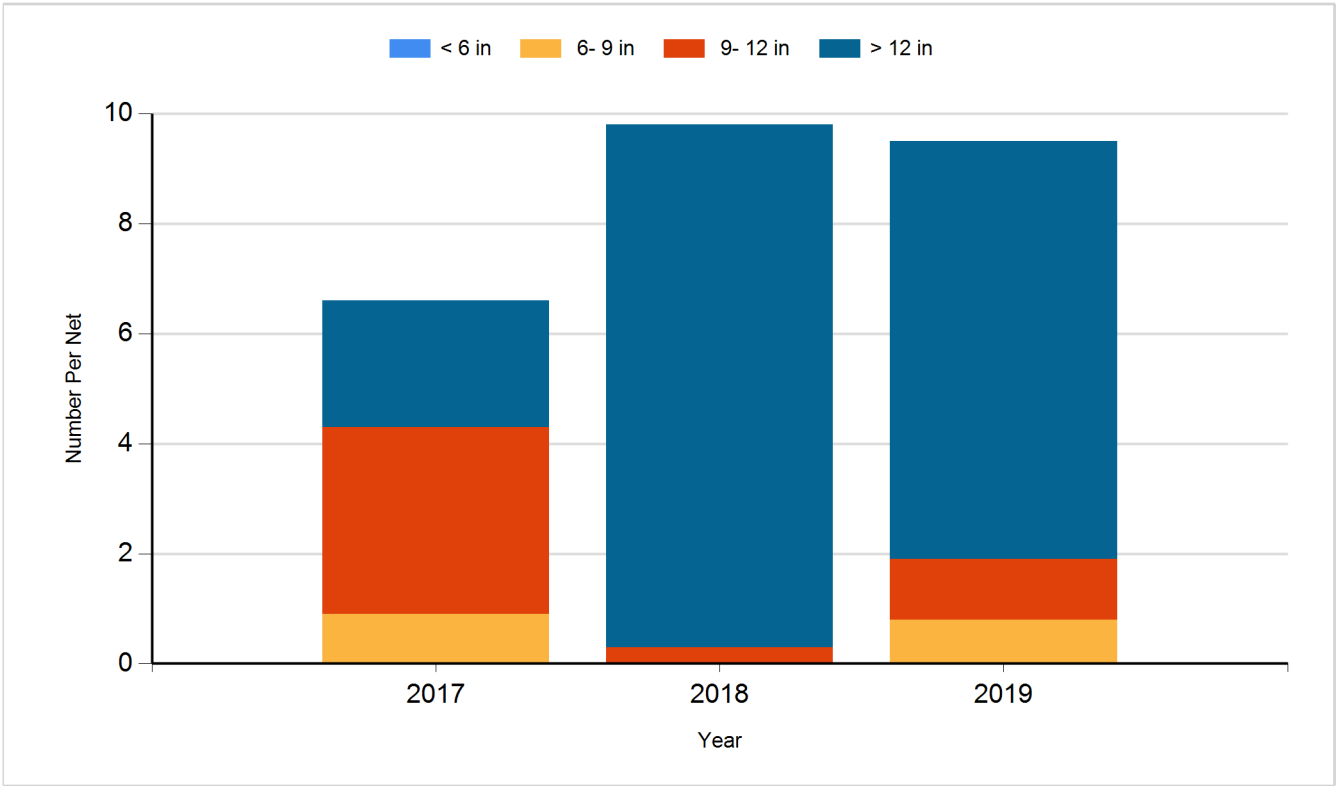
Species: Walleye
Gear: AFS std gill net



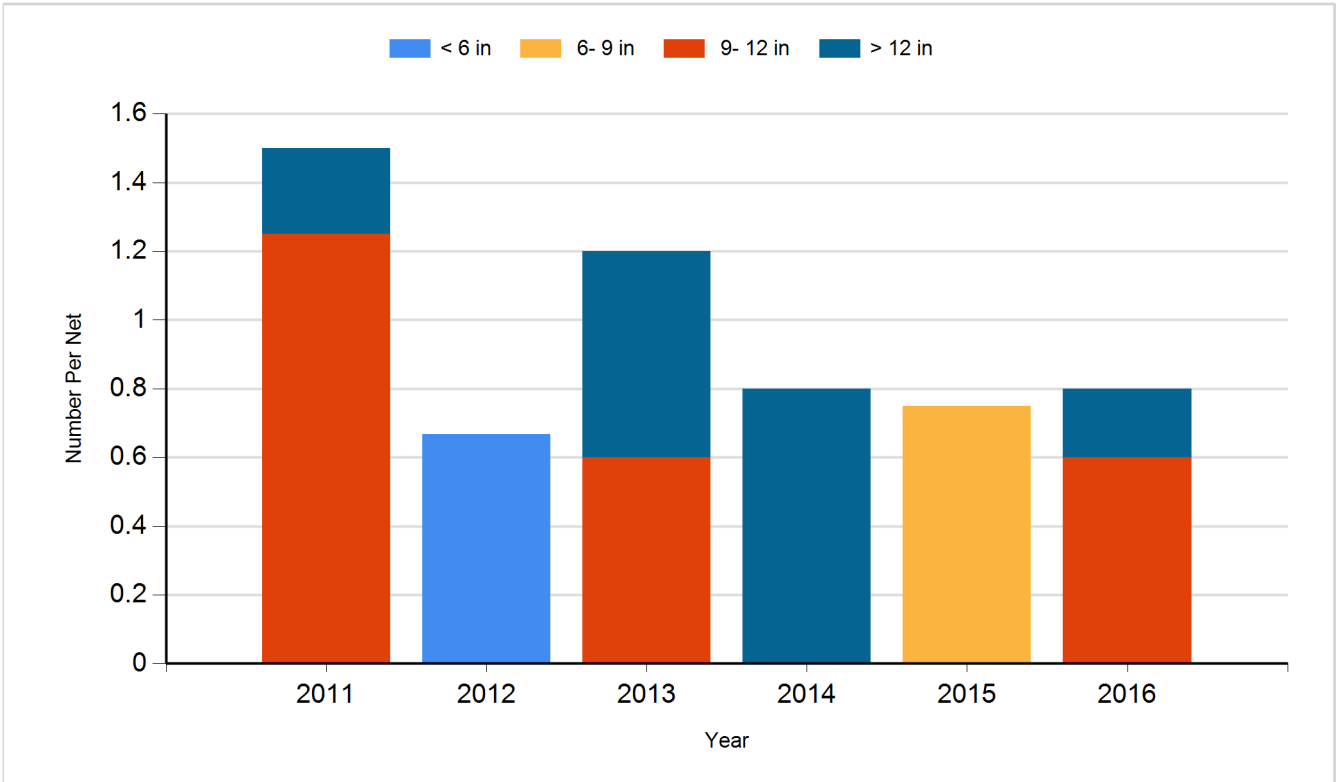
Species: Walleye
Gear: std exp gill net



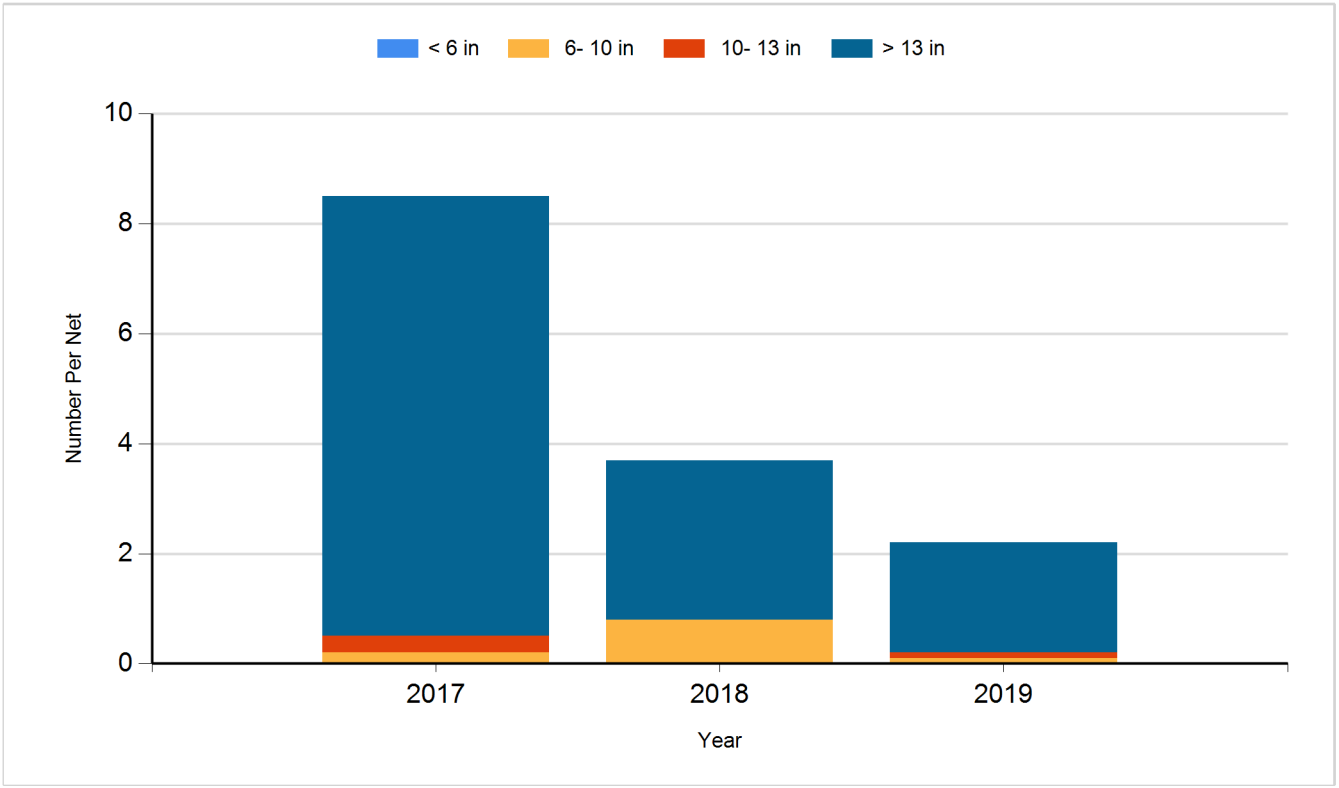
Species: White Bass
Gear: AFS std gill net



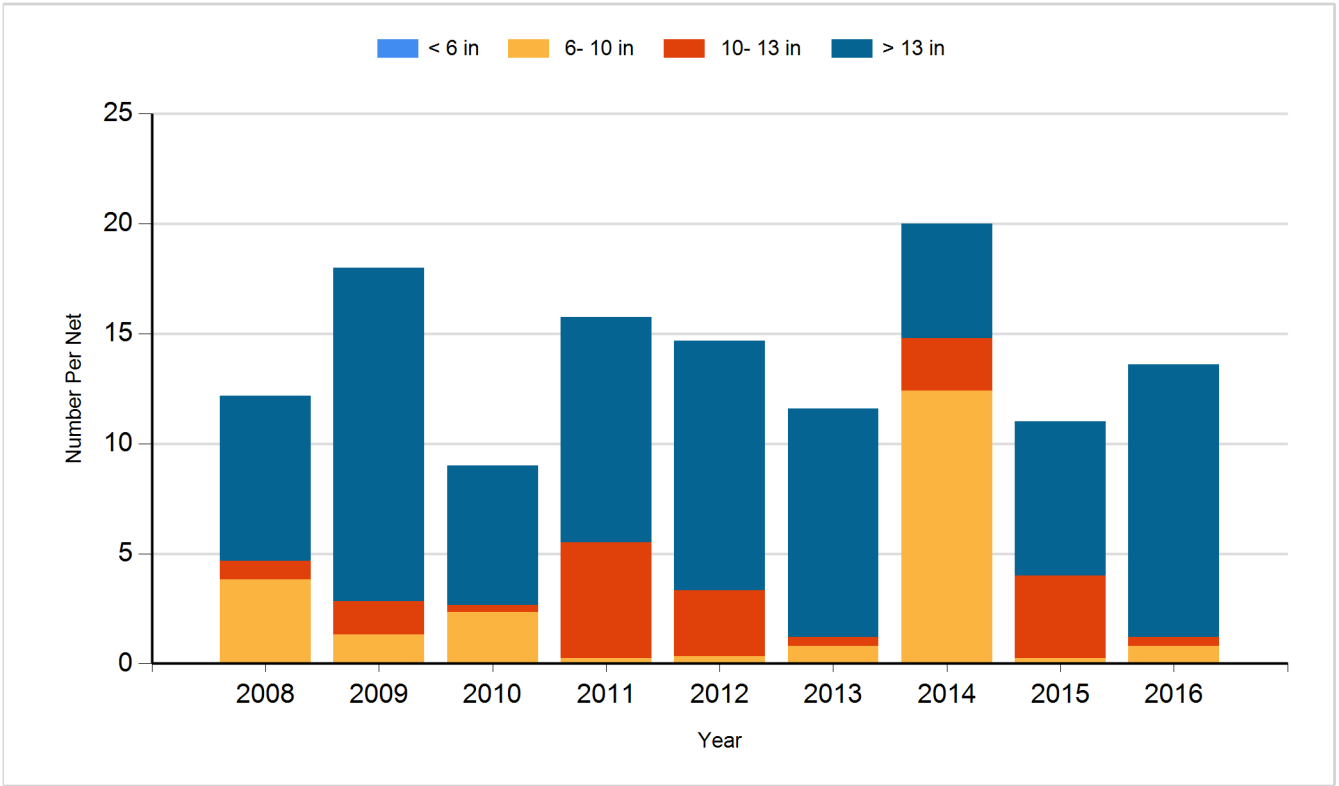
Species: White Bass
Gear: std exp gill net



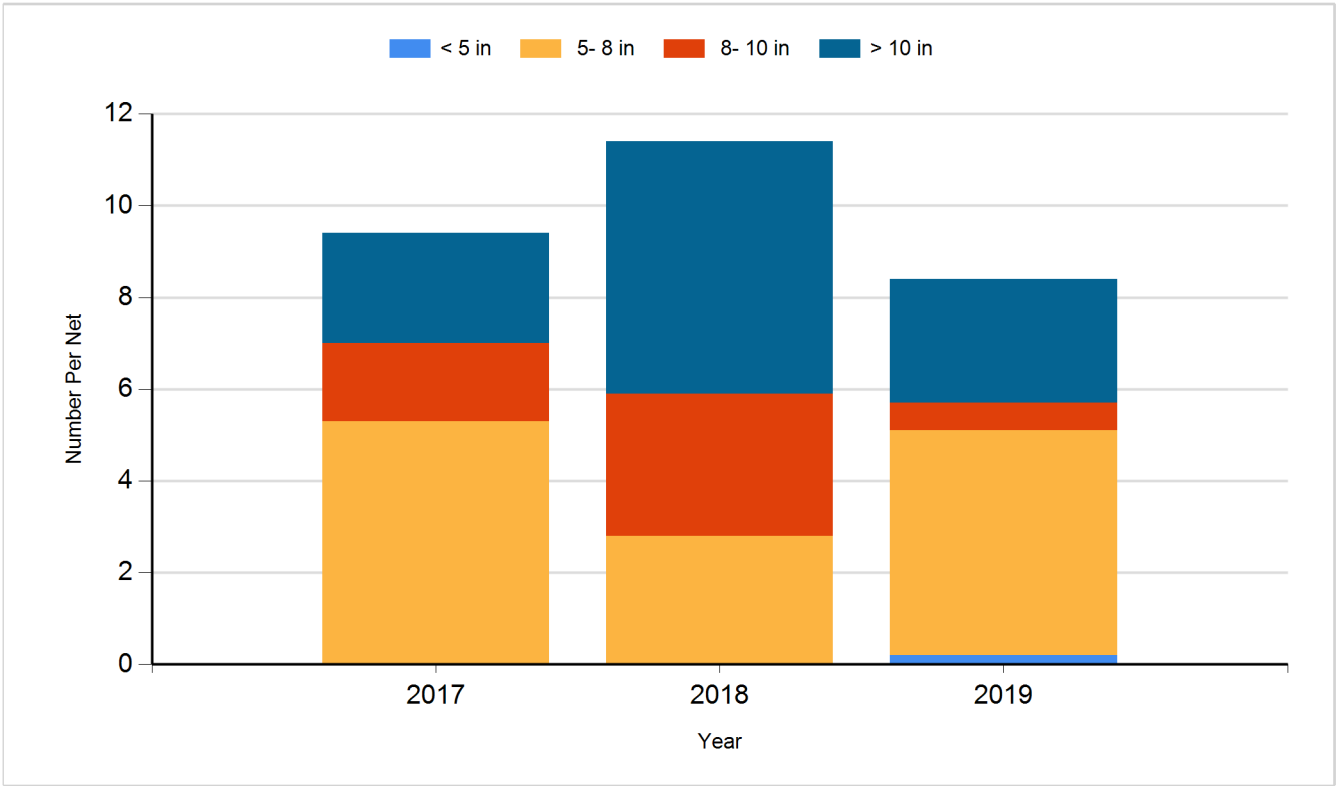
Species: White Sucker
Gear: AFS std gill net



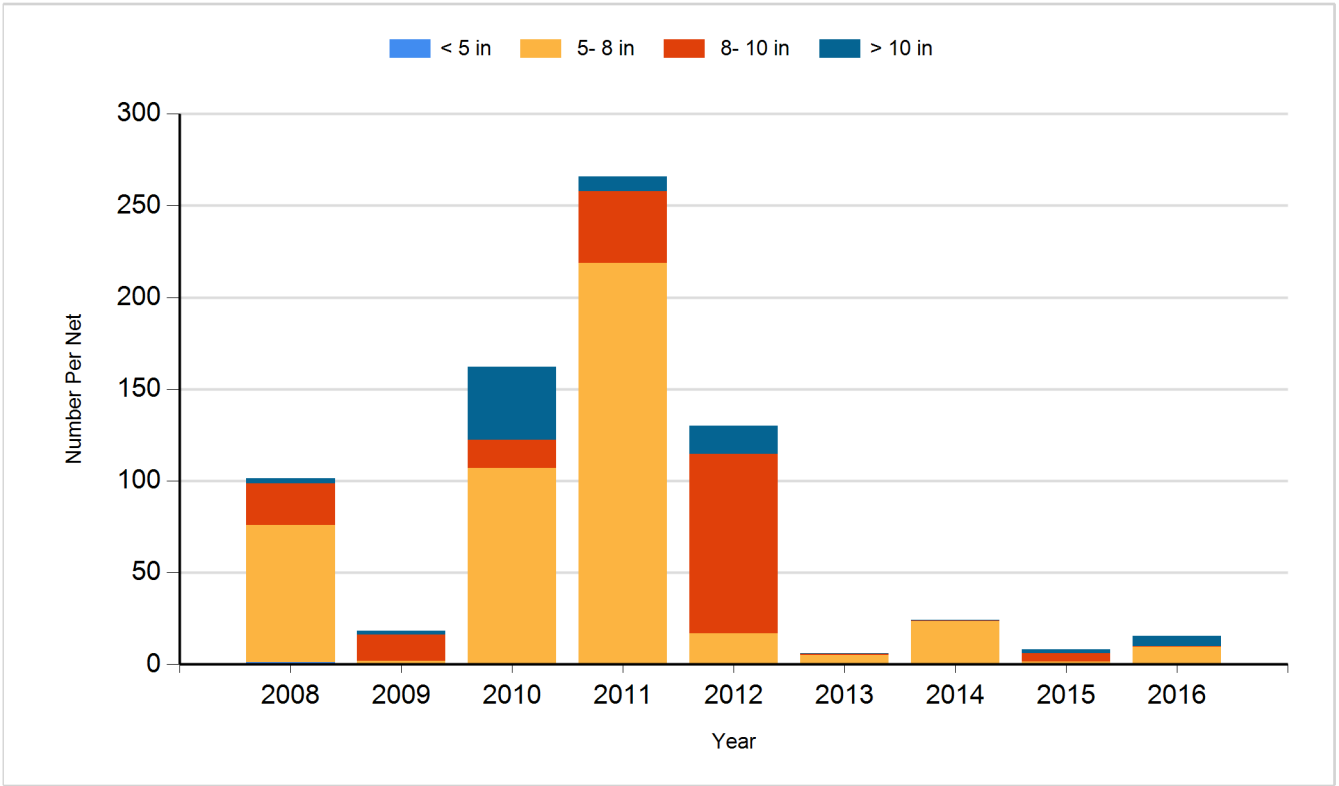
Species: White Sucker
Gear: std exp gill net



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
2008	Walleye	Small Fingerling	218,020
2010	Walleye	Small Fingerling	280,320
2011	Northern Pike	Fry	35,200
2011	Walleye	Fry	70,000
2013	Walleye	Small Fingerling	280,150
2014	Walleye	Small Fingerling	196,200
2017	Walleye	Fingerling	195,515
2019	Walleye	Small Fingerling	196,265