Kettle Lake Survey Summary

Kettle Lake, located 5.0 miles west and 3 miles north of Eden, is primarily managed as a walleye and yellow perch fishery; however, a variety of other fish species are present and contribute to the fishery.

- **Northern pike.** Fewer northern pike were sampled in 2019 than 2018. At 0.7/gill net, relative abundance was considered low. Ten individuals ranging in length from 9.1 to 28.3 inches were sampled. Northern pike respond to rising water levels and population increases are expected following high-water conditions experienced across northeast South Dakota in 2019.

- **Walleye.** Like northern pike, walleye numbers were lower in 2019 than 2018. The mean gill net CPUE was 2.0 and suggested low relative abundance. A wide length range of walleyes (6.3 to 26.8 inches) was sampled as 11 year classes (2005, 2006, 2007, 2009, 2011, and 2014 – 2019) were represented, each by 5 or fewer individuals. Growth appears to be fast with mean length at capture values of age-3 fish that approach or exceed 18.0 inches

- **Yellow Perch**. Yellow perch were the most abundant species in the 2019 gill net catch. At 14.5/gill net, relative abundance was considered moderate to high. Sampled yellow perch ranged in length from 5.1 to 8.7 inches, most (97%) were less than 8.0 inches. The entire sample was comprised of fish from year classes produced in 2016-2018 (ages 1-3); those from the 2018 (age-1) cohort, which had mean length at capture of 6.3 inches, were the most abundant accounting for 76% of fish sampled.

For more detailed results see the computer generated South Dakota Statewide Fisheries Survey for Kettle (Marshall; below).

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY
Kettle, Marshall County
UJA-Lake-866-000
2019

Lake Information

Name: Kettle

County: Marshall

Surface Area: 3,229 Acres

Maximum Depth: 18 Feet

Mean Depth: 10 Feet

Surveys and Investigations

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

Gear	Date	Effort
AFS std gill net	Aug 13, 2019	4 net-nights
AFS std gill net	Aug 14, 2019	4 net-nights
AFS std gill net	Aug 15, 2019	4 net-nights

Common Fish Species Present

Northern Pike

Walleye

Yellow Perch

Black Bullhead

Smallmouth Bass

Common Carp

Bluegill

White Sucker

White Bass

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	34	2.8	3.2	26	12	15	10	103	2
	Bluegill	2	0.2	0.2	0		0		123	3
	Common Carp	5	0.3	0.3	75		75		110	7
	Northern Pike	10	0.7	0.3	100		13		94	5
	Smallmouth Bass	5	0.4	0.5	60		40		121	2
	Walleye	28	2.0	0.8	92		63	16	102	1
	White Bass	4	0.1	0.1	100		100		101	
	White Sucker	1	0.1	0.1	100		100		99	
	Yellow Perch	174	14.5	5.8	3	2	0		108	1

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 gill net	Black Bullhead							8.8	0.6	1.7	2.8	3.5
	Black Crappie							1.3	0.7	5.1	0.0	1.8
	Bluegill							0.5	0.2	0.3	0.2	0.3
	Common Carp							0.8	0.3	1.1	0.3	0.6
	Largemouth Bass							0.0	0.0	0.1	0.0	0.0
	Northern Pike							2.4	1.3	1.7	0.7	1.5
	Smallmouth Bass							0.2	0.1	0.3	0.4	0.3
	Walleye							2.6	5.1	6.1	2.0	4.0
	White Bass							0.1	0.0	0.0	0.1	0.1
	White Sucker							0.8	0.6	0.7	0.1	0.6
	Yellow Perch							19.2	12.2	27.6	14.5	18.4
frame net (std 3/4 in)	Black Bullhead	0.0	0.1	4.4	20.2	23.7						9.7
	Black Crappie	1.9	5.5	11.9	3.2	1.9						4.9
	Bluegill	0.7	1.8	2.4	13.3	23.6						8.4
	Common Carp	0.5	0.1	0.2	0.0	0.1						0.2
	Green Sunfish	0.0	0.0	0.0	0.0	0.1						0.0
	Largemouth Bass	0.0	0.0	0.2	0.0	0.0						0.0
	Northern Pike	0.3	0.2	0.5	0.7	0.7						0.5
	Smallmouth Bass	0.7	1.3	0.6	0.7	0.5						0.8
	Walleye	0.3	0.1	0.5	0.3	0.1						0.3
	White Sucker	0.1	0.1	0.3	0.0	0.0						0.1
	Yellow Perch	18.7	19.0	21.2	26.1	36.7						24.3
std exp gill net	Black Bullhead	0.0	0.0	2.3	4.2	2.8	45.2					9.1
	Black Crappie	10.2	2.8	12.3	2.5	0.3	26.0					9.0
	Bluegill	0.0	0.0	0.0	0.0	0.5	0.2					0.1
	Common Carp	0.1	0.1	0.0	0.0	0.2	0.0					0.1
	Northern Pike	0.1	0.2	4.0	5.0	4.0	1.8					2.5
	Smallmouth Bass	1.2	0.1	0.0	0.2	0.2	0.0					0.3
	Walleye	2.8	2.5	2.8	3.7	2.0	6.3					3.4
	White Sucker	0.2	0.2	1.3	2.5	0.7	0.2					0.9
	Yellow Perch	46.8	30.7	152.0	156.8	67.2	28.8					80.4

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 gill net	Northern Pike	PSD							97	100	85	100
		PSD-P							21	31	5	13
		Wr							86	77	90	94
	Walleye	PSD							74	90	84	92
		PSD-P							61	75	48	63
		Wr							93	88	95	102
	Yellow Perch	PSD							1	8	15	3
		PSD-P							0	0	0	0
		Wr							99	102	100	108
std exp gill net	Northern Pike	PSD	50	100	75	90	100	100				
		PSD-P	50	0	4	3	13	9				
		Wr	91	88	93	88	89	91				
	Walleye	PSD	67	80	65	73	83	26				
		PSD-P	12	20	18	36	50	24				
		Wr	96	96	94	89	93	98				
	Yellow Perch	PSD	10	16	10	3	5	5				
		PSD-P	0	1	2	0	0	0				
		Wr	103	96	96	98	97	98				

Length at Capture

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

Species: Walleye

		Mean Length (expanded sample number) at capture by age									
Year	N	1	2	3	4	5	6	7	8	9	10+
2019	24	336 (2)	435 (5)	507 (3)	541 (2)	550 (4)			565 (1)		614 (7)
2018	73	346 (12)	432 (21)	467 (3)	530 (12)	553 (1)	584 (1)	593 (2)	657 (1)	639 (2)	626 (18)
2017	61	302 (6)	398 (2)	492 (6)	521 (2)		535 (4)	599 (4)	625 (2)	592 (7)	620 (28)
2016	31	292 (8)	436 (3)	520 (1)		526 (3)	545 (1)	568 (2)	573 (1)		598 (12)
2015	40	311 (30)			518 (4)	514 (1)		632 (1)		557 (4)	
2014	12	307 (1)	331 (1)	467 (4)		526 (1)			565 (5)		
2013	22	309 (1)	377 (9)	492 (4)	567 (2)	554 (1)		559 (3)			618 (2)
2012	17	301 (6)	440 (4)		494 (6)		546 (1)				
2011	45	322 (8)	408 (4)	452 (21)		517 (9)	544 (1)				605 (2)
2010	51	299 (6)	373 (20)		482 (22)			608 (1)			564 (2)

Species: Yellow Perch

		Mean Length (expanded sample number) at capture by age									
Year	N	1	2	3	4	5	6	7	8	9	10+
2019	174	160 (132)	178 (41)	224 (1)							
2018	331	155 (250)	201 (75)	215 (6)							
2017	146	158 (129)	209 (17)								
2016	231	150 (170)	171 (43)	154 (18)							
2015	258	134 (227)	192 (31)								
2014	495	144 (462)	196 (23)	212 (10)							
2013	1412	129 (788)	169 (624)								
2012	2774	121 (2573)	195 (187)	254 (14)							
2011	565	163 (453)	212 (109)	271 (4)							
2010	842	160 (711)	210 (132)								

Fish Condition

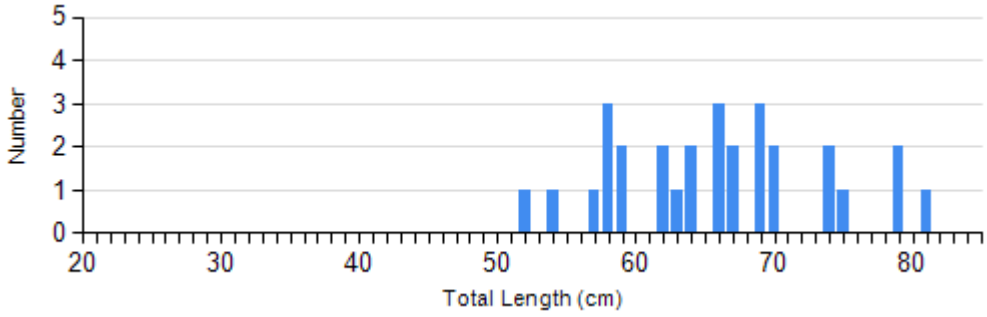
Mean relative weight (Wr) by sample size (N), length category stock to quality (S-Q), quality to preferred (Q-P), preferred to memorable (P-M), and memorable (M) for species collected across survey years with standard error (SE).

		Length Groups							
		S-Q		Q-P		P-M		M	
Species	Year	N	Wr (SE)	N	Wr (SE)	N	Wr (SE)	N	Wr (SE)
Northern Pike Gill Net	2015	0		10	92 (1.8)	1	77	0	
	2016	1	101	22	87 (1.2)	6	82 (1.7)	0	
	2017	0		11	79 (3.2)	5	71 (1.6)	0	
	2018	3	100 (1.8)	16	89 (1.0)	1	76	0	
	2019	0		7	96 (3.8)	1	86	0	
Walleye Gill Net	2015	28	98 (1.5)	1	104	8	100 (2.3)	1	86
	2016	8	92 (2.0)	4	99 (1.1)	16	94 (1.6)	3	88 (1.5)
	2017	6	92 (2.7)	9	94 (2.1)	31	89 (1.1)	15	81 (2.1)
	2018	12	96 (1.9)	26	100 (1.1)	24	93 (1.5)	11	88 (2.8)
	2019	2	100 (3.7)	7	102 (1.9)	13	102 (1.6)	2	98 (6.2)
Yellow Perch Gill Net	2015	165	99 (0.5)	8	93 (1.7)	0		0	
	2016	228	99 (0.5)	2	94 (1.8)	0		0	
	2017	134	102 (0.6)	12	96 (2.2)	0		0	
	2018	280	101 (0.5)	51	93 (0.8)	0		0	
	2019	168	109 (0.6)	6	99 (3.8)	0		0	

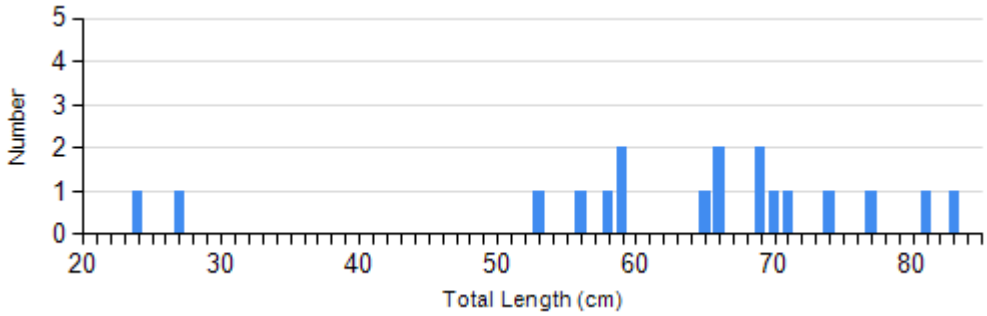
Length Frequency Distribution

Length frequency histogram of species sampled by year.

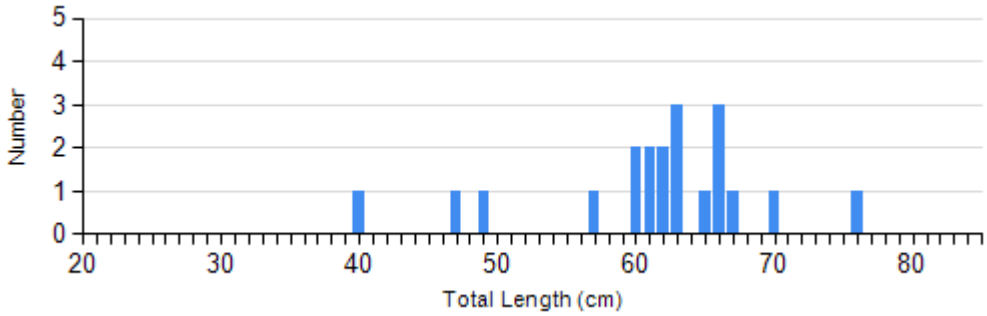
Species: Northern Pike
Gear: AFS std gill net



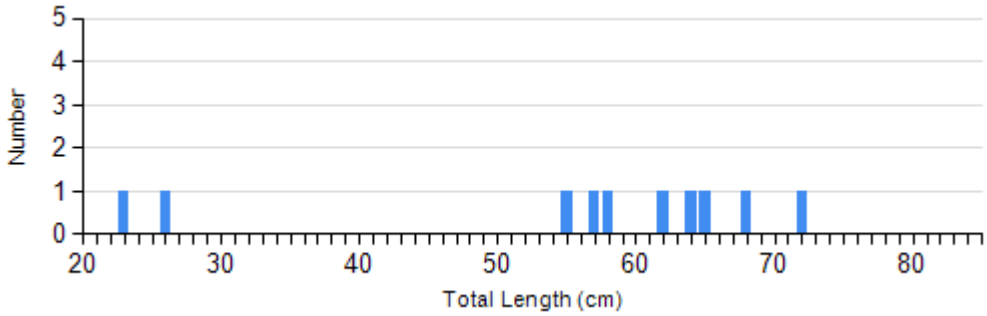
2016



2017



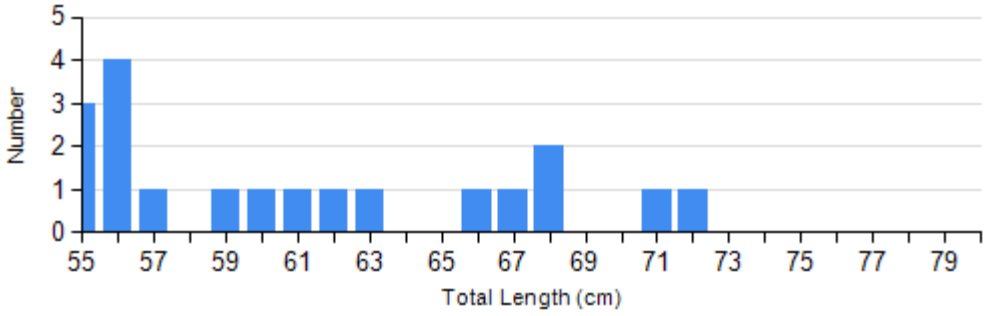
2018



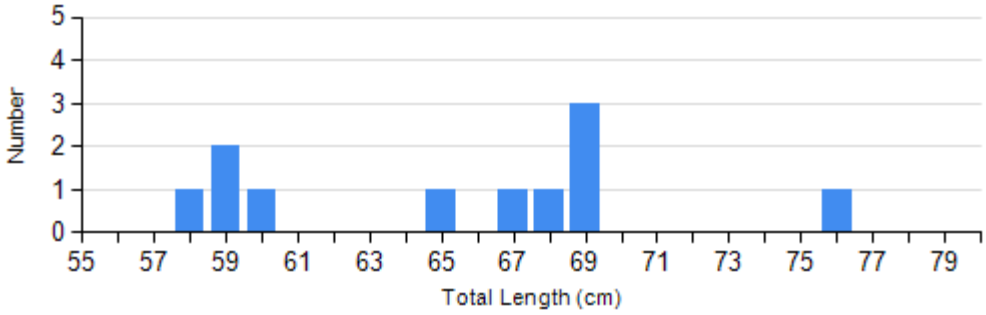
2019

Species: Northern Pike
Gear: std exp gill net

2014

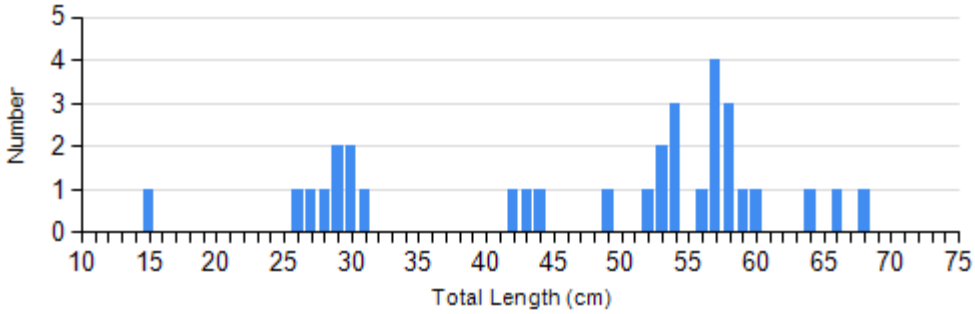


2015

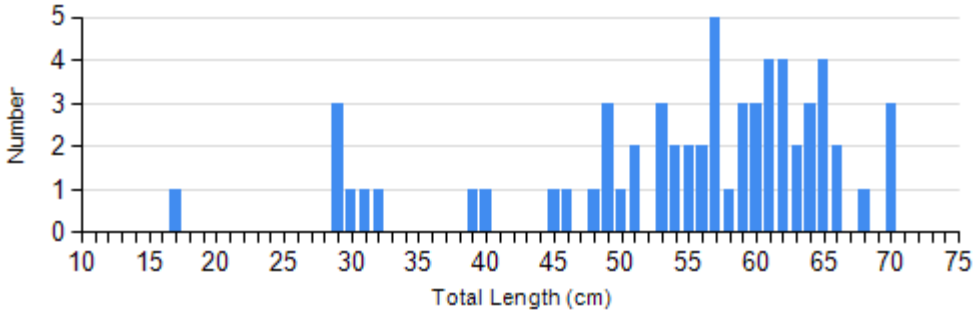


Species: Walleye
Gear: AFS std gill net

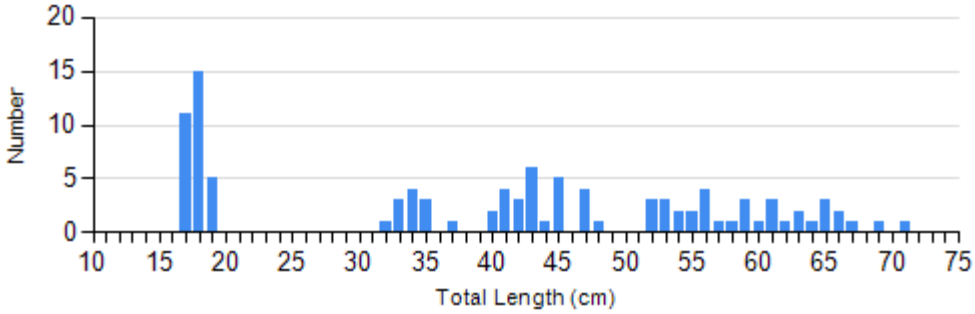
2016

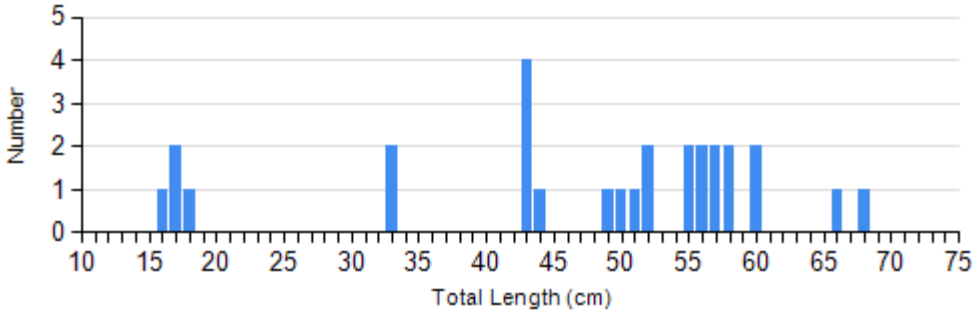


2017



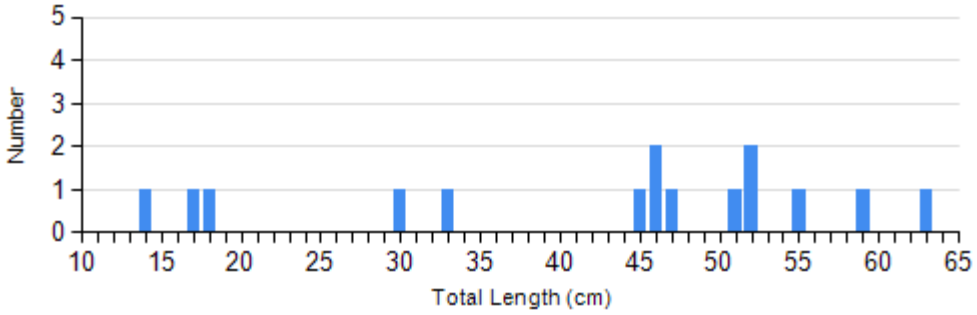
2018



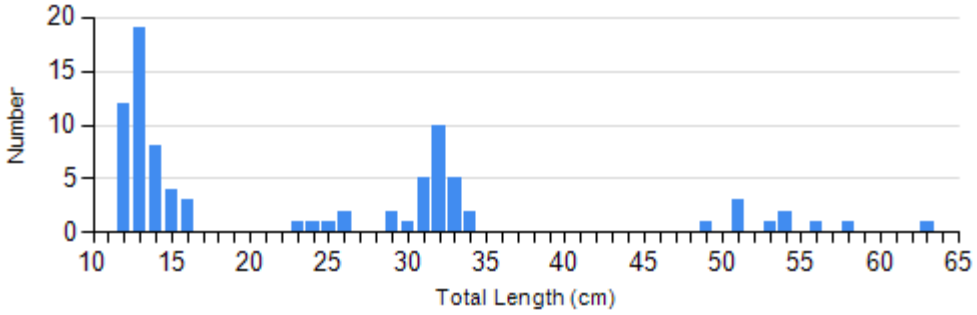


2019

Species: Walleye
Gear: std exp gill net

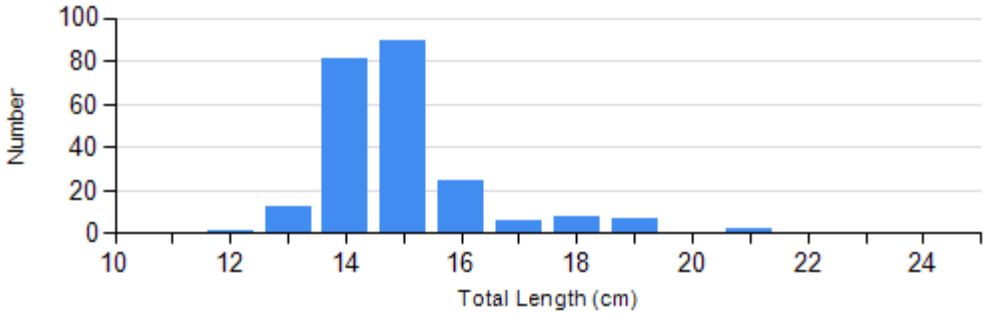


2014

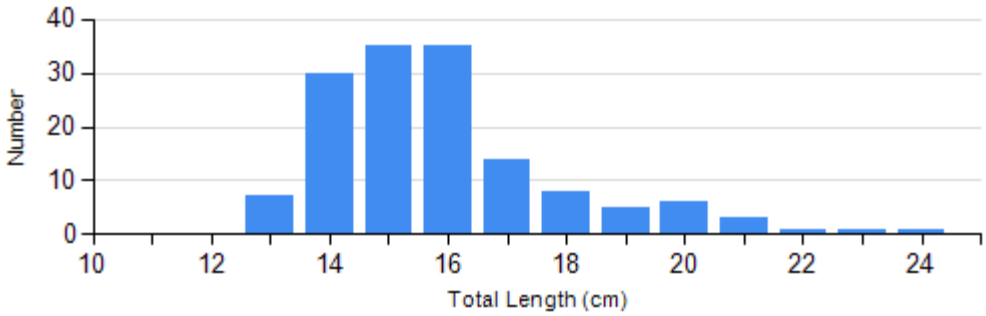


2015

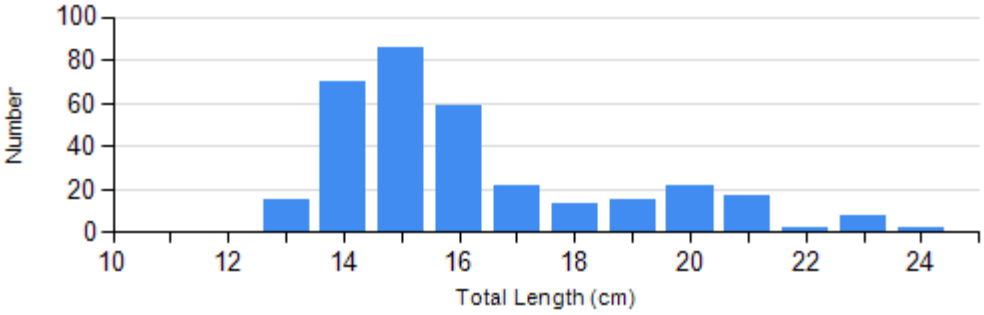
Species: Yellow Perch
Gear: AFS std gill net



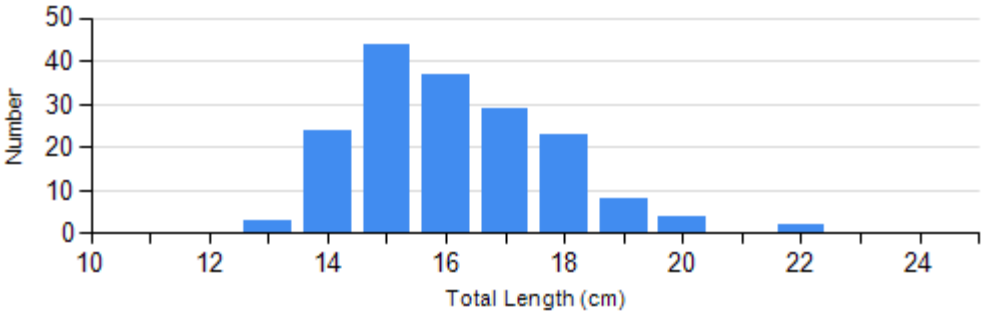
2016



2017

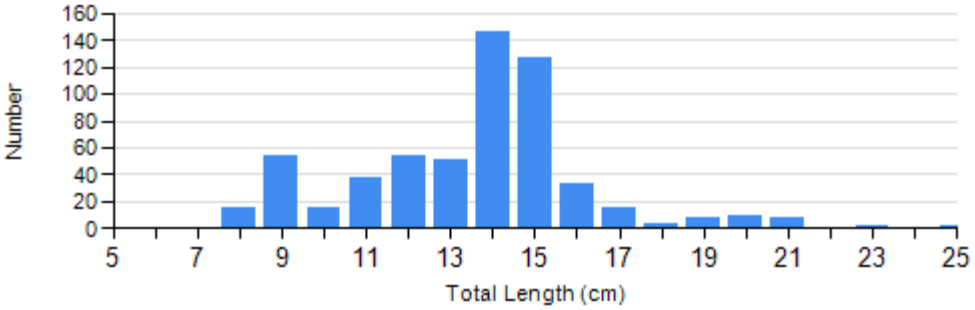


2018

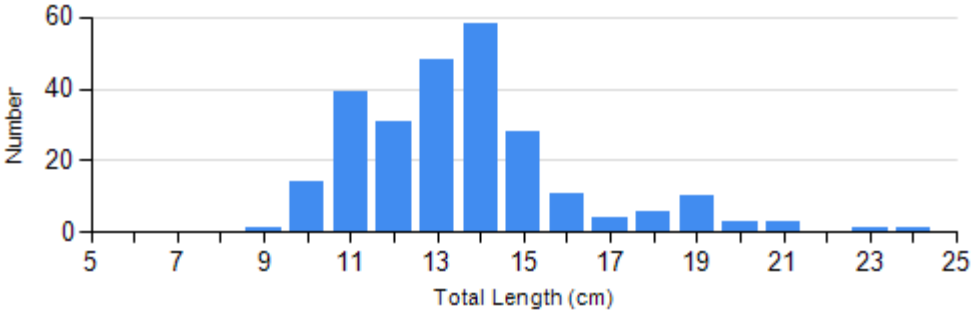


2019

Species: Yellow Perch
Gear: std exp gill net



2014

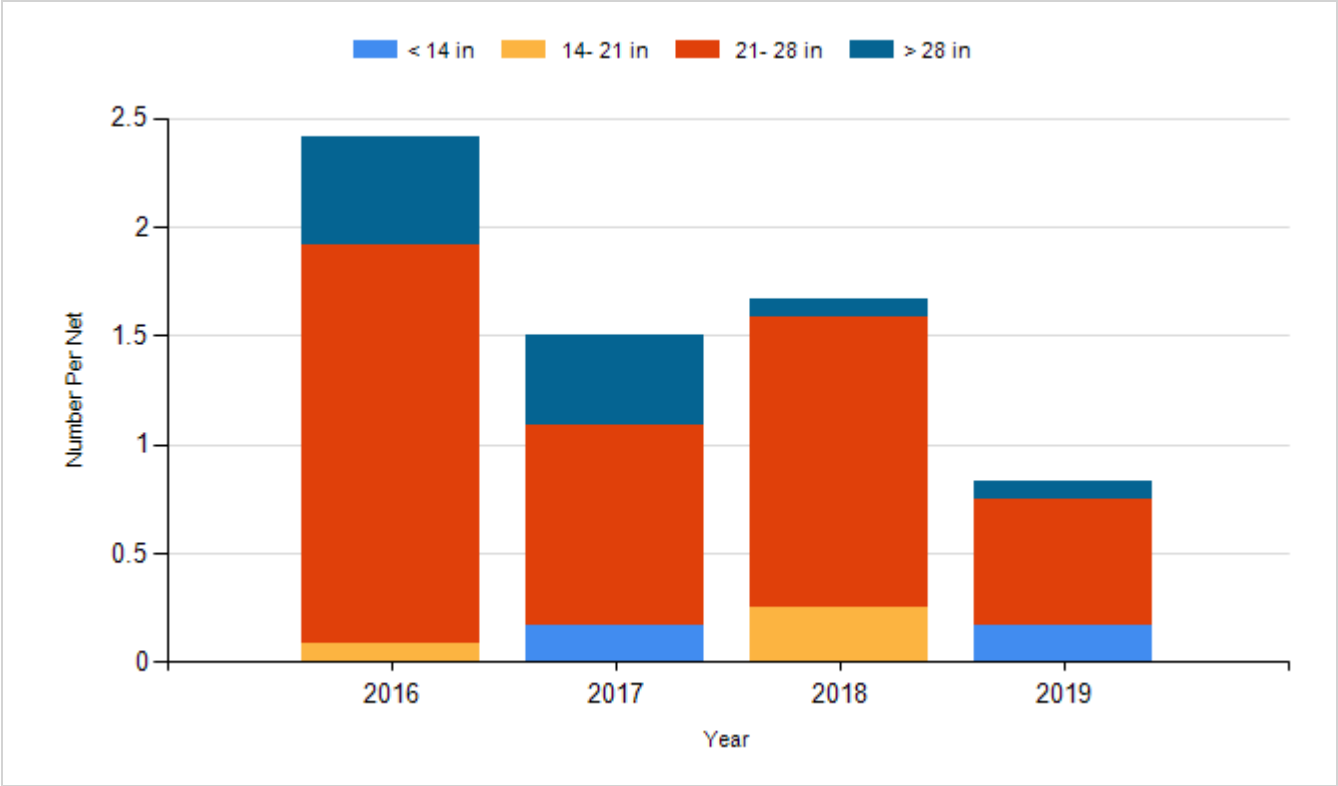


2015

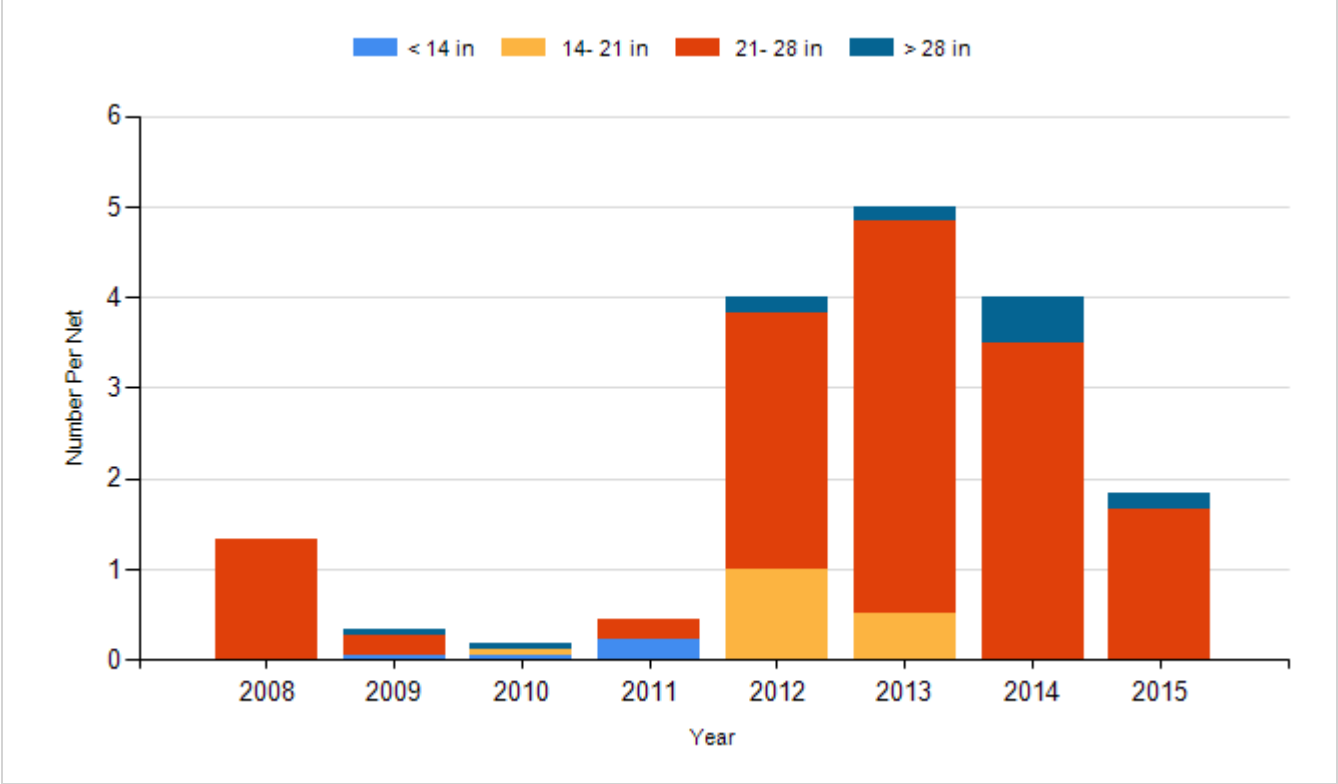
Historic Fish Sizes and Relative Abundance

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

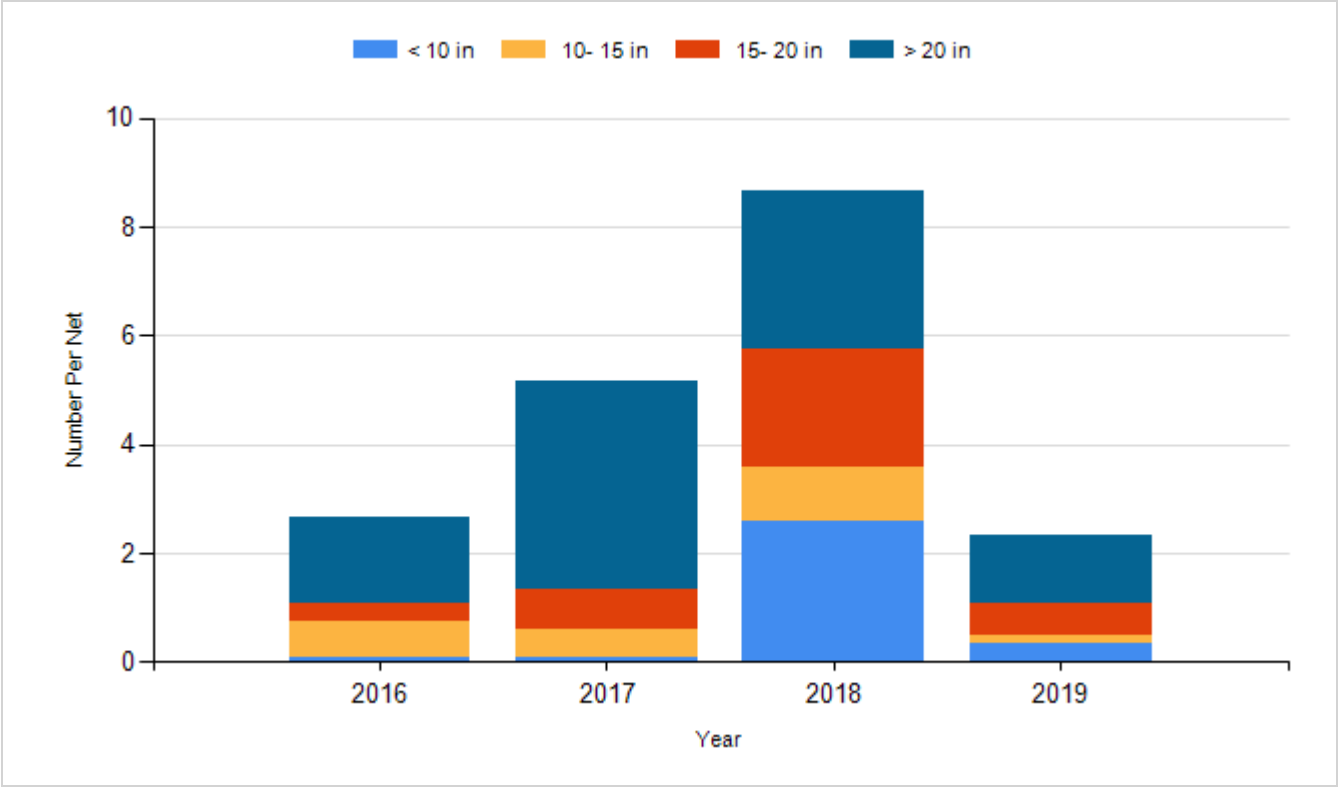
Species: Northern Pike
Gear: AFS std gill net



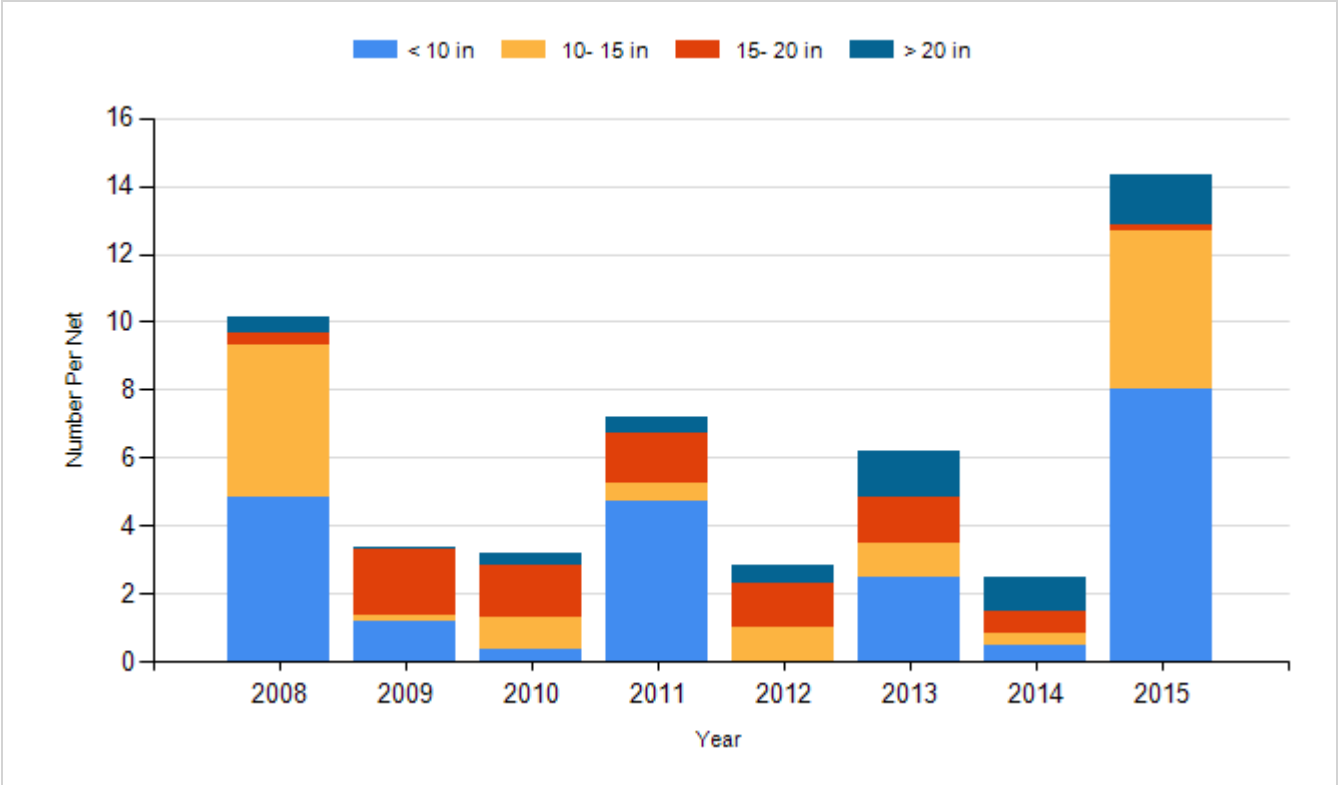
Species: Northern Pike
Gear: std exp gill net



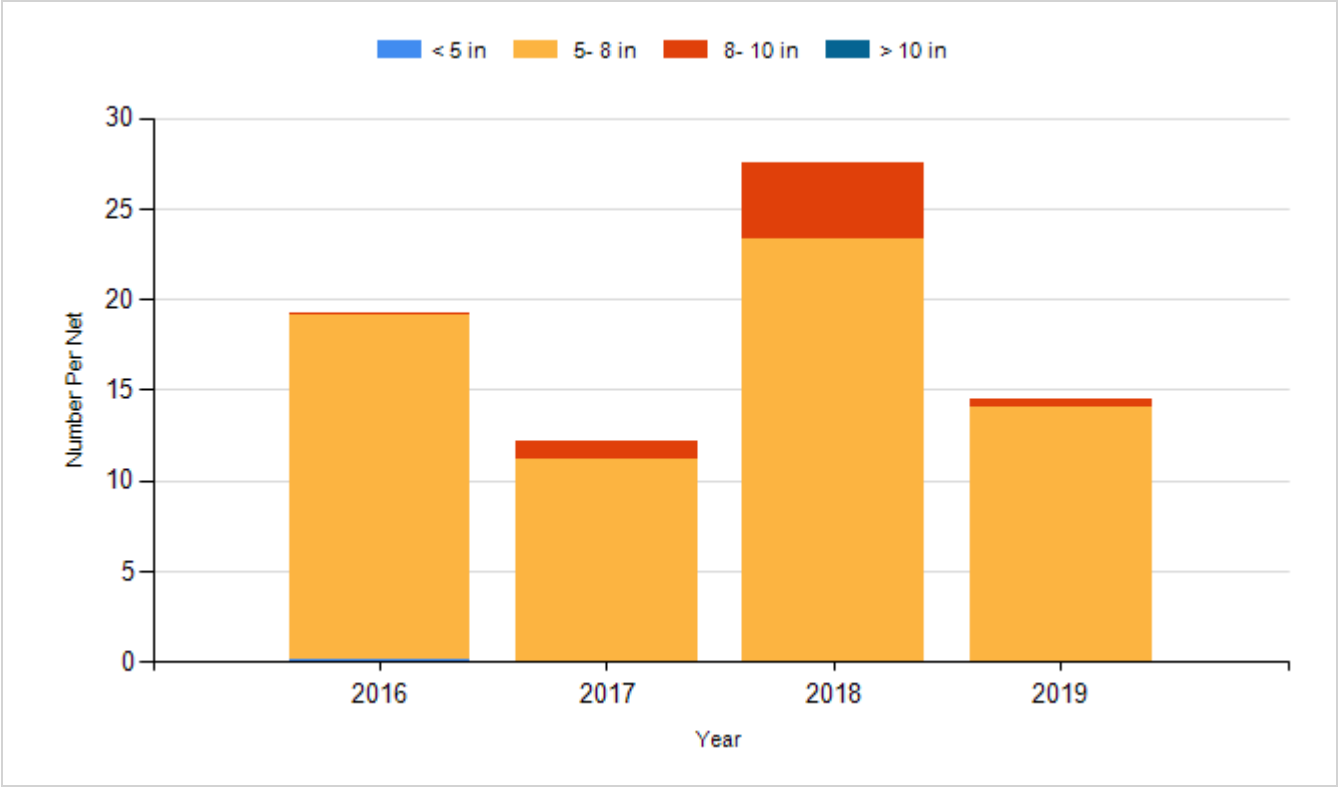
Species: Walleye
Gear: AFS std gill net



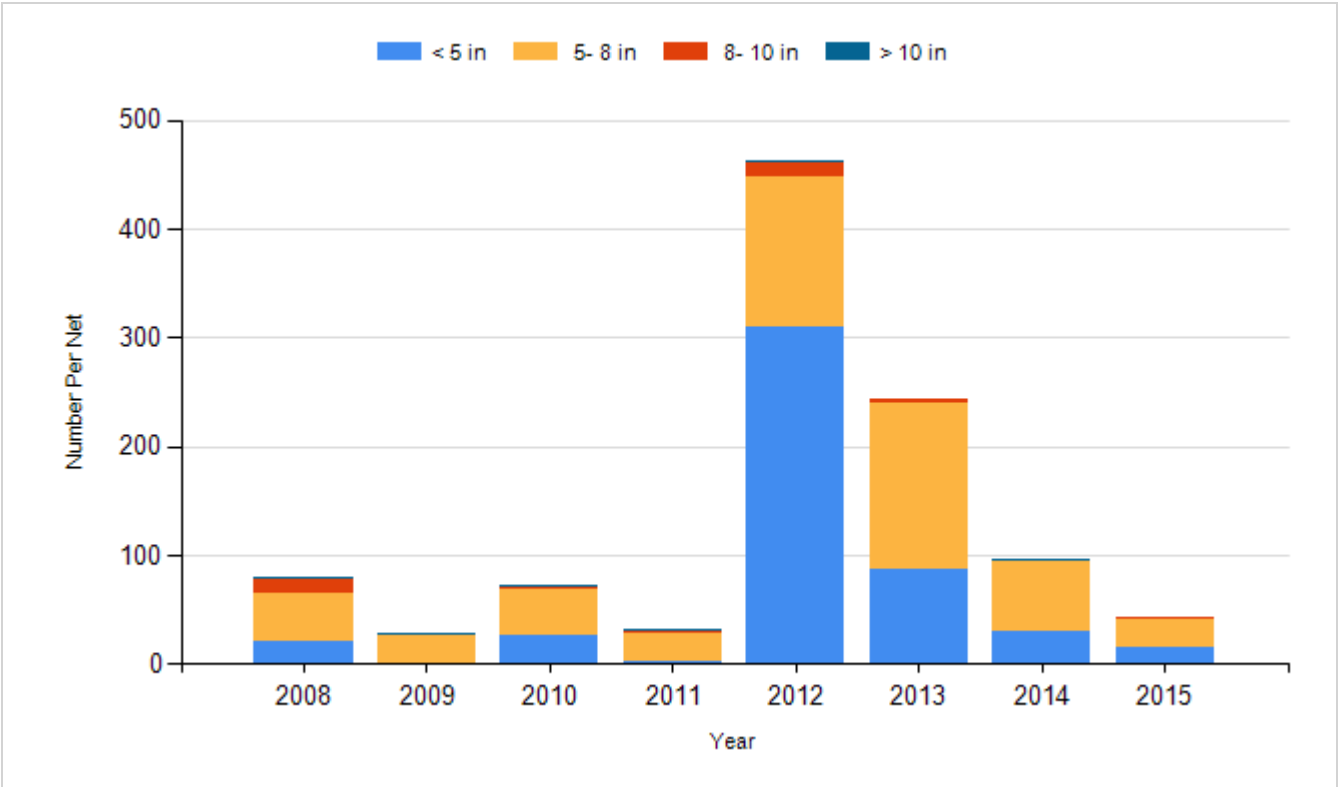
Species: Walleye
Gear: std exp gill net



Species: 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	Fry	4,000,000
2010	Walleye	Fry	1,350,000
2011	Walleye	Fry	1,400,000
2013	Walleye	Fry	1,350,000
2014	Walleye	Large Fingerling	5,165
2015	Walleye	Small Fingerling	270,120
2018	Walleye	Fry	1,350,000