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.** Northern pike numbers were slightly higher in 2018 than 2017. At 1.7/gillnet, relative abundance was considered moderate to high. Sampled northern pike ranged in length from 15.7 to 29.9 inches with most being 23.6 to 26.0 inches.

- **Walleye.** The number of walleyes $\geq$ 10.0 inches has increased in each of the last two surveys (2017 and 2018). In 2018, relative abundance was considered moderate at 6.1/gill net. A wide length range of walleyes (6.7 to 28.0 inches) was sampled as 17 year classes (2000, 2002 – 2004, and 2006 – 2018) were represented. Fish from the 2018 (age-0) cohort, which are not reported in the Length at Capture table, were the most abundant accounting for nearly 30% of walleyes sampled; while, those from the 2016 (age-2) cohort, which had a mean length of 17.0 inches, comprised an additional 20%.

- **Yellow Perch**. Yellow perch were the most abundant species in the 2018 gill net catch. Relative abundance was high (27.6/gill net). Sampled yellow perch ranged in length from 5.1 to 9.4 inches; most (76%) were members of the 2017 (age-1) cohort, which had a mean length of 6.1 inches.

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

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY
Kettle, Marshall County
UJA-Lake-866-000
2018

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 21, 2018	6 net-nights
AFS std gill net	Aug 22, 2018	6 net-nights

Common Fish Species Present

Yellow Perch

Northern Pike

Walleye

Black Crappie

Black Bullhead

Common Carp

White Sucker

Bluegill

Smallmouth Bass

Largemouth 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)
Bigmouth Buffalo	11	28	18	46	24	61	30	76	37	94
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
Channel Catfish	11	28	16	41	24	61	28	71	36	91
Common Carp	11	28	16	41	21	53	26	66	33	84
Freshwater Drum	8	20	12	30	15	38	20	51	25	63
Gizzard Shad	7	18	11	28						
Green Sunfish	3	8	6	15	8	20	10	25	12	30
Lake Herring	5	13	8	20	11	28	14	35	17	43
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
Rock Bass	4	10	7	18	9	23	11	28	13	33
Rudd	6	15	10	25	12	30	15	38	19	48
Saugeye	9	23	14	35	18	46	22	56	27	69
Shorthead Redhorse	6	15	10	25	13	33	16	41	20	51
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
White Sucker	6	15	10	25	13	33	16	41	20	51
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).

		Abundance		Stock Density Indices				Condition	
Gear	Species	CPUE	CI-80	PSD	CI-80	PSD-P	CI-80	Wr	CI-80
AFS std gill net	Black Bullhead	1.7	0.8	80		70	17	97	3
	Black Crappie	5.1	1.8	3		0		123	1
	Bluegill	0.3	0.3	50		0		124	2
	Common Carp	1.1	0.3	100		92		98	3
	Largemouth Bass	0.1	0.1	0		0		134	
	Northern Pike	1.7	0.4	85		5		90	2
	Smallmouth Bass	0.3	0.3	50		50		122	4
	Walleye	6.1	1.9	84	6	48	8	95	1
	White Bass	0.0	0.0	0		0			
	White Sucker	0.7	0.6	88		88		98	4
	Yellow Perch	27.6	4.0	15	3	0		100	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	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Avg
AFS std gill net	Black Bullhead								8.8	0.6	1.7	3.7
	Black Crappie								1.3	0.7	5.1	2.4
	Bluegill								0.5	0.2	0.3	0.3
	Common Carp								0.8	0.3	1.1	0.7
	Largemouth Bass								0.0	0.0	0.1	0.0
	Northern Pike								2.4	1.3	1.7	1.8
	Smallmouth Bass								0.2	0.1	0.3	0.2
	Walleye								2.6	5.1	6.1	4.6
	White Bass								0.1	0.0	0.0	0.0
	White Sucker								0.8	0.6	0.7	0.7
	Yellow Perch								19.2	12.2	27.6	19.7
frame net (std 3/4 in)	Black Bullhead	0.0	0.0	0.1	4.4	20.2	23.7					8.1
	Black Crappie	0.4	1.9	5.5	11.9	3.2	1.9					4.1
	Bluegill	0.1	0.7	1.8	2.4	13.3	23.6					7.0
	Common Carp	0.4	0.5	0.1	0.2	0.0	0.1					0.2
	Green Sunfish	0.0	0.0	0.0	0.0	0.0	0.1					0.0
	Largemouth Bass	0.1	0.0	0.0	0.2	0.0	0.0					0.1
	Northern Pike	0.6	0.3	0.2	0.5	0.7	0.7					0.5
	Smallmouth Bass	0.2	0.7	1.3	0.6	0.7	0.5					0.7
	Walleye	1.2	0.3	0.1	0.5	0.3	0.1					0.4
	White Bass	0.0	0.0	0.0	0.0	0.0	0.0					0.0
	White Sucker	0.1	0.1	0.1	0.3	0.0	0.0					0.1
	Yellow Perch	5.6	18.7	19.0	21.2	26.1	36.7					21.2
std exp gill net	Black Bullhead	0.0	0.0	0.0	2.3	4.2	2.8	45.2				7.8
	Black Crappie	0.7	30.7	8.3	12.3	2.5	0.3	26.0				11.5
	Bluegill	0.0	0.0	0.0	0.0	0.0	0.5	0.2				0.1
	Common Carp	1.5	0.3	0.3	0.0	0.0	0.2	0.0				0.3
	Largemouth Bass	0.0	0.0	0.0	0.0	0.0	0.0	0.0				0.0
	Northern Pike	0.8	0.3	0.7	4.0	5.0	4.0	1.8				2.4
	Smallmouth Bass	0.3	3.7	0.3	0.0	0.2	0.2	0.0				0.7
	Walleye	6.7	8.5	7.5	2.8	3.7	2.0	6.3				5.4
	White Bass	0.0	0.0	0.0	0.0	0.0.	0.0	0.0				0.0
	White Sucker	0.3	0.5	0.5	1.3	2.5	0.7	0.2				0.9
	Yellow Perch	83.0	140.2	92.2	152.0	156.8	67.2	28.8				102.9

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	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
AFS std gill net	Northern Pike	PSD								97	100	85
		PSD-P								21	31	5
		Wr								86	77	90
	Walleye	PSD								74	90	84
		PSD-P								61	75	48
		Wr								93	88	95
	Yellow Perch	PSD								1	8	15
		PSD-P								0	0	0
		Wr								99	102	100
std exp gill net	Northern Pike	PSD	100	50	100	75	90	100	100			
		PSD-P	20	50	0	4	3	13	9			
		Wr	83	91	88	93	88	89	91			
	Walleye	PSD	90	67	80	65	73	83	26			
		PSD-P	3	12	20	18	36	50	24			
		Wr	89	96	96	94	89	93	98			
	Yellow Perch	PSD	3	10	16	10	3	5	5			
		PSD-P	0	0	1	2	0	0	0			
		Wr	106	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+
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)
2009	48	242 (11)		412 (35)	435 (1)						586 (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	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)								
2009	506	156 (488)	227 (17)	285 (1)							

Fish Condition

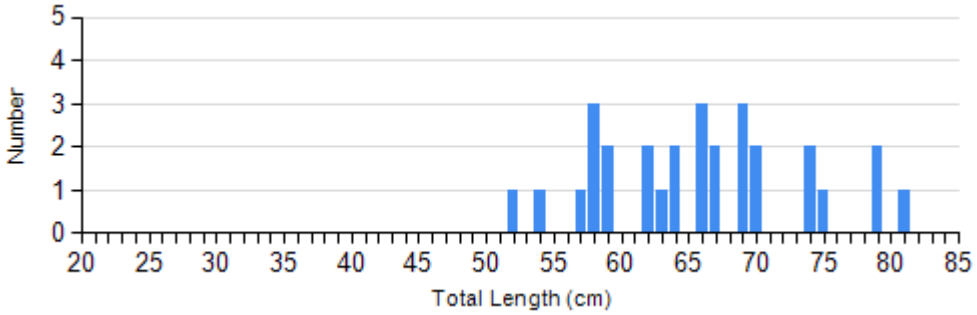
Mean relative weight (Wr) by sample size (N), length category stock to quality (S-Q), quality to preferred (Q-P), preferred to memorable (P-M), and memorable (M) for species collected across survey years with standard error (SE).

		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	2014	0		21	89 (0.8)	2	88 (1.2)	1	83
	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	
Walleye Gill Net	2014	2	92 (1.6)	4	97 (3.9)	5	92 (3.2)	1	89
	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)
Yellow Perch Gill Net	2014	384	97 (0.4)	18	96 (1.4)	1	91	0	
	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	

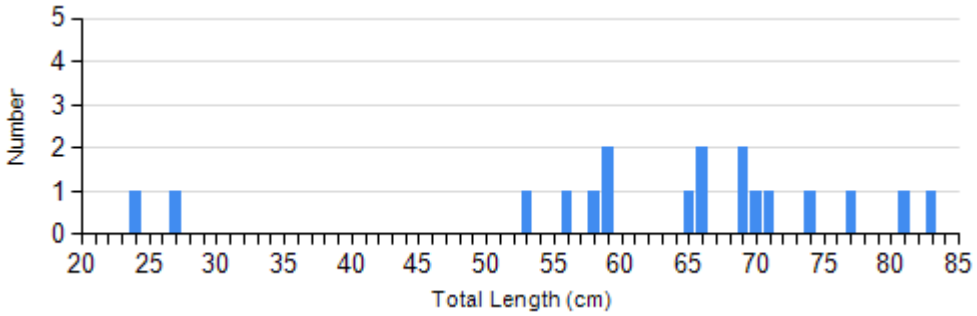
Length Frequency Distribution

Length frequency histogram of species sampled by year.

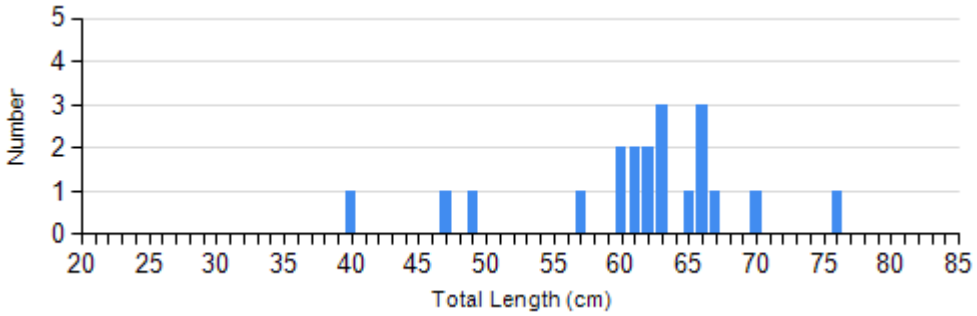
Species: Northern Pike
Gear: AFS std gill net



2016

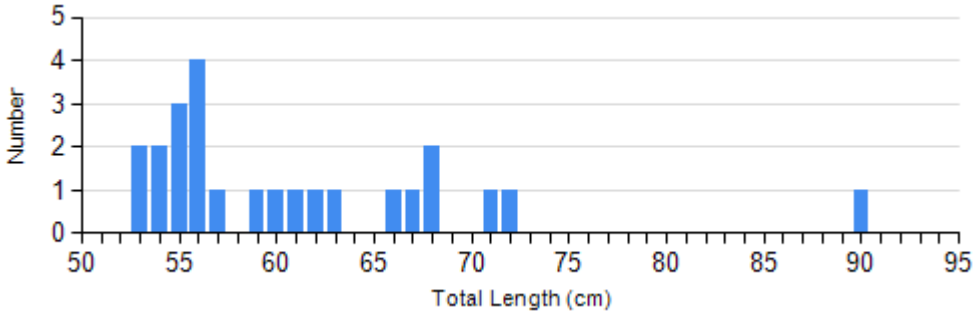


2017

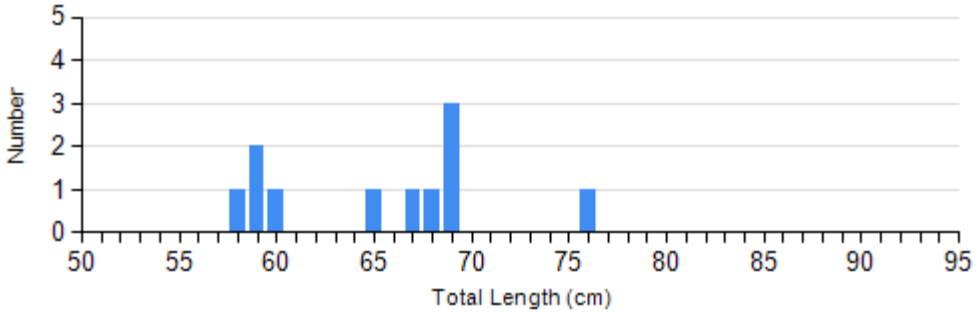


2018

Species: Northern Pike
Gear: std exp gill net

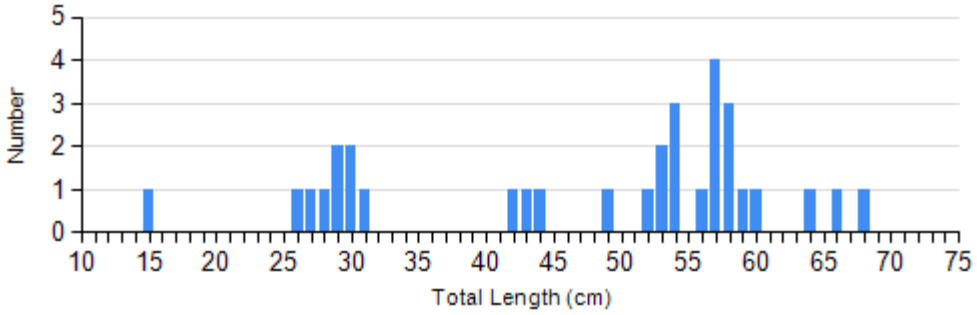


2014

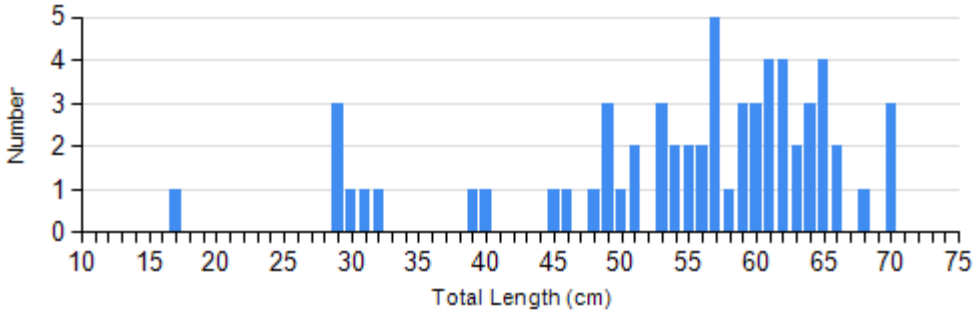


2015

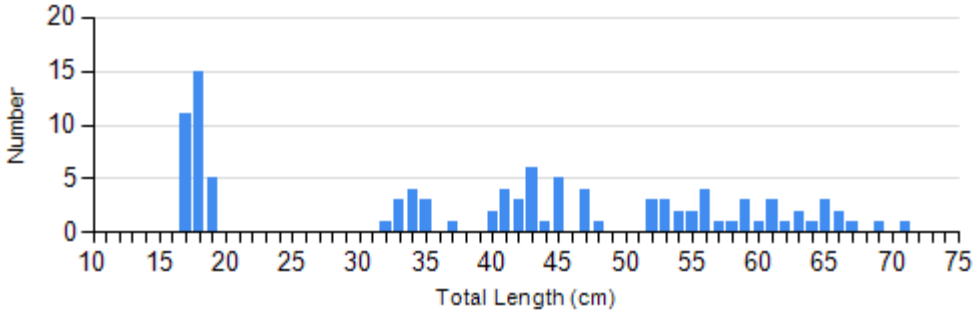
Species: Walleye
Gear: AFS std gill net



2016

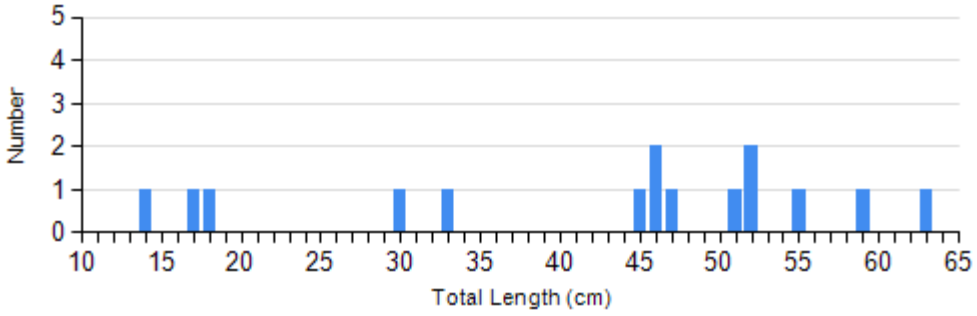


2017

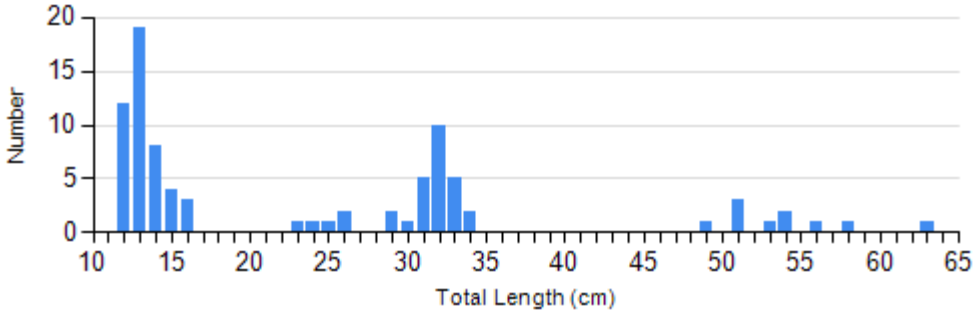


2018

Species: Walleye
Gear: std exp gill net

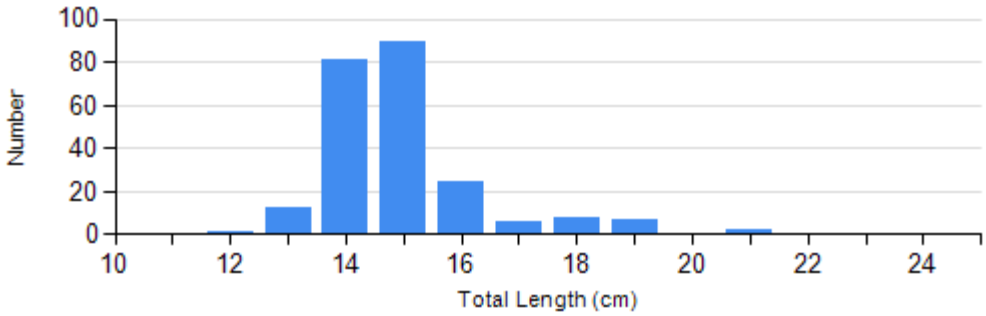


2014

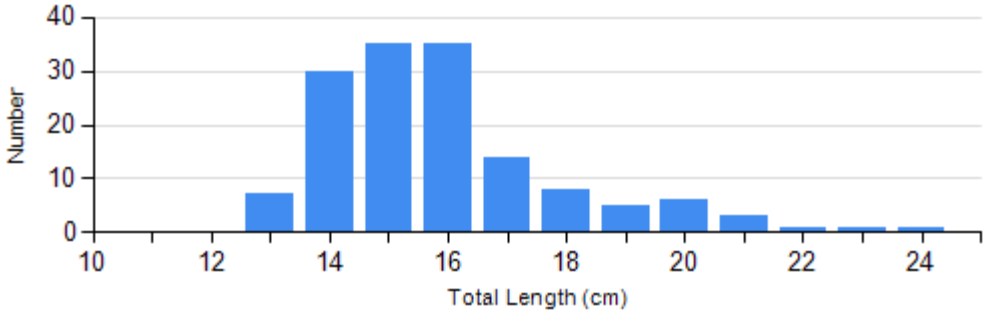


2015

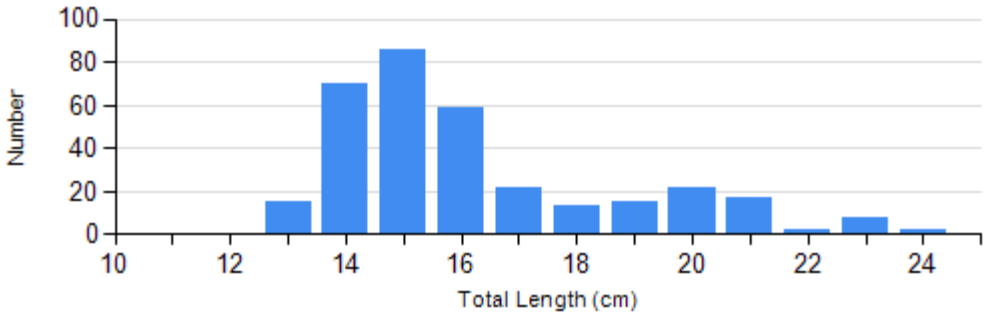
Species: Yellow Perch
Gear: AFS std gill net



2016

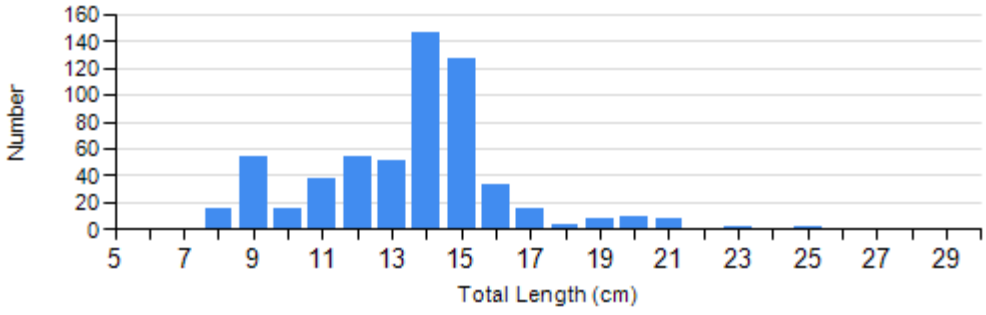


2017

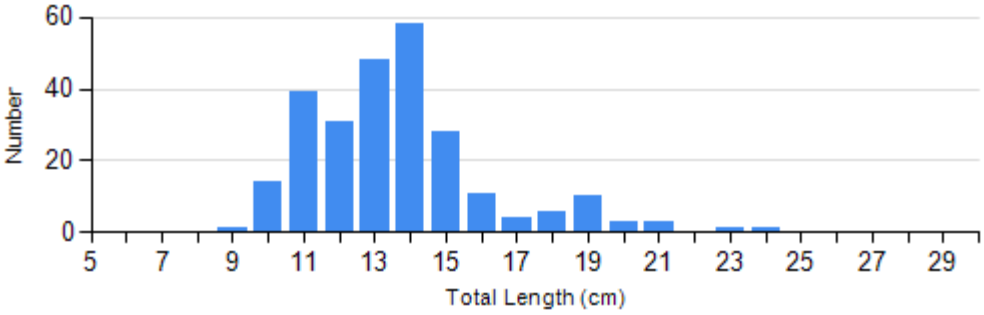


2018

Species: Yellow Perch
Gear: std exp gill net



2014

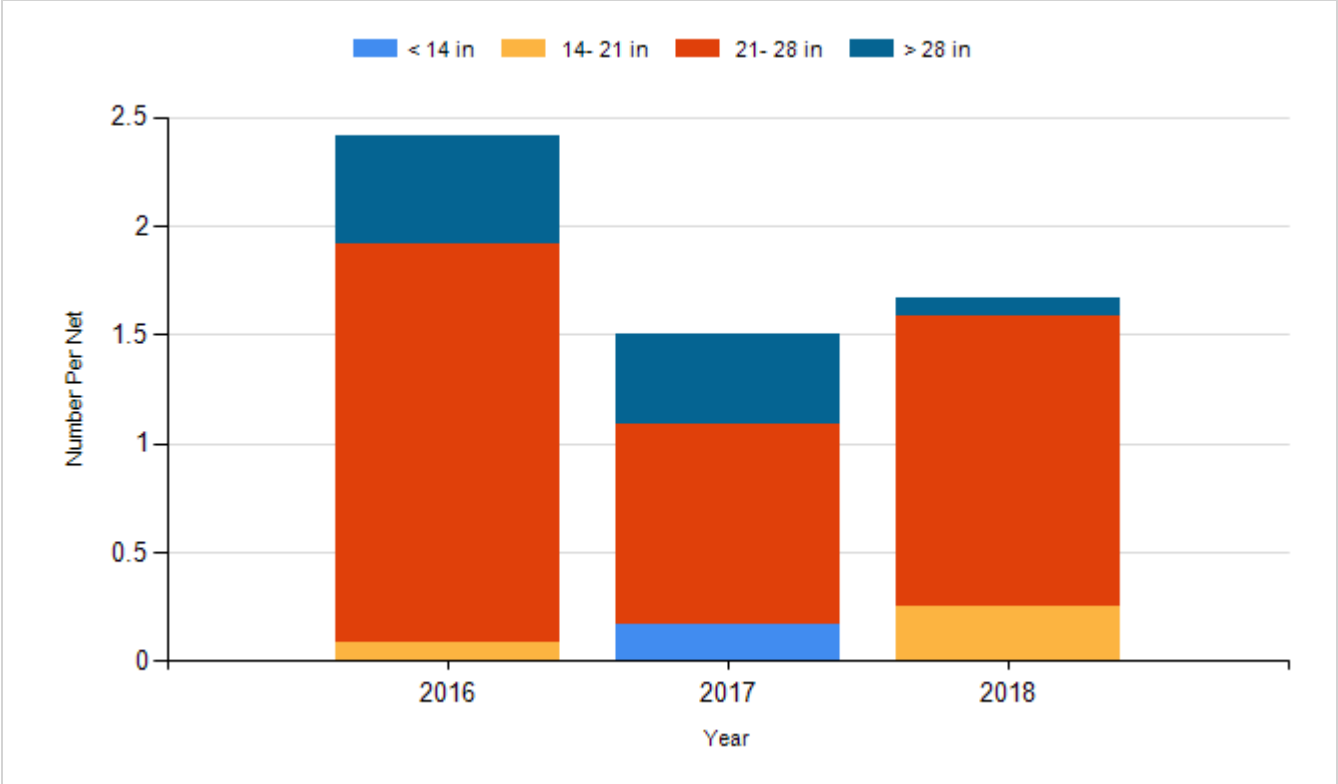


2015

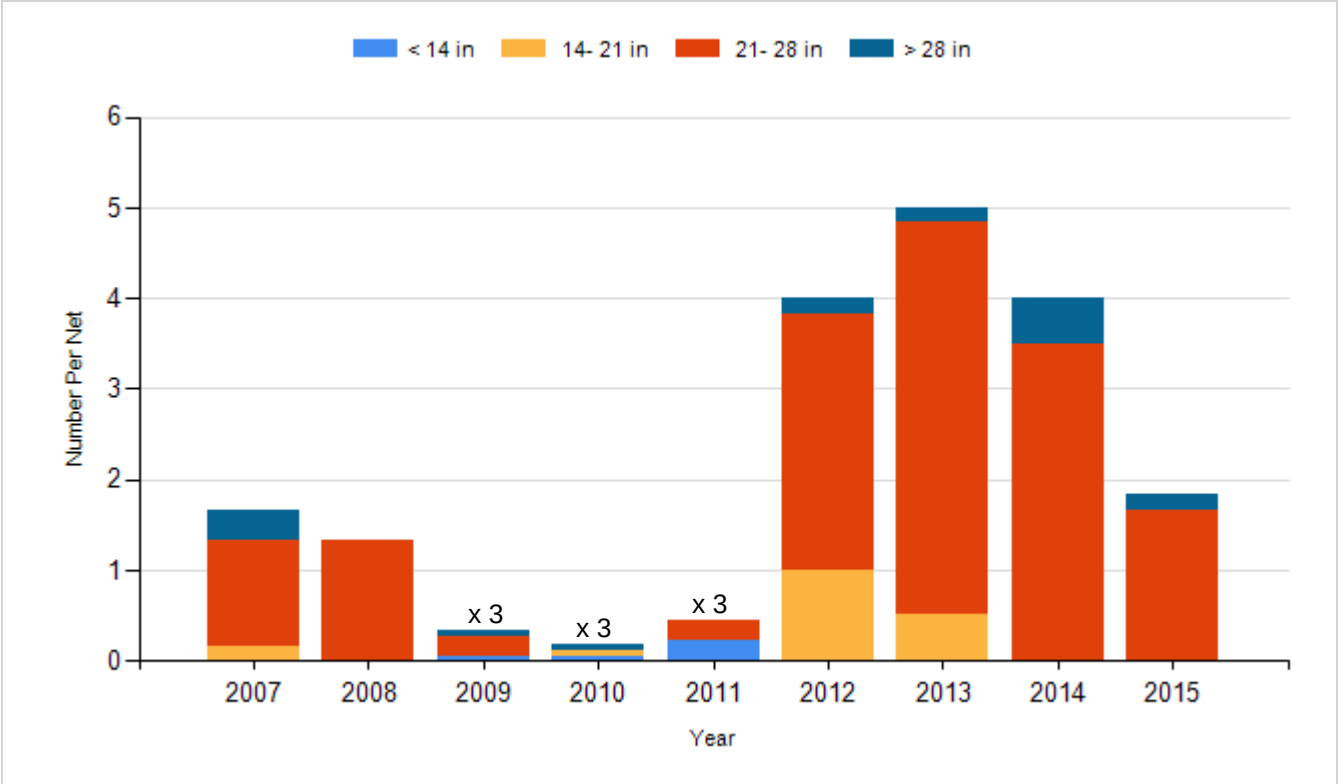
Historic Fish Sizes and Relative Abundance

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

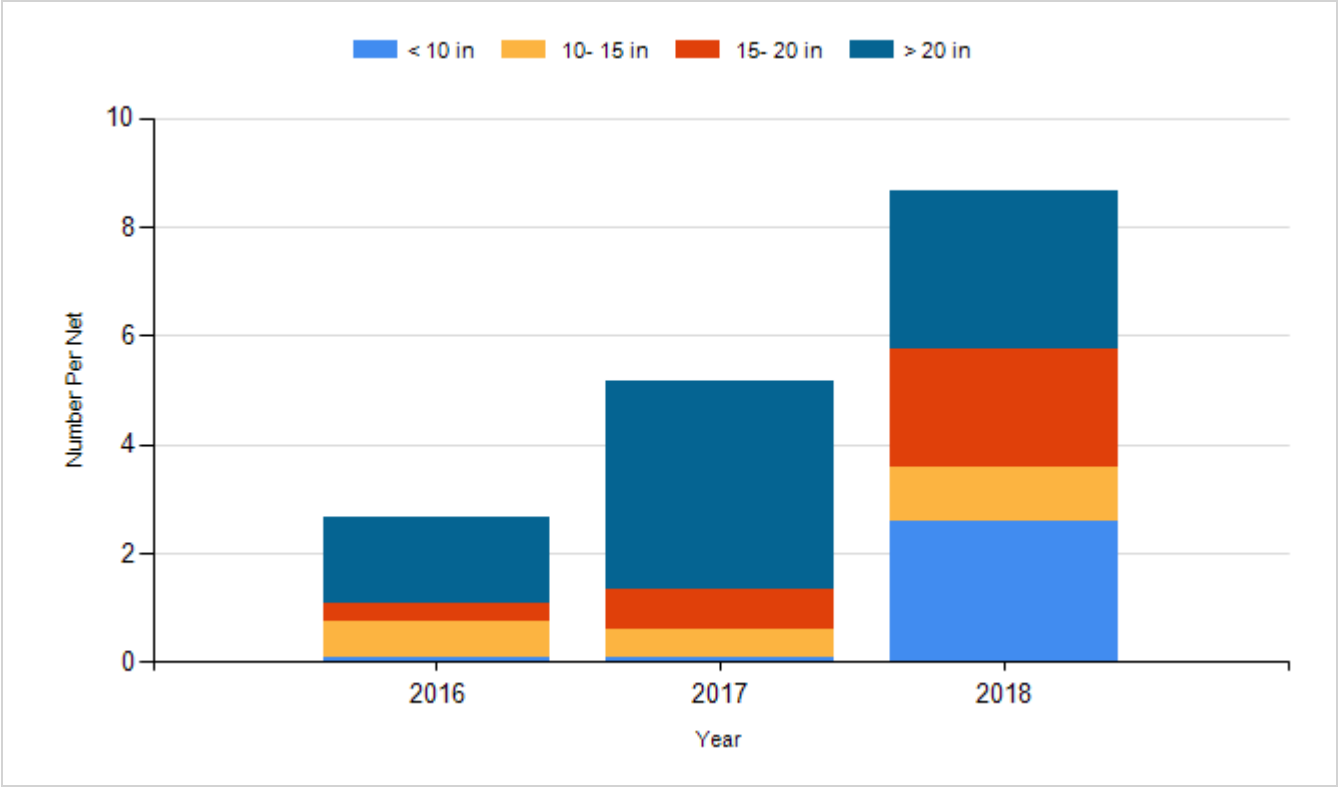
Species: Northern Pike
Gear: AFS std gill net



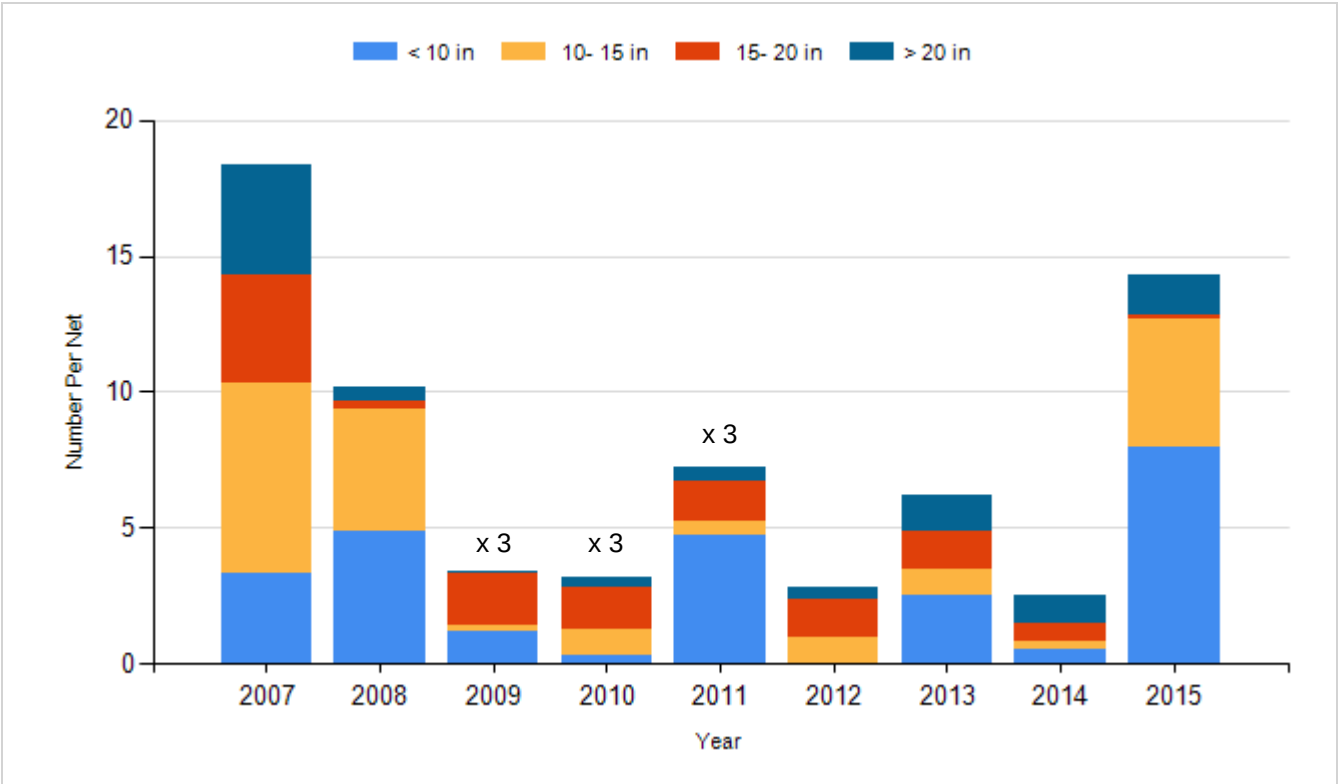
Species: Northern Pike
Gear: std exp gill net



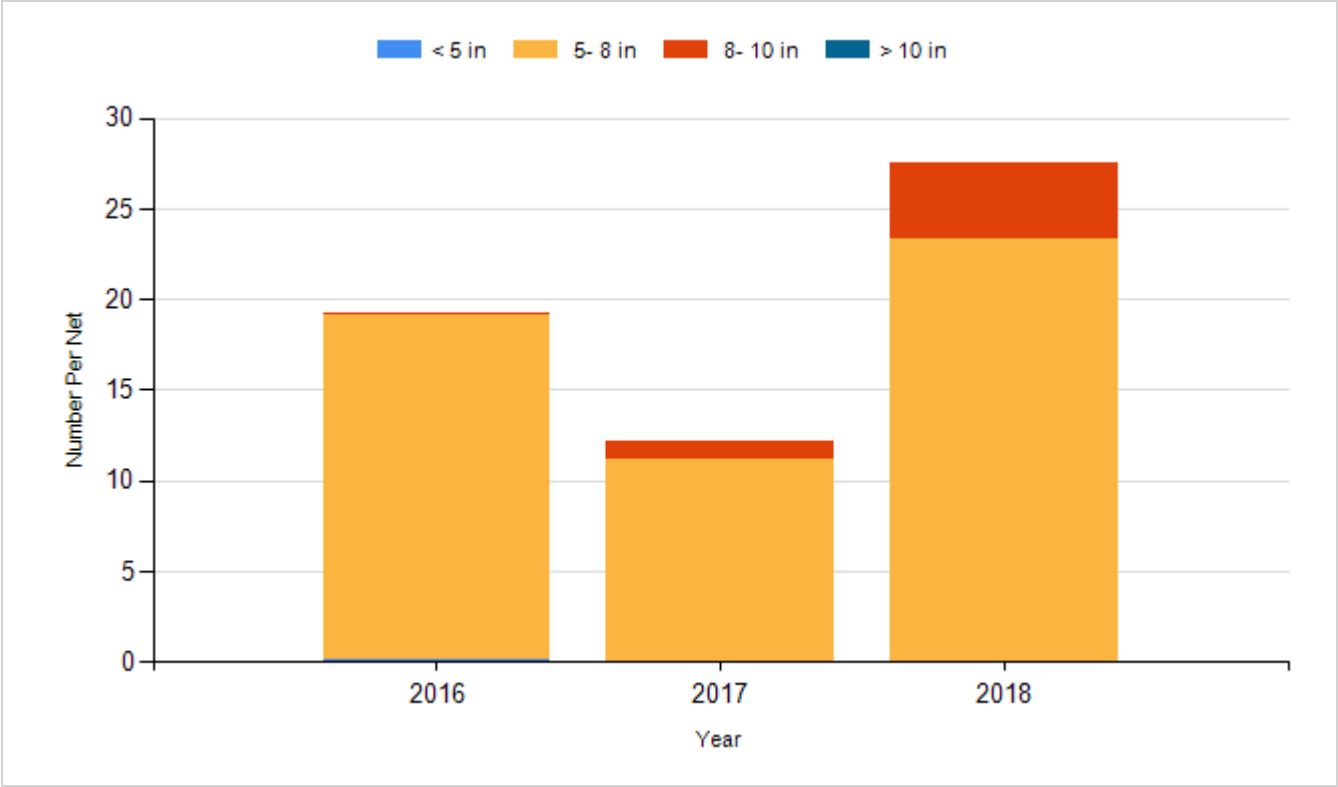
Species: Walleye
Gear: AFS std gill net



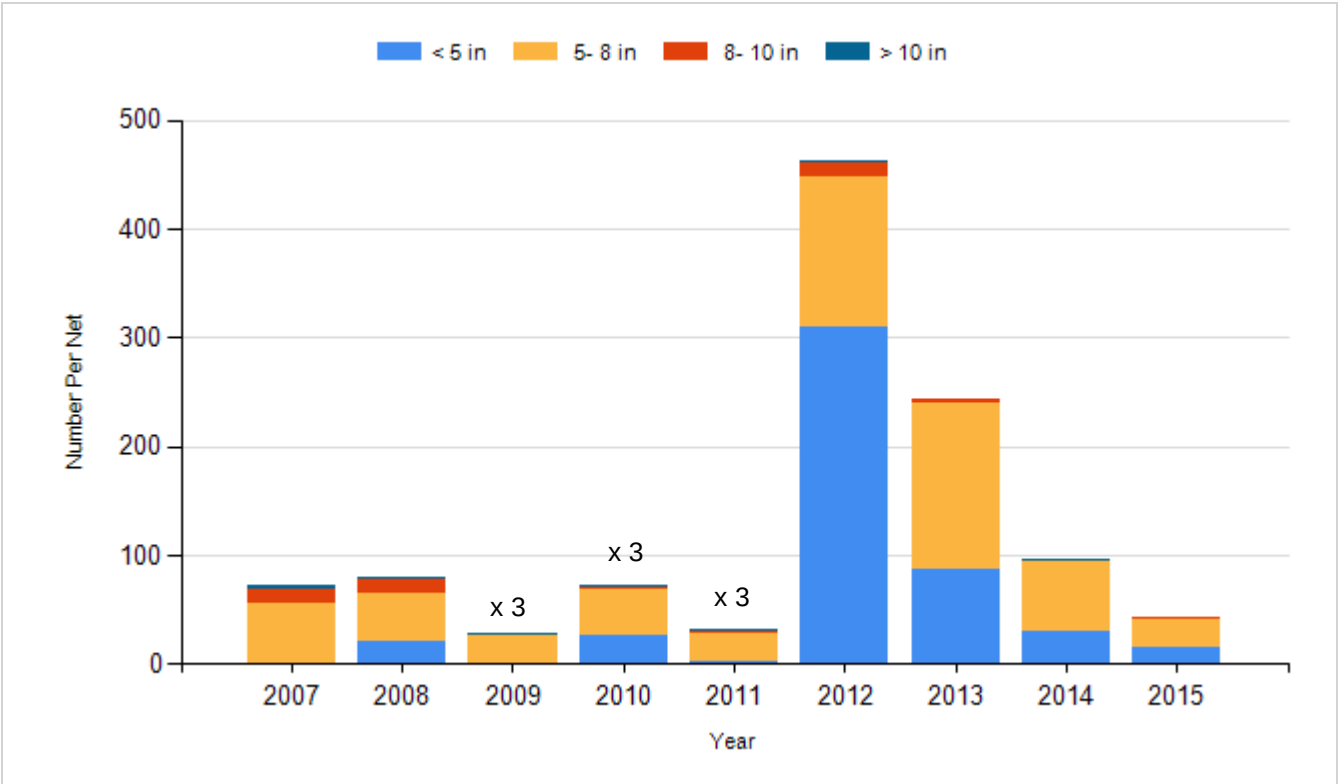
Species: Walleye
Gear: std exp gill net



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