SOUTH DAKOTA STATEWIDE FISHERIES SURVEY
Madison, Lake County
LBS-Lake-135-000
2016

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
std exp gill net	July 19, 2016	5 net-nights
std frame net (3/8 inch)	July 19, 2016	10 net-nights

Common Fish Species Present

Walleye

Black Bullhead

Yellow Perch

White Sucker

Bigmouth Buffalo

Common Carp

White Bass

Bluegill

Black Crappie

Smallmouth 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).

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

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

	Stock		Quality		Preferred		Memorable		Trophy	
Species Name	(in)	(cm)	(in)	(cm)	(in)	(cm)	(in)	(cm)	(in)	(cm)
Blue Catfish	12	30	20	51	30	76	35	89	45	114
Bluegill	3	8	6	15	8	20	10	25	12	30
Bluegill X Gr. Sunfish Hybrid	3	8	6	15	8	20	10	25	12	30
Brown Bullhead	5	13	8	20	11	28	14	36	17	43
Burbot	8	20	15	38	21	53	26	67	32	82
Channel Catfish	11	28	16	41	24	61	28	71	36	91
Common Carp	11	28	16	41	21	53	26	66	33	84
Flathead Catfish	14	35	20	51	28	71	34	86	40	102
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
Longnose Gar	16	41	27	69	36	91	45	114	55	140
Muskellunge	20	51	30	76	38	97	42	107	50	127
Northern Pike	14	35	21	53	28	71	34	86	44	112
Paddlefish	16	41	26	66	33	84	41	104	51	130
Pumpkinseed	3	8	6	15	8	20	10	25	12	30
Redear Sunfish	4	10	7	18	9	23	11	28	13	33
River Carpsucker	7	18	11	28	14	36	18	46	22	56
Rock Bass	4	10	7	18	9	23	11	28	13	33
Rudd	6	15	10	25	12	30	15	38	19	48
Sauger	8	20	12	30	15	38	20	51	25	63
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
Smallmouth Buffalo	11	28	18	46	24	61	30	76	37	94
Spotted Bass	7	18	11	28	14	35	17	43	20	51
Striped Bass	12	30	20	51	30	76	35	89	45	114
Striped Bass Hybrid (wiper)	8	20	12	30	15	38	20	51	25	63
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 Perch	5	13	8	20	10	25	12	30	15	38
White Sucker	6	15	10	25	13	33	16	41	20	51
Yellow Bass	4	10	7	18	9	23	11	28	13	33
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
std exp gill net	Black Bullhead	7.8	7.7	97		8			
	Channel Catfish	0.2	0.3	100		0			
	Common Carp	2.2	1.3	91		73			
	Northern Pike	0.2	0.3	100		100		86	
	Walleye	17.8	3.5	1		0		86	1
	White Bass	0.8	0.3	100		25		97	2
	White Sucker	13.6	3.3	94		91	5		
	Yellow Perch	15.6	4.5	37	8	36	8	108	1
std frame net (3/8 inch)	Bigmouth Buffalo	9.1	5.9	84	6	8	4		
	Black Bullhead	21.5	7.7	97	2	30	4		
	Black Crappie	3.6	2.2	100		86	9	106	3
	Bluegill	3.8	1.7	97		97		115	2
	Common Carp	7.6	3.0	87	6	37	8		
	Green Sunfish	0.1	0.1	100		100		111	
	Northern Pike	0.1	0.1	100		100			
	Smallmouth Bass	2.4	1.3	38	16	0		97	2
	Walleye	1.7	1.3	0		0		81	2
	White Bass	4.8	2.8	98		38	10	92	1
	White Sucker	2.5	1.1	100		100			
	Yellow Perch	0.8	0.7	13		13		97	4

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	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Avg
fall night EF-WAE	Walleye	379.5	347.0	27.0	710.0	28.0	2.5	113.5	31.0	10.0		183.2
	Yellow Perch						0.0					0.0
large frame net	Bigmouth Buffalo	7.2	6.1	11.0	4.0	4.3	5.7	3.6				6.0
	Black Bullhead	51.5	8.8	4.3	28.4	74.2	73.9	24.0				37.9
	Black Crappie	14.2	17.9	3.3	7.1	26.6	8.3	0.1				11.1
	Bluegill	1.0	0.9	0.1	7.7	3.9	1.4	0.7				2.2
	Channel Catfish	0.6	0.1			0.1						0.3
	Common Carp	12.4	4.7	3.2	2.0	2.2	8.2	6.3				5.6
	Green Sunfish	0.8	0.6		5.5	2.5		0.2				1.9
	Northern Pike	0.1	0.3	1.2		0.5	0.9	0.4				0.6
	Smallmouth Bass	1.6			0.2	0.2	0.1	0.1				0.4
	Sunfish Hybrid	0.0		0.0				0.0				0.0
	Walleye	1.0	0.3	0.9	0.5	1.9	16.8	0.2				3.1
	White Bass			0.2	0.1	0.3	5.1	0.2				1.2
	White Sucker	0.7	1.2	0.7	0.2	2.3	5.6	2.2				1.8
	Yellow Perch	8.5	32.0	1.5	165.9	100.9	5.5	0.6				45.0
std exp gill net	Bigmouth Buffalo	0.5	1.8	0.2	0.0		1.0		0.8	0.8		0.7
	Black Bullhead	4.3	2.0	2.7	6.3	26.8	19.7	15.8	63.4	91.0	7.8	24.0
	Black Crappie	9.5	5.2	0.2	2.3	10.8			0.2	0.3		4.1
	Bluegill	0.0			0.3	1.0	0.3			0.5		0.4
	Channel Catfish								0.2	0.3	0.2	0.2
	Common Carp	2.5	0.7	0.3		2.5	0.3	0.0	1.4	3.5	2.2	1.5
	Green Sunfish	0.3				0.3		0.0				0.2
	Northern Pike	0.3	0.8	0.2		0.3	0.7		0.2		0.2	0.4
	Smallmouth Bass	1.8							0.6			1.2
	Spottail Shiner			0.0					0.0			0.0
	Walleye	11.0	2.5	11.0	19.0	12.8	23.7	9.6	7.0	7.3	17.8	12.2
	White Bass					1.5	0.0	1.2	0.8	0.8	0.8	0.9
	White Sucker	8.5	12.2	18.0	9.0	15.8	14.7	11.6	20.0	11.0	13.6	13.4
	Yellow Bullhead					0.3						0.3
	Yellow Perch	101.5	100.2	18.3	162.3	265.8	130.0	6.0	24.2	8.3	15.6	83.2
std frame net (3/8 inch)	Bigmouth Buffalo								8.0	9.3	9.1	8.8
	Black Bullhead								301.9	61.0	21.5	128.1

		CPUE										
Gear	Species	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Avg
std frame net (3/8 inch)	Black Crappie								2.1	1.7	3.6	2.5
	Bluegill								8.6	1.7	3.8	4.7
	Common Carp								16.6	14.2	7.6	12.8
	Green Sunfish								0.4	0.2	0.1	0.2
	Northern Pike								0.2	0.3	0.1	0.2
	Smallmouth Bass								3.5	0.9	2.4	2.3
	Sunfish Hybrid								0.0	0.0		0.0
	Walleye								0.2	0.7	1.7	0.9
	White Bass									0.5	4.8	2.7
	White Sucker								0.8	3.4	2.5	2.2
	Yellow Perch								2.2	0.4	0.8	1.1

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	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
fall night EF-WAE	Walleye	Wr	95	99	107	95	100	105	83	98	92	
large frame net	Black Crappie	PSD	49	54	97	70	16	100	100			
		PSD-P	25	8	12	66	11	11	100			
		Wr	110	110	109	112	131	93	105			
	Northern Pike	PSD	0	67	75		60	67	75			
		PSD-P	0	33	25		20	22	0			
		Wr	104	86	100		92	67	85			
	Walleye	PSD	50	33	33	20	16	2	0			
		PSD-P	0	33	11	0	0	2	0			
		Wr	92	98	91	92	90	86	97			
	Yellow Perch	PSD	6	5	80	8	4	96	0			
		PSD-P	0	2	13	5	1	24	0			
		Wr	97	103	103	99	101	90	123			
std exp gill net	Black Crappie	PSD	5	45	0	29	2			0	100	
		PSD-P	3	0	0	29	2			0	0	
		Wr	126	115	112	113	120			116	117	
	Northern Pike	PSD	0	60	100		0	0		100		100
		PSD-P	0	0	100		0	0		0		100
		Wr	92	87	79		87	77		100		86
	Walleye	PSD	25	93	15	39	49	6	48	89	0	1
		PSD-P	0	7	2	0	10	3	0	11	0	0
		Wr	90	85	88	91	87	77	100	85	86	86
	Yellow Perch	PSD	10	25	89	34	18	87	17	3	82	37
		PSD-P	5	3	11	25	3	12	3	2	24	36
		Wr	110	109	114	106	102	91	112	106	110	108
std frame net (3/8 inch)	Black Crappie	PSD								14	100	100
		PSD-P								14	12	86
		Wr								107	107	106
	Northern Pike	PSD								100	100	100
		PSD-P								50	67	100

			Year									
Gear	Species	Index	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
std frame net (3/8 inch)	Northern Pike	Wr								84	91	
	Walleye	PSD								50	29	0
		PSD-P								0	14	0
		Wr								83	79	81
	Yellow Perch	PSD								9	100	13
		PSD-P								0	75	13
		Wr								93	98	97

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+
2012	83		222 (74)		288 (3)	320 (5)	326 (1)				
2011	268	147 (230)	221 (9)	254 (8)	295 (16)	302 (3)	315 (2)				
2010	74	145 (24)	235 (2)	265 (44)	286 (4)						
2009	33	150 (1)	215 (22)	240 (10)							
2008	156	155 (70)	212 (78)	259 (6)	257 (2)						
2007	142	160 (72)	229 (30)	224 (4)	286 (35)	320 (1)					

Species: Walleye

		Mean Length (expanded sample number) at capture by age									
Year	N	1	2	3	4	5	6	7	8	9	10+
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)					
2009	97	240 (45)	324 (49)		506 (1)		548 (2)				
2008	35	208 (21)		436 (9)		481 (5)					
2007	43		360 (32)	375 (3)	457 (8)						

Species: Yellow Perch

		Mean Length (expanded sample number) at capture by age									
Year	N	1	2	3	4	5	6	7	8	9	10+
2015	33	166 (6)	240 (27)								
2014	121	173 (119)	251 (1)		318 (1)						

		Mean Length (expanded sample number) at capture by age									
Year	N	1	2	3	4	5	6	7	8	9	10+
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)						
2009	110	162 (8)	228 (98)	260 (4)							
2008	608	155 (450)	229 (103)	247 (50)	223 (6)						
2007	403	163 (113)	182 (268)	244 (16)			253 (6)				

Fish Condition

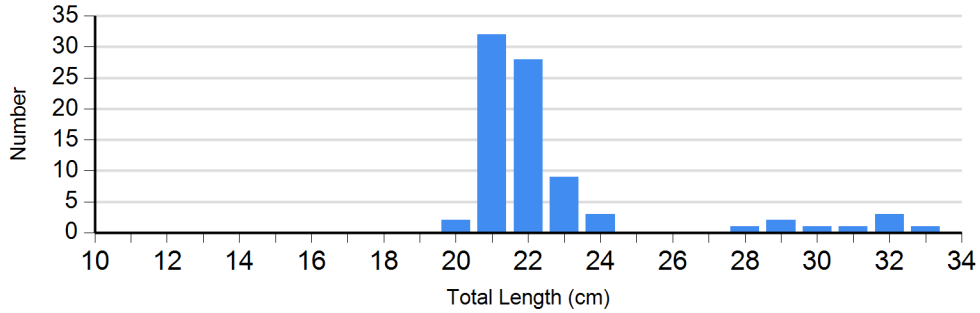
Mean relative weight (Wr) by sample size (N), length category stock to quality (S-Q), quality to preferred (Q-P), preferred to memorable (P-M), and memorable (M) for species collected across survey years with standard error (SE).

		Length Groups							
		S-Q		Q-P		P-M		M	
Species	Year	N	Wr (SE)	N	Wr (SE)	N	Wr (SE)	N	Wr (SE)
Black Crappie Frame Net	2012	0		74	95 (0.8)	3	88 (1.9)	6	85 (2.5)
	2013	0		0		1	105	0	
	2014	18	110 (2.1)	0		3	90 (3.2)	0	
	2015	0		15	109 (1.7)	1	93	1	89
	2016	0		5	119 (11.2)	29	105 (1.1)	2	87 (4.3)
Northern Pike Gill Net	2012	2	77 (5.2)	0		0		0	
	2014	0		1	100	0		0	
	2016	0		0		1	86	0	
Walleye Gill Net	2012	67	77 (0.7)	2	72 (3.5)	2	74 (7.9)	0	
	2013	25	97 (1.3)	23	102 (1.1)	0		0	
	2014	4	83 (2.1)	27	84 (1.1)	4	95 (3.2)	0	
	2015	29	86 (0.8)	0		0		0	
	2016	88	86 (0.6)	1	85	0		0	
Yellow Perch Gill Net	2012	51	91 (2.4)	293	93 (0.8)	42	86 (1.8)	4	67
	2013	25	111 (1.4)	4	121 (7.9)	1	113	0	
	2014	117	106 (1.0)	2	104 (3.5)	1	102	1	90
	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	

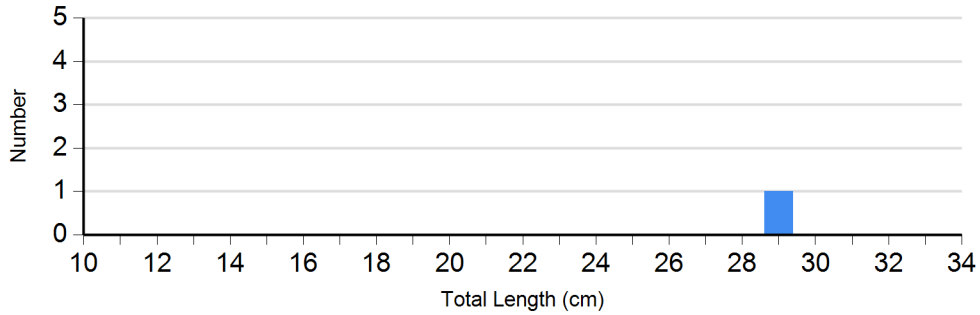
Length Frequency Distribution

Length frequency histogram of species sampled by year.

Species: Black Crappie
Gear: large frame net

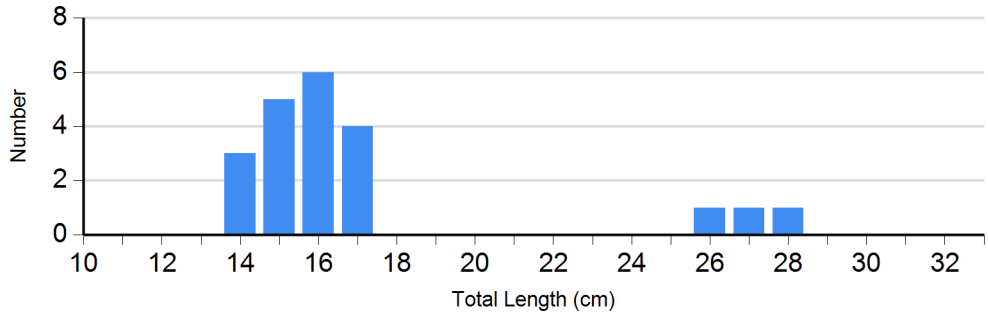


2012



2013

Species: Black Crappie
Gear: std frame net (3/8 inch)



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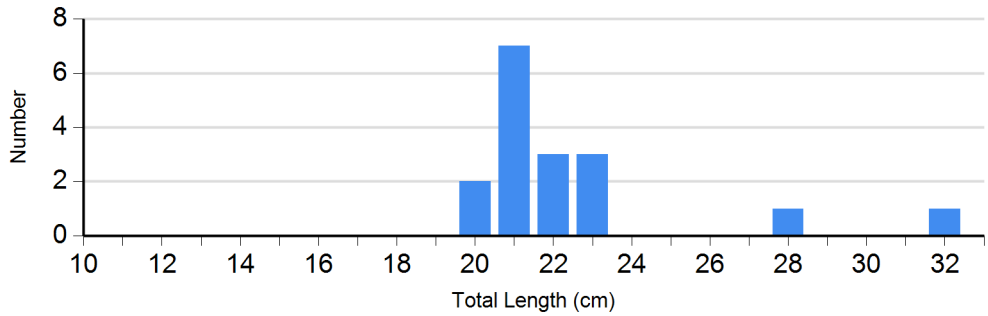
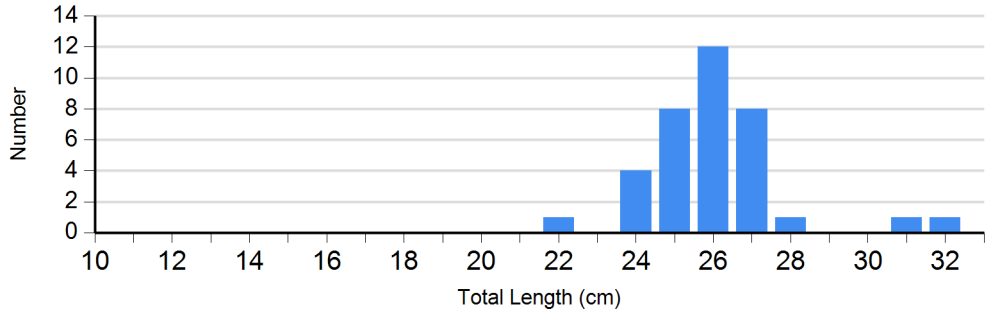


2015



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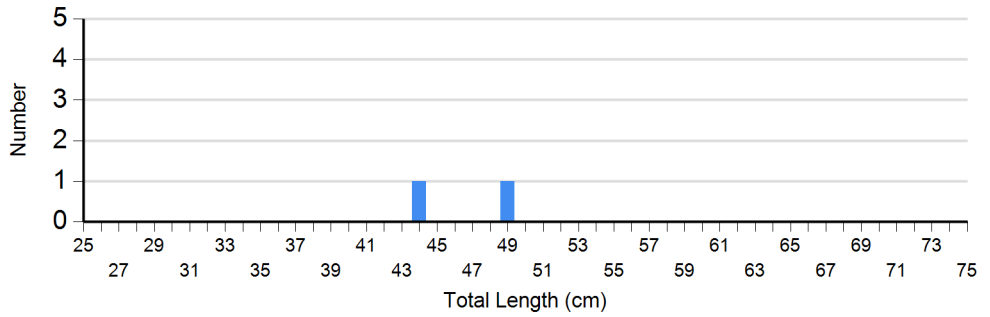
Species: Northern Pike
Gear: std exp gill net



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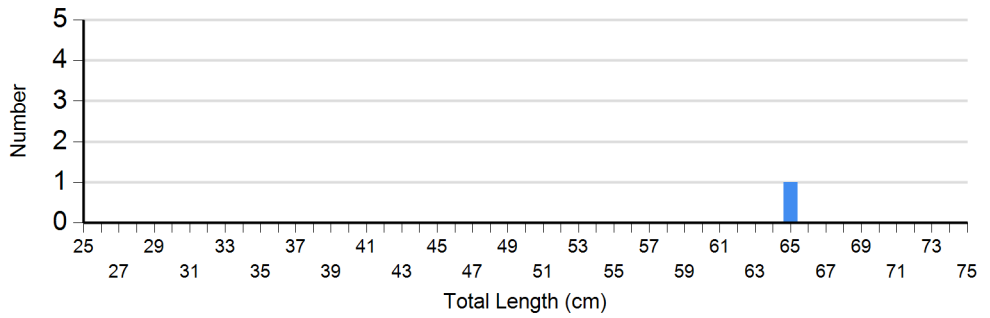

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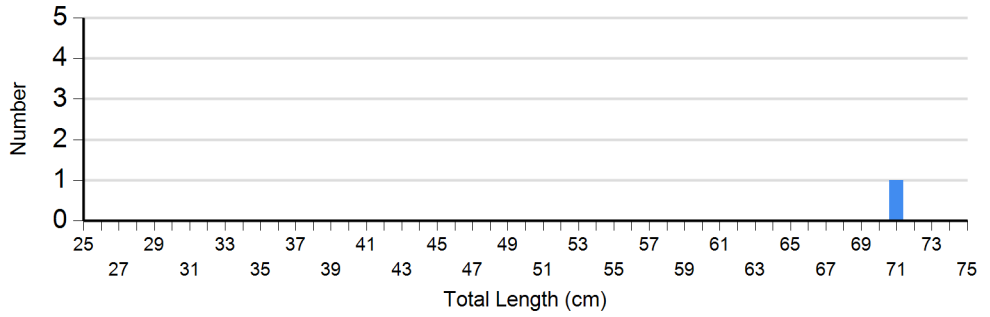

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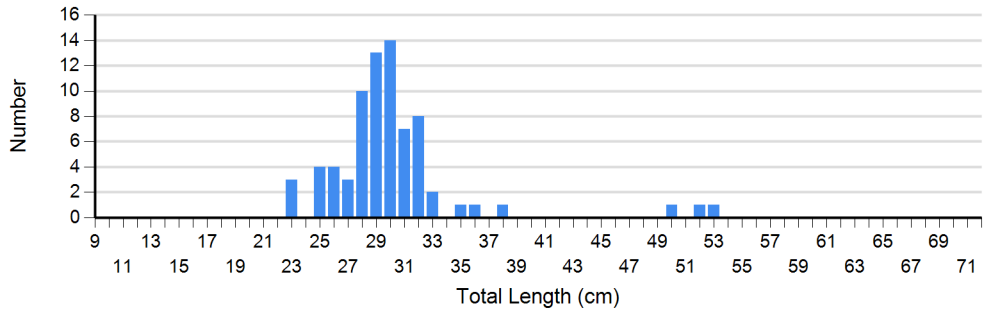
Species: Walleye
Gear: std exp gill net



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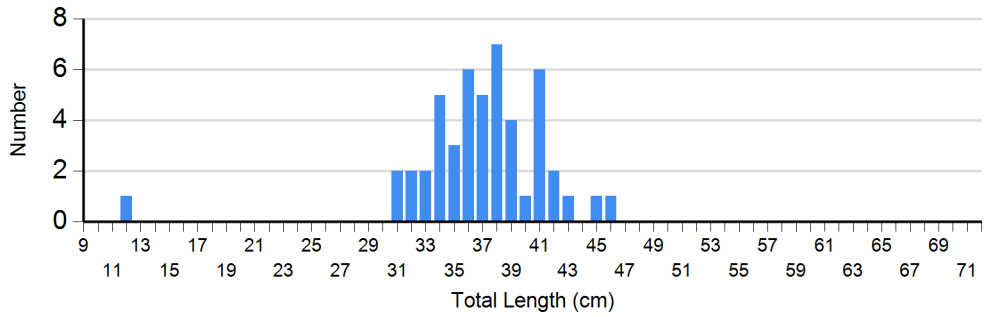
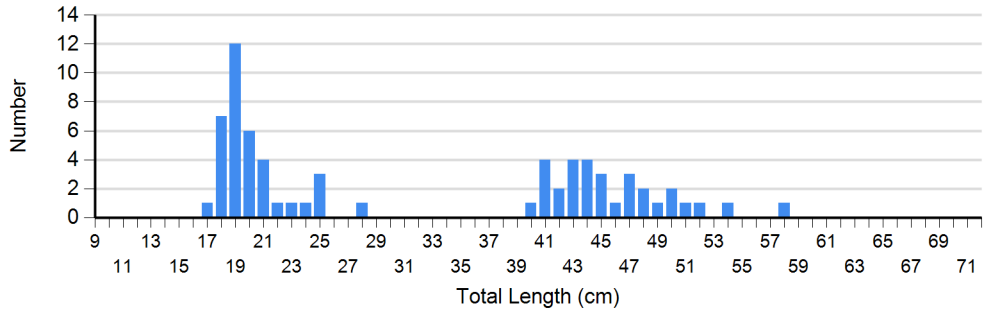
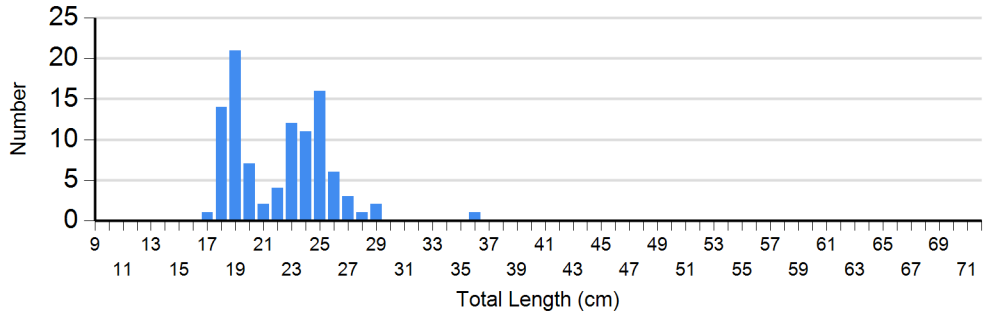


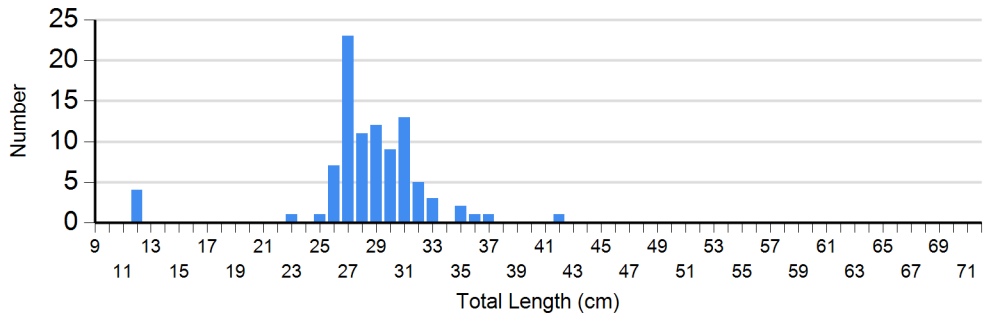
2013



2014

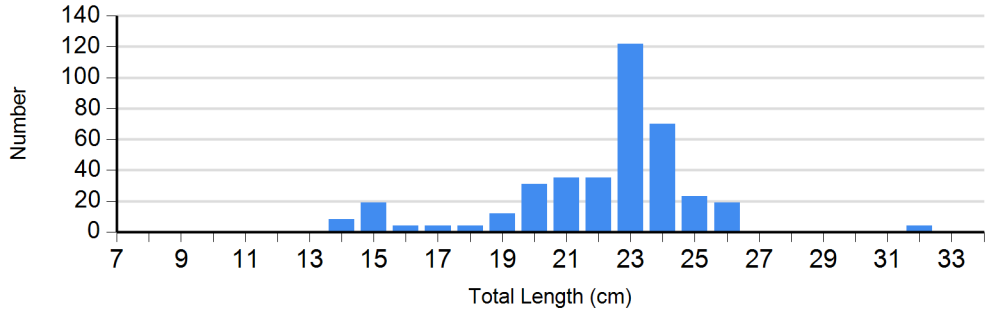


2015

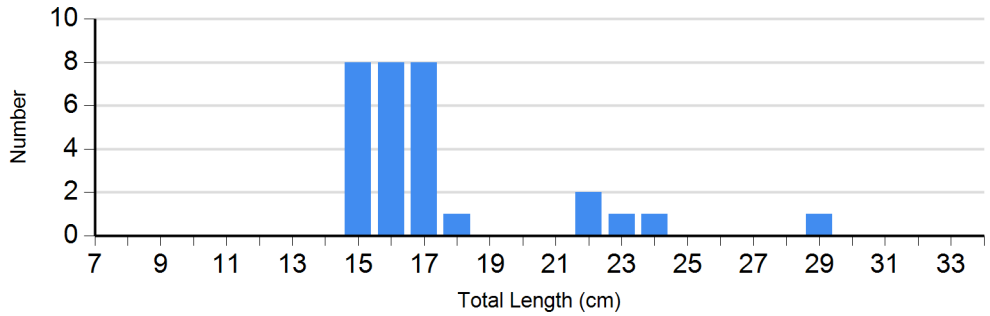


2016

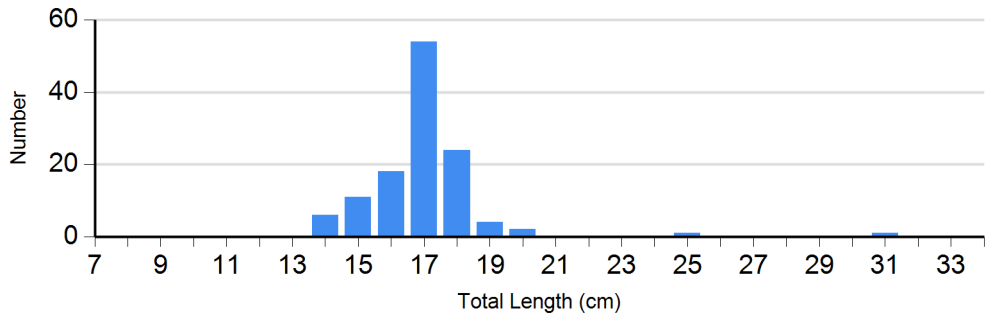
Species: Yellow Perch
Gear: std exp gill net



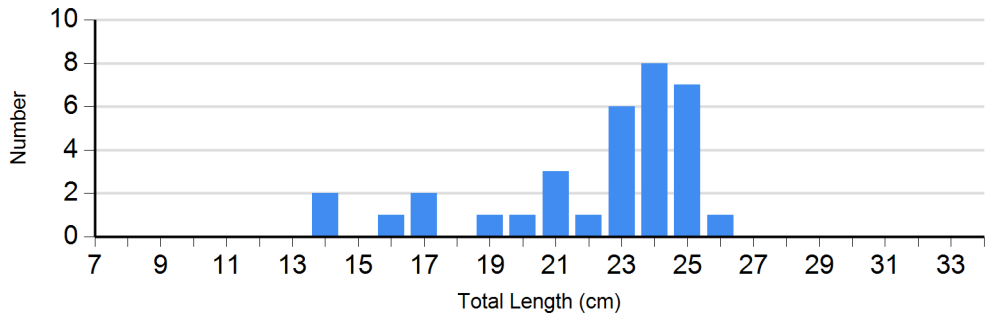
2012



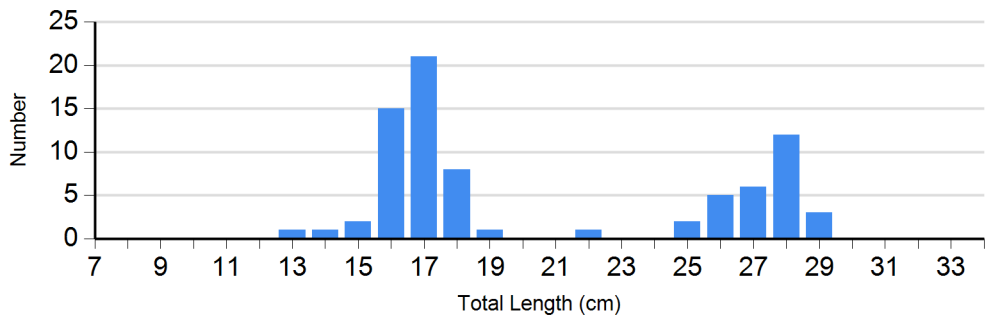
2013



2014



2015

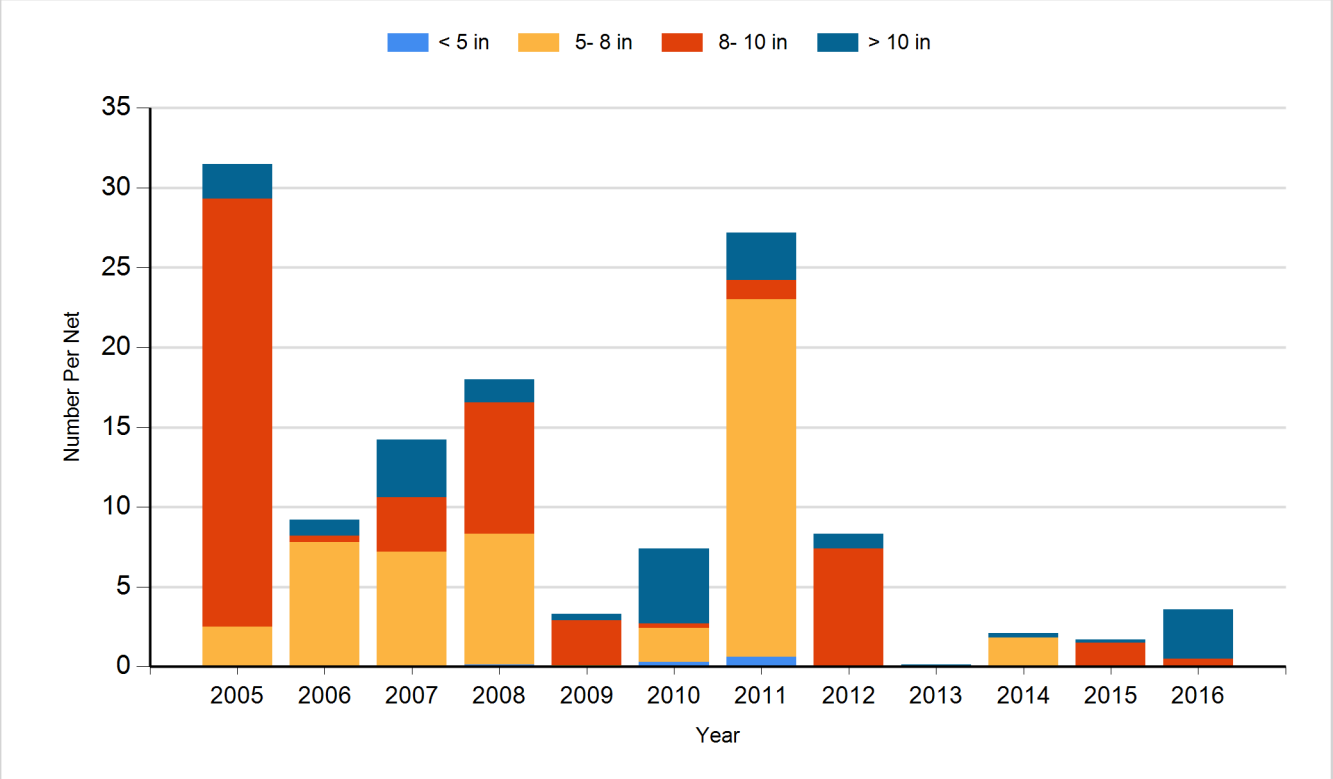


2016

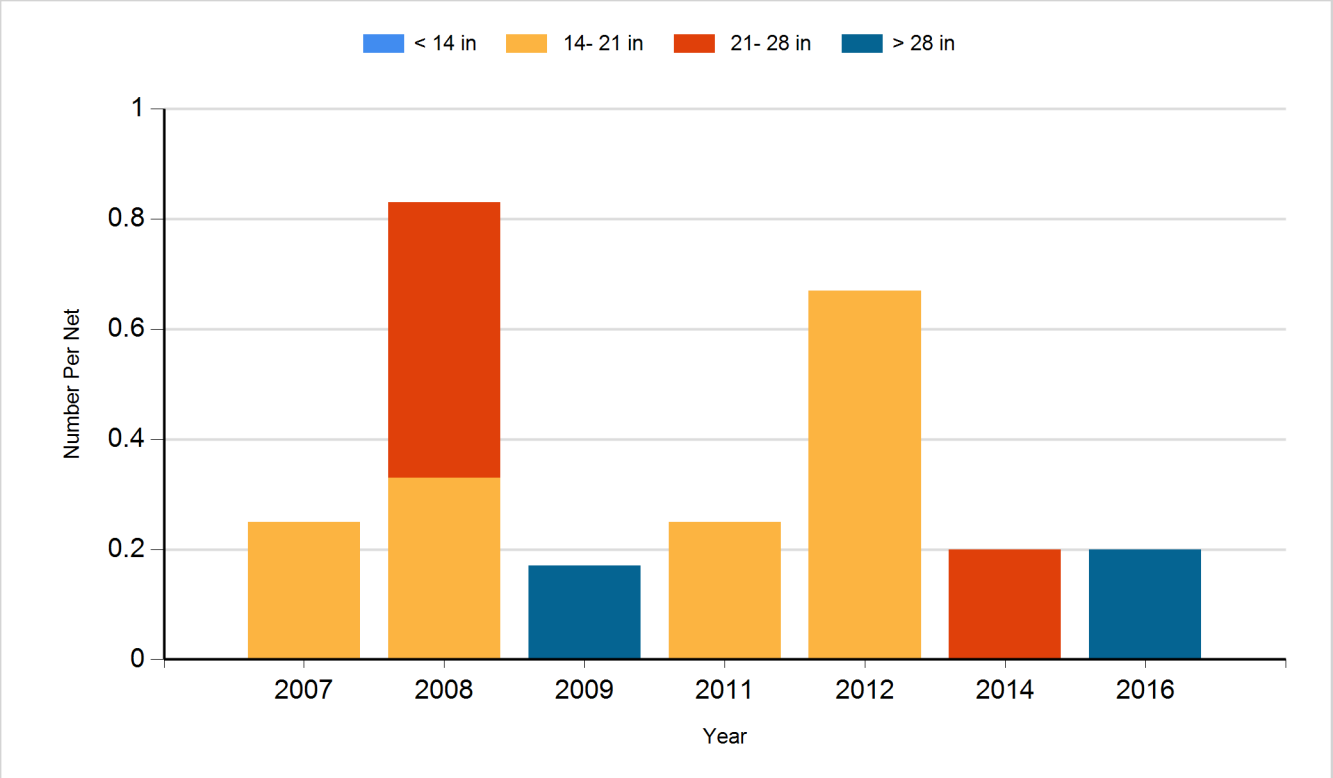
Historic Fish Sizes and Relative Abundance

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

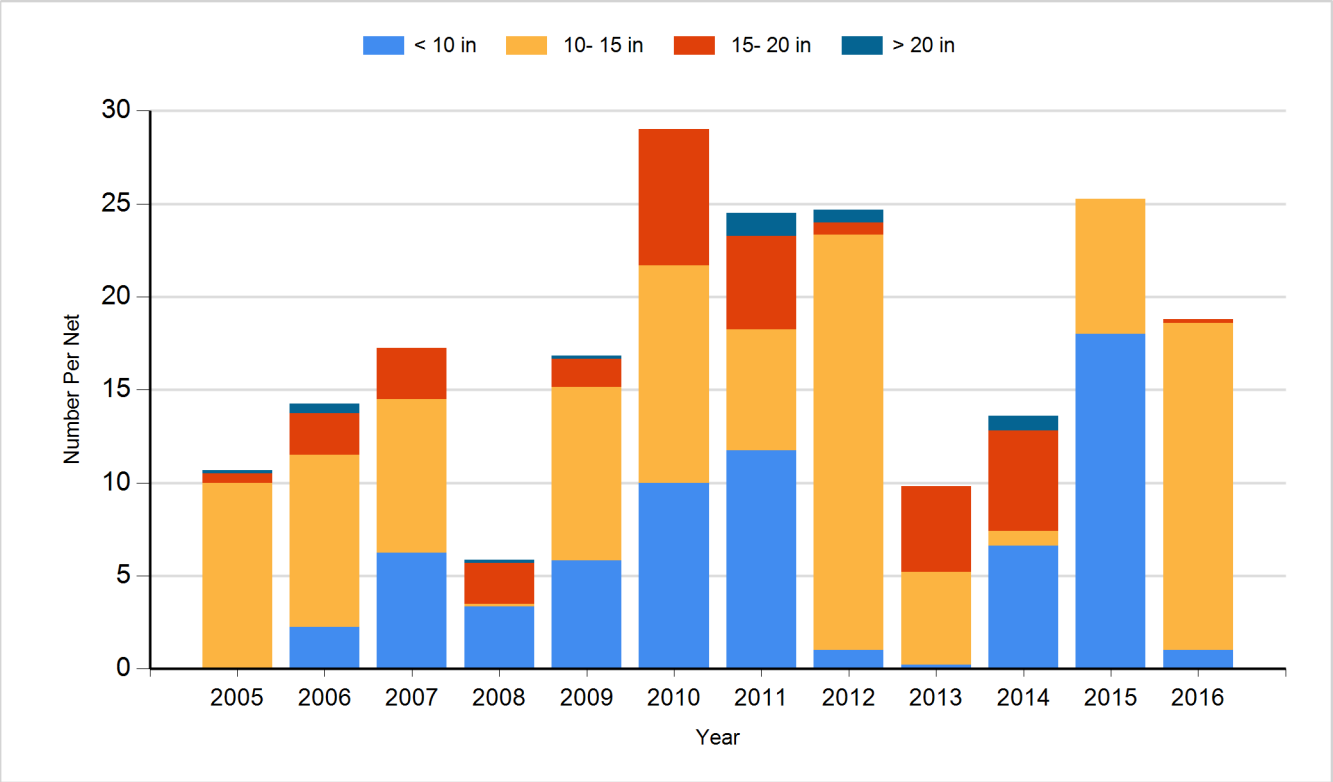
Species: Black Crappie
Gear: Frame Net



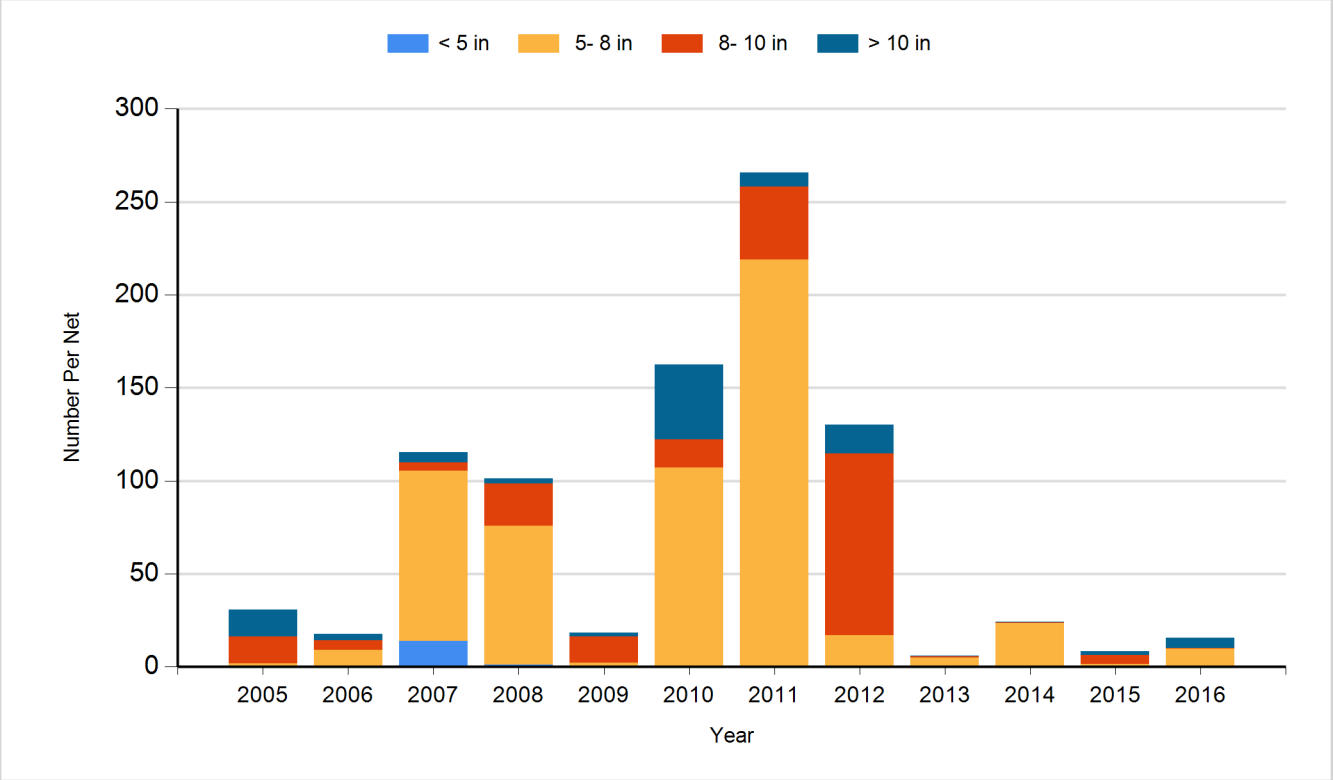
Species: Northern Pike
Gear: Gill Net



Species: Walleye
Gear: Gill Net



Species: Yellow Perch
Gear: Gill Net



Fish Stocking

Number of fish stocked by year, species, and size.

Year	Species	Size	Number
2005	Walleye	Fingerling	264,200
2007	Walleye	Small Fingerling	264,440
2007	Yellow Perch	Fingerling	187,000
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