Bitter Lake Survey Summary

Bitter Lake, located on the southern edge of the town of Waubay, is managed as a walleye and yellow perch fishery but other fish species (e.g., northern pike, white bass) also contribute to the fishery.

- **Walleye.** At 14.8 per gill net, the relative abundance of walleyes >10.0 inches remained high. A wide length range of walleyes (4.3 to 29.1 inches) was sampled, of those that were at least 10.0 inches 37% were > 15.0 inches and 14% were >20.0 inches. Individuals from 14 consecutive year-classes (2009 – 2022) contributed to the catch, those from the 2021 year class (age-2), coinciding with a fry stocking, were the most abundant accounting for more than half (58%) of the fish in the sample. The 2023 sample suggests good walleye growth with mean lengths at capture for age-4 of 17.7 inches.

- **White bass.** Relative abundance of white bass >6.0 inches was similar in 2023 (5.3 per gill net) to 2022 (5.1 per gill net). In 2023, 90 white bass from 5.1 to 18.9 inches were netted. Of those that were at least 6.0 inches, 94% were >12.0 inches.

- **Yellow perch.** Yellow perch numbers declined for the second straight year. At 4.7 per gill net, relative abundance was considered low to moderate for Bitter Lake in 2023. Sampled yellow perch ranged in length from 5.4 to 11.5 inches, 40% were >8.0 inches and 5% were >10.0 inches. Fish from four consecutive year-classes (2019 - 2022) contributed to the catch. Individuals from the 2022 (age-1) cohort were the most abundant accounting for 57% of yellow perch in the sample. Growth tends to be moderate to fast with mean length at capture of age-3 fish from 9.3 to 11.1 inches since 2012. In 2023, the mean length at capture for age-3 yellow perch was 9.4 inches.

For more detailed results see the computer-generated South Dakota Statewide Fisheries Survey for Bitter (Day; below).

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

Bitter, Day County
UBS-Lake-409-000
2023

Lake Information

Name: Bitter

Maximum Depth: 32 Feet

County: Day

Surface Area: 17,194 Acres

Surveys and Investigations

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

Gear	Date	Effort
AFS std gill net	Aug 29, 2023	8 net-nights
AFS std gill net	Aug 30, 2023	8 net-nights
fall night EF-WAE	Sep 19, 2023	3600 seconds

Common Fish Species Present

Walleye

Northern Pike

Yellow Perch

White Bass

Common Carp

Rock 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.

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

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	Common Carp	8	0.5	0.3	100		100		109	7
	Northern Pike	20	1.3	0.4	100		40	18	79	2
	Rock Bass	5	0.3	0.2	80		40		115	5
	Walleye	265	14.8	1.8	38	4	14	3	87	1
	White Bass	90	5.3	1.3	100		98		103	3
	Yellow Perch	75	4.7	1.2	40	8	9	5	116	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.

*** Methods/Species that ignore stock length**

		CPUE										
Gear	Species	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Avg
AFS std gill net	Black Bullhead								0.1	0.6	0.0	0.23
	Black Crappie								0.3	0.1	0.0	0.13
	Common Carp								1.3	1.6	0.5	1.13
	Northern Pike								0.4	1.4	1.3	1.03
	Rock Bass								1.9	0.4	0.3	0.87
	Walleye								10.3	7.8	14.8	10.97
	White Bass								6.6	5.1	5.3	5.67
	White Sucker								0.0	0.1	0.0	0.03
	Yellow Perch								16.1	8.6	4.7	9.80
fall night EF-WAE*	Walleye								410.0	70.0	105.0	195.00

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	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
AFS std gill net	Northern Pike	PSD								100	100	100
		PSD-P								29	17	40
		Wr								91	80	79
	Walleye	PSD								89	74	38
		PSD-P								13	19	14
		Wr								96	88	87
	White Bass	PSD								84	100	100
		PSD-P								73	88	98
		Wr								113	105	103
	Yellow Perch	PSD								47	27	40
		PSD-P								33	11	9
		Wr								114	117	116

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+
2023	265	209 (22)	285 (154)	396 (8)	450 (13)	472 (20)	482 (12)	523 (10)	503 (1)	586 (3)	619 (20)
2022	234	233 (133)	348 (9)	420 (11)	460 (18)	467 (36)	498 (10)		570 (5)		589 (12)
2021	165	315 (14)	398 (27)	443 (53)	455 (45)	527 (5)	475 (2)	525 (7)	563 (1)	596 (1)	615 (9)

Species: Yellow Perch

		Mean Length (expanded sample number) at capture by age									
Year	N	1	2	3	4	5	6	7	8	9	10+
2023	75	163 (43)	233 (25)	240 (6)	293 (1)						
2022	137	169 (94)	226 (36)	296 (1)	303 (6)						
2021	257	177 (153)	253 (49)	281 (50)	304 (4)	304 (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).

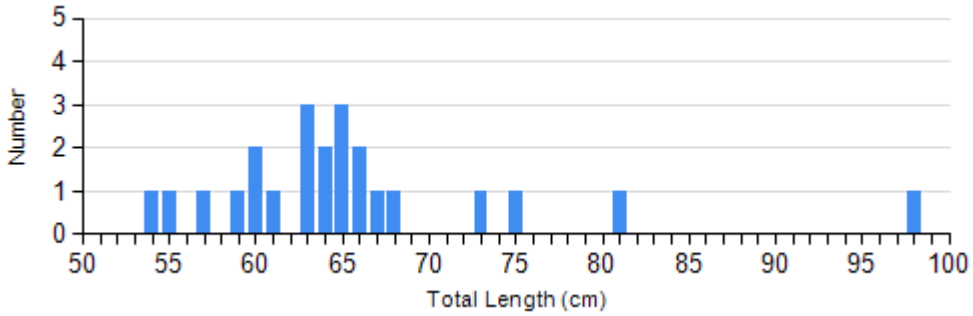
		Length Groups							
		S-Q		Q-P		P-M		M	
Species	Year	N	Wr (SE)	N	Wr (SE)	N	Wr (SE)	N	Wr (SE)
Northern Pike Gill Net	2021	0		5	92 (1.3)	2	87 (1.6)	0	
	2022	0		19	80 (1.5)	3	81 (0.4)	1	
	2023	0		12	80 (1.7)	8	78 (1.3)	0	
Walleye Gill Net	2021	18	89 (1.4)	125	97 (0.6)	18	97 (1.7)	4	92 (2.5)
	2022	32	88 (1.5)	69	87 (0.7)	18	90 (1.5)	6	96 (2.0)
	2023	148	89 (0.4)	55	84 (0.7)	21	83 (1.7)	13	87 (2.1)
White Bass Gill Net	2021	17	118 (1.4)	12	109 (1.5)	24	113 (2.2)	53	113 (1.1)
	2022	0		10	108 (2.1)	19	105 (1.6)	52	105 (1.4)
	2023	0		2	185 (77.8)	30	104 (0.8)	53	99 (1.1)
Yellow Perch Gill Net	2021	137	116 (0.8)	34	116 (1.8)	80	111 (0.7)	6	107 (2.8)
	2022	100	118 (1.0)	22	119 (2.2)	11	103 (2.8)	4	108 (4.6)
	2023	45	116 (1.4)	23	117 (1.4)	7	110 (2.1)	0	

Length Frequency Distribution

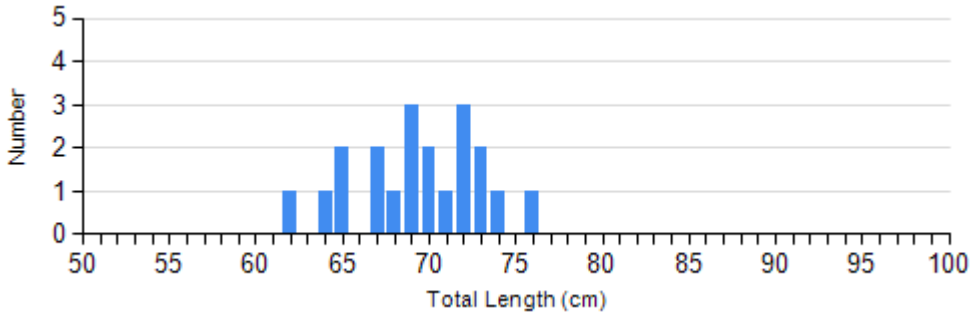
Length frequency histogram of species sampled by year.

Species: Northern Pike
Gear: AFS std gill net

2022

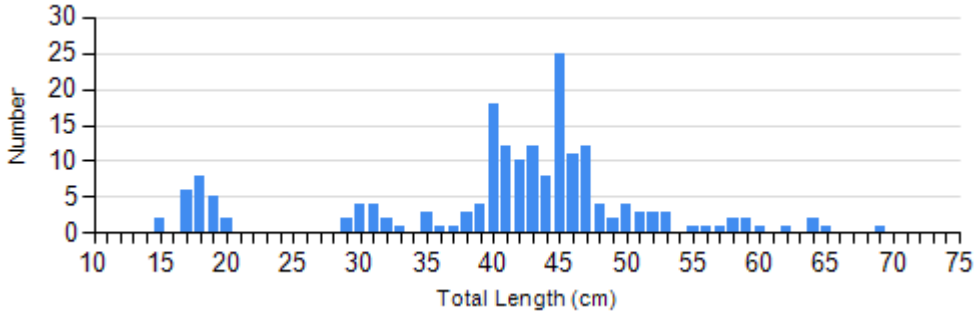


2023

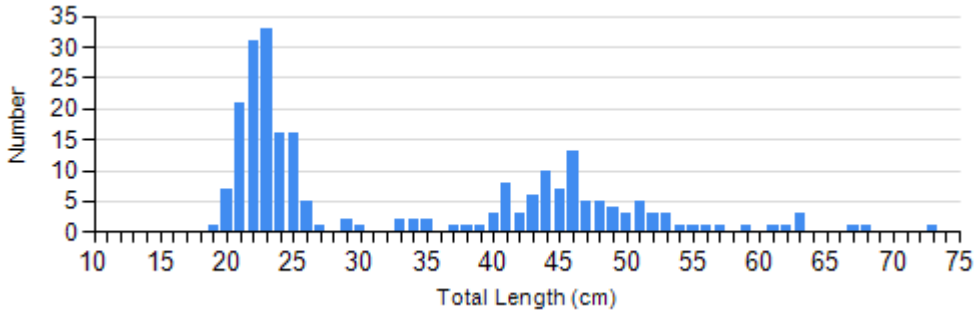


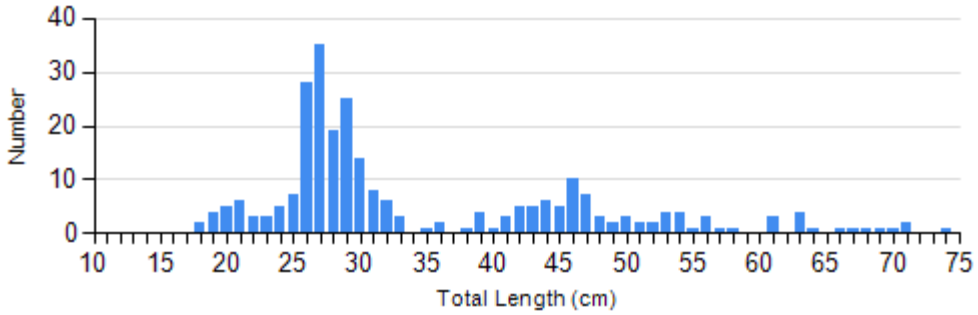
Species: Walleye
Gear: AFS std gill net

2021



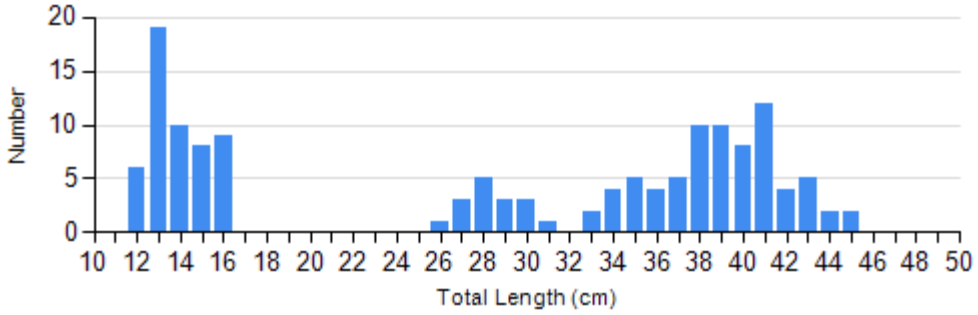
2022



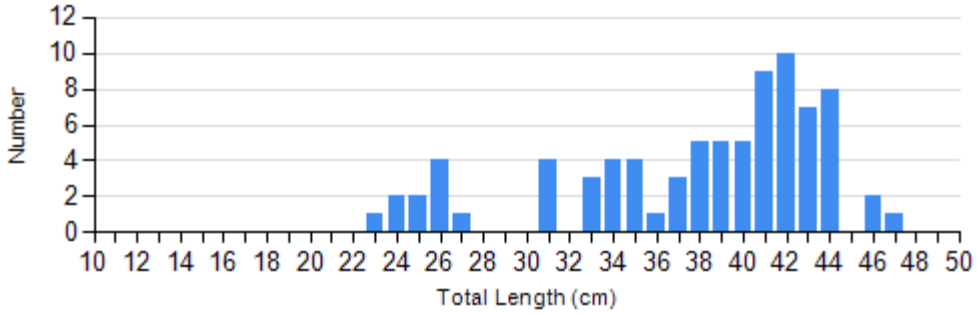


2023

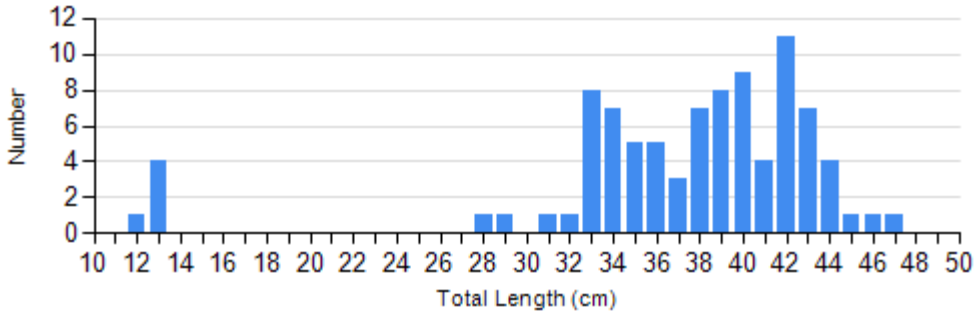
Species: White Bass
Gear: AFS std gill net



2021

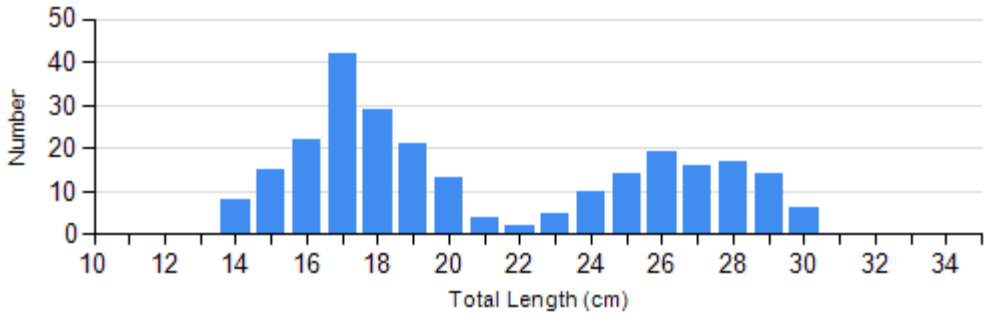


2022

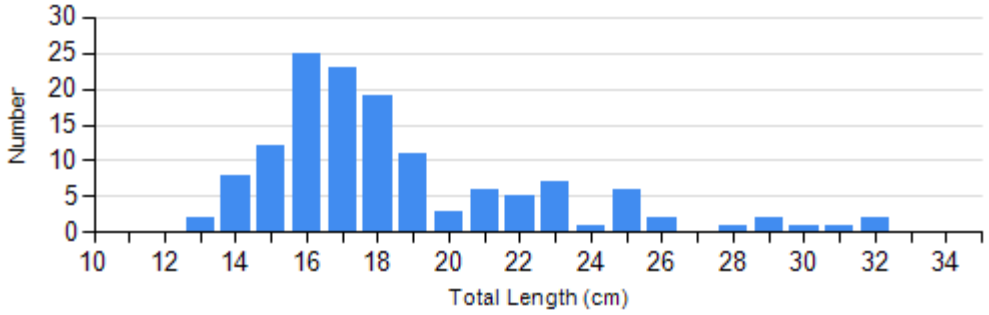


2023

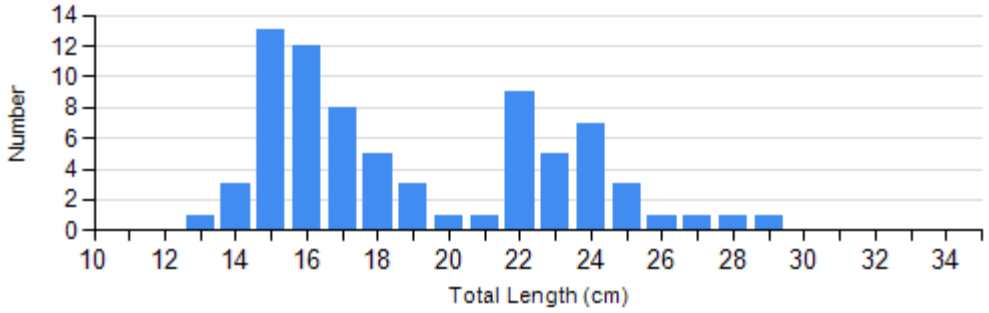
Species: Yellow Perch
Gear: AFS std gill net



2021



2022

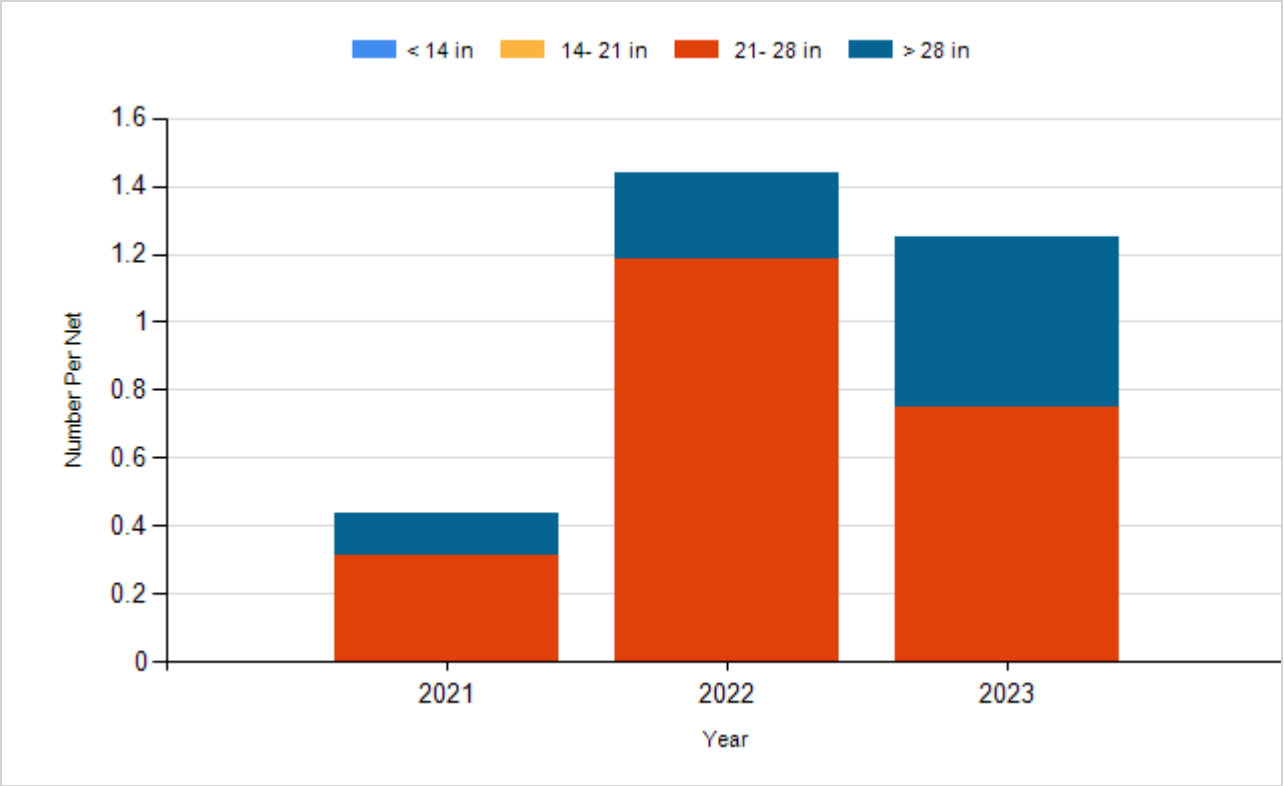


2023

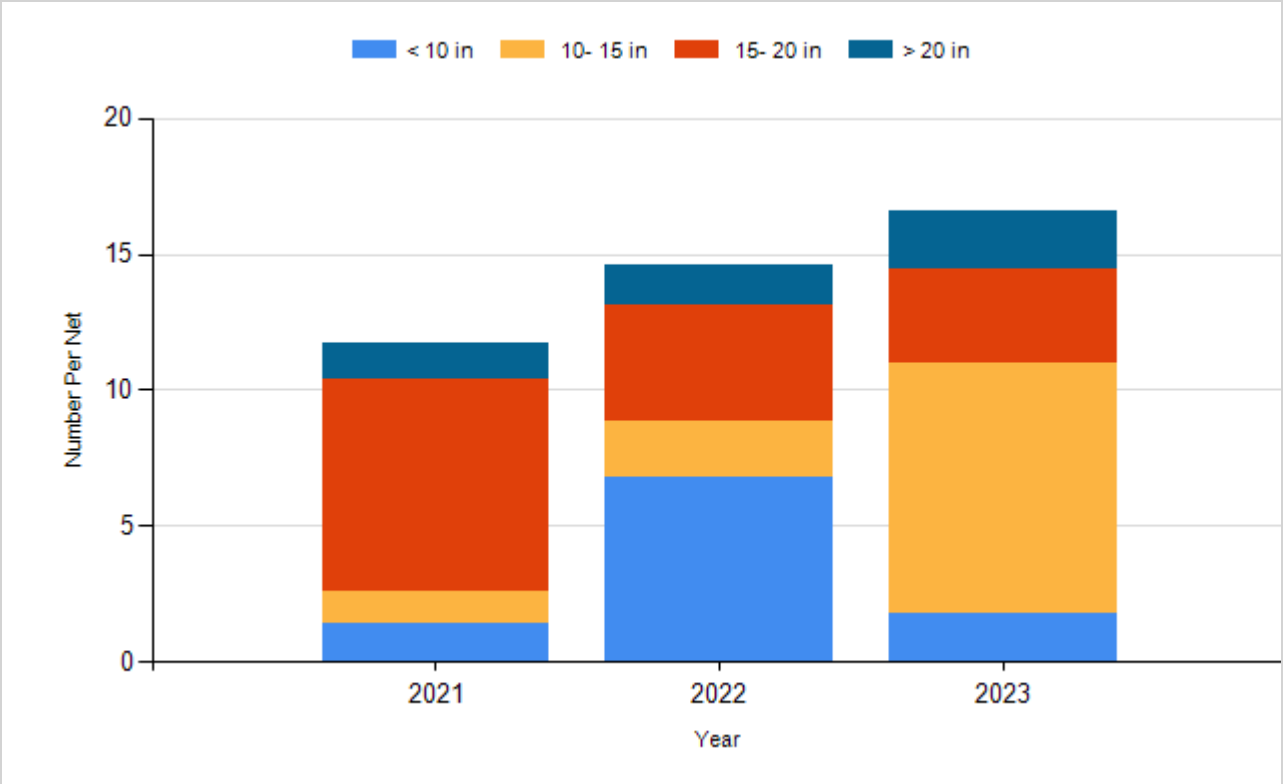
Historic Fish Sizes and Relative Abundance

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

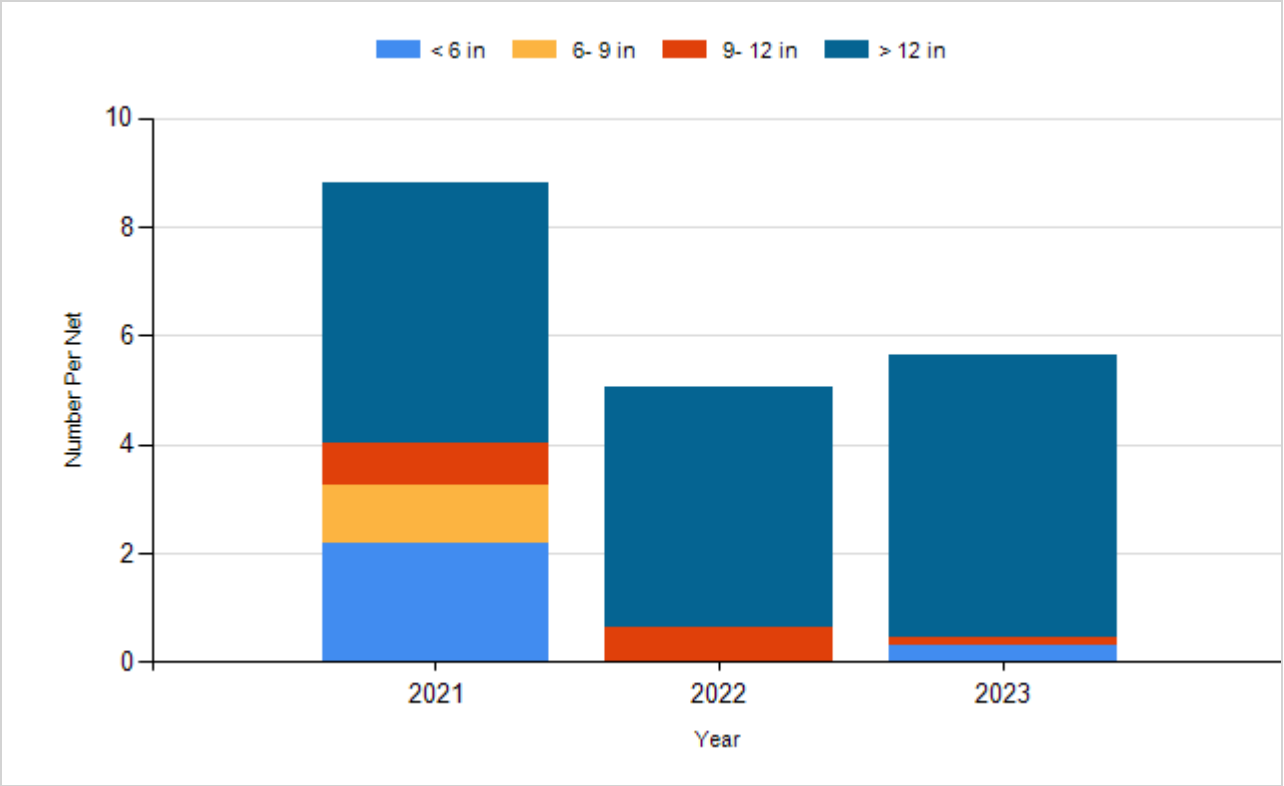
Species: Northern Pike
Gear: AFS std gill net



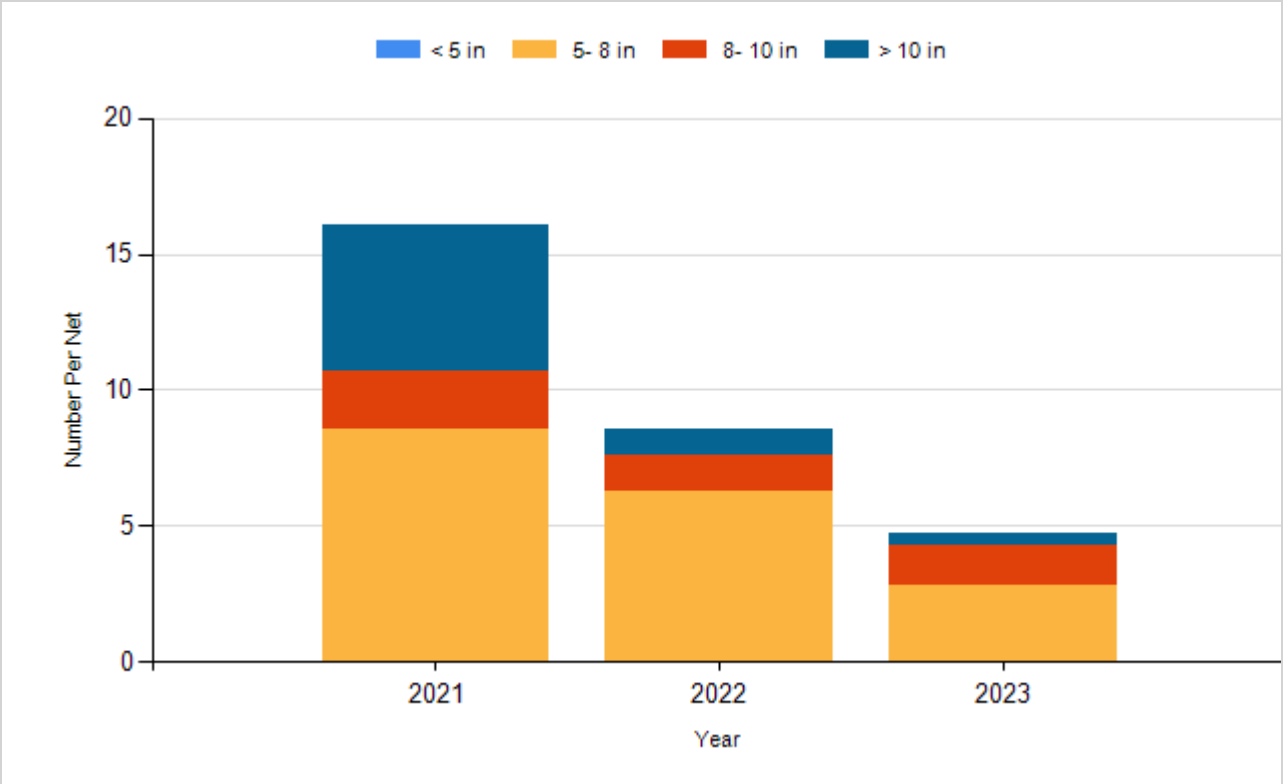
Species: Walleye
Gear: AFS std gill net



Species: White Bass
Gear: AFS std gill net



Species: Yellow Perch
Gear: AFS std gill net



Fish Stocking

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

Year	Species	Size	Number
2013	Walleye	Fry	7,500,000
2015	Walleye	Fry	4,000,000
2016	Walleye	Fry	6,500,000
2016	Gizzard Shad	Adult	600
2021	Walleye	Fry	8,000,000

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY
Bitter, Day County
UBS-Lake-409-000
2023

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County: Day

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

Gear	Date	Effort
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Yellow Perch

White Bass

Common Carp

Rock Bass

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- 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.

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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	Common Carp	8	0.5	0.3	100		100		109	7
	Northern Pike	20	1.3	0.4	100		40	18	79	2
	Rock Bass	5	0.3	0.2	80		40		115	5
	Walleye	265	14.8	1.8	38	4	14	3	87	1
	White Bass	90	5.3	1.3	100		98		103	3
	Yellow Perch	75	4.7	1.2	40	8	9	5	116	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.

*** Methods/Species that ignore stock length**

		CPUE										
Gear	Species	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Avg
AFS std gill net	Black Bullhead								0.1	0.6	0.0	0.23
	Black Crappie								0.3	0.1	0.0	0.13
	Common Carp								1.3	1.6	0.5	1.13
	Northern Pike								0.4	1.4	1.3	1.03
	Rock Bass								1.9	0.4	0.3	0.87
	Walleye								10.3	7.8	14.8	10.97
	White Bass								6.6	5.1	5.3	5.67
	White Sucker								0.0	0.1	0.0	0.03
	Yellow Perch								16.1	8.6	4.7	9.80
fall night EF-WAE*	Walleye								411.0	70.0	105.0	195.33

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	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
AFS std gill net	Common Carp	PSD								100	96	100
		PSD-P								45	76	100
		Wr								112	109	109
	Northern Pike	PSD								100	100	100
		PSD-P								29	17	40
		Wr								91	80	79
	Rock Bass	PSD								74	43	80
		PSD-P								16	14	40
		Wr								117	117	115
	Walleye	PSD								89	74	38
		PSD-P								13	19	14
		Wr								96	88	87
	White Bass	PSD								84	100	100
		PSD-P								73	88	98
		Wr								113	105	103
	Yellow Perch	PSD								47	27	40
		PSD-P								33	11	9
		Wr								114	117	116

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+
2023	265	209 (22)	285 (154)	396 (8)	450 (13)	472 (20)	482 (12)	523 (10)	503 (1)	586 (3)	619 (20)
2022	234	233 (133)	348 (9)	420 (11)	460 (18)	467 (36)	498 (10)		570 (5)		589 (12)
2021	165	315 (14)	398 (27)	443 (53)	455 (45)	527 (5)	475 (2)	525 (7)	563 (1)	596 (1)	615 (9)

Species: Yellow Perch

		Mean Length (expanded sample number) at capture by age									
Year	N	1	2	3	4	5	6	7	8	9	10+
2023	75	163 (43)	233 (25)	240 (6)	293 (1)						
2022	137	169 (94)	226 (36)	296 (1)	303 (6)						
2021	257	177 (153)	253 (49)	281 (50)	304 (4)	304 (1)					

Fish Condition

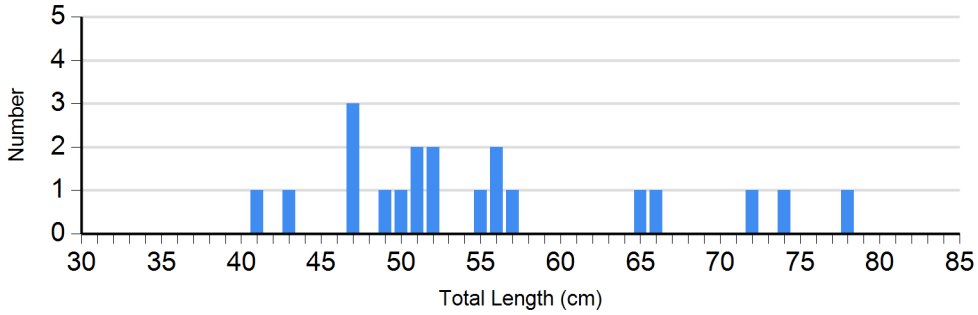
Mean relative weight (Wr) by sample size (N), length category stock to quality (S-Q), quality to preferred (Q-P), preferred to memorable (P-M), and memorable (M) for species collected across survey years with standard error (SE).

		Length Groups							
		S-Q		Q-P		P-M		M	
Species	Year	N	Wr (SE)	N	Wr (SE)	N	Wr (SE)	N	Wr (SE)
Common Carp Gill Net	2021	0		11	114 (2.6)	5	111 (3.2)	4	111 (5.9)
	2022	1	119	5	115 (4.3)	18	107 (1.8)	1	116
	2023	0		0		3	106 (2.1)	5	110 (9.2)
Northern Pike Gill Net	2021	0		5	92 (1.3)	2	87 (1.6)	0	
	2022	0		19	80 (1.5)	3	81 (0.4)	1	
	2023	0		12	80 (1.7)	8	78 (1.3)	0	
Walleye Gill Net	2021	18	89 (1.4)	125	97 (0.6)	18	97 (1.7)	4	92 (2.5)
	2022	32	88 (1.5)	69	87 (0.7)	18	90 (1.5)	6	96 (2.0)
	2023	148	89 (0.4)	55	84 (0.7)	21	83 (1.7)	13	87 (2.1)
White Bass Gill Net	2021	17	118 (1.4)	12	109 (1.5)	24	113 (2.2)	53	113 (1.1)
	2022	0		10	108 (2.1)	19	105 (1.6)	52	105 (1.4)
	2023	0		2	185 (77.8)	30	104 (0.8)	53	99 (1.1)
Yellow Perch Gill Net	2021	137	116 (0.8)	34	116 (1.8)	80	111 (0.7)	6	107 (2.8)
	2022	100	118 (1.0)	22	119 (2.2)	11	103 (2.8)	4	108 (4.6)
	2023	45	116 (1.4)	23	117 (1.4)	7	110 (2.1)	0	

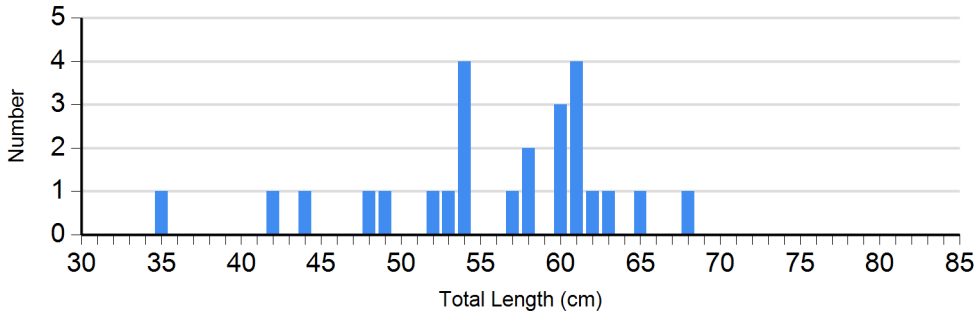
Length Frequency Distribution

Length frequency histogram of species sampled by year.

Species: Common Carp
Gear: AFS std gill net

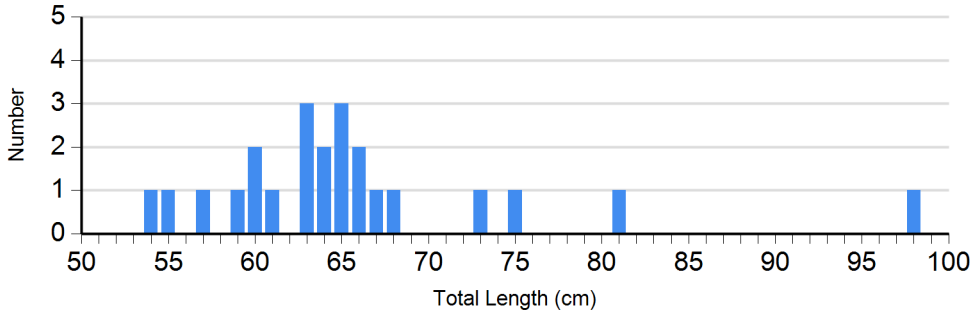


2021

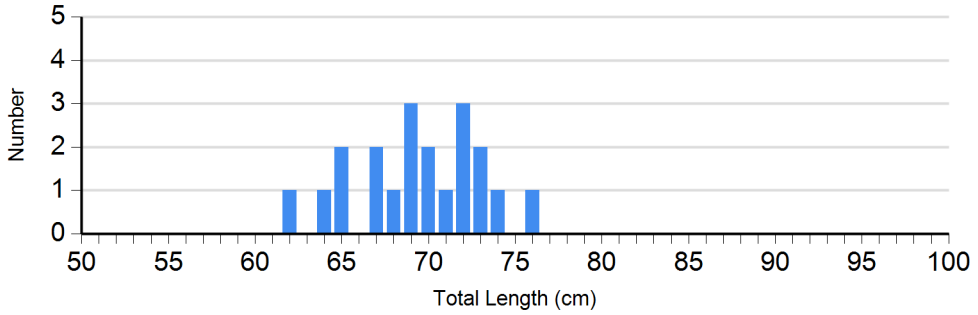


2022

Species: Northern Pike
Gear: AFS std gill net

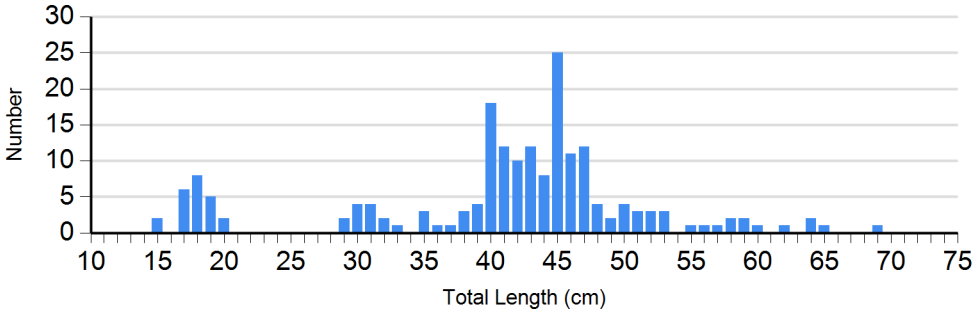


2022

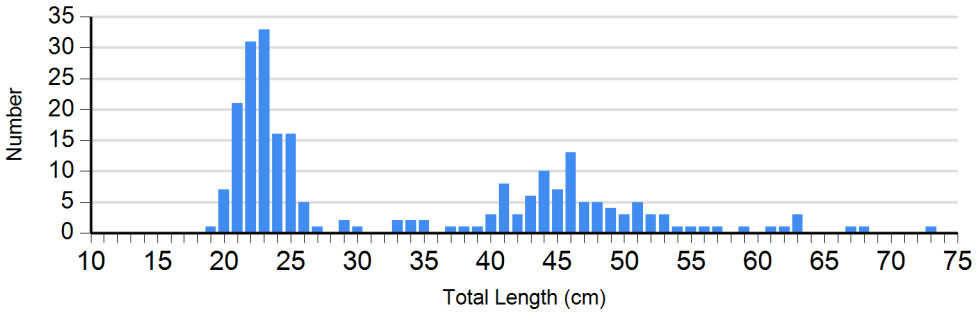


2023

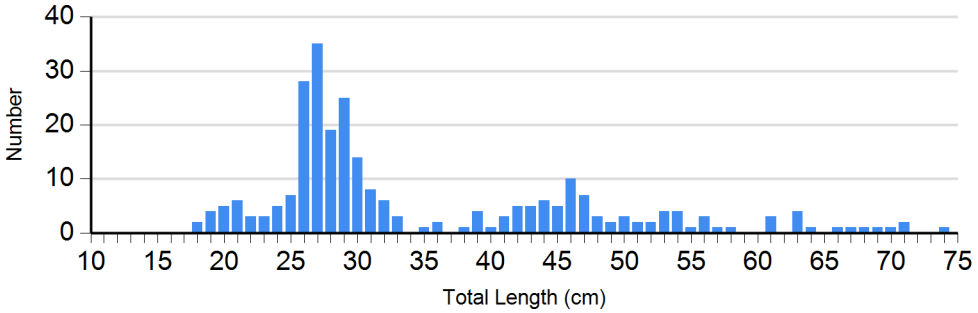
Species: Walleye
Gear: AFS std gill net



2021

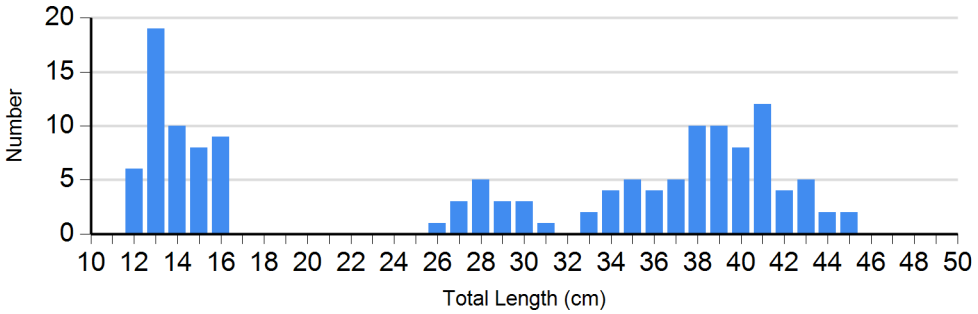


2022

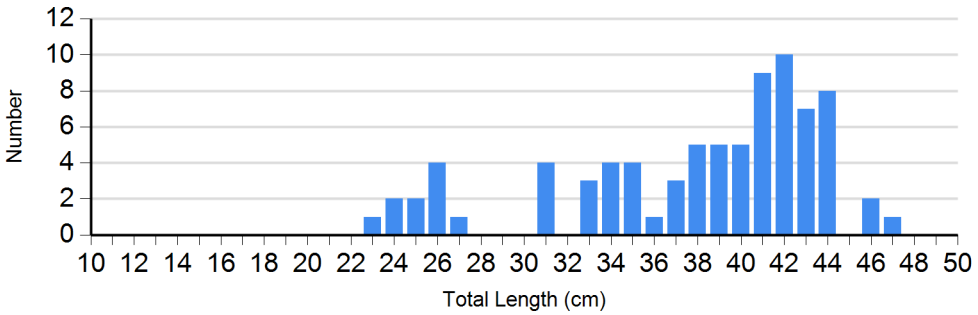


2023

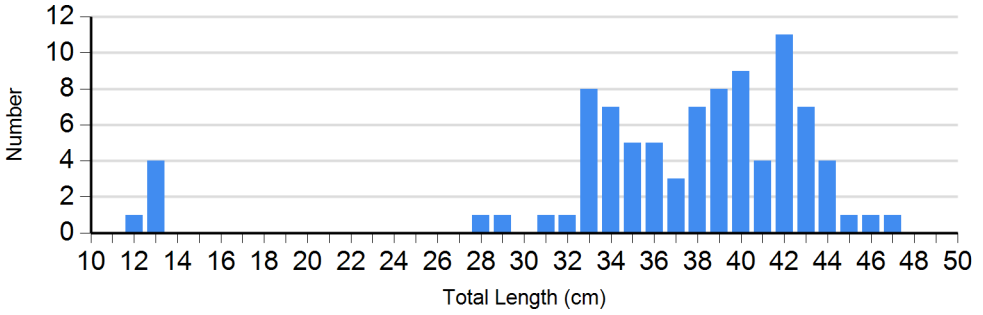
Species: White Bass
Gear: AFS std gill net



2021

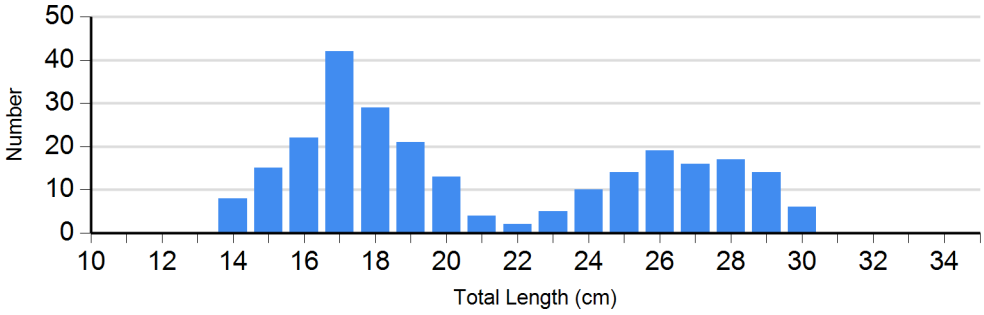


2022

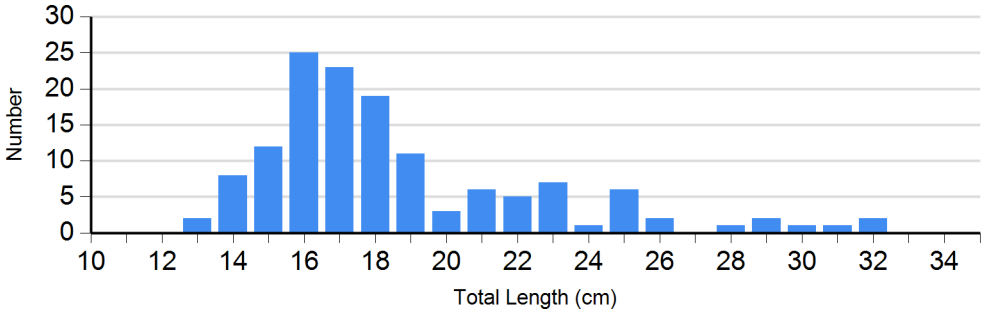


2023

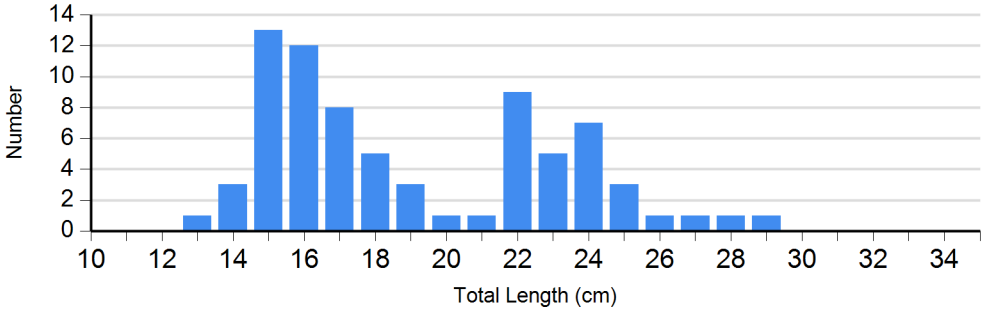
Species: Yellow Perch
Gear: AFS std gill net



2021



2022

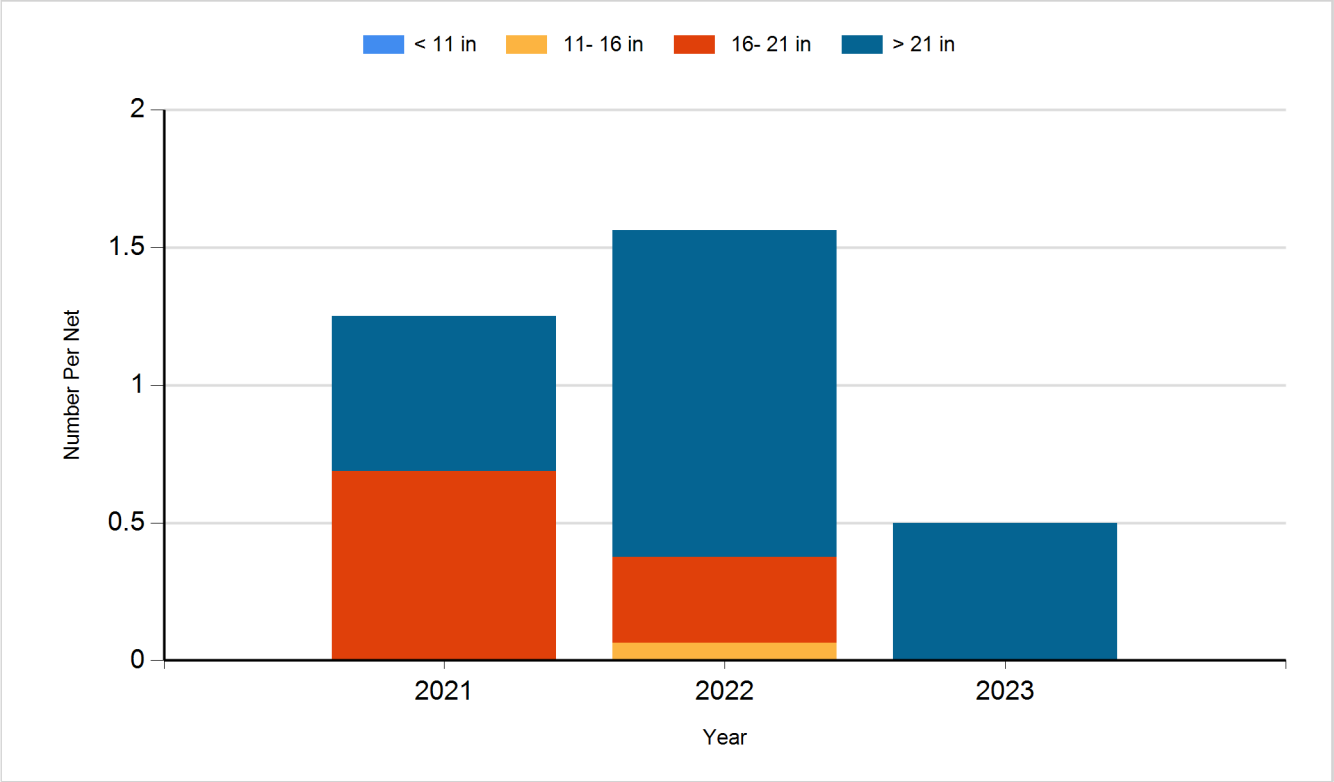


2023

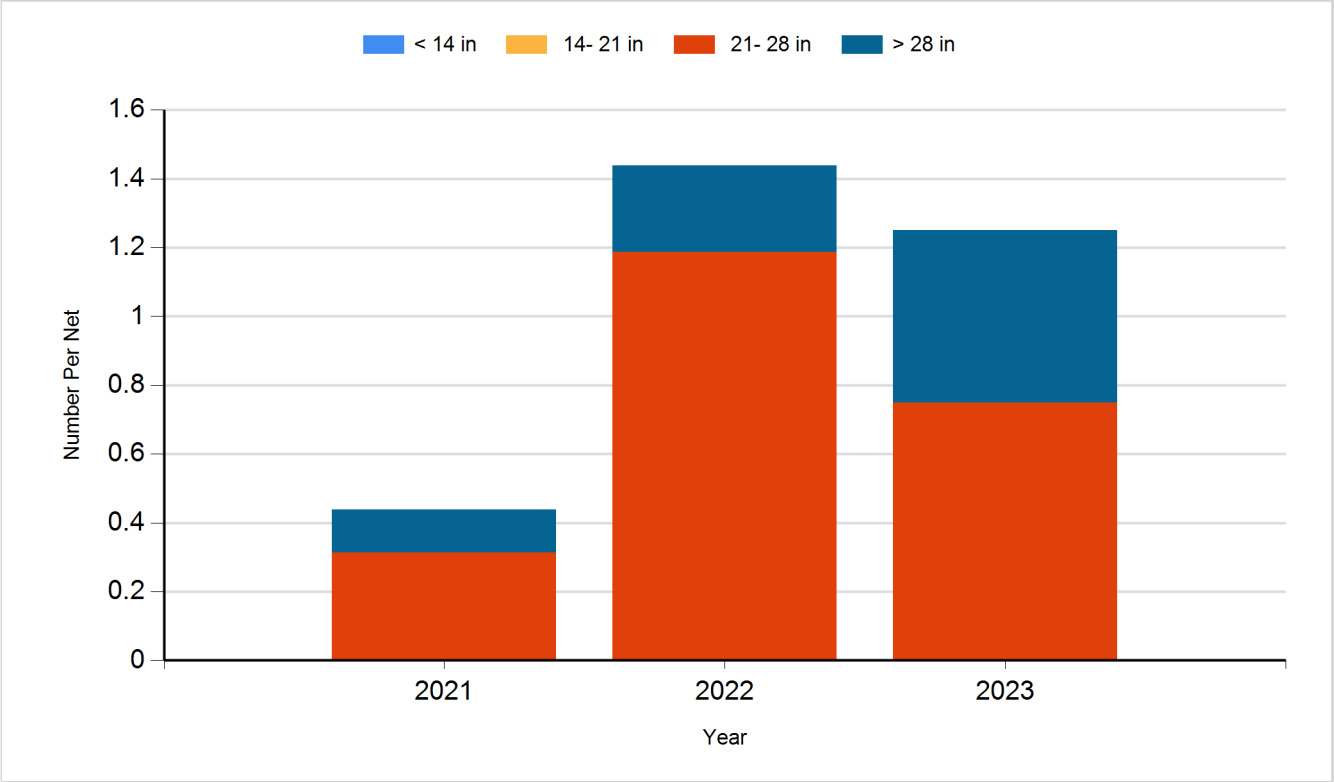
Historic Fish Sizes and Relative Abundance

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

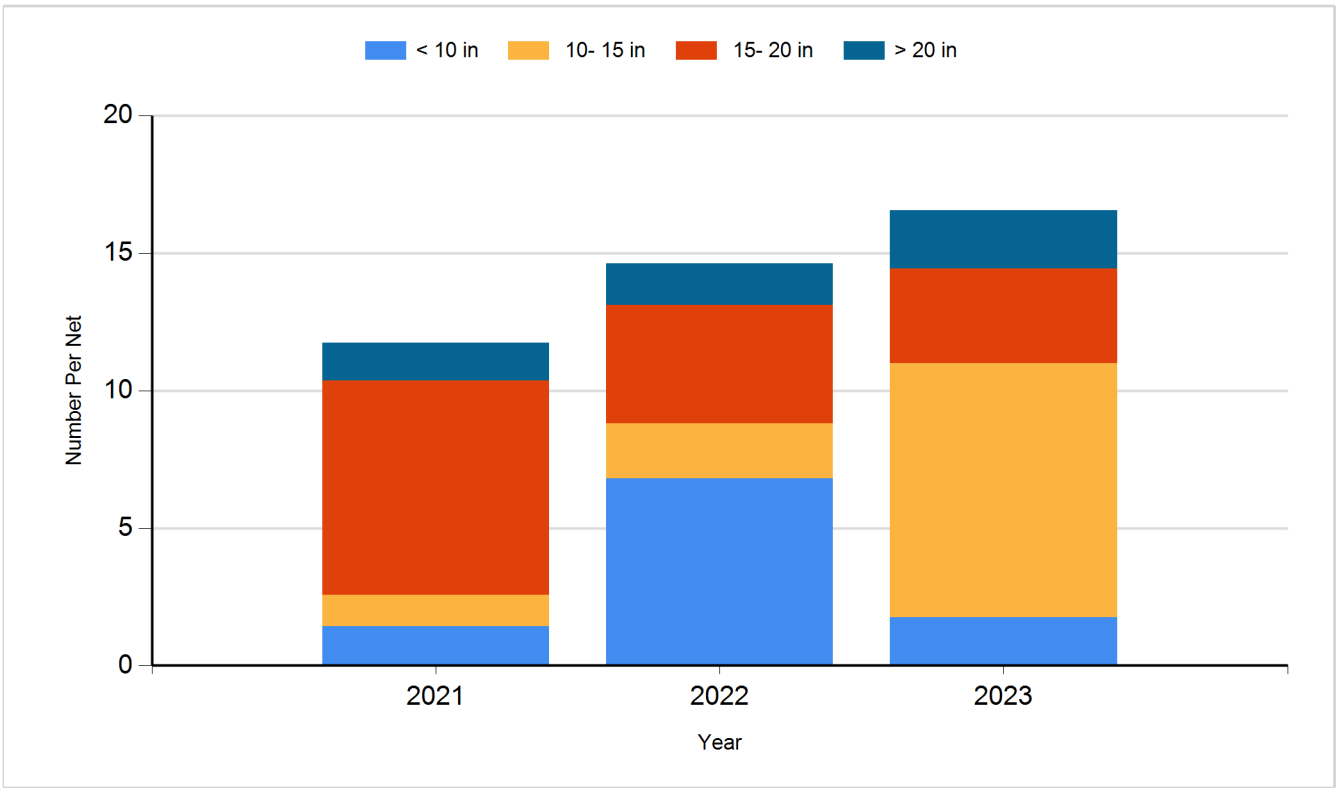
Species: Common Carp
Gear: AFS std gill net



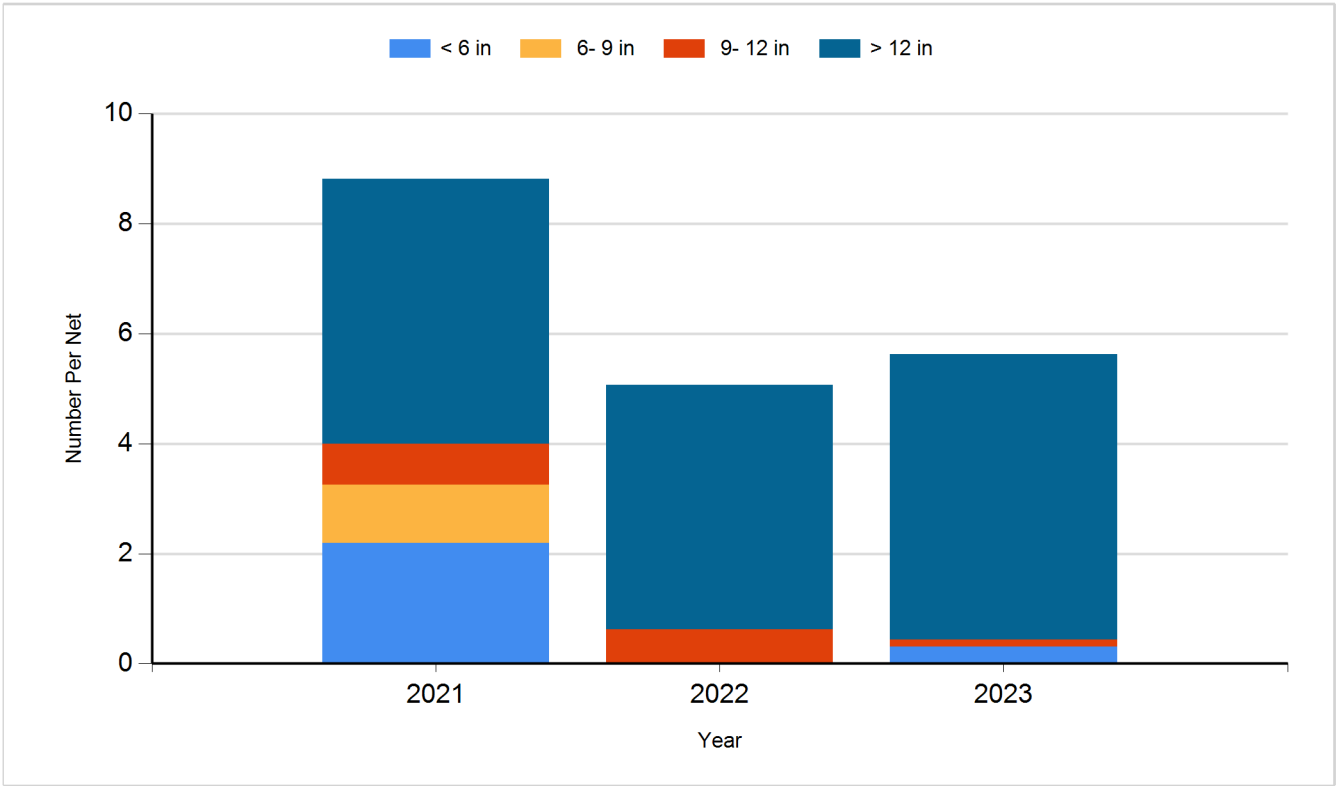
Species: Northern Pike
Gear: AFS std gill net



Species: Walleye
Gear: AFS std gill net



Species: White Bass
Gear: AFS std gill net



Species: Yellow Perch
Gear: AFS std gill net