

Belle Fourche Reservoir Lake Survey Summary

Belle Fourche reservoir is the largest reservoir in SD west of the Missouri River at over 8,000 acres and is located nine miles east of the town of Belle Fourche. The reservoir contains multiple species but is primarily a walleye, channel catfish, yellow perch fishery with gizzard shad as a forage species. The lake is run by the United States Bureau of Reclamation (BOR) as an Irrigation reservoir, so the lake experiences higher water in the spring and lower water by early fall on an annual basis.

Walleye. Walleye numbers averaged 7.5 fish per gill net, up from 2.9 last year. Fish ranged from 8 to 20 inches with the bulk of the population between 16-19 inches. All age classes from 1 to 10 were represented in the sample indicating consistent natural recruitment. Growth showed fish reaching 15 inches between age 3 and 4. To increase walleye growth and condition adult yellow perch and gizzard shad were stocked this spring to help add to the forage base.

Yellow perch. Forty-five perch were sampled in the ten-gill net survey, this is up from 39 last year and 24 on 2021. Fish ranged from 5.5 to 11 inches. In the past two years, over 36,000 adult yellow perch have been stocked to increase forage base for walleye and provide more angling opportunity. In addition to the adult stockings, multiple Christmas tree spawning habitat projects have taken place the last couple of years.

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY
Belle Fourche Reservoir, Butte County
LBF-Lake-768-000
2023

Lake Information

Name: Belle Fourche Reservoir
County: Butte
Surface Area: 6,570 Acres

Surveys and Investigations

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

Gear	Date	Effort
AFS std gill net	Aug 15, 2023	10 net-nights
boat shocker (day)	Aug 11, 2023	6600 seconds

Common Fish Species Present

Channel Catfish

Black Crappie

Gizzard Shad

Walleye

White Crappie

Yellow Perch

Common Carp

White Bass

Smallmouth Bass

Shorthead Redhorse

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.
- **std 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.

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

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.

$$PSD = \left(\frac{\text{number of fish} \geq \text{quality length}}{\text{number of fish} \geq \text{stock length}} \right) \times 100$$

$$PSD - P = \left(\frac{\text{number of fish} \geq \text{preferred length}}{\text{number of fish} \geq \text{stock length}} \right) \times 100$$

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.

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

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).

Species Name	Stock		Quality		Preferred		Memorable		Trophy	
	(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**

Gear	Species	Sample Size (n)	Abundance		Stock Density Indices			Condition		
			CPUE	CI-80	PSD	CI-80	PSD-P	CI-80	Wr	CI-80
AFS std gill net	Channel Catfish	7	0.7	0.5	100		57		97	5
	Common Carp	28	2.8	0.9	96		43	15	87	2
	Freshwater Drum	4	0.4	0.3	100		50		92	3
	Gizzard Shad	2	0.1	0.1	100				97	
	River Carpsucker	5	0.5	0.4	100		100		92	4
	Shorthead Redhorse	8	0.8	0.5	100		75		96	3
	Smallmouth Bass	11	1.1	0.8	91		64		95	2
	Walleye	75	7.1	1.3	90	5	4		77	1
	White Bass	31	2.8	1.8	79	12	50	15	94	3
	White Crappie	1	0.1	0.1	100		100		104	
boat shocker (day)	Yellow Perch	41	4.1	1.8	29	11	10		87	2
	Walleye*	52	28.4	11.2	98		4		75	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

Gear	Species	CPUE										Avg	
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		
AFS gill net (1/2 inch)*	Black Crappie						0.3						0.30
	Gizzard Shad						2.3						2.30
	Spottail Shiner						0.5						0.50
	Walleye						0.3						0.30
	White Crappie						0.3						0.30
	Yellow Perch						1.3						1.30
AFS std gill net	Black Crappie				0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.04
	Channel Catfish				4.1	2.6	0.3	1.6	2.1	0.7	0.7	0.7	1.73
	Common Carp				0.6	0.7	1.6	2.2	2.2	2.2	2.8	2.8	1.76
	Freshwater Drum				1.0	1.4	0.7	0.9	0.4	3.0	0.4	0.4	1.11
	Gizzard Shad				0.2	0.9	0.4	0.0	0.0	0.0	0.1	0.1	0.23
	Northern Pike				0.0	0.1	0.1	0.3	0.2	0.0	0.0	0.0	0.10
	River Carpsucker				0.6	0.3	0.7	0.2	0.2	0.2	0.5	0.5	0.39
	Shorthead Redhorse				0.8	0.3	2.4	0.4	0.2	0.4	0.8	0.8	0.76
	Smallmouth Bass				0.2	0.2	0.2	0.0	0.6	0.0	1.1	1.1	0.33
	Spottail Shiner				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
	Walleye				12.7	9.2	5.9	4.3	6.3	2.8	7.1	7.1	6.90
	White Bass				1.3	2.9	6.3	6.7	5.0	5.2	2.8	2.8	4.31
	White Crappie				0.2	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.06
Yellow Perch				1.3	1.7	0.3	1.9	2.4	3.9	4.1	4.1	2.23	
boat shocker (day)	Walleye*											28.4	28.40
frame net (std 3/4 in)	Black Bullhead	0.0	0.0										0.00
	Black Crappie	0.8	0.0										0.40
	Channel Catfish	0.1	0.1										0.10
	Common Carp	6.1	1.3										3.70
	Gizzard Shad	0.3	0.0										0.15
	Green Sunfish	0.3	0.0										0.15
	Rainbow Trout	0.1	0.0										0.05
	River Carpsucker	0.4	0.0										0.20
	Rudd	0.1	0.0										0.05
	Shorthead Redhorse	0.1	0.0										0.05
	Smallmouth Bass	0.1	0.0										0.05
Walleye	2.0	1.5										1.75	

CPUE

Gear	Species	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Avg
frame net (std 3/4 in)	White Bass	11.0	1.8									6.40
	White Crappie	16.9	15.0									15.95
	Yellow Perch	0.4	0.1									0.25
rod and reel	Channel Catfish									0.0		0.00
	Largemouth Bass									0.0		0.00
std exp gill net	Black Crappie	0.0	0.0	0.5								0.17
	Channel Catfish	1.8	3.3	4.0								3.03
	Common Carp	0.3	0.7	1.0								0.67
	Freshwater Drum	2.0	0.2	0.3								0.83
	Gizzard Shad	0.7	0.0	0.3								0.33
	Northern Pike	0.0	0.0	0.0								0.00
	River Carpsucker	0.7	0.0	0.8								0.50
	Shorthead Redhorse	0.8	0.7	0.5								0.67
	Smallmouth Bass	0.7	0.8	0.0								0.50
	Spottail Shiner	0.0	0.0	0.0								0.00
	Walleye	8.5	20.3	23.0								17.27
	White Bass	3.5	6.7	5.8								5.33
	White Crappie	0.0	0.0	0.2								0.07
White Sucker	0.2	0.0	0.0								0.07	
Yellow Perch	3.2	9.5	14.8								9.17	

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.

Gear	Species	Index	Year											
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		
AFS std gill net	Black Crappie	PSD				100	100							
		PSD-P				0	50							
		Wr				123	110							
	Channel Catfish	PSD				97	100	100	94	95	71	100		
		PSD-P				30	31	100	81	62	57	57		
		Wr				86	92	93	91	89	92	97		
	Common Carp	PSD				100	100	100	95	91	100	96		
		PSD-P				0	0	14	27	9	18	43		
		Wr				93	87	84	85	80	86	87		
	Gizzard Shad	PSD				100	100	100	0	0	0	100		
		Wr				106	99	96						97
	Shorthead Redhorse	PSD				100	100	100	100	100	100	100		
		PSD-P				86	33	82	100	50	100	75		
		Wr				99	96	104	101	95	92	96		
	Smallmouth Bass	PSD				50	100	50		100		91		
		PSD-P				0	0	50		17		64		
		Wr				96	94	87		92		95		
	Walleye	PSD				56	55	53	74	81	68	90		
		PSD-P				0	0	0	0	3	0	4		
		Wr				83	81	78	78	76	79	77		
	White Bass	PSD				100	100	98	100	100	100	79		
PSD-P					100	100	95	97	100	100	50			
Wr					94	95	86	84	87	83	94			
White Crappie	PSD				100					100			100	
	PSD-P				100					100			100	
	Wr				104					94			104	
Yellow Perch	PSD				67	59	67	11	83	69	29			
	PSD-P				17	12	0	5	25	18	10			
	Wr				91	96	94	92	90	90	87			
boat shocker (day)	Walleye	PSD												98
		PSD-P												4
		Wr												75

Gear	Species	Index	Year																						
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023													
frame net (std 3/4 in)	Black Crappie	PSD	100																						
		PSD-P	83																						
		Wr	98																						
	Channel Catfish	PSD	100	100																					
		PSD-P	0	0																					
		Wr	89	80																					
	Common Carp	PSD	100	100																					
		PSD-P	33	50																					
		Wr	80	87																					
	Gizzard Shad	PSD	100																						
		Wr	86																						
	Shorthead Redhorse	PSD	100																						
		PSD-P	100																						
		Wr	83																						
	Smallmouth Bass	PSD	100																						
		PSD-P	0																						
		Wr	88																						
	Walleye	PSD	100	100																					
		PSD-P	63	58																					
		Wr	74	70																					
	White Bass	PSD	99	100																					
		PSD-P	99	57																					
		Wr	96	96																					
	White Crappie	PSD	100	100																					
PSD-P		100	100																						
Wr		98	98																						
Yellow Perch	PSD	67	100																						
	PSD-P	67	0																						
	Wr	67	82																						
rod and reel	Channel Catfish	PSD																						100	
		PSD-P																							100
std exp gill net	Black Crappie	PSD				67																			
		PSD-P				0																			
		Wr				129																			
	Channel Catfish	PSD	100	90	96																				
		PSD-P	36	40	29																				

Gear	Species	Index	Year									
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
std exp gill net	Channel Catfish	Wr	89	96	87							
		PSD	50	25	67							
	Common Carp	PSD-P	0	0	0							
		Wr	84	95	80							
		PSD	100		100							
	Gizzard Shad	Wr	96		102							
		PSD	80	100	100							
	Shorthead Redhorse	PSD-P	40	50	100							
		Wr	102	101								
		PSD	100	40								
	Smallmouth Bass	PSD-P	0	20								
		Wr	91	104								
		PSD	76	18	20							
	Walleye	PSD-P	10	1	0							
		Wr	81	84	81							
		PSD	81	100	100							
	White Bass	PSD-P	52	100	100							
		Wr	96	103	94							
		PSD			100							
	White Crappie	PSD-P			100							
		Wr			91							
PSD		58	16	29								
Yellow Perch	PSD-P	5	2	1								
	Wr	86	90	85								

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+
2020	46	219 (3)	305 (7)	383 (15)	425 (10)	439 (7)	446 (4)				
2019	53	224 (4)	319 (15)	381 (11)	403 (7)	436 (4)	453 (12)				
2018	102	243 (16)	340 (29)	384 (13)	403 (15)	425 (25)	462 (1)		462 (2)	453 (1)	
2017	126	241 (21)	321 (15)	363 (23)	401 (62)	441 (3)			494 (1)		494 (2)
2016	292	241 (26)	318 (75)	365 (174)	397 (4)	437 (13)					
2015	252	226 (8)	310 (200)	393 (2)	440 (21)	435 (9)	441 (2)		473 (7)	525 (2)	
2014	196	217 (102)	331 (8)	390 (36)	413 (4)	466 (17)	476 (11)	538 (6)	513 (4)		482 (9)

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).

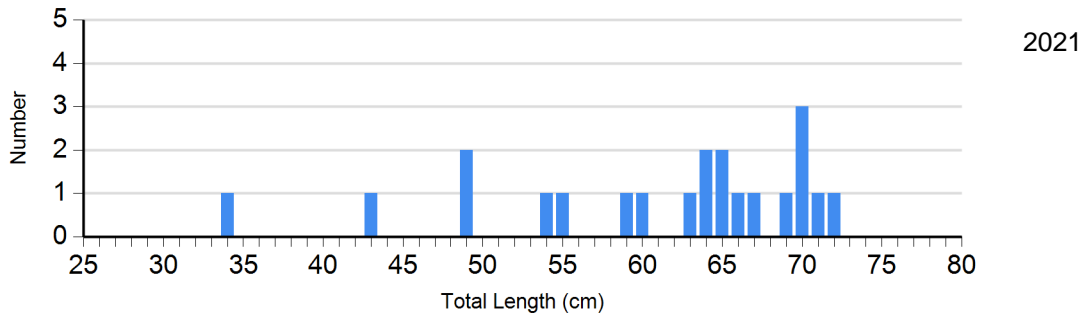
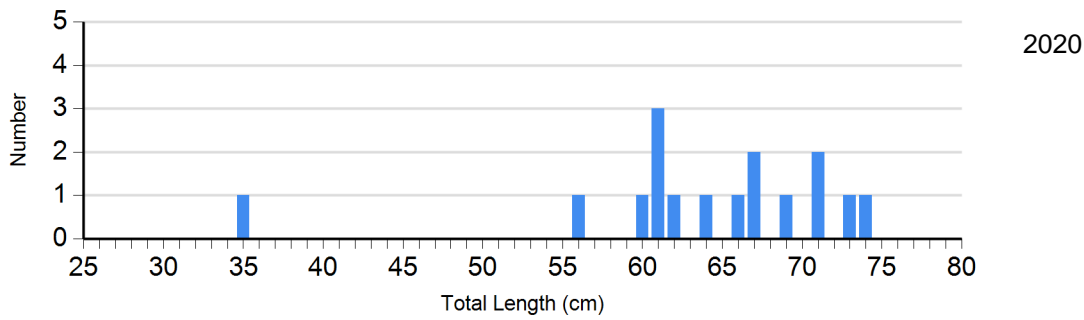
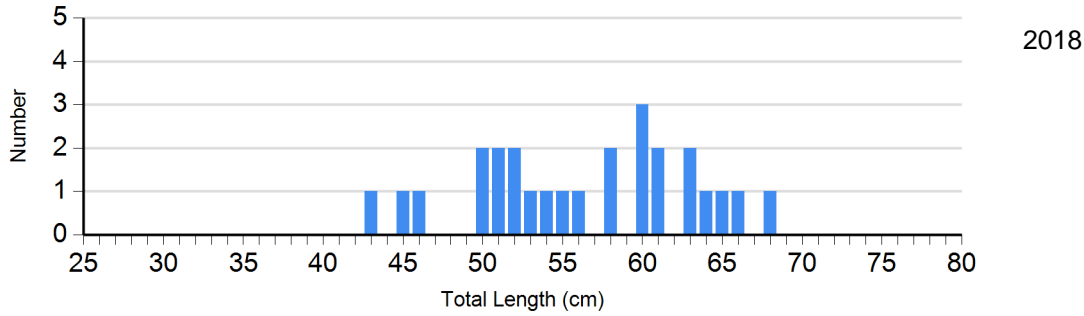
Species	Year	Length Groups							
		S-Q		Q-P		P-M		M	
		N	Wr (SE)	N	Wr (SE)	N	Wr (SE)	N	Wr (SE)
Channel Catfish Gill Net	2019	0		0		3	93 (5.4)	0	
	2020	1	86	2	72 (12.3)	9	94 (2.7)	4	97 (3.3)
	2021	1	89	7	84 (1.4)	11	93 (2.3)	2	83
	2022	2	86 (6.6)	1	96	3	93 (8.6)	1	96
	2023	0		3	89 (4.0)	2	100 (0.0)	2	105 (7.6)
Common Carp Gill Net	2019	0		12	85 (2.1)	2	81 (1.4)	0	
	2020	1	89	15	87 (2.5)	6	80 (3.5)	0	
	2021	2		18	79 (1.5)	2	87	0	
	2022	0		18	87 (1.8)	4	83 (3.8)	0	
	2023	1		15	90 (2.4)	12	82 (1.1)	0	
Walleye Gill Net	2019	25	78 (0.7)	28	77 (0.9)	0		0	
	2020	11	82 (2.3)	32	77 (0.8)	0		0	
	2021	12	81 (1.1)	49	75 (0.9)	2	60 (11.8)	0	
	2022	9	82 (1.8)	19	78 (1.1)	0		0	
	2023	7	82 (2.0)	61	77 (0.6)	3	78 (1.2)	0	
White Bass Gill Net	2019	1	99	2	108 (3.2)	38	87 (0.7)	16	81 (1.5)
	2020	0		2	101 (4.0)	39	87 (1.1)	26	79 (1.3)
	2021	0		0		29	91 (1.3)	21	82 (1.0)
	2022	0		0		25	89 (1.3)	27	78 (2.4)
	2023	6	99 (2.3)	8	98 (2.1)	6	97 (4.2)	8	81 (2.4)
Yellow Perch Gill Net	2019	1	100	2	90 (3.9)	0		0	
	2020	17	93 (2.1)	1	84	1	79	0	

Species	Year	Length Groups							
		S-Q		Q-P		P-M		M	
		N	Wr (SE)	N	Wr (SE)	N	Wr (SE)	N	Wr (SE)
Yellow Perch Gill Net	2021	4	80 (1.8)	14	96 (3.1)	6	81 (1.5)	0	
	2022	12	90 (1.7)	20	91 (1.5)	7	90 (2.0)	0	
	2023	29	88 (1.7)	8	82 (2.6)	4	92 (1.6)	0	

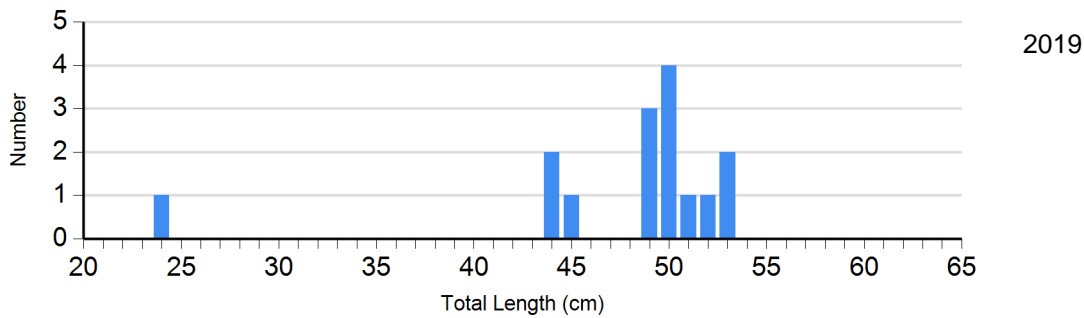
Length Frequency Distribution

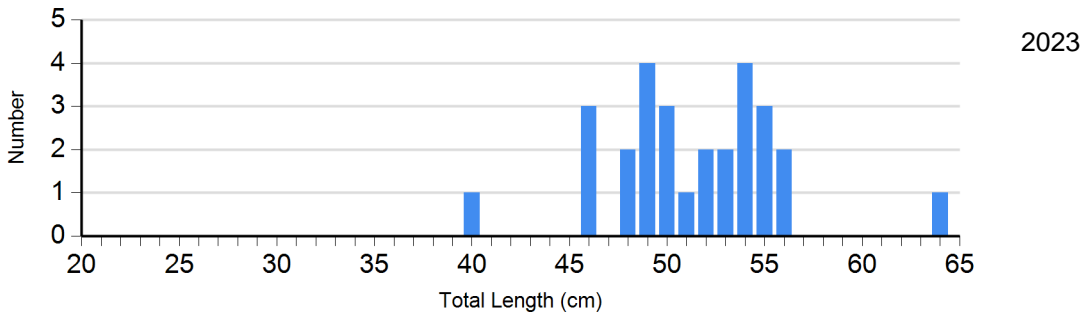
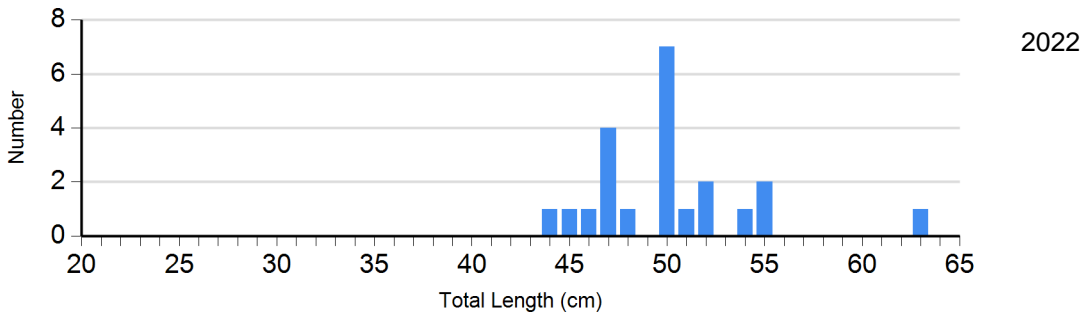
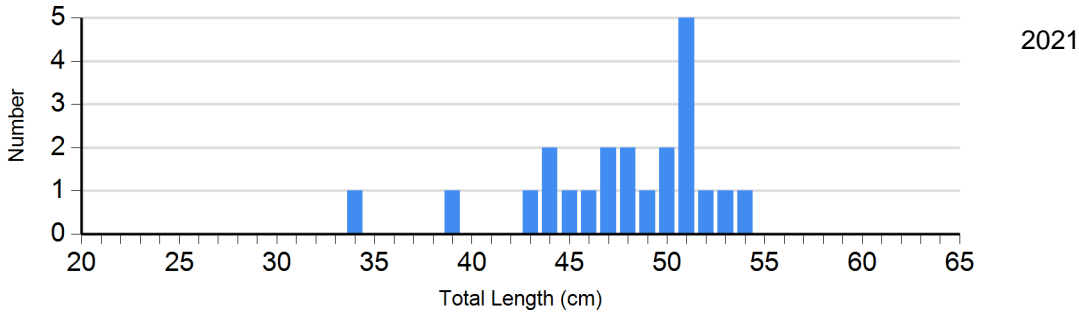
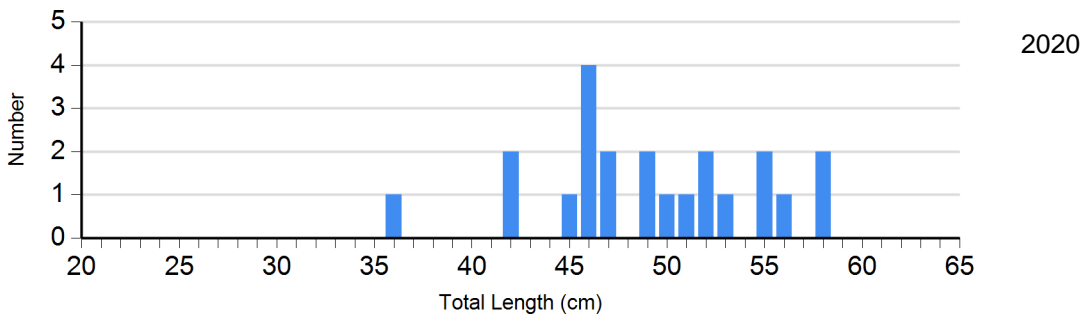
Length frequency histogram of species sampled by year.

Species: Channel Catfish
Gear: AFS std gill net

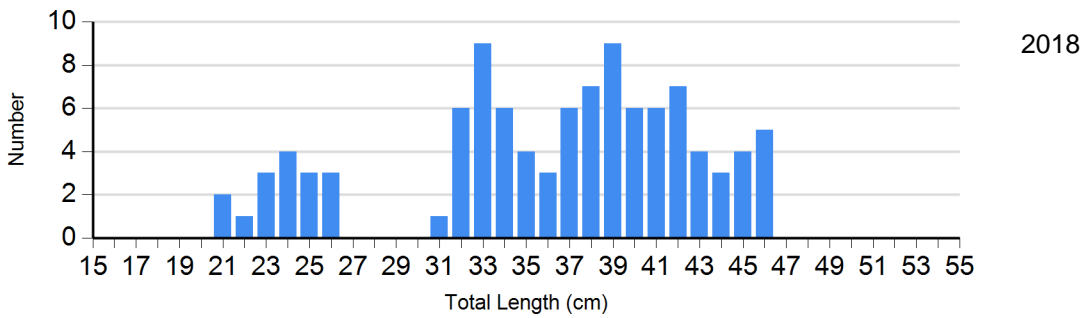


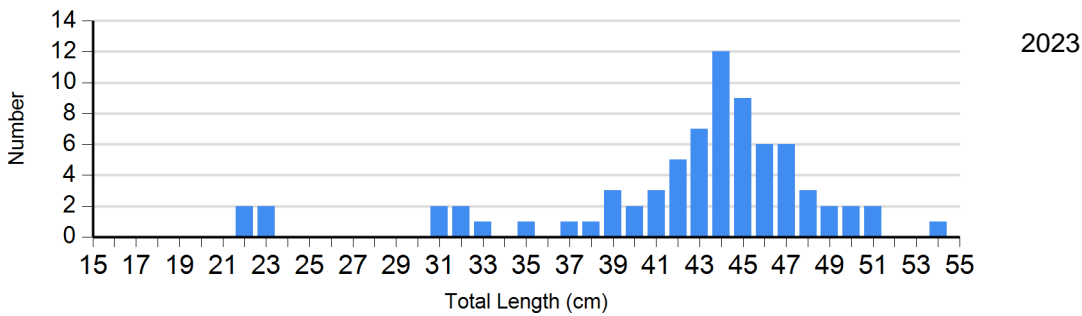
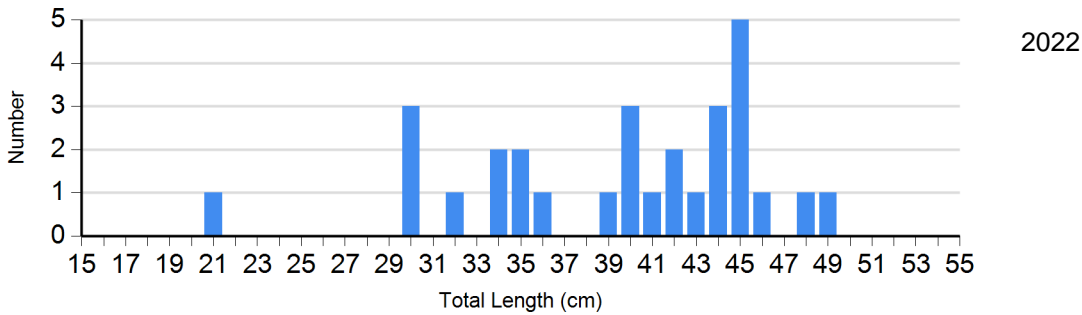
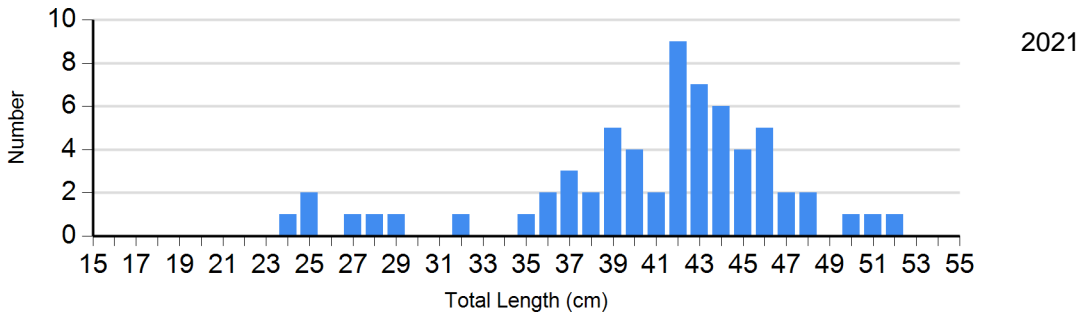
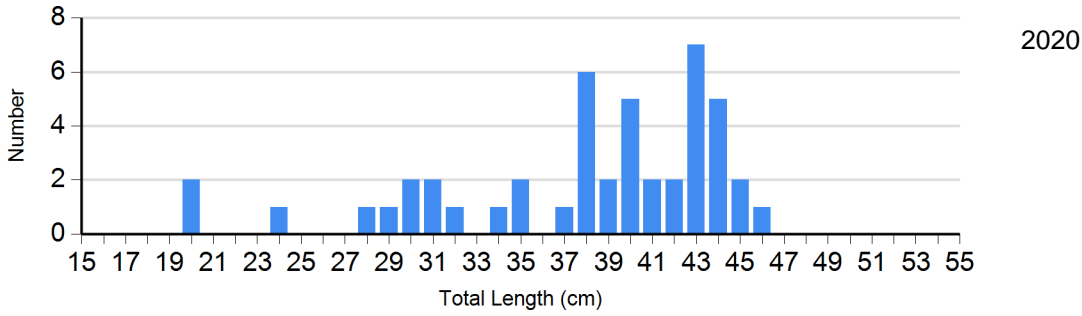
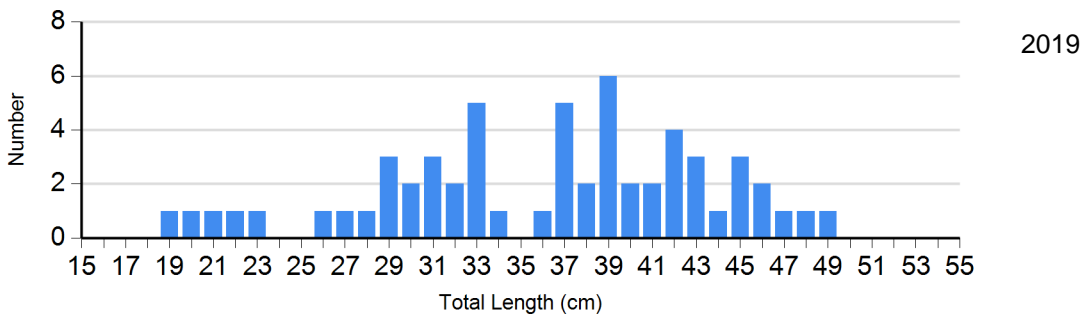
Species: Common Carp
Gear: AFS std gill net



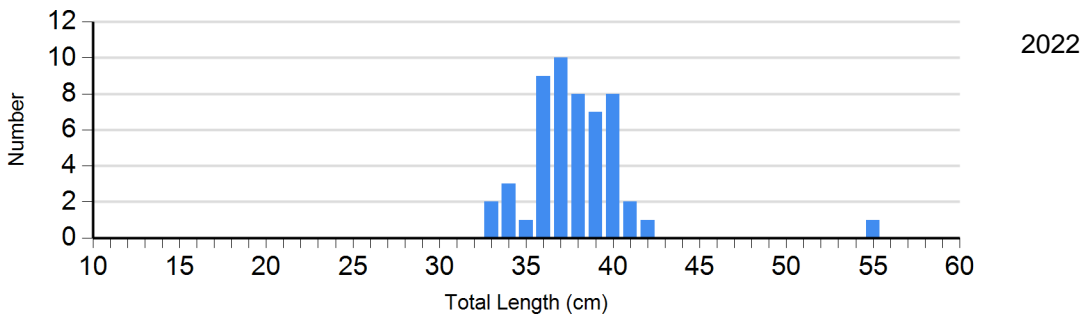
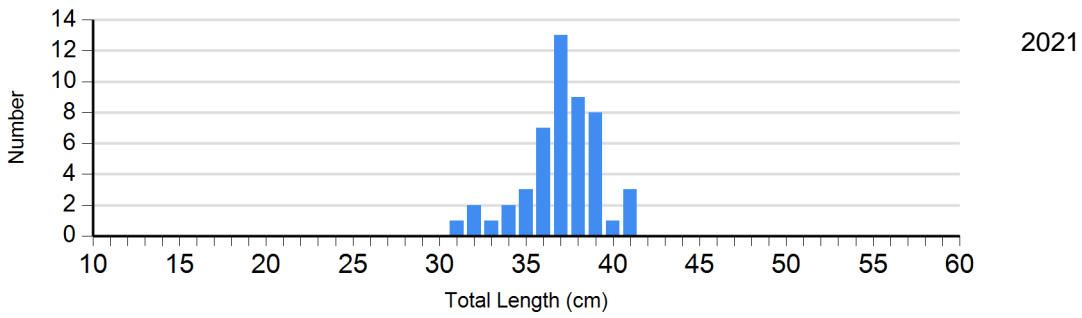
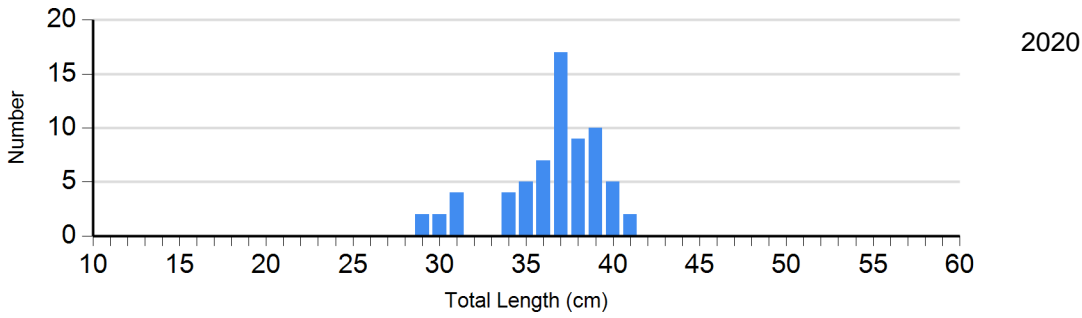
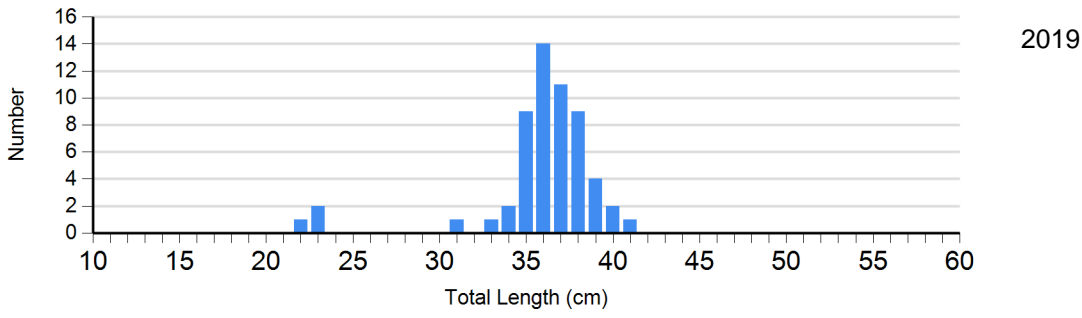
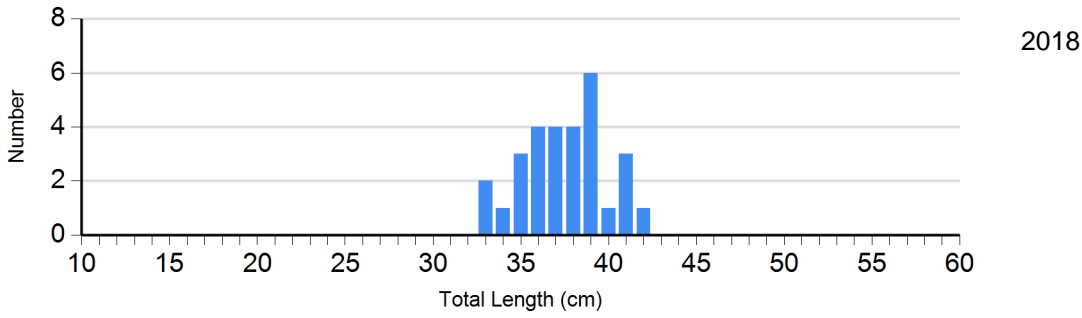


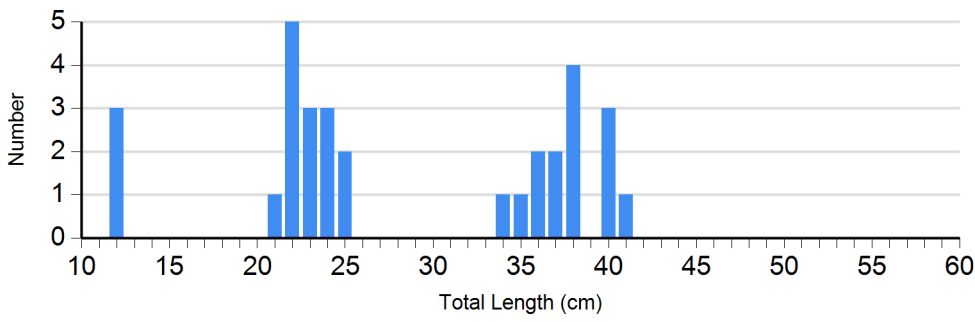
Species: Walleye
 Gear: AFS std gill net





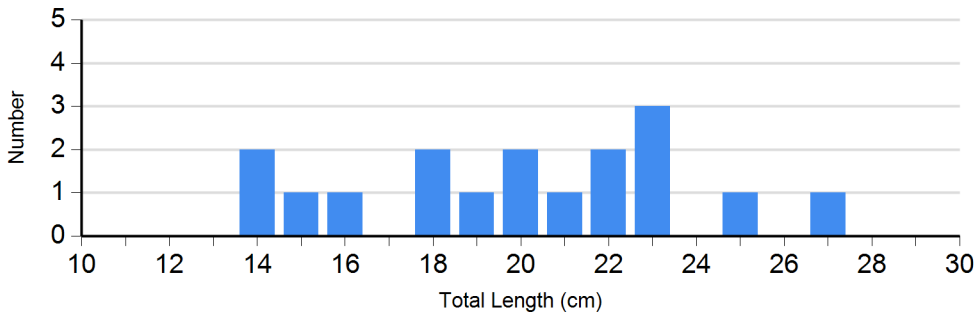
Species: White Bass
Gear: AFS std gill net



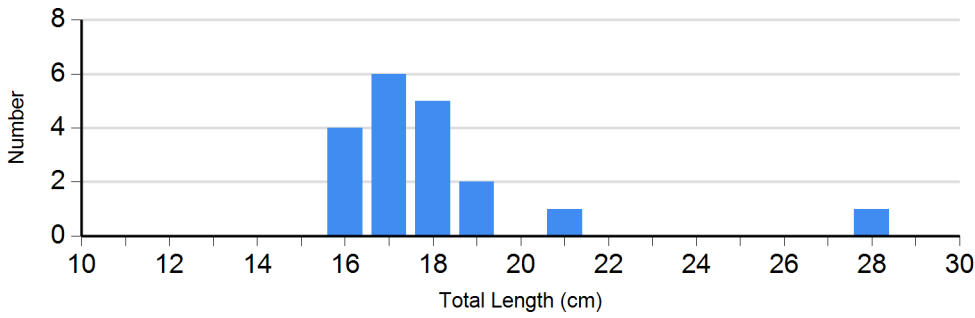


2023

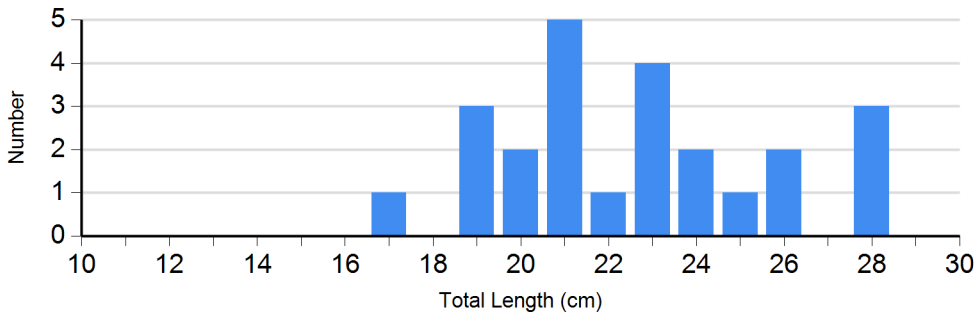
Species: Yellow Perch
Gear: AFS std gill net



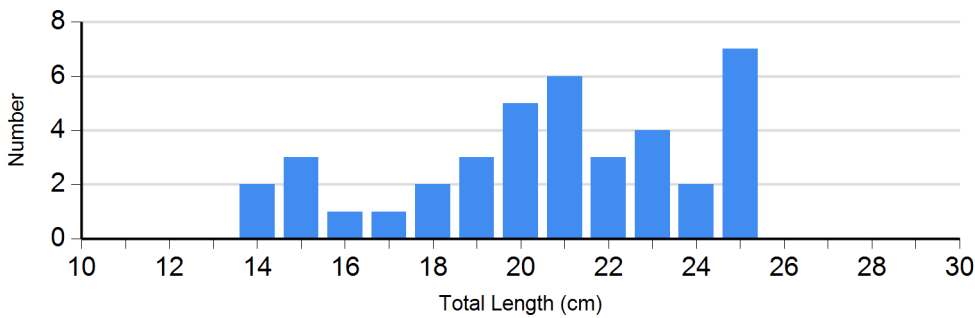
2018



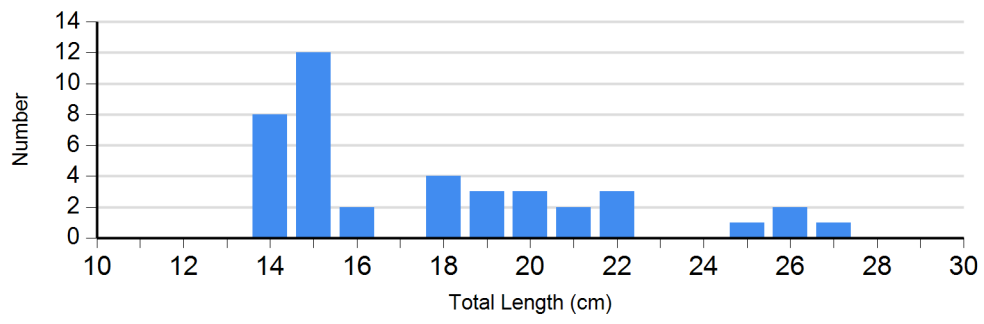
2020



2021



2022

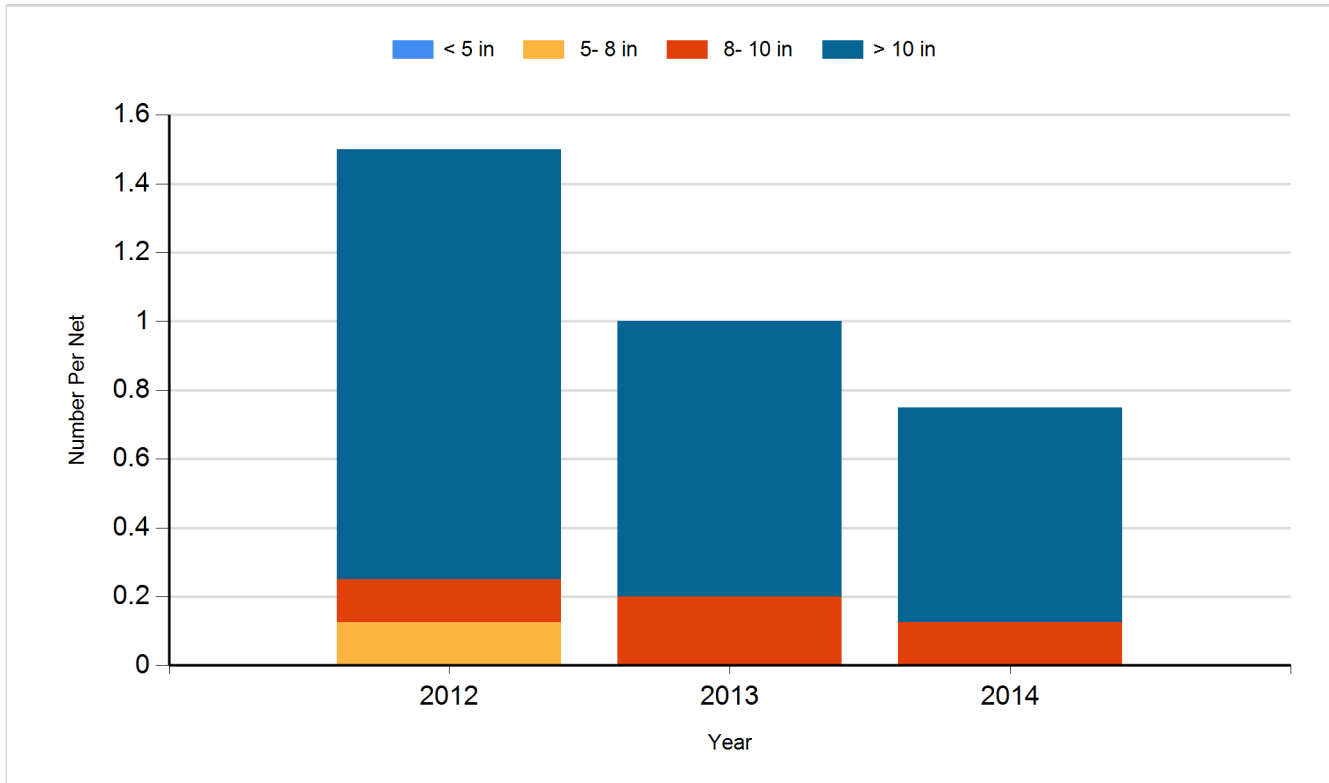


2023

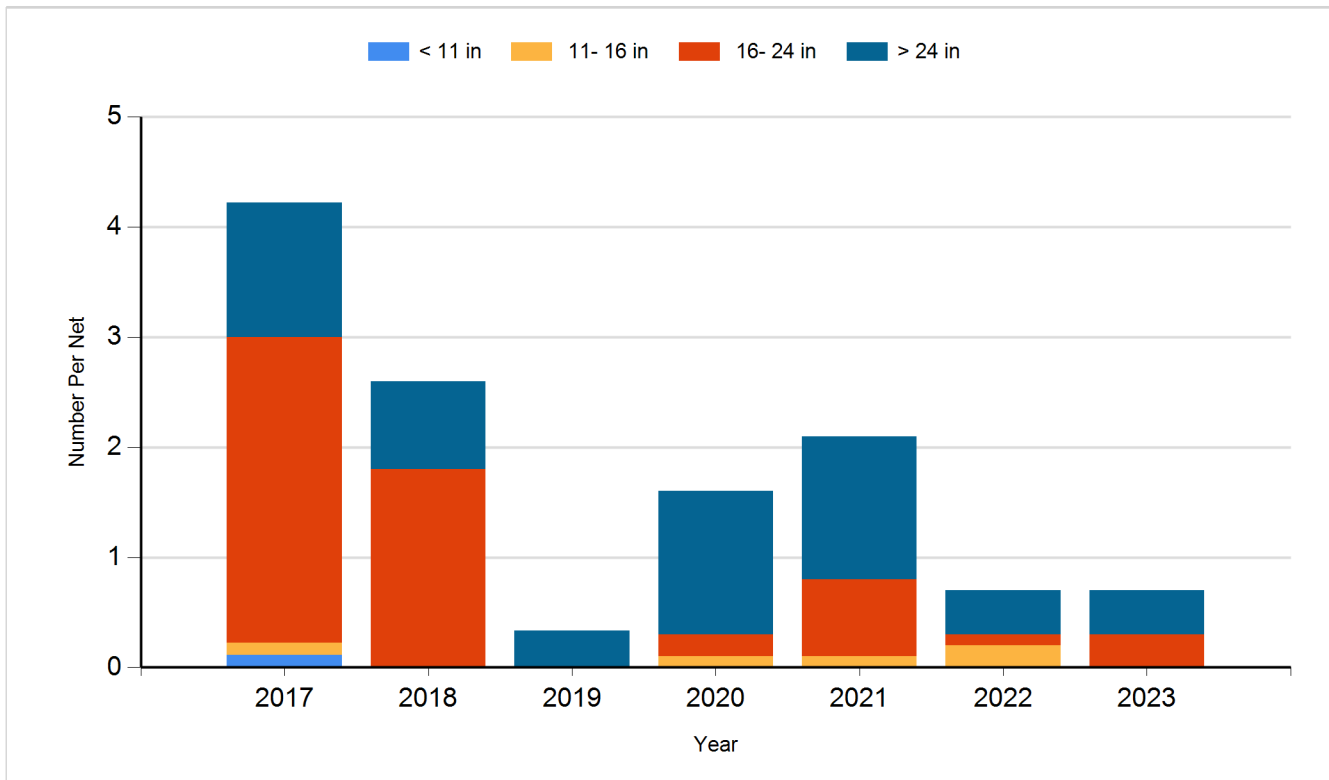
Historic Fish Sizes and Relative Abundance

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

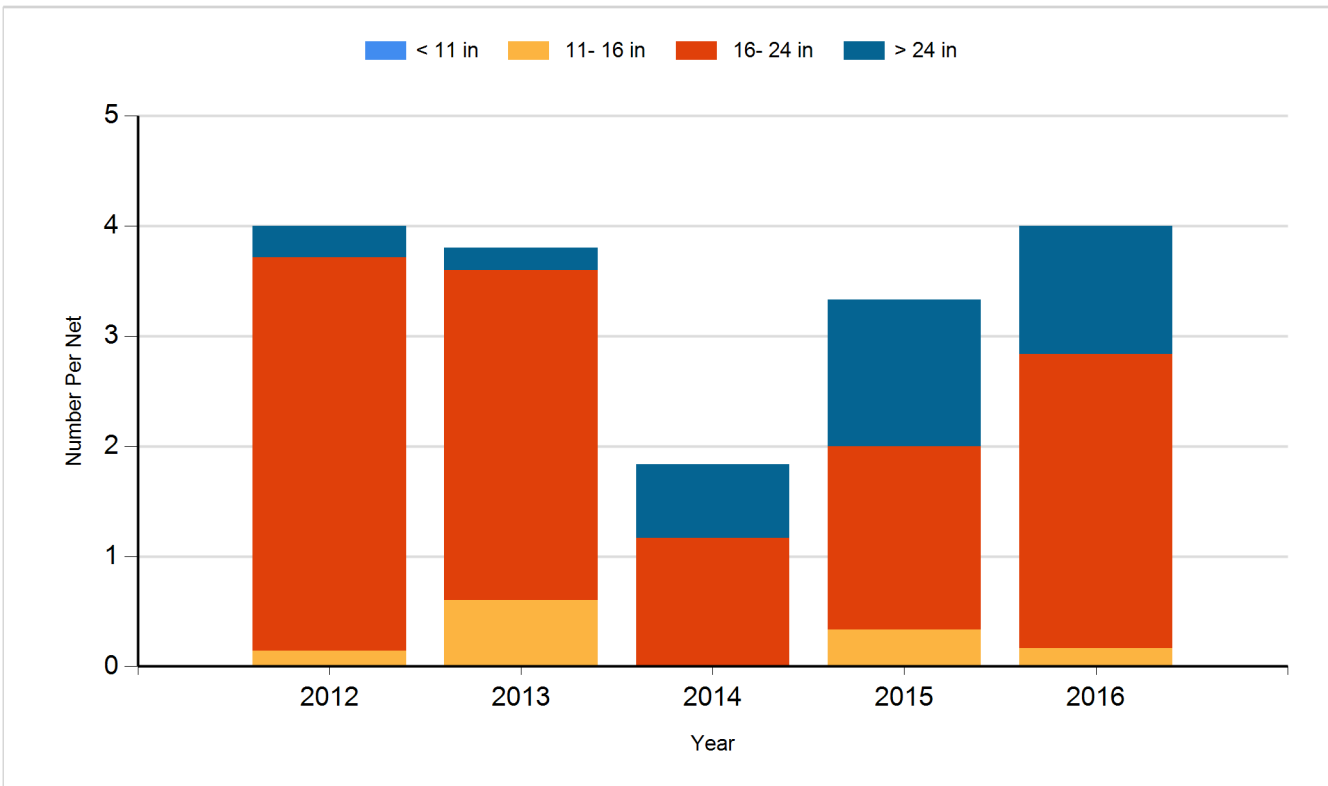
Species: Black Crappie
Gear: frame net (std 3/4 in)



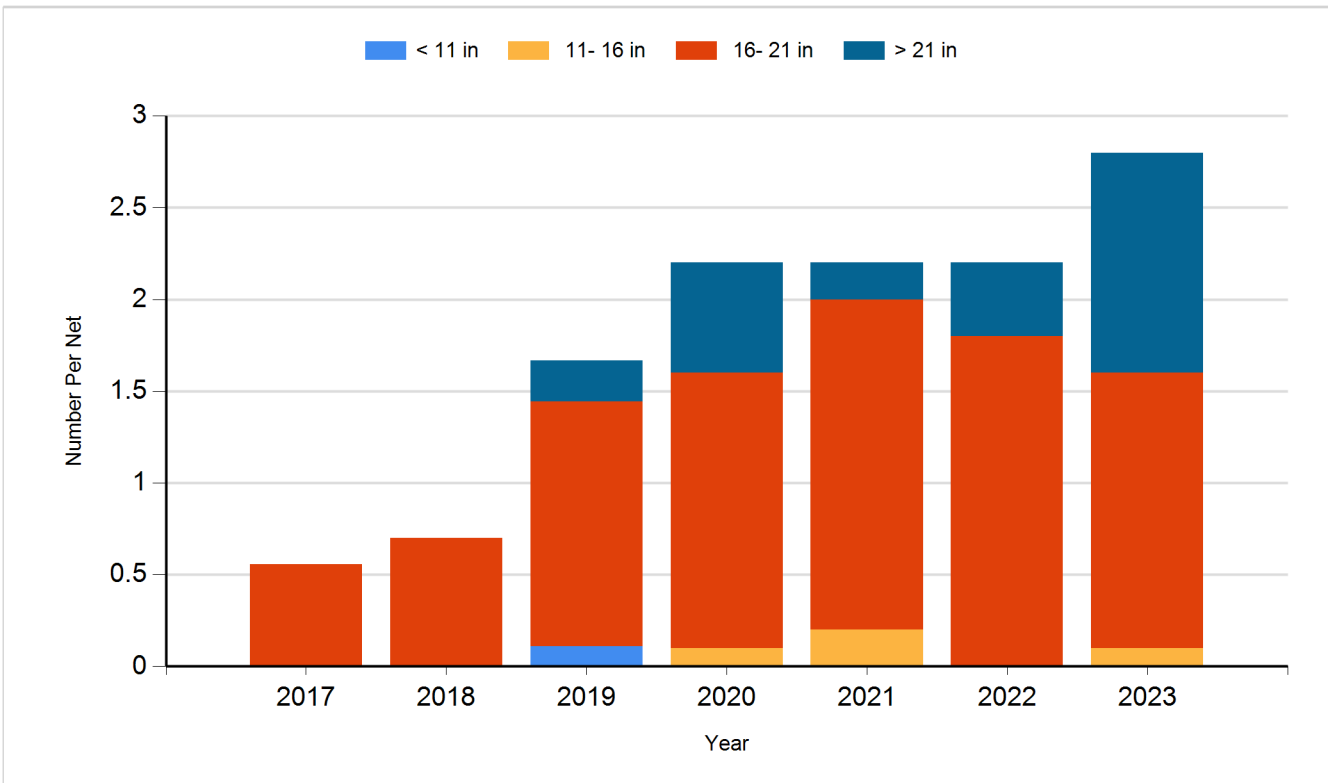
Species: Channel Catfish
Gear: AFS std gill net



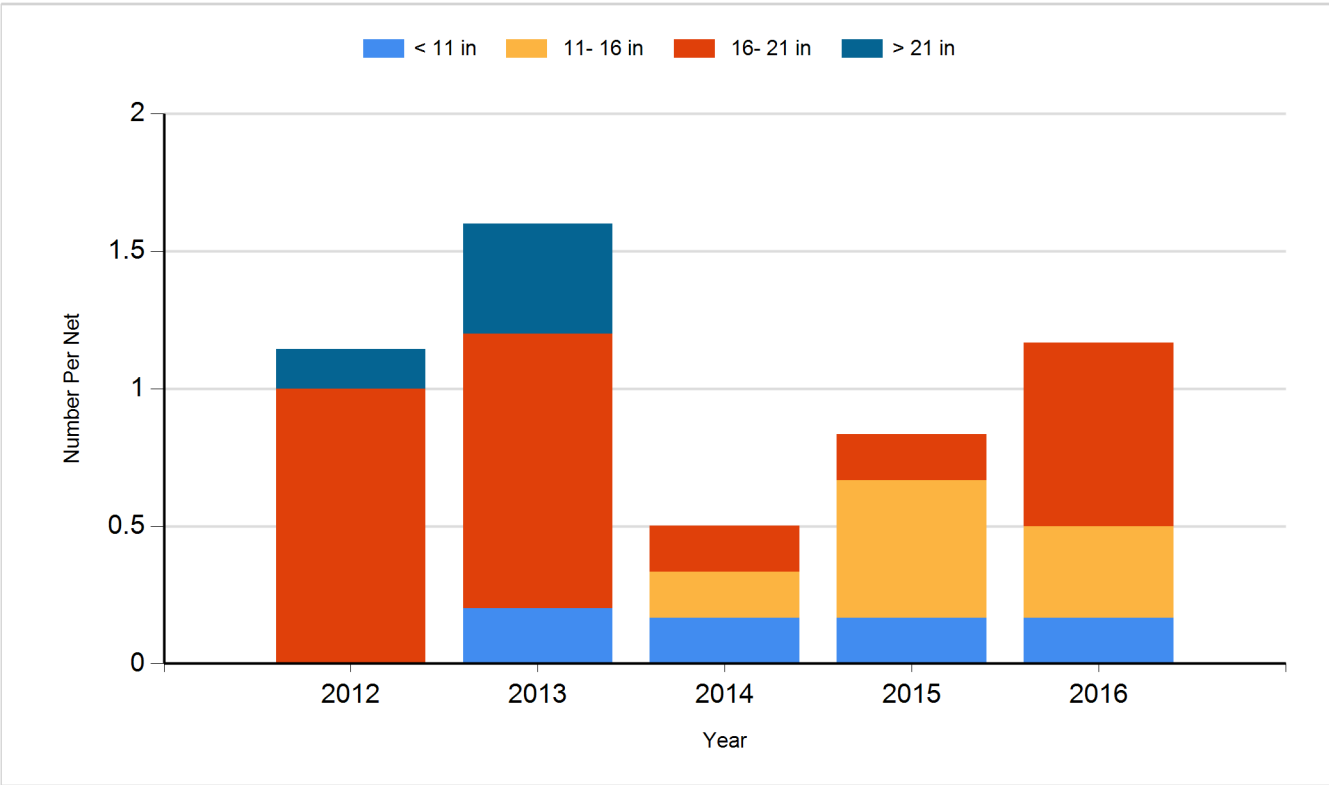
Species: Channel Catfish
Gear: std exp gill net



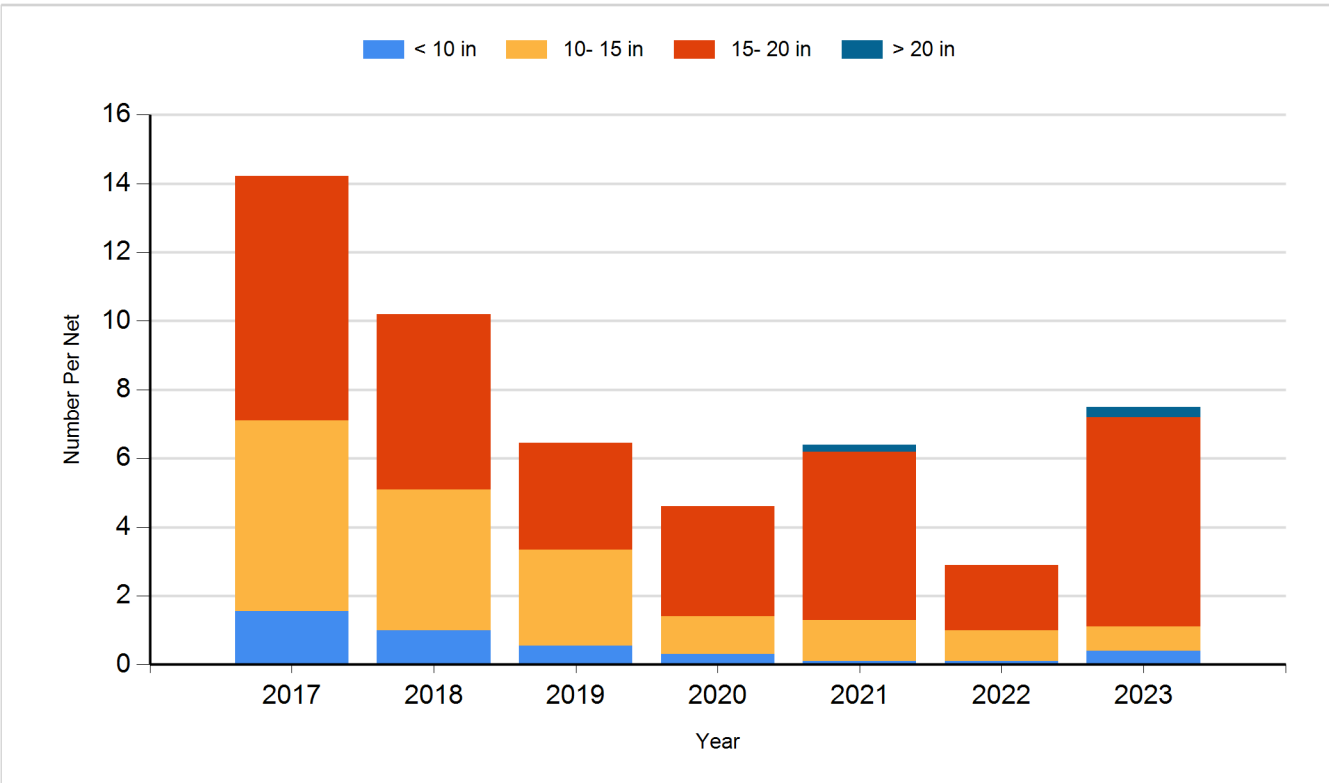
Species: Common Carp
Gear: AFS std gill net



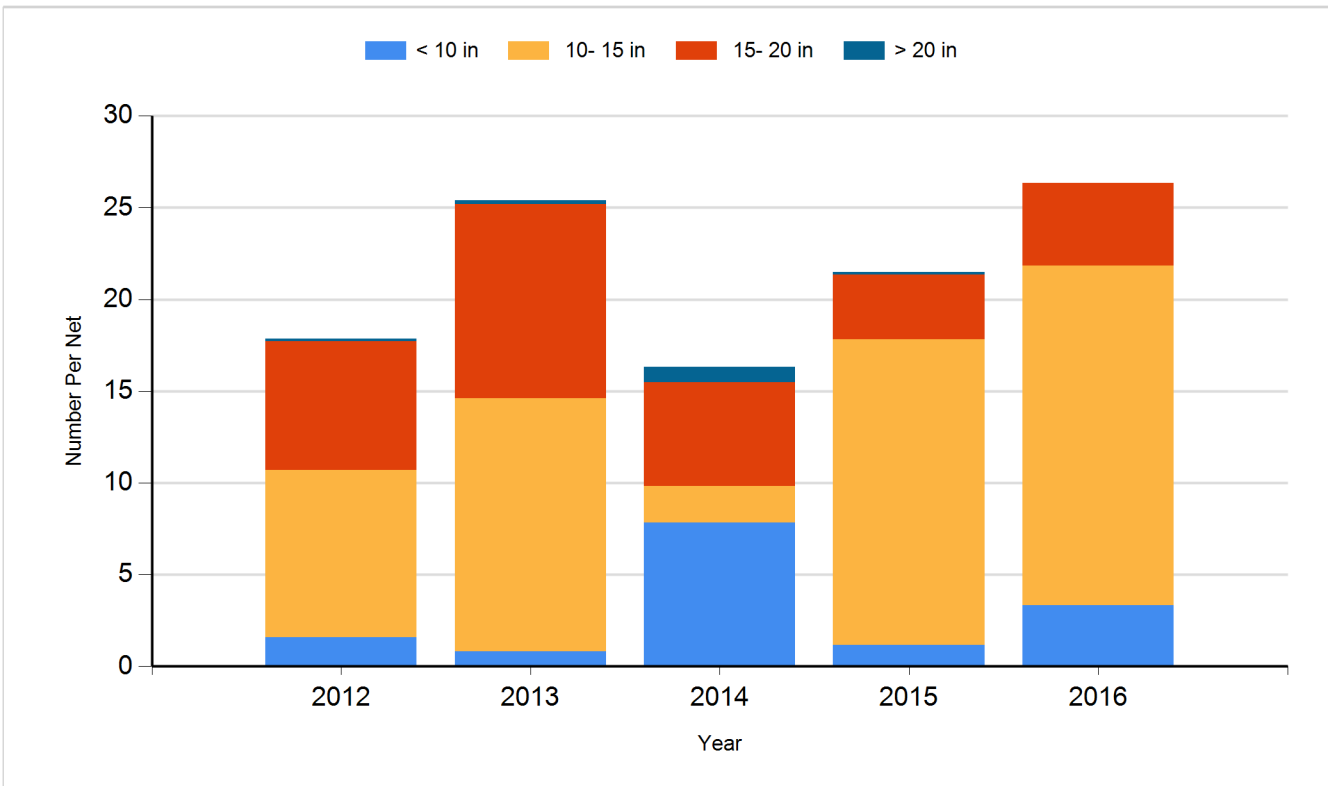
Species: Common Carp
Gear: std exp gill net



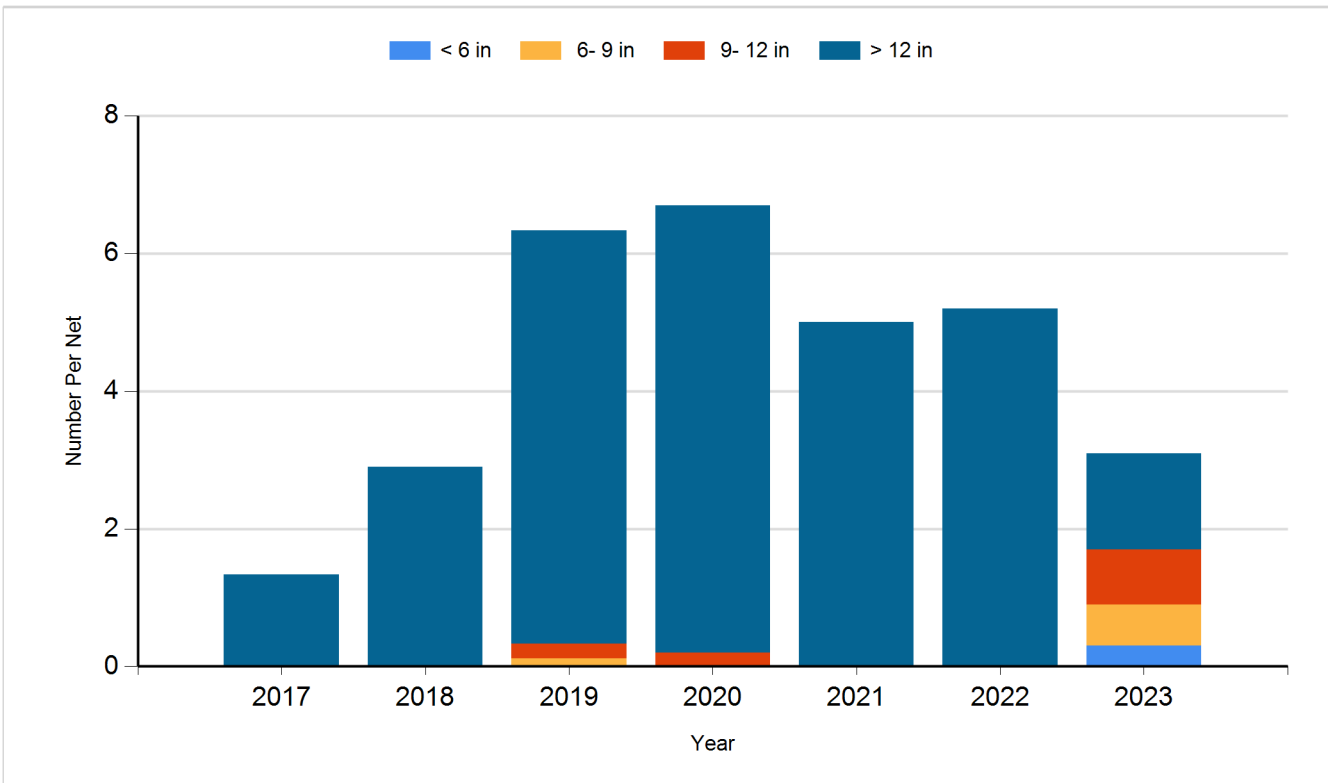
Species: Walleye
Gear: AFS std gill net



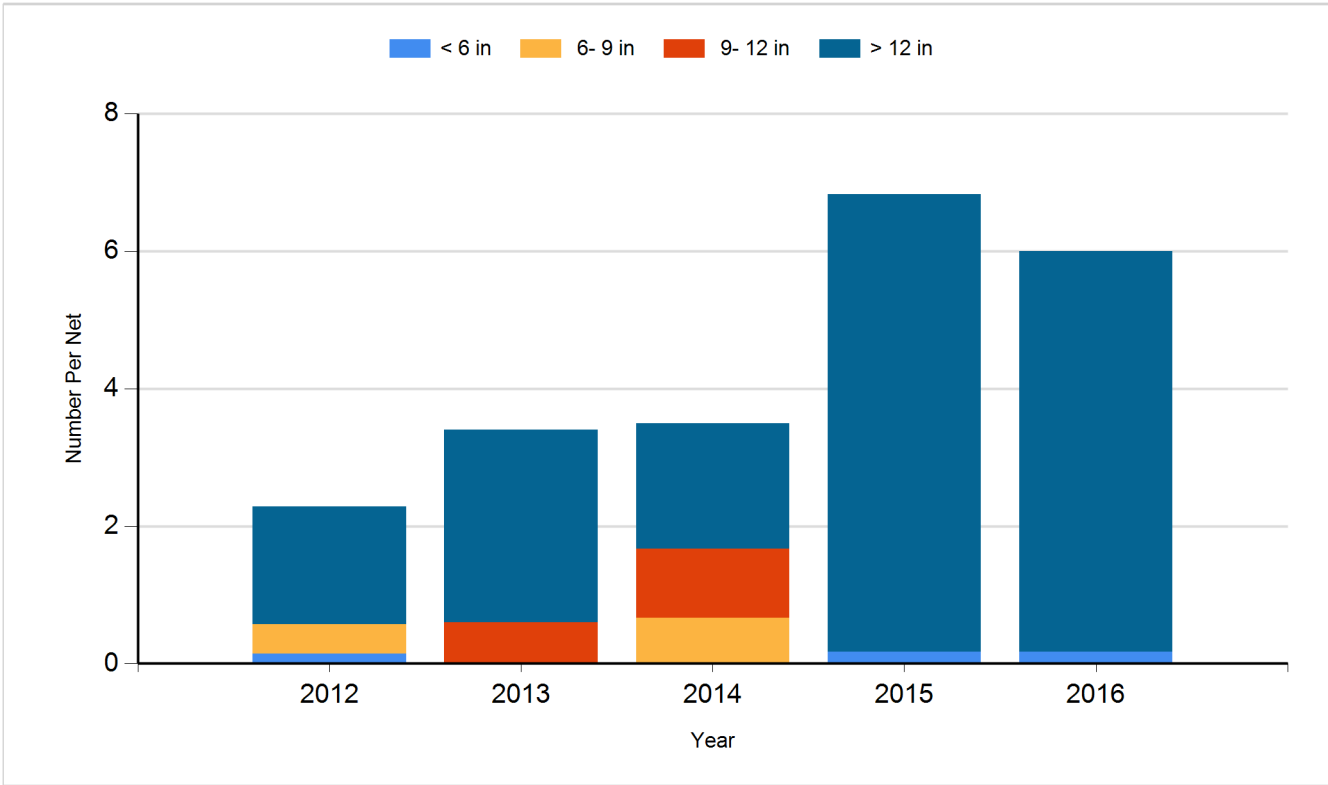
Species: Walleye
Gear: std exp gill net



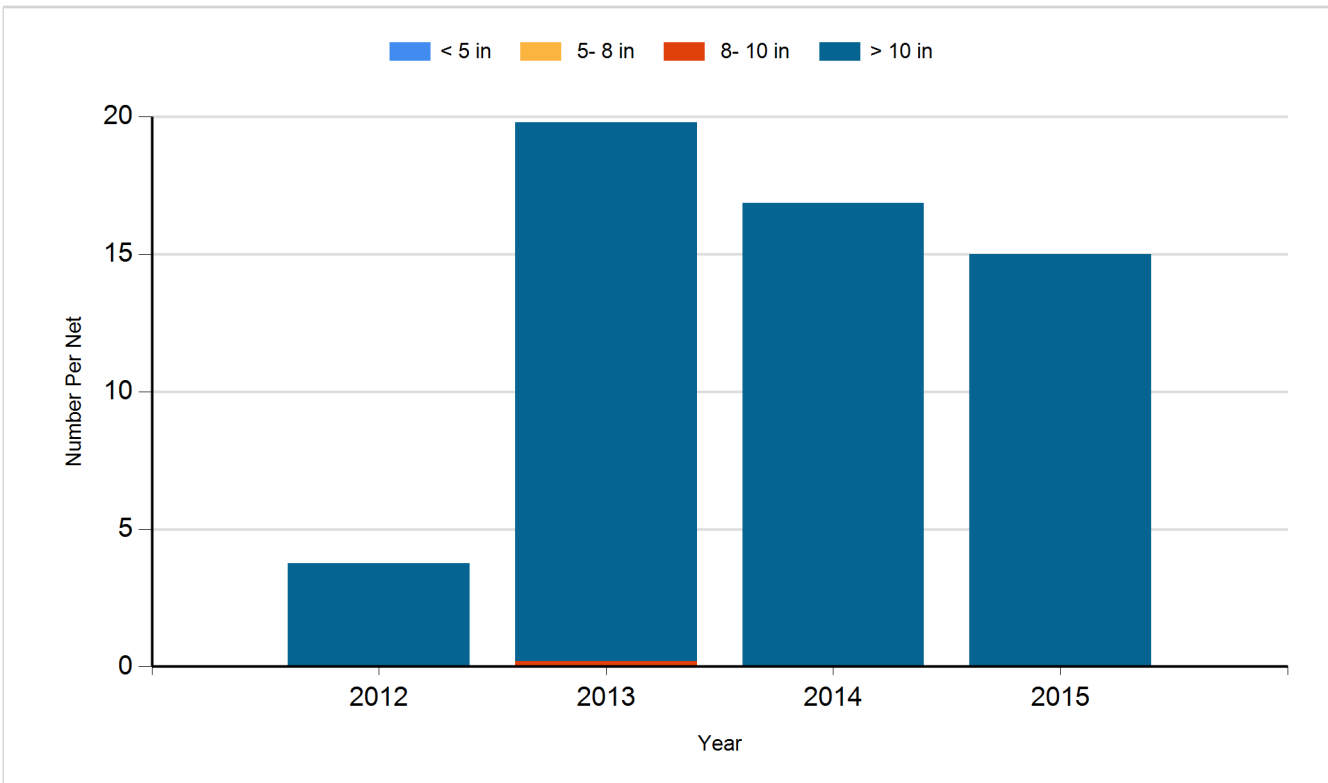
Species: White Bass
Gear: AFS std gill net



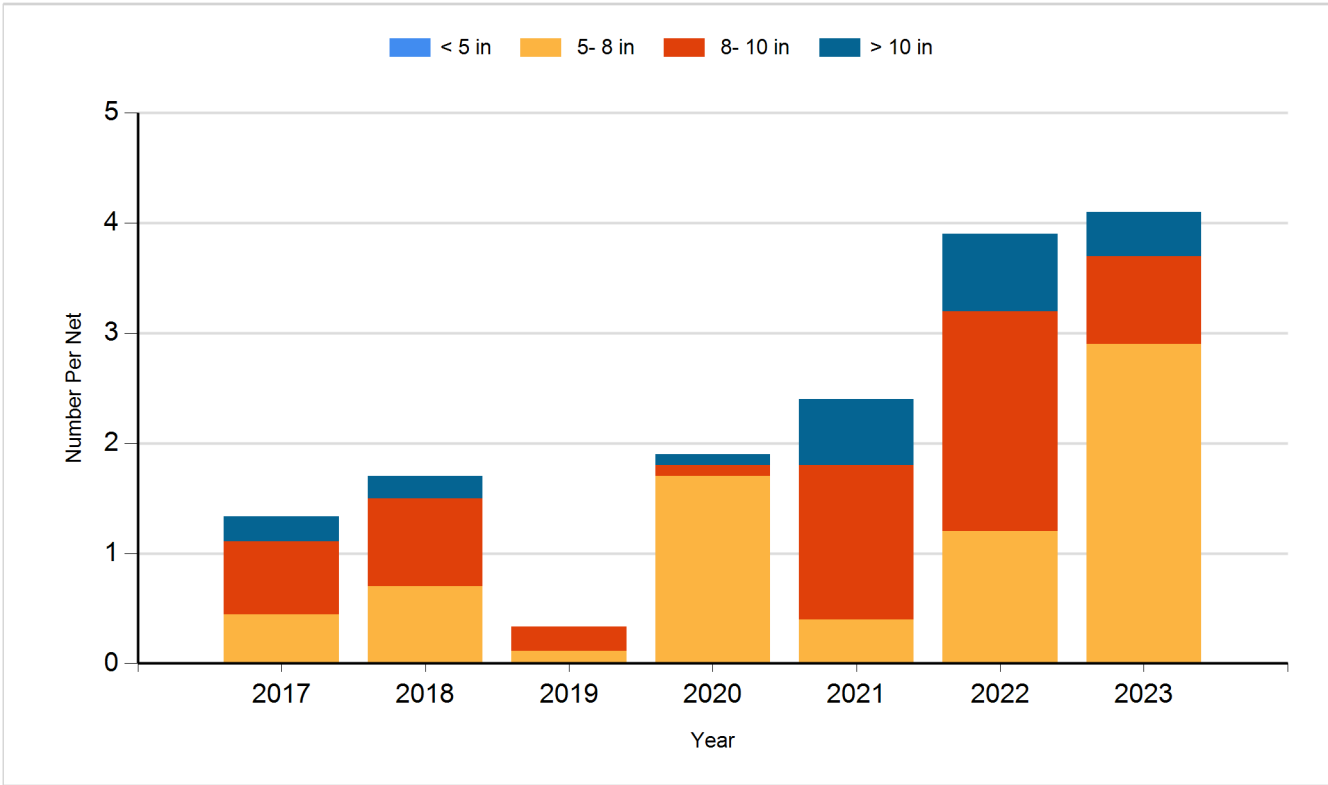
Species: White Bass
Gear: std exp gill net



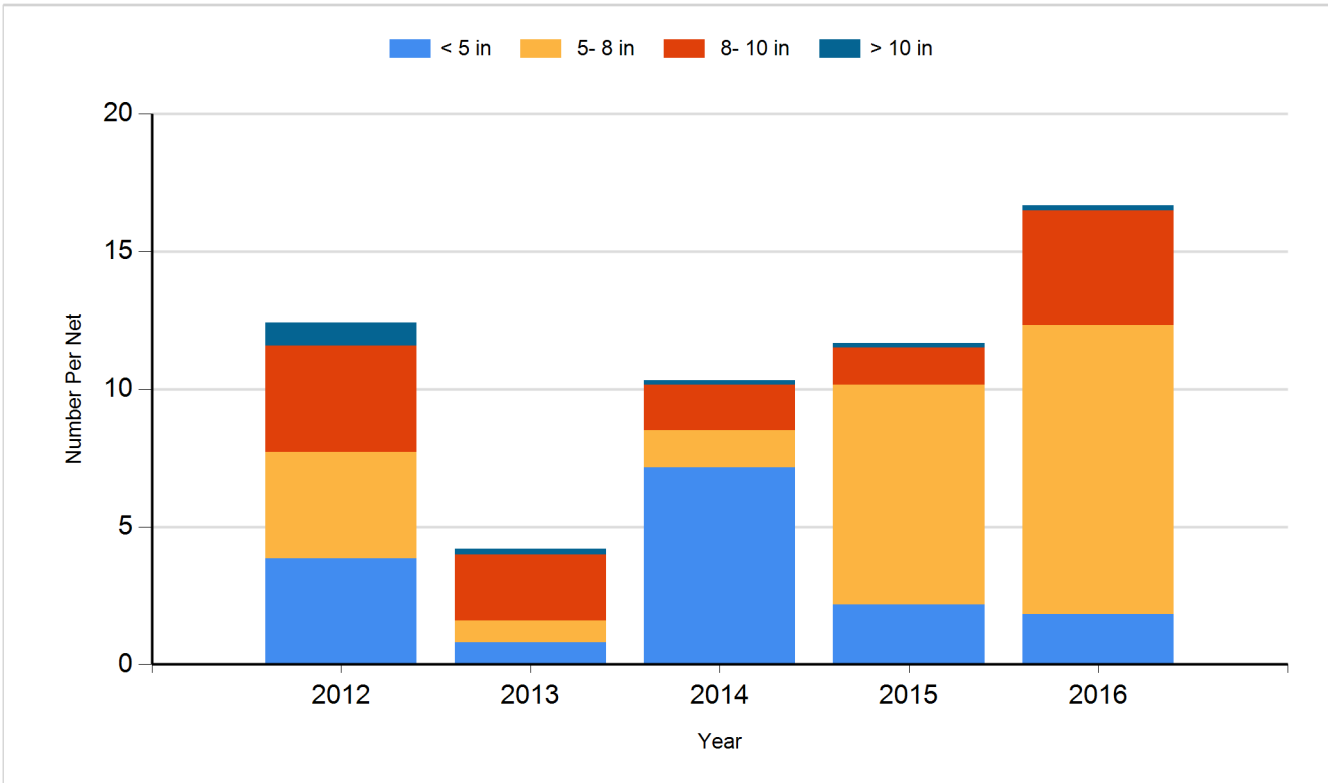
Species: White Crappie
Gear: frame net (std 3/4 in)



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
2012	Gizzard Shad	Adult	37
2012	Yellow Perch	Adult	2,507
2013	Bluegill	Adult	660
2013	Gizzard Shad	Adult	111
2014	Gizzard Shad	Adult	220
2014	Yellow Perch	Adult	2,150
2015	Yellow Perch	Adult	1,600
2019	Yellow Perch	Adult	1,050
2021	Yellow Perch	Adult	3,000
2022	Yellow Perch	Adult	12,800
2023	Gizzard Shad		225
2023	Gizzard Shad	Adult	250
2023	Yellow Perch		8,000
2023	Yellow Perch	Adult	15,500