MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION
JOB PROGRESS REPORT

STATE: MONTANA PROJECT TITLE: STATEWIDE FISHERIES INVESTIGATIONS

PROJECT NO.: F-78-R-6 STUDY TITLE: SURVEY AND INVENTORY OF WARMWATER LAKES

JOB NO.: IV-C JOB TITLE: FORT PECK RESERVOIR STUDY

PROJECT PERIOD: JULY 1, 2019 THROUGH JUNE 30, 2020
REPORT PERIOD: MARCH 1, 2019 THROUGH FEBRUARY 29, 2020

ABSTRACT

Fort Peck Reservoir reached peak elevation on July 14th, 2019 at 2246.8 mean feet above sea level (MSL) from a minimum elevation on March 5th, 2019 at 2234.33 MSL, an increase of 12.47 feet. Spawning walleye populations were sampled in the upper Big Dry Arm with modified fyke nets from April 11th to April 26th, 2019. Walleye eggs were collected and the fertilized eggs were sent to Fort Peck and Miles City fish hatcheries. Trap netting (non-standardized) captured 2,058 walleye for a catch rate of 10.0 per net night which was up from the previous year of 5.7 per net night. Due to favorable spawning conditions, 68 million walleye eggs were collected. A total of 21.7 million fry and 1.9 million walleye fingerlings were stocked in various locations throughout Fort Peck Reservoir. One hundred gill nets were set in standard locations throughout the reservoir from July 17th to August 16th, 2019. Walleye, northern pike, and common carp were the most abundant species captured overall, with catch rates of 4.9, 3.0, and 2.3 per net night, respectively. Relative abundance of walleye in 2019 was up from the previous year at 4.9 per net night and above the long-term average of 3.9 per net for the period from (1989 to 2019). Gill-netted walleye averaged 16.7 inches and 2.3 pounds. In 2019, relative abundance increased slightly for stock-size walleye while catch rates for all other length groups remained similar. Relative weights of walleye for all size groups decreased slightly in 2019. Northern pike relative abundance increased to 3.0 per net night which is above the long-term average of 2.0 per net night for the period of 1989 to 2019. Average size of gill-netted northern pike was 24.7 inches and 4.0 pounds. Overall, relative abundance of shoreline forage was up from the previous year at 244.3 per haul in 2019 and above the long-term average of 166.9 per haul from 1989 to 2019. Relative abundance of young-of-year crappie showed the largest increase in 2019 at 101.2 per seine haul. A total of 533,867 chinook salmon were stocked at Duck Creek, Rock Creek, and Pines Bay in May and June of 2019 at an average size of 43.6 fish/pound. Young-of-year cisco relative abundance decreased to 0 per net night in 2019 which was below the long-term average of 75.1 per net night for the period of 1989 to 2019.

OBJECTIVES AND DEGREE OF ATTAINMENT

Activity 1 - Survey and Inventory

Objective: To survey and monitor the characteristics and trends of fish populations and to assess habitat conditions in Fort Peck Reservoir. This objective was met and is presented in the Results and Discussion section of this report.

Activity 2 - Fish Population Management

Objective: To implement fish stocking programs to maintain fish populations at levels consistent with habitat conditions and other limiting factors. This objective was met and results are presented in Results and Discussion of this report.

Activity 3 - Technical Guidance

Objective: To review projects by government agencies and private parties that have the potential to affect fisheries resources, provide technical advice or decisions to mitigate effects on these resources, and provide landowners and other private parties with technical advice and information to sustain and enhance fisheries resources. This objective was met by evaluating the impact of reservoir water levels on the Fort Peck Reservoir fishery and was presented to North and South Dakota fisheries personnel during annual Missouri River mainstem reservoir meetings. This information was also presented to Corps of Engineers to make recommendations for Annual Operating Plan (AOP). Objectives of the Fort Peck Reservoir Fisheries Management Plan (FPRFMP) are presented in the Results and Discussion of this report. The FPRFMP will guide fisheries management activities on Fort Peck Reservoir for a ten-year period (2012-2022). Objective accomplished.

Activity 4 - Aquatic Education

Objective: To enhance the public's understanding, awareness and support of the state's fishery and aquatic resources and to assist young people to develop angling skills and to appreciate the aquatic environment. Sixty-seven volunteers assisted with the annual walleye egg-taking operation in the upper Big Dry Arm of Fort Peck Reservoir in 2019. Reservoir staff assisted with kids fishing clinics and as science fair judges. Staff also assisted the regional information and education officer with multiple press releases, interviews on the Montana Outdoor Radio Show, and fisheries information for the R6 Facebook page. Staff attended Walleyes Unlimited meetings in Billings, Lewistown, and Glendive to present annual updates on the status of the Fort Peck Reservoir fishery. Staff also presented presentations and updates to Region 6 CAC members. Objective accomplished.

STUDY AREA

Fort Peck Reservoir is a large earth-filled dam on the Missouri River located in northeastern Montana. Figure 1 depicts major roads around Fort Peck Reservoir, select locations and 5 sampling regions the reservoir is divided into: upper Big Dry Arm (UBD), lower Big Dry Arm (LBD), lower Missouri Arm (LMA), middle Missouri Arm (MMA), and upper Missouri Arm (UMA). The dam was closed in 1937 and is the largest water body in the state of Montana, with 240,000 surface acres at full multiple use pool. Full flood pool is reached at 2250 and multiple use pool is reached at 2246 mean feet above sea level (MSL). At full multiple use pool 1,500 miles of shoreline exists in 130 linear miles of the reservoir with a maximum depth of 220 feet. The bottom of the multiple use pool is 2234.19 MSL and the bottom of the multipurpose carryover zone is 2160 feet MSL. Fort Peck Reservoir reached peak elevation on July 14th, 2019 at 2246.8 mean feet above sea level (MSL) from a minimum elevation on March 5th, 2019 at 2234.33 MSL, an increase of 12.47 feet (Figure 2). Reservoir elevations are predicted to rise approximately 5 feet from March through July and fall beginning in July of 2020 based on the December median runoff forecast (USACE 2019).

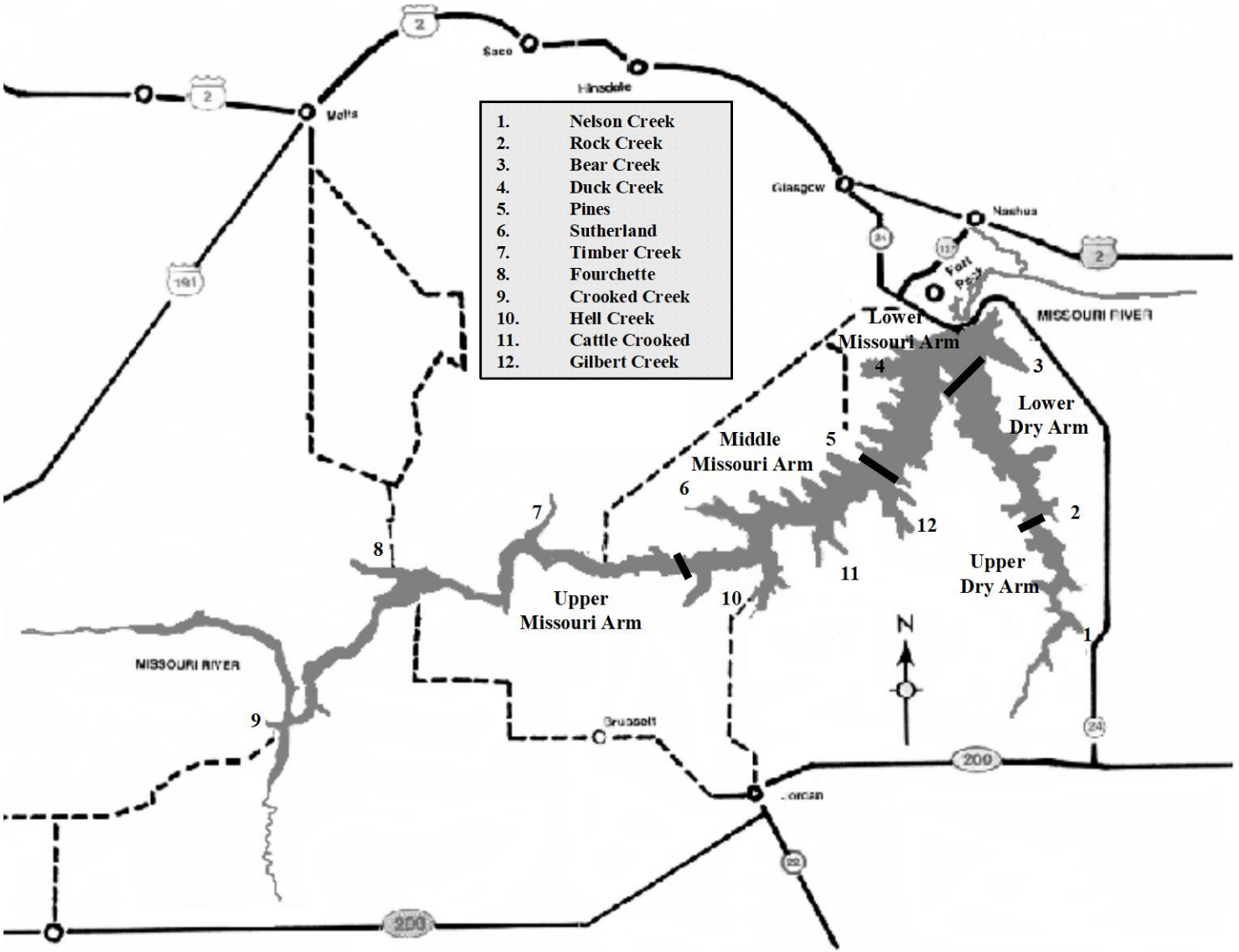


Figure 1. Fort Peck study area describing major sampling zones and select specific locations.

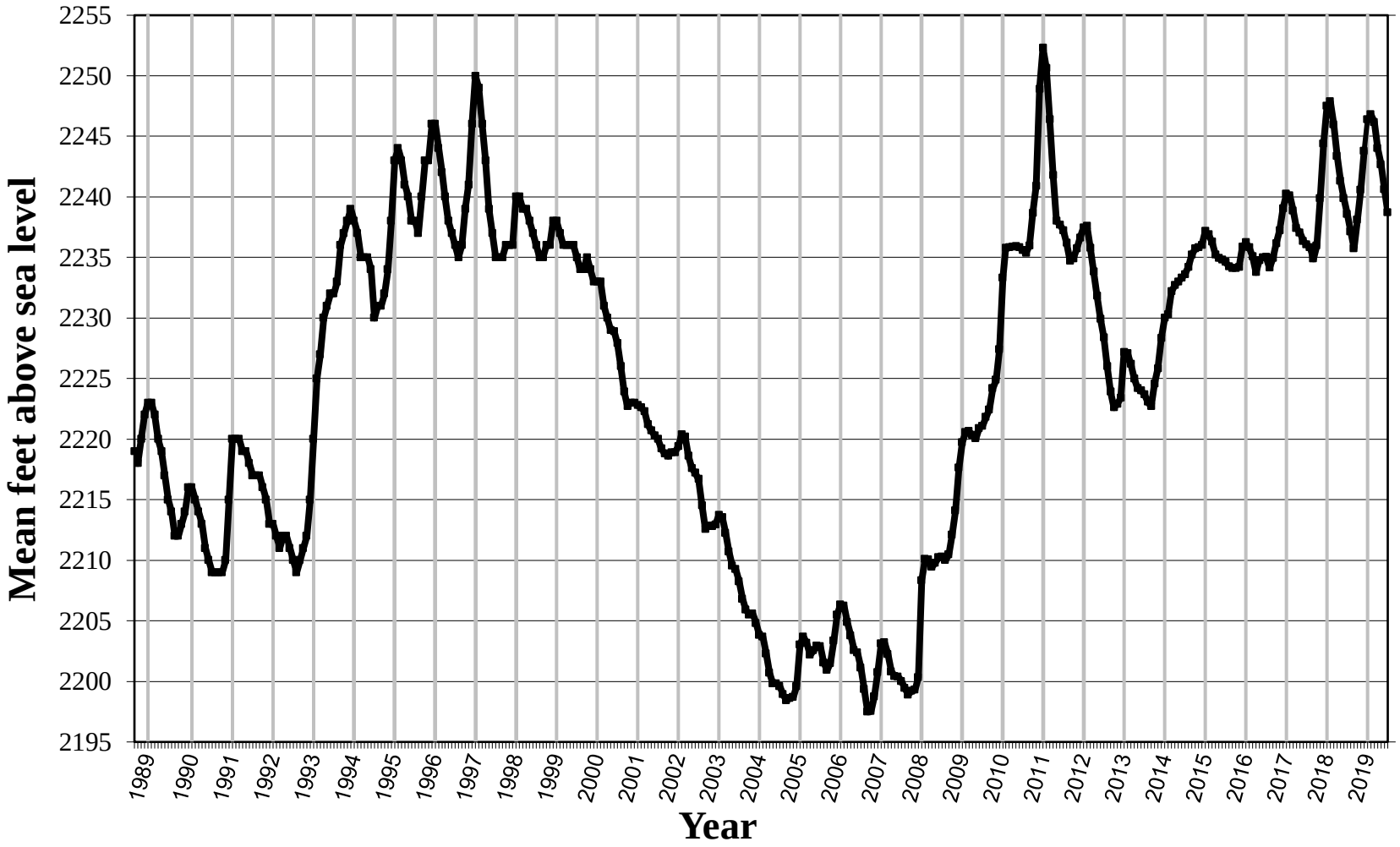


Figure 2. Peak monthly reservoir elevations on Fort Peck Reservoir from January 1989 to January 2019 (Data provided by the U.S. Army Corps of Engineers).

SAMPLING METHODS

Data Collection

- Spring trap netting efforts were conducted from April 11th to April 26th, 2019 in the Big Dry Arm with 4-ft x 6-ft modified fyke nets of 1-in square mesh rigged and 30 to 50-ft leads. These sites are not standardized due to fluctuations in reservoir elevations. This netting effort is targeted for collection of walleye and northern pike to provide an egg source to meet stocking requests for Fort Peck Reservoir and other sport fisheries for the state of Montana. Not all fish are weighed and measured during the egg-taking effort due to time constraints, limited manpower, and rough conditions at times. Therefore, subsamples of fish are presented in the tables and length frequency distributions of this report. Vokoun et al. (2001) recommended using 300-400 individuals when constructing length frequency distributions with a given accuracy and precision.
- Limnological sampling was conducted at six sites (Bug Creek, Spring Creek, Haxby, Pines, Hell Creek, and Timber Creek) throughout the reservoir. Profile measurements were collected at 10-ft intervals using a Hydrolab equipped with a DS5 probe and Surveyor 4 data logger from May through September during the middle of each month. Profile measurements were recorded from the subsurface to the maximum depth at each site. Specific measurements included: temperature (°C), dissolved oxygen (mg/L), pH (standard units), turbidity (NTU), and total dissolved solids (g/L). A detailed table is located in Appendix 3 of the report.
- Zooplankton samples were collected using a 153 µ mesh net with a 12-in diameter opening and a 1:3 cone. Sampling was conducted at the same six sites listed above to address differences in general productivity and morphology of the reservoir. Fifty-foot vertical tows were made monthly at each of the sampling stations from May through September. Two tows were conducted at each site and pooled into one sample. Zooplankton processing methods follow those described by Leathe and Graham (1982).
- One hundred sinking experimental multifilament gill nets 125-ft x 6-ft deep consisting of 25-ft panels of ¾, 1, 1 ¼, 1 ½, and 2-in square mesh were fished from 10 to 30-ft depths at standardized locations. Gill netting occurred from July 17th to August 16th, 2019 to monitor distribution, species composition, relative abundance, and population parameters for game and native species throughout the reservoir. A list of sampling dates by region, water surface temperature and reservoir elevation during time of sampling are presented in Appendix 3.
- Walleye otoliths were removed from all walleye collected during reservoir-wide gillnetting. Otoliths were mounted in epoxy and cut into thin sections on an Isomet saw and later mounted on glass slides. Walleye otoliths were used as an aging structure because of their higher precision when compared to scales and spines (Erickson 1983; Isermann et al. 2003). Growth was expressed as mean length-at-age at time of capture in July/August for walleye.
- Beach seining was conducted from August 13th to September 4th, 2019 using a 100-ft x 9-ft beach seine of 3/16-in square mesh at 100 standardized locations throughout the reservoir, to determine relative abundance and reproductive success of game and forage fish.
- Twelve multifilament gill nets 100-ft x 6-ft with ½-in square mesh were fished vertically from the water's surface to sample young-of-year cisco from September 19th to October 4th, 2019. Additional mesh sizes of ¾, 1, 1 ¼, 1 ½-in mesh were incorporated in 2013 to sample adult cisco. Only the lower Big Dry, lower Missouri, and middle Missouri Arms were sampled because they contained sufficient depths of 100 ft. Lengths and weights were collected from the first 100 cisco captured per mesh, per site.
- Boat mounted electrofishing was used during October 4th to October 24th, 2019 to locate, sample, and collect chinook salmon as part of the annual egg-take effort.
- Chinook salmon otoliths were collected from all fish used in the egg taking process. Otolith preparation followed methods outlined by Secor et al. (1992). Otoliths were mounted in epoxy and cut into thin sections on an Isomet saw and later mounted on glass slides.

Data Analysis

Relative abundance of fish species was expressed as mean catch per unit effort (CPUE) for modified fyke nets (No./net night), gill net (No./net night), and seine catches (No./haul).

Proportional stock density (PSD; Anderson and Weithman 1978) and relative stock density (RSD) values were calculated for channel catfish, northern pike, sauger, smallmouth bass, and walleye (Gablehouse 1984). However, the terminology to PSD has been changed to proportional size distribution and use of RSD was discontinued to assist in communication and name the index more correctly (Guy et al. 2007). Length categories used to calculate PSD values are listed in Table 1.

Table 1. Minimum lengths (in) of length-class designations used when calculating proportional size distribution values for fish population survey samples.

Species	Length Class				
	Stock	Quality	Preferred	Memorable	Trophy
Channel catfish	11	16	24	28	36
Northern pike	14	21	28	34	44
Sauger	8	12	15	20	25
Smallmouth bass	7	11	14	17	20
Walleye	10	15	20	25	30

Relative weights (*Wr*; Anderson 1980) were calculated using the standard weight (*Ws*) equations developed for channel catfish (Brown et al. 1995), northern pike (Willis 1989), and walleye (Murphy et al. 1990). Calculated values for channel catfish and northern pike are presented in Appendix 4, while values for walleye are presented in the results and discussion section of this report. Proportional size distribution, PSD-P, and *Wr* values were calculated using EXCEL.

RESULTS AND DISCUSSION

Spring Trap Netting

Spawning walleye and northern pike populations were sampled from Nelson Creek to McGuire Creek area of Fort Peck Reservoir from April 11th to April 26th, 2019. A total of 205-trap days were committed to walleye spawning efforts in 2019. Netting effort was lower than the previous year due to favorable water temperatures during trap netting efforts which led to increased catch rates of walleye and more eggs collected in a short amount of time. Ice cover has typically receded by the first week in April and the walleye spawning operation concludes in three to four weeks. Water surface temperatures were 43°F when trap netting efforts commenced and gradually increased to 51°F by April 16th. Walleye spawning activity peaks when water temperatures are 43°F to 50°F in the north-central United States (Becker 1983).

Because of normal ice-off conditions and gradually increasing water temperatures in 2019, the egg-take goal of 60 million was exceeded and 68 million total eggs were collected. Due to these favorable water temperatures and ice receding at a normal time, large numbers of ripe female walleye (42%) were captured during the operation. In addition, 33% of the female walleye captured were green and 24% were spent female walleye during the 2019 trap netting effort. In contrast, higher than normal numbers of spent female walleye were captured in 2018 compared to previous years due to late ice cover followed by a rapid increase in water temperatures. In 2018, 61% of the female walleye captured were spent compared to only 7% in 2017. It's possible some walleye ascended portions of the Big Dry Creek while there was still ice on the main portion of the reservoir and attempted to spawn in 2018. It should be noted that Liebelt (1979) observed natural reproduction of walleye during periods of higher reservoir elevations and higher inflows to the Big Dry Arm.

The fertilized walleye eggs were sent to Fort Peck and Miles City Fish Hatcheries. A total of 21.7 million fry and 1.9 million walleye fingerlings were stocked in various locations throughout Fort Peck Reservoir in 2019 (Appendix 2). Kerr (2011) recommended walleye release sites should be increased as size and basin complexity of the waterbody increases to distribute them over as wide an area as possible. The goal of 3 million fingerlings for Fort Peck Reservoir was not met (FPRFMP 2012). This was due to below average fingerling production at the Miles City and Fort Peck hatcheries. Fluctuating water temperatures were observed in the rearing ponds at Fort Peck and Miles City hatcheries during the time of fry stocking which likely reduced survival (i.e., Wade Geraets, personal communication).

Walleye

Relative abundance of walleye captured in spring trap nets was 10.0 per net in 2019, which increased from the previous year, and was above the long-term average of 6.7 per net (1989-2019; Table 2). Average length and weight were similar over the last two years; 21.1 inches in 2018 to 21.2 inches in 2019. Length frequency distributions showed 60% of walleye were greater than 20 inches in 2019 compared to 64% in 2018 (Figure 3). The combination of good numbers of female walleye measured in 2019 and large 2011-year class as indicated by the higher number of fish from 23-25 inches influenced this trend (Figure 4). Typically, more male walleye are captured than females during trap netting, but more females were captured in 2019. A total of 1,128 female and 821 male walleye were captured in 2019 compared to 808 female and 322 male walleye in 2018. In general, length frequency distributions during the spring trap netting effort indicated male walleye were smaller when compared to female; however, male walleye up to 28 inches were captured (Figure 4).

Table 2. Summary of mean CPUE (No./net-night), mean length (in), and mean weight (lb)walleye and northern pike captured during spring trap netting in the upper Big Dry Arm of Fort Peck Reservoir, 1989-2019. N is the total number of walleye and northern pike collected.

Year	Date	Net-Nights	Walleye N	Walleye CPUE	Northern pike N	Northern pike CPUE
1989	(4/25-5/06)	207	2,360	11.4	383	1.9
1990	(4/05-5/04)	292	1,863	6.4	513	1.8
1991	(4/09-5/10)	375	793	2.1	491	1.3
1992	(4/07-4/29)	278	1,585	5.7	684	2.5
1993	(4/15-4/30)	172	1,945	11.3	201	1.2
1994	(4/12-4/26)	168	1,882	11.2	160	1.0
1995	(4/11-4/28)	473	3,284	6.9	648	1.4
1996	(4/15-5/02)	391	3,231	8.3	2,307	5.9
1997	(4/15-4/29)	307	3,937	12.8	2,652	8.6
1998	(4/04-4/29)	477	2,806	5.9	1,354	2.8
1999	(3/27-4/26)	434	5,673	13.1	2,573	5.9
2000	(4/04-4/28)	392	2,126	5.4	603	1.5
2001	(4/06-4/27)	328	3,362	10.3	1,922	5.9
2002	(4/17-5/09)	349	2,377	6.8	1,713	4.9
2003	(4/11-5/01)	426	2,366	5.6	1,579	3.7
2004	(4/09-4/26)	324	2,323	7.2	2,174	6.7
2005	(4/06-4/27)	537	2,030	3.8	1,327	2.5
2006	(4/12-5/01)	579	2,345	4.1	503	0.9
2007	(4/03-5/01)	617	2,478	4	1,425	2.3
2008	(4/18-5/07)	383	1,151	3	629	1.6
2009	(4/18-4/28)	176	1,740	9.9	813	4.6
2010	(4/13-4/30)	289	1,470	5.1	525	1.8
2011	(4/18-5/06)	399	1,341	2.8	911	2.3
2012	(3/27-5/01)	730	1,576	2.2	1,499	2.1
2013	(4/17-5/10)	484	2,176	4.5	5,082	10.5
2014	(4/18-5/05)	363	1,670	4.6	2,864	7.9
2015	(3/31-4/23)	405	1,740	4.3	1,147	2.8
2016	(3/29-4/21)	427	2,672	6.3	2,382	5.6
2017	(4/05-4/23)	277	2,261	8.2	1,040	3.8
2018	(4/23-5/08)	255	1,280	5.7	936	4.2
2019	(4/11-4/26)	205	2,058	10.0	1,301	6.3

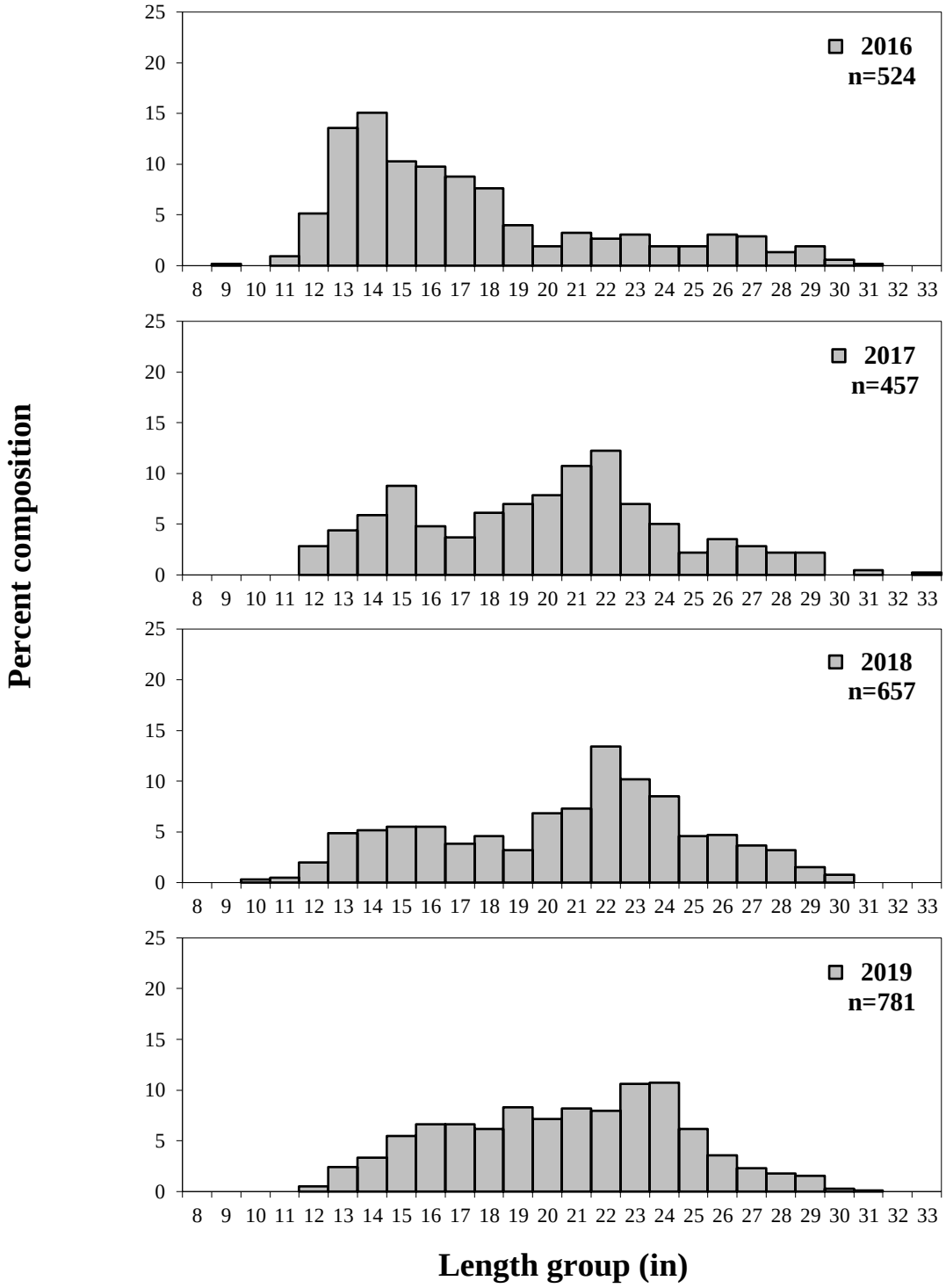


Figure 3. Length frequency of subsampled walleye collected during spring trap netting in the upper Big Dry Arm of Fort Peck Reservoir, 2016-2019.

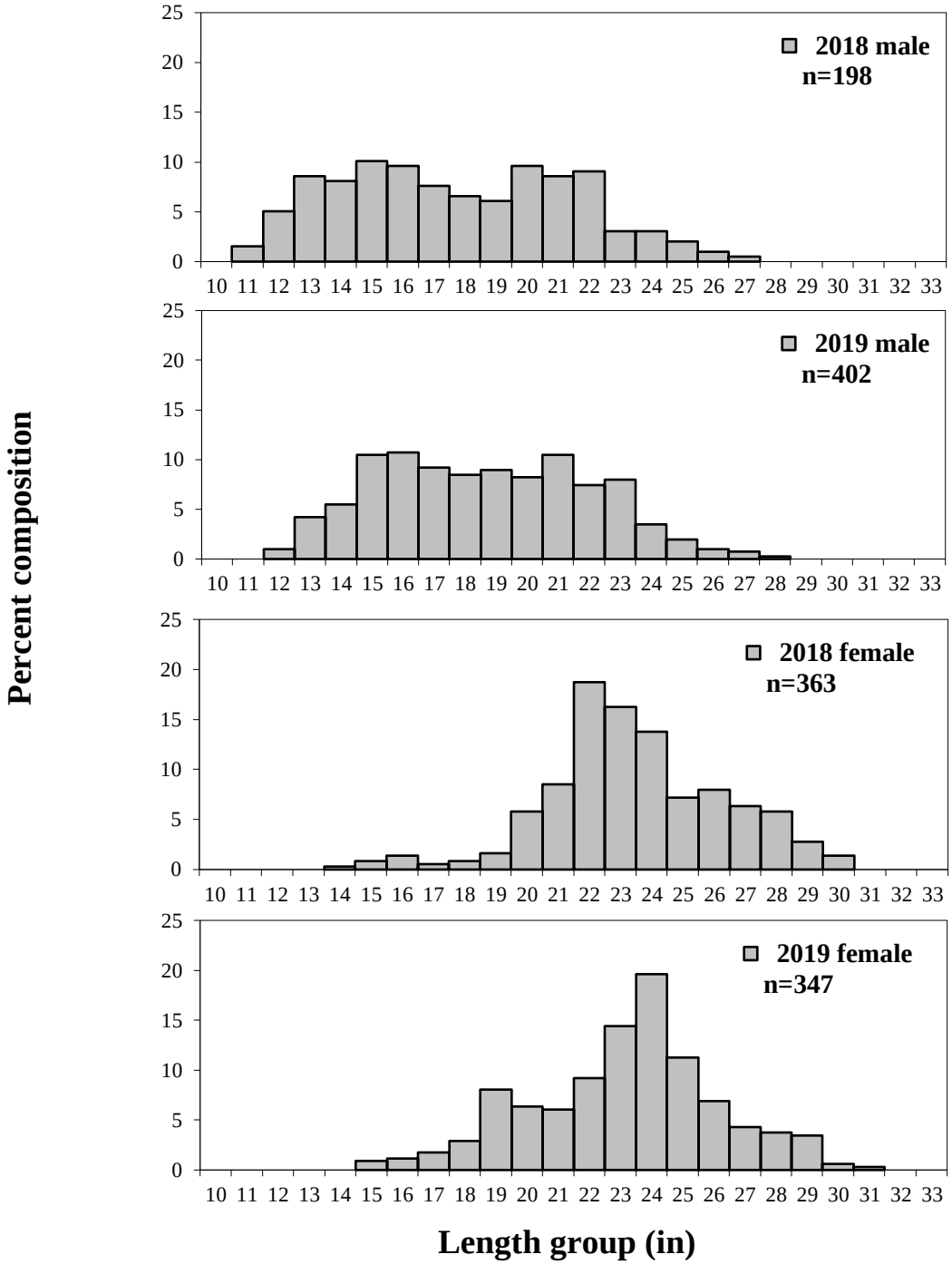


Figure 4. Length frequency of subsampled male and female walleye collected during spring trap netting in the upper Big Dry Arm of Fort Peck Reservoir, 2018-2019.

LIMNOLOGY AND ZOOPLANKTON MONITORING

Water temperature in Fort Peck Reservoir ranged from 22.3°C at the subsurface to 3.8°C at the bottom (Appendix 3). Temperatures throughout the water column were coolest during May and warmest during August. Water temperatures below the surface were warmest at the uppermost sites (Timber Creek and Bug Creek) during the sampling period but gradually decreased at each site moving downstream towards the dam area.

Near isothermal conditions are observed during the month of May at each site. Thermal stratification of Fort Peck Reservoir was not observed until July and strong thermoclines were present in August and September (Appendix 3). Each site was thermally stratified during the month of August and continued into September with the exception of Timber Creek. Thermocline depth varied by month and site. The most pronounced thermocline was located at the Haxby site during July (Figure 5; Appendix 3).

Dissolved oxygen concentrations at the subsurface were highest (10.9 mg/L) during May when the reservoir was coolest. More uniform dissolved oxygen levels were also observed during this time when near isothermal conditions were present (Appendix 3). Dissolved oxygen concentrations decreased to their lowest levels during late summer/early fall. Dissolved oxygen levels fell below 5 mg/L at Hell Creek and Timber Creek during August and September. It should be noted that dissolved oxygen levels of less than 5 mg/L may limit some deep-water salmonid habitat (e.g., lake trout; Sellers et al. 1998). No anoxic conditions were observed at any of the locations in 2019.

The maximum estimated zooplankton density was 110.3/L which occurred in May of 2019 and was comprised largely of rotifers. Cyclopoids represented the zooplankton community throughout the sampling season and highest densities were observed during June at 31.8/L. *Daphnia* were the most abundant cladoceran sampled and were most abundant during July (Figure 6). Cladocerans, *Leptodora* and *Diaphanosoma*, were present in small numbers and were only collected periodically. These trends in seasonal abundance are similar to previous findings on Fort Peck Reservoir and other large mainstem Missouri River Reservoir systems (Wiedenheft 1985; Mullins 1991; Fielder 1992).

Comparison of total densities for all zooplankton from each station varied slightly by year and location (Figure 7). Wiedenheft (1985) noted a similar trend in zooplankton density. Mean densities of zooplankton by location in 2019 was similar to those observed in 2018. A possible explanation for the similar zooplankton densities in 2019 and 2018 could be explained by higher reservoir elevations and increased flows into the reservoir. Higher inflows into Fort Peck Reservoir occurred in 2018 and 2019, which increased reservoir elevations, due to higher than normal plains and mountain snowpack. Increased inflows and increases in reservoir elevation have been shown to increase standing crops of zooplankton and diversity of the zooplankton community (Martin et al. 1981).

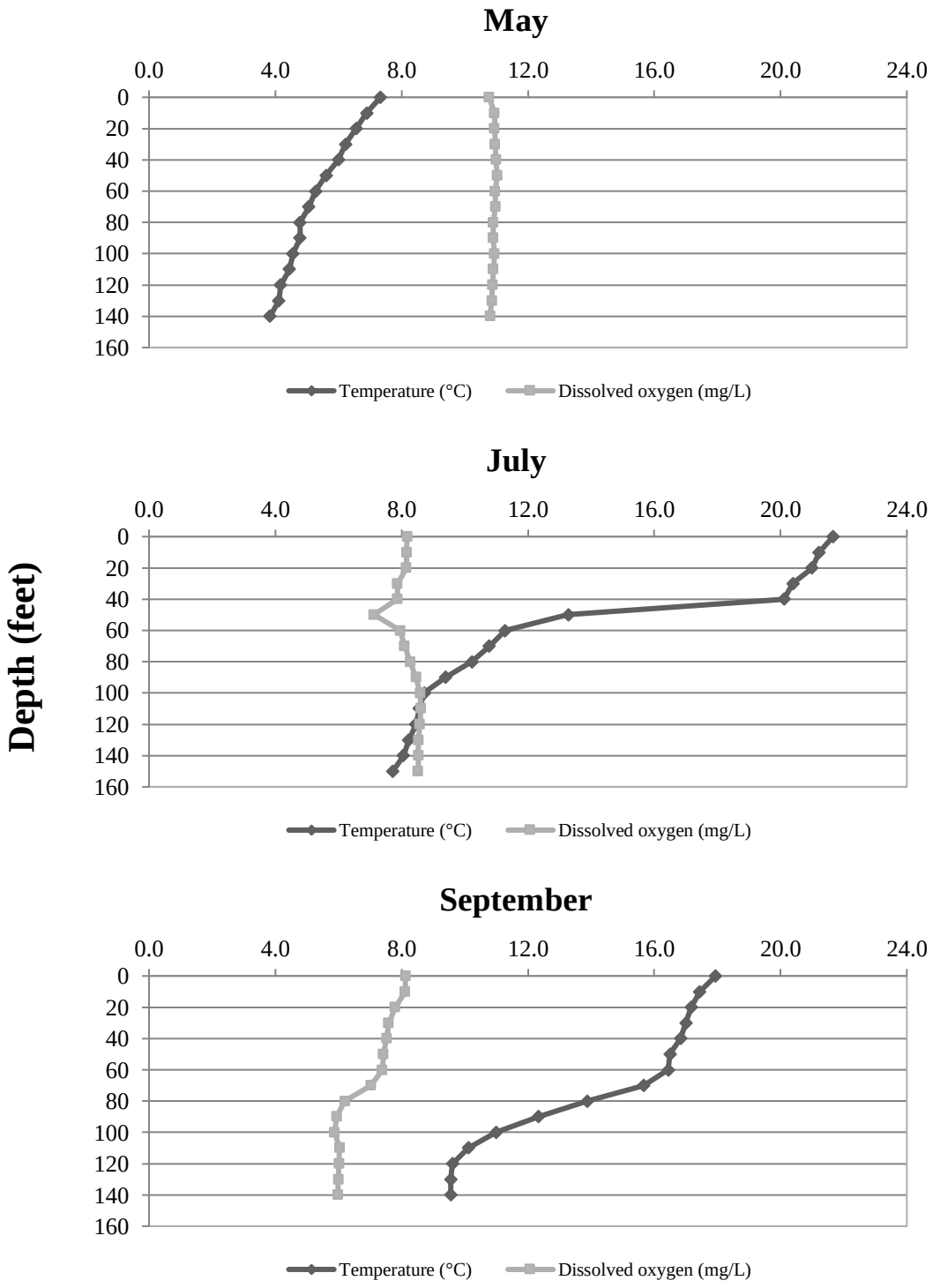


Figure 5. Depth profiles of temperature (°C) and oxygen (mg/L) located near Haxby Point on Fort Peck Reservoir, May-September 2019.

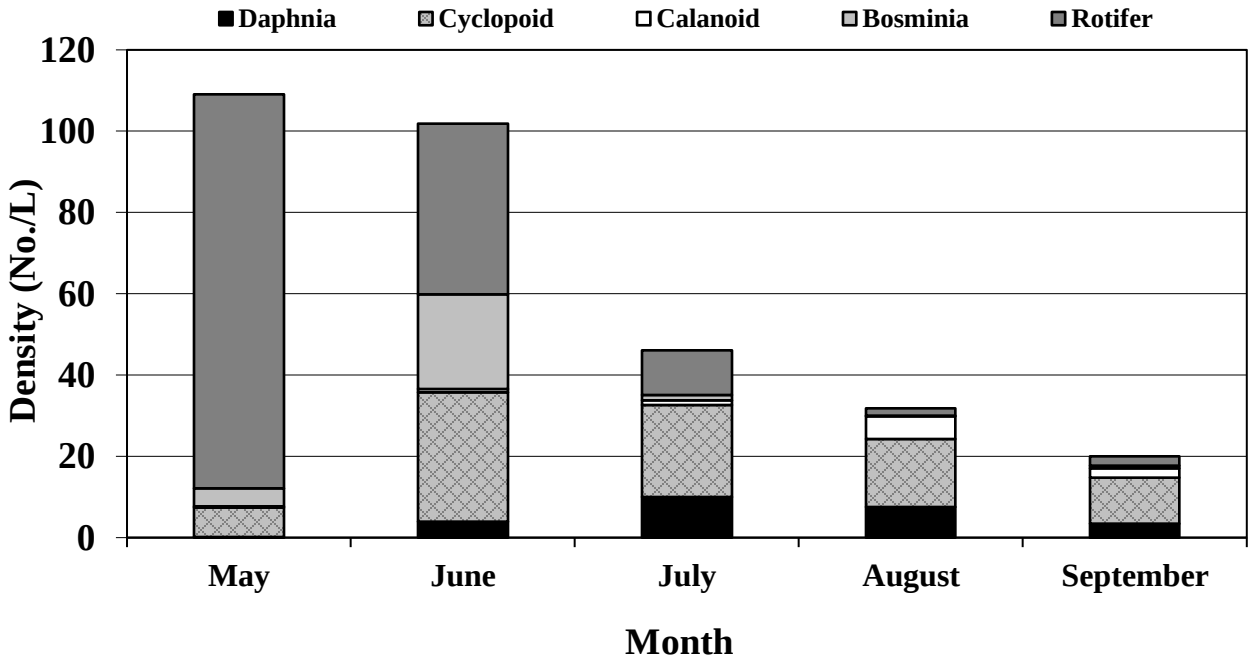


Figure 6. Mean zooplankton density (number of organisms/L) pooled from reservoir-wide samples by taxonomic group and month for Fort Peck Reservoir, 2019.

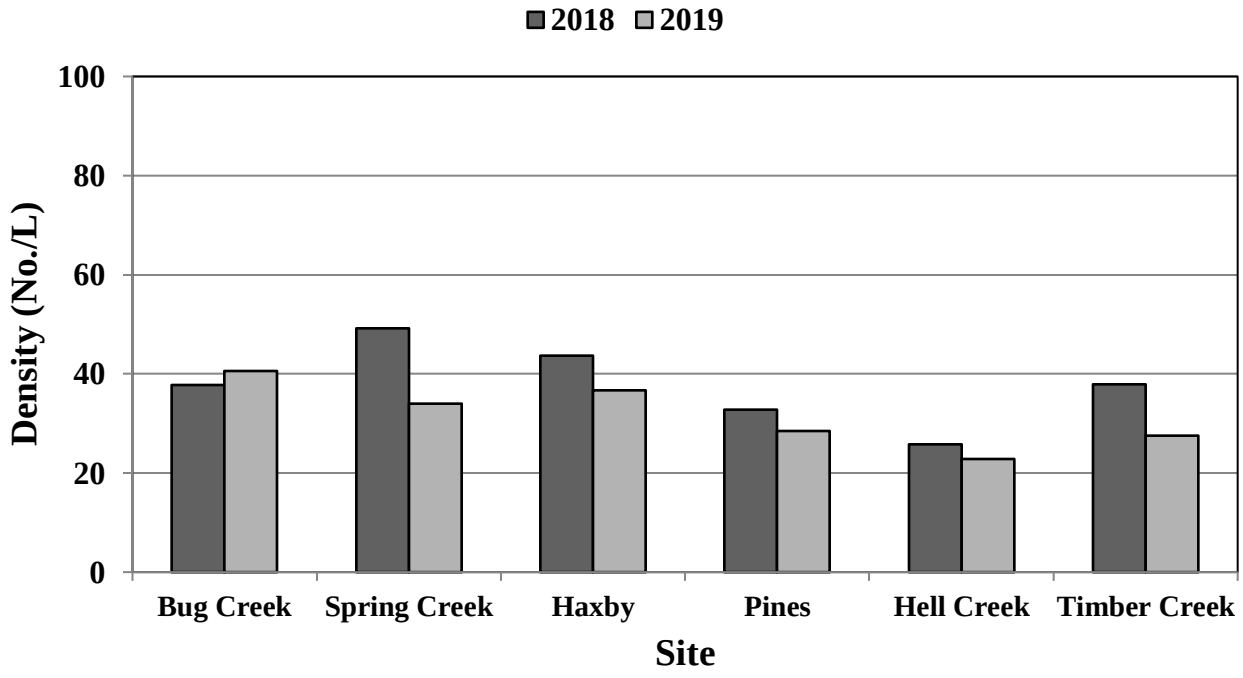


Figure 7. Mean zooplankton density (number of organisms/L) pooled for all months (May-September) for Fort Peck Reservoir, 2018-2019.

RESERVOIR-WIDE GILL NETTING

Standard experimental gill nets were set throughout the reservoir from July 17th to August 16th, 2019 when water surface temperatures ranged from 69.2°F to 77.4°F. Gill netting provides information on species distribution; composition, relative abundance, population parameters, and stomach contents of game species. Fifteen species were captured for a total of 2,159 fish (Table 2). Walleye, northern pike, and common carp were the most abundant species captured overall, with catch rates of 4.9, 3.0, and 2.3 per net night, respectively. Fish with catch rates equal to or greater than 1.0 per-net night include: channel catfish, goldeye, river carpsucker, shorthead redhorse, smallmouth bass, smallmouth buffalo, and yellow perch.

Walleye

Relative abundance of walleye in 2019 was 4.7 per net which was up slightly from the previous year (Figure 8). This was above the long-term average of 3.9 per net from 1989 to 2019. The three-year running average goal of 3.6 per net was met (4.2 per net in 2017-2019) as outlined in the FPRFMP. Quality and stock-length groups comprised the largest group of walleye sampled in 2019 suggesting favorable growth and survival (Figure 8). Relative abundance of walleye was greatest in the upper Missouri arm with a catch rate of 6.0 per net (Table 3).

Length frequency distributions of walleye in 2019 indicated a large abundance of 11 to 15-inch fish that comprised 49% of the walleye sampled in 2019. Walleye ranging from 23 to 28 inches represented 18% of all walleye sampled (Figure 9). In 2018, this group measured 21 to 25-inches and represented 25% of all walleye captured and 32% of all walleye gill netted in 2017 as 19 to 22-inch fish. In 2016, this group was in the 17 to 21-inch range and comprised 39% of all walleye captured suggesting a large year class(es) present. Based on length frequencies, walleye in Fort Peck Reservoir don't recruit to experimental gill nets until they are greater than 10 inches in length.

Mean length-at-age for walleye in 2019 varied compared to the six-year average (Table 5). Mean lengths-at-age were slightly higher for age-10 and older fish indicating favorable growth over the last few years due to higher relative abundance of large, adult cisco. In contrast, mean lengths-at-age for age-4 to age-9 were lower in 2019 compared to the average. A large group of age-2 and age-5 walleye were documented which comprised 34% of all walleye aged. The 2011-year class (8-year old fish) comprised 13% of all walleye sampled. This year class comprised 21% of all walleye aged in 2018. Maximum age of walleye sampled was 26.

Overall, relative weights of walleye in 2019 decreased compared to the previous year (Table 6). The most notable decrease in relative weights were for stock and quality length groups (Figure 10). Relative weights for all length groups of walleyes captured in 2019 were higher than the drought/low water years of 2005-2008. The stable relative weights of preferred and memorable+ length groups of walleye can be attributed to an abundance of adult cisco (>8") currently in the system. Cisco have been found to be an important prey item for walleye greater than 18 inches in Fort Peck Reservoir (Mullins 1991).

Since 1992, walleye PSD would have fallen into the favorable category, with the exception of 1995 and 1996. The favorable trend resumed in 1998 and continued into 2015 with a value of 59 (Table 6). However, PSD of walleye in 2016 was 72 making it the highest on record and PSD-P was 34 indicating a greater abundance of preferred size walleye. A ratio between 10 and 20 is considered desirable as a PSD-P for a balanced population. High values of PSD-P indicate an abundance of larger fish with a small stock size available. PSD and PSD-P in 2019 decreased to 53 and 29, respectively. This would suggest an improvement in stock length fish.

Table 3. Mean CPUE (No./net-night), mean length (in), and mean weight (lb) of fish collected by experimental gill nets in Fort Peck Reservoir during July-August, 2019. *N* is total number collected for length and weight measurements.

			Average			
			Length		Weight	
Species	Number	CPUE	Inches	*N*	Pounds	*N*
Black bullhead	2	0.0	6.5	2	0.1	2
Black crappie	18	0.2	9.5	18	0.5	18
Bluegill	1	0.0	6.1	1	0.1	1
Channel catfish	110	1.1	20.3	110	3.1	110
Cisco	8	0.1	8.7	8	0.2	8
Common carp	233	2.3	21.5	233	4.7	233
Freshwater drum	80	0.8	15.8	80	2.0	80
Goldeye	143	1.4	12.9	143	0.7	143
Green sunfish	1	0.0	6.9	1	0.4	1
Northern pike	302	3.0	24.7	302	4.0	302
Paddlefish	1	0.0	0.0	1	0.0	1
River carpsucker	116	1.2	20.7	116	4.7	116
Sauger	13	0.1	16.0	13	1.5	13
Shorthead redhorse	147	1.5	15.3	147	1.5	147
Smallmouth bass	174	1.7	12.7	174	1.3	174
Smallmouth buffalo	101	1.0	25.3	101	9.6	101
Walleye	494	4.9	16.7	494	2.3	494
White crappie	1	0.0	11.7	1	0.8	1
White sucker	8	0.1	16.0	8	1.7	8
Yellow perch	206	2.1	6.2	204	0.1	204

Table 4. Number (*N*) and mean catch per unit effort (CPUE; No./net-night) of fish species collected by experimental gill nets in Fort Peck Reservoir during July-August, 2019.

	UBD[1]		LBD[2]		LMA[3]		MMA[4]		UMA[5]		Total	
Species	N	CPUE	N	CPUE	N	CPUE	N	CPUE	N	CPUE	N	CPUE
Black bullhead	0	--	1	<0.1	0	--	0	--	1	0.05	2	<0.1
Black crappie	2	0.1	0	--	0	--	1	<0.1	15	0.8	18	0.2
Bluegill	0	--	0	--	0	--	0	--	1	<0.1	1	<0.1
Channel catfish	18	0.9	11	0.6	11	0.6	13	0.7	57	2.9	110	1.1
Cisco	2	0.1	2	0.1	1	<0.1	3	0.2	0	--	8	<0.1
Common carp	28	1.4	44	2.2	42	2.1	63	3.2	56	2.8	233	2.3
Freshwater drum	14	0.7	12	0.6	14	0.7	6	0.3	34	1.7	80	0.8
Goldeye	37	1.9	5	0.3	21	1.1	16	0.8	64	3.2	143	1.4
Green sunfish	0	--	0	--	0	--	0	--	1	<0.1	1	<0.1
Northern pike	81	4.1	76	3.8	53	2.7	56	2.8	36	1.8	302	3.0
Paddlefish	0	--	0	--	0	--	0	--	1	<0.1	1	<0.1
River carpsucker	19	1.0	26	1.3	5	0.3	22	1.1	44	2.2	116	1.2
Sauger	0	--	0	--	2	0.1	0	--	11	0.6	13	0.1
Shorthead redhorse	30	1.5	13	0.7	2	0.1	12	0.6	90	4.5	147	1.5
Smallmouth bass	31	1.6	64	3.2	21	1.1	29	1.5	29	1.5	174	1.7
Smallmouth buffalo	16	0.8	21	1.1	10	0.5	26	1.3	28	1.4	101	1.0
Walleye	92	4.6	82	4.1	110	5.5	91	4.6	119	6.0	494	4.9
White crappie	0	--	0	--	0	--	0	--	1	<0.1	1	<0.1
White sucker	3	0.2	1	<0.1	2	0.1	1	0.1	1	<0.1	8	<0.1
Yellow perch	62	3.1	11	0.6	24	1.2	65	3.3	44	2.2	206	2.1
Total	435	21.75	369	18.45	318	15.9	404	20.2	633	31.65	2,159	21.59

[1]Upper Big Dry (UBD): Nelson Creek., Lone Tree Creek, McGuire Creek, Bug Creek, Lost Creek
[2]Lower Big Dry (LBD): Box Creek, South Fork Rock Creek, North Fork Rock Creek, Box Elder Creek, Sand Arroyo, Spring Creek
[3]Lower Missouri Arm (LMA): Spillway Bay, Bear Creek, North Fork Duck Creek, South Fork Duck Creek, Main Duck Creek
[4]Middle Missouri Arm (MMA): Pines Bay, Gilbert Creek, Cattle/Crooked Creek, Hell Creek, Sutherland Creek, Snow Creek
[5]Upper Missouri Arm (UMA): Cabin Coulee, Wagon Coulee, Bone Trail, Timber Creek, Seven Blackfoot, Fourchette Bay, Devils Creek

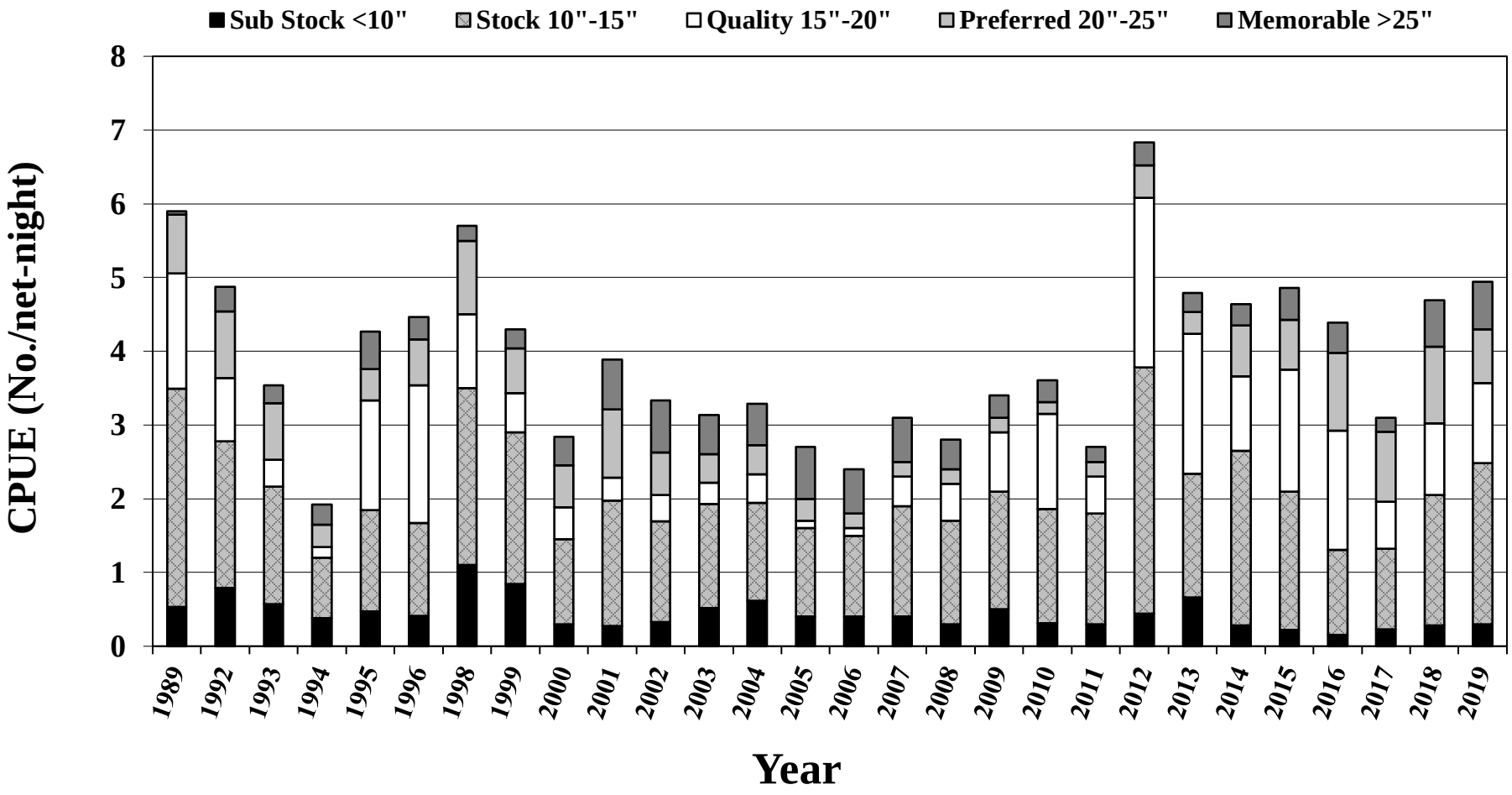


Figure 8. Catch per unit effort (CPUE) of PSD category of walleye collected by experimental gill nets throughout Fort Peck Reservoir during July-August, 1988-2019 (no data for 1990-1991 and 1997).

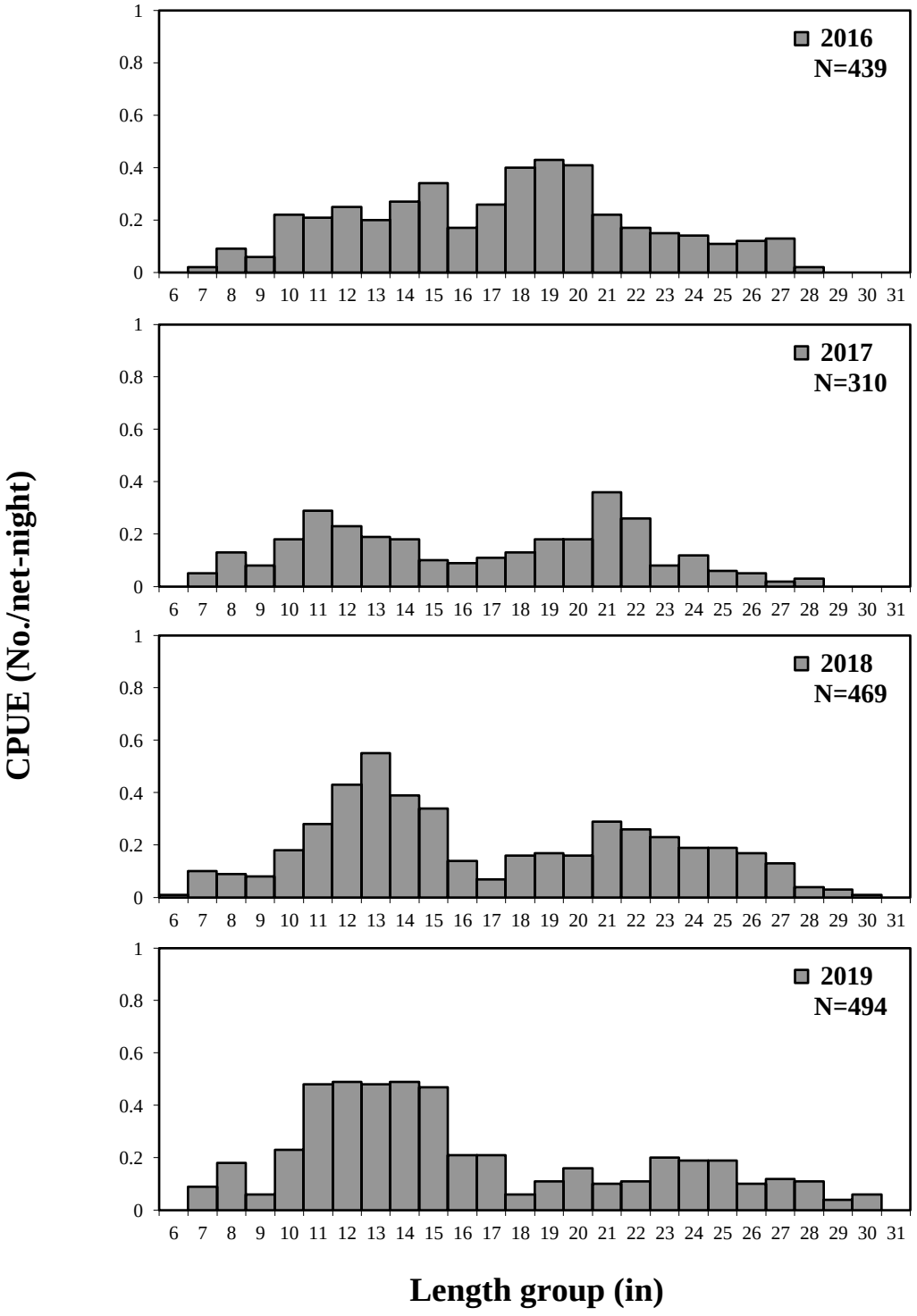
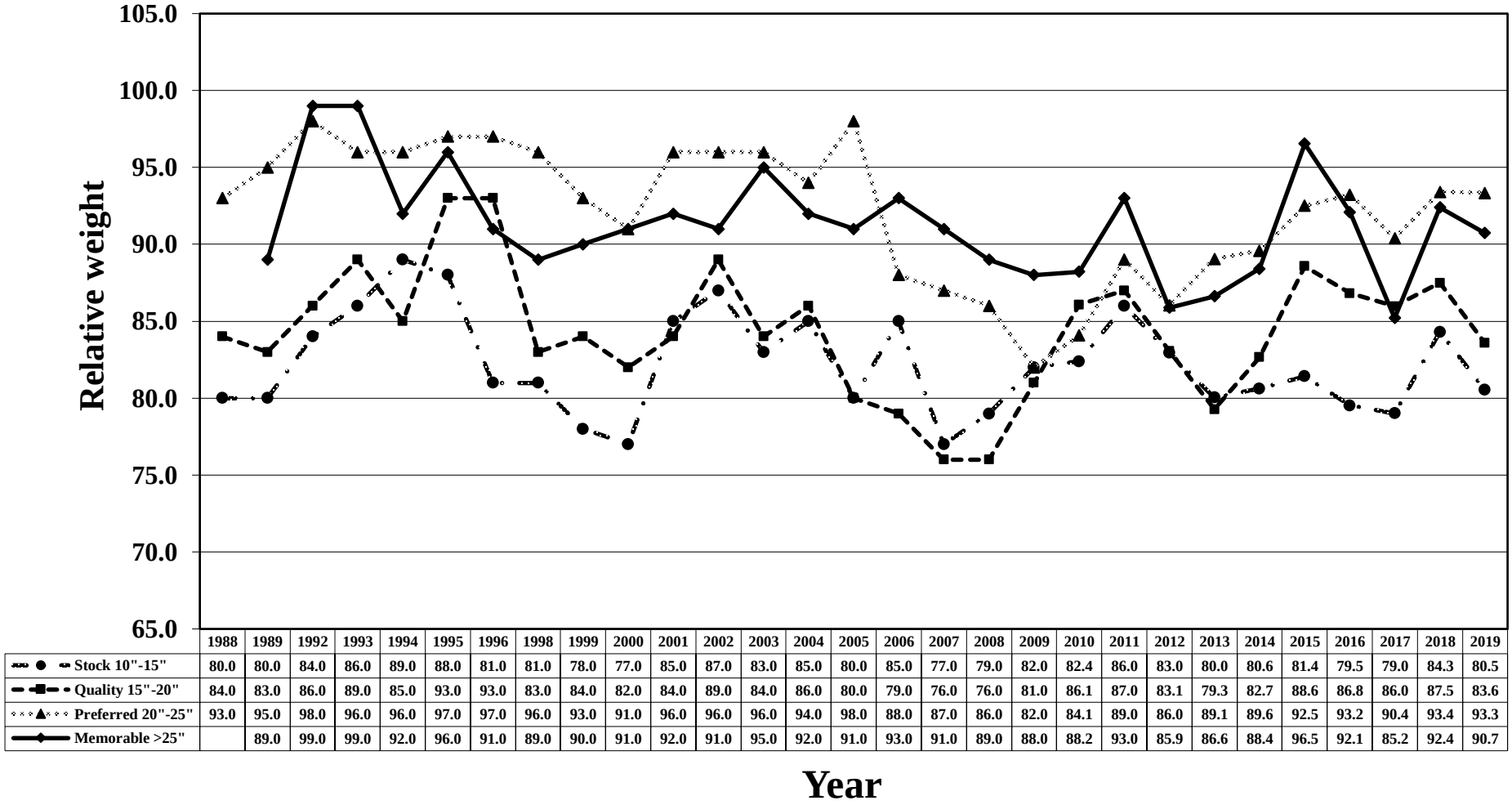


Figure 9. Length frequency, as catch per unit effort, of walleye collected by experimental gill nets in Fort Peck Reservoir during July-August, 2016-2019.



	1988	1989	1992	1993	1994	1995	1996	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Stock 10"-15"	80.0	80.0	84.0	86.0	89.0	88.0	81.0	81.0	78.0	77.0	85.0	87.0	83.0	85.0	80.0	85.0	77.0	79.0	82.0	82.4	86.0	83.0	80.0	80.6	81.4	79.5	79.0	84.3	80.5
Quality 15"-20"	84.0	83.0	86.0	89.0	85.0	93.0	93.0	83.0	84.0	82.0	84.0	89.0	84.0	86.0	80.0	79.0	76.0	76.0	81.0	86.1	87.0	83.1	79.3	82.7	88.6	86.8	86.0	87.5	83.6
Preferred 20"-25"	93.0	95.0	98.0	96.0	96.0	97.0	97.0	96.0	93.0	91.0	96.0	96.0	96.0	94.0	98.0	88.0	87.0	86.0	82.0	84.1	89.0	86.0	89.1	89.6	92.5	93.2	90.4	93.4	93.3
Memorable >25"		89.0	99.0	99.0	92.0	96.0	91.0	89.0	90.0	91.0	92.0	91.0	95.0	92.0	91.0	93.0	91.0	89.0	88.0	88.2	93.0	85.9	86.6	88.4	96.5	92.1	85.2	92.4	90.7

Figure 10. Relative weights for stock, quality, preferred, and memorable length groups of walleye collected by experimental gill nets in Fort Peck Reservoir, 1989-2019 (no data for 1990-1991 and 1997).

Table 5. Mean length-at-age at time of capture (in) for walleye collected in experimental gill nets, 2014-2019, on Fort Peck Reservoir, and aged from sectioned otoliths.

Year		Length at age at capture (in)													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
2014	Mean	7.1	10.5	11.6	14.6	16.0	19.3	20.2	22.6	22.3	21.0	25.2	21.2	26.9	--
	N	5	14	169	89	39	56	11	15	12	4	1	3	3	--
	SE	0.1	0.4	0.1	0.2	0.4	0.4	1.0	0.5	0.9	1.2	--	1.0	2.4	--
	Range	6.8-7.3	6.9-12.6	7.7-17.1	11.4-23.2	10.4-21.6	13.2-24.4	14.7-24.1	19.2-25.2	15.5-26.5	17.8-23.2	--	19.3-22.4	22.2-30.1	--
2015	Mean	7.8	9.5	13.0	14.2	16.8	18.7	20.9	23.7	22.3	24.1	27.0	25.8	21.4	21.0
	N	2	26	27	184	55	27	45	14	9	11	1	11	3	3
	SE	0.1	0.3	0.4	0.1	0.3	0.5	0.5	0.9	1.8	1.2	--	0.8	3.7	1.4
	Range	7.8-7.9	7.3-12.5	9.4-17.0	9.8-19.8	12.7-22.1	13.4-23.5	15.4-26.2	15.2-27.4	11.6-27.2	17.0-29.4	--	21.3-29.1	17.4-28.8	18.3-22.8
2016	Mean	--	9.5	12.1	15.4	16.8	19.0	21.5	23.0	24.1	19.6	24.0	24.9	23.8	18.2
	N	--	18	58	32	141	55	15	45	17	2	15	4	5	1
	SE	--	0.3	0.3	0.5	0.2	0.4	0.6	0.4	0.8	0.6	0.7	1.6	1.1	--
	Range	--	7.6-12.5	8.3-16.1	10.1-19.8	10.5-23.3	14.0-24.3	18.5-26.8	18.1-27.4	16.9-27.6	19.0-20.2	18.9-27.7	20.9-27.6	21.2-27.8	--
2017	Mean	7.4	9.1	10.6	13.0	16.6	18.4	19.8	23.5	23.6	23.5	23.3	28.3	--	23.4
	N	2	16	33	49	22	103	22	11	20	3	4	1	--	1
	SE	0.3	0.2	0.2	0.3	0.9	0.3	0.8	0.6	0.5	1.6	1.8	--	--	--
	Range	7.1-7.7	7.6-10.6	7.7-13.1	9.6-18.0	10.4-22.2	11.8-24.4	10.9-24.6	20.8-27.8	18.1-26.6	21.9-26.7	19.8-28.3	--	--	--
2018	Mean	8.4	9.8	11.7	13.6	14.6	17.2	18.9	21.8	23.4	24.3	25.9	25.6	26.9	23.1
	N	20	16	38	58	74	34	89	36	13	29	6	5	9	1
	SE	0.2	0.3	0.2	0.2	0.3	0.7	0.4	0.4	0.7	0.5	1.2	1.3	0.6	--
	Range	7.0-9.6	7.4-12.0	8.6-13.9	10.6-17.1	10.9-22.9	12.0-25.3	11.5-25.3	16.2-26.0	17.5-27.0	18.7-28.0	22.3-29.2	21.3-27.7	23.6-28.5	--
2019	Mean	8.3	11.4	13.1	13.8	15.3	16.4	18.7	20.3	22.2	24.0	26.0	27.9	27.6	28.0
	N	27	84	46	47	76	25	28	60	22	12	19	6	10	7
	SE	0.1	0.1	0.2	0.2	0.2	0.5	0.7	0.5	0.7	0.8	0.5	0.3	0.8	1.0
	Range	7.0-10.2	8.1-13.7	10.2-16.7	11.9-17.0	8.3-21.2	12.3-24.8	13.0-25.4	13.4-27.6	14.8-25.9	20.4-28.5	20.2-28.4	27.2-29.1	24.0-30.1	23.3-30.7
Mean of means		7.8	10.0	12.0	14.1	16.0	18.1	20.0	22.5	23.0	22.8	25.2	25.6	25.3	22.7

Northern Pike

Relative abundance of northern pike captured in gill nets was 3.0 per net in 2019 which increased from the previous year (Table 3; Figure 11). The three-year running average goal of 2.0 northern pike per net was not met (2.2 per net in 2019) as outlined in the FPRFMP. Average length and weight of northern pike in 2019 was 24.7 inches and 4.0 pounds which was similar compared to the rising water years (2007-2012; Table 7). This was due to smaller-sized individuals recruiting into the population as a result of limited natural reproduction. Similarly, 56% of the northern pike captured were less than 25 inches in 2019 (Figure 12). In contrast, 80% of the northern pike captured in gill nets were greater than 25 inches during the low water years of 2005-2006 (Headley 2007).

In 2019, northern pike PSD was 81 and PSD-P was 24. During the drought years, PSD ranged from 93 to 98 and PSD-P ranged from 55-71 indicating a population comprised of larger fish. With stable to increasing water levels from 2017 to 2019, inundation of terrestrial vegetation has become more prevalent throughout the reservoir increasing the amount of ideal spawning/rearing habitat. Relative abundance of shoreline forage has also increased over the last two years increasing food availability for juvenile northern pike. As a result, relative abundance of stock and quality length groups of northern pike has increased over the last two years. Relative weight of northern pike increased slightly from 95 in 2018 to 97 in 2019.

Channel Catfish

Relative abundance of channel catfish captured by gill netting was 1.1 per net in 2019. This was a slight decrease compared to the previous year and below the 28-year average of 1.9 per net (Figure 13). Similar to previous years, the highest abundance was observed in the Upper Missouri Arm at 2.9 per net (Table 4). In 2019, mean length and weight was 20.3 inches and 3.1 pounds, respectively. This was slightly higher than the long-term average of 16.2 inches and 1.7 pounds (Table 8). Relative weights of channel catfish remained similar from 2018 to 2019 at 88. Catfish PSD and PSD-P were 83 and 14, respectively, indicating a population comprised of good numbers of larger fish.

Sauger

Sauger numbers have declined in Fort Peck Reservoir since 1985 and remained low since then (Figure 13). This decline has occurred in spite of restrictive angling regulations (i.e., 1 sauger daily and 2 in possession) implemented in 2002. However, fishing regulations changed in 2016 allowing anglers to keep 2 sauger daily and 4 in possession within the walleye/sauger combination of 5 daily and 10 in possession. Relative abundance in 2019 was 0.1 per net which was similar to the previous year. Average size of sauger in 2019 was 16.0 inches and 1.5 pounds with a relative weight of 74. This population relies on natural reproduction from the Missouri River where more suitable spawning habitat is available (Bellgraph et al. 2008). Relative abundance for sauger was highest in the upper Missouri arm with a catch rate of 0.6 per net (Table 4).

Table 6. Summary of mean catch per unit of effort (CPUE; No./net-night), standard error (SE), mean length (in), mean weight (lb), mean *Wr*, and stock density indices of walleye collected in experimental gill nets on Fort Peck Reservoir, 1995-2019 (no data for 1997).

Year	No. walleye	CPUE	SE	Length	Weight	*Wr*	Substock[1]	Stock[2]	Quality[3]	Preferred[4]	PSD[5]	PSD-P[6]
1995	330	4.2	0.3	16.6	2.4	91	34	295	189	73	64	25
1996	361	4.4	0.4	16.5	2.1	89	31	327	228	75	70	23
1998	418	5.6	0.4	14.8	1.6	86	79	339	159	89	47	26
1999	329	4.2	0.3	14.4	1.5	90	63	266	108	67	41	25
2000	250	2.8	0.2	16.6	2.3	83	26	224	122	84	54	38
2001	272	3.9	0.4	17.4	2.8	88	19	253	134	112	53	44
2002	324	3.3	0.2	17.4	2.8	90	32	291	159	124	55	43
2003	301	3.1	0.3	17.3	2.8	88	38	263	156	105	59	40
2004	250	3.3	0.3	15.9	2.3	88	47	203	102	73	50	36
2005	227	2.7	0.3	16.3	2.6	85	37	190	88	78	46	41
2006	207	2.4	0.2	16.2	2.6	87	38	168	78	66	46	39
2007	261	3.1	0.3	16.2	2.3	81	36	225	100	70	44	31
2008	234	2.8	0.3	15.5	1.9	81	21	212	89	45	42	21
2009	393	3.3	0.3	14.6	1.4	83	59	332	143	53	43	16
2010	361	3.6	0.3	15.4	1.7	84	31	330	175	46	53	13
2011	267	2.8	0.3	14.9	1.7	88	25	251	99	45	39	18
2012	683	6.8	0.4	15.1	1.4	83	44	639	305	75	47	12
2013	479	4.8	0.4	15.0	1.5	81	66	413	245	55	59	13
2014	466	4.7	0.3	15.5	1.7	84	28	436	199	98	46	22
2015	486	4.9	0.4	16.6	2.1	87	22	464	276	111	59	24
2016	440	4.4	0.3	17.8	2.5	87	15	424	308	147	72	34
2017	310	3.1	0.3	17.0	2.2	85	23	287	178	114	62	40
2018	471	4.7	0.3	17.4	2.5	88	28	441	263	167	60	38
2019	494	4.9	0.4	16.7	2.3	85	30	464	246	137	53	29

[1]Substock is the number of all walleye less than 10 inches, [2]Stock is the number of all walleye greater than 10 inches, [3]Quality is the number of all walleye greater than 15 inches, [4]Prefered is the number of all walleye greater than 20 inches, [5]PSD is the proportional size distribution (Quality/Stock), [6]PSD-P is the relative stock density, preferred (Preferred/Stock).

Table 7. Summary of mean catch per unit of effort (CPUE; No./net-night), mean length (in), mean weight (lb), and mean *Wr* of northern pike collected in experimental gill nets on Fort Peck Reservoir during July-August, 1988-2019 (no data for 1990-1991 and 1997).

Year	*N*	CPUE	Length	Weight	*Wr*
1988	43	0.6	26.4	5.3	107
1989	47	0.7	24.4	4.5	110.2
1992	35	0.6	26.6	5.5	112.3
1993	47	0.6	28.3	6.4	113.9
1994	104	1.4	22.6	4.4	107.3
1995	295	3.8	20.1	2.5	114.6
1996	321	3.9	23.3	3.7	112.8
1998	231	3.1	24.7	4.3	104.6
1999	151	1.9	26.5	5.1	103.2
2000	134	1.5	28	6	106.5
2001	73	1	28.6	6.5	110.6
2002	144	1.5	29.5	7.2	102
2003	126	1.3	28.1	6.2	101.1
2004	75	1	29.1	6.7	100.1
2005	86	1	28.4	6.5	100.3
2006	108	1.3	26.1	5.2	98.9
2007	147	1.7	24.8	4.6	101
2008	137	1.6	26.6	5.2	100
2009	176	1.5	24.5	4.3	93.1
2010	191	1.9	23.4	3.9	100
2011	293	2.9	23.2	3.6	100
2012	503	5.0	23.6	3.6	99.3
2013	324	3.2	24.6	3.9	93.0
2014	336	3.4	25.8	4.6	96.2
2015	264	2.6	26.3	5.0	97.5
2016	226	2.3	25.8	4.6	92.9
2017	184	1.8	26.0	4.4	90.2
2018	165	1.7	27.1	5.0	95.0
2019	302	3.0	24.7	4.0	96.1

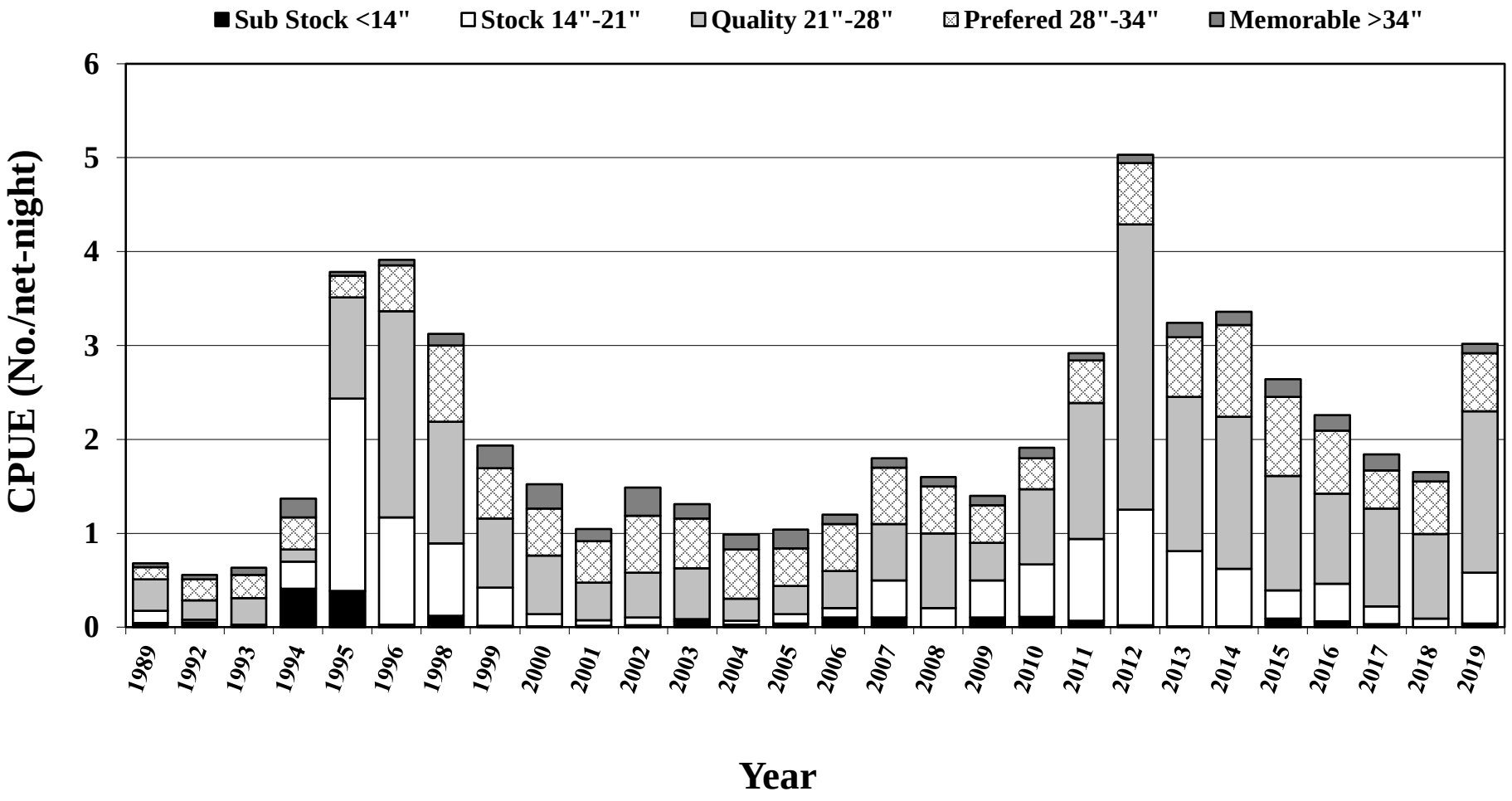


Figure 11. Catch per unit effort (CPUE) of PSD category of northern pike collected by experimental gill nets throughout Fort Peck Reservoir during, July-August, 1988-2019, (no data for 1990-1991 and 1997).

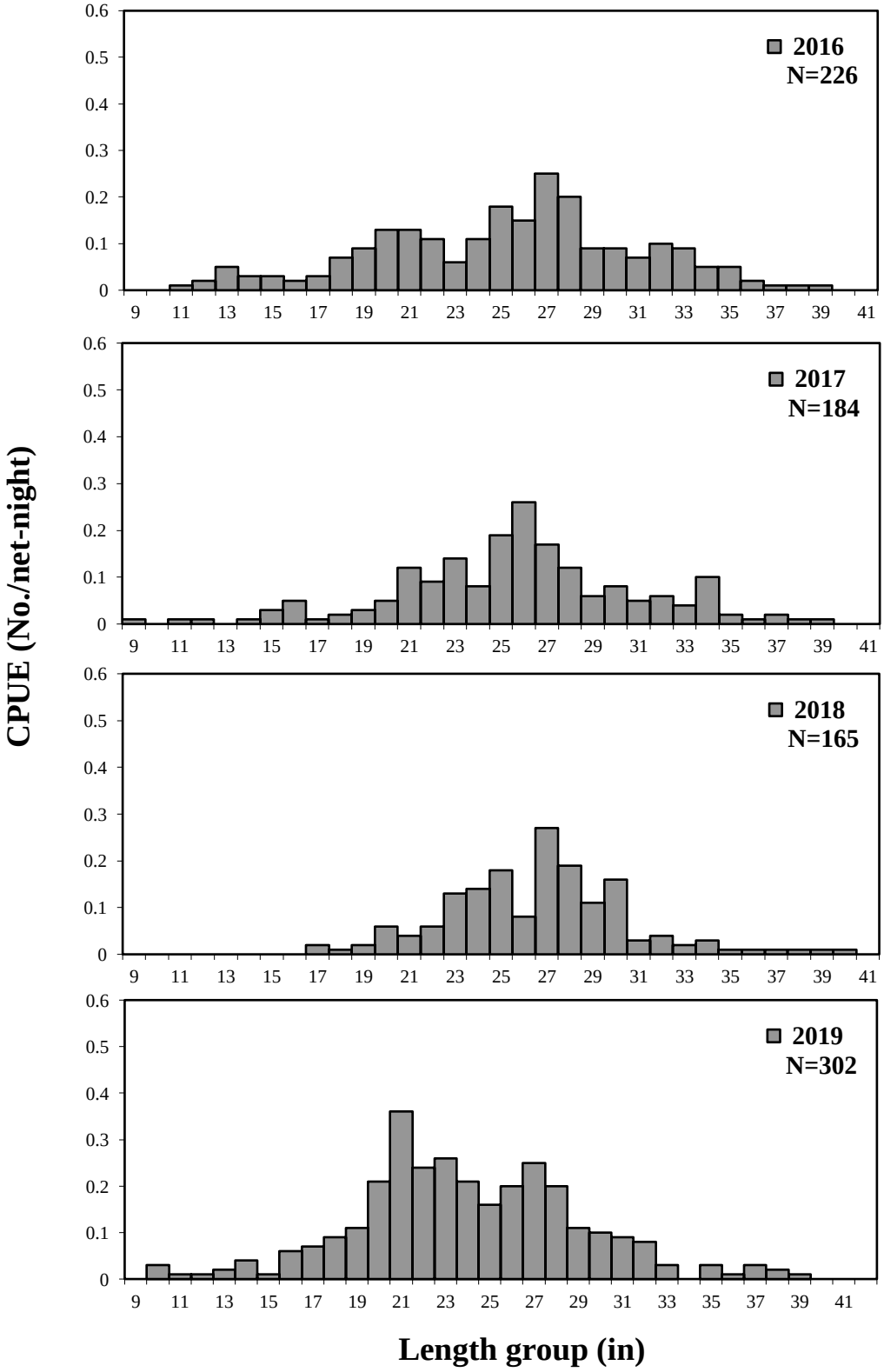
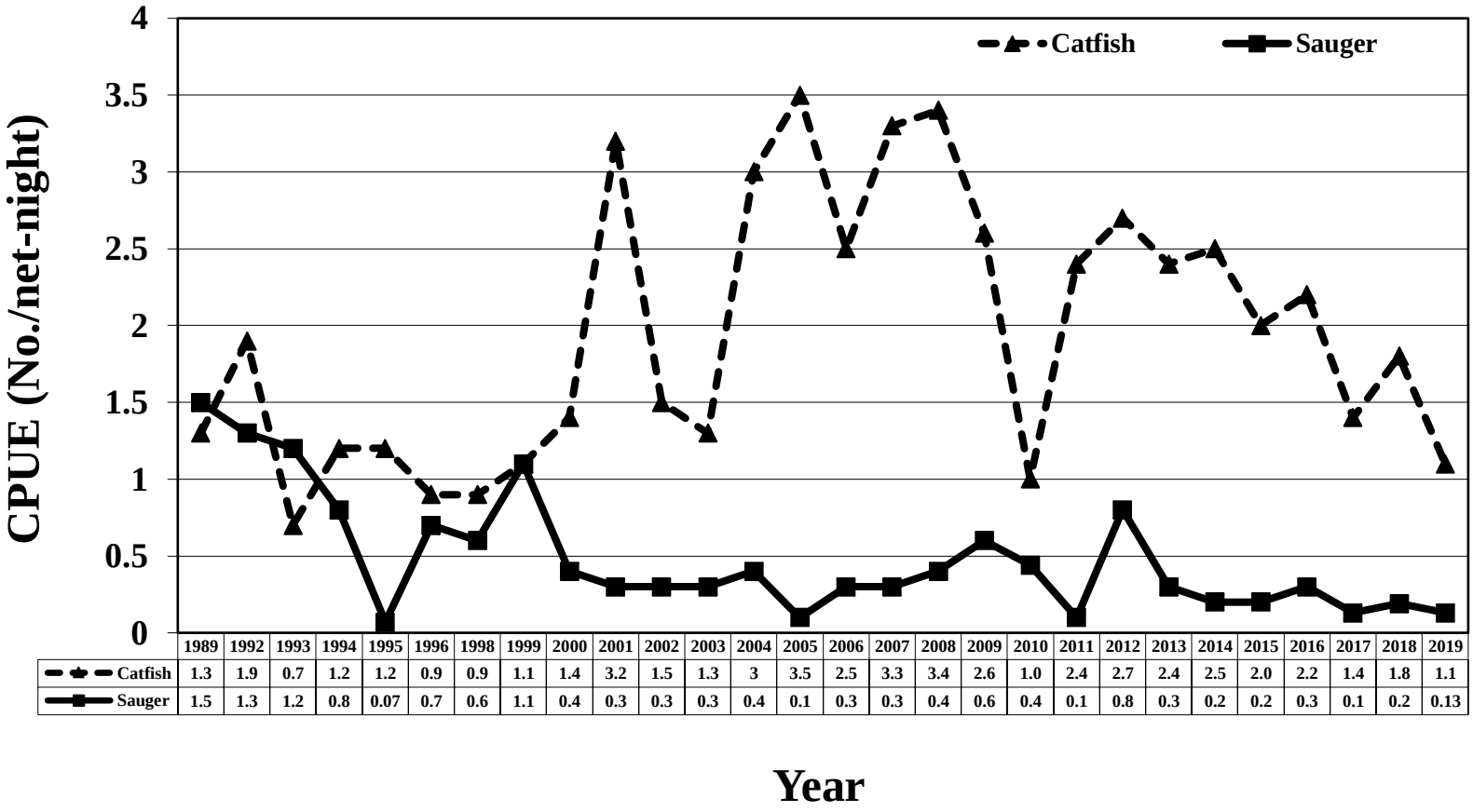


Figure 12. Length frequency, as catch per unit effort (CPUE), of northern pike collected by experimental gill nets in Fort Peck Reservoir during July-August, 2016-2019.



	1989	1992	1993	1994	1995	1996	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Catfish	1.3	1.9	0.7	1.2	1.2	0.9	0.9	1.1	1.4	3.2	1.5	1.3	3	3.5	2.5	3.3	3.4	2.6	1.0	2.4	2.7	2.4	2.5	2.0	2.2	1.4	1.8	1.1
Sauger	1.5	1.3	1.2	0.8	0.07	0.7	0.6	1.1	0.4	0.3	0.3	0.3	0.4	0.1	0.3	0.3	0.4	0.6	0.4	0.1	0.8	0.3	0.2	0.2	0.3	0.1	0.2	0.13

Figure 13. Mean catch per unit of effort (CPUE; No./net-night) of channel catfish and sauger collected by experimental gill nets in Fort Peck Reservoir, 1989-2019 (no data for 1990-1991 and 1997).

Table 8. Summary of mean catch per unit of effort (CPUE; No./net-night), mean length (in) and mean weight (lb) of channel catfish collected in experimental gill nets on Fort Peck Reservoir, 1988-2019 (no data for 1990-1991 and 1997).

Year	*N*	CPUE	Length	Weight
1988	69	0.9	15.9	1.7
1989	99	1.4	16.5	1.5
1992	165	2.6	15	1.4
1993	68	0.9	14.9	1.4
1994	119	1.6	14.4	1.1
1995	123	1.6	16.3	1.6
1996	93	1.1	15.6	1.4
1998	91	1.2	18	2.3
1999	88	1.1	17.2	2.0
2000	122	1.4	17.5	2.0
2001	222	3.2	17.6	2.1
2002	145	1.5	18	2.1
2003	129	1.3	17.6	2.1
2004	227	3.0	15.7	1.8
2005	297	3.5	14.3	1.3
2006	215	2.5	15.1	1.4
2007	278	3.3	15.3	1.3
2008	289	3.4	14.2	1.1
2009	314	2.6	16.8	1.9
2010	104	1.0	18.4	2.4
2011	241	2.4	17.9	2.3
2012	272	2.7	17.4	1.8
2013	240	2.4	17.5	1.9
2014	246	2.5	18.0	2.0
2015	201	2.0	18.5	2.1
2016	217	2.2	17.1	1.8
2017	140	1.4	18.0	2.0
2018	179	1.8	17.8	2.4
2019	110	1.1	20.3	3.1

STOMACH CONTENTS OF GILL NETTED GAME FISH

Stomach contents of walleye, northern pike, sauger, and smallmouth bass captured in experimental gill nets from July 17th to August 16th, 2019 were examined for the presence of forage items. Northern pike had the most diverse diet followed closely by walleye (Table 9). Cisco were the most commonly identified fish found in northern pike and walleye. The high frequency of occurrence of cisco observed in stomach contents can be explained by the high abundance of young-of-year and adult cisco observed in 2019 (Table 14). Similar to previous years, empty stomach contents comprised a large portion of the walleye, northern pike, sauger, and smallmouth bass stomachs, which is attributed to purging of the stomach during stress (Bowen 1996).

Table 9. Percent frequency of occurrence for various forage items found in stomach contents of northern pike, sauger, smallmouth bass, and walleye collected in experimental gill nets in Fort Peck Reservoir 2019. Sample size is given in parentheses.

Forage items	Northern pike (*N*=265)	Sauger (*N*=11)	Smallmouth bass (*N*=121)	Walleye (*N*=472)
Common carp	0.4%	--	--	--
Chinook salmon	0.8%	--	--	0.2%
Cisco	17.4%	--	6.6%	10.0%
Crayfish	4.5%	--	25.6%	--
Empty	59.2%	81.8%	38.8%	51.7%
Invertebrates	1.1%	9.1%	11.6%	18.6%
Pomoxis spp.	--	--	--	0.4%
Smallmouth bass	--	--	0.8%	--
Spottail shiner	0.4%	--	--	0.6%
Unknown	11.3%	9.1%	14.9%	17.6%
Walleye	--	--	--	0.2%
White sucker	0.4%	--	--	--
Yellow perch	4.5%	--	1.7%	0.6%

BEACH SEINING

Shoreline beach seining was conducted to determine reproductive success of age-0 game and non-game fish from August 13th to September 4th, 2019. Seine hauls at 100 standardized locations throughout the reservoir captured 15 species of young-of-year and forage fish for a total of 26,125 fish (Table 10). Combined relative abundance of spottail shiner, emerald shiner, age-0 yellow perch, and age-0 crappie increased to 244 fish per seine haul and was above the long-term average of 166 fish per seine haul. Relative abundance of shoreline forage typically follows changes in reservoir elevations (Figure 15). In 2019, reservoir elevations increased approximately 12.5 feet from March to July due to increased amounts of plains runoff as well as above average mountain snowpack (Figure 14). An increased amount of terrestrial vegetation was inundated beginning in spring and early summer of 2019.

Eurasian watermilfoil (EWM) was first discovered in Fort Peck Reservoir by Montana Fish, Wildlife & Parks and the U.S. Army Corp of Engineers in 2010. Since then, it has become established throughout the reservoir. EWM was documented at 72% of the sites in 2018 and 81% of the seining sites in 2019. The increase of EWM could be attributed to stable reservoir elevations from 2018-2019. Although a spring rise and fall drawdown occurred during this period, maximum reservoir elevations during the summer months and minimum reservoir during the winter months were nearly identical during the 2018-2019 period (Figure 2). Prior to this, reservoir elevations fluctuated greatly. In contrast, reservoir elevations during 2012-2013 experienced a loss of 15 feet resulting in EWM present at 46% of the seining sites. Furthermore, a gain of 10 feet was observed in 2013-2014 and only 24% of the seining sites contained EWM. It appears large fluctuations that change reservoir elevation from year to year make it difficult for EWM to become established in littoral areas of the reservoir.

It is uncertain what impacts EWM have to the fishery on Fort Peck Reservoir. Some studies have suggested slow growth and poor size structure for some fish species (Unmuth et al. 1999). In contrast, EWM has proved beneficial to fisheries if it occurs in lakes that typically do not support much growth of native submersed species (Engel 1995). Similarly, Pratt and Smokorowski (2003) found more fish and invertebrates in areas with EWM than areas devoid of any submerged aquatic vegetation. Due to Fort Peck Reservoir's fluctuating reservoir elevation, lack of native submerged aquatic vegetation, and complex basin characteristics, it is possible that EWM may provide spawning and rearing habitat for some forage and/or game fish species.

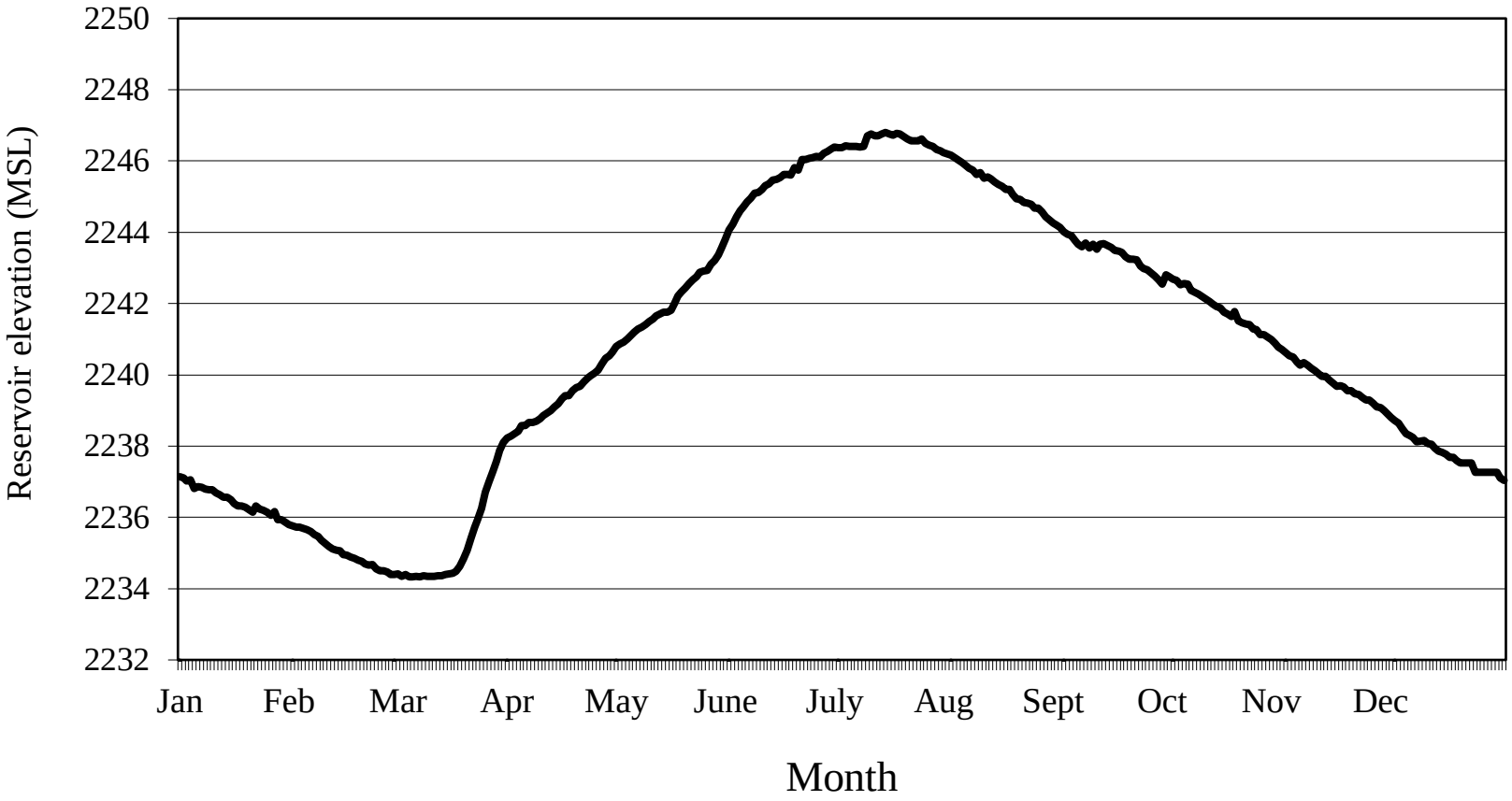


Figure 14. Average daily reservoir elevation for Fort Peck Reservoir from January 1, 2019 to December 31, 2019 (data provided by USACE).

Table 10. Number (*N*) and mean catch per unit effort (CPUE; No./haul) for fish species collected by seine hauls in Fort Peck Reservoir during August-September 2019. Catches are for young-of-year fishes except where noted.

	UBD[1]		LBD[2]		LMA[3]		MMA[4]		UMA[5]		Total	
Species	*N*	CPUE	*N*	CPUE	*N*	CPUE	*N*	CPUE	*N*	CPUE	*N*	CPUE
Bigmouth buffalo	0	--	0	--	0	--	0	--	1	<0.1	1	<0.1
Black bullhead	715	35.8	0	--	0	--	0	--	0	--	715	7.2
Common carp	3	0.2	1	<0.1	2	0.1	1	<0.1	0	--	7	<0.1
Emerald shiner*	1	<0.1	6	0.3	52	2.6	8	0.4	2,245	112.3	2,312	23.1
Freshwater drum	0	--	0	--	0	--	0	--	1	<0.1	1	<0.1
Goldeye	0	--	0	--	0	--	0	--	11	0.6	11	0.1
*Hybognathus spp.**	0	--	0	--	0	--	0	--	524	26.2	524	5.2
Northern pike	5	0.3	36	1.8	24	1.2	20	1.0	1	<0.1	86	0.9
Pomoxis spp.	884	44.2	127	6.4	13	0.7	548	27.4	8,543	427.2	10,115	101.2
Sauger	0	--	0	--	0	--	0	--	1	<0.1	1	<0.1
Smallmouth bass	89	4.5	52	2.6	24	1.2	66	3.3	91	4.6	322	3.2
Smallmouth buffalo	1	<0.1	0	--	0	--	2	0.1	14	0.7	17	0.2
Spottail shiner*	390	19.5	1029	51.5	948	47.4	3,385	169.3	3,962	198.1	9,714	97.1
Walleye	0	--	1	<0.1	3	0.2	0	--	1	<0.1	5	<0.1
Yellow perch	652	32.6	525	26.3	270	13.5	234	11.7	613	30.7	2,294	22.9
Total	2,740	137.0	1,777	88.9	1,336	66.8	4,264	213.2	16,008	800.4	26,125	261.3

*Includes all ages.
[1]Upper Big Dry (UBD): Nelson Cr., Lone Tree Cr., McGuire Cr., Bug Cr., Lost Cr.
[2]Lower Big Dry (LBD): Box Cr., S. Fork Rock Cr., N. Fork Rock Cr., Box Elder Cr., Sand Arroyo, Spring Cr.
[3]Lower Missouri Arm (LMA): Spillway Bay, Bear Cr., N.Fork Duck Cr., S. Fork Duck Cr., Main Duck
[4]Middle Missouri Arm (MMA): Pines, Gilbert Cr., Cattle Crooked Cr., Hell Cr., Sutherland Cr., Snow Cr.
[5]Upper Missouri Arm (UMA): Bone Trail, Timber Cr., Seven Blackfoot, Fourchette Bay, Devils Cr.

Yellow Perch

Young-of-year yellow perch relative abundance in 2019 was 22.9 per seine which was similar compared to 29.2 per seine in 2018 (Figure15). Increases in reservoir elevation beginning in March and rising approximately 12.5 feet into July appear to have provided some spawning and rearing habitat as terrestrial vegetation was inundated in 2019. Nelson and Walburg (1977) determined that newly flooded vegetation was the most important factor affecting year-class strength of yellow perch in two large Missouri River reservoir systems. Relative abundance of young-of-year yellow perch in 2019 was still lower when compared to the high-water years (i.e., 2009-2012; Figure 15). Yellow perch were most abundant in the upper Big Dry arm with a catch rate of 32.6 per seine haul in 2019 (Table 10).

Crappie

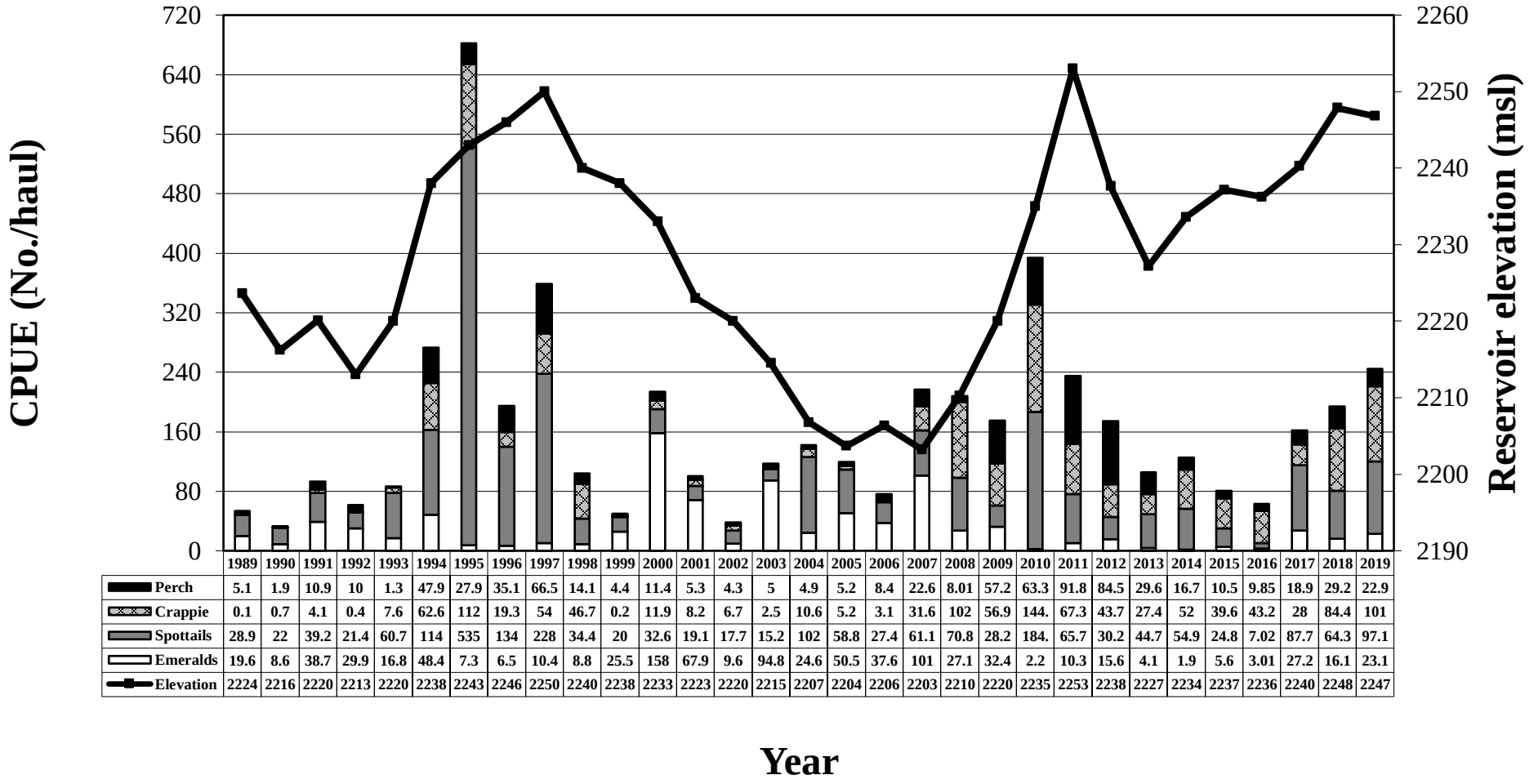
Young-of-year crappie relative abundance increased greatly from 84.4 per seine haul in 2018 to 101.1 per seine haul in 2019. Unlike young-of-year yellow perch, relative abundance of young-of-year crappie remains higher than during the drought years (Figure 15). Similar to previous years, crappie were most abundant in the upper Missouri arm with a catch rate of 427.2 per seine haul which comprised 84% of the fish sampled in 2019 (Table 10). Typically, the upper Missouri arm contains a majority of the young-of-year crappie captured due to more suitable spawning and rearing habitat (i.e., submerged brush and aquatic macrophytes).

Emerald Shiner

Emerald shiner relative abundance in 2019 was 23.1 per seine haul, which was slightly higher than 16.1 per seine haul in 2018. However, relative abundance of emerald shiners has been relatively low over the last several years making them similar to the mid to late 1990's when reservoir elevations were relatively high or increasing (Figure 15). A possible explanation for these decreases could be upstream movement into more riverine type habitat. In 2018, 71% of the emerald shiners were captured in the upper Missouri arm (Table 10).

Spottail Shiner

Relative abundance of spottail shiners increased from 64.3 per seine haul in 2018 to 97.1 per seine haul in 2019 which was slightly lower than long-term average of 75.2 per seine haul. Relative abundance typically increases during rising reservoir elevations in late spring/early summer (Figure 15). Spottail shiner relative abundance was highest in the upper Missouri arm at 198.1 per seine haul (Table 10). Typically, relative abundance is higher in main lake portions (i.e., lower Big Dry arm, lower Missouri arm, middle Missouri arm) of the reservoir.



	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Perch	5.1	1.9	10.9	10	1.3	47.9	27.9	35.1	66.5	14.1	4.4	11.4	5.3	4.3	5	4.9	5.2	8.4	22.6	8.01	57.2	63.3	91.8	84.5	29.6	16.7	10.5	9.85	18.9	29.2	22.9
Crappie	0.1	0.7	4.1	0.4	7.6	62.6	112	19.3	54	46.7	0.2	11.9	8.2	6.7	2.5	10.6	5.2	3.1	31.6	102	56.9	144.	67.3	43.7	27.4	52	39.6	43.2	28	84.4	101
Spottails	28.9	22	39.2	21.4	60.7	114	535	134	228	34.4	20	32.6	19.1	17.7	15.2	102	58.8	27.4	61.1	70.8	28.2	184.	65.7	30.2	44.7	54.9	24.8	7.02	87.7	64.3	97.1
Emeralds	19.6	8.6	38.7	29.9	16.8	48.4	7.3	6.5	10.4	8.8	25.5	158	67.9	9.6	94.8	24.6	50.5	37.6	101	27.1	32.4	2.2	10.3	15.6	4.1	1.9	5.6	3.01	27.2	16.1	23.1
Elevation	2224	2216	2220	2213	2220	2238	2243	2246	2250	2240	2238	2233	2223	2220	2215	2207	2204	2206	2203	2210	2220	2235	2253	2238	2227	2234	2237	2236	2240	2248	2247

Figure 15. Maximum annual reservoir elevation compared to mean catch per unit effort (CPUE; No./haul) of emerald, spottail, young-of-year yellow perch, and young-of-year crappie collected by seine hauls in Fort Peck Reservoir from 1989-2019.

Chinook salmon

A total of 533,867 spring-stocked chinook salmon were released into Fort Peck Reservoir during late May/early June of 2019 at 29-53 per pound. This surpassed the management goal of 200,000 fingerlings as outlined in the Fort Peck Reservoir Fisheries Management Plan (Headley et al. 2012). Compared to previous years, this was the most salmon released since the program began (Table 11; Figure 16). In the past, Montana has typically stocked fewer fingerlings and less total pounds than North and South Dakota. However, Montana has increased stocking numbers and/or size in efforts to create a more stable fishery and more fish for spawning beginning in 2000 (Figure 16 and 17). North and South Dakota Game and Fish have used this strategy and been successful in developing a return run from larger spring-stocked chinook salmon (Lott et al. 1997). Salmon were stocked further from the dam area in 2019 once again in hopes of reducing entrainment through the spillway due to evacuation of flood waters (Table 11).

Return of salmon to the release site has been variable over the years. In 2019, the number of females spawned and eggs collected increased from the previous year (Figure 18). The 2019 egg-take effort for Montana resulted in 431,280 green eggs from 97 females. Fecundity of female salmon was 4,446 eggs per female in 2019 which was similar to 3,963 eggs per female in 2018. The high fecundity can be attributed to a larger, younger age group (age-3) captured during both years. In addition, egg size was smaller when compared to previous years (Wade Geraets, personal communication).

Fisheries personnel relied exclusively on electrofishing to obtain brood stock for the annual chinook salmon egg-take in 2019. This has proven to be a more cost effective and efficient manner due to limited time and manpower issues as opposed to the fish ladder. Electrofishing was conducted from October 4th to October 24th, 2019 in various embayments adjacent to the marina, spillway, Duck Creek and dam area.

Biological data was collected from adult chinook salmon during spawning to provide more information on age, growth, and stocking-and-rearing history. In 2018, 96% of all males captured were 2-year old suggesting a strong age class present (Table 12). Females spawned in 2018 were comprised of a combination of 3 and 4-year old fish. The high number of younger, mature male salmon observed and captured in 2018 continued to the fishery in 2019. Age-3 male salmon comprised 100% of all males captured and age-3 females comprised 97% of all females during the 2019 egg collection effort. The earlier maturity observed for age-2 males in 2018 and age-3 females in 2019 could be attributed to improved growing conditions (i.e., increases in cisco abundance) which would allow more energy to be allocated to gonad production instead of somatic growth. Lott et al. (1997) noted a similar trend with chinook salmon age classes in Lake Oahe, SD when rainbow smelt populations, which are the primary forage, were at peak abundances.

In general, mean weights increased for both male and female chinook salmon spawned in 2019. When examining mean weight at each age, age-3 male and female salmon collected in 2019 were slightly larger than those collected in 2018 (Table 12; Table 13). Three-year old females averaged 12.7 pounds in 2018 compared to 14.5 pounds in 2019. In addition, age-3 male and female salmon captured in 2019 were higher compared to previous years (Headley 2017). The higher relative abundance of adult cisco beginning in 2013 and continuing into 2018 has contributed to increased weights at age-2 males as well as the improved numbers observed. Cisco have been found to be the primary forage item of age 1+ chinook salmon in Fort Peck Reservoir (Brunsing 1998; Headley 2010).

Table 11. Chinook salmon stocked by number, size, and location in Fort Peck Reservoir, 2015-2019.

Date	Number	Pounds Stocked	No./lb	Mark	Location
6/8/2015	27,224	1,131	24.1	None	Milk Coulee Bay
6/8/2015	27,310	1,134	24.1	None	Marina
6/6/2016	25,357	1,018	24.9	None	Milk Coulee Bay
6/6/2016	31,307	1,257	24.9	None	Marina
5/23/2017	41,916	1,062	38.9	None	Duck Creek
5/23/2017	29,732	806	38.1	None	Marina Bay
5/23/2017	38,989	1,037	38.9	None	Milk Coulee Bay
5/30/2017	25,111	728	34.5	None	Duck Creek
5/30/2017	20,663	599	34.5	None	Marina Bay
5/30/2017	7,015	203	34.5	None	Milk Coulee Bay
5/31/2017	50,412	1,387	36.6	None	Duck Creek
5/31/2017	12,980	352	36.7	None	Marina Bay
5/31/2017	23,011	607	37.9	None	Milk Coulee Bay
5/31/2017	19,384	715	27.1	Adipose Clip	Marina Bay
6/1/2017	11,703	297	39.3	None	Duck Creek
6/1/2017	21,795	571	38.2	None	Marina Bay
6/1/2017	23,295	601	38.7	None	Milk Coulee Bay
6/1/2017	19,380	750	25.8	Adipose Clip	Marina Bay
5/25/2018	57,925	1,881	30.8	Adipose Clip	Duck Creek
6/5/2018	65,815	1,489	44.2	None	Pines Bay
6/6/2018	34,386	770	44.7	None	Pines Bay
6/6/2018	37,814	847	44.7	None	Rock Creek
6/7/2018	31,296	720	43.4	None	Rock Creek
6/8/2018	31,222	757	41.3	None	Rock Creek
6/8/2018	42,298	1,025	41.3	None	Duck Creek
6/11/2018	14,265	317	45	None	Pines Bay
6/11/2018	14,911	332	45	None	Rock Creek
6/11/2018	21,063	468	45	None	Duck Creek
6/12/2018	28,659	552	52	None	Pines Bay
5/30/2019	45,750	1,536	29.8	OTC	Duck Creek
5/30/2019	25,450	854	29.8	OTC	Marina
5/30/2019	25,455	854	29.8	OTC	Spillway
5/31/2019	7,147	162	44.2	None	Duck Creek
5/31/2019	29,547	669	44.2	None	Marina
6/3/2019	73,301	1,581	46.4	None	Duck Creek
6/3/2019	52,667	1,136	46.4	None	Marina
6/4/2019	27,388	605	45.3	None	Duck Creek
6/4/2019	33,004	729	45.3	None	Marina
6/11/2019	82,524	1,685	49.0	None	Pines
6/11/2019	41,490	847	49.0	None	Rock Creek
6/12/2019	24,324	454	53.6	None	Pines
6/12/2019	65,820	1,228	53.6	None	Rock Creek

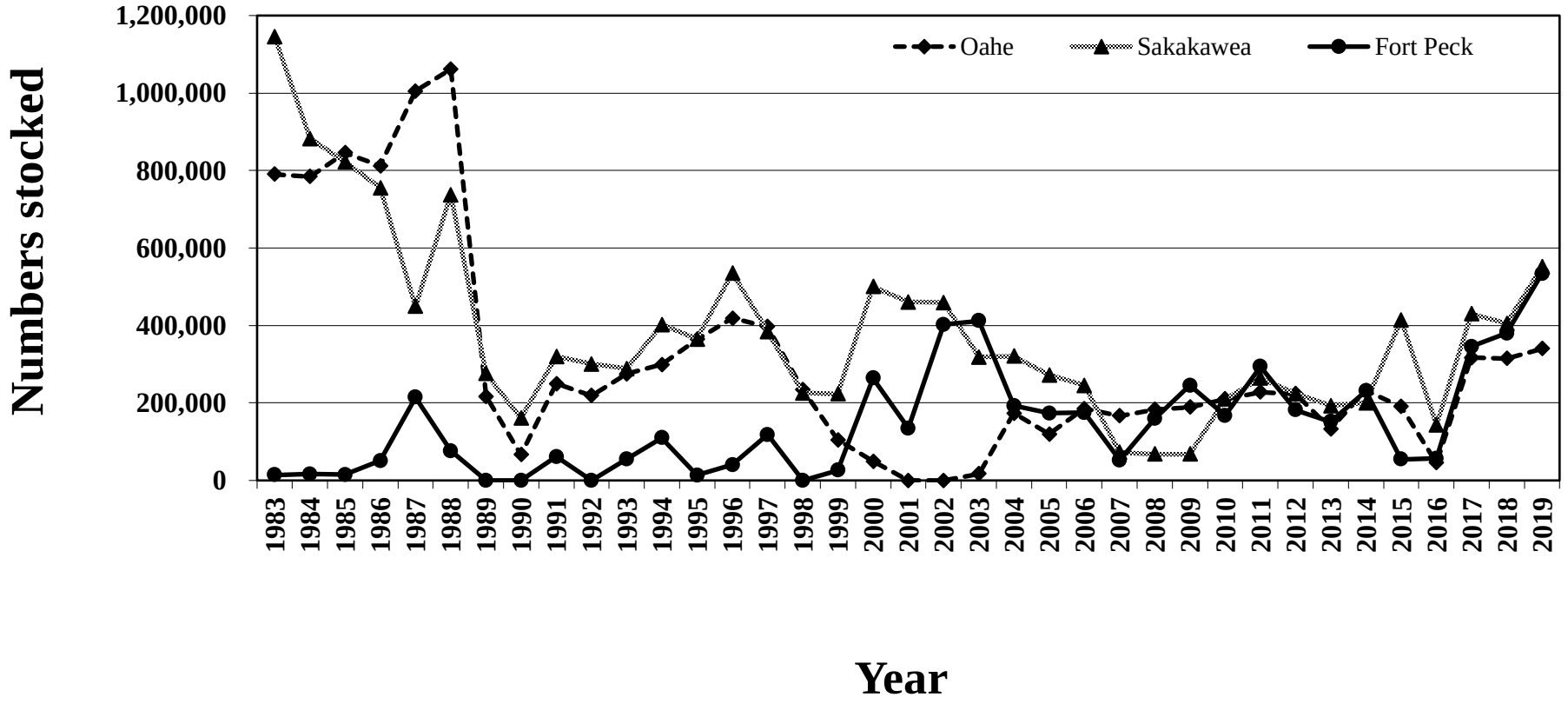


Figure 16. Annual comparison of total chinook salmon numbers stocked in Oahe, Sakakawea, and Fort Peck Reservoir, 1983-2019.

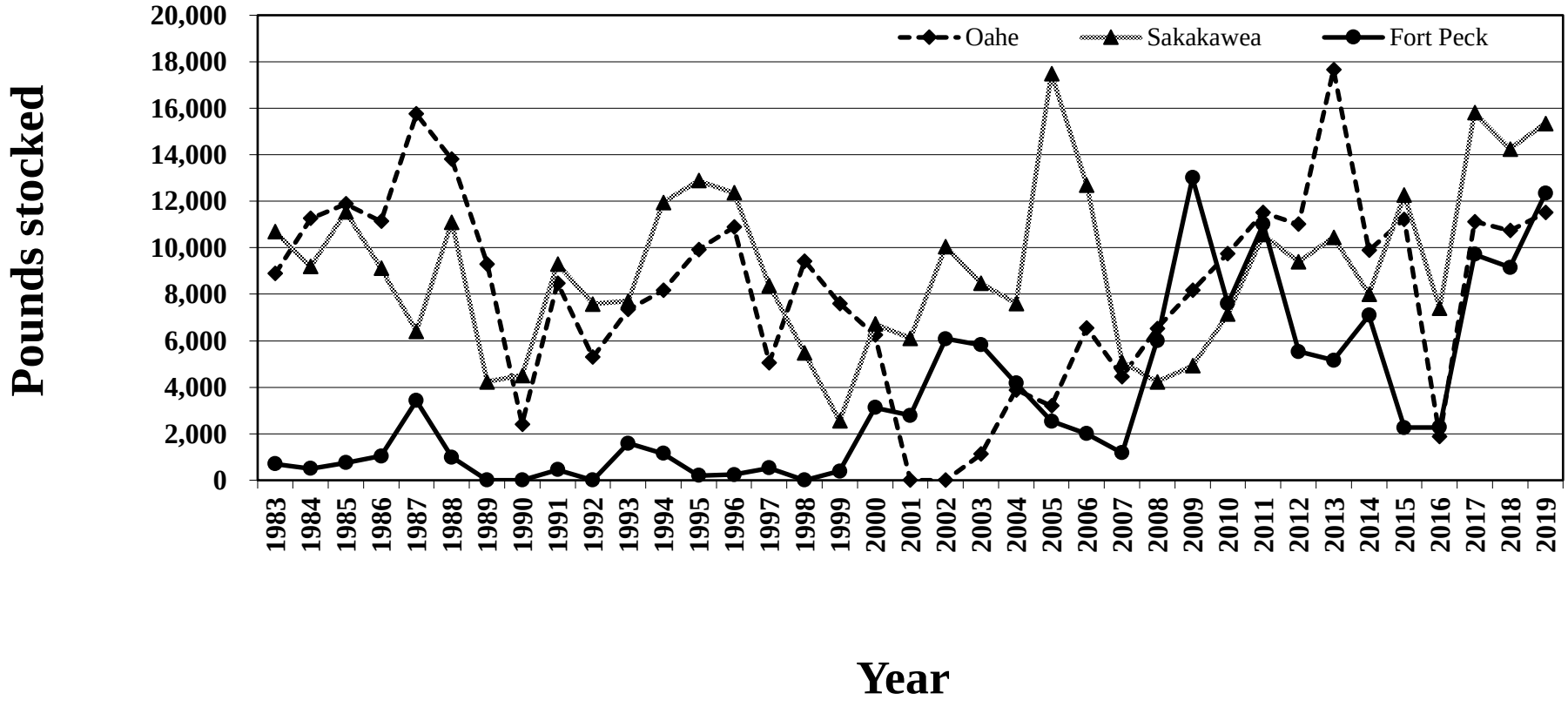


Figure 17. Annual comparison of total chinook salmon pounds stocked in Oahe, Sakakawea, and Fort Peck Reservoir, 1983-2019.

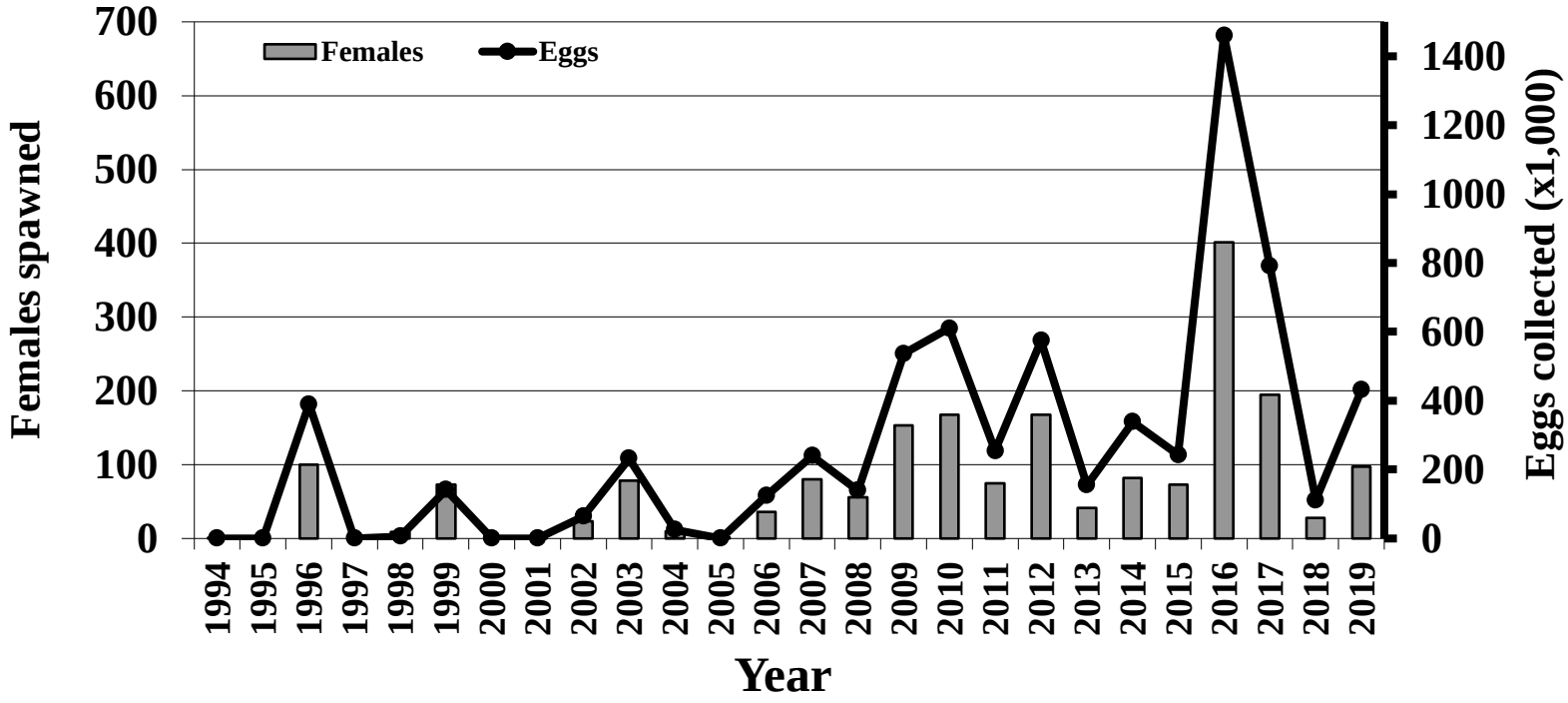


Figure 18. Annual comparison of female chinook salmon spawned and eggs collected from Fort Peck Reservoir, 1994-2019.

Table 12. Age composition, length and weight of 318 chinook salmon collected by electrofishing, fall 2018.

Age	Sex	Brood year	Number	Mean length (in)	Range	Mean weight (lb)	Range
1	Male	2017	0	--	--	--	--
	Female		0	--	--	--	--
2	Male	2016	121	23.6	19.7-26.8	5.9	3.0-9.9
	Female		0	--	--	--	--
3	Male	2015	0	--	--	--	--
	Female		15	29.5	27.9-33.9	12.7	9.1-17.4
4	Male	2014	5	36.3	34.6-37.5	20.2	18.4-23.0
	Female		12	33.5	30.3-35.3	17.2	14.8-22.8
5	Male	2013	0	--	--	--	--
	Female		2	32.2	31.2-33.1	14.8	14.1-15.5

Table 13. Age composition, length and weight of 155 chinook salmon collected by electrofishing, fall 2019.

Age	Sex	Brood year	Number	Mean length (in)	Range	Mean weight (lb)	Range
1	Male	2018	0	--	--	--	--
	Female		0	--	--	--	--
2	Male	2017	0	--	--	--	--
	Female		0	--	--	--	--
3	Male	2016	115	31.8	26.9-35.8	14.2	7.2-19.9
	Female		98	31.2	25.9-35.1	14.5	8.4-22.0
4	Male	2015	0	--	--	--	--
	Female		3	31.5	30.9-32.3	12.8	10.6-14.7
5	Male	2014	0	--	--	--	--
	Female		0	--	--	--	--

Cisco Vertical Gill Netting

Young-of-year cisco

Relative abundance of young-of-year cisco in Fort Peck Reservoir decreased greatly in 2019 as no fish were captured during fall sampling efforts. Relative abundance of young-of-year cisco was 99 per net-night in 2018. The long-term average of 75 per net-night from 1989 to 2019. Young-of-year cisco relative abundance has fluctuated over the years on Fort Peck Reservoir and similar trends have been observed in other reservoirs where cisco populations occur (Dave Yerk, personal communication; Figure 19).

Limited ice cover appears to correlate with decreases in young-of-year cisco relative abundance on Fort Peck Reservoir. Duration of ice cover has been shown to reduce the wind and wave action, which decreases sedimentation over incubating eggs, and ultimately reduces mortality (Freeberg et al. 1990; Rook et al. 2013). For example, in 1987 and 1992 the reservoir did not freeze over and resulted in very few young-of-year cisco captured. In contrast, ice cover occurred on December 13th, 1985 and December 21st, 2000 resulting in two of the largest year classes ever produced. Ice cover occurred on February 4th, 2019 and receded on April 11th, 2019 resulting in a very poor year class.

Decreases in reservoir elevation could also explain reductions in young-of-year cisco on Fort Peck Reservoir. Decreases in reservoir elevation, which dewater incubating eggs, have been shown to reduce to young-of-year cisco abundance in other reservoir systems (Gaboury and Patalas 1984; Zollweg and Leathe 2006). For example, large decreases in reservoir elevation during 1989, 1996, 2003, and 2007 resulted in low relative abundance of young-of-year cisco (Figure 19). In contrast, when water levels were increasing over winter of 1993-1994 and again in 2008-2009, two of the best year classes of cisco were produced. Reservoir elevations decreased 4.3 feet during the 2018-2019 winter months. It is possible that limited ice cover and declining reservoir elevations influenced the low relative abundance of young-of-year cisco in 2019.

Adult cisco

Additional mesh sizes (¾, 1, 1 ¼-in) were incorporated in 2013 vertical gill netting efforts in an attempt to provide additional information on the adult cisco population in Fort Peck Reservoir. This technique has been used successfully on other water bodies that contain cisco and other pelagic species (Dave Yerk, personal communication). The large year classes of cisco produced in 2013 and 2014, which were observed in the ½-in mesh, appear to have recruited to the population as indicated by the increase in relative abundance of cisco captured in the ¾-in mesh from 2015-2016 and a similar trend was observed in 2018 and 2019 (Figure 20). When examining length frequencies from 2016-2019, similar trends exist as age-0 fish ranging from 110 to 130 mm grow and recruit to the population as age-1 fish that range from 170 mm to 190 mm (Figure 21). Length frequency distribution in 2019 suggest multiple year classes and slower growth with a majority of fish stockpiling from 180 to 250 mm in length.

Mean length for cisco captured by vertical gill nets in Fort Peck Reservoir during 2019 was 205, 234, and 211-mm for ¾, 1, 1 ¼-in mesh, respectively. Relative weight of adult cisco captured increased from 70 in 2018 to 77 in 2019 which was an improvement from the previous several years. The high abundance of adult cisco and low relative weights would suggest intraspecific competition. Rook et al. (2013) observed similar trends with cisco in Lake Superior and found a negative correlation to post year class survival. Currently, it is uncertain what impacts these large year classes are having on the overall zooplankton density and composition in Fort Peck Reservoir because long-term zooplankton data is unavailable. Large year classes of cisco have been shown to alter the zooplankton community by selecting for the largest zooplankters in the system (Rudstrum et al. 1993).

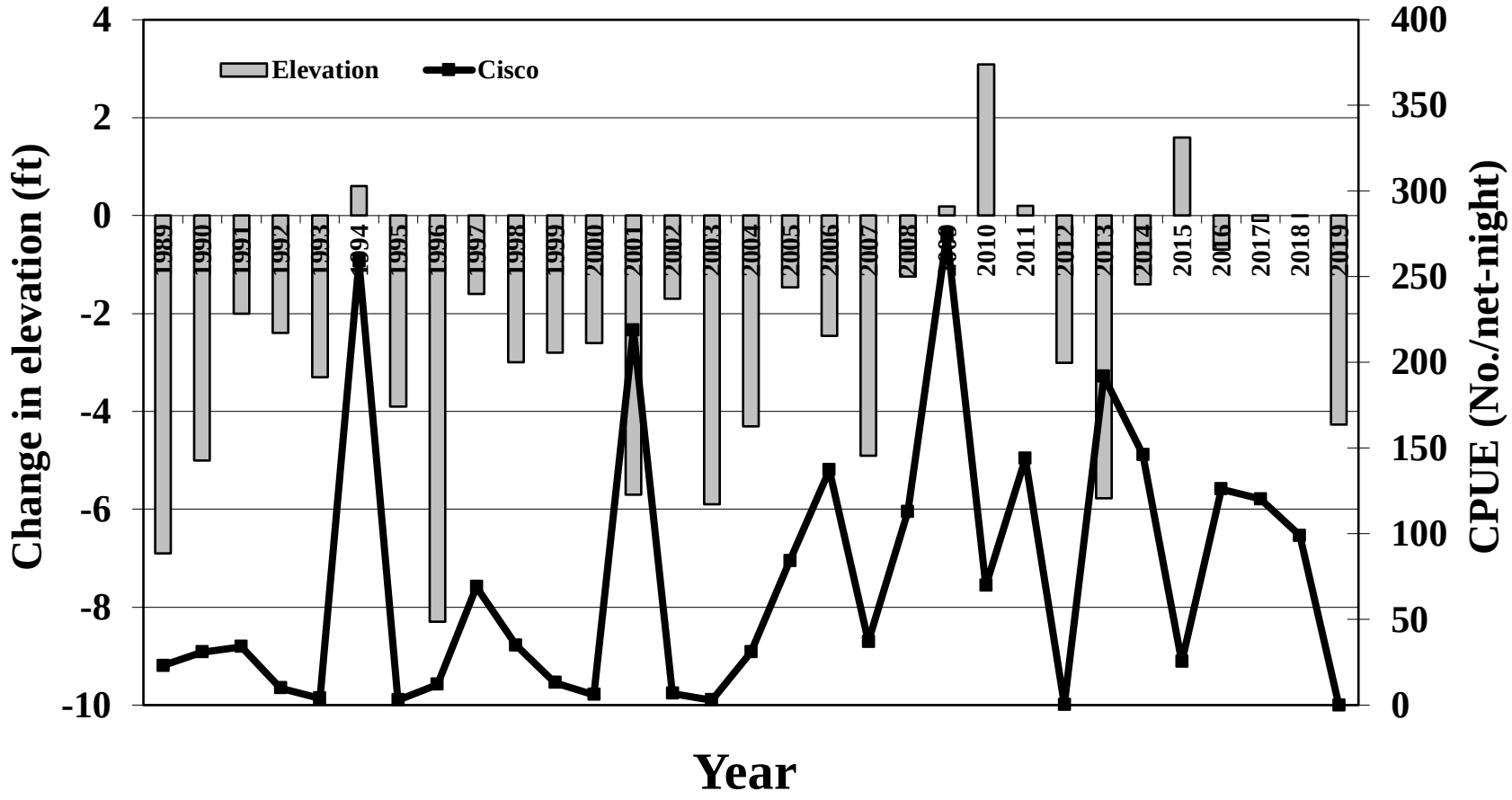


Figure 19. Change in reservoir elevation from December high to March low in contrast to mean CPUE (No./net-night) of young-of-year cisco collected in vertical gill nets on Fort Peck Reservoir, 1989-2019.

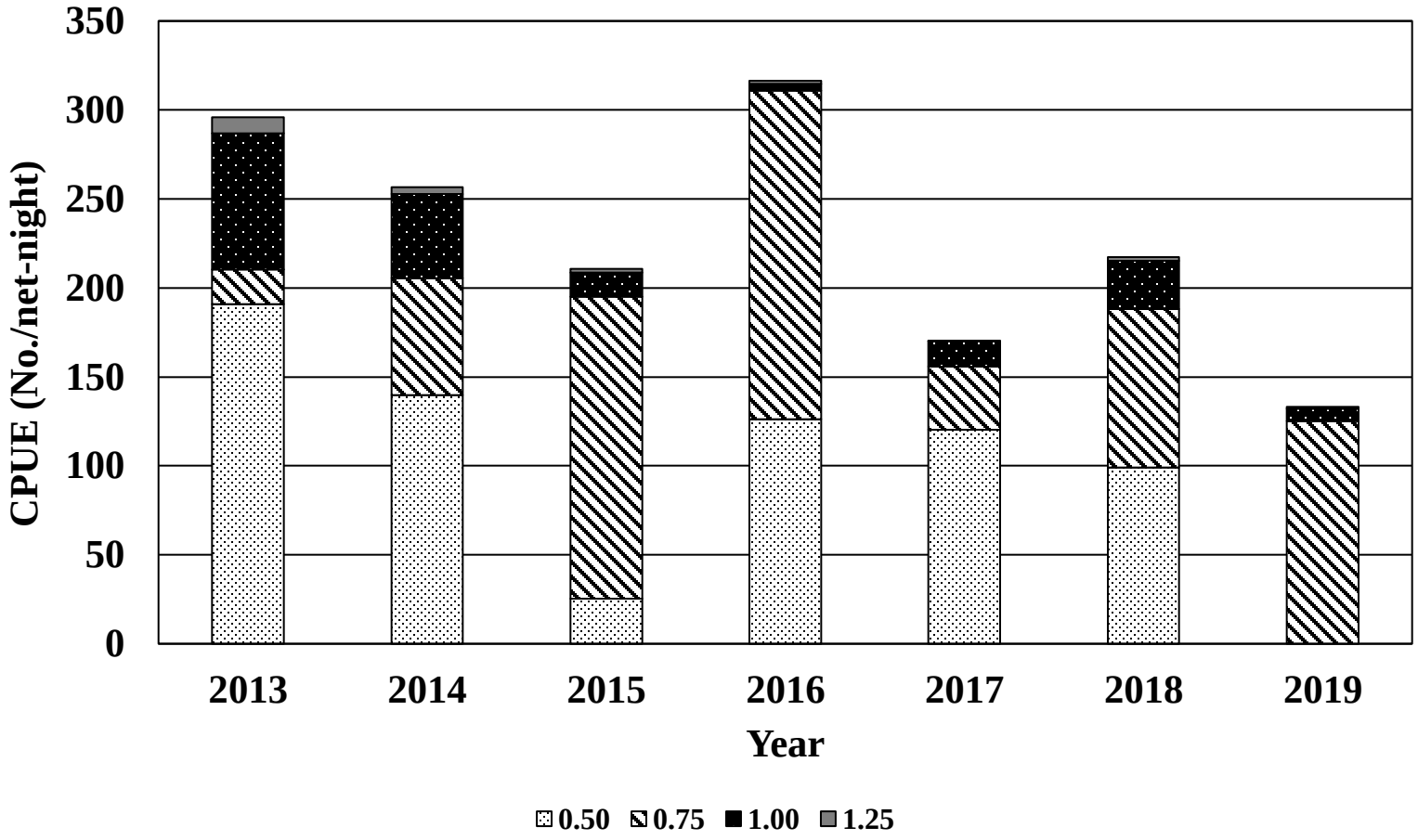


Figure 20. Mean CPUE (No./net-night) of cisco by mesh size collected in vertical gill nets on Fort Peck Reservoir, 2013-2019.

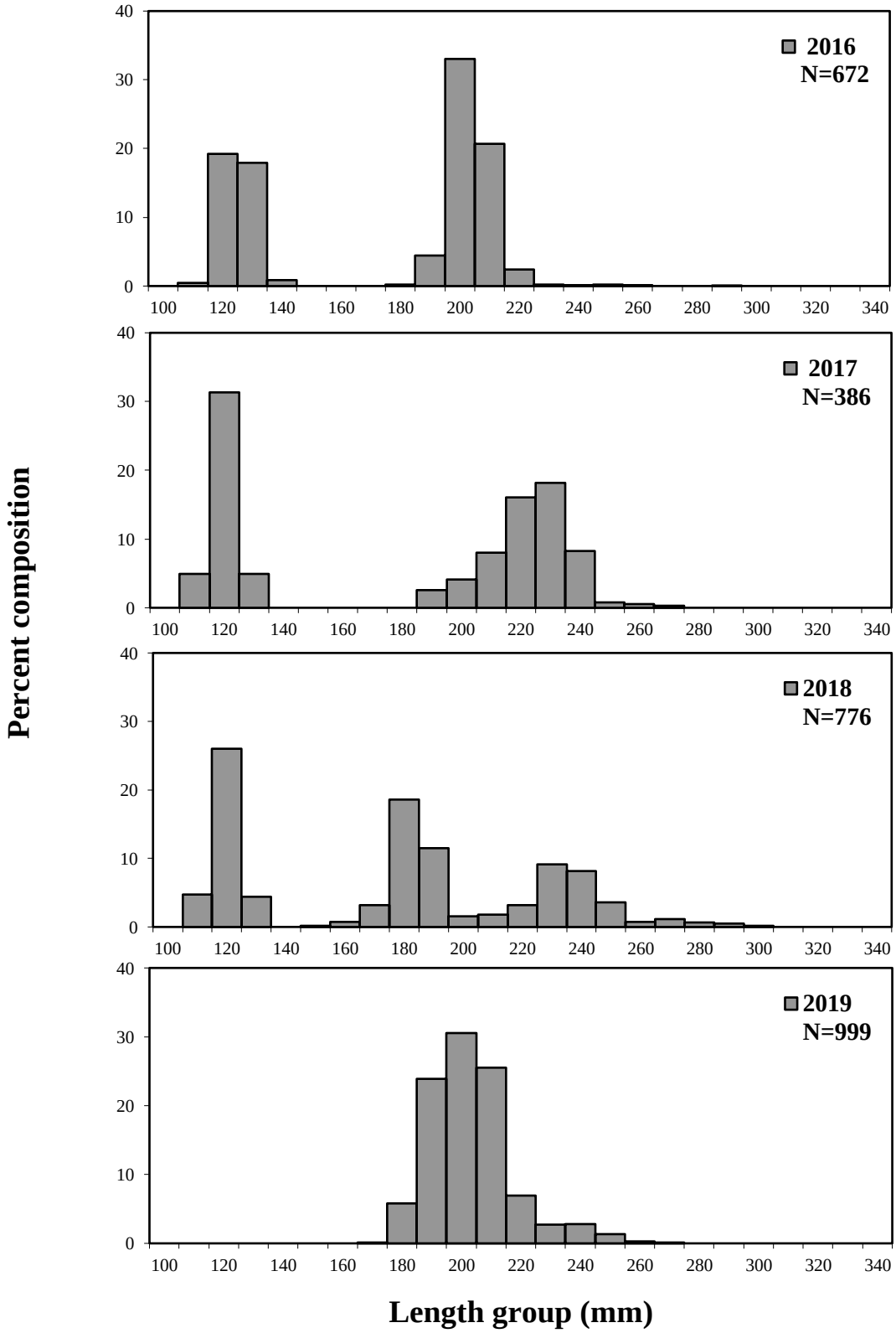


Figure 21. Length frequency of subsampled cisco collected by vertical gill nets in Fort Peck Reservoir during September, 2016-2019.

RECOMMENDATIONS

- Spring trapping of walleye and northern pike will continue to provide an egg source for supplementing Fort Peck Reservoir and sport fisheries in and out of state.

- Provide walleye eggs to Fort Peck Hatchery staff to develop methods to produce sterile walleye.

- Annual standardized sampling with modified fyke nets, experimental gill nets, vertical gill nets and beach seines will continue to obtain relative abundance data on game and forage fish distribution, abundance, production and condition.

- Evaluate native species (sauger, channel catfish, burbot) more closely by continuing to collect additional length, weight, and age information during routine sampling.

- Reservoir water levels will be monitored to determine impacts to the overall fishery. Information will be utilized to make recommendations to Corps of Engineers for Annual Operating Plan in conjunction with the Missouri River Natural Resource Committee.

- Continue working with South Dakota and North Dakota to develop a stronger tri-state chinook salmon fishery. This may require traveling out of-state to help collect and spawn salmon to receive additional eggs or collection of eggs from Fort Peck to support North and South Dakota needs.

- An evaluation of stocking strategies indicates the size of salmon released is more important than the timing of release. Efforts should be made to increase the numbers of total pounds stocked as opposed to total numbers of fish.

- Continue efforts to spawn Fort Peck salmon when numbers of adults permit. Adults should be captured with the aid of an electrofishing boat due to time and manpower constraints.

- Continue to evaluate the use of deepwater summer gill netting surveys to determine relative abundance and population dynamics of lake trout.

- Continue young-of-year and adult cisco standardized monitoring (vertical gill netting) to further explore the population dynamics of this species. Work to develop age structure and growth information for adult cisco.

- Continue annual public informational meetings and press releases to disseminate information from the previous year’s work and to discuss stocking goals and work plans for the coming year.

- Continue transferring or entering historical data to create a full database of all documented work with Fort Peck’s fishery while ensuring data is proofed and error checked.

- Continue limnological sampling program for Fort Peck Reservoir and collect water samples for “baseline” information to use in conjunction with walleye otolith microchemistry study. Evaluate chemical marking of hatchery-reared walleye fry for the use of otolith microchemistry.

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Appendix 1. Common and scientific names of fishes mentioned in this report.

Common Name	Scientific name
Bigmouth buffalo	*Ictiobus cyprinellus*
Black bullhead	*Ictalurus melas*
Black crappie	*Pomoxis nigromaculatus*
Brassy minnow	*Hybognathus hankinsoni*
Brook stickleback	*Culaea inconstans*
Brown trout	*Salmo trutta*
Burbot	*Lota lota*
Channel catfish	*Ictalurus punctatus*
Chinook salmon	*Oncorhynchus tshawytscha*
Cisco	*Coregonus artedii*
Common carp	*Cyprinus carpio*
Creek chub	*Semotilus atromaculatus*
Emerald shiner	*Notropis atherionoides*
Fathead minnow	*Pimephales promelas*
Flathead chub	*Hybopsis gracilis*
Freshwater drum	*Aplodinotous grunniens*
Goldeye	*Hiodon alosoides*
Green sunfish	*Lepomis cyanellus*
Lake chub	*Couesius plumbeus*
Lake trout	*Salvelinus namaycush*
Largemouth bass	*Micropterus salmoides*
Northern pike	*Esox lucious*
Paddlefish	*Polyodon spathula*
Pallid sturgeon	*Scaphirhynchus albus*
Plains minnow	*Hybognathus placitus*
Rainbow trout	*Oncorhynchus mykiss*
River carpsucker	*Carpoides carpio*
Sauger	*Sander canadense*
Shorthead redhorse	*Moxostoma macrolepidotum*
Shovelnose sturgeon	*Scaphiryhynchus platorynchus*
Silvery minnow	*Hybognathus argyritis*
Smallmouth bass	*Micropterus dolemieu*
Smallmouth buffalo	*Ictiobus bubalus*
Spottail shiner	*Notropis hudsonius*
Walleye	*Sander vitreum*
White crappie	*Pomoxis annularis*
White sucker	*Catostomus commersoni*
Yellow perch	*Perca flavescens*

Appendix 2. Number of walleye stocked in Fort Peck Reservoir during 2019 by date, region, location, and size.

Date	Location	Region	Fry	Fingerling	Hatchery
5/20/2019	Nelson Creek Ramp	UBD	2,750,000		Fort Peck
5/21/2019	Nelson Creek Ramp	UBD	4,500,000		Fort Peck
6/27/2019	Lost Creek	UBD		91,197	Miles City
6/27/2019	Little Bug	UBD		91,197	Miles City
5/23/2019	Rock Creek Ramp	LBD	2,425,000		Fort Peck
6/19/2019	Box Creek	LBD		144,052	Fort Peck
6/19/2019	Old Rock Creek State Park Ramp	LBD		110,026	Fort Peck
6/20/2019	Sand Arroyo	LBD		82,354	Fort Peck
6/20/2019	Box Elder	LBD		82,355	Fort Peck
6/24/2019	Rock Creek Ramp	LBD		81,536	Miles City
7/1/2019	Bobcat Creek	LBD		37,631	Fort Peck
7/1/2019	Spring Creek	LBD		37,631	Fort Peck
6/21/2019	Marina Ramp	LMA		45,311	Fort Peck
6/21/2019	Duck Creek Ramp	LMA		34,547	Fort Peck
6/24/2019	Third Coulee	LMA		62,124	Fort Peck
6/27/2019	Duck Creek Ramp	LMA		13,594	Fort Peck
7/2/2019	Main Duck	LMA		59,958	Fort Peck
7/2/2019	Mid Duck	LMA		58,958	Fort Peck
7/2/2019	Youth Camp	LMA		68,661	Fort Peck
7/2/2019	South Fork Duck Creek	LMA		41,779	Fort Peck
7/3/2019	Bear Creek	LMA		45,132	Fort Peck
7/3/2019	Cut Coulee	LMA		45,132	Fort Peck
7/9/2019	Duck Creek Ramp	LMA		127,886	Fort Peck
7/10/2019	Sage Creek	LMA		27,633	Fort Peck
7/10/2019	Skunk Coulee	LMA		27,633	Fort Peck
5/8/2019	Hell Creek Ramp	MMA	6,100,000		Miles City
5/10/2019	Hell Creek Ramp	MMA	6,000,000		Miles City
6/21/2019	Hell Creek Ramp	MMA		25,146	Miles City
6/25/2019	Middle Eighth Coulee	MMA		98,296	Fort Peck
6/25/2019	Seventh Coulee	MMA		98,295	Fort Peck
6/26/2019	Gilbert Creek	MMA		46,348	Fort Peck
6/26/2019	Penick Coulee	MMA		46,347	Fort Peck
6/28/2019	Johnson Coulee	MMA		65,912	Miles City
6/28/2019	Sutherland Creek	MMA		65,912	Miles City
7/2/2019	Cattle/Crooked Creek	MMA		59,958	Fort Peck
8/16/2019	Hell Creek Ramp	MMA		3,669	Miles City
Total			21,775,000	1,926,210	

[1]Upper Big Dry (UBD), Lower Big Dry (LBD), Lower Missouri Arm (LMA), Middle Missouri Arm (MMA). * Denotes advanced fingerlings.

Appendix 3. Temperature (°C), dissolved oxygen (mg/L), pH (standard units), turbidity (NTU), and total dissolved solids (g/L), profiles by month at Bug Creek site, Fort Peck Reservoir, 2019.

Depth (feet)	Temperature (C)	Dissolved oxygen (mg/L)	pH (units)	Turbidity (NTU)	TDS (g/L)		Depth (feet)	Temperature (C)	Dissolved oxygen (mg/L)	pH (units)	Turbidity (NTU)	TDS (g/L)
		May							**June**			
0	11.1	10.5	8.4	8.6	0.399		0	19.3	8.3	8.1	11.4	0.430
10	10.1	10.6	8.3	8.1	0.397		10	17.8	8.4	8.2	10.8	0.429
20	8.4	10.3	8.3	7.9	0.402		20	17.2	8.5	8.2	12.1	0.428
30	6.9	10.4	8.1	7.1	0.415		30	16.7	8.3	8.1	11.8	0.427
40	6.7	10.4	8.1	6.8	0.416		40	16.4	8.1	8.1	13.3	0.427
50	5.8	10.4	8.1	6.5	0.422		50	13.9	7.7	8.0	14.5	0.425
60	5.6	10.5	8.0	6.9	0.423		60	12.2	7.7	7.9	14.1	0.425
							70	9.9	8.3	7.9	12.4	0.426
		July							**August**			
0	22.0	7.8	8.2	13.2	0.429		0	20.7	7.4	8.5	10.9	0.435
10	20.7	7.9	8.3	13.1	0.427		10	20.4	7.4	8.5	13.2	0.434
20	19.9	7.8	8.2	13.0	0.425		20	20.3	7.3	8.5	14.9	0.434
30	16.9	7.4	8.1	13.4	0.427		30	20.3	7.3	8.5	15.6	0.433
40	15.9	7.1	8.0	13.7	0.426		40	20.1	7.3	8.5	16.2	0.432
50	14.2	7.0	7.9	14.4	0.425		50	15.9	5.4	8.1	17.7	0.434
60	13.3	6.7	7.8	14.9	0.424		60	13.3	5.5	7.9	19.3	0.431
70	12.6	6.8	7.8	15.4	0.426		70	12.3	5.7	7.9	19.7	0.430
		September										
0	19.9	8.1	8.6	8.9	0.437							
10	18.1	8.1	8.6	9.8	0.436							
20	17.3	8.1	8.6	10.3	0.433							
30	16.6	7.7	8.5	10.1	0.430							
40	16.3	7.5	8.5	10.5	0.430							
50	16.2	7.4	8.5	11.1	0.430							
60	15.9	7.1	8.5	12.2	0.430							
70	12.9	5.0	8.0	11.7	0.430							

Appendix 3 continued. Temperature (°C), dissolved oxygen (mg/L), pH (standard units), turbidity (NTU), and total dissolved solids (g/L), profiles by month at Spring Creek site, Fort Peck Reservoir, 2019.

Depth (feet)	Temperature (C)	Dissolved oxygen (mg/L)	pH (units)	Turbidity (NTU)	TDS (g/L)		Depth (feet)	Temperature (C)	Dissolved oxygen (mg/L)	pH (units)	Turbidity (NTU)	TDS (g/L)
		May							**June**			
0	8.2	10.7	7.9	5.9	0.429		0	17.7	8.8	8.2	9.8	0.426
10	6.9	10.8	8.0	6	0.429		10	16.9	8.9	8.3	10.3	0.426
20	6.7	10.8	8.0	7.7	0.430		20	16.5	8.9	8.3	10.9	0.425
30	6.6	10.8	8.0	7	0.430		30	16.1	8.8	8.2	11.3	0.426
40	5.3	10.9	7.9	7.3	0.430		40	15.5	8.7	8.2	13.4	0.426
50	5.1	10.9	7.9	6.7	0.429		50	14.7	8.6	8.1	12.1	0.427
60	4.9	10.8	7.9	6.6	0.430		60	12.5	8.4	8.0	10.6	0.426
70	4.8	10.9	7.9	6.4	0.430		70	9.1	9.0	8.0	10.0	0.428
80	4.7	10.9	7.9	5.6	0.430		80	8.1	9.3	7.9	9.5	0.427
90	4.6	10.9	7.9	6.1	0.430		90	7.6	9.3	7.9	9.3	0.428
100	4.4	10.8	7.9	6.6	0.430		100	6.9	9.4	7.9	9.6	0.429
		July							**August**			
0	21.8	7.9	8.3	15.2	0.429		0	20.1	7.5	8.5	12.7	0.431
10	20.6	7.9	8.3	15.4	0.427		10	20.0	7.5	8.5	13.1	0.431
20	19.9	7.9	8.3	13.7	0.426		20	19.7	7.4	8.5	13.0	0.431
30	17.7	7.5	8.2	13	0.427		30	19.6	7.4	8.5	13.8	0.430
40	15.9	7.2	8.1	13.1	0.425		40	19.6	7.3	8.5	13.4	0.430
50	13.7	7.2	8.0	13.1	0.425		50	19.4	7.2	8.5	14.1	0.430
60	12.7	7.3	7.9	13.3	0.427		60	16.3	5.9	8.2	15.9	0.429
70	11.9	7.5	7.9	13.3	0.427		70	12.8	6.0	8.0	15.5	0.429
80	11.1	7.6	7.9	13.6	0.425		80	10.9	6.5	7.9	13.4	0.428
90	10.0	7.9	7.8	13.6	0.423		90	10.4	6.6	7.9	12.9	0.429
100	9.5	8.0	7.8	13.3	0.428		100	10.1	6.7	7.9	12.3	0.428
		September										
0	18.4	8.3	8.6	6.6	0.431							
10	17.4	8.3	8.6	9.9	0.429							
20	17.1	8.2	8.6	10.4	0.429							
30	16.5	7.9	8.5	10.1	0.429							
40	16.4	7.7	8.5	10.7	0.429							
50	16.3	7.6	8.5	11.2	0.429							
60	16.2	7.5	8.5	12.1	0.429							
70	16.1	7.4	8.4	12.5	0.429							
80	12.8	5.9	8.1	12.5	0.430							
90	12.1	5.8	8.0	12.2	0.430							
100	11.6	5.7	8.0	11.1	0.429							

Appendix 3 continued. Temperature (°C), dissolved oxygen (mg/L), pH (standard units), turbidity (NTU), and total dissolved solids (g/L), profiles by month at Haxby site, Fort Peck Reservoir, 2019.

Depth (feet)	Temperature (C)	Dissolved oxygen (mg/L)	pH (units)	Turbidity (NTU)	TDS (g/L)		Depth (feet)	Temperature (C)	Dissolved oxygen (mg/L)	pH (units)	Turbidity (NTU)	TDS (g/L)
		May							**June**			
0	7.3	10.8	7.5	5.7	0.416		0	16.8	9.2	8.3	10.8	0.424
10	6.9	10.9	7.7	6.1	0.413		10	15.9	9.3	8.3	11.3	0.423
20	6.6	10.9	7.7	6.4	0.414		20	14.6	9.2	8.2	11.3	0.423
30	6.2	11.0	7.5	6.6	0.412		30	13.3	9.1	8.2	10.3	0.424
40	6.0	11.0	7.9	6.5	0.417		40	12.1	8.9	8.1	9.9	0.423
50	5.6	11.0	7.4	7.0	0.420		50	10.9	9.1	8.0	9.7	0.426
60	5.3	11.0	7.4	6.6	0.425		60	10.0	9.3	8.0	9.8	0.428
70	5.1	11.0	7.3	6.3	0.426		70	8.9	9.6	8.0	9.5	0.428
80	4.8	10.9	7.3	7.1	0.425		80	7.8	9.8	8.0	9.7	0.428
90	4.8	10.9	7.2	7.0	0.424		90	7.6	9.8	7.9	10.6	0.428
100	4.6	10.9	7.2	6.1	0.424		100	7.0	9.8	7.9	9.3	0.428
110	4.4	10.9	7.2	6.5	0.425		110	6.4	9.9	7.9	8.9	0.425
120	4.2	10.9	7.2	6.1	0.427		120	6.1	9.9	7.9	7.5	0.426
130	4.1	10.9	7.3	6.1	0.428		130	6.1	9.9	7.9	9.1	0.426
140	3.8	10.8	7.3	6.2	0.431		140	5.9	9.8	7.9	9.5	0.427
		July							**August**			
0	21.7	8.2	8.4	11.3	0.425		0	20.2	7.5	8.5	15.2	0.432
10	21.2	8.2	8.4	12.3	0.425		10	20.2	7.5	8.6	15.2	0.431
20	21.0	8.2	8.4	12.6	0.425		20	20.2	7.4	8.6	15.3	0.431
30	20.4	7.9	8.4	13.0	0.425		30	20.2	7.4	8.6	15.8	0.431
40	20.1	7.9	8.4	13.7	0.425		40	20.1	7.3	8.6	15.2	0.431
50	13.3	7.1	8.0	13.4	0.426		50	20.0	7.2	8.5	16.3	0.431
60	11.3	8.0	8.0	13.3	0.422		60	17.4	6.2	8.3	15.6	0.429
70	10.8	8.1	7.9	12.9	0.425		70	13.4	5.8	8.0	15.7	0.429
80	10.2	8.3	7.9	12.8	0.426		80	10.7	6.8	8.0	14.6	0.425
90	9.4	8.5	7.9	12.9	0.426		90	10.2	7.0	8.0	15.7	0.427
100	8.7	8.6	7.8	12.7	0.429		100	9.4	7.2	8.0	14.7	0.428
110	8.6	8.6	7.8	13.2	0.427		110	9.3	7.2	7.9	15.1	0.426
120	8.4	8.6	7.8	13.2	0.428		120	8.4	7.2	7.9	15.3	0.426
130	8.2	8.5	7.8	13.2	0.427		130	8.4	7.2	7.9	15.2	0.427
140	8.1	8.5	7.8	13.4	0.427		140	8.4	7.2	7.9	15.2	0.426
150	7.7	8.5	7.7	13.8	0.427		150	8.4	7.2	7.9	15.5	0.426
		September										
0	17.9	8.1	8.6	6.9	0.429							
10	17.4	8.1	8.6	7.2	0.431							
20	17.2	7.8	8.6	7.5	0.430							
30	17.0	7.6	8.5	6.9	0.430							
40	16.8	7.5	8.5	7.4	0.430							
50	16.5	7.4	8.5	6.8	0.429							
60	16.4	7.4	8.5	6.9	0.428							
70	15.7	7.0	8.4	6.5	0.429							
80	13.9	6.2	8.2	6.8	0.430							
90	12.3	5.9	8.1	6.6	0.429							
100	11.0	5.9	8.0	7.5	0.428							
110	10.1	6.0	7.9	7.1	0.427							
120	9.6	6.0	7.9	6.6	0.427							
130	9.6	6.0	7.9	6.4	0.427							
140	9.6	6.0	7.9	6.6	0.427							

Appendix 3 continued. Temperature (°C), dissolved oxygen (mg/L), pH (standard units), turbidity (NTU), and total dissolved solids (g/L), profiles by month at Pines site, Fort Peck Reservoir, 2019.

Depth (feet)	Temperature (C)	Dissolved oxygen (mg/L)	pH (units)	Turbidity (NTU)	TDS (g/L)		Depth (feet)	Temperature (C)	Dissolved oxygen (mg/L)	pH (units)	Turbidity (NTU)	TDS (g/L)
		May							**June**			
0	9.1	10.9	8.0	6.7	0.394		0	17.7	9.7	8.3	9.3	0.432
10	8.6	11.0	8.0	6.7	0.395		10	16.8	9.9	8.3	9.3	0.430
20	7.0	11.0	8.0	7.4	0.397		20	14.9	9.4	8.2	9.6	0.425
30	5.5	10.7	7.9	7.0	0.401		30	13.8	9.3	8.2	9.6	0.422
40	5.3	10.7	7.9	6.7	0.400		40	12.5	9.2	8.1	9.6	0.421
50	5.2	10.7	7.9	6.6	0.404		50	10.2	9.3	8.0	8.7	0.423
60	5.2	10.8	7.9	7.5	0.408		60	9.4	9.5	8.0	8.5	0.426
70	4.8	10.7	7.8	7.2	0.410		70	9.1	9.5	8.0	8.8	0.426
80	4.7	10.8	7.8	7.0	0.411		80	8.4	9.6	7.9	8.4	0.426
90	4.6	10.8	7.8	7.1	0.415		90	7.5	9.6	7.9	8.6	0.421
100	4.4	10.8	7.6	7.2	0.417		100	6.4	9.7	7.9	8.0	0.422
110	4.2	10.8	7.6	7.3	0.419		110	5.9	9.7	7.9	8.1	0.422
		July							**August**			
0	21.2	8.4	8.4	14.3	0.426		0	21.3	7.5	8.6	11.6	0.436
10	20.5	8.5	8.4	14.7	0.426		10	21.1	7.5	8.6	13.5	0.436
20	20.1	8.3	8.4	15.1	0.425		20	21.0	7.4	8.6	13.2	0.436
30	15.7	7.3	8.1	14.9	0.426		30	20.6	6.9	8.5	12.7	0.435
40	13.0	7.3	7.9	14.1	0.424		40	15.4	5.1	8.0	14.0	0.429
50	12.3	7.5	7.9	14.6	0.425		50	12.3	6.0	8.0	13.4	0.426
60	11.6	7.7	7.9	13.9	0.424		60	11.4	6.3	7.9	13.3	0.426
70	11.2	8.0	7.9	14.1	0.423		70	10.6	6.7	8.0	12.5	0.425
80	10.2	8.0	7.9	15.6	0.423		80	10.5	6.7	7.9	12.3	0.426
90	9.3	8.2	7.8	15.4	0.422		90	10.4	6.7	7.9	12.2	0.426
100	8.7	8.3	7.8	14.9	0.423		100	10.2	6.9	7.9	12.4	0.426
110	7.9	8.4	7.8	15.0	0.424		110	10.2	6.9	7.9	12.6	0.425
							120	9.9	6.9	7.9	13.1	0.4261
		September										
0	19.6	8.0	8.6	6.4	0.435							
10	17.9	7.7	8.6	6.7	0.434							
20	17.7	7.2	8.5	7.1	0.434							
30	17.6	7.2	8.5	6.9	0.433							
40	17.5	7.3	8.5	7.3	0.432							
50	17.2	7.0	8.5	7.5	0.431							
60	15.2	5.6	8.2	7.4	0.429							
70	13.3	5.5	8.0	6.8	0.428							
80	11.8	5.6	8.0	6.1	0.427							
90	11.2	5.7	7.9	5.6	0.436							
100	10.8	5.8	7.9	5.4	0.426							
110	10.6	5.8	7.9	4.8	0.427							

Appendix 3 continued. Temperature (°C), dissolved oxygen (mg/L), pH (standard units), turbidity (NTU), and total dissolved solids (g/L), profiles by month at Hell Creek site, Fort Peck Reservoir, 2019.

Depth (feet)	Temperature (C)	Dissolved oxygen (mg/L)	pH (units)	Turbidity (NTU)	TDS (g/L)		Depth (feet)	Temperature (C)	Dissolved oxygen (mg/L)	pH (units)	Turbidity (NTU)	TDS (g/L)
		May							**June**			
0	10.9	11.6	8.2	8.3	0.378		0	18.7	9.5	8.3	9.5	0.442
10	10.2	11.4	8.2	8.4	0.379		10	16.2	8.8	8.2	9.7	0.443
20	8.3	10.7	8.0	7.4	0.377		20	14.9	8.3	8.0	9.8	0.437
30	7.7	10.7	8.0	7.1	0.374		30	13.4	8.4	8.0	9.5	0.432
40	7.2	10.5	8.0	6.6	0.374		40	11.2	8.6	7.9	9.6	0.420
50	6.9	10.5	8.0	6.6	0.375		50	8.8	8.8	7.9	9.1	0.409
60	6.8	10.2	7.9	6.6	0.377		60	6.1	9.5	7.8	8.3	0.413
70	6.2	10.1	7.9	6.0	0.378		70	5.7	9.5	7.8	8.0	0.416
80	5.3	9.1	7.6	7.4	0.401		80	5.6	9.6	7.8	7.5	0.418
90	5.1	8.7	7.5	8.1	0.414		90	5.6	9.6	7.8	7.9	0.417
100	4.9	8.5	7.5	9.0	0.418		100	5.6	9.6	7.8	7.8	0.418
110	3.8	6.6	7.2	9.1	0.471		110	5.6	9.5	7.8	7.9	0.418
		July							**August**			
0	21.7	8.5	8.4	14.1	0.428		0	22.2	7.6	8.5	14.0	0.438
10	20.9	8.4	8.3	14.8	0.428		10	22.2	7.6	8.5	13.6	0.438
20	20.4	8.1	8.3	15.7	0.428		20	22.1	7.6	8.5	13.5	0.438
30	20.0	8.1	8.3	15.6	0.427		30	22.1	7.5	8.5	13.9	0.437
40	13.9	6.6	7.8	15.0	0.426		40	20.1	4.9	8.1	14.3	0.439
50	12.1	7.0	7.8	14.6	0.424		50	12.9	4.6	7.7	15.5	0.430
60	11.3	7.6	7.8	15.0	0.423		60	10.4	6.0	7.8	15.2	0.423
70	10.4	7.8	7.8	14.7	0.422		70	9.6	6.4	7.8	14.3	0.422
80	9.1	7.6	7.7	15.5	0.419		80	9.2	6.0	7.7	14.1	0.421
90	8.5	7.8	7.7	16.0	0.417		90	8.8	6.1	7.7	13.4	0.421
100	8.4	7.8	7.7	15.3	0.417		100	8.7	6.2	7.7	15.7	0.422
110	8.0	7.7	7.7	16.8	0.417		110	8.6	6.1	7.6	14.4	0.422
		September										
0	19.6	8.5	8.66	26.5	0.438							
10	18.5	7.9	8.61	23.5	0.437							
20	18.3	7.2	8.54	23.2	0.437							
30	18.1	7.1	8.53	23.7	0.436							
40	17.9	7.0	8.53	23.3	0.435							
50	17.9	7.0	8.53	24.0	0.436							
60	14.8	4.1	7.97	26.4	0.433							
70	11.7	3.6	7.72	32.0	0.427							
80	10.9	4.1	7.75	32.6	0.425							
90	10.4	4.7	7.78	31.5	0.425							
100	10.1	4.8	7.79	32.1	0.426							
110	10.1	4.9	7.79	34.2	0.425							

Appendix 3 continued. Temperature (°C), dissolved oxygen (mg/L), pH (standard units), turbidity (NTU), and total dissolved solids (g/L), profiles by month at Timber Creek site, Fort Peck Reservoir, 2019.

Depth (feet)	Temperature (C)	Dissolved oxygen (mg/L)	pH (units)	Turbidity (NTU)	TDS (g/L)		Depth (feet)	Temperature (C)	Dissolved oxygen (mg/L)	pH (units)	Turbidity (NTU)	TDS (g/L)
		May							**June**			
0	13.3	10.8	8.0	8.7	0.496		0	18.2	8.3	8.0	14.2	0.426
10	12.7	10.8	8.1	9.2	0.496		10	14.7	7.7	7.9	13.9	0.433
20	10.0	9.2	7.8	9.1	0.503		20	10.3	7.3	7.7	10.6	0.433
30	9.2	8.9	7.7	8.6	0.499		30	8.1	8.0	7.7	10.1	0.414
40	8.7	8.8	7.6	7.7	0.491		40	7.1	8.3	7.7	9.9	0.409
50	8.6	8.6	7.6	8.4	0.489		50	7.0	8.3	7.6	9.1	0.408
60	8.5	8.4	7.6	8.2	0.497		60	6.8	8.4	7.6	9.6	0.408
							70	6.8	8.4	7.7	9.7	0.407
		July							**August**			
0	21.3	7.7	8.2	18.0	0.434		0	22.3	7.2	8.4	16.3	0.450
10	21.1	7.6	8.2	18.9	0.434		10	22.2	7.2	8.4	15.9	0.449
20	15.2	5.4	7.7	17.6	0.432		20	22.2	7.1	8.4	17.1	0.449
30	13.1	6.7	7.7	16.7	0.425		30	20.9	5.1	8.1	17.5	0.453
40	12.2	6.3	7.7	18.5	0.425		40	16.4	3.6	7.7	19.1	0.446
50	11.2	6.6	7.7	18.6	0.423		50	13.0	3.0	7.5	23.8	0.435
60	10.9	6.6	7.6	18.8	0.423		60	11.7	3.3	7.5	30.4	0.429
70	10.4	6.5	7.6	21.9	0.421		70	11.3	3.4	7.5	38.2	0.427
		September										
0	19.9	8.6	8.6	16.4	0.430							
10	19.3	8.1	8.6	16.9	0.430							
20	18.6	7.7	8.6	17.1	0.437							
30	18.4	7.0	8.5	17.5	0.437							
40	18.4	6.9	8.5	17.5	0.437							
50	18.3	7.1	8.5	22.0	0.441							
60	17.8	5.7	8.3	41.8	0.454							
70	14.3	1.1	7.6	32.8	0.437							

Appendix 4. Gill netting dates by region, water surface temperature range (°F), and reservoir elevation (MSL) during standard experimental gill net surveys on Fort Peck Reservoir. Mean water surface temperatures are given in parentheses.

	Region[1]					Water surface	Reservoir
Year	UBD	LBD	LMA	MMA	UMA	Temperature (°F)	Elevation (MSL)
1995	7/18 to 7/21	7/25 to 7/28	8/8 to 8/24	8/1 to 8/15	8/15 to 8/17	68 to 76 (71.0)	2242.6 to 2244.1
1996	7/16 to 7/18	7/23 to 7/25	7/30 to 8/1	8/6 to 8/13	8/13 to 8/15	66 to 74 (69.4)	2246.5 to 2244.2
1998	7/17 to 7/28	7/15 to 7/21	7/14 to 7/30	8/5 to 8/11	8/11 to 8/13	NA	2239.7 to 2239.9
1999	7/13 to 7/20	7/15 to 7/22	7/23 to 7/28	7/29 to 8/9	8/10 to 8/11	67 to 76 (71.6)	2238.0 to 2236.9
2000	7/26 to 9/8	7/19 to 7/27	7/11 to 7/14	8/8 to 8/11	8/23 to 8/24	NA	2232.6 to 2231.0
2001	7/31 to 8/2	8/7 to 8/16	8/16 to 8/17	8/21 to 8/28	7/23 to 8/28	NA	2222.5 to 2221.8
2002	7/17 to 9/6	7/18 to 9/6	7/23 to 8/1	7/25 to 9/4	8/6 to 8/14	68 to 81 (74.3)	2220.2 to 2219.3
2003	7/10 to 8/20	7/10 to 8/5	7/8 to 8/13	7/15 to 8/12	7/22 to 7/24	NA	2213.0 to 2211.6
2004	7/14 to 7/15	7/13 to 7/15	7/20 to 7/22	7/21 to 7/27	7/27 to 7/29	69 to 77 (73.6)	2203.2 to 2201.6
2005	7/19 to 7/21	7/21 to 7/27	7/28 to 8/2	8/2 to 8/17	8/16 to 8/17	68 to 78 (72.1)	2203.4 to 2202.7
2006	7/11 to 7/13	7/18 to 7/20	7/20 to 7/26	7/26 to 8/3	8/3 to 8/16	69 to 80 (74.3)	2205.6 to 2204.2
2007	7/17 to 7/24	7/24 to 7/27	7/27 to 8/1	8/1 to 8/7	8/14 to 8/15	70.3 to 84.9 (78.2)	2202.9 to 2201.6
2008	7/15 to 7/17	7/17 to 7/23	7/24 to 7/30	7/30 to 8/4	8/4 to 8/6	67.1 to 80.2 (74.3)	2209.9 to 2210.0
2009	7/16 to 7/21	7/21 to 7/23	7/24 to 7/28	7/29 to 8/3	8/3 to 8/5	66.7 to 76.3 (71.1)	2220.5 to 2220.4
2010	7/13 to 7/20	7/20 to 7/22	7/22 to 7/28	7/28 to 8/5	8/3 to 8/5	67.3 to 77.9 (73.3)	2235.2 to 2235.7
2011	7/26 to 7/28	7/28 to 7/29	8/2 to 8/3	8/3 to 8/5	8/9 to 8/11	70.5 to 79.8 (75.2)	2249.3 to 2244.7
2012	7/17 to 7/19	7/19 to 7/20	7/24 to 7/25	7/25 to 8/1	7/30 to 8/1	67.2 to 83.5 (75.5)	2236.6 to 2235.8
2013	7/23 to 7/25	7/25 to 8/1	8/1 to 8/7	8/8 to 8/9	8/13 to 8/15	63.5 to 77.9 (72.3)	2236.3 to 2234.9
2014	7/17 to 7/22	7/22 to 7/24	7/24 to 7/30	7/30 to 8/7	8/5 to 8/7	67.8 to 79.8 (74.0)	2230.3 to 2229.9
2015	7/21 to 7/23	7/23 to 7/31	7/31 to 8/5	8/5 to 8/13	8/11 to 8/13	67.9 to 79.2 (73.0)	2236.4 to 2235.9
2016	7/19 to 7/21	7/21 to 7/27	7/27 to 8/3	8/2 to 8/5	8/9 to 8/11	69.4 to 77.7 (73.1)	2235.4 to 2234.7
2017	7/18 to 7/20	7/20 to 7/26	7/26 to 8/3	8/2 to 8/9	8/7 to 8/9	68.6 to 75.5 (72.1)	2239.6 to 2238.5
2018	7/18 to 7/20	7/20 to 7/24	7/24 to 7/31	7/31 to 8/8	8/6 to 8/8	69.2 to 77.4 (74.4)	2233.8 to 2247.9
2019	7/17 to 7/19	7/19 to 7/23	7/23 to 8/1	7/30 to 8/15	8/14 to 8/16	69.4 to 79.4 (73.2)	2246.7 to 2245.2

[1]Upper Big Dry (UBD), Lower Big Dry (LBD), Lower Missouri Arm (LMA), Middle Missouri Arm (MMA), and upper Missouri Arm (UMA).

Appendix 5. Northern pike and channel catfish proportional stock density (PSD) relative stock density of preferred-length (PSD-P) fish and mean relative weight values (*Wr*), for 2005-2019, for fish collected in the standard July-August gill net survey, on Fort Peck Reservoir.

Northern pike				
Year	PSD	PSD-P	*Wr*	Sample size
2004	96	71	100.1	75
2005	93	59	100.3	86
2006	89	60	98.9	108
2007	75	41	101.0	147
2008	89	39	100.0	137
2009	73	39	93.1	176
2010	68	24	100.0	191
2011	69	18	100.5	293
2012	75	15	99.0	503
2013	75	24	93.1	324
2014	82	33	96.2	336
2015	88	40	97.5	264
2016	82	38	92.9	226
2017	90	32	90.3	184
2018	94	40	95	165
2019	81	24	96.1	302

Channel catfish				
Year	PSD	PSD-P	*Wr*	Sample size
2004	57	11	98.1	227
2005	35	6	91.3	297
2006	46	10	95.1	215
2007	38	4	85.3	278
2008	35	2	88.2	289
2009	57	5	91.6	314
2010	74	11	88.2	104
2011	72	8	90.5	241
2012	65	3	87.9	272
2013	64	4	85.7	240
2014	80	3	84.7	246
2015	86	3	85.5	201
2016	65	4	86.5	217
2017	73	6	84.7	140
2018	53	13	88.2	179
2019	83	14	87.9	110