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, 2016 THROUGH JUNE 30, 2017
REPORT PERIOD: MARCH 1, 2016 THROUGH FEBRUARY 29, 2017

ABSTRACT

Fort Peck Reservoir reached peak elevation on June 6th, 2016 at 2236.627 mean feet above sea level (MSL) from a minimum elevation on October 1st, 2016 at 2233.42 MSL, a decrease of 3.2 feet. Spawning walleye populations were sampled in the upper Big Dry Arm with modified fyke nets from March 29th to April 21st. Walleye eggs were collected and the fertilized eggs were sent to Fort Peck and Miles City fish hatcheries. Trap netting captured 2,672 walleye for a catch rate of 6.3 per net night in 2016 which was down slightly from the previous year of 4.3 per net night. Due to favorable spawning conditions, 79 million walleye eggs were collected in 2016. A total of 20.5 million fry and 2.3 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 19th to August 11th, 2016. Walleye, northern pike, and channel catfish were the most abundant species captured overall, with catch rates of 4.4, 2.3, and 2.2 per net night, respectively. Relative abundance of walleye in 2016 was down slightly from the previous year at 4.4 per net night but above the long-term average of 3.8 per net for the period from 1984 to 2016. Gill-netted walleye averaged 17.8 inches and 2.5 pounds. In 2016, relative abundance increased for preferred-size walleye while catch rates for stock-size decreased. Relative weights of walleye increased for quality-size groups while other groups decreased slightly. Northern pike relative abundance in 2016 decreased slightly to 2.3 per net night but was above the long-term average of 1.8 per net night for the period of 1984 to 2016. Average size of gill-netted northern pike in 2016 was 25.8 inches and 4.6 pounds. Overall, relative abundance of shoreline forage decreased to 63.1 per haul in 2016 and was below the long-term average of 164 per haul from 1984 to 2016. Relative abundance of young-of-year yellow perch remained low again in 2016 at 9.9 per seine haul. In June of 2016, 56,664 chinook salmon were stocked at the Fort Peck Marina and Milk Coulee. Young-of-year cisco relative abundance increased to 126.1 per net night in 2016 which was above the long-term average of 78 per net night for the period of 1986 to 2016.

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 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. One hundred and four volunteers assisted with the annual walleye egg-taking operation in the upper Big Dry Arm of Fort Peck Reservoir. Reservoir staff assisted with kids fishing clinics and as science fair judges. Staff also assisted the regional information and education officer with multiple press and fisheries information for the R6 Facebook page. Staff attended Walleyes Unlimited meetings in Billings and Malta to present annual updates on the status of the Fort Peck Reservoir fishery. Staff also presented multiple 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. The reservoir reached peak elevation on June 6th, 2016 at 2236.627 MSL from a minimum elevation on October 1st, 2016 at 2233.42 MSL, a decrease of 3.2 feet (Figure 2). Reservoir elevations are predicted to rise approximately four to six feet from March through June and fall beginning in August of 2017based on the March 2017 basic forecast (USACE 2016).

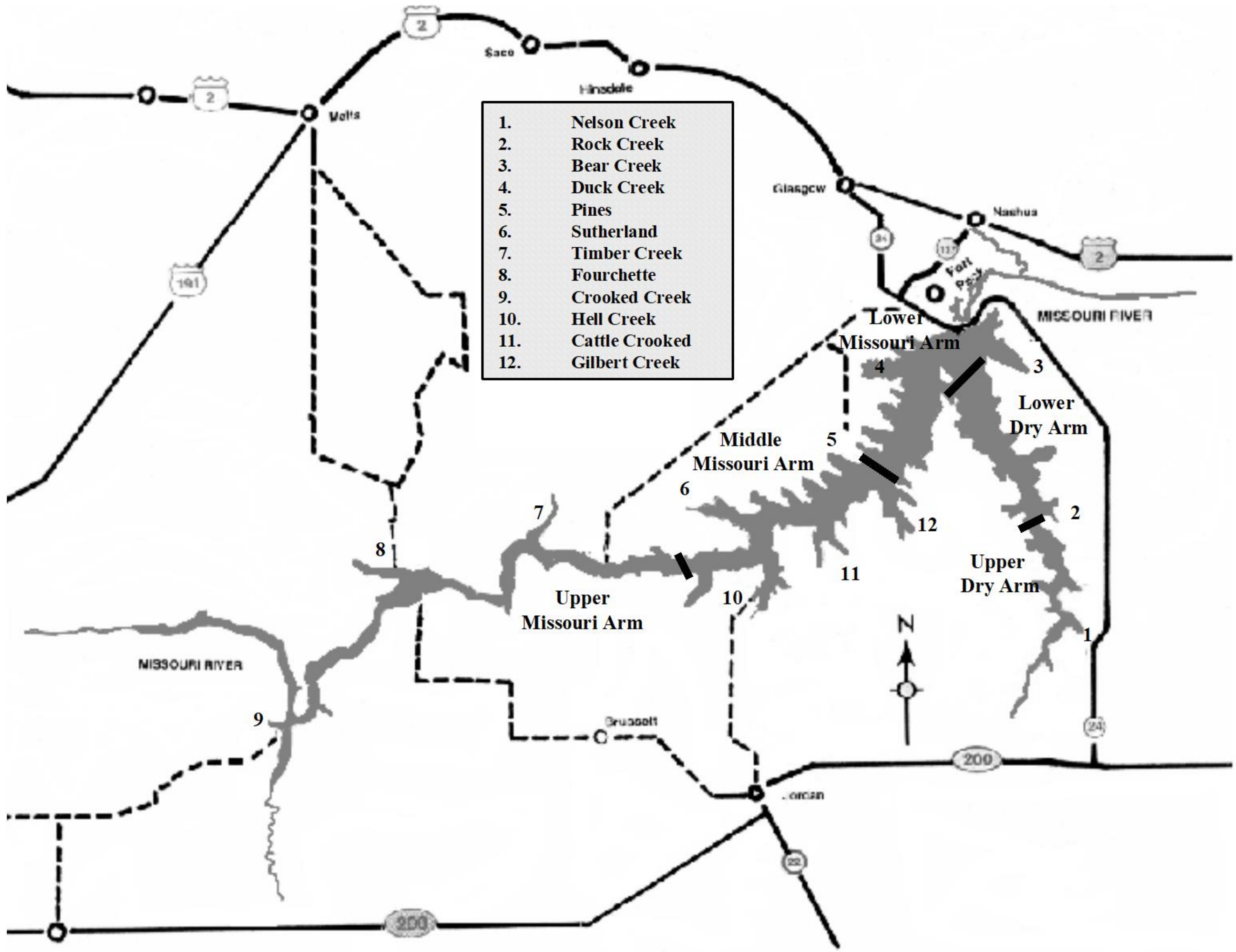

Figure 1. Fort Peck study area describing major sampling zones and select specific locations.

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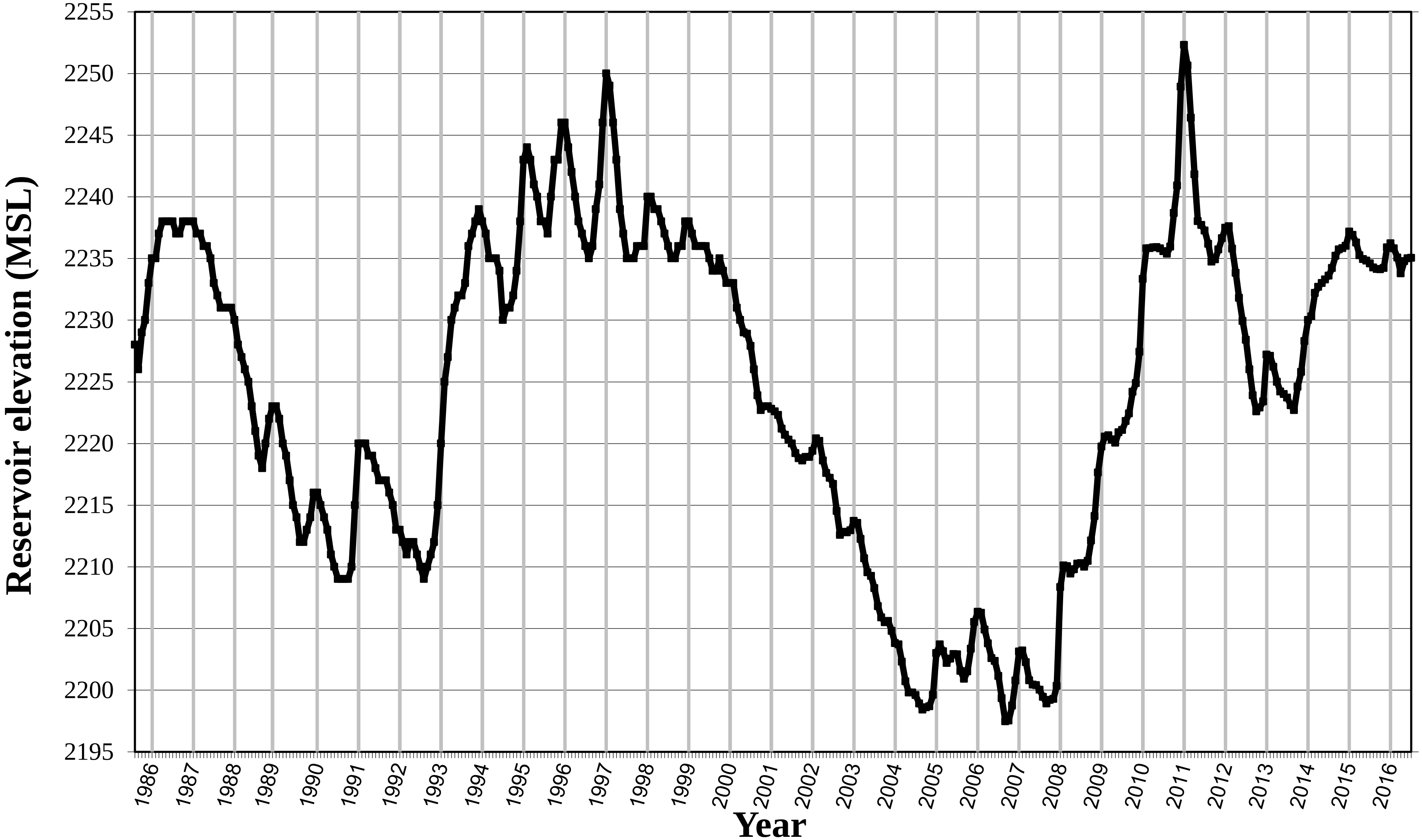


Figure 2. Peak monthly reservoir elevations on Fort Peck Reservoir from January 1986 to January 2016 (Data provided by the U.S. Army Corps of Engineers).

SAMPLING METHODS

Data Collection

- Spring sampling was conducted from March 29th to April 21st, 2016 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. 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. Gill netting occurred from July 19th to August 11th, 2016 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.
- All walleye otoliths were collected at all sampling locations. 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 8th to September 7th, 2016 using a 100-ft x 9-ft beach seine of 3/16-in square mesh at 100 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 16th to September 29th, 2016. 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.
- Electrofishing was used during September 29th to October 19th, 2016 to locate, sample, and collect chinook salmon as part of the annual egg-take effort.
- Chinook salmon otoliths were collected from all mortalities 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 in the Nelson Creek to McGuire Creek area of Fort Peck Reservoir from March 29th to April 21st, 2016. A total of 427-trap days were committed to walleye spawning efforts in 2016. Netting effort was higher than the previous year due to earlier ice out. 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 42°F when trap netting efforts commenced and gradually increased to 50°F. Walleye spawning activity peaks when water temperatures are 43°F to 50°F in the north-central United States (Becker 1983).

Because of the favorable and gradually increasing water temperatures in 2016, walleye egg collection efforts were exceeded. The egg-take goal of 60 million was met and 79 million total eggs were collected. A total of 2.5 million northern pike eggs were also collected to meet statewide stocking requests in 2016. The fertilized walleye eggs were sent to Fort Peck and Miles City Fish Hatcheries. A total of 20.5 million fry and 2.3 million walleye fingerlings were stocked in various locations throughout Fort Peck Reservoir (Appendix 2). Kerr (2011) recommended walleye release sites should be increased as size and basin complexity of the water body 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. Cooler water temperatures and decreased zooplankton densities were observed in the rearing ponds at Fort Peck and Miles City hatcheries during the time of fry stocking (i.e., Wade Geraets, personal communication). These conditions have been shown to be unfavorable for growth and survival for stocked walleye fry.

Walleye

Relative abundance of walleye in spring trap nets was 6.3 per net in 2016, which increased from the previous year, but slightly below the long-term average of 7.0 per net (1982-2016; Table 2). Average length and weight of walleye measured was 21.1 inches and 4.5 pounds in 2015 and 17.8 inches and 3.0 pounds in 2016. Length frequency distributions showed 59% of walleye were greater than 20 inches in 2015 compared to 23% in 2016 (Figure 3). Typically, more male walleye are captured than female walleye during spring trap netting efforts as indicated by length frequency histograms (Figures 3 and 4). 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 29 inches were captured (Figure 4). Average length and weight of males in 2016 was 15.9 and 1.7 while females averaged 23.8 inches and 7.2 pounds.

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, 1982-2016. 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
1982	(4/21-5/07)	89	655	7.4	221	2.5
1983	(4/06-5/09)	106	725	6.8	87	0.8
1984	(4/10-5/04)	96	579	6	21	0.2
1985	(4/08-4/26)	97	1,202	12.4	69	0.7
1986	(4/07-4/24)	102	1,448	14.2	174	l.7
1987	(4/07-4/24)	220	1,512	6.9	78	0.3
1988	(4/06-4/22)	214	1,610	7.5	163	0.8
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
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	(4/18-5/5)	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

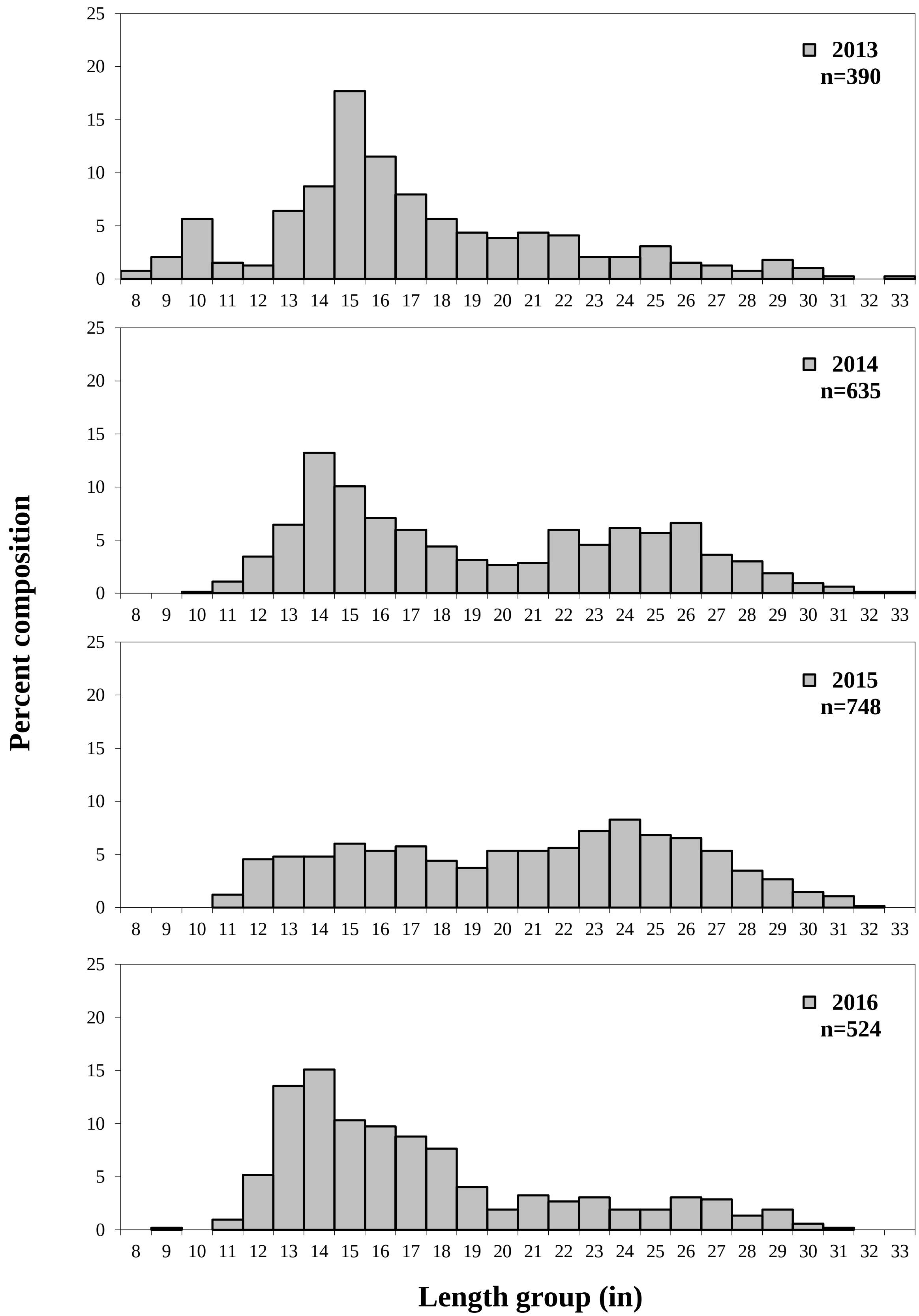


Figure 3. Length frequency of subsampled walleye collected during spring trap netting in the upper Big Dry Arm of Fort Peck Reservoir, 2013-2016.

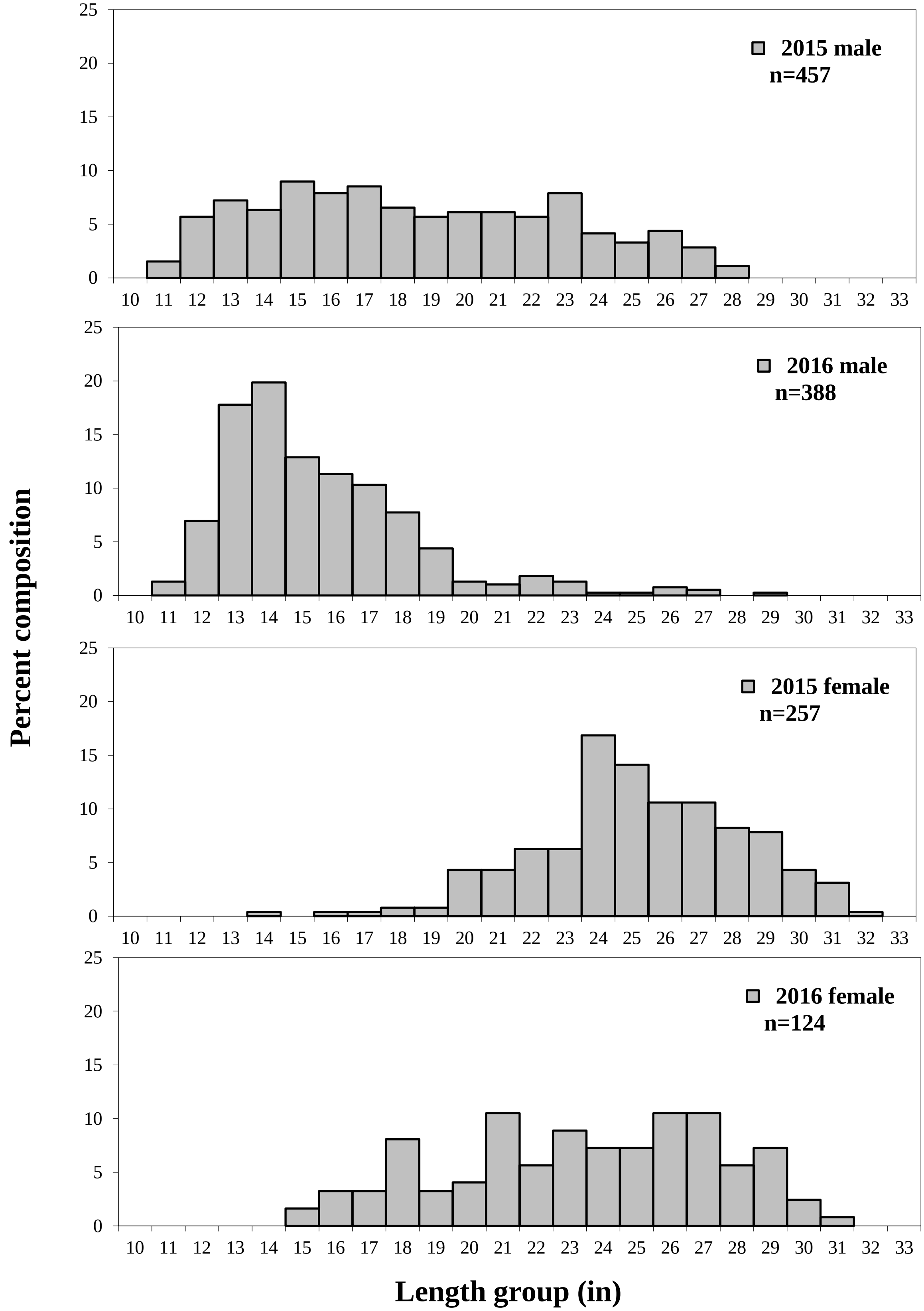


Figure 4. Length frequency of subsampled male and female walleye collected during spring trap netting in the upper Big Dry Arm of Fort Peck Reservoir, 2015-2016.

LIMNOLOGY AND ZOOPLANKTON MONITORING

Water temperature in Fort Peck Reservoir ranged from 21.3°C below the water surface to 8.9°C at the bottom in 2016 (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 were 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 (Appendix 3). Each site was thermally stratified during the month of August 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 were highest (9.4 mg/L) during May when the reservoir was coolest. 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 Timber Creek during August. Although no anoxic conditions were observed at any of the locations in 2016, dissolved oxygen levels of less than 5 mg/L may limit some deep-water salmonid habitat (e.g., lake trout; Sellers et al. 1998). It should be noted that dissolved oxygen levels of 2.2 mg/L were observed in August near the bottom at the Timber Creek site. This would explain the high mortality of adult cisco that occurred in the upper portion of the reservoir during that time (Jacobsen et al. 2008).

The maximum estimated zooplankton density was 56.3/L which occurred in June of 2016 and was comprised largely of bosmina and cyclopoids. With the exception of May and June, cyclopoids dominated the zooplankton community into September and reached peak density in August at 19.6/L. *Bosmina* and *Daphnia* were the two most abundant cladocerans sampled. *Bosmina* were more abundant in May and June while *Daphnia* where more abundant in June through September (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 indicated that the mid to lower portions of Fort Peck Reservoir were slightly more productive than other areas sampled (Figure 7). Wiedenheft (1985) noted a similar trend in zooplankton density. Mean densities of zooplankton were similar to lower in 2015at all locations with the exception of the Pines. A possible explanation for similar zooplankton densities in 2015 and 2016 could be explained by stable reservoir elevations and similar flows into the reservoir. Increases in reservoir elevation and inflows have been shown to increase standing crops of zooplankton and diversity of the zooplankton community (Martin et al. 1981).

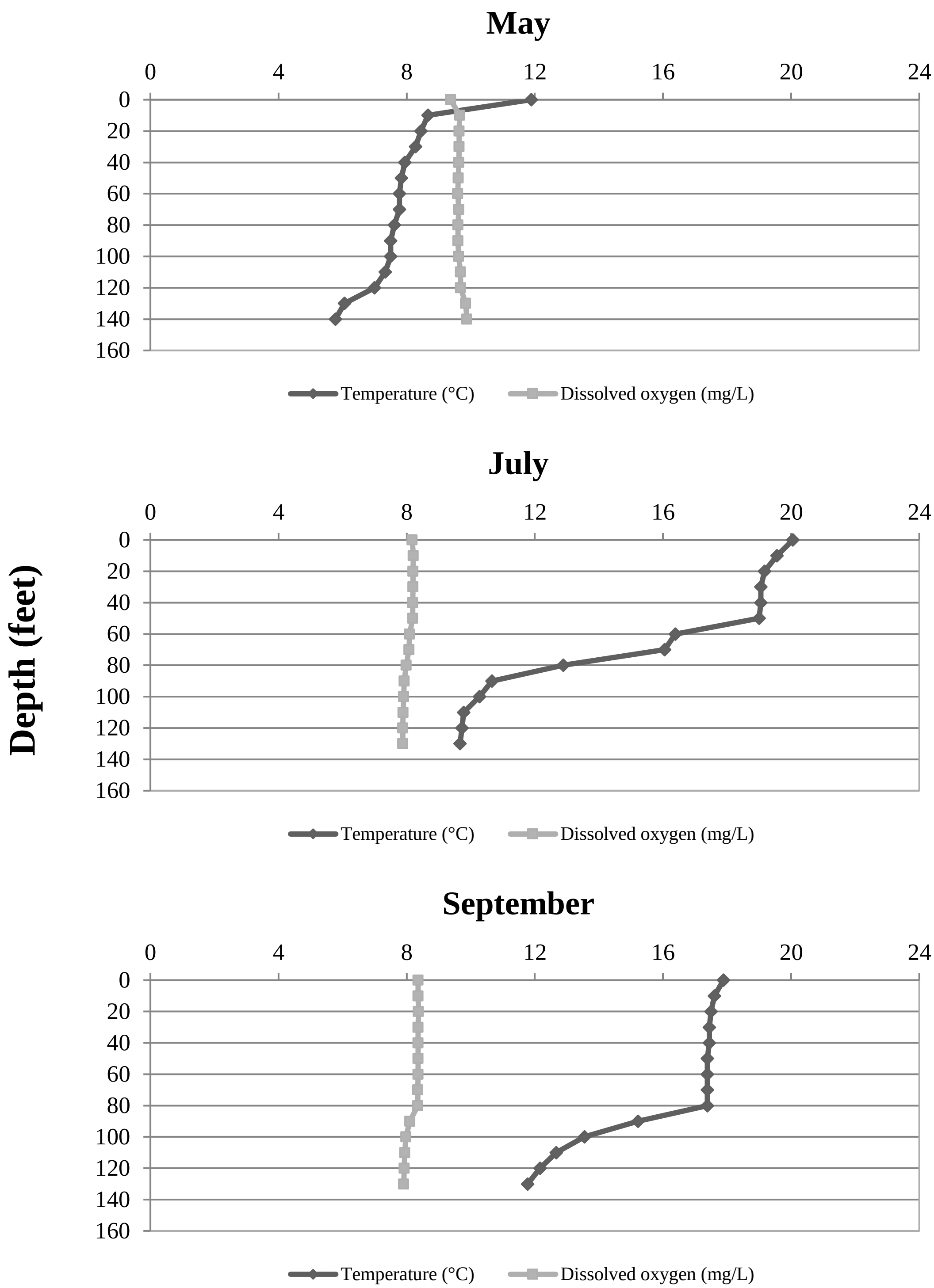


Figure 5. Depth profiles of temperature (°C) and oxygen (mg/L) located near Haxby Point on Fort Peck Reservoir, May-September 2016.

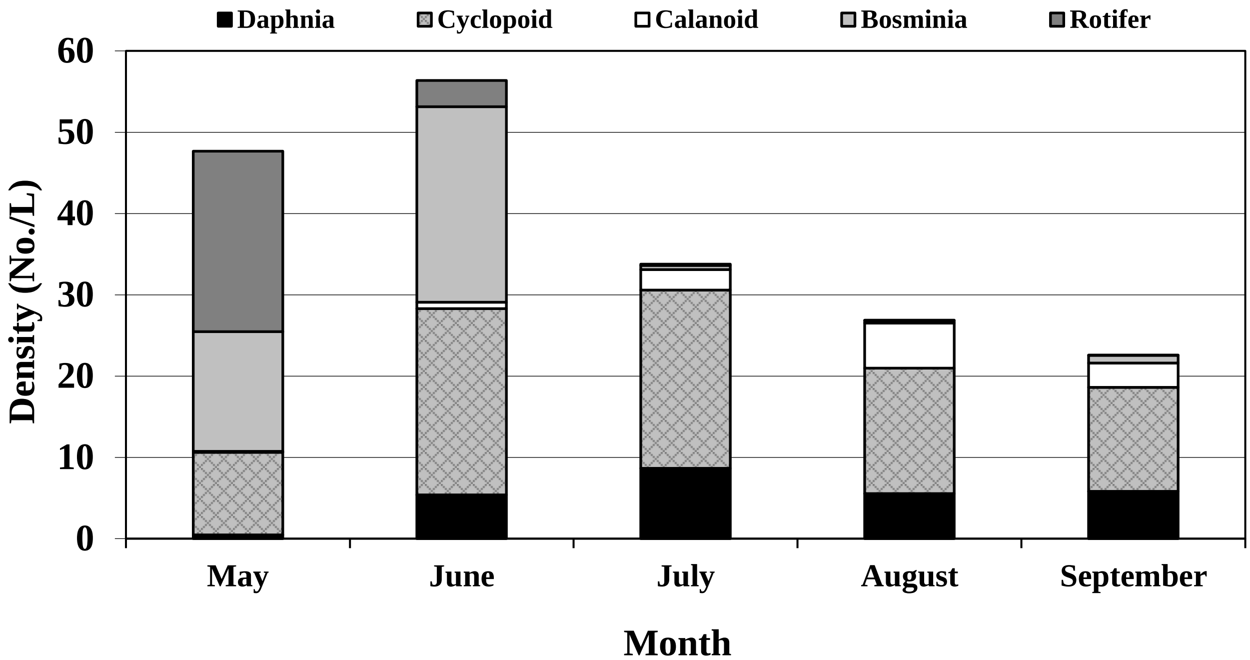


Figure 6. Mean zooplankton density (number of organisms/L) pooled from reservoir-wide samples by taxonomic group and month for Fort Peck Reservoir, 2015.

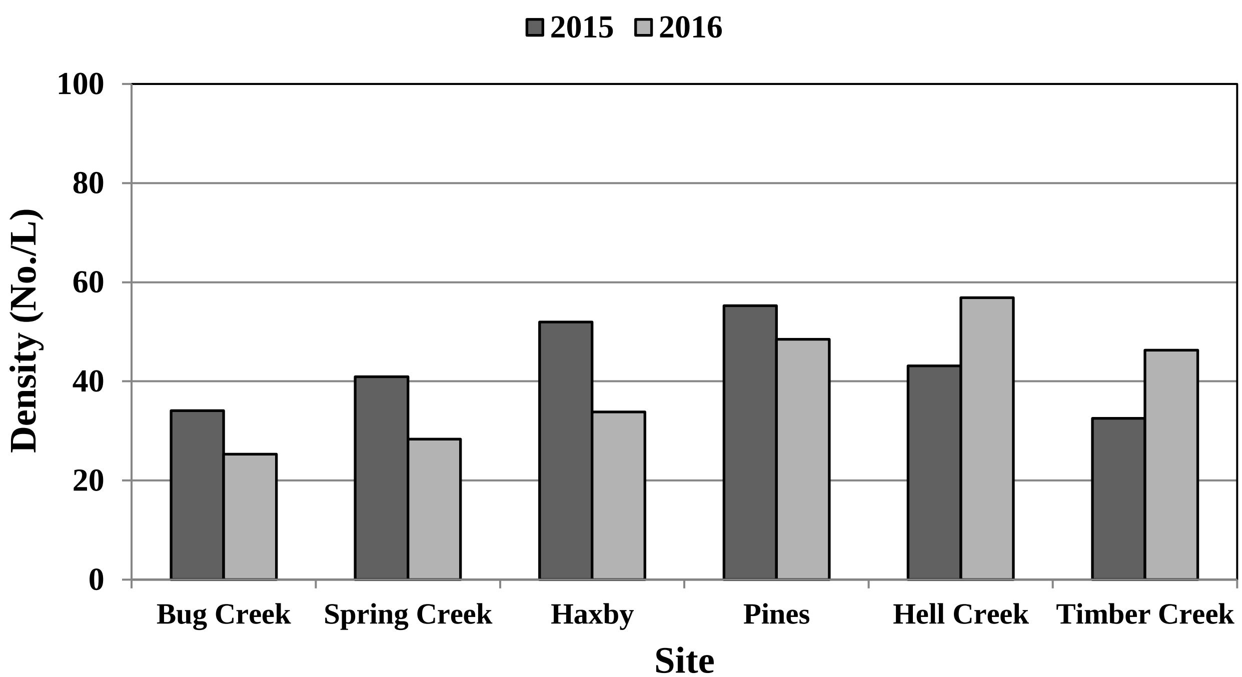


Figure 7. Mean zooplankton density (number of organisms/L) pooled from monthly samples for Fort Peck Reservoir, 2015-2016.

RESERVOIR-WIDE GILL NETTING

Standard experimental gill nets were set throughout the reservoir from July 19th to August 11th, 2016 when water surface temperatures ranged from 69°F to 78°F. Gill netting provides information on species distribution; composition, relative abundance, population parameters, and stomach contents of game species. Nineteen species were captured for a total of 1,926 fish (Table 2). Walleye, northern pike, and channel catfish were the most abundant species captured overall, with catch rates of 4.4, 2.3, and 2.2 per net night, respectively. Fish with catch rates equal to or greater than 1.0 per-net night include: common carp, goldeye, shorthead redhorse, river carpsucker, and smallmouth bass.

Walleye

Relative abundance of walleye in 2016 was 4.4 per net which was down slightly from the previous year (Figure 8). This was above the long term average of 3.8 per net from 1984 to 2016. The three-year running average goal of 3.6 per net was met (4.6 per net in 2014-2016) as outlined in the FPRFMP. Quality and preferred length groups comprised the largest group of gill-netted walleye (Figure 8). Relative abundance of walleye was greatest in the middle Missouri arm with a catch rate of 5.4 per net (Table 3).

Length frequency distributions of walleye in 2016 indicated a broad distribution of fish with a moderate abundance of 18 to 20- inch fish (Figure 9). This group represented 28% of all walleye gill netted in 2016. In 2015, this group of fish was in the 12 to 16-inch range and comprised 50% of all walleye gill netted and as 10 to 14-inch fish in 2014 they comprised 50% of all fish sampled. This would suggest a large year class or classes 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 2016 was generally higher compared to the six-year average (Table 5). Higher mean lengths-at-age were observed for age-4 through age-9 walleye indicating favorable growth over the last few years. However, mean lengths-at-age 3 for walleye were lower in 2016 compared to previous years. It should also be noted that a large group of 5-year old fish (2011 year classes) were observed in 2016 and comprised 35% of all walleye aged. Similar to previous years, multiple year classes were present with walleye up to age-14.

Relative weights of walleye in 2016 were similar to those observed in 2015 (Table 6). Relative weights increased slightly for the preferred length group, but decreased slightly for other length groups (Figure 10). The slight decrease in relative weights for quality length and smaller walleye can be explained by a decrease in shoreline forage fish production over the last several years. In contrast, preferred length and greater walleye relative weights can be attributed to a large abundance of adult cisco (< 8"). Cisco have been found to be an important prey item for walleye greater than 18 inches in Fort Peck Reservoir (Mullins 1991).

Proportional size distribution (PSD) and proportional size distribution-preferred (PSD-P) are measures of balance for fish populations (Gabelhouse 1984). The measures are percents of fish captured at substock (<10"), and numbers of fish of each size and larger for stock (> 10"), quality (>15"), preferred (>20"), and memorable (>25") size fish. Changes in each group can be from increases or decreases in recruitment and natural or fishing mortality. Anderson and Weithman (1978) models of walleye PSD's suggest a range of 30-60 as favorable values for walleye populations. Since 1988, 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. In addition, 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.

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, 2016. *N* is total number collected for length and weight measurements.

			Average			
			Length		Weight	
Species	Number	CPUE	Inches	*N*	Pounds	*N*
Bigmouth buffalo	1	<0.1	30.9	1	19.7	1
Black bullhead	12	0.1	8.5	12	0.3	12
Black crappie	24	0.2	7.5	24	0.3	24
Channel catfish	217	2.2	17.1	217	1.8	217
Cisco	28	0.3	7.2	28	0.2	28
Common carp	137	1.4	20.7	137	4.2	137
Freshwater drum	45	0.5	13.6	45	1.3	45
Goldeye	208	2.1	13.3	208	0.7	208
Northern pike	226	2.3	25.8	226	4.6	226
Pallid sturgeon	1	<0.1	18.8	1	0.4	1
River carpsucker	111	1.1	19.8	111	4.3	111
Sauger	26	0.3	16.3	26	1.4	26
Shorthead redhorse	129	1.3	14.5	129	1.3	129
Smallmouth bass	125	1.3	13.7	125	1.7	125
Smallmouth buffalo	91	0.9	23.6	91	8.3	91
Walleye	440	4.4	17.8	440	2.5	440
White crappie	7	0.1	9.1	7	0.4	7
White sucker	13	0.1	16.3	13	1.7	13
Yellow perch	85	0.9	6.8	85	0.1	85

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, 2016.

	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	--	1	<0.1	0	--	1	<0.0
Black bullhead	12	0.6	0	--	0	--	0	--	0	--	12	0.1
Black crappie	10	0.5	0	--	0	--	0	--	14	0.7	24	0.2
Channel catfish	59	3.0	11	0.6	6	0.3	19	1.0	122	6.1	217	2.2
Cisco	0	--	0	--	0	--	19	1.0	9	0.5	28	0.3
Common carp	7	0.4	20	1.0	41	2.1	33	1.7	36	1.8	137	1.4
Freshwater drum	5	0.3	6	0.3	5	0.3	8	0.4	21	1.1	45	0.5
Goldeye	44	2.2	25	1.3	24	1.2	33	1.7	82	4.1	208	2.1
Northern pike	76	3.8	44	2.2	43	2.2	40	2.0	23	1.2	226	2.3
Pallid sturgeon	0	--	0	--	0	--	0	--	<1	0.1	1	<0.0
River carpsucker	35	1.8	16	0.8	2	0.1	34	1.7	24	1.2	111	1.1
Sauger	3	0.2	4	0.2	0	--	9	0.5	10	0.5	26	0.3
Shorthead redhorse	26	1.3	5	0.3	0	--	19	1.0	79	4.0	129	1.3
Smallmouth bass	29	1.5	28	1.4	16	0.8	32	1.6	20	1.0	125	1.3
Smallmouth buffalo	17	0.9	21	1.1	14	0.7	17	0.9	22	1.1	91	0.9
Walleye	50	2.5	86	4.3	102	5.1	108	5.4	94	4.7	440	4.4
White crappie	0	--	0	--	0	--	0	--	7	0.4	7	0.1
White sucker	3	0.2	4	0.2	3	0.2	1	<0.1	2	0.1	13	0.1
Yellow perch	14	0.7	13	0.7	25	1.3	19	1.0	14	0.7	85	0.9
Total	390	19.5	283	14.2	281	14.1	392	19.6	580	29.0	1,926	19.3

[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

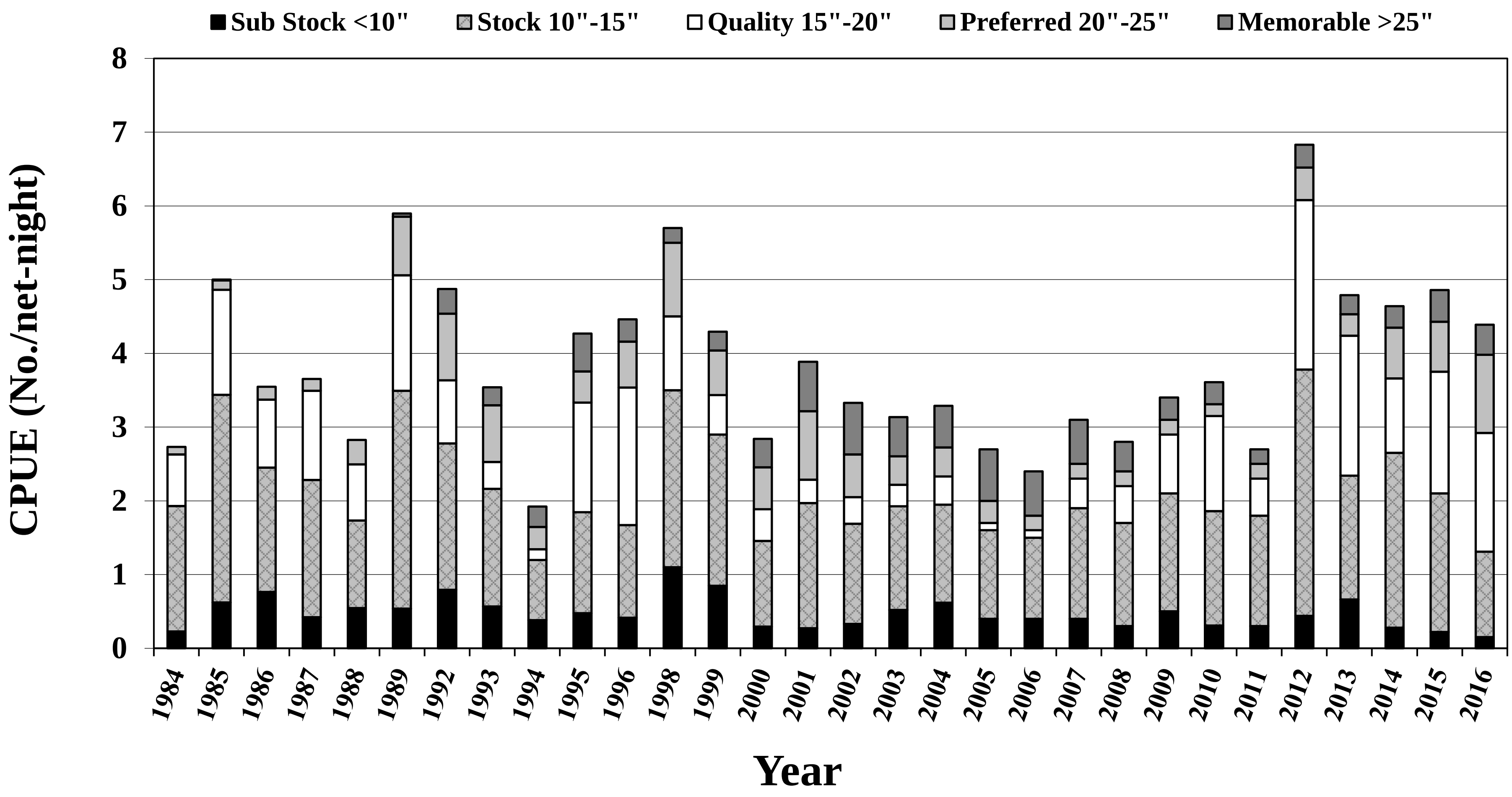


Figure 8. Length structure, in terms of catch per unit effort (CPUE), of walleye collected by experimental gill nets in Fort Peck Reservoir during July-August, 1984-2016 (no data for 1990-1991 and 1997).

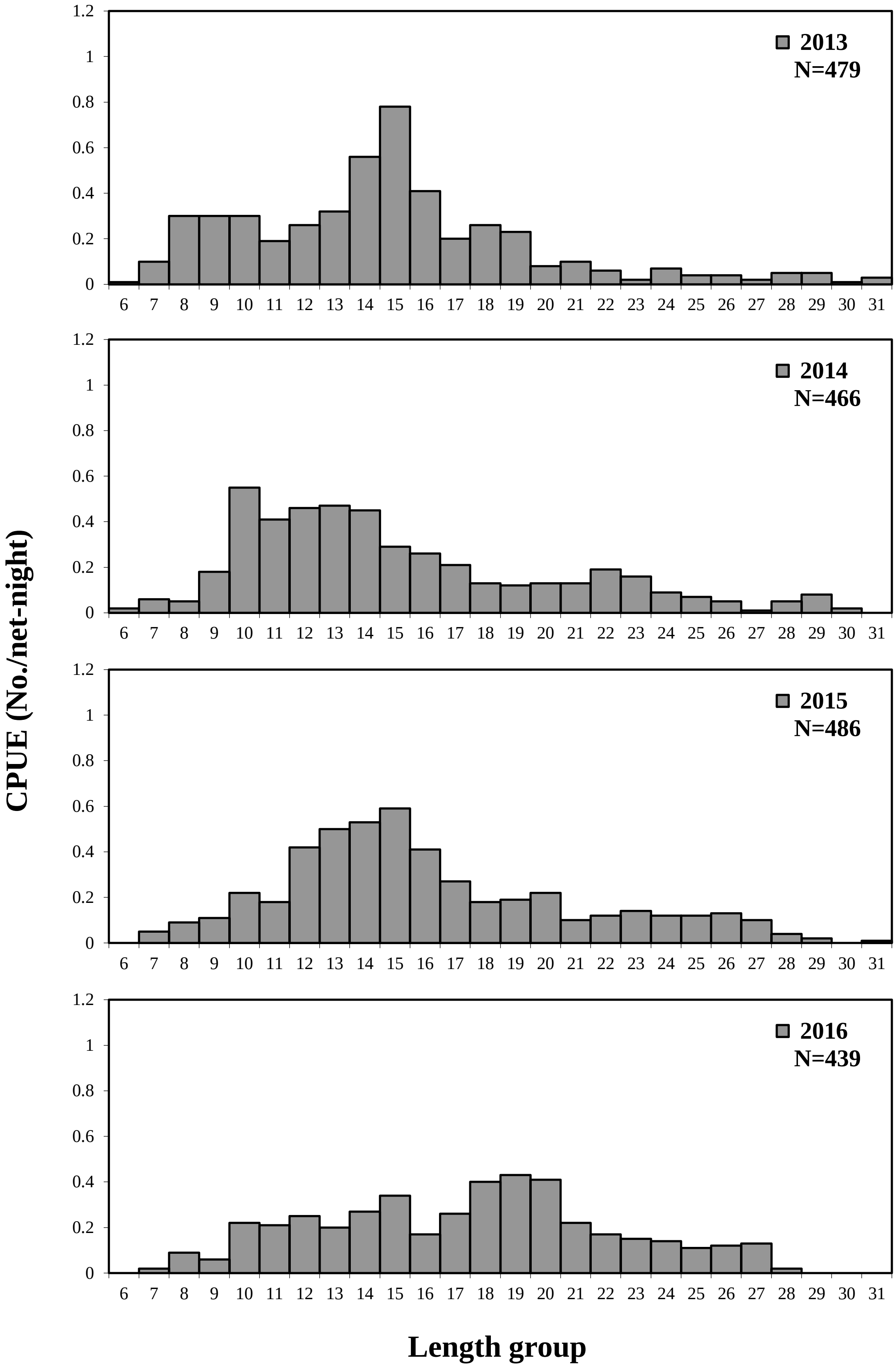
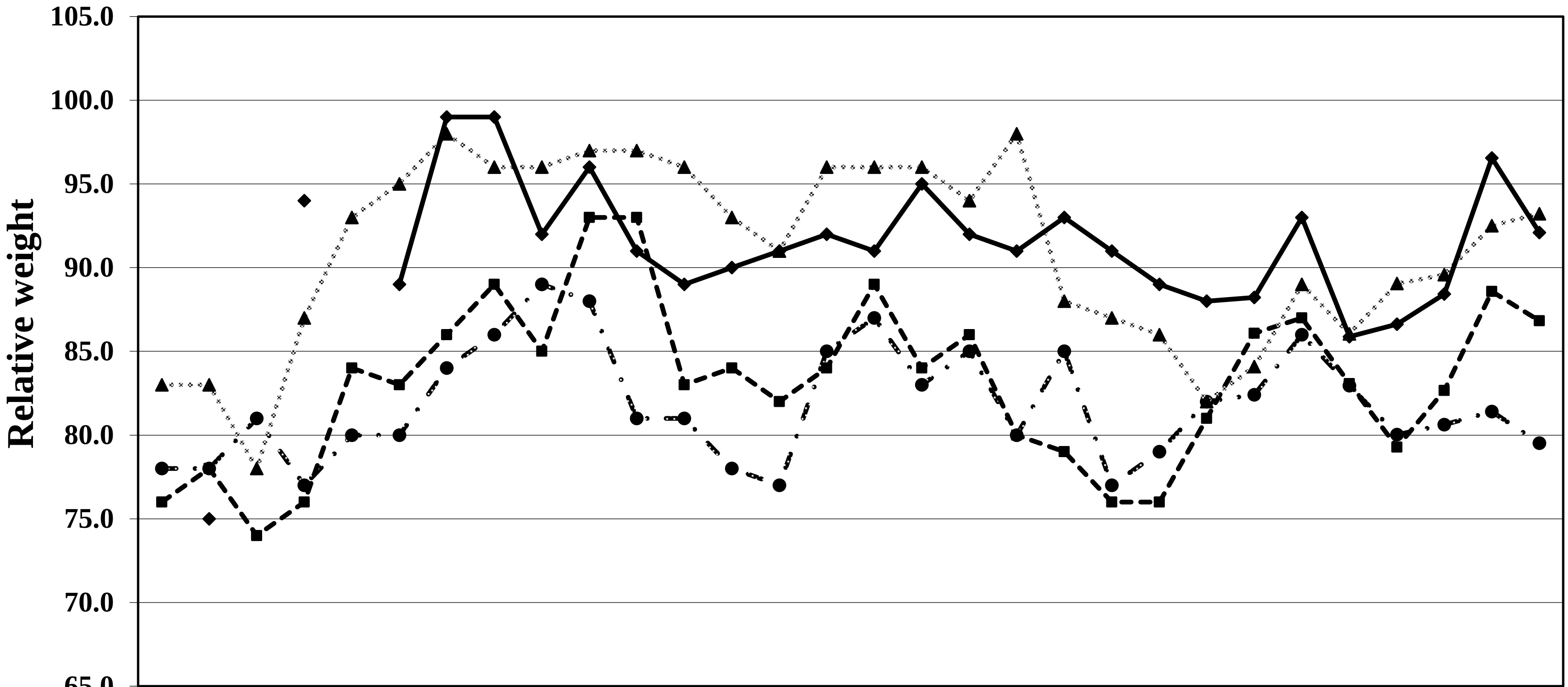


Figure 9. Length frequency, as catch per unit effort, of walleye collected by experimental gill nets in Fort Peck Reservoir during July-August, 2013-2016.



	1984	1985	1986	1987	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
Stock 10"-15"	78.0	78.0	81.0	77.0	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
Quality 15"-20"	76.0	78.0	74.0	76.0	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
Preferred 20"-25"	83.0	83.0	78.0	87.0	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
Memorable >25"		75.0		94.0		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

Year

Figure 10. Relative weights for stock, quality, preferred, and memorable length groups of walleye collected by experimental gill nets in Fort Peck Reservoir, 1984-2016 (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, 2011-2016, 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
2011	Mean	7.6	9.7	12.4	14.2	17.3	18.4	14.5	21.3	20.7	26.5	--	--	--	28.8
	N	11	22	120	36	17	32	1	5	5	1	--	--	--	2
	SE	0.2	0.3	0.1	0.3	0.5	0.5	--	1.6	1.2	--	--	--	--	1.2
	Range	6.5-8.7	7.3-12.2	9.3-17.7	11.6-16.9	13.8-22.4	12.9-22.9	--	17.9-26.3	17.3-23.9	--	--	--	--	27.6-30.1
2012	Mean	8.4	12.2	13.0	15.3	16.7	18.3	19.8	18.8	21.1	21.8	18.9	17.7	20.3	28.6
	N	34	181	67	235	42	28	22	3	5	7	2	1	1	2
	SE	0.2	0.1	0.2	0.1	0.3	0.3	0.5	1.6	1.4	1.6	2.8	--	--	0.4
	Range	6.1-10.5	7.9-16.7	10.4-17.0	10.6-20.6	13.6-20.5	15.5-21.1	14.7-22.9	15.7-21.3	16.7-24.6	15.9-27.3	16.1-21.8	--	--	28.2-28.9
2013	Mean	7.7	9.7	14.1	15.5	17.2	18.2	21.6	22.7	26.5	22.9	27.8	--	21.4	--
	N	6	77	147	27	66	16	9	8	1	4	1	--	1	--
	SE	0.3	0.2	0.2	0.4	0.3	0.7	1.1	1.3	--	1.9	--	--	--	--
	Range	7.2-8.8	6.7-14.2	8.5-18.5	11.5-21.1	8.9-22.5	14.1-22.8	17.3-28.5	16.9-26.5	--	18.8-27.6	--	--	--	--
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	--
Mean of means		7.7	10.2	12.7	14.9	16.8	18.6	19.7	22.0	22.8	22.7	24.6	22.4	22.8	24.2

Northern Pike

Relative abundance of northern pike captured in gill nets was 2.3 per net in 2016 which decreased from the previous year (Figure 11). The three-year running average goal of 2.0 northern pike per net was met (2.8 per net in 2016) as outlined in the FPRFMP. Average length and weight of northern pike in 2016 was 25.8 inches and 4.6 pounds, respectively which was lower when compared to the drought years (2000-2006; Table 7). This is due to small to medium-sized individuals recruiting into the population as a result of natural reproduction following several years where reservoir water levels were increasing and flooding suitable habitat. In 2016, 39% of the northern pike captured were less than 25 inches (Figure 12). This was an improvement compared to 2005-2006 when 20% of the northern pike captured in gill nets were less than 25 inches (Headley 2007).

In 2016, northern pike PSD was 82 and PSD-P was 38. 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 decreasing to stable water levels from 2011 to 2016, inundation of terrestrial vegetation has become limited throughout the reservoir decreasing the amount of ideal spawning/rearing habitat. Relative abundance of shoreline forage has also decreased over the last several years limiting food availability for juvenile northern pike. As a result, relative abundance of stock length groups of northern pike has started to decrease. It should be noted that substock northern pike have been captured in 2015 and 2016 suggesting some natural reproduction. Relative weight of northern pike decreased from 98 in 2015 to 93 in 2016.

Channel Catfish

Relative abundance of channel catfish captured by gill netting was 2.2 per net in 2016. This was a slight increase compared to the previous year and above the 29-year average of 1.9 per net (Figure 13). Similar to previous years, the highest abundance was observed in the Upper Missouri Arm at 6.1 per net (Table 4). In 2016, mean length and weight was 17.1 inches and 1.8 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 increased slightly from 86 in 2015 to 87 in 2016. Catfish PSD and PSD-P were 65 and 4, 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 2016 was 0.3 per net which was similar to the previous year. Average size of sauger in 2016 was 16.3 inches and 1.4 pounds with a relative weight of 75. 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 0.5 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, 1992-2016 (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]
1992	297	4.7	0.4	15.8	2	88	39	257	132	78	51	30
1993	258	3.5	0.4	15.3	2	91	38	219	101	75	46	34
1994	139	1.8	0.2	15.9	2.4	92	23	116	54	43	47	37
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

[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, 1984-2016 (no data for 1990-1991 and 1997).

Year	*N*	CPUE	Length	Weight	*Wr*
1984	52	0.6	20.8	2.4	94
1985	36	0.4	24.1	3.5	97.8
1986	21	0.4	23.7	3.6	94.3
1987	60	0.7	19.7	2.3	106.7
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

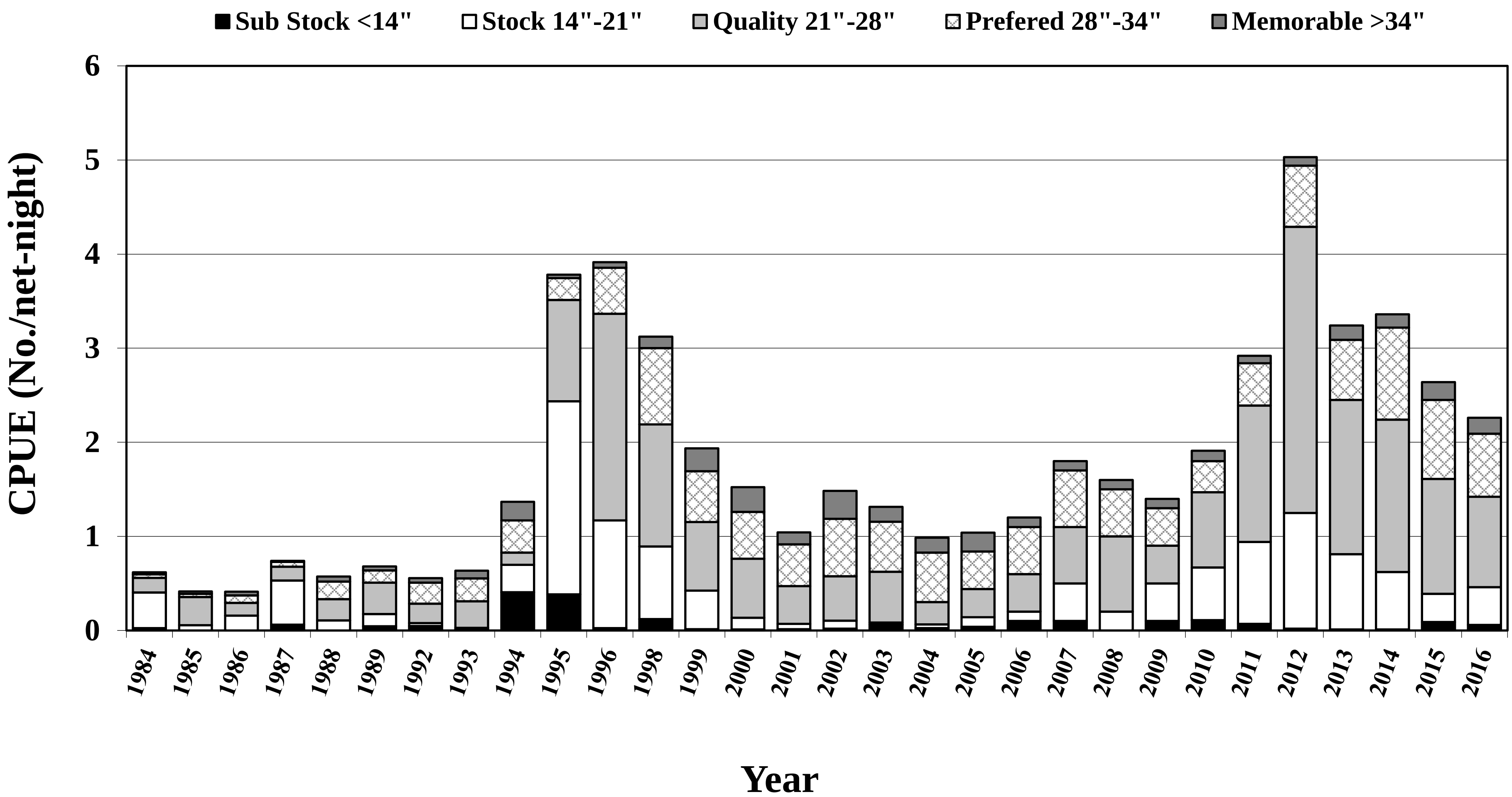


Figure 11. Length structure, in terms of catch per unit effort (CPUE), of northern pike collected by experimental gill nets in Fort Peck Reservoir during, July-August, 1984-2016, (no data for 1990-1991 and 1997).

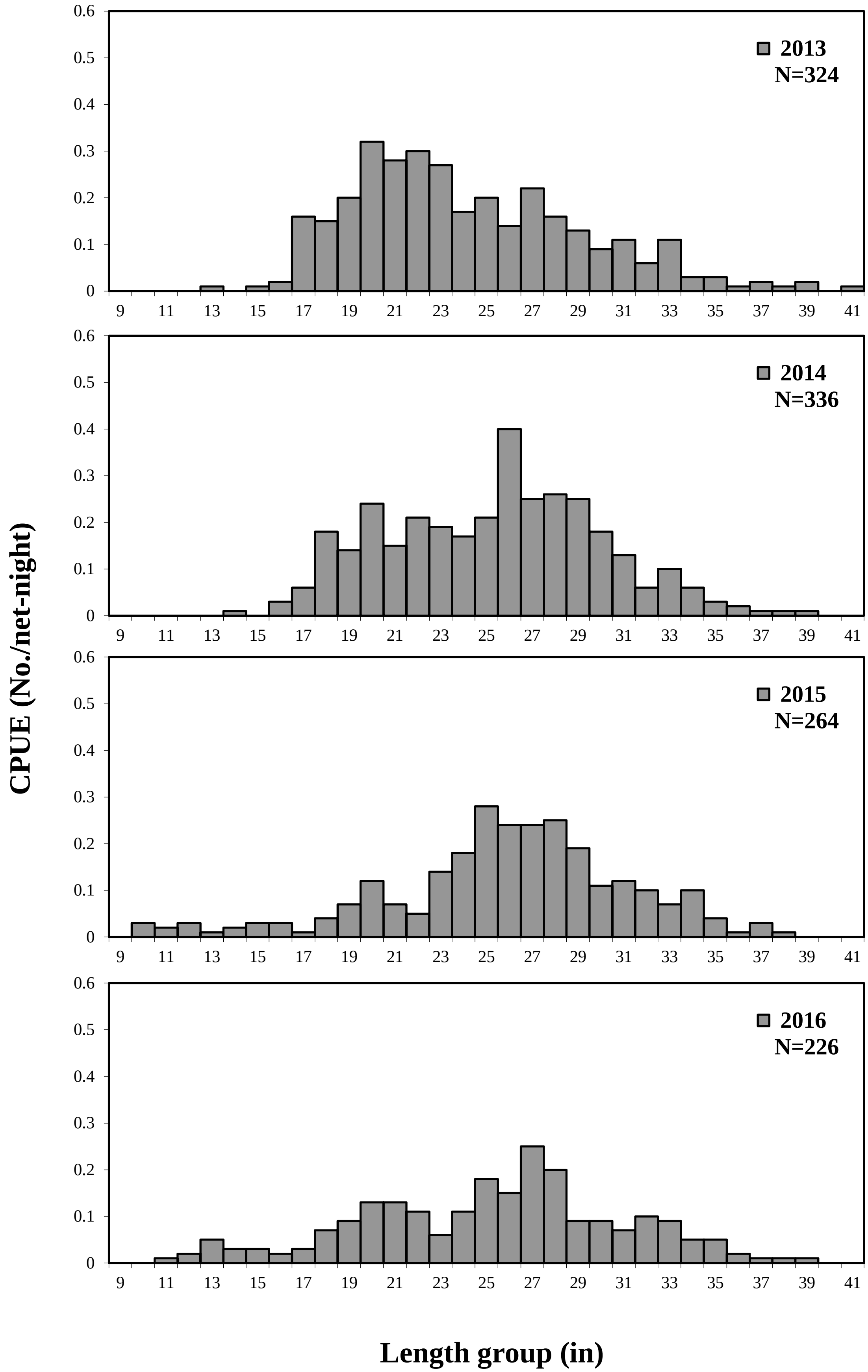
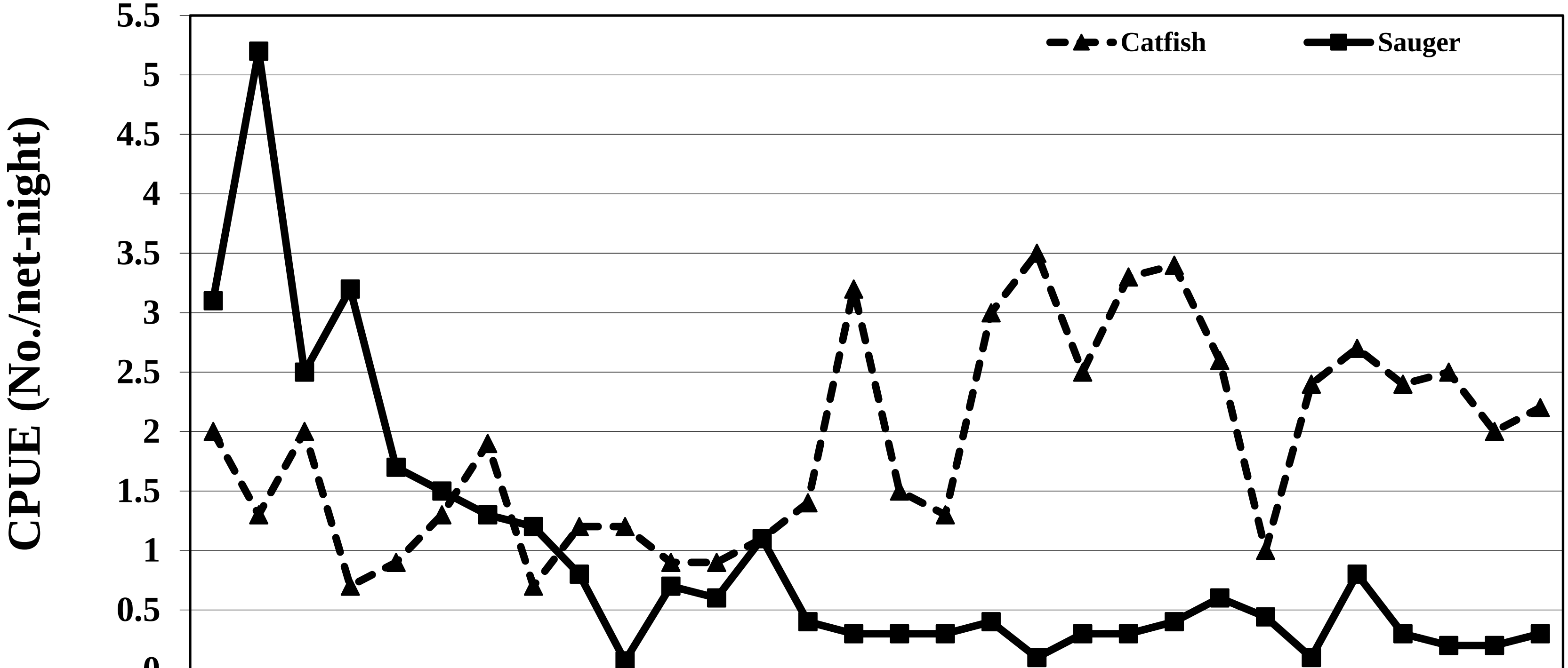


Figure 12. Length frequency, as catch per unit effort (CPUE), of northern pike collected by experimental gill nets in Fort Peck Reservoir during July-August, 2013-2016.



	1984	1985	1986	1987	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
Catfish	2	1.3	2	0.7	0.9	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
Sauger	3.1	5.2	2.5	3.2	1.7	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

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, 1984-2016 (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, 1984-2016 (no data for 1990-1991 and 1997).

Year	*N*	CPUE	Length	Weight
1984	167	2.0	14.2	0.9
1985	115	1.3	14.5	1.1
1986	105	2.0	14.6	1.1
1987	53	0.7	15.3	1.2
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

STOMACH CONTENTS OF GILL NETTED GAME FISH

Stomach contents of walleye, northern pike, sauger, and smallmouth bass captured in experimental gill nets from July 19th to August 11th, 2016 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 at 19.5%. Similarly, cisco were the most commonly identified item found in walleye at 13.3%. The high frequency of occurrence of cisco in the stomachs of northern pike and walleye can be explained by the high abundance of young-of-year and adult cisco observed in 2016 (Table 14). 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.

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 2016. Sample size is given in parentheses.

Forage items	Northern pike (*N*=215)	Sauger (*N*=25)	Smallmouth bass (*N*=69)	Walleye (*N*=407)
Cisco	19.5%	16.0%	2.9%	13.3%
Common carp				0.2%
Crayfish	2.3%		7.2%	0.5%
Empty	70.2%	64.0%	58.0%	53.3%
Invertebrates		4.0%	11.6%	8.8%
Northern pike	0.5%			
Pomoxis *spp*.	0.5%			1.5%
Sauger	0.5%			
Smallmouth bass	0.5%			
Spottail shiner				0.5%
Unknown	4.7%	12.0%	18.8%	21.1%
Walleye	0.5%			
Yellow perch	0.9%	4.0%	1.4%	0.7%

BEACH SEINING

Shoreline beach seining was conducted to determine reproductive success of age-0 game and non-game fish from August 8th to September 7th, 2016. Seine hauls at 100 locations throughout the reservoir captured 14 species of young-of-year and forage fish for a total of 6,752 fish (Table 10). Overall, relative abundance in 2016 reached a 5-year low of 63.1 fish per seine haul. Relative abundance of shoreline forage typically follows changes in reservoir elevations (Figure 15). In 2016, reservoir elevations remained stable over the winter months due to reduced discharges. Reservoir elevations increased approximately two feet from May to June due to runoff from mountain snowpack (Figure 14). Little to no terrestrial vegetation was inundated in 2016.

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 70% of the seining sites in 2015 and 64% of the sites in 2016. The similarity between years could be attributed to stable reservoir elevations from 2015-2016. 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 these fluctuations 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.

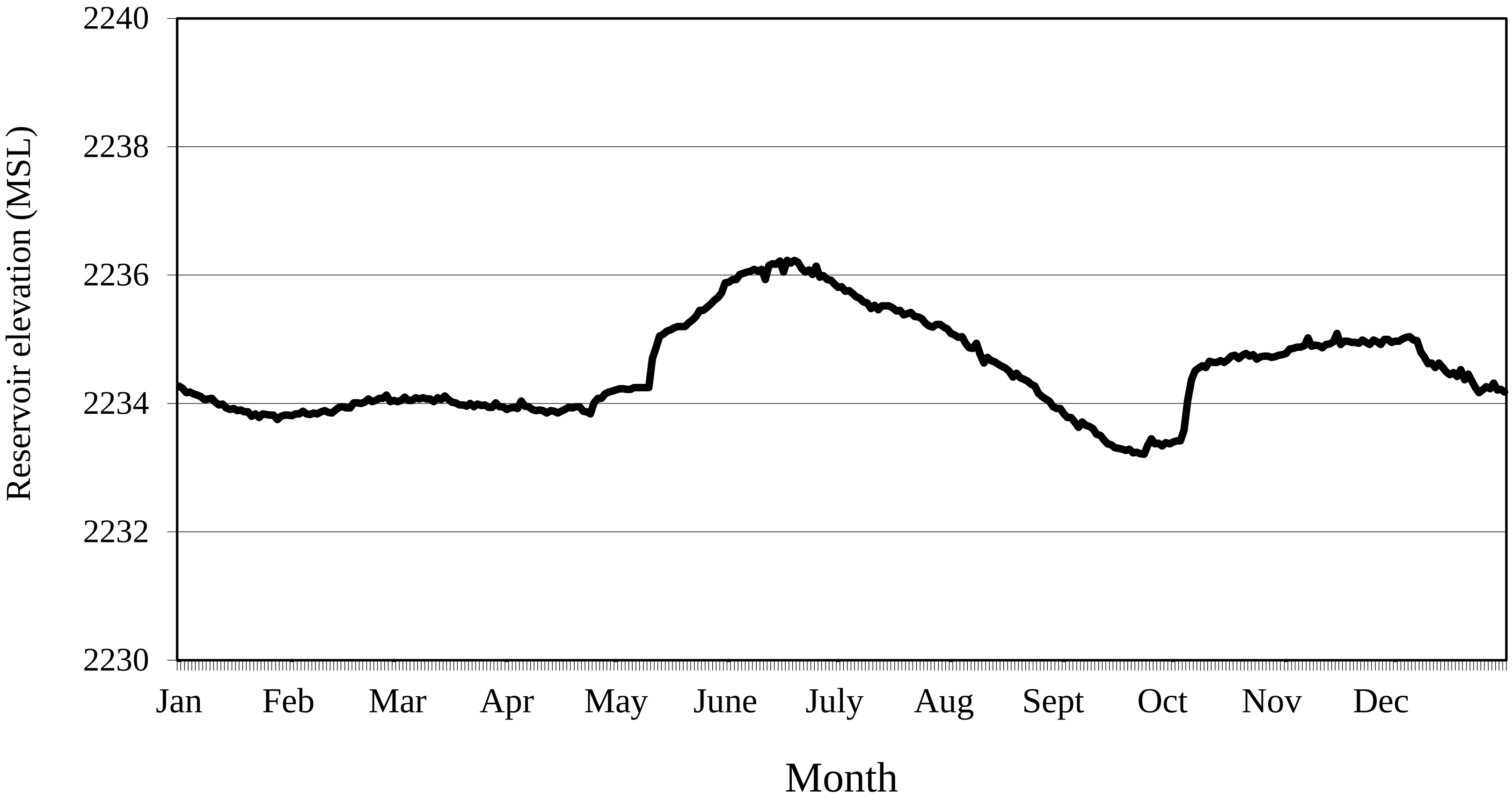


Figure 14. Average daily reservoir elevation for Fort Peck Reservoir from January 1, 2016 to December 31, 2016 (data provided by USACE).

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 2016. 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
Black bullhead	188	9.4	1	<0.1	0	--	0	--	0	--	189	1.9
Common carp	1	<0.1	2	0.1	5	0.3	1	<0.1	3	0.2	12	0.1
Emerald shiner*	5	0.3	17	0.9	31	1.6	44	2.2	104	5.2	201	2.0
Freshwater drum	0	--	0	--	0	--	0	--	8	0.4	8	0.1
Green sunfish	0	--	1	<0.1	0	--	0	--	0	--	1	<0.1
*Hybognathus spp.**	0	--	0	--	0	--	0	--	22	1.1	22	0.2
Northern pike	2	0.1	13	0.7	18	0.9	1	<0.1	1	<0.1	35	0.4
Pomoxis spp.	701	35.1	25	1.3	64	3.2	225	11.3	3,303	165.2	4,318	43.2
Smallmouth bass	53	2.7	35	1.8	39	2.0	104	5.2	33	1.7	264	2.6
Smallmouth buffalo	0	--	0	--	0	--	2	0.1	1	<0.1	3	<0.1
Spottail shiner*	7	0.4	149	7.5	120	6.0	403	20.2	23	1.2	702	7.0
Walleye	0	--	4	0.2	3	0.2	2	0.1	0	--	9	0.1
White sucker	1	<0.1	1	<0.1	0	--	1	<0.1	0	--	3	<0.1
Yellow perch	214	10.7	254	12.7	185	9.3	227	11.4	105	5.3	985	9.9
Total	1,172	58.6	502	25.1	465	23.3	1,010	50.5	3,603	180.2	6,752	67.5

*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 2016 was 9.9 per seine which was similar to 2015(Figure15). Stable reservoir elevations from April to May, which resulted in little to no terrestrial vegetation being inundated in 2016, could explain the low abundance of young-of-year yellow perch. Relative abundance of young-of-year yellow perch in 2016 was similar to levels observed during the drought years (i.e., 1998-2006; Figure 15). Yellow perch were most abundant in the lower Big Dry arm with a catch rate of 12.7 per seine haul in 2016 (Table 10).

Crappie

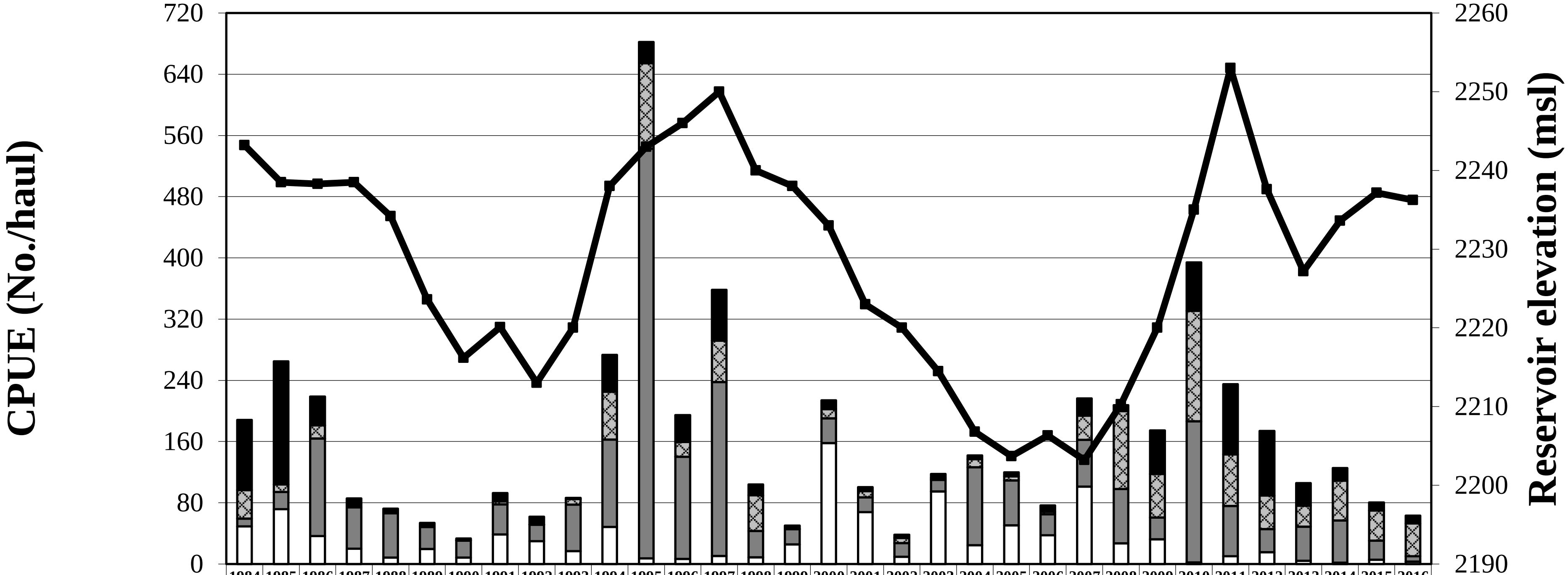
Young-of-year crappie relative abundance increased slightly from 39.6 per seine haul in 2015 to 43.2 per seine haul in 2016. Unlike young-of-year yellow perch, relative abundance of young-of-year crappie was still higher than during the drought years (Figure 15). Crappie were most abundant in the upper Missouri arm with a catch rate of 165.2 per seine haul (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 2016 was 3.0 per seine haul, which was lower than 5.6 per seine haul in 2015. 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 2016, 52% of the emerald shiners were captured in the upper Missouri arm (Table 10).

Spottail Shiner

Relative abundance of spottail shiners decreased from 24.8 per seine haul in 2015 to 7.0 per seine haul in 2016 and was lower than long-term average of 75 per seine haul. Relative abundance was highest in the middle Missouri arm at 20.2 per seine haul (Table 10). Typically, relative abundance is higher in the main lake portions (i.e., lower Big Dry arm, lower Missouri arm, middle Missouri arm) of the reservoir.



	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Perch	91.8	161	37.5	11.3	6	5.1	1.9	10.9	10	1.3	47.9	27.9	35.1	66.5	14.1	4.4	11.4
Crappie	37.4	9.7	17.1	0.2	0	0.1	0.7	4.1	0.4	7.6	62.6	112	19.3	54	46.7	0.2	11.9
Spottails	10.1	22.6	128	54.2	58	28.9	22	39.2	21.4	60.7	114	535	134	228	34.4	20	32.6
Emeralds	49.1	71.6	36.6	19.9	8.3	19.6	8.6	38.7	29.9	16.8	48.4	7.3	6.5	10.4	8.8	25.5	158
Elevation	2243	2239	2238	2239	2234	2224	2216	2220	2213	2220	2238	2243	2246	2250	2240	2238	2233

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Perch	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
Crappie	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
Spottails	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
Emeralds	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
Elevation	2223	2220	2215	2207	2204	2206	2203	2210	2220	2235	2253	2238	2227	2234	2237	2236

Year

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 1984-2016.

Chinook salmon

Chinook salmon were stocked in Fort Peck Reservoir in the spring of 2016 and the minimum objective of 200,000 fingerlings was not met as outlined in the FPRFMP. A total of 56,664 spring-stocked chinook salmon were released in June at 25 per pound. Compared to previous years, the spring-stocked fish were reared to a larger size in an attempt to create salmon large enough to avoid predation (Table 11). Both 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). In the past, Montana has typically stocked fewer fingerlings and less total pounds than North and South Dakota. 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).

Return of salmon to the release site has been variable over the years. In 2016, the number of females spawned and eggs collected increased greatly from the previous year (Figure 18). The 2016 egg-take effort for Montana resulted in 1,461,044 green eggs which averaged approximately 3,692 eggs per female. However, poor hatching success and eye-up occurred at the Fort Peck Hatchery due to sedimentation entering the hatchery via the intake and filtration system. North Dakota was able to supplement fish needed to approach the stocking goal of 200,000+ fingerlings for 2017.

Fisheries personnel relied exclusively on electrofishing to obtain brood stock for the annual chinook salmon egg-take. This has proved 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 September 29th to October 19th in various embayments adjacent to the marina, spillway, and Duck Creek.

Biological data was collected from adult chinook salmon during spawning to provide more information on age, growth, and stocking-and-rearing history. In 2015, 47% of females spawned in were 3-year old (Table 12). In contrast, 97% of females spawned in 2016 were 3-year old. A very high number of younger, mature male salmon were observed and captured in 2015 when compared to previous years. Age-2 male salmon comprised 84% of all males captured during the 2015 egg collection efforts indicating a strong year class. The earlier maturity observed for males in 2015 and females in 2016 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.

Mean weight of pre-spawn female chinook salmon remained similar from 13.3 pounds in 2015 to14 pounds in 2016. When examining mean weight at each age, a majority of male and female salmon collected in 2016 were slightly higher than those collected in 2015 (Table 12; Table 13). Four-year old females averaged 15.7 pounds in 2015 compared to 15.5 pounds in 2015. Age-3 males increased from 11.1 pounds in 2015 to 12.7 in pounds in 2016. Similarly, age-4 females increased from 11.0 in 2015 to 13.2 in 2016. The higher relative abundance of adult cisco in 2015 and 2016, as well as young-of-year cisco in 2106, could have contributed to increased weights for age-3 male and female salmon as well as 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, 2006-2016.

Date	Number	Pounds Stocked	No./lb	Mark	Location
6/7/2006	65,558	509	128.92	None	Marina Bay
6/14/2006	60,283	502	120	None	Milk Coulee Bay
6/15/2006	49,376	457	108	None	Marina Bay
10/13/2006	4,988	529	9.43	Adipose Clip	Marina Bay
6/18/2007	36,418	331	110	None	Marina Bay
10/25/2007	15,559	841	18.5	Adipose Clip	Marina Bay
6/5/2008	60,482	1,960	30.86	None	Marina Bay
6/11/2008	35,100	716	49	None	Marina Bay
6/12/2008	30,900	1,000	30.9	None	Marina Bay
8/12/2008	12,913	683	18.9	None	Marina Bay
8/12/2008	15,291	823	18.58	None	Marina Bay
11/18/2008	4,402	823	5.35	Adipose Clip	Marina Bay
6/16/2009	188,906	5,145	36.71	None	Marina Bay
11/4/2009	56,513	7,859	7.19	Adipose Clip	Marina Bay
6/10/2010	143,966	4,223	34.09	None	Marina Bay
10/22/2010	23,801	3,365	7.1	Adipose Clip	Marina Bay
6/10/2011	108,760	1,729	62.9	None	Duck Creek
6/10/2011	108,706	1,828	59.4	None	Pines Bay
6/15/2011	38,026	561	67.8	None	Rock Creek
11/1/2011	38,605	6,893	5.6	Adipose Clip	Marina Bay
6/4/2012	55,366	1,700	32.6	None	Duck Creek
6/4/2012	50,203	1,512	33.2	None	Bear Creek
6/5/2012	75,750	2,320	32.6	None	Marina Bay
6/6/2013	11,247	530	21.2	Adipose Clip	Marina Bay
6/6/2013	15,915	750	21.2	Adipose Clip	Milk Coulee Bay
6/10/2013	33,772	1,018	34	None	Duck Creek
6/10/2013	59,870	1,878	33.4	None	Marina Bay
6/10/2013	30,892	987	32.1	None	Milk Coulee Bay
6/2/2014	32,173	663	35.2	None	Marina
6/2/2014	32,137	915	35.1	None	Milk Coulee Bay
6/2/2014	25,040	714	35.1	None	Duck Creek
6/3/2014	31,123	1,350	23	Adipose Clip	Marina Bay
6/3/2014	15,213	660	21.2	Adipose Clip	Milk Coulee Bay
6/9/2014	42,868	1,261	34	None	Marina
6/9/2014	17,084	502	34	None	Milk Coulee Bay
6/9/2014	35,202	1,034	34	None	Duck Creek
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

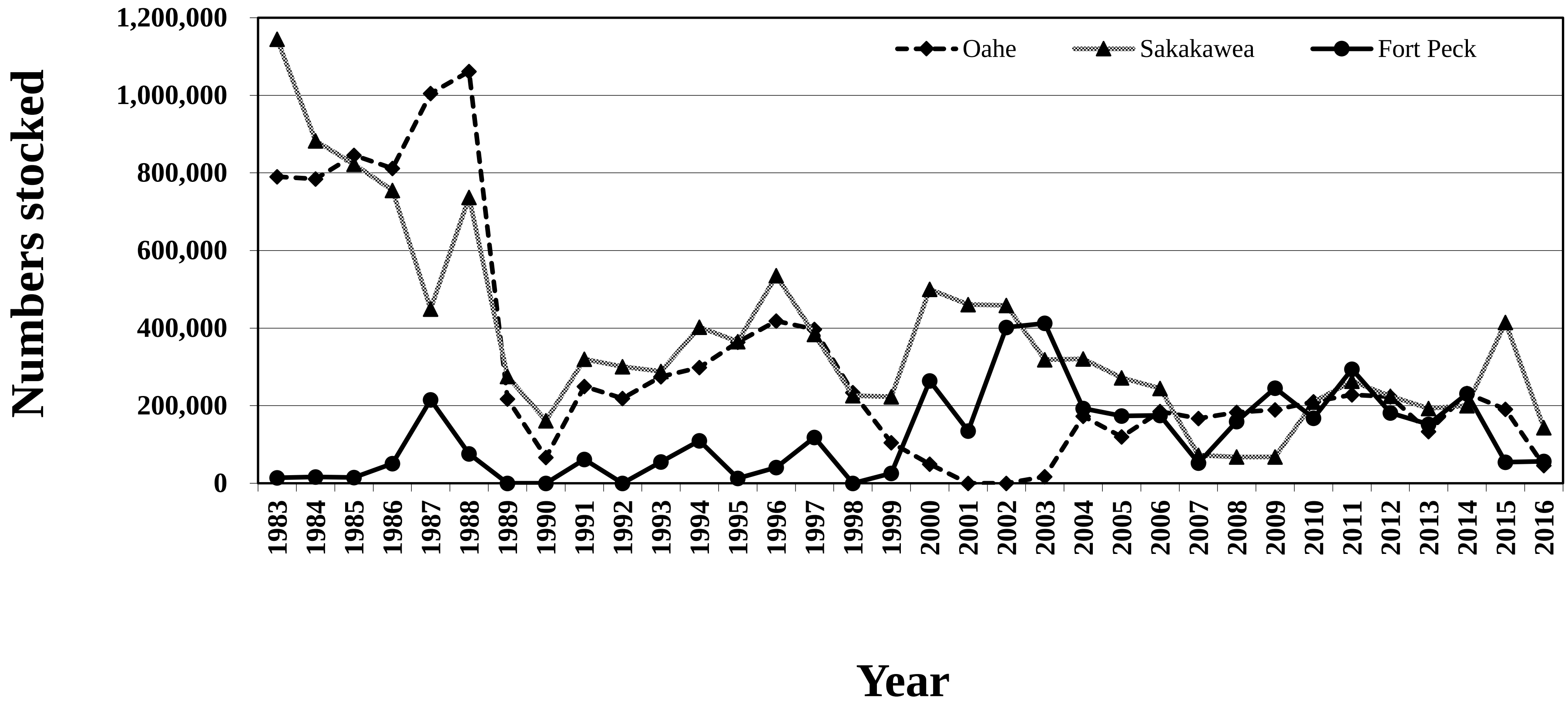


Figure 16. Annual comparison of total chinook salmon numbers stocked in Oahe, Sakakawea, and Fort Peck Reservoir, 1983-2016**.**

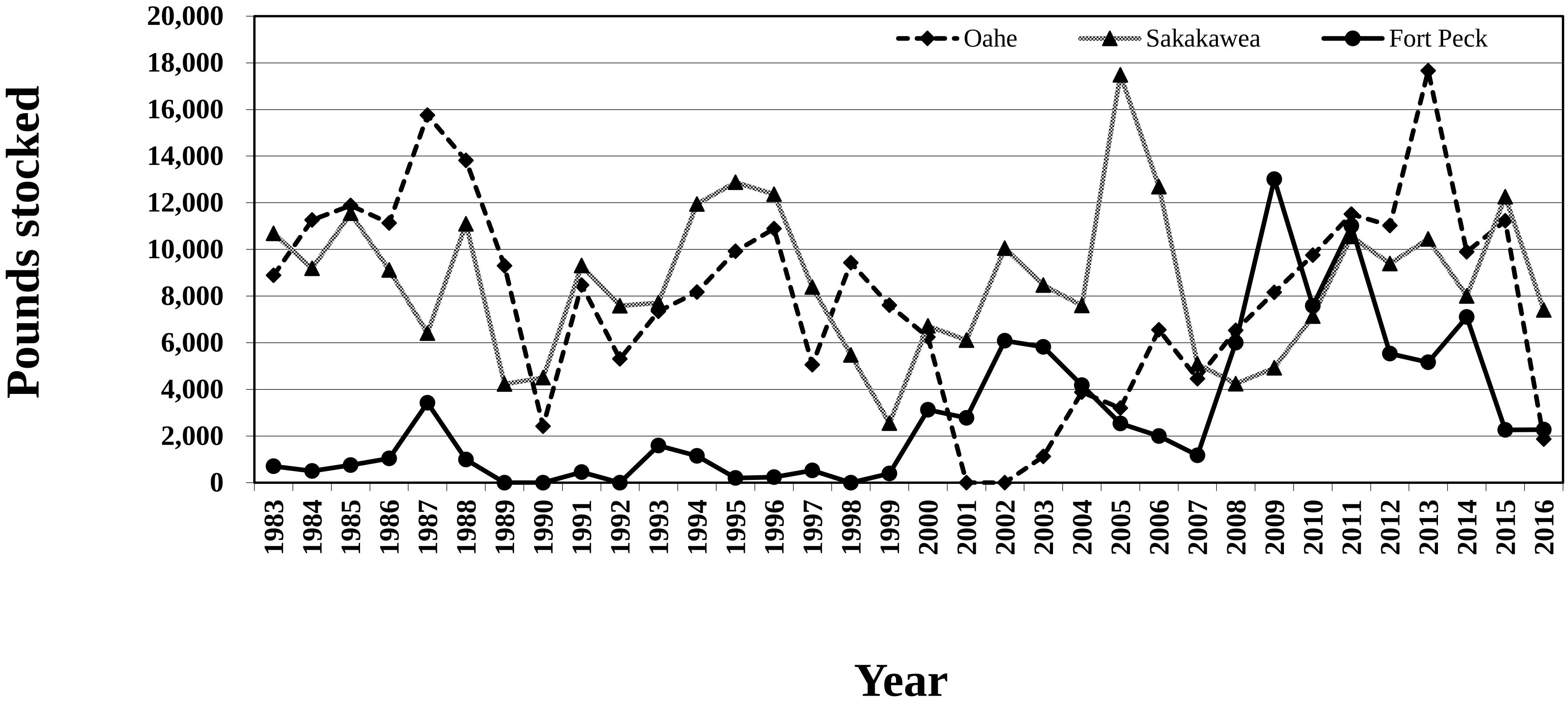


Figure 17. Annual comparison of total chinook salmon pounds stocked in Oahe, Sakakawea, and Fort Peck Reservoir, 1983-2016.

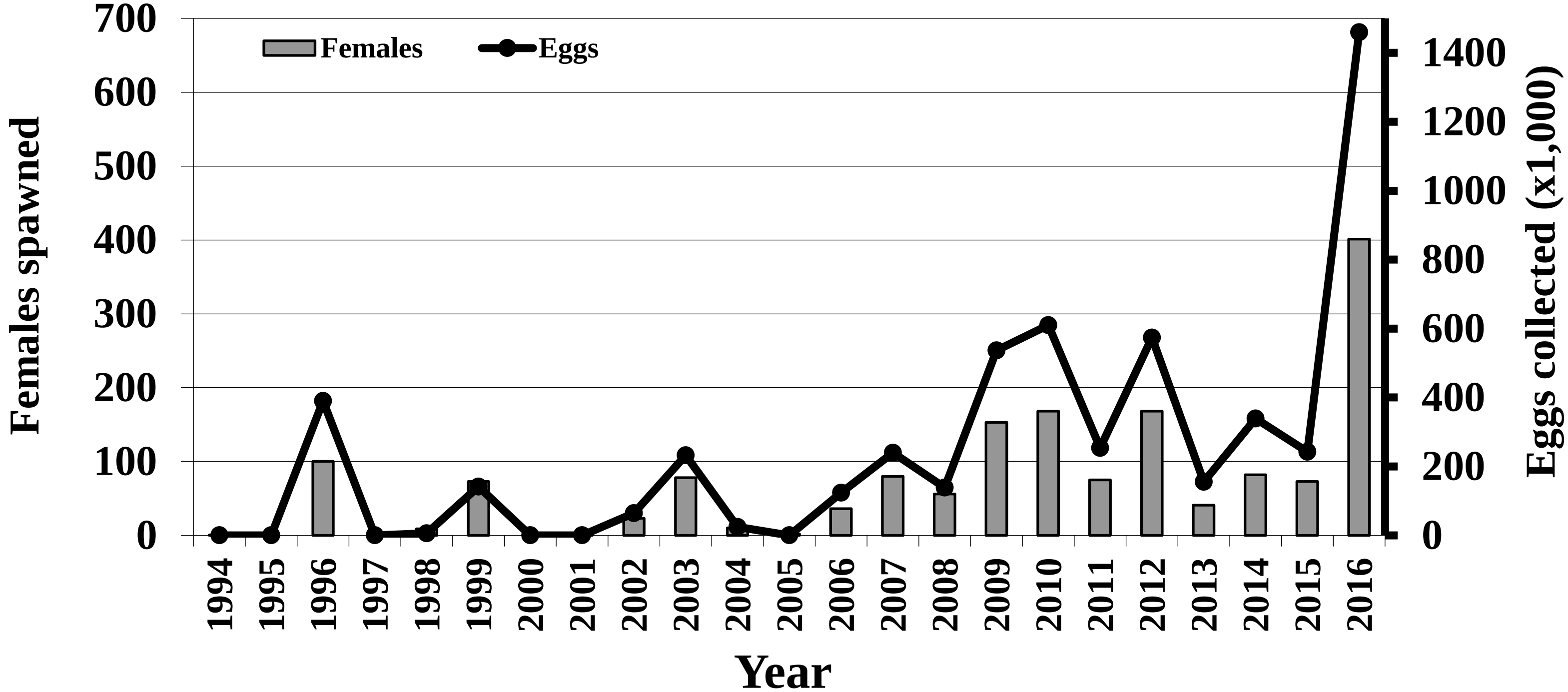


Figure 18. Annual comparison of female chinook salmon spawned and eggs collected from Fort Peck Reservoir, 1994-2016.

Table 12. Age composition, length and weight of 231chinook salmon collected by electrofishing, fall 2015.

Age	Sex	Brood year	Number	Mean length (in)	Range	Mean weight (lb)	Range
1	Male	2014	0	--	--	--	--
	Female		0	--	--	--	--
2	Male	2013	143	24.2	20.7-32.6	6.4	2.9-13.1
	Female		4	27.5	24.0-31.5	9.2	5.2-14.6
3	Male	2012	27	29.1	22.9-34.1	11.1	5.0-20.1
	Female		36	28.3	23.9-32.2	11.0	6.6-20.2
4	Male	2011	0	--	--	--	--
	Female		31	32.7	29.3-36.8	15.5	9.1-23.5
5	Male	2010	0	--	--	--	--
	Female		6	34.6	32.3-36.9	17.9	12.7-22.4

Table 13. Age composition, length and weight of 590 chinook salmon collected by electrofishing, fall 2016.

Age	Sex	Brood year	Number	Mean length (in)	Range	Mean weight (lb)	Range
1	Male	2015	0	--	--	--	--
	Female		0	--	--	--	--
2	Male	2014	0	--	--	--	--
	Female		0	--	--	--	--
3	Male	2013	161	31.7	24.8-36.0	12.7	5.5-18.2
	Female		411	30.3	23.0-35.3	13.2	4.6-18.2
4	Male	2012	4	33.8	32.7-35.8	15.0	13.0-17.6
	Female		14	32.1	29.6-35.0	15.7	11.2-22.3
5	Male	2011	0	--	--	--	--
	Female		0	--	--	--	--

Cisco Vertical Gill Netting

Young-of-year cisco

Relative abundance of young-of-year cisco in Fort Peck Reservoir increased to 126 per net-night in 2016; up from 25 per net-night in 2015. This increase was below the long term average of 78 per net-night from 1986 to 2016. Young-of-year cisco relative abundance has fluctuated over the years and similar trends have been observed in other reservoirs where cisco populations occur (Dave Yerk, personal communication; Figure 19).

Late 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, ice cover occurred on December 13th, 1985 and December 21st, 2000 resulting in two of the largest year classes ever produced. In contrast, during the winters of 1987 and 1992 the reservoir did not completely freeze and resulted in very few young-of-year cisco captured. However, ice cover occurred on January 18th, 2016 and receded on March 17th 2016and a relatively large year class of cisco was observed.

Reservoir elevations during the winter months could also explain year class strength of cisco in 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, reservoir elevations decreased only 0.7 feet during the winter months which favored young-of-year cisco production in 2016. It is possible that stable reservoir elevations during the winter months influenced young-of-year cisco abundance more than ice cover in 2016.

Adult cisco

Additional mesh sizes (¾, 1, 1 ¼, 1 ½-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 on Fort Peck Reservoir have recruited to the population as indicated by the increase in relative abundance of cisco captured in some of the larger mesh size. Since 2013, relative abundance of adult cisco have steadily increased in ¾-in mesh (Figure 20). Relative abundance of cisco was 184 per net-night in 2016 compared to 19 per net-night in 2013. Less than 1 cisco per net-night were captured in 1 ½-in mesh.

Length frequency distribution of cisco captured in 2016 indicated a large group 120-130 millimeters and another group 200-210 millimeters (Figure 21). The 120-130 millimeter group would indicate a strong year class of age-0 (young-of-year) cisco and the 200 millimeter group would suggest a strong group of age-2 and/or age-3 fish; however, limited age and growth data is available. When examining previous years, length frequency distributions showed a broader length distribution. It's uncertain what the causes are but, possible explanations for the decrease in size distribution could be increased predation rates from larger predatory fish and/or intraspecific competition.

Overall, relative weight of cisco captured in 2016 was 73. 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 also 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).

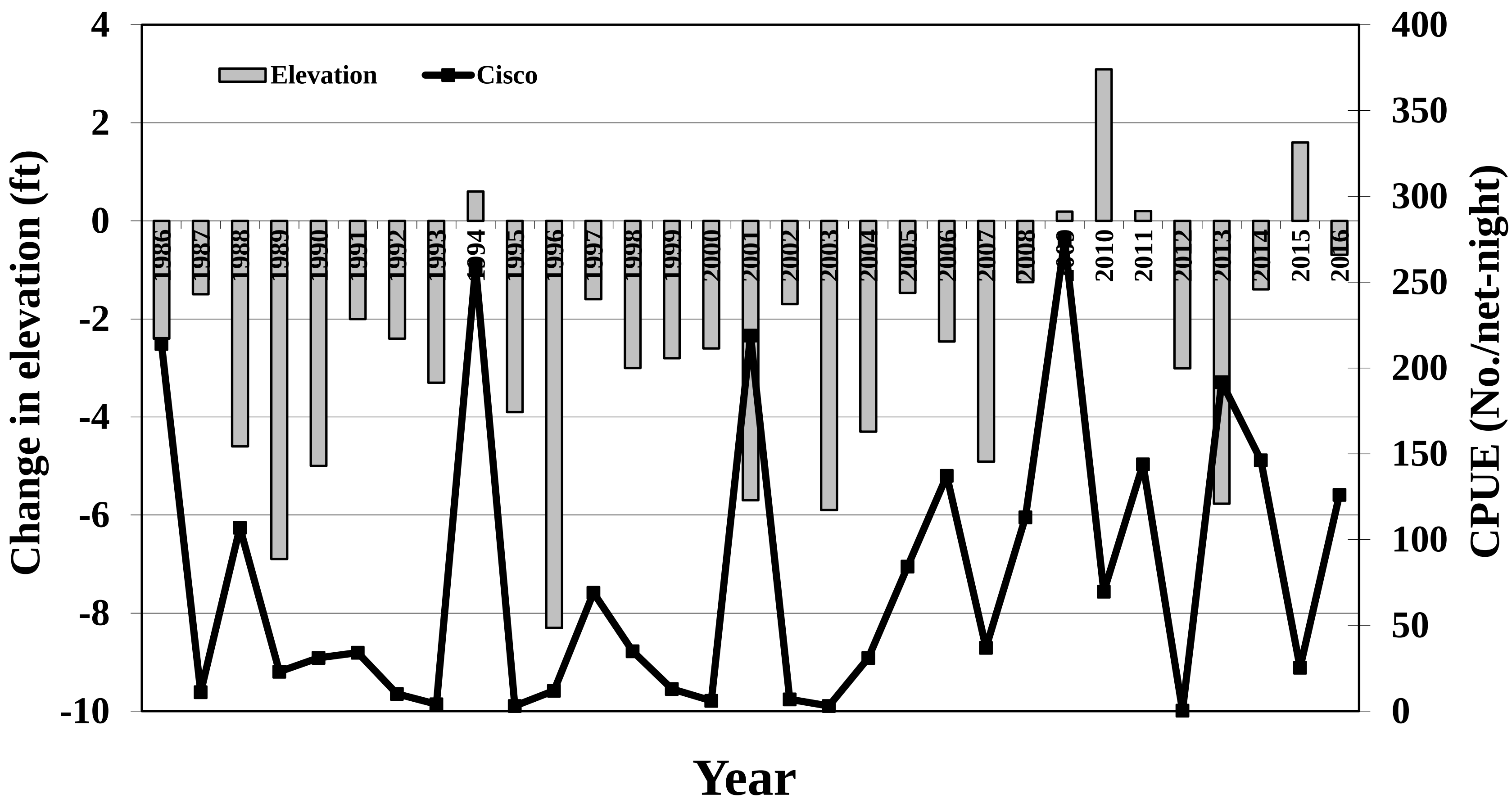


Figure 19. Change in reservoir elevation from December high to March low in contrast to mean CPUE (No./net-night) of young-of-year cisco collected in vertical gill nets on Fort Peck Reservoir, September 1986-2016.

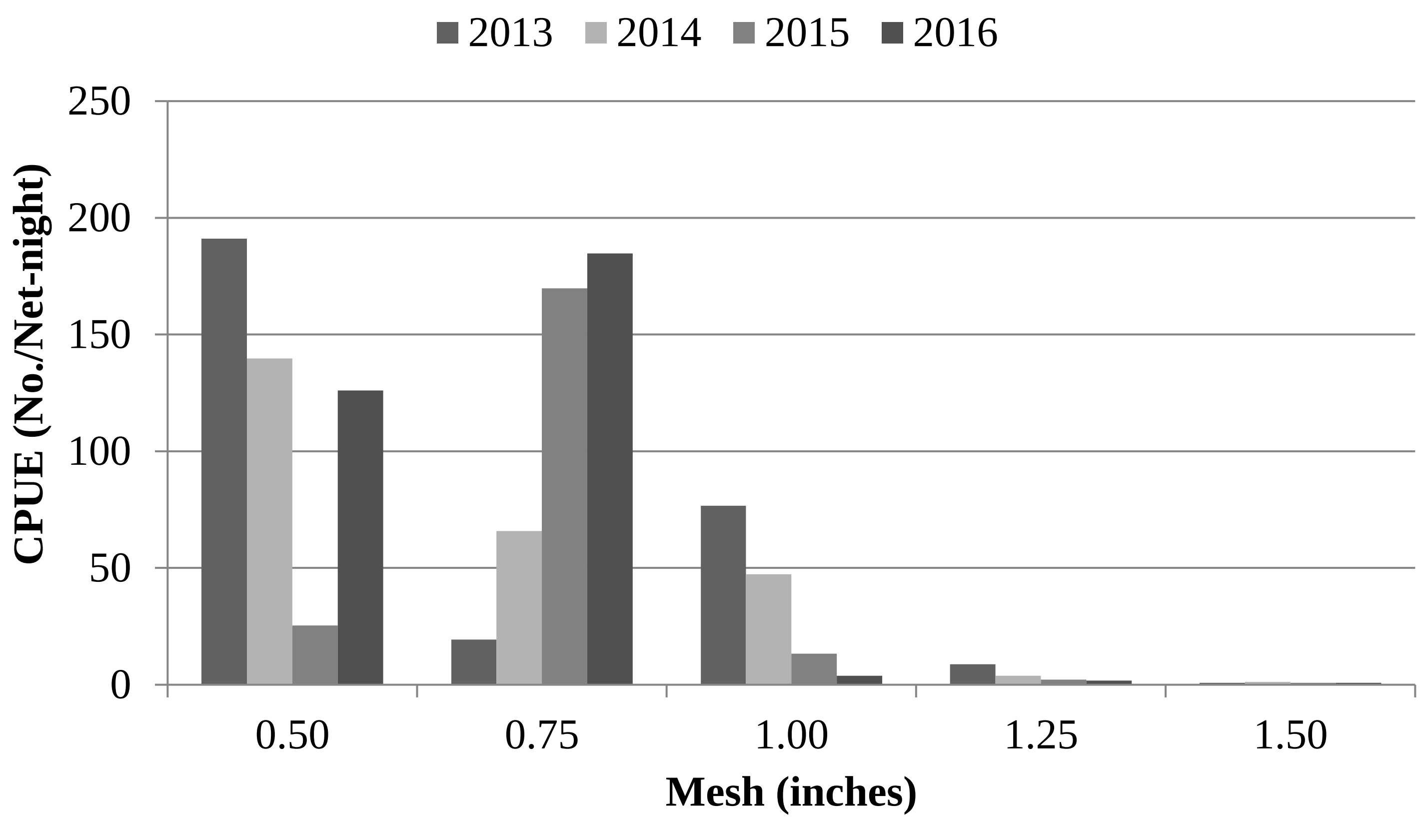


Figure 20. Mean CPUE (No./net-night) of cisco by mesh size collected in vertical gill nets on Fort Peck Reservoir, September 2013-2016.

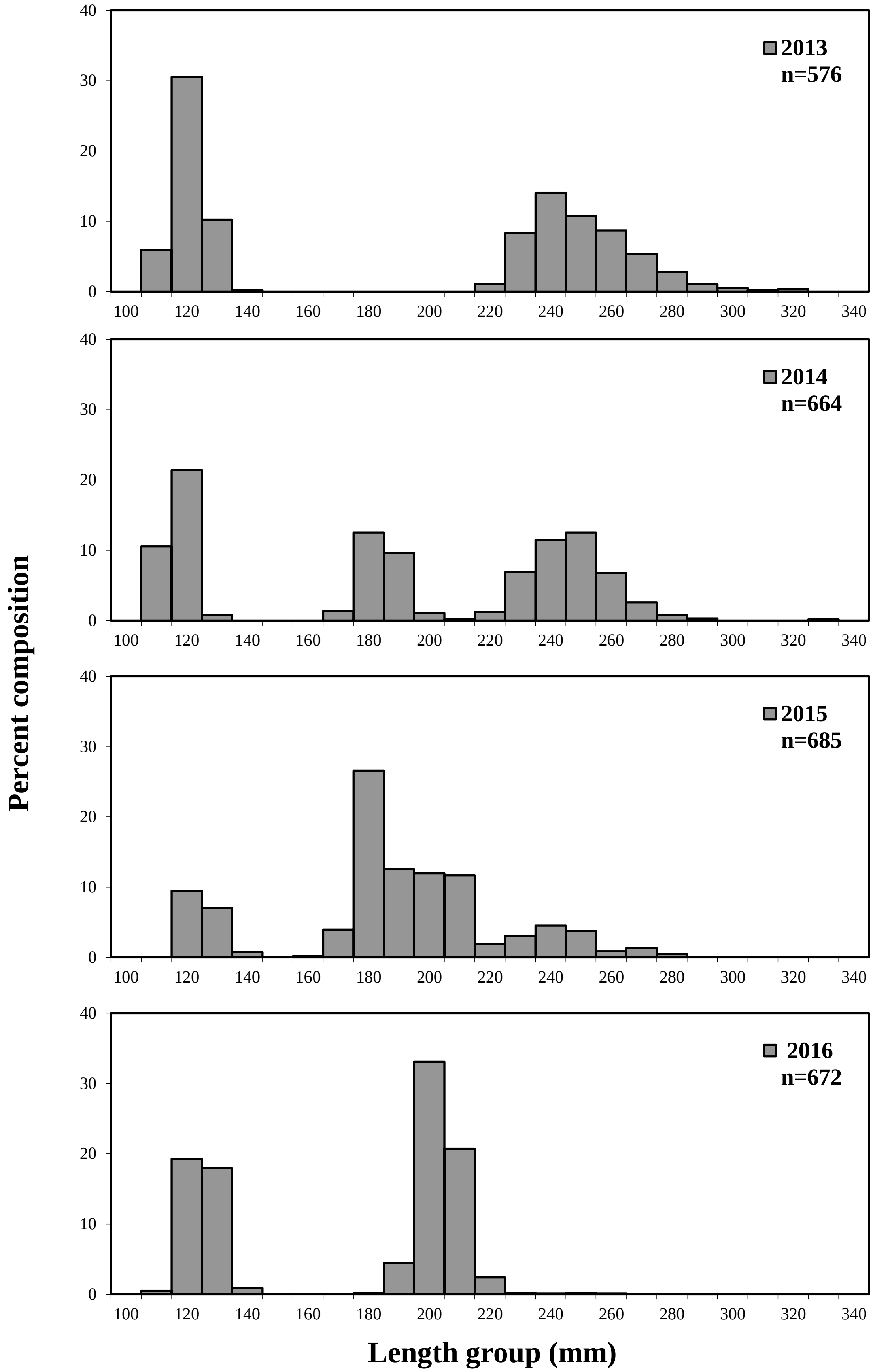


Figure 21. Length frequency of subsampled cisco collected by vertical gill nets (½, ¾, 1, 1 ¼, 1 ½-in) in Fort Peck Reservoir during September, 2013-2016.

RECOMMENDATIONS

- Spring trapping of walleye and northern pike will continue to provide an egg source for sustaining 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.

- Investigate using fisheries computer models to evaluate angler exploitation of the lake trout population. Continue to evaluate the use of spring and fall 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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Prepared by: Heath Headley
Date: March 31st, 2017

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 2016 by date, region, location, and size.

Date	Location	Region[1]	Fry	Fingerling	Hatchery
5/16/2016	Nelson Creek	UBD	4,100,000		Fort Peck
5/17/2016	McGuire Creek	UBD	2,916,664		Fort Peck
6/17/2016	Nelson Creek	UBD		52,281	Miles City
5/13/2016	Rock Creek	LBD	4,750,000		Fort Peck
6/21/2016	Rock Creek	LBD		182,621	Fort Peck
6/23/2016	Sand Arroyo	LBD		89,808	Fort Peck
6/28/2016	Bobcat Creek	LBD		55,253	Fort Peck
6/28/2016	Spring Creek	LBD		55,253	Fort Peck
6/29/2016	Cut Coulee	LBD		75,368	Fort Peck
6/29/2016	Box Elder Creek	LBD		75,368	Fort Peck
6/15/2016	Bear Creek	LMA		122,043	Fort Peck
6/16/2016	Skunk Coulee	LMA		100,046	Fort Peck
6/16/2016	Third Coulee	LMA		100,045	Fort Peck
6/17/2016	Milk Coulee	LMA		91,596	Fort Peck
6/20/2016	Sage Creek	LMA		65,856	Fort Peck
6/20/2016	Fifth Coulee	LMA		65,855	Fort Peck
6/22/2016	South Fork Duck Creek	LMA		51,459	Fort Peck
6/22/2016	North Fork Duck Creek	LMA		51,459	Fort Peck
6/27/2016	Main Duck	LMA		85,816	Fort Peck
6/30/2016	Marina	LMA		16,372	Fort Peck
4/29/2016	Hell Creek?	MMA	1,600,000		Miles City
5/3/2016	Hell Creek?	MMA	1,800,000		Miles City
5/6/2016	Hell Creek?	MMA	5,300,000		Miles City
6/10/2016	Upper Eighth Coulee	MMA		239,136	Miles City
6/14/2016	Gilbert Creek	MMA		22,504	Fort Peck
6/15/2016	Hell Creek	MMA		243,685	Miles City
6/22/2016	Sutherland	MMA		74,773	Miles City
6/24/2016	Cattle/Crooked Creek	MMA		123,471	Miles City
6/27/2016	Middle Eighth Coulee	MMA		85,817	Fort Peck
6/30/2016	Seventh Coulee	MMA		67,302	Fort Peck
6/30/2016	Pines Bay	MMA		72,635	Fort Peck
Total			20,466,664	2,265,822	

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

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, 2016.

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	12.9	9.1	8.2	2.0	0.463		0	18.2	7.7	8.2	3.8	0.472
10	12.6	9.1	8.2	2.3	0.462		10	17.6	7.8	8.2	3.8	0.469
20	11.8	9.2	8.2	2.3	0.462		20	16.8	7.8	8.1	3.1	0.466
30	9.7	9.4	8.2	2.2	0.458		30	15.6	7.8	8.1	3.2	0.464
40	9.2	9.4	8.1	3.0	0.457		40	11.7	8.1	8.0	3.2	0.461
50	9.0	9.2	8.1	2.6	0.458		50	10.2	8.2	8.0	2.9	0.459
60	8.9	9.2	8.1	2.9	0.457		60	9.8	8.3	8.0	2.8	0.459
		July							**August**			
0	21.2	7.3	8.2	2.7	0.474		0	21.3	7.0	8.3	3.7	0.476
10	20.7	7.3	8.2	3.2	0.472		10	21.3	7.0	8.3	3.7	0.476
20	20.6	7.3	8.2	3.3	0.472		20	21.3	6.9	8.3	4.2	0.476
30	20.6	7.3	8.2	3.7	0.473		30	21.3	6.9	8.3	4.0	0.476
40	19.8	7.1	8.2	4.4	0.468		40	21.3	6.8	8.3	4.2	0.475
50	18.7	6.5	8.1	6.8	0.465		50	21.2	6.6	8.2	4.5	0.476
60	17.6	6.3	8.0	9.0	0.466		60	19.2	5.0	8.0	16.4	0.474
		September										
0	17.0	7.6	8.4	3.5	0.472							
10	17.0	7.6	8.4	3.6	0.472							
20	17.0	7.6	8.4	3.9	0.472							
30	16.9	7.5	8.4	3.5	0.474							
40	16.8	7.4	8.4	5.4	0.475							
50	16.6	7.4	8.4	8.0	0.479							
60	16.6	7.4	8.4	9.7	0.478							

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, 2016.

Depth (feet)	Temperature (C)	Dissolved oxygen (mg/L)	pH (units)	Turbidity (NTU)	TDS (g/L)
		May			
0	11.3	9.3	8.0	2.2	0.459
10	11.1	9.3	8.1	2.3	0.460
20	11.0	9.3	8.1	2.3	0.459
30	9.7	9.5	8.1	2.3	0.458
40	8.9	9.6	8.1	2.8	0.457
50	8.7	9.6	8.1	3.2	0.458
60	8.7	9.6	8.1	3.5	0.457
70	8.6	9.6	8.1	3.3	0.457
80	8.6	9.5	8.1	3.8	0.457
90	8.1	9.5	8.1	3.9	0.457
		July			
0	19.8	7.4	8.2	2	0.461
10	19.4	7.5	8.2	2.2	0.460
20	19.3	7.5	8.2	2.6	0.460
30	19.2	7.5	8.2	2.9	0.458
40	19.0	7.4	8.2	3.5	0.459
50	19.0	7.3	8.2	4.5	0.460
60	18.9	7.2	8.2	4.4	0.458
70	18.6	7.1	8.1	10.7	0.459
80	11.9	7.4	7.9	3.8	0.459
90	10.3	7.7	7.9	2.9	0.457
		September			
0	18.0	7.5	8.4	2.7	0.461
10	17.8	7.5	8.4	3.5	0.461
20	17.6	7.5	8.4	3.5	0.461
30	17.6	7.4	8.4	4.5	0.460
40	17.6	7.4	8.4	4.5	0.460
50	17.6	7.5	8.4	4.4	0.460
60	17.5	7.5	8.4	4.4	0.460
70	17.2	7.5	8.4	6.1	0.460
80	12.4	5.9	8.0	5.8	0.457
90	11.8	6.0	7.9	5.1	0.456
		June			
0	15.8	8.2	8.1	3.6	0.459
10	15.8	8.1	8.1	3.7	0.459
20	15.5	8.1	8.1	3.3	0.458
30	14.4	8.3	8.1	2.7	0.458
40	10.6	8.5	8.0	1.9	0.457
50	9.1	8.7	8.0	2.2	0.458
60	9.0	8.7	8.0	2.1	0.457
70	9.0	8.7	8.0	1.4	0.458
80	9.0	8.7	8.0	1.7	0.457
90	8.6	8.7	8.0	1.3	0.458
		August			
0	21.1	7.2	8.3	2.3	0.462
10	20.9	7.2	8.3	2.3	0.462
20	20.7	7.1	8.3	2.6	0.462
30	20.6	7.0	8.3	3.8	0.462
40	20.4	6.9	8.3	4.3	0.462
50	20.4	6.9	8.3	4.5	0.463
60	20.1	6.8	8.3	4.2	0.463
70	19.1	6.4	8.2	4.9	0.463
80	17.8	6.1	8.1	6.3	0.462
90	14.7	6.1	8.0	9.0	0.459

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, 2016.

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	11.9	9.4	8.1	2.3	0.455		0	17.8	8.2	8.1	2.1	0.452
10	8.7	9.7	8.1	2.0	0.451		10	16.7	8.3	8.1	2.4	0.450
20	8.4	9.6	8.1	2.2	0.451		20	16.1	8.3	8.1	2.3	0.450
30	8.3	9.6	8.1	2.5	0.451		30	15.1	8.4	8.1	3.2	0.450
40	7.9	9.6	8.1	2.5	0.451		40	13.8	8.4	8.1	2.5	0.448
50	7.8	9.6	8.1	2.7	0.452		50	12.7	8.4	8.0	2.7	0.446
60	7.8	9.6	8.1	2.3	0.451		60	12.1	8.5	8.0	2.5	0.448
70	7.8	9.6	8.1	2.8	0.452		70	11.4	8.5	8.0	2.2	0.449
80	7.6	9.6	8.1	2.5	0.452		80	10.5	8.6	8.0	2.3	0.449
90	7.5	9.6	8.0	2.9	0.452		90	9.9	8.6	8.0	2.2	0.445
100	7.5	9.6	8.1	2.6	0.452		100	9.6	8.8	8.0	2.1	0.452
110	7.3	9.7	8.1	2.2	0.453		110	9.4	8.8	7.9	1.4	0.453
120	7.0	9.7	8.0	2.2	0.452		120	8.4	8.9	7.9	1.4	0.455
130	6.1	9.8	8.0	1.7	0.457		130	8.1	8.8	7.9	1.1	0.455
140	5.8	9.9	8.0	1.4	0.457		140	7.4	8.9	7.9	1.1	0.456
		July							**August**			
0	20.1	7.5	8.2	2.1	0.454		0	21.0	7.3	8.3	3.8	0.460
10	19.6	7.5	8.2	2.1	0.454		10	21.0	7.3	8.3	3.1	0.460
20	19.2	7.4	8.2	2.3	0.454		20	20.9	7.2	8.3	3.0	0.459
30	19.1	7.4	8.2	2.1	0.454		30	20.9	7.2	8.3	3.4	0.459
40	19.1	7.4	8.2	2.6	0.454		40	19.7	6.7	8.3	3.2	0.458
50	19.0	7.4	8.2	2.6	0.454		50	17.8	6.2	8.1	3.0	0.457
60	16.4	7.4	8.1	3.1	0.454		60	16.4	6.3	8.1	2.8	0.456
70	16.1	7.4	8.1	2.9	0.455		70	13.6	6.6	8.0	2.7	0.455
80	12.9	7.6	8.0	2.8	0.455		80	12.6	6.7	8.0	2.7	0.455
90	10.7	7.9	7.9	2.5	0.453		90	11.9	6.8	7.9	2.6	0.454
100	10.3	8.0	7.9	1.2	0.453		100	11.6	6.9	7.9	2.2	0.456
110	9.8	8.1	7.9	1.4	0.454		110	11.2	6.8	7.9	2.2	0.453
120	9.7	8.0	7.9	1.1	0.454		120	10.9	6.9	7.9	2.3	0.453
130	9.7	8.0	7.9	1.0	0.454		130	10.7	6.9	7.9	2.2	0.453
		September										
0	17.9	7.5	8.4	2.4	0.460							
10	17.6	7.5	8.4	2.4	0.459							
20	17.5	7.4	8.4	2.6	0.459							
30	17.4	7.4	8.4	2.7	0.459							
40	17.4	7.4	8.4	2.8	0.459							
50	17.4	7.3	8.4	2.7	0.458							
60	17.4	7.3	8.4	2.7	0.459							
70	17.4	7.3	8.4	2.9	0.459							
80	17.4	7.3	8.4	2.9	0.459							
90	15.2	6.2	8.1	3.5	0.458							
100	13.6	6.0	8.0	3.8	0.456							
110	12.7	6.0	7.9	3.9	0.455							
120	12.2	6.0	7.9	4.7	0.455							
130	11.8	6.1	7.9	5.0	0.455							

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, 2016.

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	9.4	8.0	2.1	0.438		0	19.4	8.0	8.1	3.5	0.440
10	10.3	9.4	8.0	2.4	0.437		10	16.2	8.3	8.1	4.4	0.440
20	9.1	9.5	8.1	2.3	0.437		20	15.2	8.3	8.1	3.3	0.445
30	8.9	9.5	8.1	3.0	0.435		30	14.4	8.3	8.1	3.5	0.443
40	8.7	9.4	8.1	3.1	0.438		40	13.8	8.3	8.0	3.5	0.444
50	8.6	9.5	8.1	2.9	0.447		50	11.9	8.3	8.0	3.0	0.440
60	8.2	9.5	8.0	2.7	0.444		60	9.6	8.4	7.9	2.7	0.443
70	7.9	9.5	8.0	2.4	0.445		70	8.6	8.6	7.9	2.4	0.447
80	7.8	9.5	8.0	2.1	0.448		80	8.2	8.6	7.9	2.2	0.448
90	7.7	9.5	8.0	2.4	0.449		90	7.4	8.7	7.8	1.4	0.453
100	7.6	9.6	8.0	2.5	0.449		100	7.3	8.8	7.8	1.0	0.453
110	7.4	9.5	8.0	2.1	0.466		110	7.3	8.8	7.8	0.9	0.453
		July							**August**			
0	20.1	7.5	8.2	1.7	0.455		0	21.4	7.2	8.3	2.6	0.461
10	19.3	7.4	8.2	2.3	0.456		10	21.5	7.2	8.3	3.2	0.460
20	18.8	7.4	8.2	2.0	0.455		20	21.5	7.2	8.4	3.4	0.460
30	18.6	7.4	8.2	2.3	0.453		30	21.4	7.1	8.3	3.4	0.460
40	18.2	7.4	8.2	2.4	0.453		40	21.4	7.1	8.3	3.4	0.460
50	17.3	7.4	8.1	2.9	0.452		50	20.1	6.3	8.2	3.2	0.459
60	17.2	7.4	8.1	3.2	0.452		60	17.6	6.1	8.1	2.5	0.458
70	15.3	7.4	8.0	2.8	0.452		70	15.2	6.2	8.0	3.1	0.456
80	14.1	7.5	8.0	2.9	0.452		80	13.6	6.1	7.9	4.2	0.454
90	13.8	7.5	8.0	2.9	0.452		90	NA	NA	NA	NA	NA
100	12.3	7.4	7.9	3.5	0.450		100	NA	NA	NA	NA	NA
		September										
0	18.0	7.4	8.4	2.0	0.461							
10	17.7	7.4	8.4	2.2	0.460							
20	17.7	7.4	8.4	2.8	0.461							
30	17.7	7.3	8.4	2.8	0.460							
40	17.7	7.3	8.4	2.8	0.460							
50	17.7	7.3	8.4	2.8	0.460							
60	17.6	7.3	8.4	2.8	0.460							
70	17.6	7.3	8.4	3.1	0.460							
80	15.7	5.8	8.1	3.4	0.458							
90	13.9	5.6	7.9	3.4	0.456							
100	11.7	5.8	7.9	4.8	0.455							

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, 2016.

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	11.4	9.4	8.1	3.8	0.410		0	21.1	7.7	8.2	5.5	0.445
10	9.7	9.5	8.1	3.8	0.409		10	18.7	8.1	8.2	6.1	0.441
20	9.2	9.4	8.1	3.1	0.409		20	17.9	8.1	8.2	5.4	0.440
30	9.0	9.4	8.1	3.8	0.411		30	16.6	8.0	8.2	5.7	0.437
40	8.7	9.2	8.1	3.4	0.410		40	14.6	8.1	8.1	5.3	0.439
50	8.4	9.2	8.0	3.0	0.411		50	12.8	8.2	8.0	5.0	0.441
60	8.3	9.2	8.0	3.0	0.410		60	10.7	8.3	8.0	4.4	0.445
70	8.2	9.2	8.0	4.5	0.416		70	10.1	8.3	7.9	4.4	0.444
80	8.1	9.1	8.0	4.0	0.417		80	9.3	8.3	7.9	4.5	0.444
90	7.3	9.1	8.0	3.6	0.424		90	8.9	8.3	7.9	4.3	0.443
100	6.7	9.3	8.0	3.9	0.428		100	8.6	8.4	7.9	2.8	0.443
		July							**August**			
0	21.1	7.5	8.3	2.6	0.463		0	21.9	7.1	8.3	3.1	0.466
10	18.8	7.6	8.2	2.9	0.468		10	21.9	7.0	8.3	3.3	0.465
20	18.2	7.4	8.1	3.3	0.466		20	21.8	6.9	8.3	4.0	0.465
30	17.7	7.2	8.1	3.6	0.466		30	21.8	6.9	8.3	3.9	0.465
40	16.2	7.1	8.0	3.7	0.459		40	21.8	6.8	8.3	5.1	0.465
50	12.3	7.4	7.9	3.6	0.451		50	21.8	6.8	8.3	5.3	0.465
60	10.9	7.4	7.9	3.8	0.449		60	21.7	6.8	8.3	6.9	0.465
70	10.0	7.6	7.9	4.1	0.449		70	16.5	5.1	7.9	5.6	0.461
80	9.5	7.6	7.8	3.2	0.449		80	14.0	5.2	7.8	8.2	0.457
90	9.2	7.7	7.8	3.0	0.449		90	12.7	5.2	7.7	7.7	0.454
100	9.1	7.6	7.8	2.0	0.449		100	12.2	5.3	7.7	7.6	0.453
		September										
0	18.1	7.4	8.37	2.7	0.463							
10	17.8	7.4	8.38	2.9	0.463							
20	17.8	7.4	8.37	3.5	0.463							
30	17.8	7.3	8.37	3.3	0.463							
40	17.8	7.3	8.37	3.3	0.464							
50	17.8	7.3	8.37	3.3	0.463							
60	17.7	7.3	8.37	3.7	0.463							
70	14.7	5.1	7.89	4.9	0.458							
80	13.2	4.6	7.78	6.1	0.456							
90	12.7	4.7	7.75	6.1	0.455							
100	12.1	5.0	7.79	7.7	0.454							

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, 2016.

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	12.6	9.2	8.1	7.0	0.422		0	20.9	8.0	8.3	5.4	0.532
10	11.8	9.2	8.2	7.6	0.421		10	20.3	8.1	8.3	6.2	0.527
20	11.7	9.2	8.2	7.0	0.422		20	19.9	8.1	8.3	6.3	0.523
30	10.2	8.9	8.1	7.8	0.425		30	18.1	8.1	8.2	6.7	0.521
40	9.6	8.9	8.0	7.6	0.244		40	16.1	7.7	8.1	10.4	0.508
50	9.4	8.9	8.0	6.9	0.421		50	10.1	7.4	7.8	12.2	0.456
60	9.1	8.7	8.0	11.3	0.430		60	9.4	7.4	7.8	11.2	0.448
		July							**August**			
0	19.6	7.4	8.1	5.2	0.453		0	21.7	6.6	8.3	4.0	0.465
10	19.1	7.3	8.1	6.4	0.459		10	21.7	6.5	8.3	4.4	0.465
20	16.8	6.4	8.0	6.1	0.468		20	21.6	6.2	8.2	4.9	0.466
30	13.4	6.7	7.9	5.7	0.455		30	21.3	5.4	8.1	5.0	0.466
40	12.2	6.6	7.8	7.6	0.453		40	20.4	5.1	8.1	5.7	0.468
50	11.6	6.8	7.8	7.2	0.451		50	18.1	4.0	7.8	6.1	0.465
60	11.4	6.6	7.8	11.4	0.452		60	15.2	2.2	7.4	10.2	0.464
		September										
0	17.7	7.1	8.2	5.3	0.456							
10	17.5	7.0	8.3	6.2	0.455							
20	17.4	6.9	8.3	5.2	0.454							
30	17.4	6.9	8.3	5.9	0.455							
40	17.4	6.9	8.3	5.8	0.454							
50	17.2	7.0	8.3	18.7	0.456							
60	16.1	5.1	8.0	15.3	0.459							

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)
1992	7/27 to 7/28	7/22 to 7/30	7/21 to 8/5	8/6 to 8/20	8/18 to 8/19	66 to 75 (69.3)	2212.9 to 2211.9
1993	7/27 to 8/3	8/10 to 8/20	8/25 to 8/27	8/10 to 8/20	8/5 to 8/6	64 to 72 (67.9)	2219.6 to 2224.7
1994	7/19 to 7/27	7/26 to 7/29	8/2 to 8/3	8/4 to 8/16	8/16 to 8/18	68 to 76 (72.6)	2238.1 to 2236.7
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 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

[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 2002-2016, for fish collected in the standard July-August gill net survey, on Fort Peck Reservoir.

Northern pike				
Year	PSD	PSD-P	*Wr*	Sample size
2002	94	62	102.0	144
2003	98	55	101.1	126
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

Channel catfish				
Year	PSD	PSD-P	*Wr*	Sample size
2002	74	3	89.9	145
2003	71	5	89.4	129
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