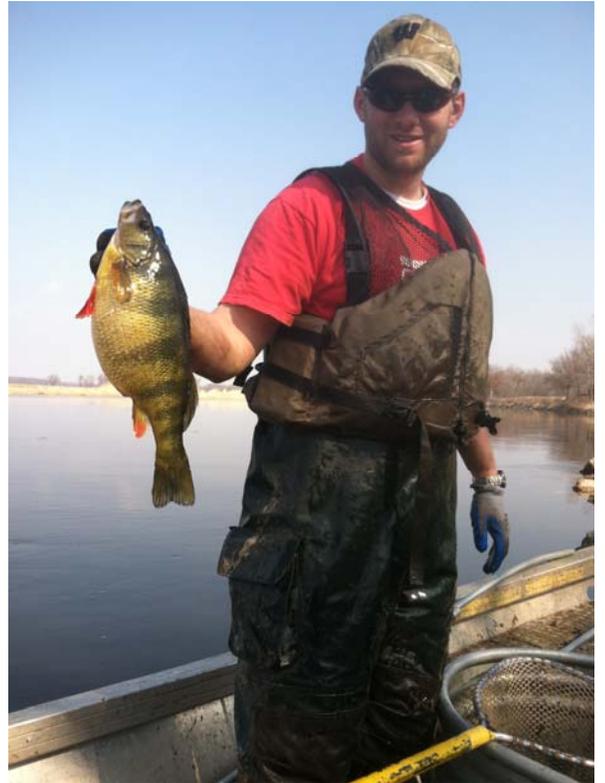


Summary Report

Results of Fyke Netting for Northern Pike in the Goose Island/Stoddard Lake Unit, Navigation Pool 8 of the upper Mississippi River, Spring 2012

Mississippi River Fisheries Team
Wisconsin Department of Natural Resources
La Crosse, WI
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Purpose

The purpose of this work is to continue to monitor the spring population length frequency and catch per unit effort of northern pike and yellow perch in Navigation Pool 8 of the upper Mississippi River.

Methods

Standard Upper Mississippi River Conservation Committee (UMRCC) fyke nets were set by WDNR personnel. These fyke nets had a 50ft floating lead line, 3ft high and 6ft wide frame, and had a 0.75 inch bar mesh.

Nets were set at locations thought likely to catch northern pike on spawning runs from March 6, 2012 through March 23, 2012 (Figure 1). A total of 13 locations were chosen, with one fyke net at each, in the Goose Island area, La Crosse and Vernon counties, Wisconsin. Nets were first set when backwater lakes were almost completely ice covered. Winter ice was completely gone by March 15 – nine days after the first day of netting.

Up to seven nets fished on any day, for a total of 71.52 net-days (24 hours) and were emptied every day during which all northern pike (*Esox lucius*) and yellow perch (*Perca flavescens*) were counted, measured in total length, sexed and their reproductive status was determined. In addition, northern pike were weighed using a digital bench scale and a hanging Chatillon® spring scale. Sex and reproductive status were determined primarily by the type and ease of which gametes were expressed through the urogenital pore. Fish were either classified as male or female based on the expression of sperm or eggs after manual massage of the abdomen. Based on the ease of and amount of gamete release, both males and females were classified as either green, immature, partially spent, ripe, or spent. For those northern pike that did not express gametes, sex was determined by visual examination of the urogenital region (Casselman, 1974). Sampling ceased when the proportion of green females decreased to almost zero.

This 2012 data was compared to data similarly collected by the Wisconsin Department of Natural Resources (WDNR) during 1964 in upper Pool 8 (Finke, 1966), 1976 in upper Pool 8 (WDNR Unpublished), 2008 collected in the middle of Pool 8 (Heath, Bailey and Von Ruden, 2009) and 2010 collected about 4 river miles upstream of the 2012 Goose Island/Stoddard sampling area on the Minnesota side of the river (Heath, Von Ruden, Schweitzer and Stuhr, 2010).

Statistical tests were done using SAS® (2002-2003) software for Windows version 9.13's General linear models (ANOVA and ANCOVA) and were done at the $\alpha=0.05$ level. For catch per effort calculations, tests of means were done natural logarithm transformed data.

Findings

Relative abundance

A total of 539 northern pike was caught. Of these, 538 were sexed, 538 had their reproductive condition recorded and 449 were weighed. A total of 1353 yellow perch was caught. Of these, 1351 were sexed, 1351 had their reproductive condition recorded and none were weighed. In addition to these two target fishes, thousands of non-target fish, primarily bluegill, were caught and immediately released.

Water Temperature and Elevation

The mean daily ambient water temperatures during 2012 sampling was 8.9°C and generally rose over the 11 days of sampling (Figure 2). During sampling, the water surface elevation at the Brownsville, MN gage peaked on March 16th and varied as much as 0.8ft (Figure 2).

Sex Ratios

Of the 538 sexed northern pike, 199 (37.0%) were females, 328 (61.0%) were males and 11 (2.0%) were unknown (Table 1). The sex ratio was 1 female to 1.65 males. This compares to 1 female to 2.0- 2.3 males in other studies (Becker, 1983), 1 to 3.24 in the 1976 study, 1 to 1.15 in the 2008 study and 1 female to 0.37 males in the 2010 study. This suggests that in 2012, there were about the same proportion of females relative to males

when compared to other investigations.

TABLE 1. SEX AND REPRODUCTIVE CONDITION OF SPRING 2012 NORTHERN PIKE, GOOSE ISLAND/STODDARD LAKE UNIT.

SEX	REPRODUCTIVE CONDITION				
	Green	Immature	Partially Spent	Ripe	Spent
Female	116	46	10	20	7
Male	70	14	25	215	4
Unknown	0	11	0	0	0

Of the 1351 yellow perch that had sex recorded, 582 (43.1%) were females, 763 (56.5%) were males and 6 (0.4%) were unknown (Table 2). The sex ratio was 1 female to 1.31 males. This compares to 1 female to 2.25 males during 2010 and 1 female to 1 male in the 2008 study,

TABLE 2. SEX AND REPRODUCTIVE CONDITION OF SPRING 2012 YELLOW PERCH, GOOSE ISLAND/STODDARD LAKE UNIT.

SEX	REPRODUCTIVE CONDITION				
	Green	Immature	Partially Spent	Ripe	Spent
Female	544	0	0	24	14
Male	449	1	0	308	5
Unknown	0	6	0	0	0

Northern Pike Male Size Structure

Mean total length for all 2012 males was 19.58 inches (n=328, minimum=8.11, maximum=28.70 (Figure 4). A total of 41.60 percent was greater than 21 inches. Mean total length for all 2010 males was 22.39 inches (n=40, minimum= 13.39, maximum=38.2) (Figure 5) (Table 3). A total of 60.0 percent was greater than 21 inches. During 1976, the mean total length for all males was 22.94 inches (n=847, minimum=10.5, maximum=32.9, standard deviation = 3.25) (Figure 6). A total of 72.56 percent was greater than 21 inches. During 2008, the mean total length for all males was 20.57 inches (n=152, minimum= 8.47, maximum=26.77, standard deviation=3.46) (Figure 7). A total of 43.42 percent was greater than 21 inches. The mean total length for 2012 males was significantly different from all years except 2008 (Table 3). The magnitude of this difference between the earlier years and the 2000's was 3 inches.

There was a significant change in total length of males through the 2012 sampling period (n=328, $r^2=0.101$, $P<0.0001$) (Figure 8) suggesting that the size of males leading up to and during the initial period of spawning did increase as others have observed (Priegel and Krohn, 1975).

In the present investigation, 314 of the 328 males were sexually mature. The smallest sexually mature male was 8.1 inches in total length. This compares to size at maturity of 16-18 inches for lakes and 11 inches for the Mississippi River, Pool 8 reported by Becker (1983).

TABLE 3. MEAN LENGTH OF MALE NORTHERN PIKE, 1964-2012.

Year & Location	Mean Length (inches)	Standard Deviation	Minimum	Maximum	n	Percent > 21 inches	Different (means with the same letter are not Sign. Different)
1964, Pool 8	23.73	3.90	11.50	33.5	210	79.52	A
1976, Pool 8	22.94	3.25	10.50	32.9	847	72.56	AB
2010, Pool 8	22.39	5.02	13.39	38.2	40	60.0	B
2008, Pool 8	20.57	3.46	8.47	26.8	152	43.42	C
2012, Pool 8	19.58	4.08	8.11	28.7	328	41.60	C

Northern Pike Female Size Structure

Mean total length for all 2012 females was 21.94 inches (n=199, minimum=8.15, maximum=41.34 (Figure 9). A total of 85.32 percent was greater than 25 inches. In 2010, the mean total length for all females was 30.94 inches (n=109, minimum= 17.3, maximum=40.6, standard deviation= 5.17) (Figure 10) (Table 4). A total of 85.3 percent was greater than 25 inches. During 2008, the mean total length for all females was 25.59 inches (n=131, minimum= 12.21, maximum=39.37, standard deviation= 5.325) (Figure 11). A total of 46.56 percent was greater than 25 inches. During 1976, the mean total length for all females was 26.36 inches (n=262, minimum=16.50, maximum=36.50, standard deviation=4.413) (Figure 12). A total of 58.40 percent was greater than 25 inches. During 1964, the mean total length for all females was 28.73 inches (n=146, minimum=19.50, maximum=40.50, standard deviation=4.836) (Figure 13). A total of 73.29 percent was greater than 25 inches.

During 2012, the mean size of was smaller than all previous years. Mean total length for females was significantly different than all other years (p<0.001) (Table 4). Means from 1976 and 2008 were the same.

There was a significant change in total length of females through the 2012 sampling period (n=199, p<0.001) suggesting that the size of females during sampling did increase (Figure 14). In contrast, from 1989 through 2007, no trend in female size was documented during the spawning season in Navigation Pool 9 of the upper Mississippi River (WDNR, 2008).

In the present investigation, 153 of the 199 total females found were gravid. The smallest female found gravid was 11.1 inches in total length. This compares to size at maturity of 20-22 inches for lakes and 20-36 inches for the Mississippi River, Pool 8 reported by Becker (1983).

TABLE 4. MEAN LENGTH OF FEMALE NORTHERN PIKE, 1964-2012.

Year & Location	Mean Length (inches)	Standard Deviation	Minimum	Maximum	n	Percent > 25 inches	Different (means with the same letter are not Sign. Different)
2010, Pool 8	30.94	5.17	17.3	40.55	109	85.32	A
1964, Pool 8	28.73	4.836	19.50	40.50	146	73.29	B
1976, Pool 8	26.36	4.413	16.50	36.50	262	58.40	C
2008, Pool 8	25.59	5.325	12.21	39.37	131	46.56	C
2012, Pool 8	21.94	8.100	8.15	41.34	199	85.32	D

Proportional Size Structure

Proportional Size Structure for quality northern pike (PSS_Q) in Pool 8 as summarized by the Graphical Fish Data Browser (http://www.umesc.usgs.gov/data_library/fisheries/graphical/fish_front.html) of the Long Term Resource Monitoring Program (LTRMP) suggests a downward trend from 1993 to 2011 (Figure 15). The negative slope of a linear regression was significantly different from zero ($p=0.0495$) suggesting downward trend where quality size fish have gradually comprised a smaller proportion of the sample. This data contained both male and females since fish were not sexed.

We looked at any similar patterns in 1964-2012 WDNR data. For males, females and both sexes combined, there was a decreasing trend in PSS_Q (Figures 15 – 17) although none of these trends were significant ($p=0.4196, 0.1944, 0.4020$, respectively).

Spawning Progression

In 2012, most northern pike females were green (58.29%), followed by sexually immature (23.12%), ripe (10.05%), partially spent (5.03%), and spent (3.52%). Reproductive condition changed through time. During the first eight days of sampling, a total of 92.7% of sexually mature females ($n=124$) was green, 5.6% were ripe, and 1.61% was spent. During the last 3 days of sampling, 3.44% were green, 44.83% were ripe, and 51.72% were spent (Figure 2). There was an increasing trend in water temperatures and the proportion of ripe and green females precipitously fell when water temperatures reached about 13 °C. This compares to 2010, when northern pike appeared to have completed spawning when the temperature reached 12.0 °C. Spawning *runs* have been recorded to occur at temperatures between 1.1 and 4.4°C (Becker, 1983). These temperatures correspond to our highest catch rates, (see Figure 19) but not our observed spawning temperatures.

In 2012, most yellow perch females were recorded as green (93.47%), followed by ripe (4.12%) and spent (2.41%). Reproductive condition changed through time. During the first seven days of sampling, 95.94% of sexually mature females were green and 4.06% were ripe ($n=567$). During the last four days of sampling, a total of 0% of was green, 6.67% was ripe and 93.33% was spent ($n=15$) (Figure 3). There was an increasing trend in water temperatures and the proportion of ripe and green females precipitously fell when water temperatures exceeded 9.1°C. It appears that spawning started when the temperature was about 9°C and continued until temperatures reached about 13.4°C. Spawning *runs* have been recorded to occur at temperatures between 7.2 and 11.1°C (Becker, 1983). In the present investigation, the spawning run peaked when the water temperature was about 3°C (Figure 19) and spawning occurred between 9.1°C and 13.4°C.

Catch per Effort

Mean daily catch rates by species are given in Figure 19. Northern pike catch rates peaked on the third day of netting when the water temperature was about 3.0°C, then gradually decreased as temperatures increased.

For northern pike, 2012 mean catch per net-day for all sampling dates was 7.54 (Table 5). This was not significantly different than the 2008 Pool 8 catch per net-day (8.73), and the 1976 catch rate (7.40). It was different from the 2010 catch rate (1.57). During hatchery netting on the Mississippi River near Guttenberg, Iowa from 1995 to 2000, the catch rate was 2.2 fish per net set (Pitlo and Rasmussen, 2004), lower than the 2008, 2012 and 1976 rates but about the same as the 2010 rate. This suggests that, with the exception of 2010, WDNR Pool 8 catch rates have been similar through time.

Nearly annual year-round sampling by the LTRMP from 1993 through 2011 suggests roughly a doubling in northern pike catch rates in Pool 8 through time (Figure 20). Mean catch rates from these data are substantially lower than WDNR because samples are not taken during the spring spawning run.

TABLE 5. NORTHERN PIKE MEAN CATCH PER NET-DAY, SPRING 2012, 2010, 2008 AND 1976.

Year & Location	Mean	Standard Dev.	Min.	Max.	Net-Days	Different (means with the same letter are not Sign. Different)
2008, Pool 8	8.73	7.70	0	28.84	33.2	A
2012, Pool 8	7.54	11.16	0	62.05	71.52	A
1976, Pool 8	7.40	9.10	0	47.00	199.0	A
2010, Pool 8	1.57	2.73	0	17.71	98.9	B

Identical to northern pike, mean daily catch rates of 2012 yellow perch peaked on the third day, then drastically fell as water temperatures rose. These daily rates were as high as 93, then dropped to about 1.

It appears that yellow perch abundance has significantly increased since about 2009. The 2012 mean catch per net-day for all sampling dates was 18.60. This was significantly higher than both the 2008 (1.12) and 1976 (0.29) rates (Table 6) and was statistically the same as 2010. Similar increases in Pool 8 yellow perch catch rates were found in recent WDNR electroshocking conducted in the fall of 2010 and 2011 as well as the LTRMP data from 1993-2011 (Figure 21). It appears yellow perch abundance is very high compared to pre-2010 levels possibly due to substantially lower ambient suspended solids and turbidity during the last few years.

TABLE 6. YELLOW PERCH MEAN CATCH PER NET-DAY SPRING 2010, 2008 AND 1976.

Year & Location	Mean	Standard Dev	Min.	Max.	Net-Days	Different (means with the same letter are not Sign. Different)
2012, Pool 8	18.60	51.86	0	334.05	71.52	A
2010, Pool 8	8.01	14.98	0	94.0	98.91	A
2008, Pool 8	1.12	2.43	0	11.91	33.24	B
1976, Pool 8	0.29	0.76	0	6.0	199.00	B

Weight and Length Relationship

Northern pike length and weight regressions using 2012 data were done for various combinations of sex and reproductive condition (Figures 22- 25). Regressions were generated for immature, green and ripe, spent and partially spent, and all conditions combined, for both male and female fish. Regression parameters are presented in Table 7. For male and female fish less than 25 inches, the slope for this regression was significantly different ($P < 0.001$). For male and female fish less than 16.25 inches, the slopes were not significantly different ($P = 0.0661$). This suggests that for spring fish up to 16.25 inches, weight gained per inch of growth is similar between sexes; and for fish larger than 16.25 inches, weight gained per inch of growth is greater in females than males.

TABLE 7. TOTAL LOG₁₀ LENGTH (INCHES) AND LOG₁₀ WEIGHT (POUNDS) REGRESSION PARAMETERS FOR THE EQUATION LOG₁₀(WEIGHT) = SLOPE(LOG₁₀ (LENGTH)) + INTERCEPT.

SEX	REPRODUCTIVE CONDITION	SLOPE	INTERCEPT	R ²	N	P
F	IMMATURE	3.6708	-4.4049	0.9433	42	<0.0001
M	IMMATURE	2.7908	-3.4926	0.7650	12	=0.0002
F	GREEN & RIPE	3.2227	-3.8922	0.9884	111	<0.0001
M	GREEN & RIPE	3.1656	-3.8541	0.9830	234	<0.0001
F	SPENT & PARTIALLY SPENT	2.8606	-3.4674	0.9079	17	<0.0001
M	SPENT & PARTIALLY SPENT	2.8964	-3.5231	0.9421	29	<0.0001
F	ALL CONDITIONS	3.2882	-3.9993	0.9913	170	<0.0001
M	ALL CONDITIONS	3.1532	-3.8416	0.9850	275	<0.0001

Conclusions

Northern pike and yellow perch continue to comprise an important part of the sport fish community in Navigation Pool 8 of the upper Mississippi River. Northern pike catch rates in 2012 were similar to 1976 and 2008 but were up substantially from 2010. Yellow perch catch rates have increased about 18 times over the past four years.

There is some indication, from both WDNR and LTRMP data going back to 1964 that the proportion of quality sized northern pike has decreased over the years. In addition, mean size of both male and female northern pike in 2012 was smaller than most previous years. This is reason for concern. In addition, two previous studies we observed about a 2.5 inch decrease in the mean size of males from 1989 to 2007 in Pool 9 and between 1976 and 2008 in Pool 8.

Female northern pike minimum size at sexual maturity in the 2012 investigation was less than found in other studies and males were about the same.

In the Mississippi River bordering Minnesota, the northern pike bag and size limits are more liberal than the general inland regulations. The river is open all year, with no size limit and a bag limit of five fish. Inland, the general season extends from May 6 through March 4. In the northern zone the bag limit is five fish; there is no minimum size limit. In the southern zone the bag limit is two fish, with a 26 inch minimum size limit.

In the Mississippi River bordering Minnesota, the yellow perch bag limit is slightly more liberal than the general inland regulations. The river is open all year and has a bag limit of 25 perch. Inland, the season extends all year as well, but the bag limit is a total of 25 panfish combined.

Recommendations

1. Continue to monitoring northern pike populations in Pool 8 to verify or invalidate these findings.
2. Continue to monitoring northern pike catch by the Genoa National Fish Hatchery in Pool 9 to determine long-term trends in the upper Mississippi River outside of Pool 8.

References Used

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- Wisconsin Department of Natural Resources. 1976. Unpublished Northern Pike Data Collected in upper Pool 8 of the Mississippi River. WDNR, La Crosse, Wisconsin.
- Wisconsin Department of Natural Resources. 2008. A Summary of Northern Pike Data Collected in Pool 9 of the Mississippi River 1989-2007. WDNR, La Crosse, Wisconsin, 6 pp plus Figs and Tables.

FIGURE 1. LOCATION OF THIRTEEN FYKE NET SETS, MISSISSIPPI RIVER, NAVIGATION POOL 8, SPRING 2012.
(2010 NAIP PHOTO).

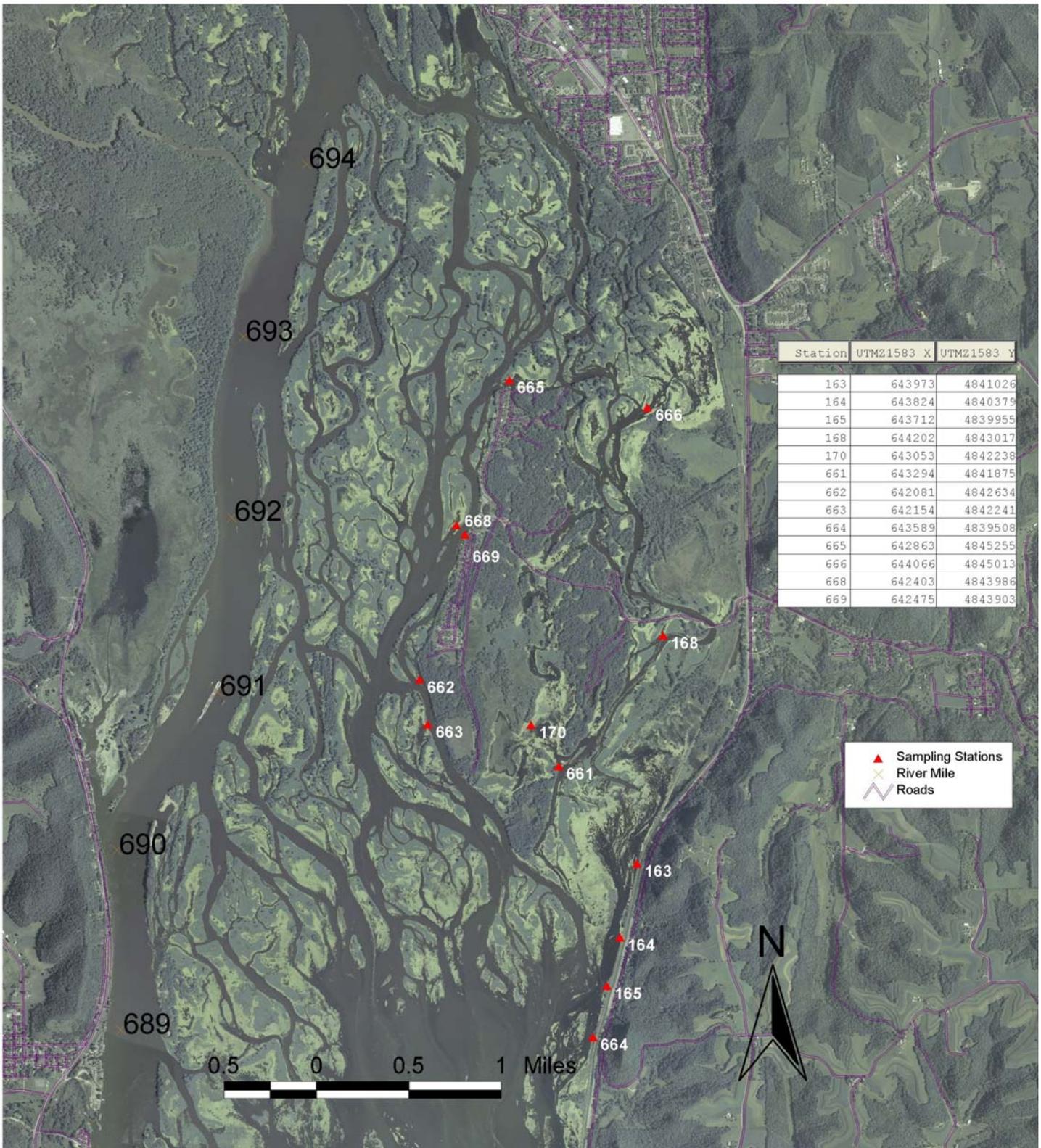


FIGURE 2. REPRODUCTIVE CONDITION OF 2012 FEMALE NORTHERN PIKE BY DATE, TEMPERATURE AND WATER SURFACE ELEVATION.

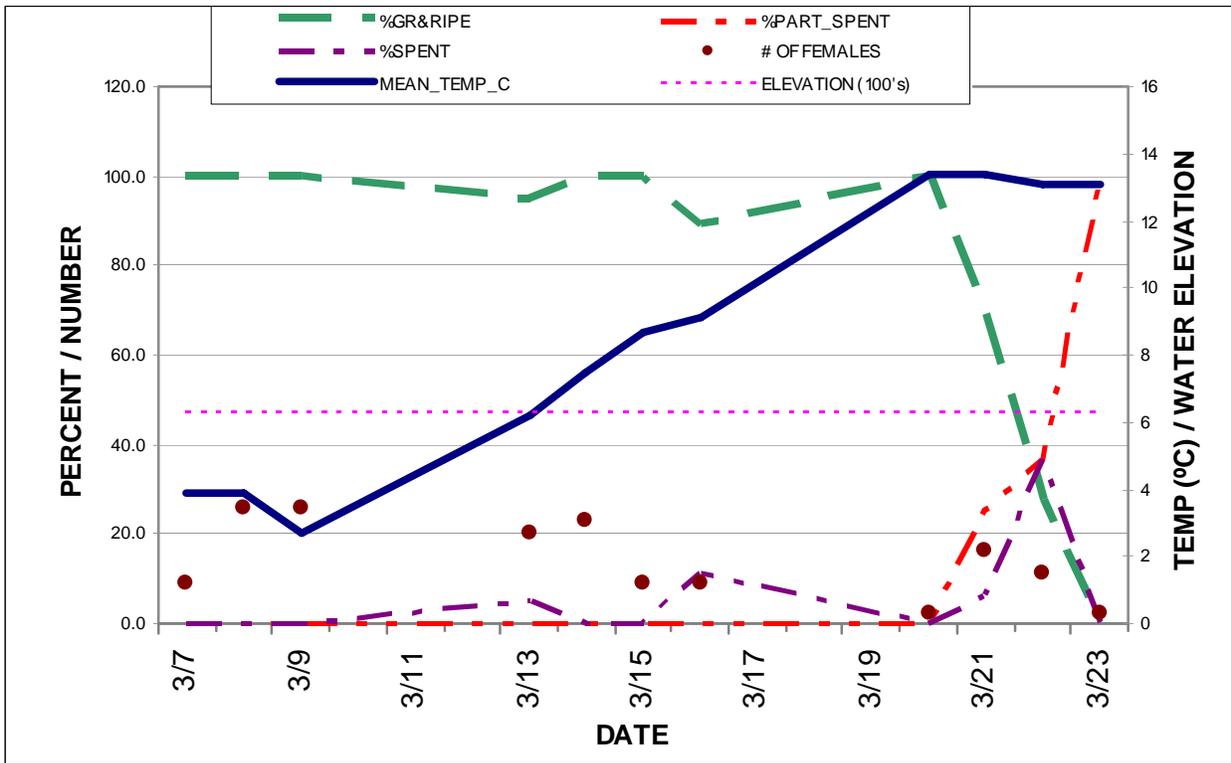


FIGURE 3. REPRODUCTIVE CONDITION OF 2012 FEMALE YELLOW PERCH BY DATE, TEMPERATURE AND WATER SURFACE ELEVATION.

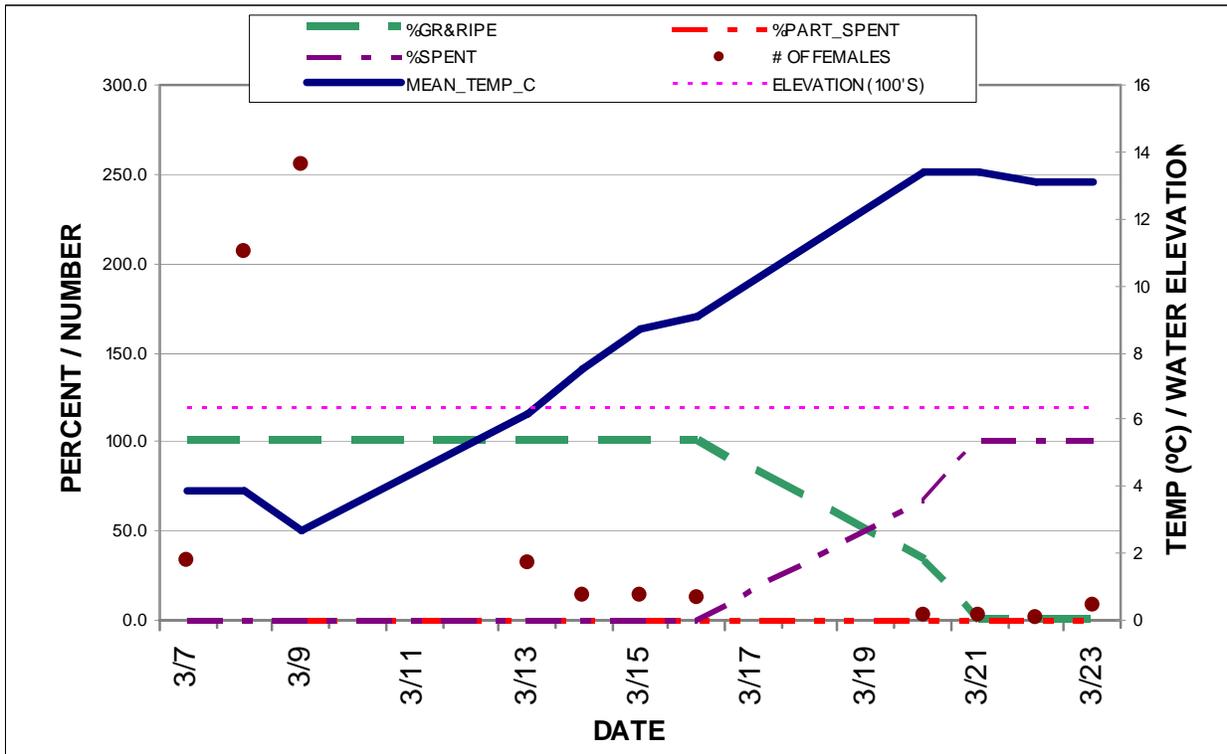
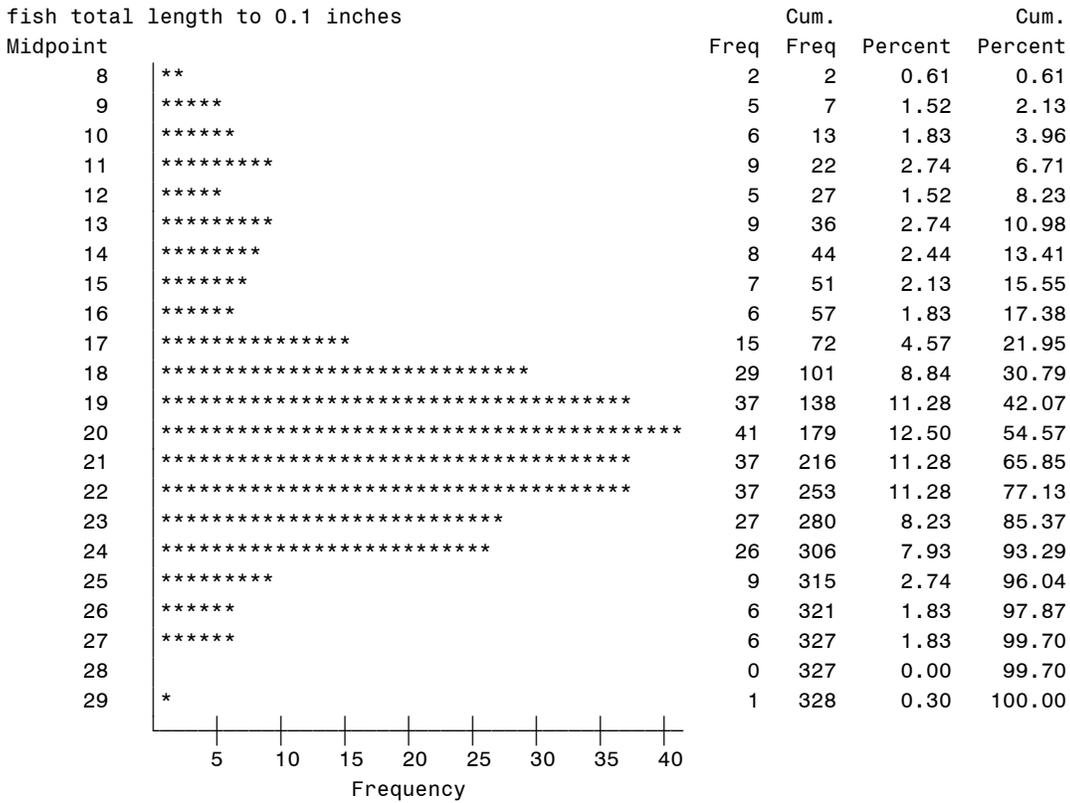


FIGURE 4. SPRING 2012 MALE NORTHERN PIKE LENGTH DISTRIBUTION (INCHES), GOOSE ISLAND/STODDARD LAKE UNIT.



N	Mean	Std Dev	Minimum	Maximum
328	19.5820488	4.0754823	8.1100000	28.7010000

FIGURE 5. SPRING 2010 MALE NORTHERN PIKE LENGTH DISTRIBUTION (INCHES), POOL 8.

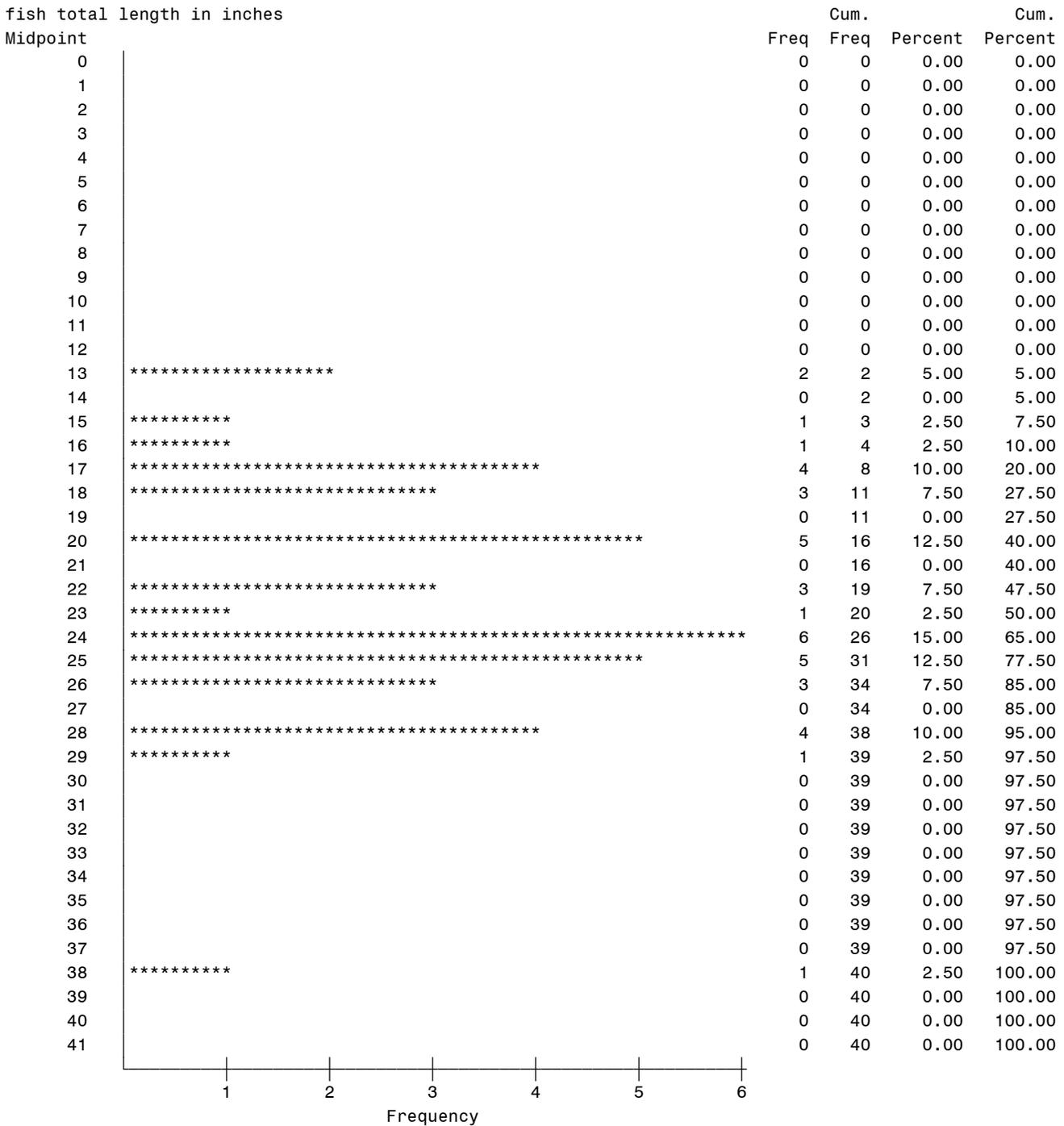


FIGURE 6. SPRING 1976 MALE NORTHERN PIKE LENGTH DISTRIBUTION (INCHES), POOL 8.

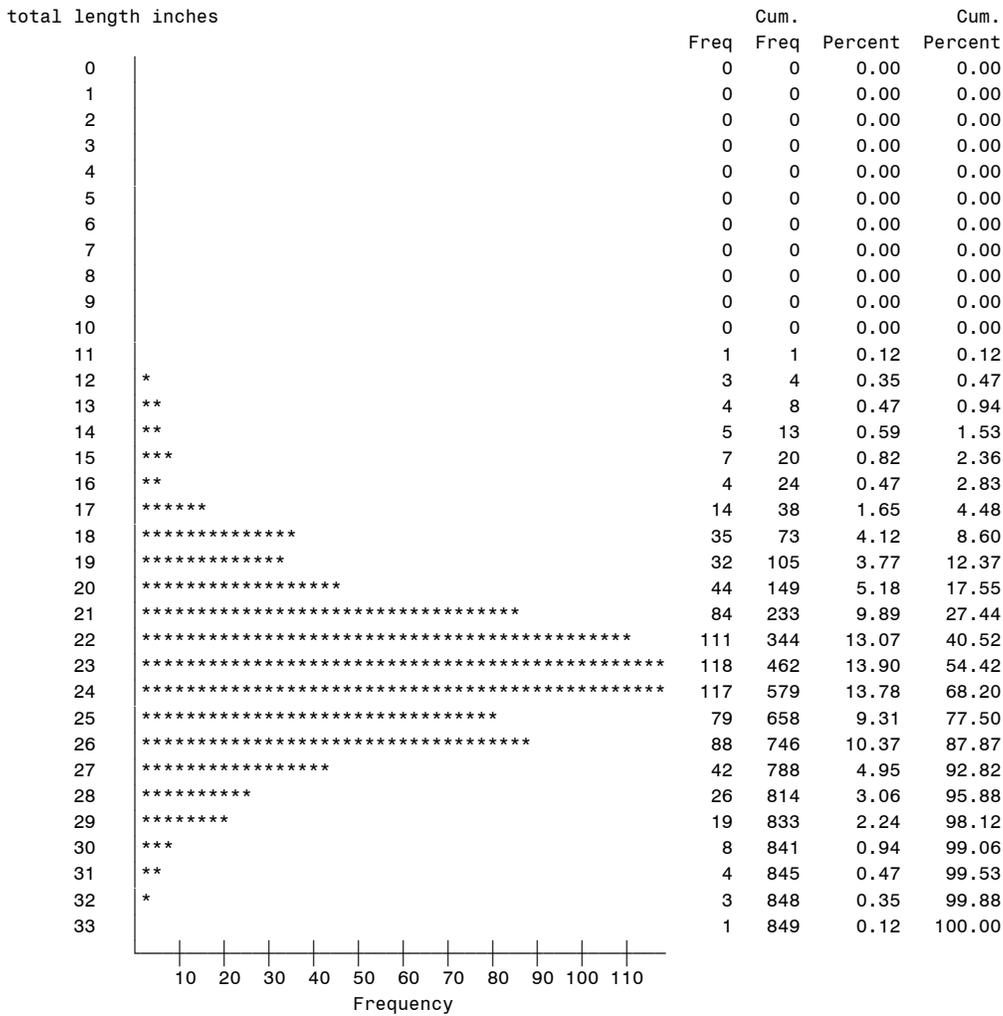


FIGURE 7. SPRING 2008 MALE NORTHERN PIKE LENGTH DISTRIBUTION (INCHES), POOL 8.

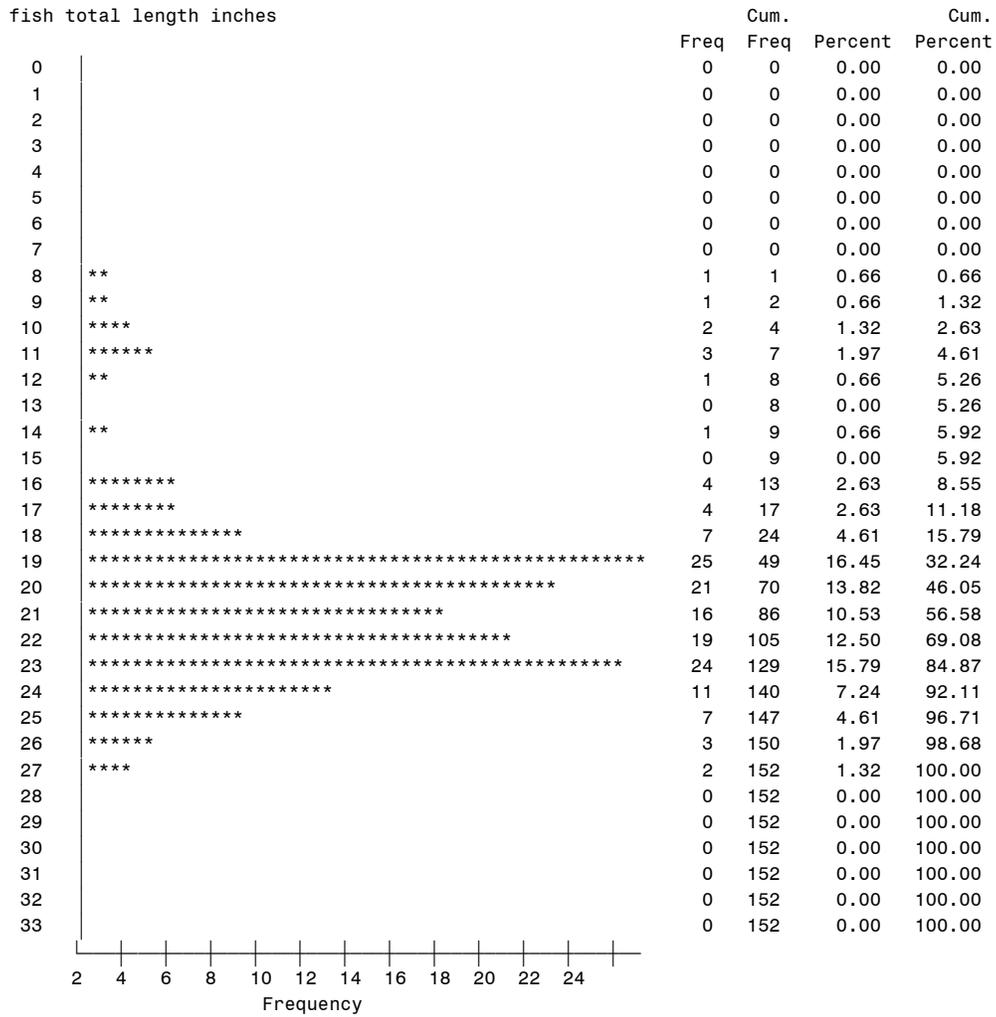


FIGURE 8. POOL 8, SPRING 2012 MALE NORTHERN PIKE TOTAL LENGTH THROUGH TIME.

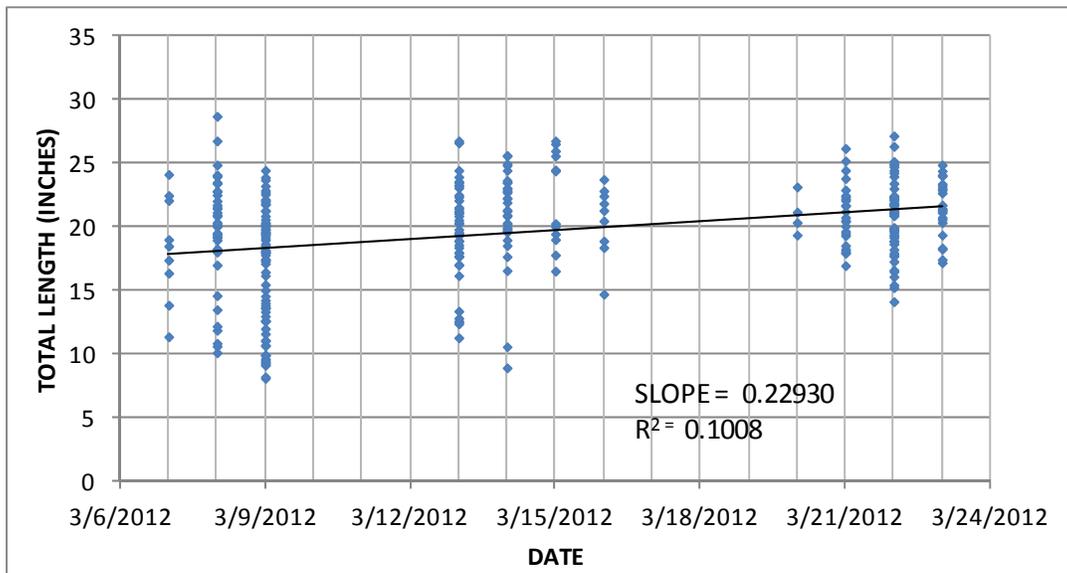
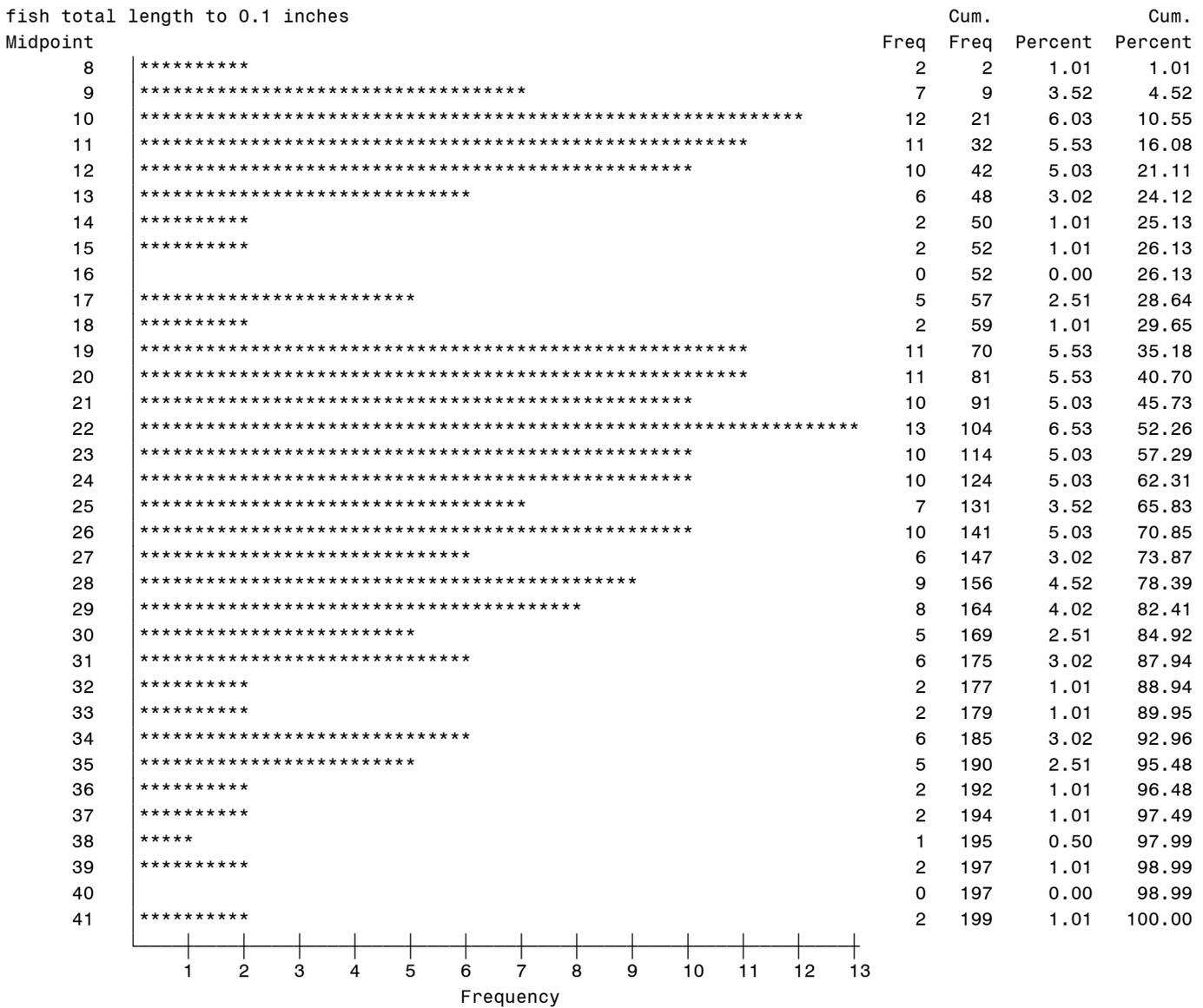


FIGURE 9. SPRING 2012 FEMALE NORTHERN PIKE LENGTH DISTRIBUTION (INCHES), GOOSE ISLAND/STODDARD LAKE UNIT.



N	Mean	Std Dev	Minimum	Maximum
199	21.9376281	8.1023598	8.1500000	41.3390000

FIGURE 10. SPRING 2010 FEMALE NORTHERN PIKE LENGTH DISTRIBUTION (INCHES) POOL 8.

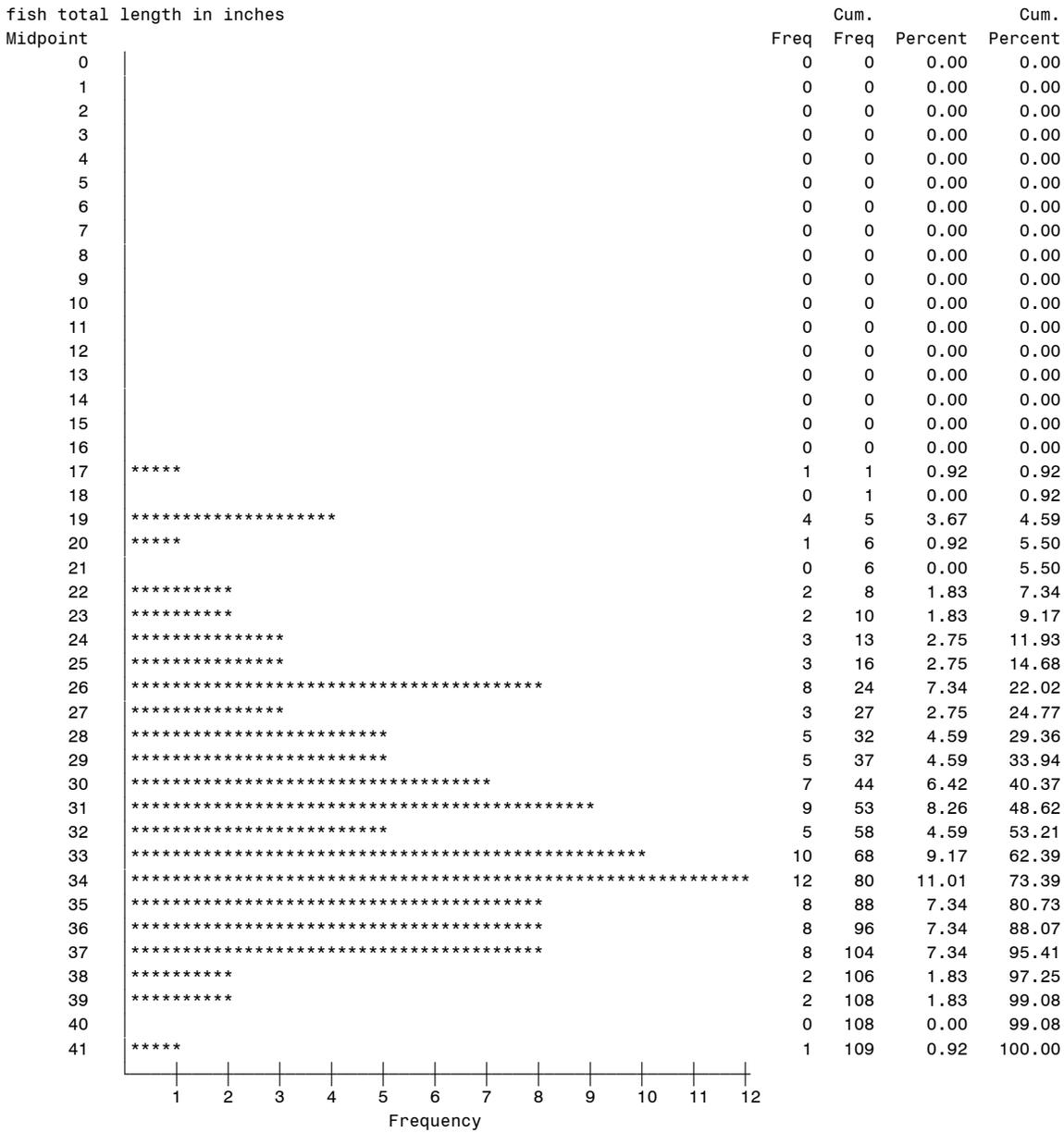


FIGURE 11. SPRING 2008 FEMALE NORTHERN PIKE LENGTH DISTRIBUTION (INCHES), POOL 8.

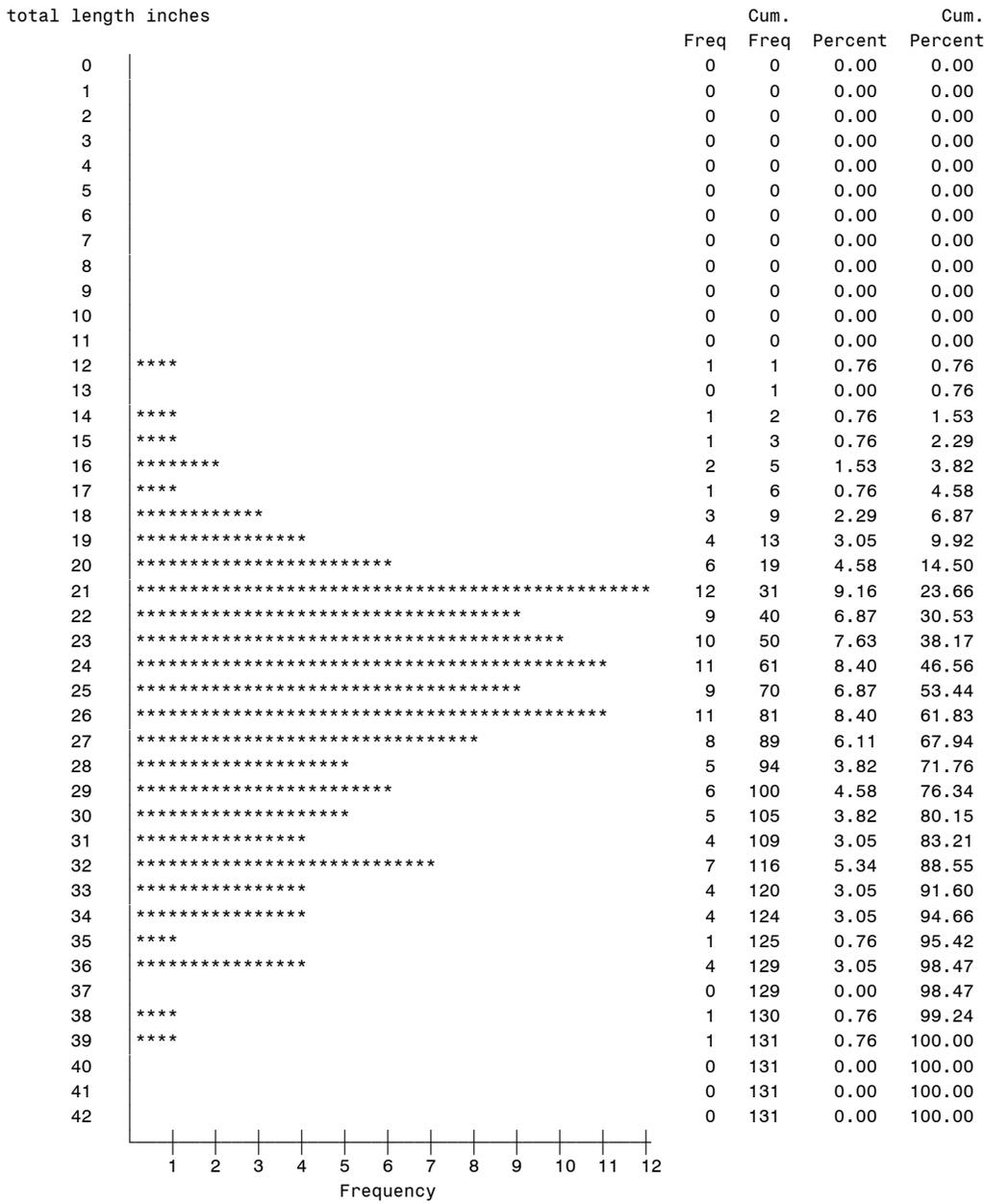


FIGURE 12. SPRING 1976 FEMALE NORTHERN PIKE LENGTH DISTRIBUTION (INCHES), POOL 8.

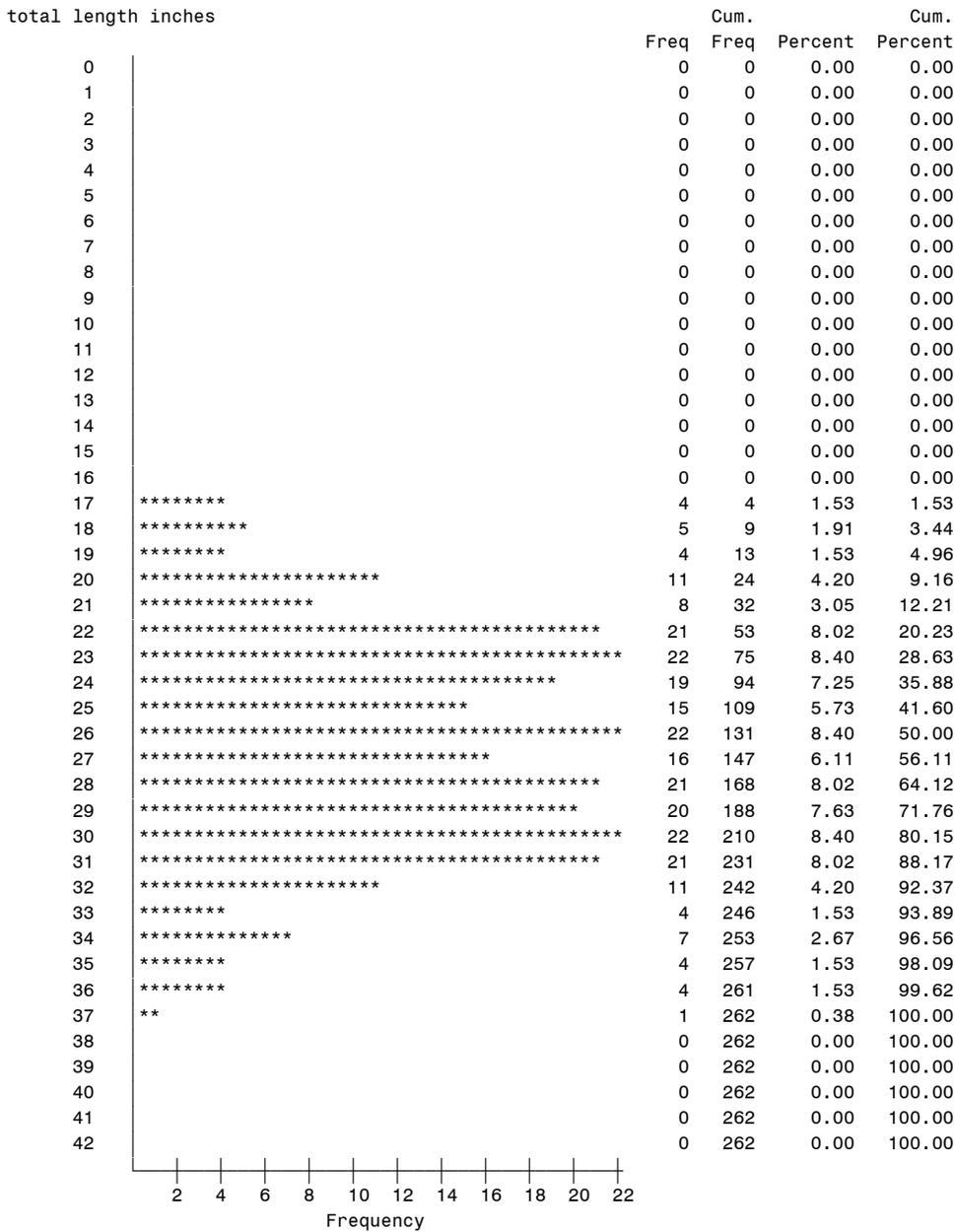
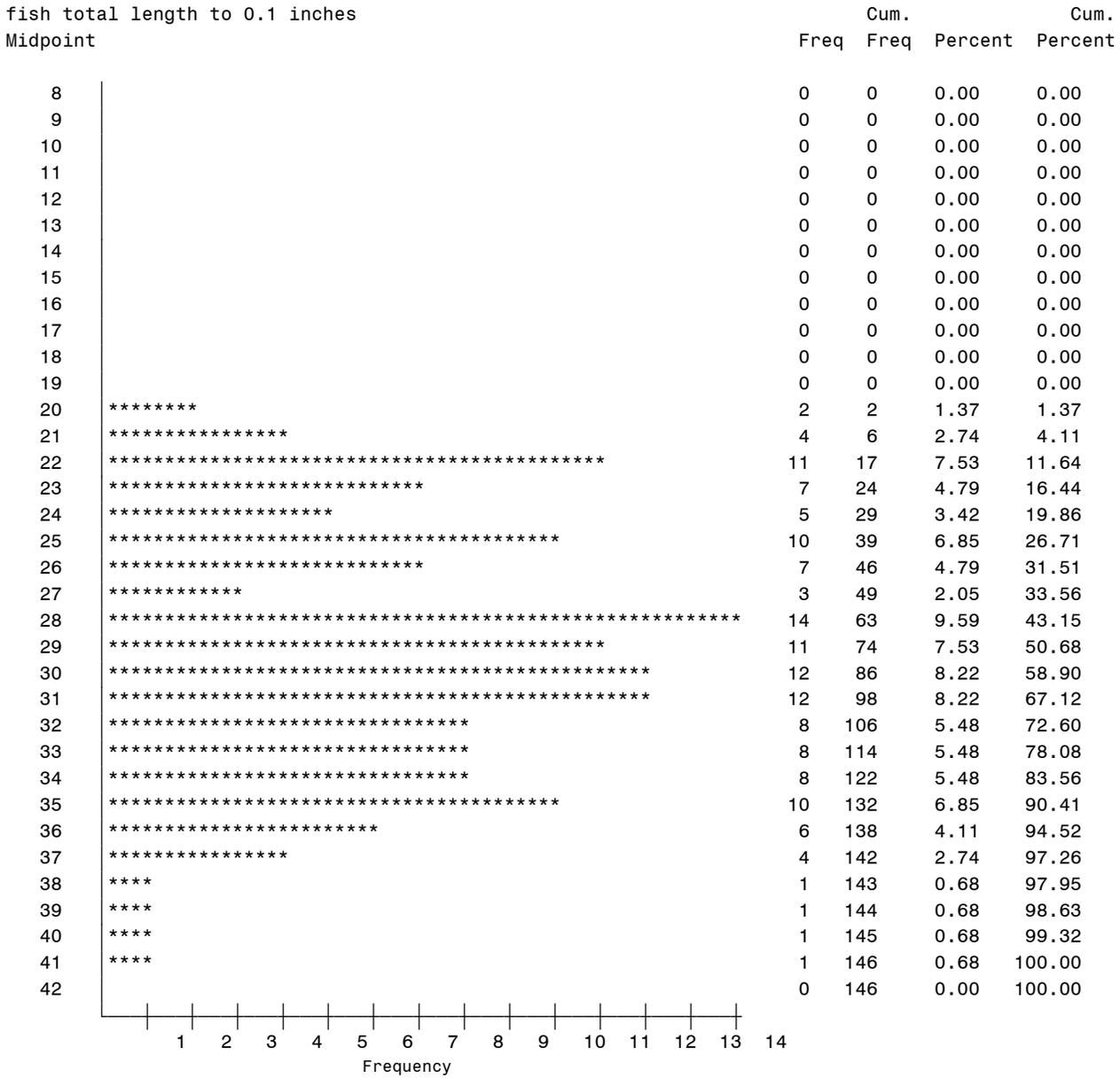


FIGURE 13. SPRING 1964 FEMALE NORTHERN PIKE LENGTH DISTRIBUTION (INCHES), POOL 8.



N	Mean	Std Dev	Minimum	Maximum
146	28.7260274	4.8363146	19.5000000	40.5000000

FIGURE 14. POOL 8, 2012 FEMALE NORTHERN PIKE TOTAL LENGTH THROUGH TIME.

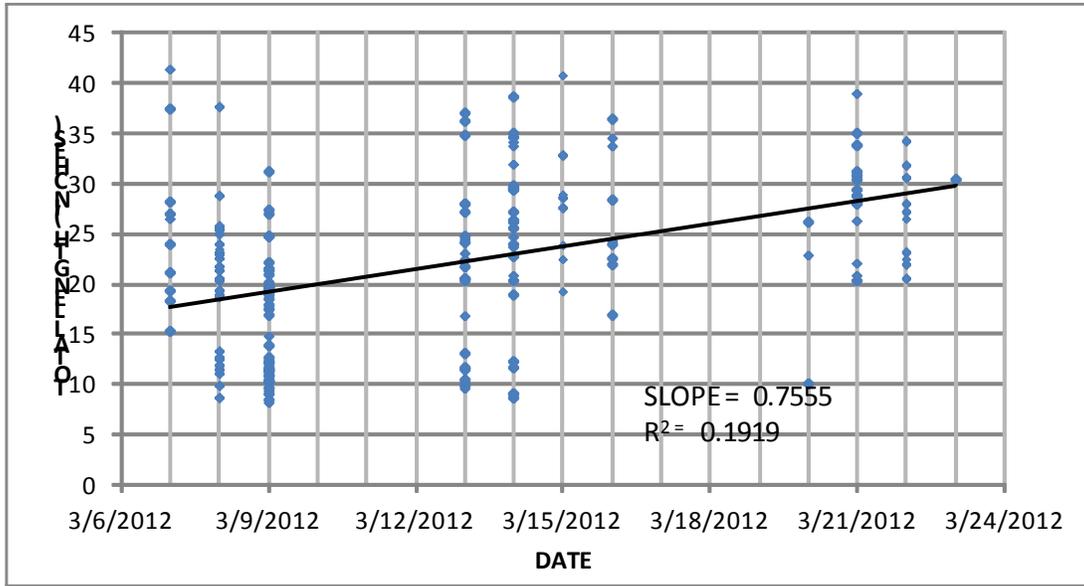


FIGURE 15. POOL 8, 1993-2011 NORTHERN PIKE PROPORTIONAL SIZE STRUCTURE (PSS_q) FROM LONG TERM RESOURCE MONITORING FYKE NETTING DATA.

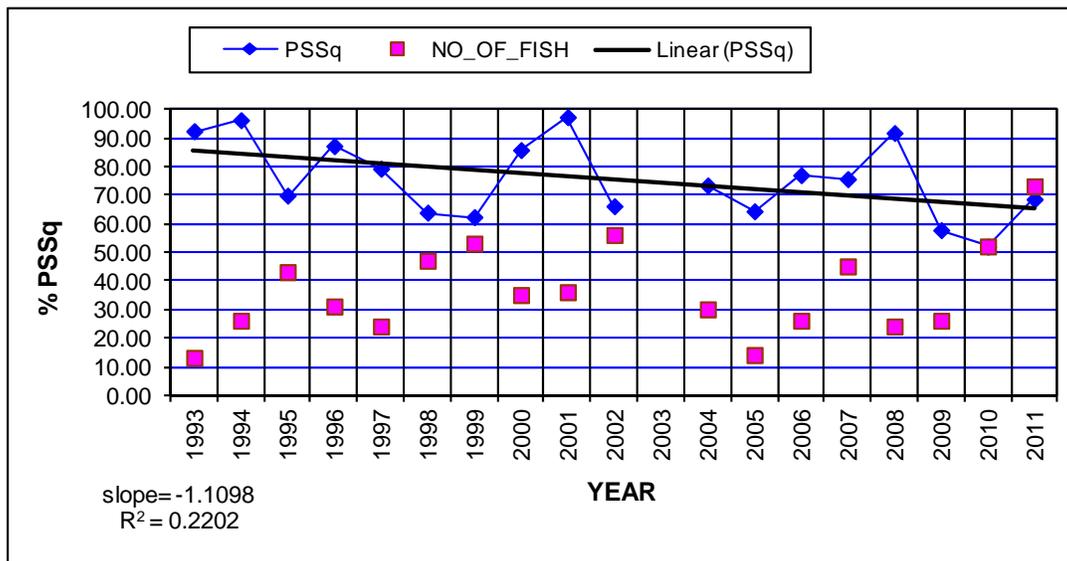


FIGURE 16. POOL 8, 1964-2012 NORTHERN PIKE PROPORTIONAL SIZE STRUCTURE (PSS_q) FROM WDNR FYKE NETTING DATA. MALES.

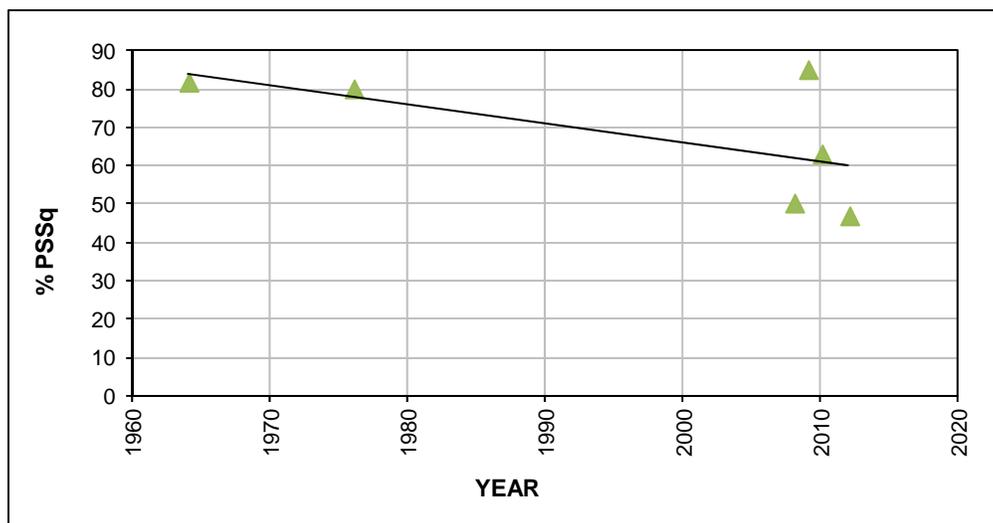


FIGURE 17. POOL 8, 1964-2012 NORTHERN PIKE PROPORTIONAL SIZE STRUCTURE (PSS_q) FROM WDNR FYKE NETTING DATA. FEMALES.

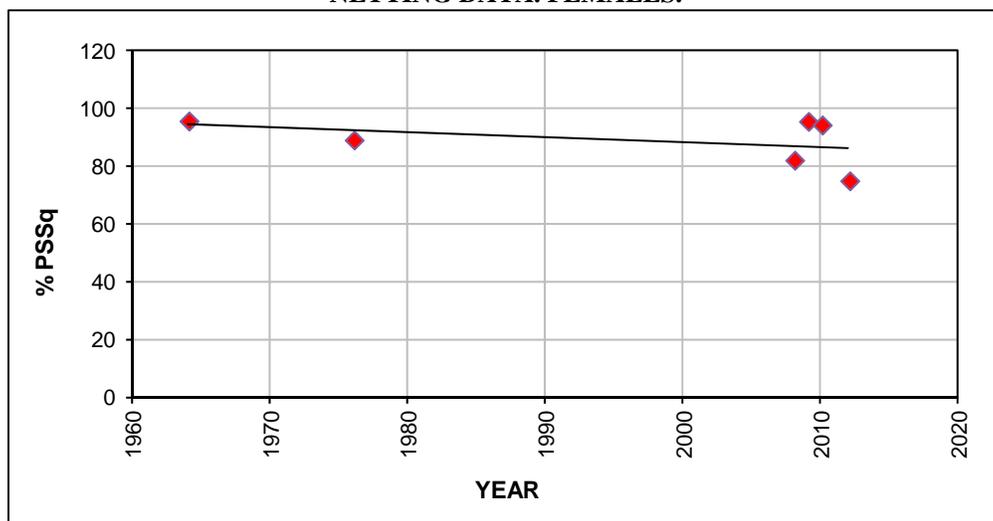


FIGURE 18. POOL 8, 1964-2012 NORTHERN PIKE PROPORTIONAL SIZE STRUCTURE (PSS_q) FROM WDNR FYKE NETTING DATA. ALL SEXES.

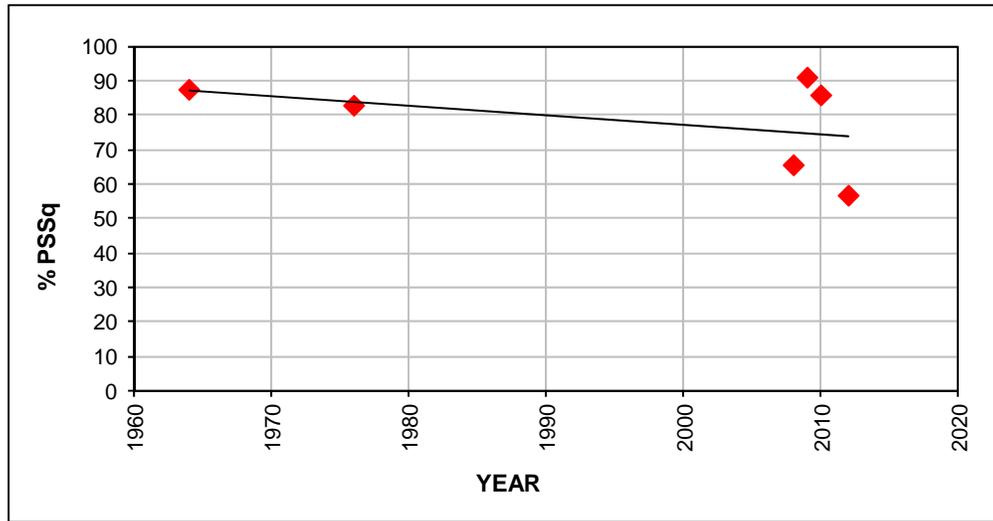


FIGURE 19. POOL 8 SPRING 2012 CATCH PER NET-DAY (24 HOURS) THROUGH TIME.

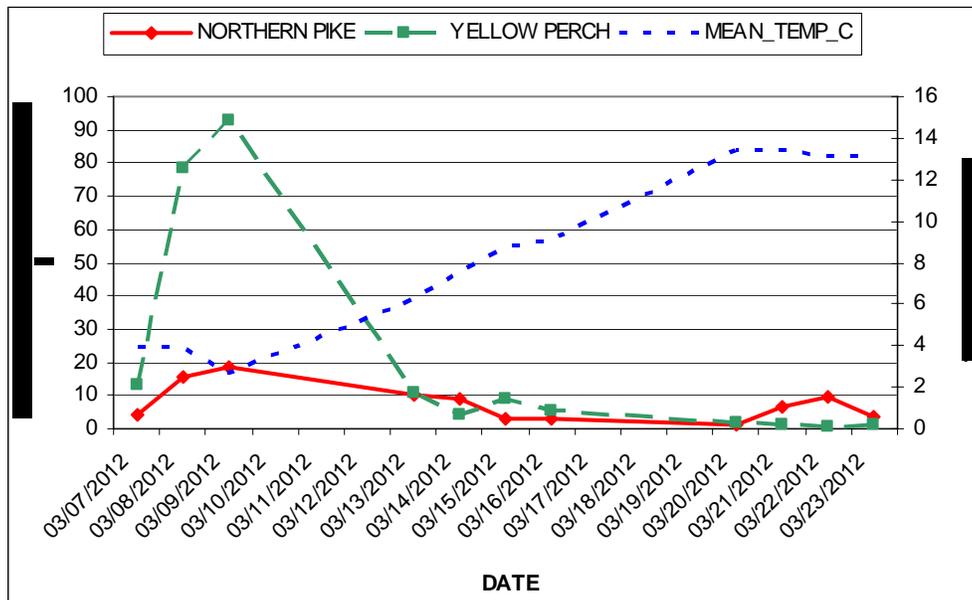


FIGURE 20. POOL 8, 1993-2011 NORTHERN PIKE CATCH PER NET-DAY FROM LTRMP FYKE NETTING DATA. ALL SEXES.

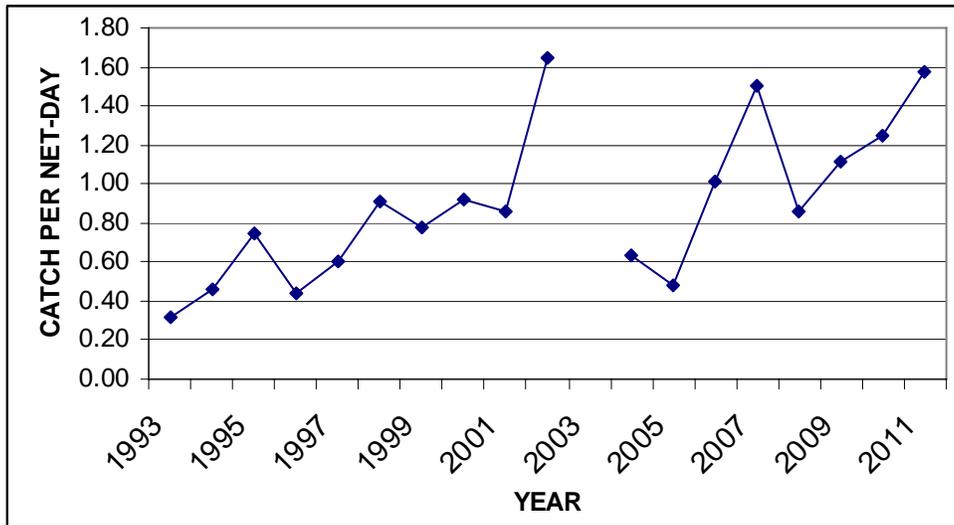


FIGURE 21. POOL 8, 1993-2011 YELLOW PERCH CATCH PER NET-DAY FROM LTRMP FYKE NETTING DATA. ALL SEXES.

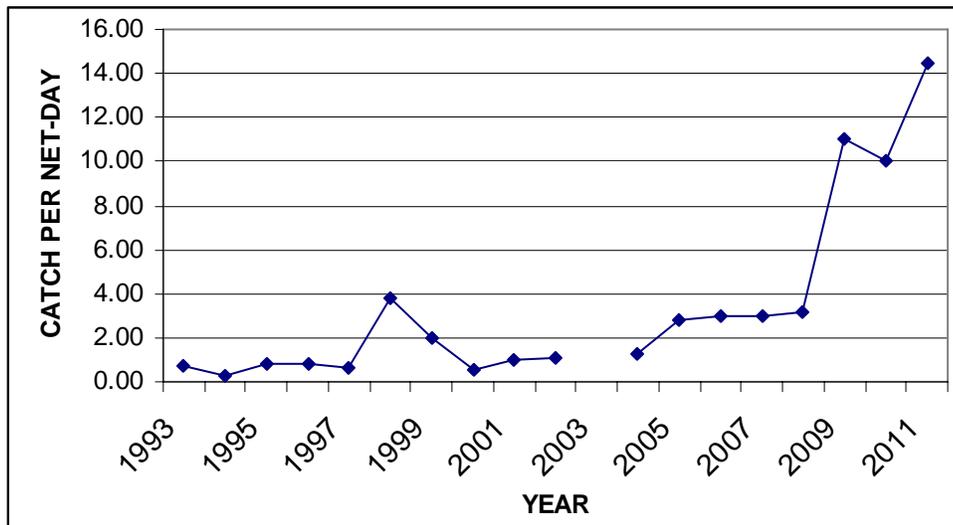


FIGURE 22. POOL 8, 2012 TOTAL LENGTH AND WEIGHT RELATIONSHIP, IMMATURE MALES AND FEMALES.

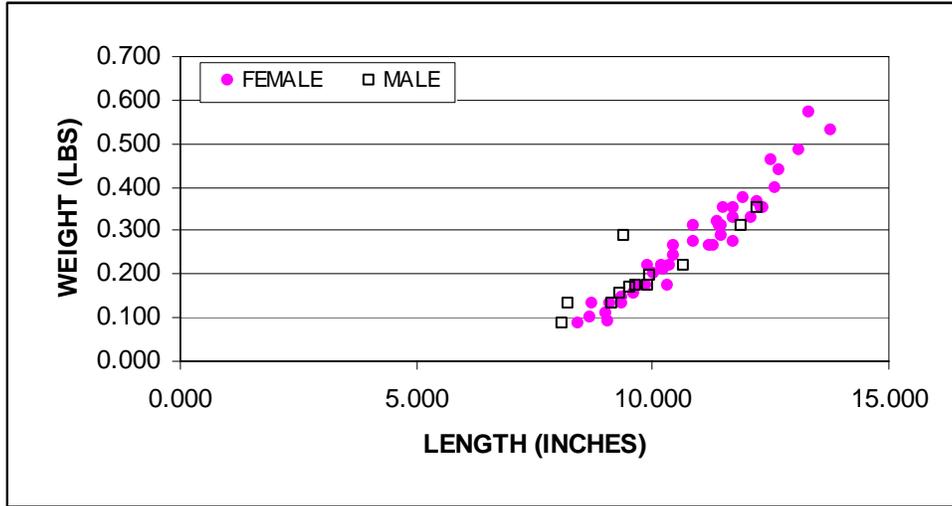


FIGURE 23. POOL 8, 2012 TOTAL LENGTH AND WEIGHT RELATIONSHIP, GREEN AND RIPE MALES AND FEMALES.

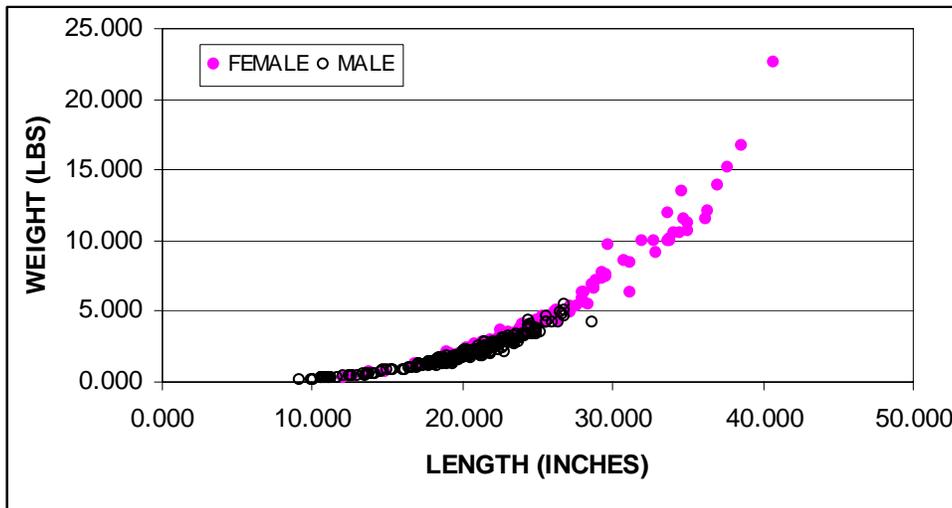


FIGURE 24. POOL 8, 2012 TOTAL LENGTH AND WEIGHT RELATIONSHIP, SPENT AND PARTIALLY SPENT MALES AND FEMALES.

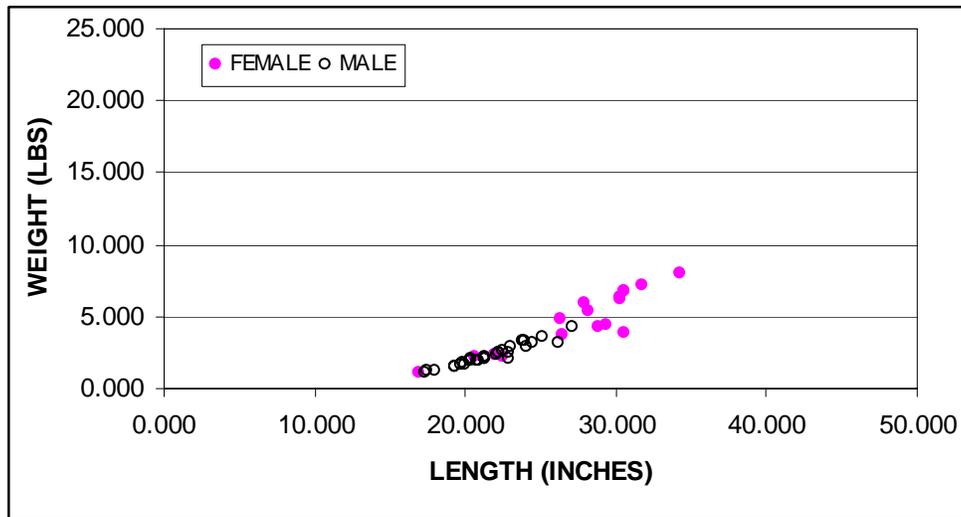


FIGURE 25. POOL 8, 2012 TOTAL LENGTH AND WEIGHT RELATIONSHIP, ALL REPRODUCTIVE CONDITIONS MALES AND FEMALES.

