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"AN EVALUATION OF STOCKING LARGE MUSKELLUNGE FINGERLING"

by

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Fish managers are always interested in the results of management efforts. Stocking of muskellunge is a management practice regularly employed in northern Wisconsin which required evaluation. There were indications that the results of stocking large muskellunge fingerling are extremely variable. In some waters, no results are apparent while in others, there are more stocked muskellunge than native fish in the population.

Evaluation of stocking is difficult because of the small size and tenderness of fish stocked. To obtain an indication of success, marking of large-size fingerling to be stocked in several waters was initiated. Then the incidence of stocked fish in northwestern Wisconsin lakes and rivers as found in routine surveys, muskellunge spawning and in angler catch records in cooperating resorts was noted. At the same time, other circumstances which may have affected the success of stocking were evaluated, notably the presence of predatory or competing species. Attempts are made to correlate the relative abundance of stocked muskellunge with the populations of other species.

Muskellunge propagation is a sizeable program in Wisconsin. In the 12 northwestern counties alone about 100,000 2-inch fingerling and 25,000 7 to 12-inch fingerling are stocked annually in about 80 lakes and rivers. Throughout this paper 2-inch fish are referred to as "small" and 7 to 12-inch fish are classified as "large". Although the success of the stocking program has been studied quite intensively in a few waters, a more extensive evaluation of this type has not been made.

METHODS

From 1960 through 1964, all state survey and muskellunge spawning crews have kept records of the muskellunge catches. Some information was also gathered in 1958. Fyke nets were used to catch fish for the spawning operation which takes place in May. Electroshocking equipment and fyke nets were used for survey work. Surveys were carried on throughout the entire open water season each year.

Voluntary creel census data were collected from 1961 through 1964 by resort operators and a few other cooperators who were particularly interested in the evaluation program. Many of these individuals have kept records independently for many years.

Data were obtained from 43 waters by state crews and from 26 by creel census cooperators. Seventeen lakes were sampled by both groups. Data from a total of 52 waters are included.

Stocking rates in the waters considered here have varied considerably. The number of large fingerling stocked per acre range from .3 to 15.3 and averages 1.0. This number per acre includes those stocked in all years from 1955 on, which, because of their expected size could have been sampled by the particular sampling method used.

For purposes of identification, all large fingerling stocked since 1955 have been marked by a pectoral or pelvic fin clip. Although there is sometimes regeneration, the newly grown fin is somewhat deformed, allowing identification even after regeneration.

Small unmarked muskellunge were also stocked in many of the lakes studied, but unfortunately these were too small to mark. Stocking rates of these fish were generally two per acre per year. Stocking from all applicable years varied considerably between different waters and ranged from 0 to 31.3 per acre and averaged 11.2. Any of these unmarked fish collected during this study could not be differentiated from native fish and, therefore, they are considered as coming from natural reproduction.

In this report only those fish are considered which are of the same size range as the known-age stocked fish. These fish were chosen by considering the growth rate expected in the particular water. Growth rate studies have been made on a number of these waters. For example, if a lake was stocked for five consecutive years before a survey, only those fish were considered which were smaller than the expected maximum size of five year old fish. For this reason data from approximately 13 percent of the muskellunge captured in this study were not used.

The incidence of the marked fish in the population and harvest from each lake has been determined and used as the basis of this project. This method considers the incidence of marked fish in small waters just as important as that in large waters. Likewise the incidence in waters with small muskellunge populations is of the same importance as that in waters with large populations. Since the density of the population as well as the sampling effort affected the number of fish captured, all samples are regarded as equally reliable regardless of size.

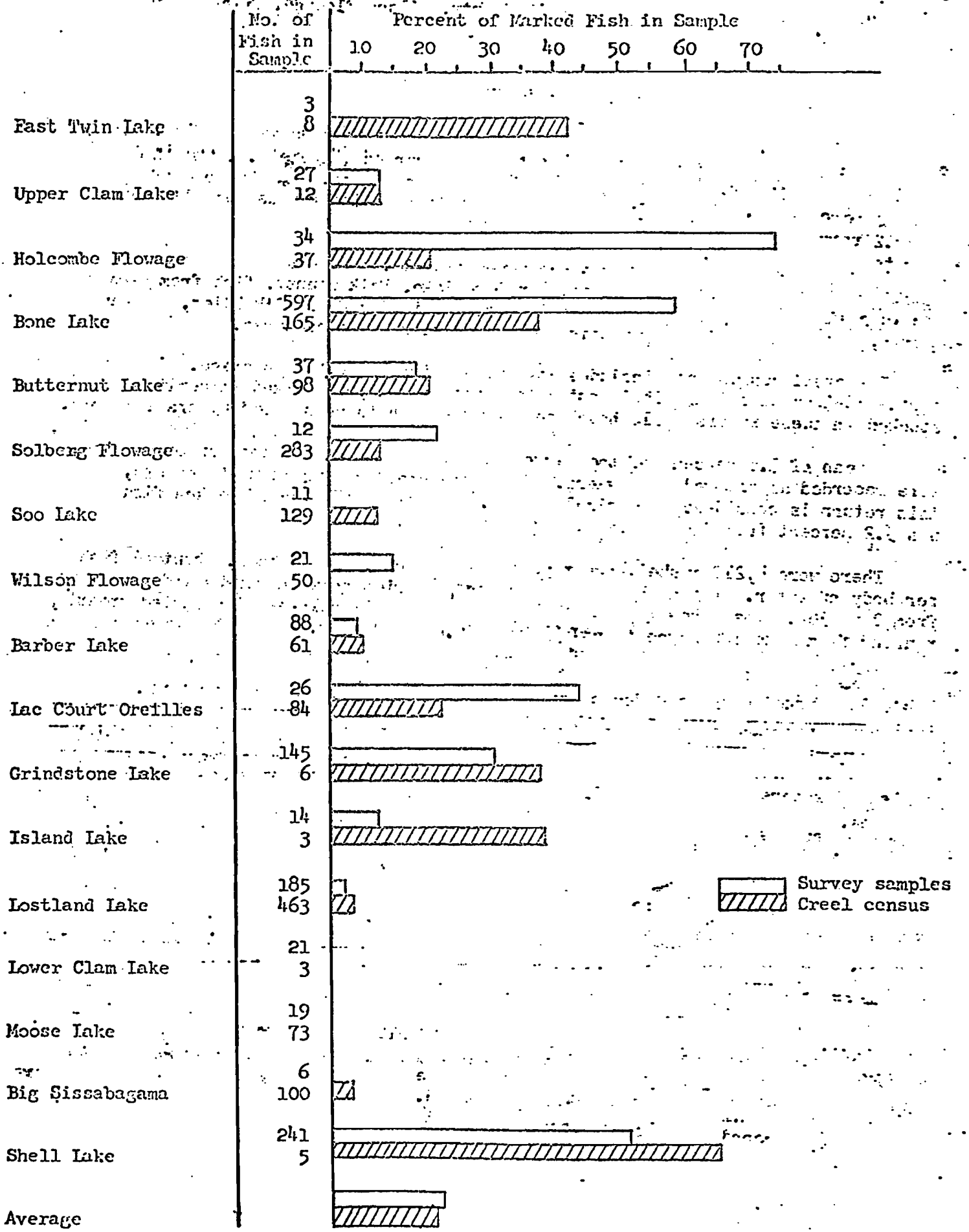
VALIDATION OF CREEL CENSUS DATA

Most biologists doubt the validity of cooperative creel census data. It is true that most cooperators do not have the interest nor take the time to record complete and accurate information. In this census, however, because of the relatively few muskellunge which are creeled and the genuine interest of the cooperators, the data included here is thought to be generally accurate. Data from cooperators who were thought to be unreliable or lacking interest have been omitted.

The validity of the data is further established by a comparison of information collected from 17 waters by both survey crews and creel census cooperators (Figure 1.). Although there are major differences in some instances, the averages are very close. The catch of marked fish in the Department data averages 17.3 compared to 16.4 in the creel census data. Major differences between data from different sources is explainable in most instances. In the cases of East Twin Lake, Ashland County, Soo Lake, Price County and Island Lake, Sawyer County the number of fish captured are small, and therefore, large differences can be expected.

Generally, marked fish are more available for Department sampling than for creel census because Department samples include fish of all sizes but angler caught fish include only those over 30 inches, the minimum size limit. This is particularly noteworthy in the case of Holcombe Flowage, Chippewa County, where there was apparently good survival of one year's stocking. At the time of the survey these fish ranged in size from 15 to 20 inches, and therefore, were not large enough to be available to the angler. Because the survival of this particular stocking was much better than average, the survey sample indicated a much higher percent of

Figure 1. Comparison of percent marked muskellunge in survey and creek census samples in all 17 lakes in which samples were collected by both methods.



stocked fish than is shown by the creel census data. This may also account for differences in data from Bone Lake, Polk County, Wilson Flowage, Price County and Lac Court O'Reilles, Sawyer County.

RESULTS

Samples from half the waters contained 10 percent or less marked fish. In 21.1 percent of the waters no marked fish were recorded (Figure 2.), and in 17.2 percent more than half the fish collected were marked. All but one of the waters, Clear Lake, Sawyer County, are thought to have indigenous muskellunge populations.

At least one stocked fish was recovered from 37.6 percent of the separate stockings in all the waters sampled. In Bone Lake, Polk County, fish from each of 8 consecutive years stocking were collected, and in Lac Court O'Reilles, Sawyer County, fish from 8 of 9 consecutive years stockings were captured.

The creel census data includes 169 marked fish and 1,818 unmarked. Because of the 30-inch size limit it is estimated that only 16,856 marked fingerling stocked in these waters could have been large enough to be sampled by creel census.

A mean of 1.6 percent of the marked fish which could have been of legal size, were recorded as removed by anglers. Since the creel census is not complete, this return is considered a minimal figure. The highest catch of marked fish was 5.2 percent from Buffalo Lake, Bayfield County.

There were 4,219 muskellunge reported captured by all methods, about 81 fish per body of water. The number of fish recorded varied between waters and ranged from 2 to 762. The percentage of stocked fish from all samples also varied greatly, ranging from 0 to 100 percent and averaged 24.1 (Table 1.).

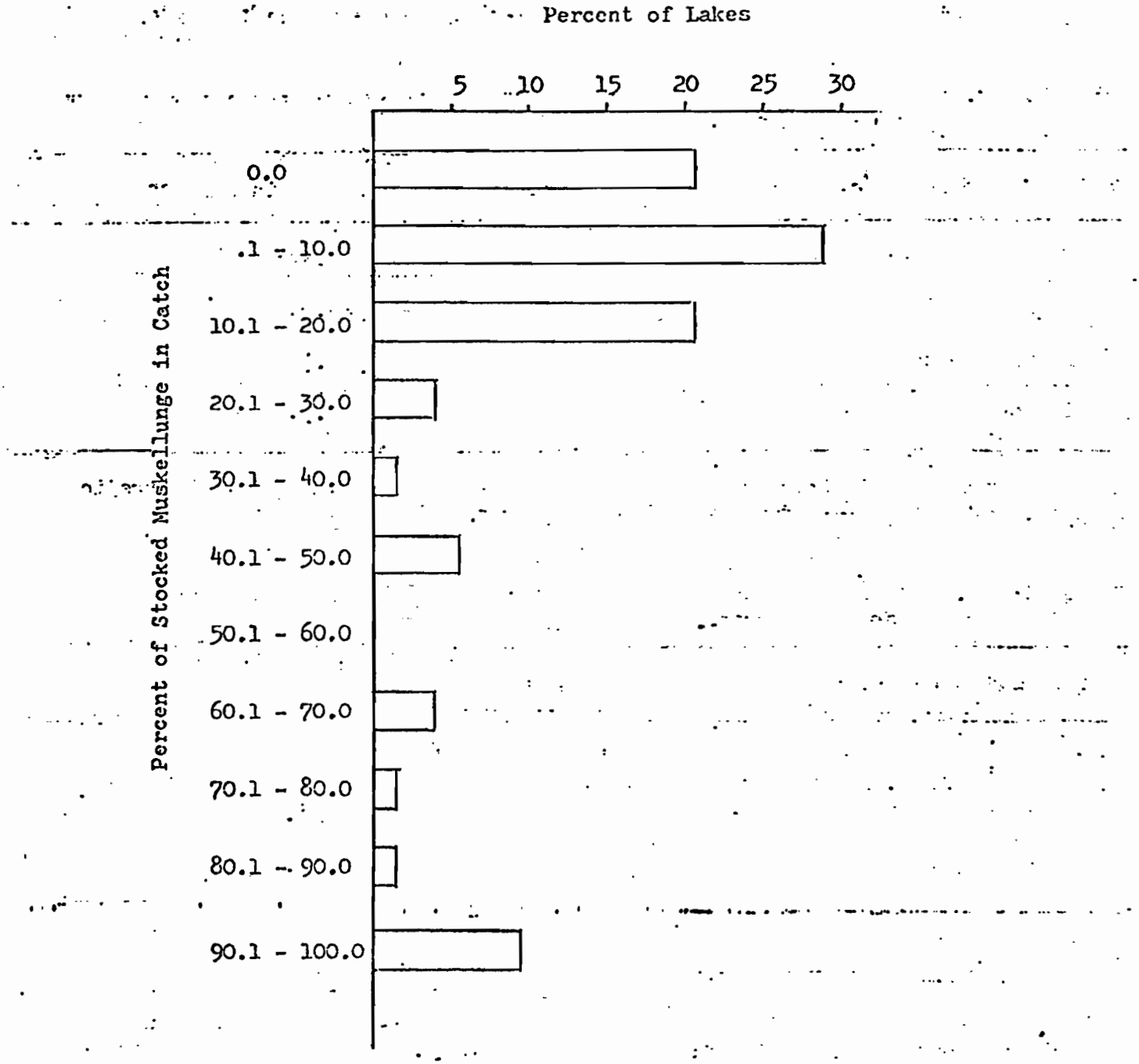
Table 1. Muskellunge recorded by state crews and creel census cooperators.

	State Crews	Creel Census	Total
Number of waters	43	26	52
Number of fish sampled	2,232	1,987	4,219
Number of fish per water	52	76	81
Average percent stocked fish per water	26.6	16.0	24.1

FACTORS CONTROLLING STOCKING SUCCESS

Sufficient data are available to assess the relative abundance of major fish species in 41 of the 52 waters considered. Lakes were classified in four general groups according to the abundance of walleye.

Figure 2. Percent of lakes sampled by all methods having various percentages of stocked muskellunge in the catch.



Criteria used to determine walleye abundance includes the number of fish captured during survey investigations per unit effort, spawning observations, growth rates and in cases of apparent high populations, creel census data and angler reports.

There appears to be an inverse relationship between the size of the walleye population and the percent of stocked muskellunge in the sample (Table 2.)

Table 2. Comparison between percent of stocked muskellunge in the sample and walleye abundance.

Walleye Abundance	Number of Waters	Average % Marked Muskellunge in Catch
Very high	6	6.3
High	8	19.8
Medium	11	29.8
Low or absent	16	34.6

No correlations are evident between the percent stocked muskellunge in the sample and the abundance of panfish (Table 3.)

Table 3. Comparison between percent of stocked muskellunge in the sample and panfish abundance.

Panfish Abundance	Number of Waters	Average % Marked Muskellunge in Catch
High	7	27.2
Medium	20	26.7
Low	12	25.2

DISCUSSION

The stocking of large fingerling has contributed little to the muskellunge population or harvest in half the waters studied. In these waters almost the entire population is from either natural reproduction or from the stocking of small fingerling. The latter possibility is remote in most instances. Stocking large fingerling on the other hand appears to be important in about 20 percent of the waters studied. It is very probable, however, that conditions in a body of water may change enough to alter the success of natural reproduction, making stocking less necessary in some waters and more essential in others during certain years.

Although no actual survival figures are considered in this report, an arithmetic mean of 1.6 percent of the large stocked fingerlings have been taken by anglers during the period of record. This is a minimum percentage because no attempt was made to obtain complete harvest figures and undoubtedly many legal sized stocked fish remain in these waters some of which will be taken in future years by anglers. In Buffalo Lake, 5.2 percent of the stocked fish were removed by anglers; this is the largest percent of harvest in any of the waters studied. Undoubtedly the survival rate of stocked fish to legal angling size was considerably larger.

It is logical to assume that the stocking of large fingerling muskellunge is more successful than stocking small fingerling; results of this study substantiate this idea. If all of the unmarked fish captured by anglers for this study were attributed to the stocking of small fingerling, only 1.5 percent of the fish stocked would have been captured. Although there is little difference between 1.5 percent for small fingerling and 1.6 percent for large fingerling, it is known that natural muskellunge reproduction occurs in many of the waters included in this study. The percent of small fingerling stocked and returned to the creel as legal sized fish is therefore considerably less than 1.5.

Undoubtedly there are many factors which could affect the survival of stocked muskellunge. These include the condition of the fingerling at stocking time, predation, cover, food supplies and water quality. Detailed studies of these factors have not been made.

Many fishery workers believe that northern pike prey on muskellunge populations. Northern pike spawn earlier than muskellunge and the resultant fry inhabit the same areas and are generally larger at any given time.

Young northern pike are extremely voracious even if only a few weeks old. Adult northern pike are very cannibalistic and would probably not hesitate to eat juvenile muskellunge. In spite of this, good muskellunge populations have been established in a few lakes having medium sized northern pike populations and no indigenous muskellunge. Bone Lake, Polk County is a prime example. Good northern pike waters are generally not stocked with muskellunge. Because of a lack of stocking in these waters, no evaluation of this factor could be made.

Consideration has not been given generally to the effect of walleye populations upon muskellunge. Many waters that have a high walleye population also have a good natural muskellunge population and successful muskellunge reproduction. Results of this study indicate that there was an inverse relationship between the size of the walleye populations and the percent of stocked muskellunge in the population. This suggests that walleyes affect the stocked fish more than they do the native muskellunge. Where large walleye populations are present, forage fish are scarce and slow growing walleyes are common. In most cases these walleyes are not large enough to be effective predators on the large muskellunge fingerlings. This suggests that the limiting factor in these waters might be food. Available food may regulate the growth rate of native fish so that they are of more optimum size for utilization of the food items present.

It has been assumed by some fish managers that slow growing panfish populations provide large amounts of suitable feed for muskellunge and therefore fill one of the requirements for survival of the large stocked fingerling. The relative abundance of panfish appeared to have little influence on the occurrence of the stocked fish in the catch however. Bluegills are the primary panfish species in most of the waters involved. It may be that in stunted populations of this species

relatively few are of acceptable forage size for muskellunge fingerling in fall at the time of stocking. It is also possible that sufficient forage is available in most waters so that it is not a frequent limiting factor to fingerling survival.

Because of the large variation in the rate of stocking, sampling procedure and fishing intensity and in the waters themselves, comparisons and gross evaluations are valuable only because of the volume of data available. From the standpoint of management, these data are most valuable in determining the role of stocking in individual waters. Because of this, basic data is listed in the appendix.

CONCLUSIONS

1. In half of the waters studied, less than 10 percent of the fish caught had been stocked as large fingerling.

2. In 17 percent of the waters over half of the fish caught had been stocked as large fingerling.

3. There was some survival from at least 37.6 percent of all large fingerling stockings.

4. On the average, anglers caught a minimum of 1.6 percent of the stocked fish after they became legal size.

5. The larger the walleye populations, the smaller the percent of stocked muskellunge in the population.

6. The size of the panfish population has no relationship to the percent of stocked muskellunge in the population or the catch.

ACKNOWLEDGMENTS

Mr. Leon Johnson is hereby recognized for initiating the marking system on stocked fish. He has detailed studies of muskellunge survival in a number of waters. Data from his studies are not included in this paper because of the general scope considered here.

Recognition is also given to district fish managers, spawn takers and creel cooperators for keeping records on fish captured.

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Appendix I. The waters stocked with large muskellunge fingerling, rate of stocking and returns on marked fish.

Waters	County	Acreage	Means of Capture	No. Yrs. Sampled	No. Stocked Per Acre	No. Fish Captured	% Stocked
E. Fk. Chippewa R.	Ashland	200	Shocker	2	2.1	27	0.0
E. Twin L.	Ashland	110	Shocker	1	2.5	3	0.0
			Creel cn.	1	.5	8	37.5
			All	2	1.0	11	27.3
English L.	Ashland	240	Shocker	1	5.0	19	63.2
Gallilee L.	Ashland	217	Shocker	1	1.4	62	4.8
Lt. Clam L.	Ashland	170	Creel cn.	2	.9	8	0.0
Mineral L.	Ashland	256	Creel cn.	4	.7	190	.6
Spider L.	Ashland	85	Creel cn.	2	.6	6	16.7
Upper Clam L.	Ashland	195	Nets	1	.7	37	8.1
			Creel cn.	2	.5	12	8.3
			All	2	.7	49	8.2
Buffalo L.	Bayfield	148	Creel cn.	3	.6	31	19.4
White Bass L.	Bayfield	113	Creel cn.	1	.4	2	50.0
Holcombe Flo.	Chippewa	4,250	Shocker	1	1.1	34	69.0
			Creel cn.	2	.5	37	16.2
			All	2	.8	71	36.6
Long L.	Chippewa	1,060	Shocker	1	.9	3	66.7
Amnicon L.	Douglas	423	Nets	1	.4	139	.7
Bone L.	Polk	1,676	Nets	3	1.0	597	54.1
			Creel cn.	3	.8	165	32.1
			All	3	1.2	762	49.3
Butternut L.	Price	961	Shocker	2	2.4	37	13.5
			Creel cn.	3	1.2	98	15.3
			All	4	1.5	135	14.8
Dardis L.	Price	138	Shocker	1	.7	10	0.0
Deer L.	Price	139	Shocker	1	1.3	5	0.0
Elk L.	Price	84	Shocker	1	.6	2	0.0
Long L.	Price	223	Shocker	1	.9	11	9.1
Musser Flo.	Price	510	Shocker	2	.3	23	0.0
Sailer Cr. Flo.	Price	155	Nets	3	8.6	8	20.0

Appendix I. (continued)

Waters	County	Acreage	Means of Capture	No. Yrs. Sampled	No. Stocked Per Acre	No. Fish Captured	% Stocked
Solberg Flo.	Price	1,180	Shocker	1	.6	12	16.7
			Creel cn.	4	.5	283	7.8
			All	5	.5	295	8.1
Soo Lake	Price	745	Shocker	1	.7	11	0.0
			Creel cn.	3	.3	129	7.0
			All	3	.3	140	6.4
Wilson Flo.	Price	304	Shocker	1	1.2	21	9.5
			Creel cn.	2	.5	50	0.0
			All	2	.7	71	2.8
Island L. Chain	Rusk	1,166	Nets	1	1.0	56	5.4
			Shocker	1	1.7	3	100.0
			All	2	1.0	59	10.2
Ladysmith Flo.	Rusk	256	Shocker	1	1.9	4	100.0
Potato Lake	Rusk	489	Mortality	1	.9	11	90.9
			Shocker	1	7.1	2	100.0
			All	2	1.9	13	92.3
Sand Lake	Rusk	189	Shocker	1	2.9	12	75.0
Barber Lake	Sawyer	254	Shocker	1	1.1	15	20.0
			Nets	1	.9	73	1.4
			Creel cn.	2	.6	61	4.9
			All	3	.8	149	4.7
Chippewa R. below Arpin	Sawyer	100	Shocker	1	7.4	3	100.0
Chippewa R. west Fork	Sawyer	305	Creel cn.	3	.6	11	18.2
Clear L.	Sawyer	68	Shocker	1	5.4	3	100.0
Connors L.	Sawyer	409	Shocker	1	1.5	18	0.0
			Nets	1	1.5	40	7.5
			All	2	1.5	58	5.2
LacCourt O'Reilles	Sawyer	4,827	Nets	2	1.8	26	38.5
			Creel cn.	2	.7	84	16.7
			All	4	1.2	110	21.8
Fish Trap Lake	Sawyer	165	Shocker	1	1.3	10	0.0
Ghost Lake	Sawyer	354	Creel cn.	1	.3	25	20.0

Appendix I. (continued)

Waters	County	Acreage	Means of Capture	No. Yrs. Sampled	No. Stocked Per Acre	No. Fish Captured	% Stocked
Grindstone Lake	Sawyer	3,304	Nets	4	.5	145	24.8
			Creel cn.	1	.2	6	33.3
			All	4	.5	151	25.2
Island Lake	Sawyer	73	Shocker	1	2.4	14	7.1
			Creel cn.	1	.3	3	33.3
			All	2	2.0	17	11.8
Lost Land Lake	Sawyer	1,282	Nets	1	.8	185	2.2
			Creel cn.	4	.7	463	3.0
			All	4	.8	648	2.9
Lower Clam Lake	Sawyer	203	Nets	1	.5	21	0.0
			Creel cn.	1	.3	3	0.0
			All	2	.5	24	0.0
Mason Lake	Sawyer	180	Nets	1	.9	117	2.6
Moose Lake	Sawyer	1,801	Shocker	1	.7	19	0.0
			Creel cn.	2	.3	73	0.0
			All	3	.4	92	0.0
Ole Lake	Sawyer	85	Creel cn.	1	1.8	5	20.0
Pickerel Lake	Sawyer	290	Nets	1	1.5	87	5.7
Big Sissabagama L.	Sawyer	830	Shocker	1	1.0	6	0.0
			Creel cn.	4	.6	100	3.0
			All	4	.6	106	2.8
Little Sissabagama L.	Sawyer	302	Shocker	1	5.8	16	81.3
Teal L. & River	Sawyer	744	Creel cn.	2	1.0	129	2.3
Tigercat Flo.	Sawyer	325	Shocker	1	1.7	16	0.0
Upper Twin L.	Sawyer	235	Shocker	1	2.9	15	0.0
Mondeaux Flo.	Taylor	485	Shocker	1	3.6	7	14.3
Spirit L.	Taylor	100	Shocker	1	15.3	6	100.0
Shell L.	Washburn	2,432	Nets	3	1.1	241	46.9
			Creel cn.	1	.6	5	60.0
			All	3	1.1	246	47.2

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