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STATUS OF TIGER MUSKELLUNGE MANAGEMENT IN MICHIGAN

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SUMMARY

Muskellunge are important predators in the fish community and are considered by many anglers to be the "big game trophy" of freshwater angling. Populations diminished in Michigan by the mid-1950's, at which time efforts were initiated to develop natural, self-sustaining populations. In the mid-1960's, cultural techniques were developed to produce the hybrid tiger muskellunge, which was seen as a way to increase musky fishing opportunity through maintenance stocking.

Michigan's muskellunge program presently has an economic impact to the state of about $6 million. The hybrid tiger musky is present in 141 inland lakes in 54 of Michigan's 83 counties. Almost half are located in southern lower Michigan where fishing demand is the greatest.

Public acceptance of the musky program has been generally good, but some concern has been expressed by the public for the impact tiger muskellunge could have on other fish populations. However, thus far there is no evidence that tiger musky have had any significant detrimental effect on other fish populations.

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INTRODUCTION

History of Tiger Muskellunge

Northern pike and muskellunge are important predators in the fish community and popular game fish in many North American lakes. Fisheries managers consider them to be valuable in maintaining desirable game fish populations. Anglers regard the musky even more highly than the northern pike and many consider them to be the "big game trophy" of freshwater angling (Graff, 1978). However, the natural range of muskellunge is restricted (Figure 1) and population densities are generally low. For these reasons, fisheries managers have often sought means of improving and/or expanding musky populations.

North American fishery scientists presently recognize only one species of muskellunge (Scott and Crossman, 1973). However, three fairly distinct marking patterns exist over the normal range and have led to their being considered sub-specifically as distinct populations. These are the Great Lakes musky (spotted pattern), the Ohio River Valley musky (diffusely spotted or barred), and the northern (Minnesota or Wisconsin) musky (barred or with no pattern).

Figure 1. Geographical distribution of muskellunge in North America (Adapted from Scott and Crossman, 1973).

The subspecies of principal interest in Michigan are the Great Lakes and northern muskies (Figure 2). Another name, the "tiger musky," has been associated with the purebred northern musky in Minnesota (Scott and Crossman, 1973). Presumably, this is because of the distinct pattern of dark, vertical bars located along the sides.

More recently, the term "tiger musky" has been applied to the male northern pike x female northern musky hybrid which shows characteristics of both species, but a strong tendency toward dark, vertical barring (Figure 2). Hybridization between northern pike and muskellunge has been extensively reviewed by Beyerle (1973). The first naturally occurring hybrid was reported in Illinois in 1927. Hatchery production of this hybrid began in Minnesota and Wisconsin in 1939, in Pennsylvania in 1965, and in Michigan in 1966. Since that time, Ohio, New York, North Carolina, and Missouri have begun programs to culture and stock hybrid tiger musky. For the purpose of this report, further reference to the tiger musky will be in regard to this hybrid.

Michigan's muskellunge program has been generally well accepted statewide. However, in recent years some criticism has developed in a few areas (Iron Lake, Iron County; Grand Lake, Presque Isle County; and Upper Crooked Lake, Barry County). Some anglers have expressed fears that muskies would decimate game fish populations. And during 1979, one Michigan United Conservation Club (M.U.C.C.) affiliate introduced a resolution to their state convention which would have placed a moratorium on the statewide muskellunge program. M.U.C.C. tabled the resolution when Fisheries Division agreed to prepare a status report of the statewide muskellunge program.

During 1980, field fisheries biologists were requested to analyze their muskellunge program and provide information on growth, survival, food habits, the sport fishery, impact on fish populations and public acceptance.

History in Michigan

Purebred muskellunge populations were once abundant enough to support a limited commercial fishery in the Great Lakes (Schrouder, 1973). They were widely associated with Great Lakes bays, major river systems, and drowned river mouths. However, by the mid-1950's, there were only about 15 lakes and streams where muskies produced a fishery (Williams, 1959, and Figure 3).

Efforts to halt the decline of native musky populations were initiated in 1955 (Scott, 1963), when emphasis was placed on the development of natural, self-sustaining populations.

Experimental plantings of fry and fingerlings were made for the purpose of enhancing residual populations. In addition, introductory plants were made in 13 lakes in various locations throughout the state. Between 1955 and 1966, 339,000 fry and 92,000 fingerling purebred muskellunge were planted--an annual average of about 54,000 fry and 10,000 fingerlings during the years musky were releasted (Table 1).

In the early 1960's, coincident with purebred musky production, hatchery personnel and managers began to consider the feasibility of culturing the tiger musky. The

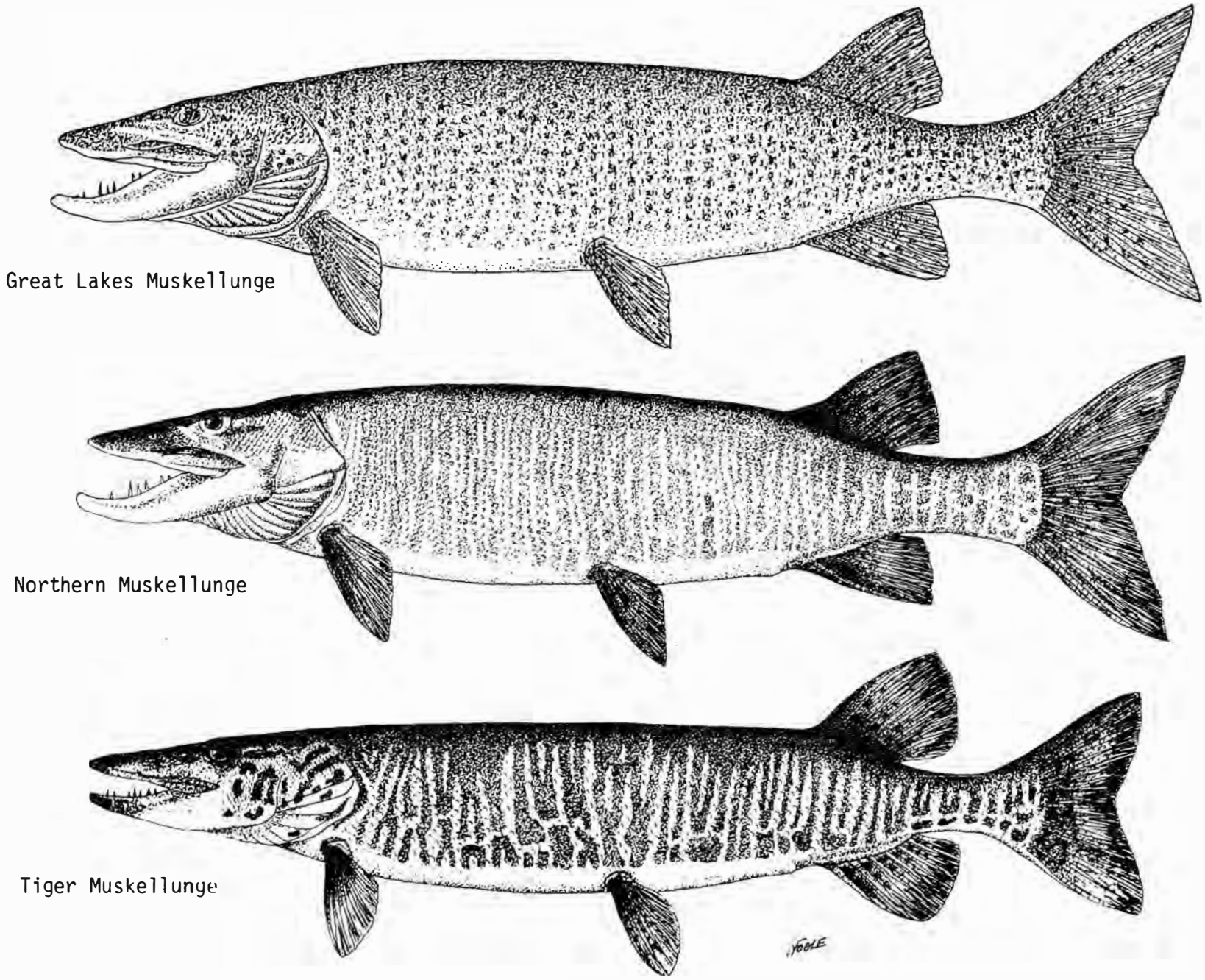


Figure 2. Marking patterns of the Great Lakes, northern, and tiger muskellunge.

Figure 3. Distribution of muskellunge in Michigan

agricultural and poultry sciences had long before demonstrated increased vigor among hybrids. There was evidence that tiger musky showed superior growth and survival in the hatchery and that they could lend themselves well to the less expensive, intensive culture techniques (Hammond and Westers, 1981, personal communication).

Table 1. Purebred muskellunge plants in Michigan, 1955-1966 (Source: Annual Fish Planting Record and Scott, 1963).

Year	Fry	Fingerling
1955	55,250	4,796
1956	40,000	2,864
1957	--	12,244
1958	--	--
1959	--	--
1960	--	--
1961	--	2,900
1962	178,796	23,700
1963	7,197	3,850
1964	42,536	2,060
1965	--	23,931
1966	15,000	15,879
TOTAL	338,779	92,224
Average	54,463 (6 years)	10,247 (9 years)

Evidence gathered by various authors, and reviewed by Beyerle (1973), indicated that the tiger musky was, for all practical purposes, sterile. From that standpoint alone, it was an excellent prospect for management because the tiger musky would only be present so long as a stocking program was maintained in any given lake or stream.

Michigan's tiger musky program was initiated in 1966 when four lakes were planted experimentally. As hatchery production levels improved and managers identified suitable waters, the program was slowly expanded (Table 2). Managers soon found that the tiger musky provided a new and exciting sport fishery. By 1980,

Table 2. Muskellunge plants in Michigan, 1966-1980 (Source: Annual Michigan Fish Planting Record).

	Purebred Musky[1]		Tiger Musky[2]		
Year	Fry	Fing.	Fing.	No. of Waters[3]	Comments
1966	15,000	15,879	3,652	4	Pure strain not identified
1967	50,000	70,706	11,578	10	Pure strain not identified
1968		2,818	3,528	3	987 were Great Lakes strain
1969		3,470	28,013	7	Pure strain not identified
1970		501	49,848	9	All Great Lakes strain
1971		10,450	49,298	11	Pure strain not identified
1972	143,000	6,968	26,601	30	
1973	40,000	2,779	9,978	10	
1974	34,362	1,798	31,762	24	
1975	50,000	6,064	21,891	14	28 fing. were Great Lakes strain
1976	167,701	13,226	93,997	46	
1977		19,725	107,194	51	
1978		21,605	128,542	62	20,520 were Great Lakes strain
1979		64,217	136,235	79	14 were Great Lakes strain
1980	133,553	13,540	251,607	96	38 were Great Lakes strain
TOTAL	633,616	253,746	953,724	141	
Average[4]	79,202	16,916	63,581		

[1]All purebreds were the northern strain except where noted under comments.

[2]Intensive cultural techniques expanded to Platte River Hatchery beginning in 1976.

[3]Number of waters planted represents the number of different waters planted from 1966-1980 and is not additive vertically.

[4]Averages are calculated based on the number of years that plants were made.

tiger musky had been stocked in 141 inland lakes totaling about 95,000 acres in 54 counties. This represents about 12 percent of the total acreage (764,000 acres; Borgeson, 1979) of inland lakes greater than five acres.

Management Policy

In 1971, Michigan's present muskellunge management policy was formulated (Robertson, 1971). Purebred muskellunge would be cultured primarily for the purpose of maintaining broodstock in natural waters. The bulk of the production effort would be aimed at hybrids for maintenance stocking purposes. Production goals were set at 10,000 to 20,000 purebred fingerlings and 100,000 hybrids annually. In 1976, these production levels were finally reached (Table 2). Because of increased demands for more tiger musky, the present production goal is 150,000 annually.

Tiger musky are planted in suitable, strategically located lakes primarily to provide a trophy fishery. Like the pure strains, they add excitement, variety, and quality to overall fishing opportunities wherever they exist. They are planted annually or biennually at a rate of two to four fingerlings per surface acre. Managers do not expect them to control panfish abundance, but they are useful in maintaining desirable population balances.

GROWTH IN THE WILD

Beyerle (1978) reported on growth of tiger musky in Round Lake, Van Buren County. Age 0 fish reached 11.5"; Age I, 21.8"; Age II, 28.8" Age III, 33.6" and Ave IV, 37.0". Such growth rates are probably optimal and attainable only in the most fertile waters, primarily in southern Michigan. It is clear, however, that in most waters tiger musky reach legal size (30 inches) in either the third or fourth summer of their life (two or three years after planting).

Fisheries managers rated tiger musky growth in 38 of 68 lakes surveyed (Table 3). Growth was rated fair or poor in only 12 (17.6%) of the lakes, while it was rated good to excellent in 26 (38%). Thirty lakes (44%) were not rated since many of these waters have only recently been stocked and data is not yet available.

Table 3. Summary of ratings of 68 lakes managed for tiger muskellunge (Source: Unpublished data compiled from district fisheries reports, 1980).

	Number (%) Of Lakes			
Rating Scale	Growth	Survival	Fishing Success	Public Acceptance
Poor	2 (2.9)	5 (7.4)	10 (14.7)	2 (2.9)
Fair/Low	10 (14.7)	7 (10.3)	12 (17.6)	4 (5.9)
Good/Mixed	21 (30.9)	18 (26.5)	11 (16.2)	37 (54.5)
Very Good/High	3 (4.4)	4 (5.9)	2 (2.9)	7 (10.3)
Excellent	2 (2.9)	2 (2.9)	4 (5.9)	6 (8.8)
No Comment	30 (44.2)	32 (47.0)	29 (42.7)	12 (17.6)
TOTAL	68 (100)	68 (100)	68 (100)	68 (100)

SURVIVAL IN THE WILD

Evidence gathered to date indicates that the survival and growth of planted tiger musky is intermediate to that of both parents (Beyerle, 1973). Schrouder (1973) expected survival to Age IV (legal size) to be about 25 percent. Beyerle (1978) studied fry vs fingerling plants and pellet-reared vs minnow-reared hybrids. He reported survival rates for pellet-reared fingerlings to be 13.2 percent to Age 0 (11.5") and 10.2 percent for Age I (21.8"). Minnow-reared hybrids planted as fingerlings exhibited a survival rate of 25 percent for Age II fish (28.8") without fishing mortality. After one year of fishing, 5.3% of the Age III (33.6") hybrids survived.

Fisheries managers rated tiger musky survival in 36 of 68 lakes surveyed (Table 3). In only 12 (18%) was survival rated as fair or poor. Twenty-four (35%) were rated as good to excellent and 32 (47%) were not rated. Generally speaking, managers found it difficult to evaluate survival rates because of the low population densities arising from our policy of planting at a rate of 2-4 fish per acre. In addition, many managers believe a significant portion of any population is harvested before the fish reach legal size (30"). In those waters where anglers are accustomed to keeping 20-inch northern pike, it is not surprising that they would choose to retain 25- to 30-inch tiger musky.

FOOD HABITS

Food habits of purebred muskellunge have been reported by many investigators and summarized by Schrouder (1973). After yolk absorption, they feed on small zooplankton for four to 10 days, then begin to feed on small fish. Soft-rayed fishes are preferred but as with other top predators, musky are opportunists and feed on those items of the appropriate size which are the most abundant or more easily captured.

Information on diet of tiger muskellunge was secured from 19 of 68 lakes being managed for this species. Panfish (bluegills and pumpkinseed sunfish) were the food items most frequently observed in stomachs, followed by yellow perch, suckers, minnows, and goldfish. In every case, the food items observed reflected the most abundant forage species present in the lake. Information on fish taken in the winter showed most stomachs were void of any food items, indicating tiger musky feed very little during this season.

SPORT FISHERY AND COST BENEFITS

Tiger muskellunge are an often sought trophy, which requires a significant amount of time and effort to insure success. Behavior is similar to their purebred parents with respect to habitat preferences, yet they are more easily taken than purebred muskellunge in most waters. Williams (1959) reported that it took anglers with guides 26 hours to catch one purebred muskellunge, but that inexperienced anglers required 226 hours. On the other hand, Schrouder (1973) estimated that it took only about 20 hours to catch one tiger musky.

Jamsen (1979) and Beyerle (1979) reported that 25,000 anglers spent 240,000 angler-days to catch 10,000 minnow reared hybrid muskies in 1977. This represented about two-thirds of the total statewide catch of all muskellunge and a return to the angler of about 25 percent of the stocked fish.

The value of the tiger muskellunge program can be estimated from Talhelm (1981) who indicated warmwater anglers would spend about $12.63 per angler-day with an economic impact twice the expenditure. Thus, based on the 1977 study, anglers would have expended $3,031,000 during the 240,000 angler-days fished, resulting in an economic impact of over $6 million.

It is presently estimated that the cost of rearing a tiger musky on pelleted food to planting size (6 inches) is about 11.3¢ each (Westers, personal communication). Considering an annual production of 150,000 fingerlings and a 25 percent return of pellet-reared fish to the angler, (Beyerle, personal communications) the annual rearing cost of the program (excluding research and evaluation) is about $17,000, or about $2.27 per fish in the creel.

Opportunities to catch tiger muskellunge are fairly well distributed statewide (Figure 4). A total of 141 inland lakes in 54 of Michigan's 83 counties have been stocked with the hybrid. Of the 95,177 acres being managed for tigers, one-third are located in each of the three regions; however, 66 (47%) of the lakes are located in southern lower Michigan.

A survey of licensed anglers in 1977 indicated that 7% rated northern pike or muskellunge as their preferred sport fish (Jamsen, 1979). By comparison, 21% selected bass as their first choice, and 13% selected walleye. Panfish were the first choice of 17% of the anglers surveyed.

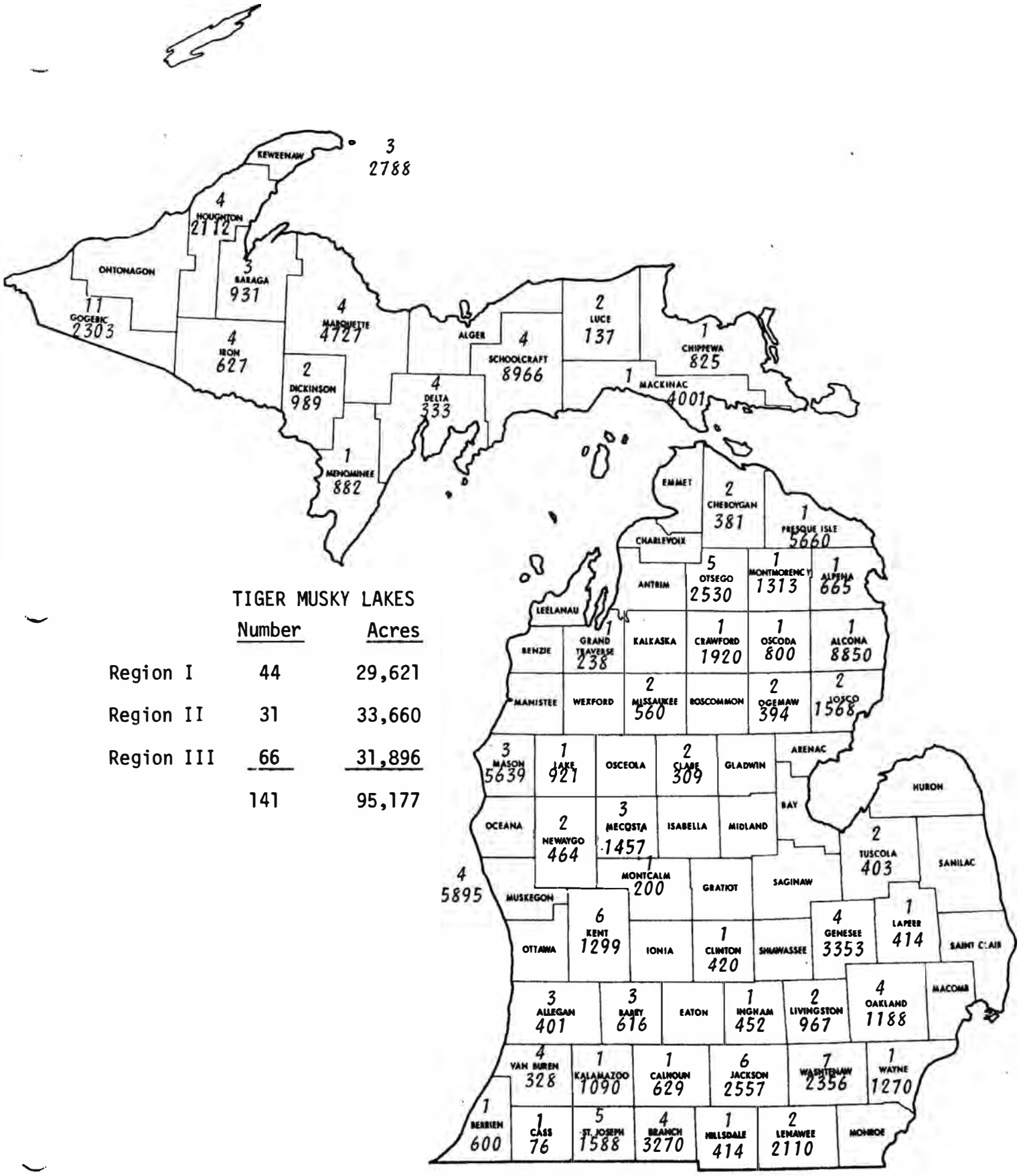
During 1980, Fisheries managers reviewed fishing success from 68 of the 141 managed lakes (Table 3). Seventeen (25%) of the 68 lakes were considered to have good to excellent fishing while 22 (32%) had fair to poor. No information was available on the remaining 29 lakes.

IMPACT ON FISH POPULATIONS AND PUBLIC ACCEPTANCE

Fisheries managers also assessed the impact of the tiger musky program on 24 of 68 stocked lakes. In 20 of the 24, tiger musky were judged to have no impact on the remaining fish community. One lake was judged to have more largemouth bass after musky introduction than before, however, this may have been due in part to other management practices. One lake was judged to have fewer panfish; one, fewer pech; and one, fewer small panfish than before introduction of tiger muskies. One biologist cited two lakes where reliable anglers perceived a decline in largemouth bass abundance. He speculated that if a decline was real, it was more apt to be due to displacement from preferred habitat rather than due to predation.

Beyerle (1980) reviewed a similar 1977 field evaluation of lakes managed for tiger musky. The review concluded that tiger muskies did not affect the number or size of panfish (in 12 lakes studied), or largemouth bass (in 5 lakes studied), but did compete with northern pike (in 4 lakes studied). In one lake where spearing was banned, the pike population increased.

One lake fish population may have been adversely affected by the introduction of purebred northern muskellunge. Iron Lake, Iron County, developed an exceptionally large population of northern musky resulting from 10 years of stocking (1962-1973), abundant natural reproduction, a restrictive size limit (36 inches) and a protective spearing ban. Abundance and size of black crappie, largemouth and smallmouth bass,



TIGER MUSKY LAKES

	Number	Acres
Region I	44	29,621
Region II	31	33,660
Region III	66	31,896
	141	95,177

Figure 4. Distribution of inland lakes stocked with tiger muskellunge from 1966-1980. Number of lakes (above) and total acres (below) are indicated.

and suckers decreased dramatically. It is unlikely, however, that tiger muskellunge would cause similar problems because their abundance can be controlled by reducing or eliminating the stocking program in any given lake.

Public acceptance of the tiger musky program was also rated during 1980. Fifty of the 68 lakes (74%) reviewed by biologists were rated as good to excellent (Table 3). Acceptance was poor to fair on only six lakes (less than 9%). Opposition to a tiger musky program usually was associated with fears of imposition of a spearing ban, or concern for other fish species. Areas of poor acceptance were centred around Iron and Chicagoan lakes (Iron County), some Grand Lake (Presque Isle County) residents, and Crooked Lake (Barry County).

Public support has been voiced for expanding the tiger musky program in several areas of the state. These include the eastern and western ends of the Upper Peninsula and the Mio and Jackson fish management districts. In several districts, especially in Region III, tiger muskellunge are second only to walleye in requests for fish to be planted.

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