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Pink Salmon in Michigan Tributaries
of the Great Lakes, 1967-1980**

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DISTRIBUTION AND ABUNDANCE OF PINK SALMON
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Abstract

By 1980, some 24 years after introduction of an odd-year spawning stock into Lake Superior, pink salmon have spawned in at least 56 tributaries of Lake Superior, 5 of northern Lake Huron, and 11 of northern Lake Michigan. Abundance trends in Lake Superior have been sharply upward. Salmon in Lakes Huron and Michigan have not shown such an increase, probably because relatively few generations have reproduced there. The occurrence of 2- and 3-year-old spawners suggests that magnitude of the spawning runs will be more stable than on the West Coast where all salmon mature at 2 years. The impact of pink salmon on other fish cannot be predicted, but food habits of salmon seem similar to those of many other fishes in the Great Lakes. Sport and commercial fisheries may develop for these small salmon.

¹ Contribution from Dingell-Johnson Projects F-31-R and F-35-R, Michigan.

Introduction

Pink salmon (Oncorhynchus gorbuscha), of an odd-year spawning stock, were introduced into a tributary of northwestern Lake Superior in 1956 (Schumacher and Eddy 1960). A few salmon spawned in Minnesota tributaries of Lake Superior in 1959, 1961, and 1963 (Schumacher and Eddy 1960, Schumacher and Hale 1962, Moore and Braem 1965). In 1969 and 1971, salmon spawned in many tributaries of Lake Superior (Lawrie and Rahrer 1972, Parsons 1973) and had extended their range into Lake Huron (Collins 1975).

By 1971, pink salmon were well established in Lake Superior. Further increases in distribution and abundance could have important effects on other fish and on the fisheries in the Great Lakes. Hence, in 1973, we began surveillance of spawning runs in Michigan tributaries of the Great Lakes. In addition, scattered records of pink salmon were available from prior casual observations. Herein, we describe the distribution and abundance of adult pink salmon in Michigan tributaries.

Methods

Most information on distribution came from annual visual observations by fisheries personnel of the Michigan Department of Natural Resources (MDNR) on a variable number of streams in 1973, 1975, and 1977-1980. To determine if pink salmon occurred, a portion of the spawning habitat in each stream was scrutinized at least once during the spawning season. Most streams observed were those where we had prior reports of pink salmon or where we suspected pink salmon might be present. The number of streams observed was not equal among or within lakes. Most observations were made on tributaries of Lake Superior, particularly in the central portion. Observations of Lakes Huron and Michigan tributaries were fewer and confined to the north shores. Incidental distribution data were provided by reports of pink salmon seen by MDNR conservation officers on patrol, by United States Fish and Wildlife Service (USFWS) personnel during sea lamprey surveys

and treatments, and by anglers. The number of streams where salmon occurred must be regarded as minimal because we were not able to check all potential or suspected spawning streams and because of the brevity of the observations on the streams that were examined.

Abundance of pink salmon within certain streams was estimated visually by fisheries personnel as: present (1-99), common (100-999), abundant (1,000-9,999), or very abundant (more than 9,999). Incidental reports, when judged to be of sufficient merit, were also used to assess abundance. Abundance data were best for 29 streams which were examined in 3 or more years and where more observations were made than on other streams. Abundance figures must be regarded as crude and minimal because of the brevity of our observations.

Distribution and abundance

Odd-year pink salmon spawners have been found in 53 tributaries of Lake Superior (Table 1 and Fig. 1). They first appeared in two streams in 1967 and were seen in three streams in 1969, all in the western half of Lake Superior. Their abundance was estimated as less than 100 in these streams. In 1971, they were common in 4 of the 10 tributaries where they were observed. The number of streams in which pink salmon were seen nearly doubled in 1973 and redoubled in 1975 (Table 2). We attributed some of the increase in distribution to our greater effort to locate pink salmon but mostly to a real expansion of their range. There was also an overall increase in the numbers of fish seen each year (Table 3). Observed distribution and abundance were down slightly in 1977, probably due to poor visibility caused by high and turbid water. In 1979, the number of streams used for spawning again increased but the increase in abundance was phenomenal. Experienced observers estimated that the 1979 population was 10-20 times that of past years. They were common or abundant in 83% of the streams; for two streams, the populations were estimated as more than 10,000.

Even-year spawners have been found in 23 Lake Superior tributaries (Table 1). They first appeared in 1976, when a single

individual was caught (Table 2). By 1978, they were present in nine tributaries. The number of streams where salmon spawned doubled in 1980 and salmon were common in 7 of the 12 tributaries observed by Michigan fisheries personnel. In all 3 years, most streams (87%) with even-year spawners had previous odd-year spawning runs.

In Lake Huron, odd-year salmon have been found in five streams (Table 4 and Fig. 2). They first appeared in 1969 when a single salmon was taken in a north shore tributary. None were reported in 1971, but in succeeding odd years (Table 2), they were present in two to five streams. No trends in abundance were observed (Table 3). Even-year salmon were first found in 1980, when they occurred in two streams.

In Lake Michigan, odd-year salmon have been found in 11 streams (Table 4 and Fig. 2). They first occurred in 1973, when they were present in four tributaries (Table 2). Distribution and abundance did not increase much in the three succeeding odd years (Table 3). Even-year salmon first appeared in 1980 when they were seen in two streams.

Prognosis

Population trends. --In Lake Superior, odd-year pink salmon occurred in at least 53 widely distributed tributaries. We anticipate that they will occur in other tributaries that appear suitable for spawning by anadromous salmonids. Trends in abundance have been upward so it is doubtful that the maximum numbers of spawning pink salmon have been reached. Even-year spawning populations have an even greater potential to increase, both in distribution and abundance. We expect a substantial increase because the early population trend of even-year salmon has been similar to that of odd-year salmon.

In Lake Huron, pink salmon were first found in 1969. Since then, five generations have spawned without a large increase in abundance or distribution. In Lake Superior, salmon achieved moderate abundance by the eighth generation and high abundance by the twelfth. The situation in Lake Huron, in respect to suitability for pink salmon, was reportedly

analogous to that in Lake Superior (Collins 1975). If so, the pink salmon population in Lake Huron can be expected to increase substantially in the early 1980's.

In Lake Michigan, pink salmon were first found in 1973. Since then, three generations have spawned without a large increase in abundance or extension of distribution into the southern portion of the lake. If the pattern in Lake Superior occurs, then population increases might be expected in the late 1980's or early 1990's. However, the situation in Lake Michigan does not appear to be analogous to that in Lake Superior. Although populations of native plankton-feeders such as larger chubs (Coregonus spp.) and lake herring (Coregonus artedii) are much reduced, the introduced alewife (Alosa pseudoharengus) is abundant (Wells and McLain 1972). Thus, the future of pink salmon, which is essentially a plankton-feeder, in Lake Michigan appears uncertain.

Population patterns in the Great Lakes may be different from those in the Pacific Ocean because of differences in age structure of the spawners. In the Pacific Ocean, all mature at 2 years, and there are large fluctuations within and between odd- and even-year stocks (Ricker 1962, Neave 1962). In the Great Lakes, the odd-year salmon introduced in 1956 produced even-year runs in 1976, 1978, and 1980. These fish were 2 and 3 years old (Kwain and Chappel 1978, Wagner 1978, Wagner and Stauffer 1980, our unpublished data). It would seem only a matter of time before odd-year runs also contain 3-year salmon (if not already present). The occurrence of two ages of spawners could produce population patterns quite different than occurs on the West Coast where spawners are only 2 years old. We might expect more stability within odd or even years and less difference between odd- and even-year runs.

Impact on other fish. --The potential impact of pink salmon on other fishes in the Great Lakes is uncertain because we lack information on salmon food habits and distribution. However, we suspect that their behavior may be like that of pink salmon in the Pacific Ocean. In the Pacific Ocean, age-0 salmon inhabit inshore waters from late April to early June, then migrate offshore at a size of 8 cm (fork length), grow

to 20 cm long by November, 32 cm by March, and spawn at about 50 cm (LeBrasseur and Parker 1964). In inshore waters, young salmon ate small planktonic organisms such as copepods, cirrepids, Larvacea and cladocerans (Annan 1958, Kaczynski et al. 1973, Manzer 1969, Bailey et al. 1975). In the open ocean, older salmon ate euphausiids, fish and amphipods (LeBrasseur 1966).

Food habits of pink salmon appear similar to many fishes in the Great Lakes. According to Anderson and Smith (1971), Mysidacea, Amphipoda, and Copepoda comprised the bulk of the diet in the majority of fishes in Lake Superior. These crustacea seem similar to the organisms eaten by pink salmon in the Pacific Ocean. In Lake Superior, at least, there is a potential for food competition between pink salmon and other fishes. On the other hand, pink salmon may be food for other fish at least during their first year in the lake.

Potential for fisheries. --As yet, a sport fishery for pink salmon has not developed in the lakes proper. We have only occasional reports of pink salmon caught in the lake. A very few salmon are caught in late summer and early fall near spawning streams. However, pink salmon are commonly caught by angling in the Pacific Ocean (Scott and Crossman 1973) and a sport fishery may develop in the open waters of the Great Lakes. A small sport fishery exists in Great Lakes tributaries during the spawning season but is not expected to increase in magnitude because the flavor of pink salmon deteriorates very rapidly during the spawning season.

The potential for a commercial fishery is uncertain. A large number of these small salmon (0.5 kg, average) would have to be easily caught for a profitable fishery. In the open lake, pink salmon distribution is unknown. Exploratory fishing may or may not reveal commercial concentrations. Perhaps the best opportunity for commercial exploitation is in inshore or estuarine waters during the spawning migration. Impoundment gear or weirs might catch enough salmon of suitable quality for a small viable fishery.

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Table 1.--Michigan tributaries of Lake Superior where pink salmon runs occurred in one or more years, 1967-1980. Streams in which even-year runs occurred are designated by an asterisk. ^a

County ^b and tributary ^c	County ^b and tributary ^c
<u>Gogebic</u>	<u>Marquette</u>
1. Montreal River	*29. Huron River
*2. Black River	30. Little Huron River
*3. Presque Isle River	31. Salmon Trout River
	32. Iron River
<u>Ontonagon</u>	33. Garlic River
4. Little Iron River	*34. Little Garlic River
5. Potato River	*35. Harlow Creek
*6. Cranberry River	*36. Dead River
7. Firesteel River	37. Carp River
8. East Sleeping River	*38. Chocolay River
9. Misery River	
<u>Houghton</u>	<u>Alger</u>
*10. Elm River	*39. Sand River
11. Graveraet River	*40. Laughing Whitefish River
12. Salmon Trout River	*41. Deer Lake Creek
13. Schlotz Creek	42. Rock River
14. Boston-Lilly Creek	*43. Furnace Creek
	44. Anna River
<u>Keweenaw</u>	*45. Miners River
15. Gratiot River	*46. Mosquito River
16. Fanny Hooe Creek	47. Seven Mile Creek
*17. Little Gratiot River	48. Sullivan Creek
*18. Tobacco River	*49. Sable Creek
	50. Sucker River
<u>Houghton</u>	<u>Luce</u>
*19. Traverse River	*51. Blind Sucker River
*20. Trap Rock River	*52. Two Hearted River
21. Sturgeon River	
22. Pilgrim River	<u>Chippewa</u>
<u>Baraga</u>	53. Tahquamenon River
23. Kelsey Creek	54. Water Wheel Creek
24. Six Mile Creek	*55. Pendills Creek
*25. Falls River	56. St. Marys River
26. Silver River	
*27. Slate River	
28. Ravine River	

^a Streams with even-year runs had odd-year runs, except Cranberry River, Deer Lake Creek, and Mosquito River.

^b Location of mouth.

^c Numbers correspond to tributaries shown in Figure 1.

Table 2.--Number of Michigan tributaries of the Great Lakes observed by Michigan fisheries biologists for pink salmon and number of streams where the presence of pink salmon was determined from incidental reports.

Lake and type of observation	Year						
	1973	1975	1976	1977	1978	1979	1980
<u>Superior</u>							
Absent ^{a/}	2	11	0	15	2	10	3
Present ^{b/}	10	21	0	17	2	36	12
Incidental ^{c/}	7	13	1	8	7	10	8
Total where found	17	34	1	25	9	46	20
<u>Huron</u>							
Absent	0	2	0	0	0	4	0
Present	1	2	0	2	0	2	1
Incidental	1	0	0	3	0	3	1
Total where found	2	2	0	5	0	5	2
<u>Michigan</u>							
Absent	0	4	0	10	0	13	0
Present	0	5	0	2	0	2	0
Incidental	4	1	0	3	0	1	2
Total where found	4	6	0	5	0	3	2

^{a/} Observed by biologists, pink salmon absent.

^{b/} Observed by biologists, pink salmon present.

^{c/} Incidental reports from USFWS personnel, conservation officers or anglers.

Table 3. --Abundance^a of pink salmon in Michigan streams that were observed 3 or more years as estimated by biologists and from reliable incidental reports.^b

Lake and tributary ^c	1973	1975	1977	1978	1979	1980
<u>Superior</u>						
10. Elm River	C	C	P	P	C	C
13. Schlotz Creek		P	O		C	
15. Gratiot River		P	P		A	
21. Sturgeon River	P	A			A	O
24. Six Mile Creek		P	P		O	
25. Falls River	P	C	P		C	C
26. Silver River	C	C	C		A	O
27. Slate River		C	O	P*	C	
28. Ravine River		C	O		C	
29. Huron River	C	A	C	C	V	C
30. Little Huron River		C	C		A	
31. Salmon Trout River		P	O		P	
33. Garlic River		P	O		C	
34. Little Garlic River	O	P	P		C	P*
35. Harlow Creek	C	C	C	P	A	C
36. Dead River	P*	C*		P	C	P
37. Carp River	P*	P	P		C	
38. Chocolay River	P	C	P	P	C	P
40. Laughing Whitefish River	C	C	C	O	A	C
43. Furnace Creek		O	P*		C	P
49. Sable Creek		C	C		A	P
51. Blind Sucker River	P*	P	A		A	P
52. Two Hearted River	P*		C		V	P
55. Pendills Creek		P	O	P*	A	
<u>Huron</u>						
57. Albany Creek	C	P	P		C	P
58. Carp River	P	O			P	P
<u>Michigan</u>						
64. Black River	P*	P	P*		C	
65. Rock River		P	P		O	
66. Crow River		P	O		P	

^a Pink salmon abundance was estimated as follows: 0 = none; P = present, 1-99; C = common, 100-999; A = abundant, 1,000-9,999; and V = very abundant, more than 9,999.

^b Incidental reports are denoted by an asterisk.

^c Numbers indicate stream locations in Figures 1 and 2.

Table 4.--Michigan tributaries of Lakes Huron and Michigan where pink salmon runs occurred in one or more years, 1969-1980. Streams in which even-year runs occurred are designated by an asterisk. ^a

Lake, county, ^b and tributary ^c	Lake, county, ^b and tributary ^c
<u>Huron</u>	<u>Michigan</u>
Chippewa	Mackinac
*57. Albany Creek	62. Cut River
	63. Hog Island Creek
Mackinac	64. Black River
*58. Carp River	65. Rock River
	66. Crow River
Cheboygan	67. Patterson Creek
59. Cheboygan River	
	Schoolcraft
Presque Isle	68. Manistique River
60. Ocqueoc River	*69. Thompson Creek
Iosco	Delta
61. Au Sable River	70. Ford River
	Menominee
	*71. Cedar River
	Leelanau
	72. Crystal River

^a Streams with even-year runs had odd-year runs.

^b Location of mouth.

^c Numbers correspond to tributaries shown in Figure 2.

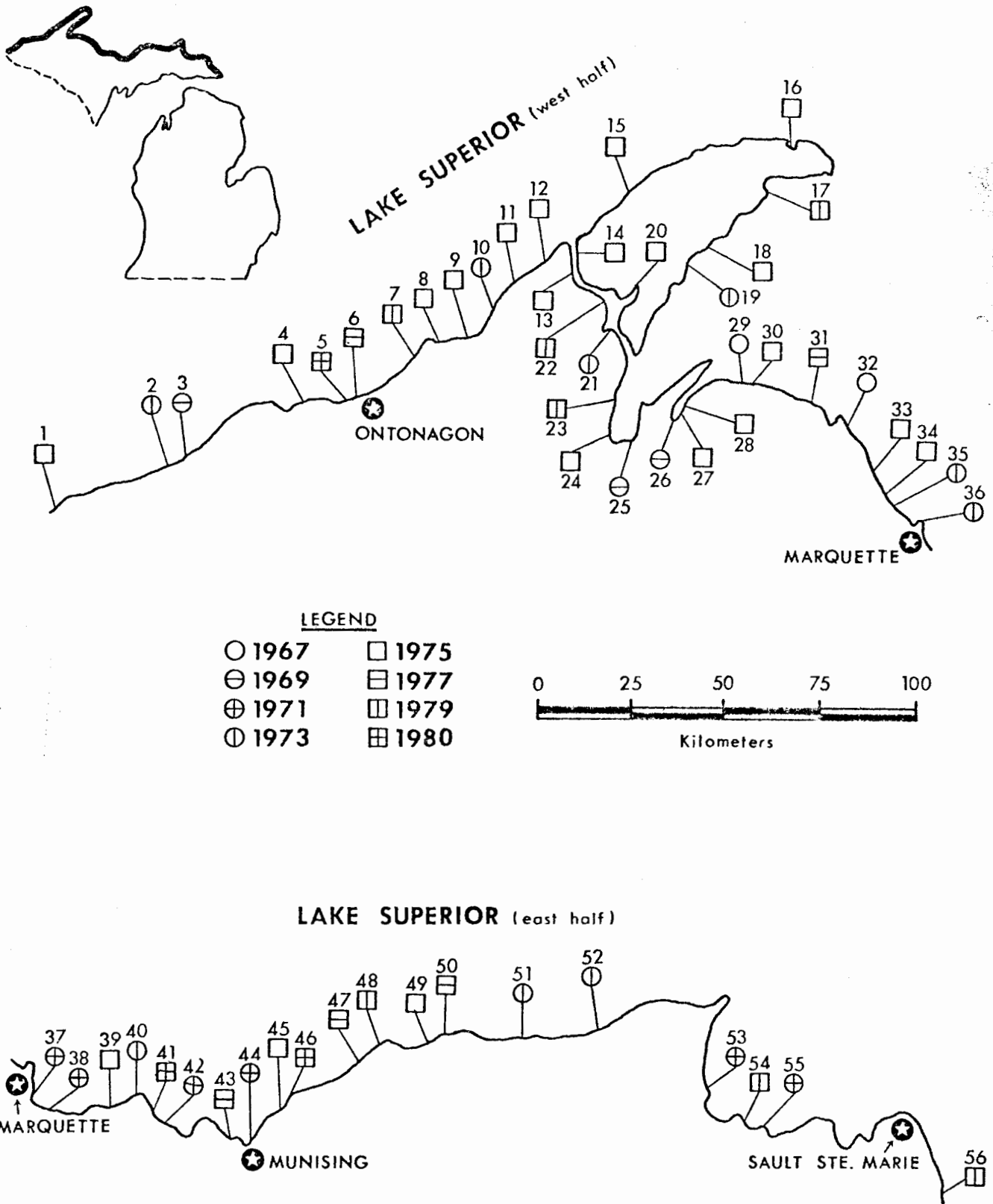


Figure 1. --Location of Michigan tributaries of Lake Superior where pink salmon occurred, 1967-1980. Symbols designate the first year that pink salmon were observed; spawning continued to occur in most streams in subsequent odd years. Numbers correspond to streams listed in Table 1.

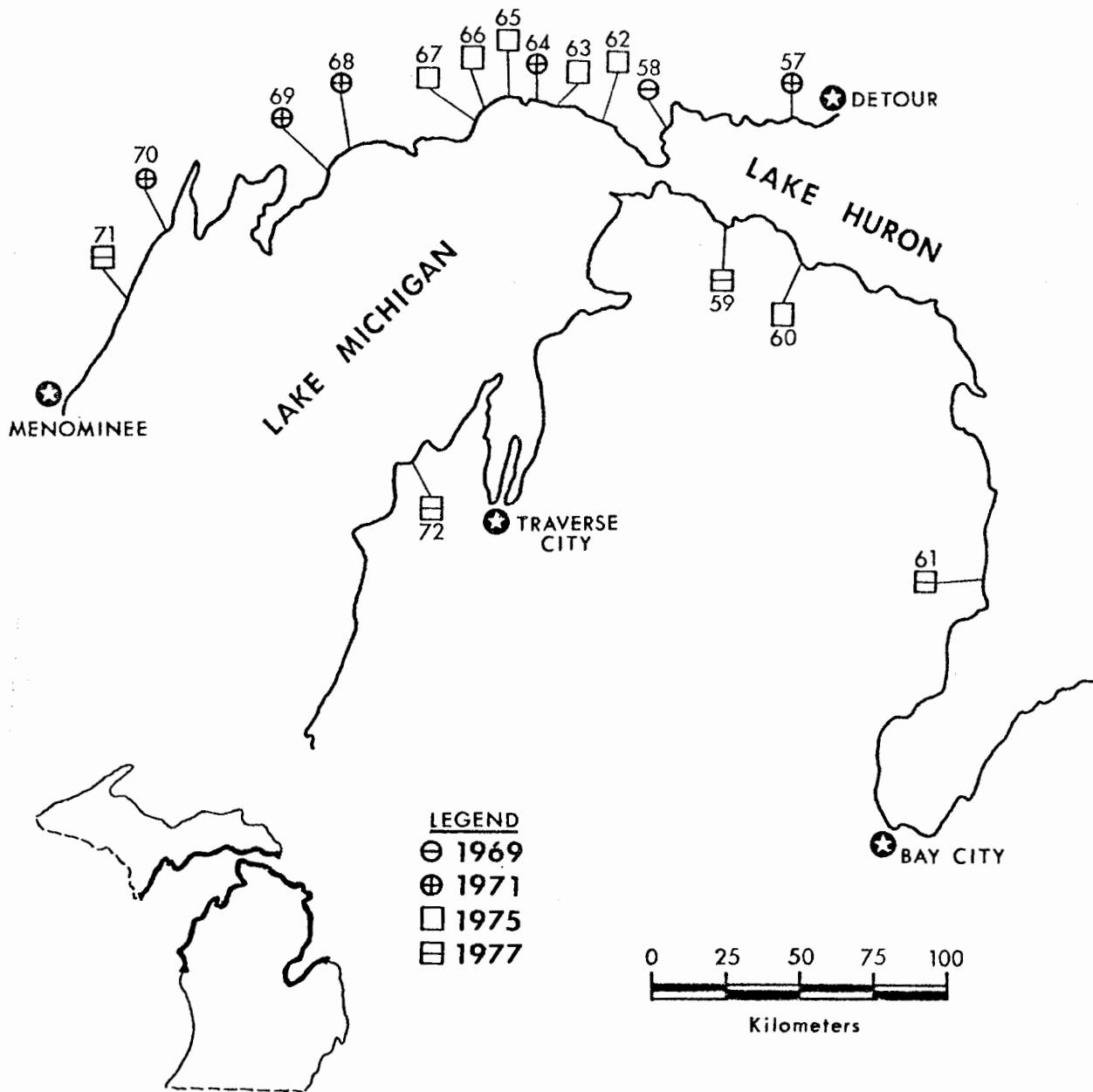


Figure 2. --Location of Michigan tributaries of Lakes Huron and Michigan where pink salmon runs occurred, 1969-1980. Symbols designate the first year that pink salmon were observed; spawning continued to occur in most streams in subsequent odd years. Numbers correspond to streams listed in Table 4.

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