

THE FISHES OF LAKES POYGAN AND WINNEBAGO

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Wisconsin's larger lakes have always been strongly patronized by fishermen because of their varied fish life. Two lakes which have been fished heavily are Lakes Poygan and Winnebago. The fish life is so varied in these waters that much confusion results as to what is caught. Although no key for identification is included, the present study attempts to assess what these waters hold. Considered together, these lakes have now (or have had in the recent past) at least 71 species of fish.

I undertook the survey of the fishes of these lakes in the fall of 1959 and continued during the summers of 1960 through 1963. Not only did my study show a rich variety of fish, it also indicated changes in fish distribution which had taken place since C. Willard Greene (1935) made his report based on the 1925-1928 survey of Wisconsin lakes and streams. During the intervening three decades, fish have moved into new areas of the state via natural or man-made waterways. They have crossed from one watershed to another, from one drainage basin to another. Sometimes man intentionally effected this movement by transferring these fish in minnow bucket or tank; some species have managed this on their own. I have tried, wherever possible, to point out these changes in the text which follows.

Assisting me in the field were my sons Kenneth and Dale, who performed their tasks gratis. Had it been otherwise, the survey would never have been made. I therefore gratefully acknowledge their help. Also I am indebted to the following for their advice, open files and assistance: Vern Hacker, Gordon Priegel, John Kessler, Thomas Wirth, all of the Wisconsin Conservation Department. I wish to thank Vern Hacker, Gordon Priegel, and Thomas Wirth for their critical reading of the manuscript and their helpful suggestions. I assume full responsibility for any errors that remain or inferences which will not stand up under the test of time.

Lakes Poygan and Winnebago lie in the Great Lakes drainage basin and drain into the Green Bay waters of Lake Michigan. Both are eutrophic lakes which in late summer present a problem to

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shoreline owners. Growths of algae and rooted aquatics make many shallows, especially in protected bays, undesirable for bathing and fishing. In late summer, for instance, the public beach at Fond du Lac on Lake Winnebago is frequently closed because of algal contamination, and in Lake Poygan large areas of dense aquatics make boating difficult, if not impossible.

Located in the counties of Waushara and Winnebago in east-central Wisconsin, Lake Poygan (Fig. 1), covering 10,992 acres (Wis. Cons. Dept., 1958), is formed by a widening of the Wolf River which drains the northeastern quarter of the state. Two other streams of medium size, Pine River and Willow Creek, flow into the west end of the lake. Poygan, the second largest natural lake in the State of Wisconsin, is 7.8 miles long and approximately 3.4 miles wide. Much of the north shore between the west end of Boom Bay and Bergner's Point is a shallow swamp thickly grown with emergent vegetation which makes this area unusable for bathing but important as a waterfowl area. This swamp, included as lake proper, extends well out into the lake. During the summer of 1961 wild rice (*Zizania aquatica*) appeared as a dominant plant in the shallower waters around the entire lake. Islands of *Scirpus* sp. were seen near all shores of the lake. The lake has a maximum depth of 12 feet but most of the lake is less than 10 feet deep. The bottom is mostly firm sand; however, the bottom of the west shore and parts of the north are overlain with a thick layer of mud. A small amount of rubble is found along the southwest shoreline.

Lake Winnebago, located in the counties of Winnebago, Calumet and Fond du Lac in eastcentral Wisconsin, is the largest inland lake in the state. It is 28.5 miles long at its longest point, 10.5 miles wide at its widest point and covers 137,708 acres. Its maximum depth is 21 feet. A natural dam of glacial drift at the north end of the lake holds the water in the basin. Its water supply which pours into the lake at the city of Oshkosh comes primarily from the Wolf and upper Fox rivers. Lake Winnebago is approximately 17 miles downstream from Poygan and drains to the north through the lower Fox River into Green Bay of Lake Michigan.

The western shores of Lake Winnebago are low, and on the southern end near Fond du Lac they are marshy. The high cliffs of the Niagara escarpment arise from the eastern shores. These cliffs are not due to wave work but to preglacial and glacial erosion of resistant limestone underlain by weak shale (Martin, 1916). The bottom along the east shore is mostly heavy gravel, rubble and boulders. Due to wave action, very little submergent vegetation is found here and practically no emergent vegetation. At Waverly Beach on the far north end of the lake the bottom consists of a

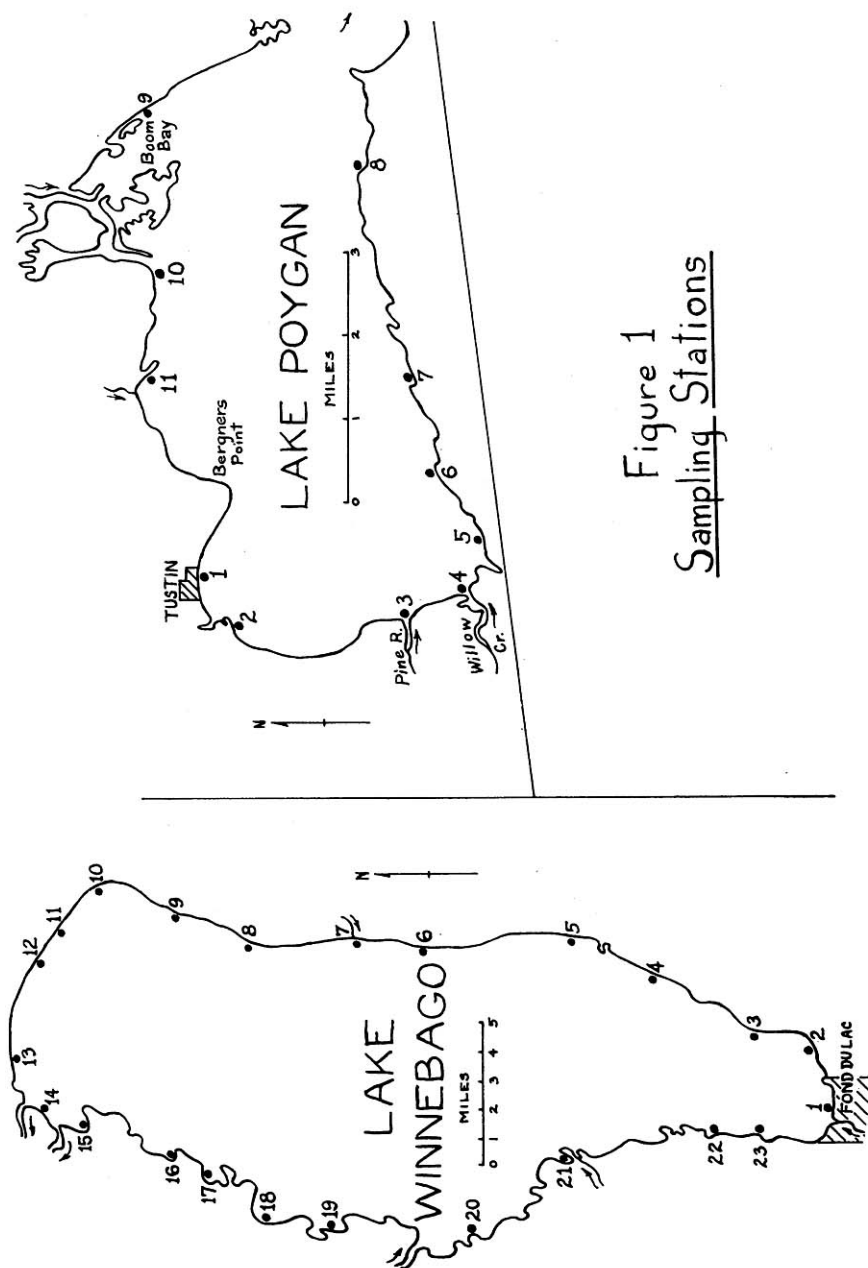


Figure 1
Sampling Stations

series of sandy ridges. The bays on the west side of the lake have bottoms with mud from a few inches to a foot in depth. Where the water is sheltered from wind and wave actions, dense beds of submergent vegetation appear in late summer. On calm days during August, shallow and pelagic waters are covered with a heavy scum of blue-green algae. Occasional points of land jutting out into the lake have their bottoms swept clear of mud and debris. Here the shore bottom is generally a firm sand, gravel and/or rubble.

ORIGIN OF DATA

The best authority for the record of a species is an actual specimen (e.g., the fish listed in Figs. 2 and 4). Where the specimen is lacking, I have relied primarily upon the reports of trained biologists (e.g., Figs. 3 and 5). Next, some species are listed on the authority of commercial fishermen. Lastly a few species are listed on the basis of newspaper accounts and the word of fishermen. I have included such species and records only when I felt reasonably sure of their accuracy.

Fig. 1 gives the stations where I sampled for fish. In Figs. 2 and 4, I have summarized my samplings in Lakes Poygan and Winnebago. At all stations I used a 20' by 4' seine with $\frac{1}{4}$ " mesh. The length of shoreline which was seined at each station varied from 100 to 200 yards. As many habitats as possible were sampled at a station. These included open water, weed beds, and various bottom types. Although hauls were made mostly along the shoreline in water two feet or less in depth, at each station a few hauls were made in waters up to three-and-one-half feet in depth. On Lake Poygan, for instance, we sampled around and through beds of *Scirpus* sp. which were, in some cases, several hundred feet from shore. We used here an unorthodox and only partially effective seining system which we called the "circle net lift". In short, after hauling the seine through a sampling area, the two ends of the seine were brought together and then a single operator, grasping both seine sticks, would quickly back away from the net, pulling the seine sticks along until the right and left halves of the lead-line and the float-line were almost touching one another. Then, reaching under water, he would gather the doubled-up lead-line to himself quickly, following this up by gathering in the doubled-up float-line. The net would then be placed into a tub for releasing or preserving whatever fish still remained in the bag. The circle net lift was used primarily with the standard seine. Superior to it is an especially constructed seine into the middle of which is sewed a large deep bag. Such a seine is somewhat more effective

FIGURE 2. FISH SPECIES TAKEN FROM LAKE POYGAN BY SHORELINE SEINING
(George Becker)

Station Number.....	1	2	3	4	5	6	7	8	9	10	11	Total	%
Date.....	9/7/59	7/19/60	7/23/60	7/23/60	7/19/60	7/23/60	8/9/61	8/9/61	8/8/61	7/8/63	8/8/61	8/8/61	
Longnose gar.....					1			1		7		3	0.1
White sucker.....					2			9				12	0.2
Northern redbreast.....	11				1						1	22	0.4
Spottail sucker.....		1										1	
Carp.....								1				31	0.6
Pugnose minnow.....	13				3				1	29		96	0.5
Golden shiner.....		8						29	18	41		70	1.3
Bluntnose minnow.....		34		14				5		17		647	11.6
Hornhead chub.....										1		126	2.3
Spottail shiner.....	43	146			31	247		83		3		23	0.4
Common shiner.....		56		35		18		14		2		90	1.6
Blackchin shiner.....		15		1		4		3	17	69		43	0.8
Blacknose shiner.....									2	41		27	0.5
Pugnose shiner.....										24		1	
Emerald shiner.....											3		
Bignmouth shiner.....		1						2				1	
Yellow bullhead.....		1						1				1	
Brown bullhead.....												1	
Channel catfish.....												1	
Tadpole madtom.....	1	3			1		1	2	1	3	7	18	0.3
Central mudminnow.....									2			2	
Northern pike.....	1	2										3	
Banded killifish.....	9	32		24						72		140	2.5
Burbot.....	19			1								3	
Trout-perch.....	18				311	13						19	0.3
White bass.....					16	34		316				350	6.3
Yellow bass.....	2	428		53	1			1				19	0.3
Yellow perch.....			16		7	10		54		617		2334+	41.9
Walleye.....	1			13								4	
Rock bass.....	23			1						39		221	4.0
Blackside darter.....												2	
River darter.....		2				3		8		3		2	
Johnny darter.....												32	
Iowa darter.....		36				16		6				3	
Largemouth bass.....	2	76		12	2		13	25	12	60	17	183	3.3
Black crappie.....	10				36	7		79	36	45	15	255	4.6
Pumpkinseed.....	+	5				10	50	104	133	42	54	374+	6.7
Bluegill.....	+	55		14	9	18	86	3	39	13	12	374+	6.7
Rock bass.....					1				2			6	
Freshwater drum.....												1	
Total.....	160+	894	31	171	422	380	224	746	451	1073	770	5572+	100
No. of Species.....	17	18	3	12	14	11	11	20	14	19	13	41	

FIGURE 3. SELECT SURVEYS SHOWING COMPOSITION OF SAMPLES
FROM LAKE POYGAN

	(1) VERN HACKER		(2) THOMAS WIRTH		(3) W. BER- WIG AND B. J. ROST	(4) GORDON PRIEGEL	
	No.	%	No.	%	No. or lbs. (#)	No.	%
Lake sturgeon.....			38	0.7	77	5	1.1
Lampreys spp.....						3	0.7
Chestnut lamprey.....			20	0.4		1	0.2
Longnose gar.....			148	2.6	210 #		
Spotted gar (1).....			1	—			
Bowfin.....					40 #		
Mooneye.....			14	0.2	20 #		
Suckers sp. (2).....					785 #		
White sucker.....	29	0.5	24	0.4		3	0.7
Spotted sucker.....	27	0.5	4	—			
Northern redhorse.....			148	2.6	1,015 #	3	0.7
Quillback.....					65 #	2	0.4
Carp.....			30	0.5	100 #	3	0.7
Shiners spp.....	10	0.2				6	1.3
Spottail shiner.....	8	0.1				28	6.2
Channel catfish.....			3,530	62.9	4,100	32	7.1
Flathead catfish.....			5	—	8	1	0.2
Bullheads spp.....					14		
Yellow bullhead.....			1	—			
Tadpole madtom.....	1	—					
Northern pike.....	1	—	4	—	46	1	0.2
Burbot.....			13	0.2	515 #		
Trout-perch.....						240	53.4
White bass.....	1	—	240	4.3	2,508	28	6.2
Yellow bass.....			1	—	25		
Walleye.....	2	—	190	3.4	975	21	4.7
Sauger.....			1	—			
Yellow perch.....	5,074	87.3	15	0.3	2	48	10.7
Logperch.....	524	9.0					
Smallmouth bass.....	6	0.1			2		
Largemouth bass.....	29	0.5			14		
Bluegill.....	74	1.3	24	0.4	216	1	0.2
Pumpkinseed.....	22	0.4	10	0.2	36		
Black crappie.....	13	0.2	143	2.5	6,711	15	3.3
White crappie.....					33		
Rock bass.....			11	0.2	3		
Freshwater drum.....			1,000	17.8	37,570 #	9	2.0
Totals.....	5,821	100	5,615	100		450	100

(1) The presence of *Lepisosteus oculatus* has not as yet been established in Wisconsin waters.

(2) White sucker, but may include others.

FIGURE 4. FISH SPECIES TAKEN FROM LAKE WINNEBAGO BY SHORELINE SEINING
(George Becker)

Station Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	TOTALS	%	
Date	8/29/61	8/29/61	8/29/61	8/29/61	8/28/61	8/20/60	8/20/60	8/20/60	8/17/60	8/17/60	8/17/60	8/18/60	8/18/60	8/18/60	8/18/60	8/18/60	8/19/60	8/19/60	8/19/60	8/30/61	8/30/61	8/28/61	8/28/61			
Silver lamprey															1									1	0.1	
Shinnoc gar																							6	6	0.4	
White sucker			1		1			10	2		1	1	1	1										18	0.4	
Carp																							8	22	0.5	
Golden shiner								1																12	0.4	
Burntose minnow															11									15	0.4	
Flathead minnow																									1	0.1
Spottail shiner	6	1			1	4	1	1	14	2	1	1	1		9	7	1		33	10	6	2		94	2.3	
Stout shiner																								1	0.1	
Common shiner																29	1		7	10	2			58	1.4	
Emerald shiner	116	2	243	11	47	11	13	3	12	31	26	9	10	1	13	29	19		16	9	2			12	0.3	
River shiner			26				1	3	8	32	13	160			3	38	11							636	15.6	
Sand shiner																								295	7.2	
Black bullhead															3		1	2						1	0.1	
Brown bullhead																								8	0.2	
Channel catfish										1														1	0.1	
Tadpole maffish																								5	0.1	
Northern pike					1																			3	0.1	
Burbot																								2	1	0.1
Trout-perch																								2	1	0.1
White bass	239	99	7		2	4	7	7	4	16	5	6	7											500	12.2	
Yellow bass																								24	1	0.1
Yellow perch	14	4	7		4	26	2	58	48	157	6	2	6	1	6	310	72	3	10	3	53	11	43	791	19.3	
Walleye	5				4					3	6	6	3	1	256	7	4		112	+	59	11	33	522	12.7	
Logperch					1			1	1	2	6				1	1	1		8	10	7	2	1	3	90	0.6
Slenderhead darter	8				1	2		25	8	3														26	0.6	
River darter						1																		3	0.1	
Johnny darter										2					1									25	0.6	
Largemouth bass															3									13	0.3	
Smallmouth bass	1	5			1																			12	0.3	
Black crappie															5	2	4		9	3	8	4		9	0.2	
White crappie																								105	2.6	
Pumpkinseed										1														7	11	3.0
Bluegill	14				1	6					3	1			47	4	1	1	16	28	122	17	222	485	11.9	
Rock bass																								14	0.2	
Freshwater drum																								3	160	3.9
Mottled sculpin															1	6	39	24	1	2	31	18	3	25	0.6	
Totals	406	116	306	16	75	52	27	121	86	263	57	30	194	5	372	436	173	60	285	73	366	100	465	4084	100	
No. of Species	9	7	9	3	13	10	6	11	10	12	6	8	12	5	21	11	16	13	15	11	15	16	20	37		

FIGURE 5. SELECT SURVEYS SHOWING COMPOSITION OF SAMPLES
FROM LAKE WINNEBAGO

	(1) VERN HACKER		(2) CALUMET HARBOR & VERN HACKER	(3) CALUMET HARBOR & GORDON PRIEGEL	(4) GORDON PRIEGEL	
	No.	%	Number	Number	No.	%
Lake sturgeon.....			927	1,264		
Lampreys spp.....			43	12		
Garfish spp.....			61	67		
Bowfin.....			3			
Mooneye.....			968	1,332		
Suckers sp.*.....			6,553	14,910		
White sucker.....	1	0.1				
Northern redhorse.....			452	188		
Quillback.....			5,408	1,655		
Carp.....				1,028		
Shiners spp.....			3,405			
Blackchin shiner.....	50 (est.)	4.7			929	2.1
Emerald shiner.....						
Channel catfish.....			4,127	5,952		
Flathead catfish.....			2			
Bullheads spp.....			2,594	1,255		
Northern pike.....	2	0.2	431	171		
Muskellunge.....			21	9		
Burbot.....			7,564	6,371		
Trout-perch.....					27,407	62.4
White bass.....	3	0.3	228,782	302,304	2,540	5.8
Yellow bass.....			278			
Saalleye.....			31,415	17,386	2,073	4.7
Yuger.....			30,258	30,602	1,230	2.8
Yellow perch.....	649	61.1	10,581	8,679	2,055	4.7
Sogperch.....	6	0.6				
Smallmouth bass.....			146	10		
Yargemouth bass.....	1	—	4	2		
Bluegill.....	50	4.7	34	4		
Pumpkinseed.....			12	2		
Black crappie.....	300	28.2	5,437	20,795	220	0.5
Rock bass.....			16	4		
Freshwater drum.....			1,310,367	1,098,816	7,454	16.9
Totals.....	1,062 (est.)	100	1,649,889	1,512,818	43,908	100

*White sucker, but may include others.

in capturing fish from open water and I used it in a few collections on Lake Poygan. I have preserved examples of all species of fish for each lake studied. These are stored at Wisconsin State University in Stevens Point, Wisconsin.

Data on the select surveys from Lake Poygan, which are tabulated in Fig. 3, are as follows:

Column 1. Vern Hacker.¹ These data include the first two of three seine hauls made on the southwest shore, September 29, 1952. Bottom, sand. Water, up to 2.5 feet in depth. 100' x 6' seine with $\frac{1}{4}$ " mesh.

Column 2. Thomas Wirth.² These data include fish taken from the extreme east end of the lake between January 9 and February 4, 1953, in two double-end trap nets with 2.5" mesh. Depth of water, 9 to 10 feet.

Column 3. W. Berwig & B. J. Rost.³ Trap nets generally of 14 hoops, size of mesh in pots—3". Nets were lifted at weekly intervals from December 22, 1958, to February 12, 1959, and from December 14, 1959, to December 30, 1959. Traps were set well out from shore opposite stations 6, 7, and 8 (See Fig. 1), in approximately 9 feet of water.

Column 4. Gordon Priegel. A total of 22 hauls were made on August 15, 1961, with a 12-foot bait trawl. This trawl was towed in open water 6 to 9 feet deep at the end of a 150-foot cable (Priegel, 1962).

Data on the select surveys from Lake Winnebago, which are tabulated in Fig. 5, are as follows:

Column 1. Vern Hacker.⁴ These data are for the second haul along the shoreline of a 100' x 6' seine with $\frac{1}{4}$ " mesh. The haul was made on September 15, 1952, in Asylum Bay which lies five miles north of the city of Oshkosh.

Column 2. Calumet Harbor & Vern Hacker.⁵ The data here are a composite from two studies made by Wisconsin Conservation Department personnel on Lake Winnebago. The Calumet Harbor rough fish removal crew inspected a total of 930 trap net sets in open water from April through November in 1958 and another 690 from April through November in 1959. Vern Hacker, fishery biologist, tabulated data from 708 trap net sets in open water from April through November of 1957 and another 397 from April through November in 1958.

Column 3. Calumet Harbor & Gordon Priegel. The data here are a composite from several studies made by the Calumet Harbor rough fish removal crew and Gordon Priegel, fishery biologist. These studies include 16 winter trap net sets inspected from December, 1959, to March, 1960; 525 open water trap net sets from April to November, 1960; 54 winter net sets from January to February, 1961; 399 open water trap net sets from April to November, 1961; and 1619 trawl hauls with a 30-foot trawl during 1961 (Priegel, 1962).

Column 4. Gordon Priegel. Total catch from 187 hauls (five to seven-minute tows), using a 12-foot bait trawl, from June to November, 1960 (Priegel, 1960).

¹ Intra-office memorandum from Vern Hacker to Richard Harris. In Lake Poygan File, Eastcentral Area Hdqts., Wis. Cons. Dept., Oshkosh, Wisconsin.

² Intra-office memorandum from Tom Wirth to Richard Harris. In Lake Poygan File, Eastcentral Area Hdqts., Wis. Cons. Dept., Oshkosh, Wisconsin.

³ Ledger on rough fish removal from Lake Poygan. On file in Eastcentral Area Hdqts., Wis. Cons. Dept., Oshkosh, Wis.

⁴ Intra-office memorandum from Vern Hacker to Richard Harris. In Lake Winnebago File, Eastcentral Area Hdqts., Wis. Cons. Dept., Oshkosh, Wis.

⁵ Ledger on rough fish removal from Lake Winnebago. On file in Eastcentral Area Hdqts., Wis. Cons. Dept., Oshkosh, Wis.

FISH SPECIES AND THEIR DISTRIBUTION

In the text which follows, after each species' name I have indicated the name of the lake(s) and station(s) where each was collected.

1. Silver lamprey—*Ichthyomyzon unicuspis* Hubbs & Trautman. Winnebago, 15. The single adult specimen which I took on August 8, 1960, in a weed-filled bay was 192 mm. long. The lake bottom at the site of capture was deep, soft mud, I examined another adult, 196 mm. in length, which was taken from Lake Winnebago by a WCD trawl on September 17, 1959. The site of capture was not indicated. Priegel (pers. comm.) reported this species as abundant in Lake Winnebago where as many as 17 lampreys have been taken off one sturgeon. He also reports this species in the upriver lakes.

2. Chestnut lamprey—*Ichthyomyzon castaneus* Girard. Wirth reported taking approximately 20 chestnut lampreys in trap nets set in Lake Poygan during January and February, 1953 (Fig. 3). In a personal letter to me (March 5, 1962) he wrote: "I recall having identified both chestnut and silver lampreys in Winnebago and connecting waters".

3. Lake sturgeon—*Acipenser fulvescens* Rafinesque. This species is found commonly in the lakes of the lower Wolf River and in Lake Winnebago. It spawns in the Wolf River up to the Shawano dam and in the Fox River up to Princeton. Sturgeon research in these waters is part of the fisheries program and special efforts have been made to tag them. A limited spearing season has been in effect in recent years in which fish 40" or more in length may be legally taken. The state record sturgeon, speared in Lake Winnebago in 1953, weighed 180 pounds with an estimated age of 82 years.

4. Longnose gar—*Lepisosteus osseus* (Linnaeus). Poygan 5, 11. Greene (1935) reported this species from Winnebago. Priegel (pers. comm.) reported that he has taken the longnose gar in South Asylum Bay regularly since 1960 and that it spawns in the bay. In Poygan 148 longnose gar were taken in WCD trap nets during January and February, 1953.

5. Spotted gar—*Lepisosteus oculatus* (Winchell). Wirth reported this species from the east end of Lake Poygan (Fig. 3). Priegel (pers. comm.) wrote: "The spotted gar was taken in great numbers in Lake Poygan and Wolf River (mouth of Rat River to Mills Landing) while boom shocking during the summer, 1962."

Since no actual specimens were available, I sent a colored slide, furnished by Priegel, to Dr. Reeve M. Bailey, curator of fishes at

the University of Michigan, for verification as to species. Bailey in a letter dated Nov. 4, 1963, wrote: "I know of no substantiation for the occurrence of *L. oculatus* in Wisconsin, although it would not be too surprising to have it turn up in eastern or southern Wisconsin. . . . It is clear from the color photo you sent that the lower specimen is either *platostomus* or *oculatus* but I cannot make a firm determination."

On the basis of the above reports this species should be considered questionable for these waters until that time when positive identification of actual specimens is possible.

6. Shortnose gar—*Lepisosteus platostomus* Rafinesque. Winnebago 23. Greene (1935) reported the shortnose gar from several stations on the Mississippi River and from Lake Mendota. To my knowledge my records for Lake Winnebago are the first for this species in the Great Lakes drainage basin. Data on five of these specimens, taken on August 28, 1961, are as follows:

TOTAL LENGTH MM.	STANDARD LENGTH MM.	SNOUT DIVIDED BY REST OF HEAD	K	LAT. LINE SCALES
558	483	1.54	0.46	60
540	472	1.38	0.52	62
536	468	1.27	0.70	61
497	425	1.37	0.61	61
467	405	1.51	0.44	62

In September, 1962, Priegel (1963a) took a specimen from South Asylum Bay (station 19), Lake Winnebago. It was sent to Dr. Bailey, who verified the identification.

It seems likely that this species may have entered the upper Fox River (Great Lakes drainage) and its lakes via the Fox-Wisconsin canal at Portage, Wisconsin. According to Hubbs and Lagler (1958) this species on the north of its range prefers open silty rivers. My specimens were captured in water less than 1.5 feet in depth between large beds of submergent aquatics. The shallows abutted a jetty extending out into the lake.

7. Bowfin—*Amia calva* Linnaeus. Two-hundred-and-fifteen pounds of dogfish were reported taken at the mouth of Willow Creek (Lake Poygan, station 9) by commercial fishermen during May, 1947. During the winter of 1958–59 forty pounds were reported taken by the WCD sturgeon research and rough fish removal unit on Poygan. On Lake Winnebago the WCD rough fish removal crew from Calumet Harbor reported taking one bowfin in 1958 and

another in 1959. Hacker reported shocking about 20 in Asylum Bay, August 5, 1962, and that he has noted this species every year since 1952 (pers. comm.).

8. Mooneye—*Hiodon tergisus* LeSueur. Greene (1935) captured this species at several places in Lake Winnebago. The WCD rough fish removal crew working out of Calumet Harbor on Lake Winnebago reported taking 258 mooneye in 1960 and 1,067 in 1961. Hacker told me in conversation that he has seen many of these fish among the docks at Oshkosh during summer evenings. This species is occasionally caught in Lake Poygan and in the Wolf River upstream from Lake Poygan.

9. Cisco—*Coregonus artedii* LeSueur. Priegel reported that on June 5, 1962, a research crew while shoreline seining in Lake Winnebago off Neenah (northwest shore) took a young cisco, 32 mm. long (pers. comm.). The fish was identified by Dr. Bailey. Normally this species is found in only cold water which is considerably deeper than that of Lake Winnebago. Its presence in Lake Winnebago must be considered accidental. Hacker (pers. comm.) believes that this individual originated from the cisco population of Green Lake.

10. Lake trout—*Salvelinus namaycush* (Walbaum). According to Hacker (pers. comm.) lake trout are occasionally taken by fishermen. One was caught in Lake Butte des Morts (between Lakes Poygan and Winnebago) during the spring of 1962. The finclip indicated that it came from Green Lake. Another, weighing 17 pounds, was caught in a fyke net in Little Lake Butte des Morts (outlet of Lake Winnebago) in about 1955. In April, 1962, a lake trout was reported caught from the upper Fox River at Eureka dam. Hacker believes that all must have come from Green Lake.

11. Brook trout—*Salvelinus fontinalis* (Mitchill). A brook trout was reported taken from Lake Winnebago early in 1957 by Ray and Don Tuttle, commercial fishermen. Otis Smith, another commercial fisherman, reported capturing a brook trout on April 16, 1958, on the north end of the same lake. The waters of Lake Winnebago can hardly be considered brook trout habitat. It is doubtful if the above migrants were able to survive summer temperatures.

12. Rainbow trout—*Salmo gairdneri* Richardson. A rainbow trout, 19" in length, was taken in WCD nets off Brothertown Point (east side of Lake Winnebago) on June 19, 1958, in 18 to 20 feet of water. John Keppler, conservation aid, reported to me that a rainbow was taken in recent years off Hospital Point (north of Oshkosh). On August 28, 1963, a 14.6" rainbow was caught off the Bowen Street dock at the front of the Wis. Cons. Dept. headquarters in Oshkosh (Priegel, pers. comm.).

13. Brown trout—*Salmo trutta* Linnaeus. The following article appeared in the Wisconsin Conservation Bulletin for September, 1938:

Oshkosh—Samuel Kingsley caught a brown trout in Lake Winnebago near Island beach, north of the city.

Priegel (pers. comm.) wrote that three brown trout were caught off Fairy Springs (near station 9) in Lake Winnebago during August and September, 1962. A resort owner on the west end of Lake Poygan told me that brown trout are occasionally taken in early spring from the open water. Undoubtedly such salmonids have drifted into Poygan and the lower lakes from streams like the Pine River (Poygan, station 3) and Willow Creek (Poygan, station 4).

Conditions in the lakes of the upper Fox River are unsuitable for trout, and the above records are unusual. It is doubtful if any spawning takes place in these lakes.

14. White sucker—*Catostomus commersoni* (Lacépède). Poygan 4, 5, 8, 9, 10; Winnebago 3, 5, 8, 9, 14, 15, 21. This species is commonly taken in Lake Poygan. Hundreds of pounds are removed yearly by rough fish removal crews. A limited study by Wirth (Fig. 3) revealed the capture of 24 common suckers which represented 0.4% of the catch. I find that this species frequents the deeper water of the lake. In our shallow-water seining we captured only 12 specimens at five stations on Poygan. On Lake Winnebago commercial fishermen removed thousands of pounds yearly. The Calumet Harbor (WCD) rough fish removal crew captured 6,553 suckers from April, 1957, to November, 1959.

15. Northern redhorse—*Moxostoma macrolepidotum* (LeSueur). Poygan 1, 5, 8, 10. This species appears to be the most common sucker in Lake Poygan. Wirth (Fig. 3) captured 148, representing 3.0% of the total catch. Between December, 1958, and December, 1959, the WCD rough fish removal crew on Lake Poygan removed 1,015 pounds of redhorse against 785 pounds of all other suckers (mostly *Catostomus commersoni* and some *Minytrema melanops*). From Lake Winnebago the Calumet Harbor (WCD) rough fish removal crew captured 452 redhorse between April, 1957, and November, 1959.

16. Spotted sucker—*Minytrema melanops* (Refinesque). Poygan 2. This species has been recorded regularly from Lake Poygan although it is the least common of the species of suckers present. Wirth (Fig. 3) took four specimens in his study. I took only one in 1960. Hacker (Fig. 3) captured 27. Greene (1935) did not capture the spotted sucker from Lake Poygan but took it from Willow

Creek, several miles upstream from its mouth at Lake Poygan. Priegel reported to me that this species is found throughout the upper Fox River and in the Wolf River up to the Shawano Dam. He captured this species from South Asylum Bay (station 9) of Lake Winnebago while boom shocking in September, 1963.

17. Lake chubsucker—*Erimyzon sucetta* (Lacépède). Priegel captured a specimen from Boom Bay in Lake Poygan while boom shocking in the summer of 1962. Greene (1935) reported the lake chubsucker from Willow Creek several miles upstream from Lake Poygan. Hacker (pers. comm.) wrote that it is abundant in the Auroraville Pond on Willow Creek.

18. Quillback—*Carpiodes cyprinus* (LeSueur). Commercial fishermen and rough fish removal crews refer to this species as the "white carp". A catch of 500 pounds was reported by WCD crews for April 29, 1947, near Herbst (station 6) on Lake Poygan. On May 14 of the same year another catch of 100 pounds was made. From December, 1958 to December, 1959, about 65 pounds of quillback were taken by WCD fishing crews between Herbst and Brettschneider (stations 6 and 7). From the records in WCD files which I have seen it is apparent that this species has decreased in numbers in Lake Poygan and it is taken infrequently at the present time. In Lake Winnebago Greene (1935) reported this species from seven different localities. The Calumet Harbor (WCD) rough fish removal crew captured 5,408 individuals from April, 1957, to November, 1959. During 1960 up through February, 1961, 1,655 individuals were captured.

19. Buffalofish—*Ictiobus* sp. Infrequent records of "buffalofish" appear in the commercial fish reports from Lake Winnebago. Otis Smith, a commercial fisherman, reported one individual captured with a trap net in May, 1956, and another with an open water trap in the fall of 1957. One individual was reported by the WCD rough fish removal crew in a trap net at Fond du Lac. Richard Harris, Area Supervisor of fisheries at Oshkosh, told me that the buffalofish is rare in Lake Winnebago. I have not been able to find any specimens to verify as to species; however, it seems likely that the form taken in Lake Winnebago may be the bigmouth buffalo, *Ictiobus cyprinellus*. Nevertheless, all the above is conjecture and must be considered tentative to the capture and verification of an actual specimen.

20. Carp—*Cyprinus carpio* Linnaeus. Poygan 8, 9; Winnebago 11, 12, 13, 15, 18, 22, 23. Priegel stated that carp are abundant in Lake Poygan and quite common in Lake Winnebago. He cited the following records for Lake Poygan: April 11, 1961, at Lone Willow one seine haul 1,200 feet long—3,000 pounds of carp; April 20,

1961, at Haulover bay, one seine haul 1,200 feet long—16,000 pounds of carp. For Lake Winnebago: June 27, 1960, at Supple's Marsh near Fond du Lac, one seine haul 4,500 feet long—18,400 pounds of carp; June 8, 1961, at Supple's Marsh, one seine haul 4,500 feet long—8,000 pounds of carp (pers. comm.).

21. Central stoneroller—*Campostoma anomalum pullum* (Agassiz). Greene (1935) reported this species from the east shore of Lake Winnebago. Although considered a stream fish, the stoneroller commonly seeks water of lower gradient after spawning and it is possible to encounter this species in lakes near the mouths of streams from which it has migrated.

22. Longnose dace—*Rhinichthys cataractae* (Valenciennes). Priegel (pers. comm., Dec. 9, 1963) reported seeing this minnow seined by a minnow dealer in late September, 1960, from the west shore of Lake Winnebago just south of the mouth of the upper Fox River.

23. Pugnose minnow—*Opsopoeodus emiliae* (Hay). Poygan 1, 3, 5. Greene (1935) reported the pugnose as a rare minnow of the Mississippi drainage. It is generally southern in distribution and is probably a recent arrival in Wisconsin. My three collections from the western end of Lake Poygan in 1959 and 1960 are the first reported from the Great Lakes drainage of the state of Wisconsin. Priegel reported taking five adult pugnose minnows while shoreline seining in Lake Winnebago on June 14, 1962, off the south side bathing beach at Oshkosh (pers. comm.).

24. Golden shiner—*Notemigonus crysoleucas* (Mitchill). Poygan 2, 8, 9; Winnebago 8, 15. Although this species appears to be generally distributed in Lake Poygan, it is not numerous. Greene (1935) captured the golden shiner at only one station for each lake.

25. Northern redbelly dace—*Chrosomus eos* Cope. Priegel (pers. comm., Dec. 9, 1963) reported seeing this minnow seined by a minnow dealer in late September, 1960, from the west shore of Lake Winnebago just south of the mouth of the upper Fox River.

26. Bluntnose minnow—*Pimephales notatus* (Rafinesque). Poygan 2, 4, 8, 9; Winnebago 15, 19, 23. This species, commonly distributed throughout the state, is uncommon in Lake Winnebago and common only in certain shoreline areas of Lake Poygan.

27. Fathead minnow—*Pimephales promelas* Rafinesque. Winnebago 5. The single individual captured was probably a release from a fisherman's minnow pail.

28. Hornyhead chub—*Hybopsis biguttata* (Kirtland). Poygan 9. This species is typically a minnow of clear medium-sized streams. It is seldom taken in lakes or quiet water.

29. Spottail shiner—*Notropis hudsonius* (Clinton). Poygan 1, 2, 5, 6, 8, 9, 10, 11; Winnebago 1, 2, 5, 6, 7, 9, 10, 12, 13, 15, 16, 17, 19, 20, 21. This species is common in Lake Winnebago and abundant in Lake Poygan. In the latter it was the most common minnow found. Large schools of young-of-the-year were captured and many more wriggled through the mesh of the net and were lost. Numerically, the spottail was second to the yellow perch (Fig. 2). Adults of this species are commonly found in the open lake. Greene (1935) took this species at one station on Lake Poygan and at several stations on Lake Winnebago.

30. Spotfin shiner—*Notropis spilopterus* (Cope). Poygan 2, 4, 6, 8, 10, 11; Winnebago 6, 13, 16, 17, 19, 21, 22, 23. This species is of general distribution in the lakes of the Wolf and Fox rivers. It is commonly found in shallow water, often in the vicinity of piers. Greene (1935) took this species at one station on Lake Poygan and at all stations on Lake Winnebago.

31. Common shiner—*Notropis cornutus* (Mitchill). Poygan 2, 4, 6, 9; Winnebago 1, 7, 8, 21, 23. In the present survey this minnow was not considered common, although its distribution appears to be general. It was more frequently found where the water was clear and the bottom of gravel.

32. Blackchin shiner—*Notropis heterodon* (Cope). Poygan 4, 8, 9. This minnow was nowhere common in Lake Poygan. At the stations where I took this minnow, the bottom was of sand or mud, covered with a fine silt which resulted in heavily roiled waters as we dragged the seine. Vern Hacker (Fig. 5) estimated that he captured 50 in Asylum Bay on Lake Winnebago in September, 1952.

33. Blacknose shiner—*Notropis heterolepis* Eigenmann & Eigenmann. Poygan 9. In Central Wisconsin I have taken this species in small silt-bottom lakes and in small streams with slow to medium current. In larger lakes, if found at all, it was taken in protected bays generally on the north side of the lake.

34. Pugnose shiner—*Notropis anogenus* Forbes. Poygan 9. Two individuals were captured from this station on Boom Bay on August 8, 1961. In order to secure an adequate study sample of this rare minnow I made a return trip to the same area on July 8, 1963, at which time I took 41 individuals. During the 1963 trip the vegetation in the area was very heavy. There were considerable stands of bulrush (*Scirpus* sp.). Submergent vegetation coupled with heavy growths of filamentous algae (primarily *Spirogyra* sp.) made seining difficult. The water was clear. Several springs had been piped into the bay at that point. The bottom consisted of fine

gravel and sand overlain with a very fine silt. Because of the problems encountered with the vegetation we seined primarily the areas which had been cleared alongside piers for boat passage and swimming. The pugnose shiners were in these open areas in schools of a dozen or more fish in water one-and-one half feet or less in depth. All individuals were taken within thirty feet of shore.

35. Emerald shiner—*Notropis atherinoides* Rafinesque. Poygan 9, 11; Winnebago 1 through 17, 19, 21, 22, 23. The emerald shiner appears to be the most common minnow in Lake Winnebago and is present in both shallow water and in the open lake. According to Priegel (1962a) it is the preferred forage fish during the winter for the walleyes of Lake Winnebago. For the sauger it is, next to the trout-perch, the most frequently found forage fish in stomach analyses. Apparently this shiner fluctuates greatly in numbers on Lake Winnebago. Priegel (1960) found that it decreased by 12.5% from 1959 to 1960. Also the young-of-the-year averaged 2.1" in length in October, 1959, but only 1.6" in October, 1960.

36. Bigmouth shiner—*Notropis dorsalis* (Agassiz). Poygan 2. The single individual captured was probably a migrant from one of the streams opening into the west end of Lake Poygan. Normally this species is found in moderate-sized streams over sand bottom.

37. River shiner—*Notropis blennioides* (Girard). Winnebago 3, 7, 8, 9, 10, 11, 13, 15, 16, 17. This species is commonly distributed over the northern and eastern shores of Lake Winnebago over sandy and rocky bottom. Next to the emerald shiner it appears to be the most common minnow in the lake. According to Hubbs and Lagler (1958), Lake Winnebago is the only water in the Great Lakes drainage from which this species is known. It is a common minnow in the larger waters of the Mississippi River drainage basin.

38. Sand shiner—*Notropis stramineus* (Cope). Winnebago 15. The sand shiner is a common species in medium and large-sized streams. In Wisconsin it is taken only infrequently in lakes. In Michigan lakes, Hubbs and Cooper (1936) report the species as frequenting sandy shoal areas.

39. Black bullhead—*Ictalurus melas* (Rafinesque). Winnebago 15, 17, 18, 23. Greene (1935) reported this species from Lake Winnebago. The black bullhead prefers the mud-bottomed and silt-covered bays found on the west side of Lake Winnebago. Priegel reported taking this species while seining in Lake Poygan during the summer of 1962 (pers. comm.).

40. Yellow bullhead—*Ictalurus natalis* (LeSueur). Poygan 2, 8. Priegel reported having taken this species often in Lakes Poygan and Winnebago while seining, trawling or netting (pers. comm.).

41. Brown bullhead—*Ictalurus nebulosus* (LeSueur). Poygan 8; Winnebago 23. Greene (1935) had a single record from Lake Winnebago at Oshkosh.

42. Channel catfish—*Ictalurus punctatus* (Rafinesque). Poygan 5; Winnebago 10. This species is one of the most common of the larger fishes in Lake Poygan. In 1953 Wirth (Fig. 3), using 2½" trap nets captured 3,530 catfish which made up 62.9% of the total catch. On the same lake other WCD research crews captured 4,100 catfish in the period between December, 1958, and December, 1959 (Fig. 3). On a pound-to-pound basis this was exceeded only by the fresh-water drum. The channel cat is also common in Lake Winnebago although numerically it is superseded by several species of game and rough fishes (Fig. 5). The catfish is distributed throughout both Poygan and Winnebago and during the day appears to confine itself to the deeper waters.

43. Flathead catfish—*Pylodictis olivaris* (Rafinesque). Greene (1935) reported this species only from the Mississippi drainage of Wisconsin. The records from Lakes Poygan and Winnebago are the first for the Great Lakes drainage in the State of Wisconsin. In recent years this species has been taken consistently but in small numbers from both Lake Winnebago and Lake Poygan (Figs. 3 and 5). From April, 1957, to November, 1959, 13 flathead catfish were reported taken in trap nets from Lake Winnebago by commercial fishermen. Individuals from 20 to 40 pounds in weight are not uncommon.

44. Tadpole madtom—*Noturus gyrinus* (Mitchill). Poygan 1, 2, 7, 8, 9, 10; Winnebago 22, 23. This species is rare in Lake Winnebago. In Lake Poygan its distribution is more general but it is still uncommon.

45. Central mudminnow—*Umbra limi* (Kirtland). Poygan 9. The mudminnow is commonly found in bog lakes and small streams in Central Wisconsin. It has seldom been taken in large lakes.

46. Northern pike—*Esox lucius* Linnaeus. Poygan 1, 2; Winnebago 5, 18, 22. Greene (1935) reported this species from several stations on Lake Winnebago. It appears to be more generally distributed than my station data indicate.

47. Muskellunge—*Esox masquinongy* Mitchill. Greene (1935) recorded a report of muskellunge from Lake Winnebago. Netting operations on that lake in recent years indicate that a small population is present (Fig. 5). Between April, 1957, and November,

1959, commercial fishermen reported capturing a total of 46 individuals from the lake. I was not able to find any reports of this species from Lake Poygan although conditions there appear to be favorable for it.

48. Banded killifish—*Fundulus diaphanus* (LeSueur). Poygan 1, 2, 4, 9, 10. Greene (1935) reported this species from five stations on Lake Winnebago although none of the recent surveys captured it there.

49. Burbot—*Lota lota* (Linnaeus). Poygan 1, 4; Winnebago 21, 23. Greene (1935) reported this species from four stations on Lake Winnebago. Priegel wrote that tons of lawyers are taken with nets from Lake Winnebago during their spawning season (pers. comm.).

50. Trout-perch—*Percopsis omiscomaycus* (Walbaum). Poygan 1; Winnebago 13. Since the trout-perch frequents open water, it is seldom taken by shoreline seining. In trawl hauls it is commonly captured, frequently appearing as the most abundant species in the catch. In Lake Poygan it comprised 53.4% of the catch in 22 trawl hauls (Fig. 3); in Winnebago, 62.4% of the catch (Fig. 5). This small species is a mainstay in the winter diet for both walleyes and sauger in Lake Winnebago (Priegel, 1962a). Priegel (1959) observed large numbers of trout-perch which were spawning among the rocks along the east shore of Lake Winnebago.

51. White bass—*Roccus chrysops* (Rafinesque). Poygan 1, 5, 6, 7; Winnebago 1, 2, 3, 5 through 13, 16, 17, 18, 20, 21, 22, 23. Greene (1935) reported this species from many stations on Lake Winnebago. The majority of white bass taken from Poygan and Winnebago by shoreline seining were young-of-the-year. They constituted a substantial percentage of the catch (Figs. 2 & 4). Fishermen complained frequently that Lake Winnebago was over-populated with this species.

52. Yellow bass—*Roccus mississippiensis* (Jordan & Eigenmann). Poygan 1, 7, 11; Winnebago 1, 2, 3, 5 through 19, 21, 22, 23. Greene (1935) reported this species from a few stations on the Mississippi River. Since then, it has been taken from many inland waters in southern Wisconsin (Helm, 1958). In Lake Winnebago I found this species as widely distributed as the white bass. The largest yellow bass on record from Wisconsin waters was taken in a state fish management trap net from Lake Poygan in January, 1964. It measured 16.2 inches in length, weighed three pounds two ounces and was six years old.

53. Yellow perch—*Perca flavescens* (Mitchell). Poygan 1 through 11; Winnebago 1, 5, 8, 9, 10, 12 through 17, 19 through 23. The perch is probably the most abundant panfish in Lake Poygan, and in Winnebago it is second only to the white bass.

54. Sauger—*Stizostedion canadense* (Smith). Hook and line winter fishing produces sauger in great numbers in Lake Winnebago. For the same lake, Priegel reported good 1957 and 1959 year classes but that there is no evidence for successful hatches in 1960, 1961 and 1962 (pers. comm.). Food habits of the sauger in Lake Winnebago are discussed by Priegel (1963b). Greene (1935) reported a record for Lake Winnebago, but he failed to take any in his own collections. A single specimen was taken in a trap net in 1953 from Lake Poygan.

55. Walleye—*Stizostedion vitreum vitreum* (Mitchill). Poygan 1, 5, 7, 8; Winnebago 5, 6, 8, 9, 10, 11, 13, 15, 16, 17, 20, 23. Greene (1935) took this species in both lakes. The walleye is considered one of the most important game fishes in Lakes Poygan and Winnebago where it appears to have general distribution. In the spring of the year many walleyes from these lakes migrate up the Wolf and Fox rivers to spawn. After the eggs are hatched, the fry are quickly carried downstream by the current to the lakes of the lower Wolf River (Priegel, 1960). Priegel (1963b) has analyzed the fall and winter food habits of walleyes from Lake Winnebago.

56. River darter—*Percina shumardi* (Girard). Poygan 11; Winnebago 10, 15, 18, 19, 20, 21, 22. Greene (1935) captured this species only from the Mississippi drainage in Wisconsin. In addition to the Poygan and Winnebago collections, I have taken the river darter from the lower Waupaca River, two miles downstream from Weyauwega, Waupaca County. These apparently are the first records of this species from the Great Lakes drainage in the State of Wisconsin. The Fox-Wisconsin canal at Portage, Wisconsin, probably acted as a connective between the two drainage basins. The spread of this species is similar to that indicated for the rainbow darter (*Etheostoma caeruleum*), discussed in a previous paper (Becker, 1959).

57. Blackside darter—*Percina maculata* (Girard). Poygan 4. This darter is taken commonly in medium to large-sized streams. It is uncommon in lakes.

58. Logperch—*Percina caprodes* (Rafinesque). Poygan 1, 4, 5, 6, 7, 8, 10, 11; Winnebago 1, 3, 4, 6, 8, 9, 10, 16 through 23. Greene (1935) reported this species from Lakes Winnebago and Poygan. The logperch is generally distributed throughout the shores of these lakes where the bottom is of heavy gravel, rubble or boulders. It is found commonly on the wave-swept shores and seldom in those areas protected from wind action.

59. Johnny darter—*Etheostoma nigrum* Rafinesque. Poygan 2, 6 through 11; Winnebago 2, 3, 6, 15, 20, 22. Greene (1935) reported this species from several stations along the eastern shore of Lake

Winnebago. The form taken in this survey was that subspecies formerly called the scaly Johnny darter (*Etheostoma nigrum eulepis*), described by Hubbs and Greene (1935), in which the nape of the neck, the cheeks and the breast are well-scaled. Recently Underhill (1936) has presented evidence that it is undesirable to continue to recognize the scaled form as a subspecies.

60. Iowa darter—*Etheostoma exile* (Girard). Poygan 9. This species is commonly taken from boggy lakes and streams draining such lakes in Central Wisconsin. Its appearance in a large lake such as Poygan is unusual.

61. Fantail darter—*Etheostoma flabellare* Rafinesque. Greene (1935) recorded this species for Lake Winnebago at the point where the upper Fox River enters the lake.

62. Smallmouth bass—*Micropterus dolomieu* Lacépède. Winnebago 16, 17, 18. Greene (1935) reported this species from Lake Winnebago. Several samplings in the deeper waters of Lake Poygan included the smallmouth (Fig. 3). In Lake Winnebago this species is found most commonly along the east and northwest shores.

63. Largemouth bass—*Micropterus salmoides* (Lacépède). Poygan 1, 2, 4 through 11; Winnebago 15, 19. The largemouth bass is commonly found throughout Lake Poygan where extensive weedy areas provide excellent habitat for it. Lake Winnebago has submergent vegetation only in a few mud-bottomed bays on the west shore. Due to restriction of proper habitat this species is uncommon in that lake. Hacker reported that he saw about 15 nice largemouth bass in Asylum Bay while shocking on September 5, 1962 (pers. comm.).

64. Pumpkinseed—*Lepomis gibbosus* (Linnaeus). Poygan 1, 2, 3, 6, 7, 8, 9, 10; Winnebago 2, 5, 15, 17, 19, 21, 22, 23. Greene (1935) reported this species from Poygan and Winnebago. I have found that the pumpkinseed has a general distribution along the shores of both lakes. In Lake Winnebago it is more commonly taken from the bays on the west shore and is rare to uncommon on the east shore. In Lake Poygan this species is abundant and constitutes a large part of the panfish population.

65. Bluegill—*Lepomis macrochirus* Rafinesque. Poygan 1 through 11; Winnebago 1, 3, 4, 5, 10, 12, 13, 15 through 23. Greene (1935) captured this species from the north end of Lake Winnebago. Although this species made up almost 12% of all the total number of fish which I captured from Lake Winnebago, I frequently heard about the absence or shortage of this species in that lake. Fishermen in some cases doubted the presence of the bluegill in Winnebago until I showed them specimens. Priegel reported that the blue-

gill, except as a rare specimen, has never entered the Lake Winnebago fishery (pers. comm.).

66. Rock bass—*Ambloplites rupestris* (Rafinesque). Poygan 5, 8, 9; Winnebago 17, 19. Greene (1935) captured this species in Lakes Poygan and Winnebago. The enrichment of these waters by effluent and chemical fertilizers will continue to interfere with the establishment of a strong population of this species. It is doubtful that the rock bass will ever contribute much to the fisherman's catch from these lakes.

67. White crappie—*Pomoxis annularis* Rafinesque. Winnebago 10. Greene (1935) captured this species from several sites on the Mississippi River and its tributaries. He took it in the Lake Michigan drainage only from the Root River in the southeastern corner of the state. In addition to the single specimen from Lake Winnebago, I made another capture on July 30, 1960, from a feeder stream to the Grand River in Green Lake County. This stream, lying in the Lake Michigan drainage basin, is not far from the Fox-Wisconsin canal at Portage. Hacker reported this species as common in Kingston Pond of the Grand River (pers. comm.). It appears possible, therefore, that the canal at Portage may have acted as a route whereby this species recently passed from the Mississippi into the Great Lakes drainage of Eastcentral Wisconsin. Berwig and Rost (Fig. 3) reported this species from Lake Poygan.

68. Black crappie—*Pomoxis nigromaculatus* (LeSueur). Poygan 1, 2, 5 through 10; Winnebago 1, 15, 17 through 23. This species was captured by Greene (1935) in both lakes. It is abundant and well distributed in Lake Poygan and common on the western and southern shores of Lake Winnebago.

69. Freshwater drum—*Aplodinotus grunniens* Rafinesque. Poygan 11; Winnebago 2, 3, 5, 6, 8, 9, 12, 13, 14, 15, 17 through 23. Greene (1935) captured this species at several stations on Lake Winnebago. Numerically it is the most successful species of large fish found in that water (Fig. 5). With the 20-foot seine I captured several individuals weighing over three pounds. According to Priegel over 30 million pounds have been removed from Lake Winnebago in the last decade (pers. comm.). More pounds of drum have been netted from Lake Poygan than any other species of fish (Fig. 3).

70. Mottled sculpin—*Cottus bairdii* (Girard). Winnebago 5, 15, 18, 20, 22, 23. This species appears to be generally distributed in Lake Winnebago. All individuals which I captured were two inches or less in total length, averaging considerably shorter than those I have taken in the streams of Central Wisconsin.

71. Brook stickleback—*Eucalia inconstans* (Kirtland). Priegel (pers. comm., Dec. 9, 1963) reported seeing this species seined by a minnow dealer in late September, 1960, from the west shore of Lake Winnebago just south of the mouth of the Fox River. In another letter (Dec. 10, 1963) he reported a specimen, 0.9 inches in length, which he took while shoreline seining off the east shore of Lake Winnebago on June 20, 1962.

Undoubtedly additional species of fish would be found in these lakes with more intensive sampling. It is of interest here to consider a collection of fishes made by Mr. Richard Simpson of Appleton who on April 21, 1962, seined the lowermost portion of a small creek and its mouth near Kerr's Resort on Boom Bay of Lake Poygan. I examined the collection and aside from some species listed above I found the northern mimic shiner (*Notropis v. volucellus*) and the rosyface shiner (*Notropis rubellus*). Mr. Simpson was not sure whether these species had been taken in the Boom Bay portion of Lake Poygan or in the stream itself.

Sampling these lakes during the winter would probably produce several species of minnows and darters which are normally found only in streams. Ice has in the past rather effectively concealed the winter distribution of our fish fauna. For instance, we know now that the creek chub (*Semotilus atromaculatus*), which spends the spring, summer and early fall near the headwaters of a stream, will migrate downstream and pass the winter in a large river or lake (Trautman, 1957). As the ice goes out, this species migrates upstream to spawn where it will remain until the following fall. The longnose dace engages in similar migratory habits. However, a few individuals may move from the torrential parts of the stream, where they are normally found from April through November, into adjacent shallow iced-over pools during the months of January, February and March (Becker, 1962). Actually the 71 species listed above are a countdown of the spring and summer forms. An equally thorough sampling of the fall and winter population of the same lakes would undoubtedly show a considerably enriched fish fauna.

REFERENCES

- BECKER, GEORGE C. 1959. Distribution of Central Wisconsin fishes. Trans. Wis. Acad. Sci. Arts & Letters. 48:65-102.
- BECKER, GEORGE C. 1962. Intra-specific variation in *Rhinichthys c. cataractae* (Valenciennes) and *Rhinichthys atratulus meleagris* (Agassiz) and anatomical and ecological studies of *Rhinichthys c. cataractae*. Ph.D. Thesis. Univ. of Wisconsin. (Order No. 62-1954) 279 pp. Univ. Microfilms. Ann Arbor, Mich.
- GREENE, C. WILLARD. 1935. Distribution of Wisconsin fishes. Wis. Cons. Comm., Madison, Wis. 235 pp.

- HELM, WILLIAM T. 1958. A "new" fish in Wisconsin. Wis. Cons. Dept., Madison, Wis. Wis. Cons. Bull. 23(7):10-12.
- HUBBS, CARL L. and GERALD COOPER. 1936. Minnows of Michigan. Cranbrook Instit. of Sci. Bull. 8:84 pp.
- HUBBS, CARL L. and C. WILLARD GREENE. 1935. Two new subspecies of fishes from Wisconsin. Trans. Wis. Acad. Sci. Arts & Letters. 28:89-101.
- HUBBS, CARL L. and KARL F. LAGLER. 1958. Fishes of the Great Lakes region (revised edit.). Cranbrook Instit. of Sci. Bull. 26:213 pp.
- MARTIN, LAWRENCE. 1916. The physical geography of Wisconsin. Wis. Geol. & Nat. Hist. Surv. Bull. 36:549 pp.
- PRIEGEL, GORDON R. 1959. Winnebago studies—annual progress report for the period Jan. 1 to Dec. 31, 1959. Wis. Cons. Dept. Fish Man. Div. Research Sect. Oshkosh, Wis. 41 pp. (mimeog.).
- PRIEGEL, GORDON R. 1960. Winnebago studies—annual progress report for the period Jan. 1 to Dec. 31, 1960. Wis. Cons. Dept. Fish Man. Div. Research Sect. Oshkosh, Wis. 56 pp. (mimeog.).
- PRIEGEL, GORDON R. 1962. Winnebago studies—annual progress report for the period Jan. 1 to Dec. 31, 1961. Wis. Cons. Dept. Fish Man. Div. Research Sect. Oshkosh, Wis. 75 pp. (mimeog.).
- PRIEGEL, GORDON R. 1962a. Winnebago winter menu. Wis. Cons. Dept. Madison, Wis. Wis. Cons. Bull. 27(1):20-21.
- PRIEGEL, GORDON R. 1963a. Dispersal of the shortnose gar, *Lepisosteus platostomus*, into the Great Lakes drainage. Trans. Amer. Fish. Soc. 92(2):178.
- PRIEGEL, GORDON R. 1963b. Food of walleye and sauger in Lake Winnebago, Wisconsin Trans. Amer. Fish. Soc. 92(3):312-13.
- TRAUTMAN, MILTON B. 1957. The fishes of Ohio. Ohio State Univ. Press. 683 pp.
- UNDERHILL, JAMES C. 1963. Distribution in Minnesota of the subspecies of the percid fish *Etheostoma nigrum* and of their intergrades. Amer. Mid. Nat. 70(2):470-478.
- Wisconsin Conservation Department. 1958. Wisconsin lakes. Wis. Cons. Dept. Madison, Wis. Publ. 218-58:35 pp.