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THE SPORT FISHERY ON LITTLE BAY DE NOC, 1965¹

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Abstract

The Michigan Department of Conservation is actively promoting sport fishing in the Great Lakes. Although the bays and connecting waters of the Great Lakes have been heavily fished, we have not had reliable information on this sport fishery--on amount of fishing, kinds of fish, and angling quality. A creel census during 1965 produced such information for Little Bay de Noc in Lake Michigan. The census was made on that part (9 square miles) of Little Bay de Noc that is north of Gladstone; south of Gladstone little fishing is done.

A stratified random creel census was used to estimate total angling effort and catch. Instantaneous angler counts were made to compute total hours of fishing, and anglers were interviewed to determine catch per hour. The product of total hours fished times the catch per hour gave the estimated total catch. The census was divided into two major periods: ice-fishing and open-water fishing. The basic sampling unit was the "car group" during the ice-fishing season, and the "boat group" during the open-water season. Further subdivisions were made in each major period, so sampling could be adjusted in proportion to fishing pressure.

During the ice-fishing season, anglers fished 29,322 hours and caught 27,248 yellow perch and 64 northern pike. During the open-water season, anglers fished 16,785 hours and caught 16,828 yellow perch, 2,896 bullheads, 2,088 rock bass, 503 pumpkinseeds, 416 northern pike and 312 smallmouth bass. Few walleyes were caught in 1965, although they were formerly abundant in the anglers' catch from this bay. Most winter anglers were local residents (Delta County), whereas only one-half of the open-water anglers were from Delta County. The catch per hour of all species combined was 1.1. The weight of the estimated catch was 13,000 pounds, or about 2 pounds per acre.

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The Michigan Department of Conservation is promoting sport fishing in the Great Lakes. Although some bays and connecting waters have been heavily fished, we have not had reliable information on this sport fishery--on amount of fishing, kinds of fish, and angling quality. A creel census in 1965 produced such information for Little Bay de Noc in Lake Michigan. This bay was selected for study because it was fished quite intensively, contained a variety of fish, and yet was small enough to be censused effectively.

The census area encompassed that part of Little Bay de Noc lying north of Saunders and Hunters points (Fig. 1). The lower 1/2-mile of the estuary of the Whitefish River was included. The censused area represents only about one-fifth of Little Bay de Noc. However, according to the district fisheries supervisor, the censused area has about 90% of the angling in the entire bay.² The census area has been closed to commercial fishing since 1929. It is 9 square miles in area, of which 4 square miles are less than 12 feet deep. Maximum depth is 51 feet. The bottom is predominantly sand, with some rock and rubble along the north and west shores and silt in deep water. The Whitefish, Rapid, and Tacoosh rivers enter at the north end of the bay, the Days River on the west side, and a small creek on the east side. Base flow of the Whitefish River was 50 cfs; the other streams ranged from 0.4 to 4.6 cfs.³

Angling was principally for yellow perch (Perca flavescens). Other fish caught, in the order of their frequency in the catch, were brown

² Personal communication, Clifford F. Long, District Fisheries Biologist, Escanaba.

³ Personal communication, Larry Hough, Engineering Technician, U.S.G.S., Escanaba.

bullhead (Ictalurus nebulosus), rock bass (Ambloplites rupestris), pumpkinseed (Lepomis gibbosus), northern pike (Esox lucius), smallmouth bass (Micropterus dolomieu), bluegill (Lepomis macrochirus), walleye (Stizostedion vitreum), and black crappie (Pomoxis nigromaculatus).

The only species protected by closed seasons were walleye and northern pike during April 1-May 20 and smallmouth bass during January 1-May 31.

Methods

A stratified random sampling plan of creel census, similar to that used at Keweenaw Bay (Stauffer, 1966), was used to estimate the angling effort and catch on Little Bay de Noc. Briefly, instantaneous angler counts were made to obtain total hours fished, and anglers were interviewed to determine the catch per hour. Total hours fished times the catch per hour gave the estimate of total number of fish caught.

The census was divided into two major periods: ice-fishing (January 1-April 12) and open-water fishing (May 1-September 6). Little fishing was done at other times of the year. Based on type, intensity, and location of angling, the major periods were divided further into six time-strata: (1) early winter, January 1-31; (2) midwinter, February 1-28; (3) late winter, March 1-April 12; (4) early spring, May 1-20; (5) late spring, May 21-June 30; and (6) summer, July 1-September 6.

Each time-stratum was divided into weekday and weekend strata; holidays were included with the weekends. Sampling was adjusted for the heavier weekend fishing pressure by censusing every day on weekends

and holidays but only on three randomly selected weekdays. The census was taken only during "daylight hours." Daylight hours were designated as 7 AM to 7 PM (ice season) and 5 AM to 9 PM (open-water season). Anglers occasionally began fishing before dawn, but seldom continued after dark. The census day consisted of three or four 4-hour periods. Two 4-hour periods were randomly selected for instantaneous counts and interviews on each census day.

Total angling time was determined from instantaneous counts of anglers' cars or boats, made at randomly selected times during the 4-hour periods. Two census clerks worked during the ice season--one interviewed and the other made instantaneous counts. During the open-water season, one census clerk did both. Interviews (see below) provided the average number of anglers per car or boat. During the ice-fishing season, the basic sampling unit was the "car group" (i. e., all persons in one car); nearly all fishermen either drove out on the ice or parked at access points on the west side of the bay. During the open-water period, when practically all angling was done from boats, the basic sampling unit was the "boat group."

Interviews were made at access points on shore; the number of interview periods at an access point was proportioned to the expected use by anglers. During the interviews, the following facts were recorded; residence of car or boat owner, number of anglers in group, hours fished, lures used, species and number of fish caught. Fish, in samples chosen systematically, were measured (total length), weighed, scale sampled, and sexed. The number of anglers interviewed, the hours which they fished, and the fish they caught are given in Table 1.

Ice fishing

Little ice fishing was done on Little Bay de Noc before the creel census was started on January 1; the ice was unsafe. When fishing began, during the first week in January, anglers fished near shore. For the winter as a whole, fishing was mostly concentrated within a half mile from shore in the area between the public access site and Brock's. However, some fishing was done over the entire bay. Nearly all anglers used shanties. Most of them fished with wigglers or minnows for perch, but a few speared for northern pike.

Fishing pressure was expected to be greatest at the beginning of the season. Observations at other locations have suggested that the better fishing occurs soon after ice forms and again just before the breakup. Because of these factors, the census was divided into the three approximately equal time strata mentioned under "Methods."

The census clerk interviewed anglers as they left the ice, during 135 randomly selected 4-hour periods which were apportioned as follows: (1) public access site, 76; (2) oil dock, 28; (3) Brock's, 15; and (4) Nelson's, 16. Less than 5% of the fishermen left the ice at other points; they were included in the instantaneous counts but were not interviewed. The majority of anglers, who were not interviewed, fished for perch and I assumed that their performance differed little from that of persons who were interviewed. Some northern pike spearers were concentrated in a small secluded bay and were neither interviewed nor included in the instantaneous counts. Thus, the numbers of pike spearers and pike caught were underestimated.

During the ice fishing season, persons were interviewed by car groups; they included 1,520 individuals who had fished 5,118 hours. Not included in the census estimate were 550 persons who did not fish but went along merely to observe the fishing.

To estimate the total number of angling hours, 541 instantaneous counts were made of cars parked on the ice and at the four access points. In January, the counts were made every 45 minutes during each interview period, but analysis of the data showed that such frequent counts were unnecessary. Subsequently, car counts were made only during approximately half of the interview periods.

It was estimated that during the ice fishing season, anglers fished 29,322 hours, and caught 27,248 yellow perch and 64 northern pike (Table 2). No estimate was made of walleyes because of the small number observed during the census periods. From other observations it was judged that not more than 25 walleyes were caught.

Mayfly nymphs were used as bait by 88% of the anglers, minnows by 8%, and miscellaneous baits by 3%. One per cent of the fishermen speared for northern pike.

The three winter strata differed in fishing pressure, catch rate and size of fish. The estimated angler hours per day dropped from 541 in January to 286 in February and to 106 in the March-April stratum. The catch per hour during these periods was 0.95, 0.70 and 1.26, respectively. I suspect that part of the relatively high catch rate near the end of the season was because only the more experienced

anglers continued to fish. The average length of yellow perch taken by anglers gradually declined from 7.8 inches in January to 7.4 inches in March-April (Table 3).

Open-water fishing

During the first open-water stratum (May 1-20), practically all fishing occurred at a perch spawning area just north of Nelson's. Counts and interviews were made at Nelson's, because at least 80% of the anglers who fished the spawning area used this access point. The creel census clerk made 168 boat counts at 45-minute intervals during the 28 interview periods. The 186 anglers who were interviewed fished 541 hours which was 21% of the total estimated fishing hours.

The estimated catch during May 1-20 was 5,437 perch, 12 bullheads, and 253 rock bass. Perch were caught at a rate of 2.1 per hour and averaged 9.2 inches long. Minnows were used by 82% of the anglers, and worms by 18%.

The remainder of the open-water season was divided into two strata, May 21-June 30 and July 1-September 6; these strata were selected to correspond with factors affecting fishing. The season on walleye and northern pike opened on May 21; from July 1 to September 6, vacationers made up a significant portion of the anglers. Interviews were made at Garth Point, at Nelson's and at the public access site. During the May 21-June 30 stratum, 4.1% of the estimated angling hours were included in the interviews; during the July 1-September 6 stratum, it was 13.4%.

During May 21-June 30, the estimated catch was 4,525 perch, 2,592 bullheads, and 1,161 rock bass, taken in 6,656 hours (Table 2). Yellow perch averaged 7.8 inches in length, rock bass, 7.3 inches. Most bullheads and rock bass were caught incidentally by perch anglers. Choice of baits was nearly reversed from the previous stratum; 18% of the anglers used minnows, 80% used worms, 2% used artificial lures.

During July 1-September 6, the estimated catch was 6,866 yellow perch, 352 northern pike, 674 rock bass and 1,107 fish of other species (smallmouth bass, bullheads and pumpkinseeds), all taken in 7,575 hours. Perch averaged 7.8 inches; pike, 23.9 inches; and rock bass, 7.2 inches (Table 3). Worms were the most popular bait, but a fourth of the anglers used artificial lures. Most anglers sought a particular species, but some were "just fishing."

Residence of anglers

Ninety-one per cent of the ice fishing was done by Delta County residents (Table 4). During May 1-June 30, 72% of the anglers were from Delta County and 22% were from the Lower Peninsula or other states. But during July 1-September 6, which included most of the tourist season, 54% of the anglers came from the Lower Peninsula or other states.

During the open-water season, out-of-state anglers were the most successful. Their average catch was 2.0 fish per hour of all species. In comparison, anglers from Delta County, other Upper Peninsula counties, and the Lower Peninsula averaged 1.8, 0.8, and 0.9 fish per hour, respectively.

Discussion

Characteristics of the catch from Little Bay de Noc are summarized below.

Yellow perch. --The estimated total catch of perch was 44,076, of which 62% was taken through the ice. Perch averaged 7.6 inches in length (sample size, 844) and were caught at a rate of 0.96 per hour. The weight of the estimated catch of perch was 9,600 pounds (1.7 pounds per acre). Angling was best during the spawning season (May 1-20) when perch averaged 9.2 inches long and were caught at the rate of 2.13 per hour. Although the average length during the May 1-20 stratum was determined from a small sample (see Table 3), general observations by the creel census clerk also indicated that perch caught in May were relatively large.

Perch fishing on Little Bay de Noc in 1965 was not especially good when compared with other waters on the Great Lakes. Keller (1965) reported catches of 2.6 to 3.5 perch per hour during the winters of 1958 to 1960 in the South Bass Island area of Lake Erie; in 1964, the rate was 6.6 perch per hour that averaged 8.4 inches long. Chapman (1954) censused angling at Sandusky Bay, Lake Erie, during July 1953 to June 1954. Overall, yellow perch comprised 45% of the total catch and were caught at a rate of 0.42 per hour. In December, when nearly all fish caught were perch, the catch per hour (all species) was 4.0. In Michigan waters of the Great Lakes, the annual sport catch per hour of yellow perch averaged 1.7 (range, 1.0-2.7) during 1955-1964 (Hubbell, 1966).

Perch angling in Little Bay de Noc was considered excellent in 1941-51, but has declined steadily since then, in the opinion of the District Fisheries Supervisor.⁴ On the other hand, a creel census taken in 1942-45 (Roelofs, 1946) suggests that perch fishing was poorer then (average, 0.4 perch per hour, range 0.3-0.6) than in 1965 (0.96 perch per hour). There are complications in making a direct comparison of the two sets of figures. The 1942-45 census was not random in respect to anglers and there could be serious bias in the results. Secondly, walleyes were abundant in 1942-45, and emphasis by anglers on walleyes would reduce the catch per hour of perch. The data provide only a rough idea of trends in quality of perch fishing.

In 1965, 57% of the perch in a systematic sample of the catch were age III. Age-IV, -V, and -VI perch also contributed substantially to the catch. Growth of perch in Little Bay de Noc (Table 5) was somewhat faster than the state average (Laarman, 1963).

Bullheads. --It was estimated that 2,896 bullheads were caught during the census period. Although bullheads usually are not considered important in Michigan, their large average size (10.6 inches) and abundance made them important in the Little Bay de Noc sport fishery.

Northern pike. --The estimated catch of northern pike was 416. Eighty-five per cent of the pike were caught during the summer stratum, mostly during the last 22 days of the period. The average catch rate for the entire census was 0.01 pike per hour, for the summer it was 0.05. Pike averaged 24.4 inches in length and 3.5 pounds in weight. The total pike catch weighed 1,441 pounds (0.2 pound per acre).

⁴ Personal communication, Clifford F. Long.

Although age-II pike predominated in the catch, ages III and IV were also well represented. Growth of pike from Little Bay de Noc was somewhat faster than the state average (Laarman, 1963), and faster than the median from various United States waters (Carlander, 1953). The comparison of lengths (inches) is shown below (number measured, in parentheses):

Source of data	Location	Age			
		II	III	IV	VI
Wagner, 1968	Little Bay de Noc	21.4 (15)	25.1 (9)	28.4 (7)	35.0 (1)
Laarman, 1963	Michigan waters (August only)	19.8 (404)	21.9 (275)	24.5 (126)	-
Carlander, 1953	United States waters	16.0 (570+)	19.8 (2680+)	21.1 (1616+)	27.4 (491+)

Because 81% of the pike scale sampled at Little Bay de Noc were caught between August 15 and September 6, the Michigan averages from Laarman are for only fish sampled in August. The median shown for United States waters (Carlander, 1953) was derived from fish taken throughout the year and are not so comparable. The average size of age-II fish from Little Bay de Noc is probably biased upward due to the 20-inch minimum size limit.

Abundance of alewives in Little Bay de Noc may be responsible for the good growth of pike. Analysis of 209 northern pike stomachs in 1966 demonstrated that they fed heavily on alewives.

Smallmouth bass. --Smallmouth bass made up an insignificant part of the sport fishery in 1965; the estimated catch was 312, the catch per hour was 0.02, and the average size was only 10.7 inches. Trap nets in 1965-67 took many smallmouth bass in some areas of the bay, so apparently the species was underharvested by anglers in 1965.

Walleye. --Only three walleyes were encountered during the 1965 census interviews, so no estimate was made of the total number. Based on conversations with resort owners and anglers, I judge that no more than 25 walleye were taken during the year. Within recent times, walleye fishing was at its best from the late 1940's to the middle 1950's (Crowe, et al., 1963). A creel census taken in 1942-45 showed that walleyes made up 14.3 to 70.2% of the catch, and the yearly catch rate varied from 0.12 to 0.72 walleye per hour (Roelofs, 1946). In late years there has not been a highly successful year-class of walleyes in Bay de Noc.

Other fish. --The estimated numbers of rock bass and pumpkin-seeds taken by anglers were 2,088 and 503, respectively. Although these species were of minor importance, they added variety to the fishery. Crappies and bluegills were caught so seldom that no estimate of total catch was made for them.

Total harvest. --In 1965, the catch per hour of all species combined was 1.1 in Little Bay de Noc. Catch rates in the vicinity of

South Bass Island, Lake Erie, during 1958-1963 for all species ranged from 2.6 to 6.7 fish per hour (Keller, 1965). However, at Sandusky Bay, Lake Erie, the catch per hour from July 1953 to June 1954 averaged only 0.9 (Chapman, 1954). The catch per hour in Great Lakes waters of Michigan ranged from 1.3 to 4.8 during 1942-1964 (Hubbell, 1966). Thus, fishing success on Little Bay de Noc was relatively poor as compared to these other areas on the Great Lakes.

The weight of the estimated catch in 1965 was 13,000 pounds or less than 3 pounds per acre. Carlander (1953) has summarized the yield per acre from many waters; production on Little Bay de Noc ranks with the lower values of his compilation.

Acknowledgments

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Table 1. --Number of anglers interviewed, their fishing effort, and catch,¹
 Little Bay de Noc, 1965

Period	Anglers	Hours fished	Catch					
			Yellow perch	Bull- head	Rock bass	Pump- kin- seed	North- ern pike	Small- mouth bass
<u>Ice fishing</u>								
Jan. 1-31	679	2,326	2,863	0	0	0	3	-
Feb. 1-28	439	1,392	1,151	0	1	0	2	-
Mar. 1-April 12	402	1,400	2,196	0	0	0	1	-
<u>Open-water fishing</u>								
May 1-20	186	541	1,150	2	73	0	-	-
May 21-June 30	98	280	246	138	64	0	0	0
July 1-Sept. 6	332	1,033	1,045	55	107	56	30	23
Total	2,136	6,972	8,651	195	245	56	36	23

¹ Other fish caught: 18 crappie, 3 walleye and 3 bluegills. No estimate made for these species because of their small numbers.

Table 2. --Estimated angling hours and catch, Little Bay de Noc, 1965

(Confidence limits, \pm one standard error, in parentheses)

Period	Hours	Catch					
		Yellow perch	Bull-head	Rock bass ¹	Pumpkin-seed	North-ern pike	Small-mouth bass
<u>Ice fishing</u>							
Jan. 1-31	16,780	15,899 (1,246)	0	0	0	56 (31)	-
Feb. 1-28	8,000	5,633 (690)	0	-	0	5 (3)	-
Mar. 1- April 12	4,542	5,716 (446)	0	0	0	3 (2)	-
<u>Open-water fishing</u>							
May 1-20	2,554	5,437 (1,150)	12 (10)	253 (85)	0	-	-
May 21- June 30	6,656	4,525 (1,068)	2,592 (1,686)	1,161 (278)	0	0	0
July 1- Sept. 6	7,575	6,866 (983)	292 (110)	674 (162)	503 (204)	352 (180)	312 (171)
Total	46,107	44,076 (2,382)	2,896 (1,690)	2,088 (332)	503 (204)	416 (183)	312 (171)

¹ No estimate made for February because of small number recorded.

Table 3. --Average length (inches) of fish in the systematic sample of anglers' catch, Little Bay de Noc, 1965
(Number of fish measured in parentheses)

Period	Species					
	Yellow perch	Bull-head	Rock bass	North-ern pike	Small-mouth bass	Wall-eye
<u>Ice fishing</u>						
Jan. 1-31	7.8 (148)	-	-	30.2 (2)	-	-
Feb. 1-28	7.5 (94)	-	-	27.9 (1)	-	-
Mar. 1-April 12	7.4 (351)	-	-	-	-	20.4 (3)
<u>Open-water fishing</u>						
May 1-20	9.2 (21)	10.9 (1)	-	-	-	-
May 21-June 30	7.8 (166)	-	7.3 (59)	-	-	-
July 1-Sept. 6	7.8 (64)	10.6 (44)	7.2 (9)	23.9 (29)	10.7 (16)	-
Average	7.6 (844)	10.6 (45)	7.3 (59)	24.4 (32)	10.7 (16)	20.4 (3)

Table 4. --Residence of anglers on Little Bay de Noc, 1965, expressed as percentages of total numbers of anglers interviewed

Period	Anglers interviewed	Delta County	Other Upper Peninsula counties	Lower Peninsula	Other states
<u>Ice fishing</u>					
Jan. 1-31	679	91	5	2	2
Feb. 1-28	439	93	5	1	1
Mar. 1-April 12	402	91	5	3	1
Total or average	1,520	91	5	2	2
<u>Open-water fishing</u>					
May 1-20	186	72	6	2	20
May 21-June 30	98	65	4	16	15
July 1-Sept. 6	332	41	5	29	25
Total or average	616	54	5	19	22
Grand total or average	2,136	81	5	7	7

Table 5. --Average total length (inches) of yellow perch, by age group, at various months in the systematic sample of the angler catch, Little Bay de Noc, 1965 and corresponding state averages ¹

(Number of fish, in parentheses)

Month(s) and source of data	Age group						
	II	III	IV	V	VI	VII	VIII
<u>January - April</u>							
Little Bay de Noc	6.1 (7)	6.9 (143)	8.0 (30)	8.4 (21)	9.0 (31)	9.8 (10)	-
State average	5.3	6.4	7.0	-	-	-	-
<u>June</u>							
Little Bay de Noc	6.6 (9)	7.1 (81)	8.3 (23)	8.7 (17)	9.4 (13)	-	-
State average	5.8	6.8	8.0	-	-	-	-
<u>July</u>							
Little Bay de Noc	6.7 (12)	7.4 (49)	8.4 (11)	8.4 (9)	8.6 (3)	10.0 (3)	11.5 (3)
State average	5.8	6.7	7.7	-	-	-	-

¹ The several state averages are each based on several hundred (from 395 to 2,054) fish.

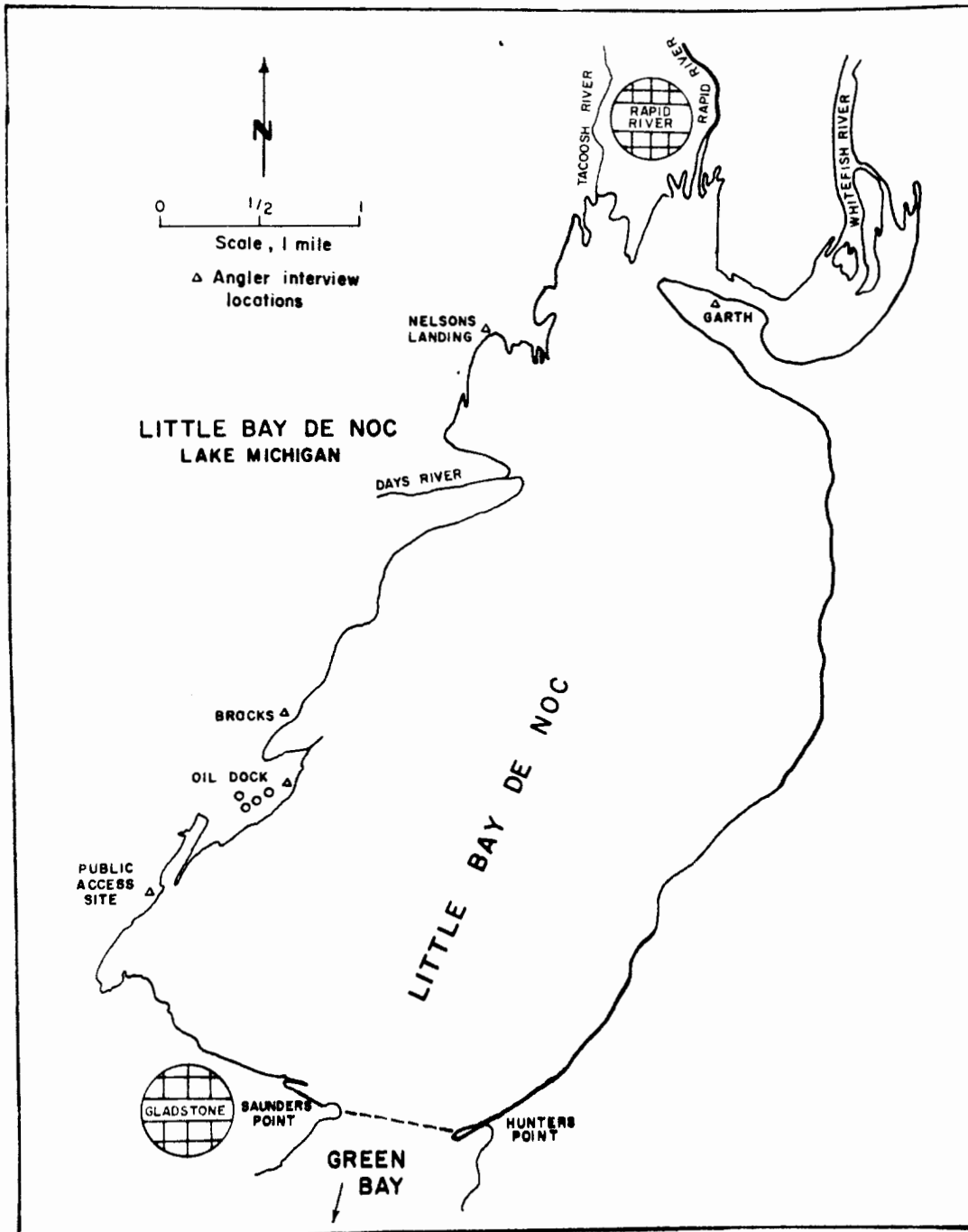


Figure 1. --Little Bay de Noc at the north end of Green Bay, Lake Michigan, with shoreline site locations related to the fishing census.