

WISCONSIN CONSERVATION DEPARTMENT

Madison, Wisconsin
Fish Management Division

Management Report No. 1

A FOUR-YEAR STUDY OF THE
SMALLMOUTH BASS IN THE
OUTLYING WATERS OF
DOOR COUNTY, WISCONSIN

by

Lawrence Wiegert

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Abstract

A four-year study of the smallmouth bass population occupying the outlying waters of Door County, Wisconsin, was conducted during 1962, 1963, 1964 and 1965. Information of significant management interest is summarized as follows:

1. The smallmouth population is made up of a series of well defined groups inhabiting the various bays and reefs, with very little interchange of individuals between isolated segments of the population.
2. The growth rate of smallmouth bass from the study area is comparable with smallmouth growth rates from other areas in the same general latitude.
3. Rate of harvest, based on tag returns, is not believed excessive. Total tag returns recorded over the four-year period since tagging was started amounted to 15.6 percent.
4. Record low water levels, increased carp and alewife populations, and an increase in pollution (fertility) could have an effect on the smallmouth bass population. Either singly or in combination, these factors may be exerting a detrimental effect on the smallmouth bass populations. Observations made while netting and operating the electrical shocker revealed adverse environmental factors such as changes in spawning areas resulting from low water, a heavy increase in carp and alewife activity, and some drastic changes in water quality caused by increased algae growth and turbidity.

Introduction

The smallmouth bass fishery of the outlying waters of Green Bay and Lake Michigan adjacent to Door County, has posed a management problem to the Fish Management Division for some time. Until 1952, the bass season in this area opened on July 1st each year. From 1952 through 1957, the season opened on the Saturday nearest to June 20th. In 1958, the season was again opened on July 1st. Since 1959, the opening date has been the first Saturday in June. Investigations were aimed toward obtaining information on the effect of this earlier opening date on smallmouth bass as it may apply to the degree of fishing intensity and harvest. In order to better understand the problem and to gather information upon which to base management plans, a four-year study of the smallmouth bass in the outlying waters was started in 1962. Included in this study were rate of growth, migration, spawning habits, and rate of bass harvest by anglers.

Methods

A total of 2,104 smallmouth bass were captured from seven different locations through the use of fyke nets and an electrical shocker unit. The fish were weighed, measured, tagged and scale samples were taken for age and growth studies. Tagged fish ranged in size from 8" to 22" at time of tagging; these fish were all tagged with monel metal jaw tags. If possible, the sex and degree of egg maturity was also determined in order to pinpoint spawning time and the temperature of the water at spawning time. Observations were made of smallmouth spawning nests as to depth of water, bottom type and cover near the nests.

Tag returns were obtained on a voluntary basis from sportsmen and party boat operators. The Brown County Alliance, a sportsman's organization contributed 500 posters which were posted throughout the Door County area. These posters stated where the tags were to be sent and information such as length, location where the fish was caught, and date when the fish was caught, which should be included in the sportsman's report. Tag returns were also solicited through personal contacts by Department personnel and through normal news media.

Migration

Information gathered from anglers who reported the catches of tagged fish was used to determine the migration pattern shown in Figure 1. Large circled numerals indicate tagging sites, smaller circles indicate fish captured for respective tagging sites. The tendency for the majority of the smallmouth bass population to remain in a given area is very apparent. Only a small portion of the larger fish move any great distances. Some minor movement is noted toward the point of the peninsula from bays on the Lake Michigan side as indicated by tagged fish recovered from the passage between the mainland and the islands. The greatest distance traveled was approximately 45 miles, by a 13-inch fish that was tagged on May 22, 1962, in Little Sturgeon Bay, and was recovered in the Ahnapee River near Algoma on July 12, 1963. Several other fish in the 12 - 16-inch size range moved 10 - 16 miles; however, there was no definite pattern to these movements. For ease of discernment, only those fish which traveled greater than five miles are shown in Figure 1. A more complete breakdown of all tag returns (330) is shown in Table 1.

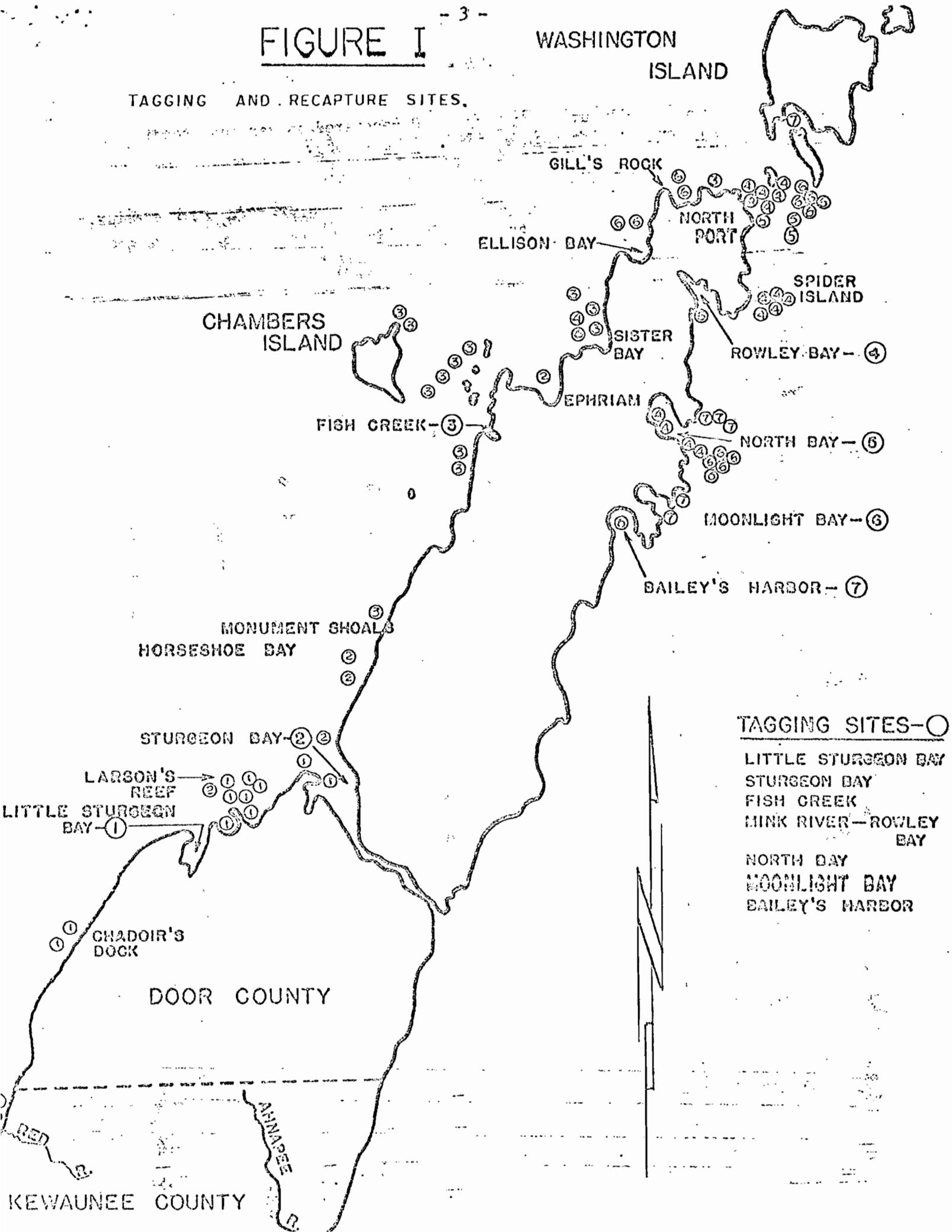
Time of Harvest

Of primary concern, both to the Conservation Department and proponents of a July 1st open season date, was the rate of harvest during the early part of the present season. The early June opening date was in effect during the entire four-year study period.

Tag returns indicate the exact date the fish was caught and furnished comparative data which can be used to assess the catch by months over the entire five-month fishing period when smallmouth bass normally are caught. Information gathered indicates that fishing during the month of June, has very little, if any, effect on the smallmouth bass population.

FIGURE I

TAGGING AND RECAPTURE SITES.



TAGGING SITES—○

LITTLE STURGEON BAY
 STURGEON BAY
 FISH CREEK
 MINK RIVER—ROWLEY BAY

NORTH BAY
 MOONLIGHT BAY
 BAILEY'S HARBOR

Table 1 - Numbers of smallmouth bass tagged and recovered at various locations in Door County, Wisconsin, waters. 1962 - 1965.

	Tagging Sites						
	Little Sturgeon Bay	Sturgeon Bay	Fish Creek	Mink River Rowley's Bay	North Bay	Moonlight Bay	Bailey's Harbor
<u>Recovery Sites</u>							
Little Sturgeon Bay	49	1					
Sturgeon Bay	3	50					
Fish Creek	0		91				
Rowley's Bay Mink River				17	2		
North Bay				1	20	5	3
Moonlight Bay						24	1
Bailey's Harbor						1	3
Larson's Reef	6	4					
Red River Chadoir's Dock	7						
Algoma	1						
Monument Shoals Horseshoe Bay		2	1				
Chamber's Island			4				
Ephriam		1					
Sister Bay			4	1		1	
Northport				6	5	4	
Spider Island				7			
Ellison's Bay Gills Rock						4	
Washington Island							1
Total Recaptured	66	58	100	32	27	39	8
Total Tagged	590	390	381	180	191	266	106
% Recaptured	11.2	14.9	26.2	17.8	14.1	14.7	7.5

Total Tagged: 2,104
 Total Recoveries: 330

Approximately 81 percent of the bass caught are taken after July 1st, and only 19 percent are taken during the month of June. The following table shows the tag returns by months and the breakdown percentage of the total catch by months.

Table 2 - Monthly tag returns from smallmouth bass during the open seasons of 1962 - 1965 in Door County, Wisconsin, waters.

	June	July	August	Sept.	Oct.	Totals
No. of Returns	64	133	94	38	1	330
% of Total Returns	19.4	40.3	28.5	11.5	.3	100

Rate of Harvest

Of the 2,104 tagged fish released in the seven tagging areas, a total of 330 were reported caught by anglers. This amounts to a total tag return of 15.6 percent involving 1,034 available to the angler for a four-year period, 743 fish for a three-year period and 327 for a two-year period. These tag returns also indicated that the harvest based on tag returns varied considerably from area to area depending upon accessibility and fishing pressure.

Table 3 on the following page shows the rate of harvest by fishermen during the first three years of the study.

Growth Rate

Determination of age and rate of growth was made from 1,050 scales impressed on cellulose acetate slides 0.03 inches thick. Examination and the measurement of scales was made by means of a micro-projector at the magnification X43. A direct proportion ratio of scale and body length was assumed in making back calculations of size at various ages.

Latta (1963) stated that the growth for previous years of life of smallmouth bass could be calculated directly from scale measurements because scale growth is directly proportional to total length. For each age group of a year class, average measurements were computed for the distance from the focus of the scale to each annulus, length of scale radius and total length of fish at the time the scale sample was taken. Then a direct proportion calculation was made to find the average length at the end of each year of life for each age group.

Evaluation of the data from the scale samples taken indicates that the smallmouth bass from the outlying waters adjacent to Door County have growth rates comparable with those of other bass from the same general latitude.

Table 3 - Annual rate of tag returns for smallmouth bass tagged in Door County, Wisconsin, waters. 1962 - 1964.

Year Tagged	No. Tagged	No. Returns 1962	Percent Returned 1962	No. Returns 1963	Percent Returned 1963	No. Returns 1964	Percent Returned 1964	No. Returns 1965	Percent Returned 1965	Total Annual Returns
1962	1,034	146	14.1	33	3.19	6	.58	1	.09	186
1963	743			63	8.48	38	5.11	5	.66	106
1964	327					28	7.34	10	3.1	38

Table 4 - A comparison of growth rates of smallmouth bass in waters of the same latitude to Door County smallmouth bass.

Year of Life	Waugoshance Point, Michigan Lake Michigan	Cayuga Lake New York	Wis. Waters Inland	Door County
3	8.1	8.4	8.2	9.2
4	9.7	10.3	10.6	10.4
5	11.5	12.1	12.5	11.9
6	13.2	13.7	14.1	13.1
7	14.6	14.7	15.3	15.0
8	15.8	15.6	16.7	15.9
9	16.8	16.7	17.6	16.3
10	17.4	17.0	18.3	17.5

Growth rates, based on reading scale samples taken during the study, as shown in Table 5, indicate that the annual growth rate is increasing. This may be a result of higher levels of organic fertility and an increase in food made available by the large alewife population. Table 5 shows comparable growth rates on eleven year classes dating back to 1951.

Spawning Habits

The exact spawning period of the smallmouth bass in these large waters is difficult to pinpoint. Some fish have been known to spawn in sheltered shallow bays as early as May 20th; on the other hand smallmouth have been caught on exposed reefs and shorelines that had not yet spawned in late July. Under normal conditions, smallmouth bass will spawn when the temperature of the water rises above 60° F. Depending upon the location, air temperature and prevailing winds, this temperature can be reached as early as May 20th, but adverse weather conditions could delay this temperature rise for as much as a month or more.

During the four-year study period, a total of 39 bass nests were observed as to location, depth of water and cover close at hand. The depth of water at the nests varied from 17 inches to 5 feet; however, nesting could have taken place in greater depths since it is difficult to make observations beyond the five-foot depth. In 27 cases, the nest was made on gravel or rubble bottom, 8 nests were on sand and the remaining four were on bedrock with overlying gravel. Adult fish were observed on only fourteen of the 39 nests and eggs were seen in nineteen.

Factors Influencing Spawning Success

Siltation of the nest after the eggs are deposited is one of the factors which can cause complete failure of a hatch. This condition was observed in Little Sturgeon Bay where a large carp population kept the water extremely turbid during the entire normal spawning period. A cold spell which lowers the water temperature from the 60^o+ level to the 50's^o is another factor which influences spawning success. When the water temperature drops, the male bass abandons the nest and the eggs are subject to predation by other fish. Predation occurs, however, even when the male is present, especially in the case where a school of minnows attack the nest. While the male bass chases several away, the rest consume large numbers of eggs. Such predation by minnows and small perch was observed in the Sawyer Harbor area during the 1964 spawning season.

Observations were made during and prior to the actual four-year study period. These observations are listed to point out that the study environment has been undergoing changes which may play an important role in the future management of the bass population.

1. Water levels in Lake Michigan were at an all-time low during 1964. This factor alone has changed some traditional bass spawning sites. Dependent upon bottom contours, new, but limited areas, have become available while others, including some of the better spawning sites, have been at least temporarily lost.
2. Low water levels have exposed and made unavailable large areas and tracts of bulrush beds which in former years of high water were excellent food producing zones for the smallmouth.
3. Many inland lakes in Wisconsin, Lake Michigan, and especially Green Bay, are experiencing accelerated enrichment in both organic and inorganic nutrients. This enrichment, coupled with low water levels, is conducive to algae growth which is becoming more noticeable each year. This excessive algae growth will at certain times of the year, render choice smallmouth trolling areas unfishable because of fouled baits and trolling gear.
4. An increased carp population has decidedly altered the habits of spawning smallmouth. This observation has been borne out by actual netting and electric shocking operations in specific areas both before and after carp made their appearance. Smallmouth bass appear to be most intolerant of turbid water associated with carp movements and carp spawning activities.
5. The alewife population is extremely high in the waters where the smallmouth bass study was conducted. At times of peak abundance, the alewife will completely dominate an area to the exclusion of not only smallmouth bass, but all other fish species as well.

Electric shocker sampling indicates that in heavy concentrations of alewife, smallmouth are not taken and as alewife numbers diminish, smallmouth numbers increase.

Literature Cited

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