

FISH MANAGEMENT REPORT 103

CREEL CENSUS OF 3 MANAGED TROUT LAKES IN FLORENCE COUNTY, WISCONSIN, 1976

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ABSTRACT

A random stratified creel census was conducted by the Bureau of Fish Management over the first 2 months of the 1976 fishing season on 3 managed trout lakes in Florence County, Wisconsin. The lakes were Anna, Montgomery, and Sand. The census was taken to evaluate the fishing pressure, catch rates, harvest rates, and trout growth rates on each of these previously uncensused stocked lakes. This evaluation would be used in determining whether trout-stocking was a profitable and worthwhile project on each of the study lakes.

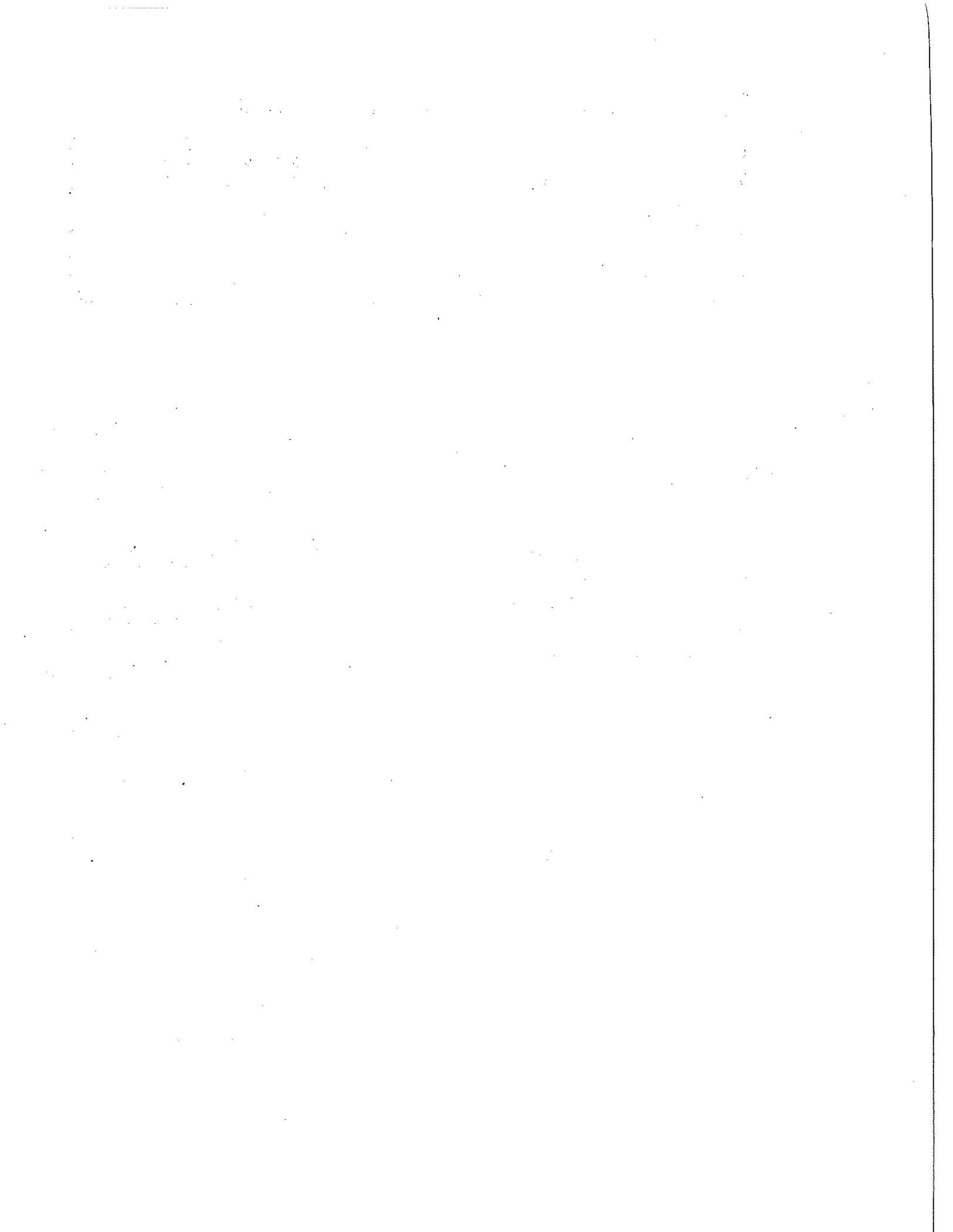
Harvest, exploitation, and growth rates were calculated for the trout stocks in each lake. Fishing pressure and other angler characteristics data were also collected. Pressure ranged from 7.5 angler-hours per acre on Anna Lake to 89.6 angler-hours per acre on Sand Lake. Catch rates for Sand and Montgomery Lakes compared favorably with those found in similar studies.

Trout growth was considerably better in Sand Lake than in the other 2 lakes. It was theorized that the plentiful supply of *Hyaella azteca*, a trout food found in Sand Lake but not in the other 2 lakes, was responsible for this growth.

Management recommendations based on survey results are made for all 3 lakes.

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INTRODUCTION

In 1975, 181 Wisconsin lakes and ponds were managed for trout. More than 97,700 pounds of trout were stocked in these waters. About 90 percent of these trout were planted in the spring as 16-17-month-old yearlings. To date few studies have been conducted to determine what percentage of stocked fish is caught by anglers.

Burdick and Cooper (1956) found a return to the angler of between 0.3 and 18.3 percent for rainbow trout fingerling stocked in Weber Lake, Wisconsin. They found larger-sized fingerling gave a better return. On Devil's Lake, Wisconsin, Brynildson et al. (1970) found a return of between 60 and 80 percent for stocked rainbow trout yearlings, and between 50 and 55 percent for stocked brown trout yearlings. Most rainbow trout were caught early in the season, while the brown trout provided a more sustained fishery. Jesien (1977) studied 3 small Wisconsin lakes stocked with catchable-sized trout; he found that most stocked fish were caught in the first month of the season and few were taken thereafter.

The present study was undertaken to determine the fishing pressure on and catch, harvest, and growth rates of planted trout in 3 small lakes in Florence County, Wisconsin -- Anna, Montgomery, and Sand Lakes. This information will be used in comparing the costs and benefits of stocking these lakes, and the conclusions derived from this comparison will be used in support of continuing, altering, or ending the trout-stocking program on each lake.

DESCRIPTION OF THE STUDY AREA

The location of each of the 3 study lakes is shown in Figure 1. All are located in northeast Florence County. According to the 1970 census, the county's population is 3,298. This is the lowest of all Wisconsin counties, with only 6.8 persons per square mile. The study lakes, however, are located within 10 miles of Iron Mountain and Kingsford, Michigan, which have a combined population of 13,978. The county is almost entirely wooded.

Sand Lake covers 22 acres and has a maximum depth of 28 feet. It is a medium hard water seepage lake with clear, moderately transparent water. The shoreline is undeveloped and entirely in public ownership. The lake has been managed exclusively for brook trout since chemical rehabilitation in 1962, although largemouth bass and golden shiners have since reinfested the lake and fair-sized populations of each now exist. Sand Lake is stocked with 2,000 yearling brook trout each spring, just prior to the fishing season.

Montgomery Lake covers 23 acres and has a maximum depth of 27 feet. This hard-water drainage lake has neutral, light brown water of moderate transparency. Difficult access is present from a town road. The remaining shoreline is in private ownership and is lightly developed. The lake is managed primarily for brook trout, although largemouth bass, yellow perch, bluegill, and pumpkinseed inhabit the lake. Two thousand brook yearlings have been planted each spring prior to the season opening since 1957. (From 1947 through 1955 the lake was stocked each spring with rainbow trout.)

Anna Lake covers 36 acres and has a maximum depth of 61 feet. It is a very soft water seepage lake with slightly acidic, clear water of high transparency. Public access is present and includes a boat landing on the lake's west end. The remaining shoreline is in private ownership. At least fourteen dwellings are located around the lake. Largemouth bass, bluegill, yellow perch, rock bass, and green sunfish are present. One thousand rainbow trout yearlings have been planted prior to the season each spring since 1968.

Physical and chemical data for the 3 study lakes are shown in Table 1.

METHODS

All 3 of the study lakes are stocked with trout each spring. Sand Lake is stocked with 2,000 yearling brook trout each spring, just before the fishing season. The trout planted in spring 1976 received right ventral finclips and averaged 3.3 to the pound. (The 1975 spring-planted trout received adipose finclips.)

Montgomery Lake is stocked each spring with 2,000 brook trout yearlings prior to the opening of the fishing season. The 1976 spring plant trout received adipose finclips and averaged, like the Sand Lake trout, 3.3 to the pound.

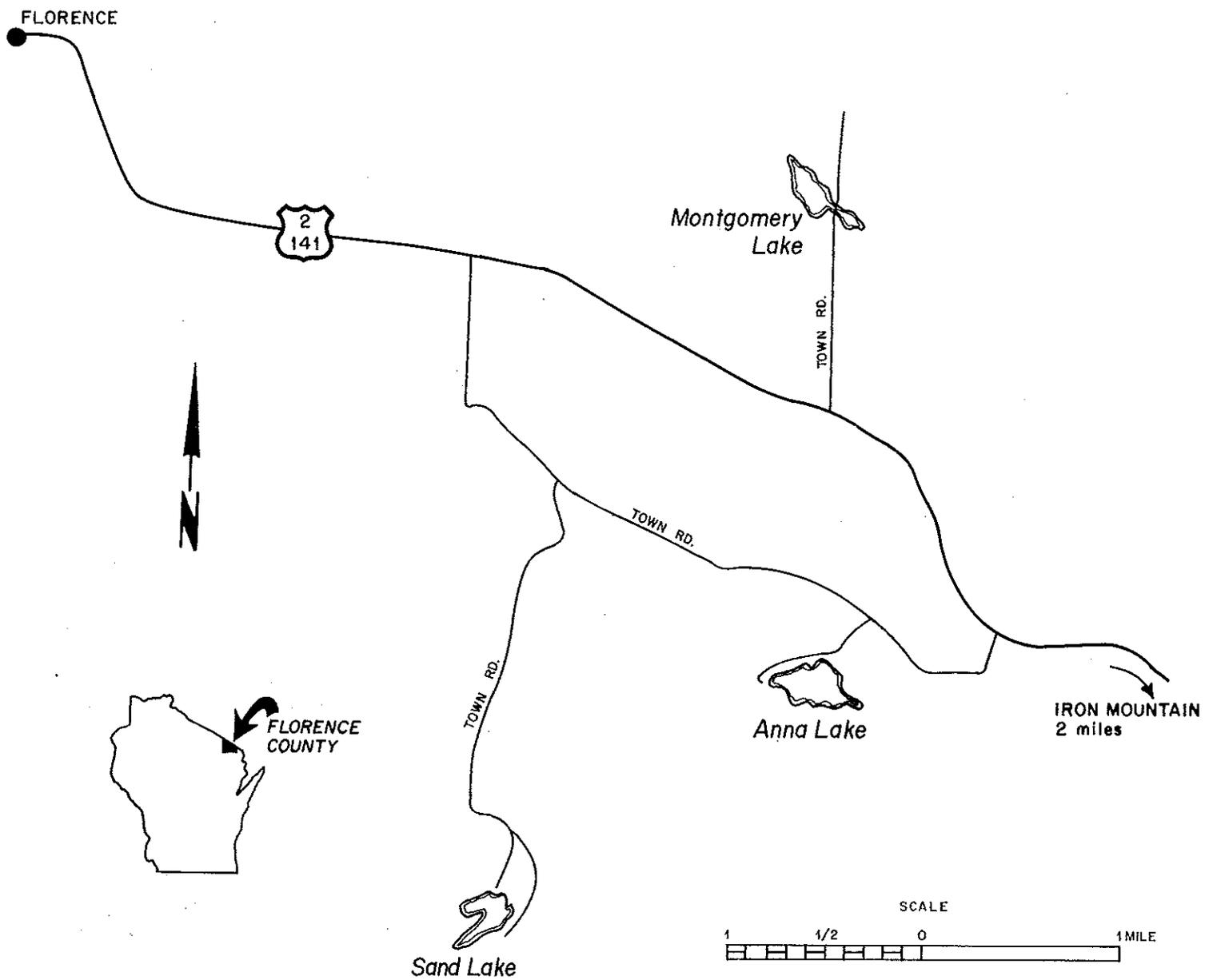


FIGURE 1. Location of study lakes, Montgomery, Sand, and Anna Lakes, Florence County, Wisconsin.

TABLE 1. Physical and chemical characteristics of Anna, Sand, and Montgomery Lakes, Florence County, Wisconsin, 1976.

Lake	Size (acres)	Maximum Depth (ft)	Secchi Disc (ft)	Water Source	MPA* (mg/l)	Conductance (micromho/cm ³)	pH	Water Color	Watershed Area (sq mi)
Anna	36	61	26	Seepage	6	27	6.4	Clear	0.2
Sand	22	28	5	Seepage	51	123	7.4	Clear	0.5
Montgomery	23	27	11	Drainage	92	222	7.0	Light brown	0.1

*Methyl Purple Alkalinity.

TABLE 2. Creel census periods and percentage of census effort expended on each of the 3 study lakes.

Census Period (Time of Day)	Angler Count Time	Census Effort
I 6 - 10 a.m.	7-9 a.m.	20%
II 10 a.m. - 2 p.m.	11 a.m. - 1 p.m.	14%
III 2 - 6 p.m.	3 - 5 p.m.	34%
IV 6 - 10 p.m.	7 - 9 p.m.	23%
V 10 p.m. - 2 a.m.	11 p.m. - 1 a.m.	9%

TABLE 3. Distance anglers travelled to Sand and Montgomery Lakes, Florence County, Wisconsin, 1976.

Distance Travelled (miles)	Sand Lake %*	Montgomery Lake %**
0 - 20	47	49
20 - 40	0	0
41 - 60	1	1
61 - 100	35	23
101+	17	26
(Out of State)	(27)	(26)

*213 anglers interviewed.

**154 anglers interviewed.

Anna Lake has been stocked each spring since 1968 with 1,000 rainbow trout prior to the season. The trout planted in 1976 received adipose finclips and averaged 5.5 to the pound.

Creel Census Procedures

A random stratified creel census was conducted on the 3 study lakes over the first 2 months of the 1976 trout-fishing season (1 May through 20 June). The methods used are those described by Lambou (1961).

During the first weekend of the trout season (1 and 2 May), complete angler counts were made every 2 hours from 7 a.m. of the first day to 1 a.m. of the next day. These data were analyzed separately from those for other seasonal periods because fishing pressure and harvest are known to be unusually high at this time. During the remainder of the season, angler counts were made at randomly selected 2-hour intervals from 7 a.m. to 1 a.m. of the next day (Table 2). Census effort was given to the 11 p.m. to 1 a.m. period in order to obtain an indication of the amount of night fishing.

Twenty-eight percent of the May periods and 29 percent of the June periods were sampled. Data collected in May were analyzed separately from those obtained in June. Thirty-seven percent of the weekend periods and 25 percent of the weekday periods were sampled. Weekend and weekday data were also analyzed separately. Memorial Day was treated as a weekend day.

During each angler count time the 3 study lakes were checked as quickly as possible. The creel clerk travelled to each lake and made his counts within 15 to 20 minutes of the appointed time. Both shore and boat anglers were counted, even if they had been present during previous counts. After angler counts were completed on all 3 lakes, as many interviews as possible were conducted. A creel census card, which was used to record the information obtained in each interview, is shown in Figure 2. Information recorded on the card included stream (lake) name and location; date of interview; angler's name, address (town and county), and mode of transportation to lake; kind of fishing (boat or shore); number of anglers in party; number and species (brown, rainbow, or brook) of trout caught; type of finclip; length (in inches) and weight (in grams) of fish; starting and ending time of day's fishing; area fished; and kind of bait used. If an angler was contacted more than once in the same day, only the time fished and the catch since the previous contact were recorded on the second contact.

Fishing pressure (expressed as angler-hours) for each seasonal period (May weekends, June weekdays, etc.) was calculated for each lake by multiplying the average number of anglers per day by 2 (representing a 2-hour fishing period length) by the number of days in the period. The total harvest was estimated by multiplying angler-hours by the average catch per hour as determined from the interview data.

RESULTS

Angler Characteristics

There were 215 anglers interviewed at Sand Lake, 154 at Montgomery Lake, and 7 at Anna Lake. No patterns of angler characteristics were discernible for the Anna Lake anglers because of the small sample.

Nearly half of those fishing Sand and Montgomery Lakes were "local residents" or resided within 20 miles of the lakes (Table 3). Because the lakes are near the Iron Mountain-Kingsford, Michigan area, more than a quarter of the anglers were not Wisconsin residents. Most of the remaining anglers, 52 percent on Sand Lake and 49 percent on Montgomery Lake, drove more than 60 miles to the lakes. Many were residents of Green Bay and the Fox River Valley.

Most anglers made only one trip during the period censused, although some came back repeatedly. One fisherman was seen on Sand Lake eight times during the 2-month period. The average number of trips per angler was 1.27 on Sand Lake and 1.25 on Montgomery Lake.

Fishing Pressure

Calculations showed that Anna Lake received only 7.5 angler-hours per acre for the study period, whereas Montgomery Lake received 68.0 angler-hours per acre and Sand Lake 89.6 angler-hours per acre. Opening weekend accounted for 33.0 percent of the total pressure on Montgomery Lake and about 20.0 percent of the Sand Lake total. Pressure dropped off in June on both Montgomery and Sand Lakes. Table 4 shows the distribution of pressure over the various seasonal periods and different times of day for the 3 lakes.

DEPARTMENT OF NATURAL RESOURCES

CREEL CENSUS REPORT
Form 3600-92

Stream: Sand Lake - Florence County Date: 5 6 76
 mo da yr
 1 Name Doughball John J.
 last first middle initial
 2 Address Florence Florence Wisc.
 town county state
 3 Is he (check): driver
 passenger
 not with a car

5 Identification: Boat of Shore 4 No. of anglers in the car 3

9 Time: (circle)

	Start		End		Area Fished	Lure
	AM	PM	AM	PM		
1			6:00	10:00		W
2						W
3						W
4						W
5						
6						
7						
8						
9						
10						

12 Are rough fish an annoyance? (check) Yes No
 A-Adipose P-Pectoral V-Ventral
 L-Left R-Right
 Total hours: 4
 13 Finished? (check) Yes No
 W-Worms F-Flies S-Spinner M-Minnow

471 *Record other species caught on back O-Other (Specify)*

FIGURE 2. Sample creel census form showing information collected.

TABLE 4. Fishing pressure in angler-hours for Montgomery, Sand, and Anna Lakes, Florence County, Wisconsin, 1976.

Seasonal Period and Hourly Parameters	Pressure (in angler-hours)										Percentage of Pressure	
	7 a.m.	9	11	1 p.m.	3	5	7	9	11	1 a.m.		Total
<u>Montgomery Lake</u>												
Opening Weekend	148	136	68	50	56	36	36	0	0	0	530	34
May Weekdays	0	0	0	0	104	100	128	0	0	0	332	21
May Weekends	0	13	54	162	103	95	30	0	0	0	457	29
June Weekdays	22	11	0	42	35	21	9	0	0	0	140	9
June Weekends	0	0	12	24	16	4	24	24	0	0	104	7
Total	170	160	134	278	314	256	227	24	0	0	1,563	100
Percent of Pressure	11	10	9	18	20	16	14	2	0	0	100	-
<u>Sand Lake</u>												
Opening Weekend	118	80	52	42	56	18	40	0	0	0	406	21
May Weekdays	13	27	20	120	104	72	136	32	0	0	524	27
May Weekends	81	49	108	45	135	49	90	12	0	0	569	29
June Weekdays	0	11	0	42	28	49	47	70	0	0	247	13
June Weekends	36	60	84	21	0	12	12	0	0	0	225	11
Total	248	227	264	270	323	200	325	114	0	0	1,971	100
Percent of Pressure	13	12	13	14	16	10	16	6	0	0	100	-
<u>Anna Lake</u>												
Opening Weekend	4	4	0	8	0	0	8	6	0	0	30	11
May Weekdays	0	0	40	0	0	7	13	40	0	0	100	37
May Weekends	0	0	0	0	13.5	13.5	0	0	9	0	36	13
June Weekdays	0	0	0	0	0	0	0	9	0	0	9	3
June Weekends	0	0	0	0	0	0	24	72	0	0	96	36
Total	4	4	40	8	13.5	20.5	45	127	9	0	271	100
Percent of Pressure	1.5	1.5	15.0	3.0	5.0	7.5	16.5	47.0	3.0	0	100	-

Little fishing occurred after 9 p.m. on Montgomery and Sand Lakes. Most pressure was distributed evenly throughout the rest of the day. Anna Lake showed a different pattern. The little pressure it received occurred in the early evening.

Total weekend fishing pressure on Montgomery and Sand Lakes was much higher than total weekday fishing pressure on all lakes during the study period. May weekends on Sand Lake averaged 63.0 angler-hours per day, but June weekends dropped to 38.0 angler-hours per day. The average weekday pressure on Sand Lake was 26.0 angler hours per day in May and 18.0 angler-hours per day in June. Montgomery Lake had an average weekend daily pressure of 51.0 and 17.0 angler-hours per day for May and June, respectively. The weekday pressure on Montgomery Lake was 17.0 and 10.0 angler-hours per day for May and June, respectively. Pressure on Anna Lake was too low to see any trends in daily fishing intensity.

Catch and Harvest Rates

Montgomery Lake

An estimated 913 brook trout were caught in Montgomery Lake during the census period. All fish were from the 1976 spring plant of 2,000 brook trout yearlings. The season's opening weekend accounted for 48 percent of the harvest, while the remainder of the fish were taken during the rest of May. No trout were known to be caught in June. This is a return of 46 percent from the 1976 spring plant, assuming that no other fish were harvested during the remainder of the season.

The length of the trout caught in Montgomery Lake ranged from 7.2 inches to 11.9 inches, with a 9.0-inch average. Weight ranged from 40.0 to 280.0 grams, with a 110.0-gram average. An estimated 221 pounds were harvested, which is a 37 percent return of the weight stocked.

The overall catch rate on Montgomery Lake was 0.584 trout per hour. Little difference was seen in the catch rates of anglers fishing from shore and from boats, but the overall catch rate did decline steadily as the season progressed (Table 5).

Based on interview data from completed trips, 43.0 percent of those fishing Montgomery Lake caught no trout. Thirty-two percent of Montgomery Lake anglers caught the limit of 5. The limit was changed to 10 fish on June 1; however, no trout were caught after this date.

Anglers made 570 trips to Montgomery Lake during the census period. An average of 1.6 trout were taken per trip. The average trip length on opening weekend was 2.44 hours. It rose to 2.94 hours in May and dropped to 2.00 hours in June. The overall average was 2.62 hours.

Table 6 shows the types of bait used by anglers on Montgomery and Sand Lakes. Most trout were taken with live bait. Worms were most common, but minnows were most successful.

Most anglers fishing Montgomery Lake were fishing for trout. The few warmwater fish taken were incidental. No catch rates or harvest estimates were made for these other species.

Sand Lake

During the census period, 642 brook trout were taken from Sand Lake. All but 7 of these fish were from the 1976 plant; these 7 were from the 1976 stocking. The harvest in Sand Lake was spread more evenly over the entire census period than the Montgomery Lake harvest. Twenty-two percent of the harvest was taken on opening weekend, 47 percent during the rest of May, and the remaining 31 percent in June. This is a return of 32 percent of the 1976 plant over the first 2 months of the season. Survival to July 1, however, appeared to be much better than in Montgomery Lake, with some carryover of the previous year's stocking.

The average length of the yearling trout caught in Sand Lake was 10.1 inches. The average weight was 194.0 grams. The age II carryovers had an average length of 16.5 inches and an average weight of 875.0 grams. Growth of trout could be seen even during the relatively short census period. Fish length ranged from 7.5 inches to 17.4 inches, and fish weight ranged from 60.0 grams to 1,040.0 grams. Two hundred eighty-five pounds of trout were harvested during the first 2 months of the season. Trout planted in the spring of 1976 accounted for 271.5 pounds, a return of 45 percent of the weight stocked.

The overall catch rate on Sand Lake was 0.326 trout per hour. There was no evidence of a decline in the catch rate as the season progressed. Anglers in boats (0.39 trout per hour) fared better than those fishing from shore (0.30 trout per hour) (Table 5).

Based on interview data from completed trips, 64.0 percent of the Sand Lake anglers caught no trout. Only 7.5 percent of the fishermen caught the limit of 5 trout. After the bag limit went up to 10 fish on 1 June, only one limit was taken.

TABLE 7. Summary of creel census statistics from 1 May-20 June 1976, Florence County, Wisconsin.

Characteristic	Sand Lake	Montgomery Lake	Anna Lake
No. acres	22	23	36
Maximum depth (feet)	28	27	61
Total fishing pressure (angler-hours)	1,972	1,564	271
Angler-hours/acre	89.6	68.0	7.5
No. trout stocked, spring 1976	2,000	2,000	1,000
No. trout harvested (total)	642	913	*
No trout harvested from spring 1976 plant	635	913	*
No. trout harvested per hour	0.326	0.584	*
No. trout harvested per acre	29	40	*
Total no. pounds harvested	285	221	*
No. pounds harvested per acre	12.95	9.6	*
Avg. weight of trout (grams)	194	110	*
Avg. length of trout (inches)	10.1	9.0	*
No. trips	671	570	*
Avg. no. trips/angler	1.27	1.25	*
Avg. no. trout/trip	0.957	1.6	*
Cost/pound to stock with trout	\$2.32***	\$2.32***	\$1.22****
Total cost to stock with trout	\$1,392	\$1,392	\$220

* Not determined; sample too small.

** One gram = 0.035 ounce.

*** Cost for brook trout (1974-75 figures).

**** Cost for rainbow trout (1974-75 figures).

TABLE 8. Condition factor (K*) of brook trout caught by anglers in Sand and Montgomery Lakes, Florence County, Wisconsin, 1976.

Size Range (inches)	Condition Factor	
	Sand	Montgomery
7.0 - 7.4	--	0.88
7.5 - 7.9	1.00	0.82
8.0 - 8.4	1.07	0.92
8.5 - 8.9	1.14	0.92
9.0 - 9.4	1.08	0.91
9.5 - 9.9	1.09	0.87
10.0 - 10.4	1.12	0.90
10.5 - 10.9	1.12	0.96
11.0 - 11.4	1.14	0.89
11.5 - 11.9	1.13	--
12.0 - 12.4	1.13	--

$$*K = \frac{W10^5}{L^3} \text{ where}$$

W = weight in grams

L = length in millimeters

10⁵ = a factor to bring the value of K near unity.

CONCLUSIONS AND MANAGEMENT RECOMMENDATIONS

Because almost half of last year's catch from Montgomery Lake was taken on opening weekend, it is recommended that the stocking quota on Montgomery Lake be reduced to 1,000 brook trout holdovers, followed by a documentation of fishing success through a creel census on opening weekend. This is a relatively inexpensive way to check the effect of the reduced stocking quota on the harvest. If the cost-benefit ratio is not improved, Montgomery Lake should be dropped from future trout-stocking quotas.

A mixed plant of 1,000 fingerling brook trout in Sand Lake in the fall and 1,000 holdover brook trout the following spring is also recommended. These fish should be differentially finclipped so that their relative importance can be assessed in the catch. Because of the good growth of trout in Sand Lake, the use of fingerlings may be a less expensive method than the present one of managing the lake. The fingerling plant should be made as late in the fall as possible to avoid avian predation, which has been a problem in other managed trout lakes (Johnson and Hasler 1954; Alexander and Shetter 1969).

One may suspect that with 250 angler-hours per acre per season on Sand Lake, the quality of the fishery would be degraded. However, catch rates are comparable to those of other lakes throughout the state and the Midwest. Brook trout taken are in excellent condition and, with the exception of opening weekend, angling pressure is fairly evenly distributed throughout the season, so there is little overcrowding.

Anna Lake does not appear to receive the pressure found on the other 2 study lakes. This conclusion could be erroneous, however, because pressure may take place later in the season. Tagging a portion of the plant may provide a better idea of the trout harvest. If there is still a poor return, stocking and management for trout should be discontinued.

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APPENDIX. Fishing pressure and catch rates for brook and rainbow trout from various trout lakes in Wisconsin and adjacent states.

Lake	Location	Size (acres)	Year*	Pressure**	Trout/hr		Reference
					Brook	Rainbow	
Ament	Lincoln Co., Wis.	12	1975	207	.21	.26	L. M. Andrews, unpublished data
Anna Devil's	Florence Co., Wis.	36	1976	7.5+	--	--	Present Study
	Sauk Co., Wis.	357	1968	95	--	--	Brynildson et al. 1970
Dorothy	Oneida Co., Wis.++	96	1969	139	--	.13+++	"
			1976	31	.44	.22	R. Jesien, unpublished data
Montgomery Moraine	Florence Co., Wis.	23	1976	68+	.58	--	Present Study
	Lincoln Co., Wis.	10	1975	286	--	.14	L. M. Andrews, unpublished data
Nebish	Vilas Co., Wis.	91	1968	59	--	.43	Brynildson and Kempinger 1973
Sand Six Wisconsin spring ponds	Florence Co., Wis.	22	1976	90+	.33	--	Present Study
	Langlade Co., Wis.	.75-6	1969-70 average	39-498	--	--	Carline 1973
Sunset	Portage Co., Wis.	63	1975	131	--	.17	R. Jesien, unpublished data
Tahoe	Lincoln Co., Wis.	7	1975	203	.30	--	L. M. Andrews, unpublished data
Thomas	Portage Co., Wis.++	42	1976	171	--	.27	R. Jesien, unpublished data
Weber	Vilas Co., Wis.	11	1947	74	--	.06+++	Burdick and Cooper 1956
			1948	155			"
			1949	226			"
			1950	147			"
			1951	200			"
			1952	164			"
Airport	Upper Michigan	7	1959-61 average	199	.22	--	Galbraith 1963
Benson	Minnesota	20	1961-63 average	90	.10	--	Micklus and Johnson 1962
Divide	Minnesota	65	1961-63 average	48	.12	.06	Micklus and Johnson 1962
East Fish	Lower Michigan	16	1959	75	--	--	Alexander and Shetter 1969
Kimball	Minnesota	79	1963	130			"
			1961-63 average	65	--	.24	Micklus and Johnson 1962
Moccasin	Upper Michigan	6	1956-61 average	343	.37	--	Galbraith 1963
Pleasant	Minnesota	22	1961-64 average	223	--	.14	Micklus and Johnson 1962
Surber	Minnesota	7	1961-63 average	167	.25	--	Micklus and Johnson 1962
Swanzy	Upper Michigan	20	1959-60 average	127	.17	--	Galbraith 1963
Willard	Minnesota	7	1961-63 average	469	--	.33	Micklus and Johnson 1962

* When pressure was measured.

** Measured in angler-hours/acre/season.

+ Covers only first 2 months of trout season.

++ Covers only first month of trout season.

+++ Average of all years.

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