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CHARACTERISTICS OF THE SPORT FISHERY IN SOME NORTHERN WISCONSIN LAKES

TECHNICAL BULLETIN NUMBER 32
Wisconsin Conservation Department
Madison, Wisconsin
1964

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**CHARACTERISTICS OF THE SPORT FISHERY IN
SOME NORTHERN WISCONSIN LAKES**

By

Warren Churchill and Howard Snow
Fishery Biologists

TECHNICAL BULLETIN NUMBER 32
Wisconsin Conservation Department
Madison, Wisconsin 53701
1964

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At Five Lakes, Oliver Baccus, William Morrison, Daniel Folz, William DeWitt and C. B. Jorgensen.

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Edited by Ruth L. Hine

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WISCONSIN CONSERVATION
DEPARTMENT

FIVE LAKES →

EXPERIMENTAL FISHING PROJECT
NO SIZE OR BAG LIMIT OR CLOSED
SEASON ON THESE LAKES

ESCANABA

**PALLETTE
MYSTERY**

**NEBISH
SPRUCE**

A SPECIAL PERMIT IS REQUIRED
TO FISH IN ANY OF THESE LAKES
GET PERMITS AT STATION ON
ESCANABA LAKE

INTRODUCTION

This paper summarizes certain information on the fisheries of two research projects on waters of northern Wisconsin. These projects, Five Lakes and Murphy Flowage, were established in 1946 and 1955, respectively, to study fish populations and the effect on them of various management procedures. This led to a study of angling practices and variations in fishing pressure and success that might influence the results of management. In view of the importance of the sport fishery in northern Wisconsin, it was felt that this information would also be of interest to all who are connected with the tourist industry and recreational planning.

The habits of anglers have not been as thoroughly studied as have those of their prey. Most of the published information on anglers and such consists of studies of the economic aspects of fishing, such as the National Survey sponsored by the U.S. Fish and Wildlife Service (USDI, 1960) and those by Fine and Werner (1960) and Scheftel (1958). Other information scattered through the literature, was collected in fragments incidental to creel censuses conducted for other purposes. Exceptions are the studies by McFadden (1956) of angler characteristics on a Wisconsin trout stream, and Eschmeyer's reports (1935 and 1936) on a Michigan lake.

The data discussed here were obtained by a complete creel census conducted by the use of compulsory fishing permits. Details of the procedure are given in Appendix A. The waters censused were under experimental management with no size, bag or season restrictions. This report covers the fishing years 1957-1961, actually the period from April 1957 to April 1962.

No attempt is made to compare such statistics as fishing pressure and harvest with those reported for other waters by numerous investigators. This type of information has been or will be published elsewhere.¹ Neither is this report comparable, in most respects, to the 1960 National Survey of Fishing and Hunting sponsored by the Fish and Wildlife Service. The latter was made by sampling the entire population and regards the angler as a component of that population. This paper is concerned only with the anglers on a specified group of waters, and these are treated as a separate population. Moreover, anglers of all ages are considered here, while the National Survey deals only with those over 12 years old.

It is the purpose of this report to point out both the similarities and the differences between the fisheries of the two study areas. Both are located in the northern zone of Wisconsin, in regions where the vacation industry makes up an important part of the economy. Taken to-

¹ A list of publications dealing with these projects is furnished in Appendix D.

gether, they present an estimate of average fishing conditions in this region. Differences are due in part to physical and biological characteristics of the waters and in part to the cultural features of the surrounding areas. A comparison of the fishing at the two locations illustrates the effect of these environmental characters on the nature of a fishery.

THE STUDY AREAS

The locations of both areas, and their relation to the distribution of the permanent population of the state are shown in Figure 1. Characteristics of the surrounding counties, which ultimately determine the characteristics of the respective fisheries, are summarized in the accompanying table.

Five Lakes

The Five Lakes project is located in central Vilas County, in typical northwoods vacation country. The land in this region is not suitable for farming. The permanent population is sparse and dependent to a great extent on the tourist and vacation industry. There is a large transient population in the summer, made up of tourists who stay at resorts for a week or two at a time and summer residents who own or rent cottages. Lakes of all kinds and sizes are abundant in this region, so that the angler has a wide choice of fishing water within easy reach. As a result, few lakes are subject to heavy fishing pressure.

The Five Lakes differ among themselves and are typical of various types of lakes found in this area. Escanaba is the largest, and sustains 87 percent of the fishing pressure. It has an area of 293 acres and a maximum depth of 25 feet. The shoreline is very irregular and there are several islands and shallow rock bars. Vegetation is abundant in the shallow areas. These are all factors which make for high productivity, within the limits imposed by fertility of the drainage area. The population includes almost all species of warm-water fish native to this area. The most prominent species in the catch are walleye, northern pike¹, perch, and pumpkinseed.

The other lakes are less productive and less heavily fished. Palette and Nebish are deep lakes with clear, soft water, producing mainly bass of both species and panfish. Mystery and Spruce are small bog lakes with limited populations of largemouth bass, panfish, and northern pike.²

¹ Northern pike have been prominent in the population and in the catch only in recent years.

² Mystery and Spruce lakes were treated with rotenone in July, 1960 to remove the existing population, and were then restocked with northern pike and largemouth bass.

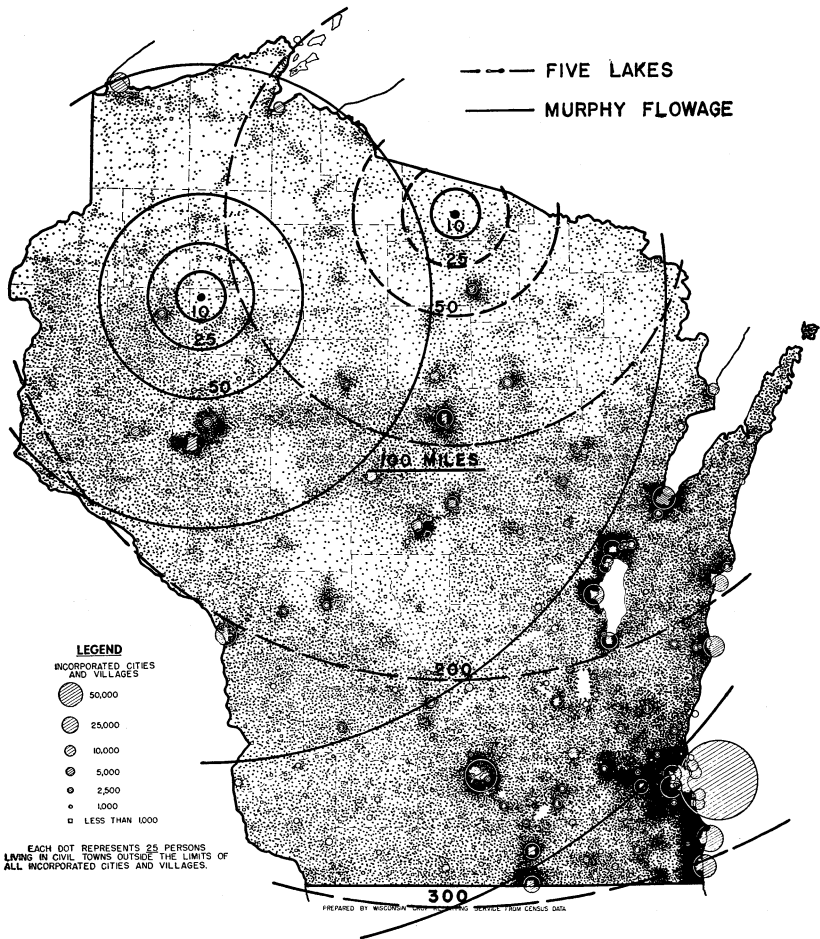


Figure 1. Distribution of Wisconsin population in relation to the location of Murphy Flowage and the Five Lakes.

Murphy Flowage

Murphy Flowage is located in northwestern Wisconsin in Rusk County. The flowage is within a region known as the Barron Hills. This area is quite hilly and rocky country covering an area about 28 miles in length and up to 10 miles in width. The most advantageous land use appears to be forestry; however, there is also some farm use within a few miles. The underlying soil is reddish in color and quite high in clay content.

The stream impounded, Hemlock Creek, had a previous history as a trout stream. In 1933 Murphy Flowage was created and a park with camping facilities was built by Rusk County. Although the maximum

Comparison of the Five Lakes and Murphy Flowage
Research Areas and their surroundings

Feature	Five Lakes	Murphy Flowage
Water area	Five lakes, 590 acres (Escanaba Lake, 293 acres)	One lake, 180 acres
Fish species	Walleye Muskellunge Northern pike Largemouth bass Smallmouth bass Panfish	Northern pike Muskellunge Largemouth bass Panfish
Region	North central Wisconsin	Northwestern Wisconsin
County	Vilas	Rusk
Lakes in county	520 lakes 88,000 acres	59 lakes 6,600 acres
Permanent population	9,800	16,400
Principal occupation	Vacation and tourist industries	Farming
Percent farmers	9	54

water depth is 14 feet, over 70 percent of the flowage is less than 10 feet in depth. The flowage covers 180 acres and has 6½ miles of very irregular shoreline and several islands. These factors make for relatively high productivity for northwestern Wisconsin. The fish population includes almost all species of warm-water fish native to this area with the exception of the walleye and smallmouth bass. The most common species in the catch are bluegill, northern pike and largemouth bass. Several other species of panfish are taken in about equal numbers.

There are very few permanent residents living near the flowage, but there are several cities and towns within a 35-mile radius. Many of these towns, especially southeast of the flowage, have very few lakes and flowages nearby. Consequently anglers do not have as wide a choice of fishing water as in many other areas of Wisconsin.

Murphy Flowage is not in the center of any extensive tourist area. The tourist activity is not nearly as concentrated in northwestern Wisconsin, such as it is in north central Wisconsin, the area in which the Five Lakes Project is located.

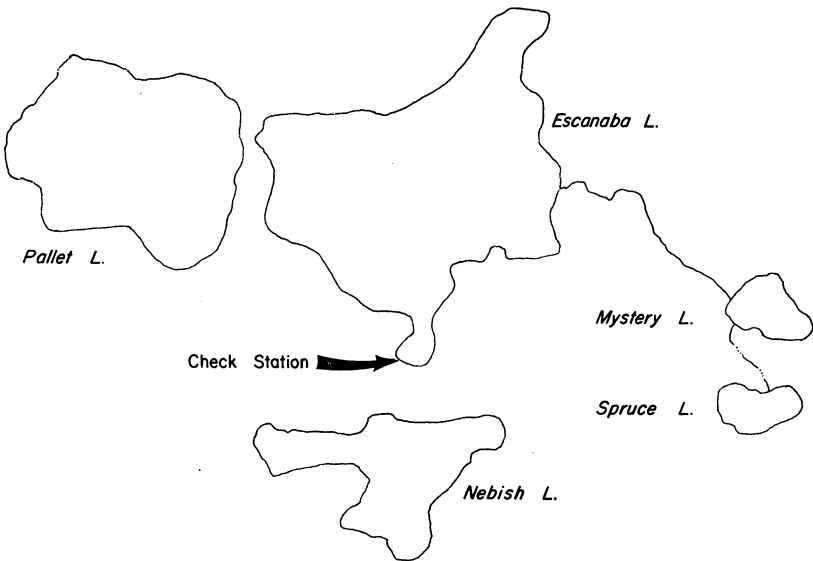
MURPHY FLOWAGE

(Rusk County)



FIVE LAKES

(Vilas County)



THE ANGLERS

During the five years covered by this report, 55,127 fishing trips were made on waters of the two study areas. Since many people fished more than once, the number of individual anglers was less than this by an unknown amount. For the purpose of this report, each fishing trip is regarded as an individual; "angler" means "angling trip."

Age and Sex

Data on age and sex are available only for the years 1958-61 (Table



The boat landing at Escanaba Lake.

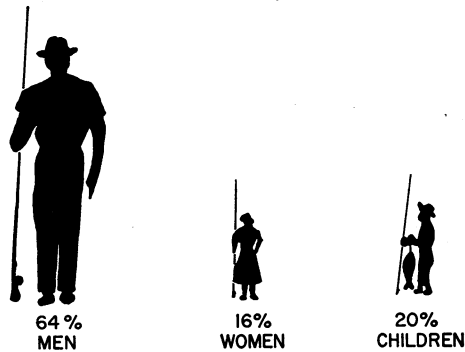
1).¹ During this time, 64 percent of all anglers were men, 16 percent were women and 20 percent were children under 16 years, the age at which a fishing license is required (Fig. 2). Twenty-one percent of the total, young and old, were female.

The percentage of women and children was higher in summer (18 and 21 percent respectively) than in winter. These results are comparable to those of Eschmeyer (1935) who found 23.5 percent female anglers on Fife Lake, Michigan, and Chapman (1954) who reported 66 percent men, 20 percent women and 14 percent children fishing on Sandusky Bay, Ohio.

Anglers over 65 years old made up 4 percent of the total. The proportion was higher on Murphy Flowage (7 percent) than on the Five Lakes (2 percent). It was also higher in winter than in summer and this difference was much greater on Murphy Flowage. This may reflect an actual difference in the local populations. It may also be explained by the greater accessibility of Murphy Flowage to population centers, and the fact that ice fishermen there could drive out on the ice, which was usually not feasible at Escanaba. As will be discussed below, most of the winter fishermen on Escanaba came from a

¹ All numbered tables will be found in Appendix B.

WHO FISHED ?



ESCANABA LAKE AND MURPHY FLOWAGE

Figure 2. Almost $\frac{2}{3}$ of all anglers are men. "Children" here means anyone under 16.

considerable distance; this, in addition to a half-mile walk across the ice to the fishing spots, may have discouraged some of the more elderly.

Residence and Distance Travelled

Two-thirds of the Five Lakes anglers and four-fifths of the Murphy Flowage anglers were from Wisconsin. On the Five Lakes one-quarter of the anglers, or three-fourths of the non-residents, were from Illinois whereas on Murphy Flowage one-tenth of the total anglers or one-half of the total non-residents were from Illinois. Numerous other states were represented by small percentages of anglers. Non-residents made a negligible contribution to the pressure in winter on both lakes.

About one-third of all fishing licenses sold in Wisconsin are bought by non-residents. Lacking definite data, it is a reasonable assumption that residents fish more than non-residents and hence do more than two-thirds of the fishing. Distribution of non-residents among the various states differed between the two areas, and both differed from that reported by Fine and Werner (1960) in a statewide survey.

Eschmeyer (1936) found that 35 percent of the anglers on a northern Michigan lake were from outside the state. About half of these came from Ohio, and only 18 percent of them from Illinois.

Local anglers, here defined as those living within 50 miles of the lake fished, accounted for 51 percent of the fishing on Murphy Flowage, but only 9 percent of that on the Five Lakes area (Fig. 3 and Table 2). This is partly due to the lower population density in Vilas County, and partly to the wide variety of fishing water available to local residents.

Among anglers from farther away, actual distance travelled is

Percent of Non-Resident Anglers Coming From:

	State <hr style="width: 100%; border: none; border-top: 1px solid black; margin-bottom: 5px;"/> (Fine and Werner)	Five Lakes	Murphy Flowage
Illinois	68	75	52
Minnesota	20	1	12
Iowa	3	2	6
Michigan	3	1	2
Indiana	2	9	19
Ohio	1	5	2
Other	3	7	7
Percent of anglers from out of state		33	21

determined by the population patterns (Fig. 1). The unequal distribution in Table 2 is merely a reflection of the distances of major population centers from the fishing areas.

Time of Fishing

Over half (55%) of the angling trips were made in the short time between June 30 and September 15, the period designated as summer in this report. Another 26 percent were made in spring, 5 percent in fall, and 14 percent in winter (Table 3). This disproportion was somewhat less extreme on Murphy Flowage, where a larger proportion of local anglers resulted in more off-season fishing (Fig. 4). On the other hand, distribution of fishing pressure through the week was more even on the Five Lakes, where a large proportion of the anglers were vacation visitors spending a week or more in the area (Fig. 5; Table 4). These people usually travel on week ends and do their fishing during the week, thus tending to balance the week-end anglers from near at hand.

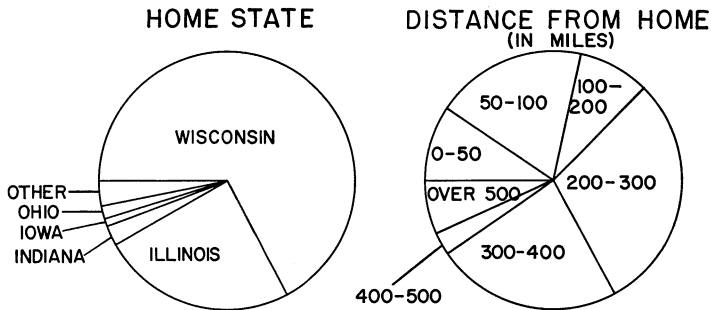
Cope (1957) found this same distribution pattern in the fishing pressure on Yellowstone Lake, Wyoming. He refers to it as a "resort" situation and contrasts it with the more usual situation where fishing pressure is high on week ends. The latter is characteristic of the winter fishing at both Murphy Flowage and Five Lakes.

Percent of Fishing Occurring on Week Ends

	Summer <hr style="width: 100%; border: none; border-top: 1px solid black; margin-bottom: 5px;"/>	Winter <hr style="width: 100%; border: none; border-top: 1px solid black; margin-bottom: 5px;"/>
Five Lakes	32	64
Murphy Flowage	46	51

WHERE DID THEY COME FROM ?

ESCANABA LAKE



MURPHY FLOWAGE

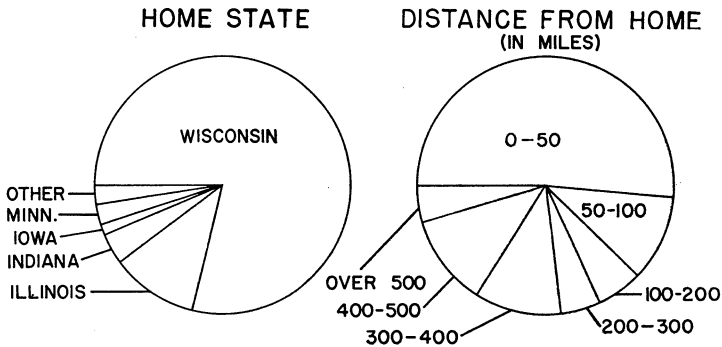


Figure 3. Half the anglers fishing Murphy Flowage were local people, living within 50 miles. Most anglers on Escanaba were vacationers from farther away. Anglers from the Milwaukee and Chicago areas are well represented on each lake, but more so on Escanaba Lake than Murphy Flowage.

Diurnal distribution of fishing pressure is almost identical in both areas in summer (Fig. 6). In winter, fishing begins and ends later in the day on Escanaba Lake because walleye fishing is considered best in the evening.

The data in Figure 6 were calculated by two-hour intervals which tends to conceal minor variations in fishing pressure. Also, all time spent on the lake was considered as fishing time, even though many anglers carried a lunch and took time out to eat it. A more refined set of data would probably show a short decrease in fishing activity at meal times resulting in a bimodal or even trimodal curve as reported by other investigators (Eschmeyer, 1935 and Cope, 1957).

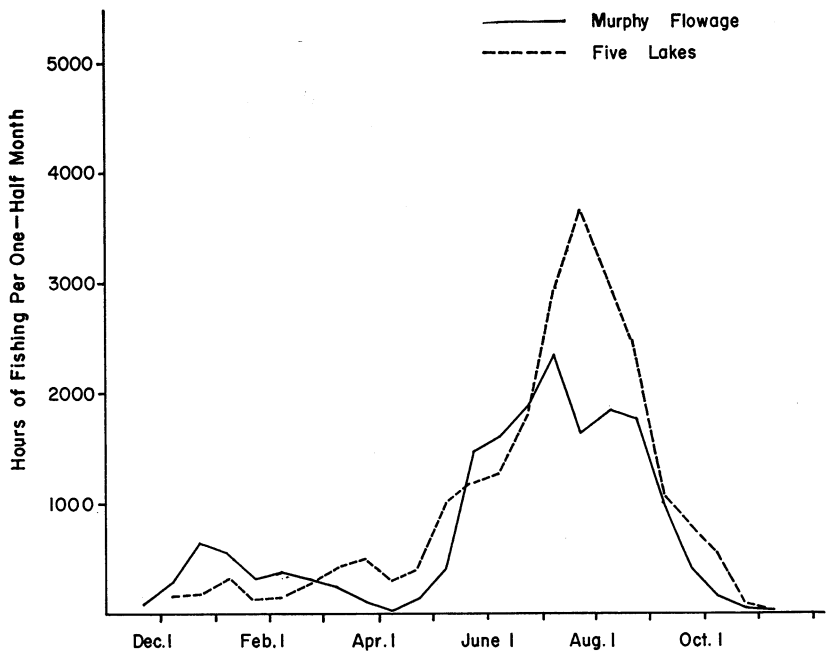


Figure 4. Seasonal distribution of fishing pressure on the Five Lakes project and Murphy Flowage, 1957-61.

WHEN DID THEY FISH?

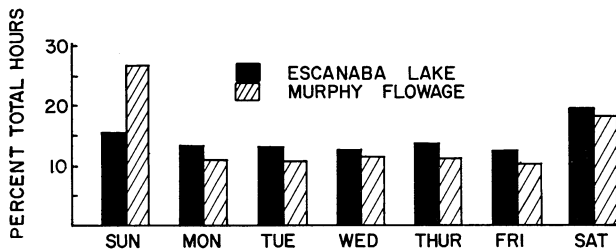


Figure 5. Distribution of fishing pressure through the week on Murphy Flowage and Escanaba Lake.

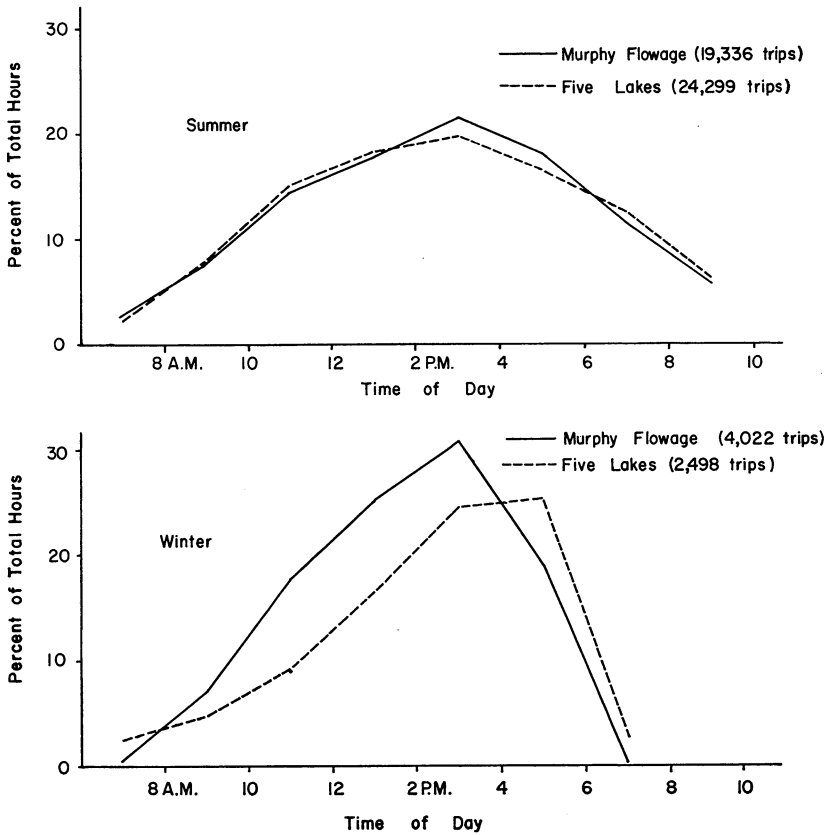


Figure 6. Diurnal distribution of fishing pressure on the Five Lakes and Murphy Flowage, 1957-61.

Length of Trip

The average angler in the open-water season fished 3.8 hours at Murphy Flowage. Boat fishermen, who made up 78 percent of the total averaged 4.2 hours per trip, while bank fishermen averaged only 2.4 hours. Most open-water fishing on the Five Lakes was done from boats, and the average trip was 4.2 hours. Ice fishermen fished 4.7 hours on the Five Lakes and 3.5 on Murphy Flowage. The difference is probably due to the fact that the average ice angler at Five Lakes had travelled farther and wanted to make his trip worthwhile. Similarly, the boat angler had invested more time and money in his trip than the bank angler, and might have been more reluctant to quit. Moreover, the boat angler can change his location more easily than the bank angler and so is less likely to lose interest.

This difference between boat and bank anglers was observed by

Moyle and Franklin (1957) on 12 Minnesota lakes. Eschmeyer, making no distinction between boat and bank anglers found that anglers fished longer in winter. In general, other investigators report shorter average fishing trips than occurred on these Wisconsin lakes.

	Average Length of Fishing Trip in Hours			Ice Fishing
	Open-Water Fishing		Total	
	From boat	From bank		
Murphy Flowage	4.2	2.4	3.8	3.5
Five Lakes	4.2	—	4.2	4.7
Fife Lake (Eschmeyer)	—	—	2.6	4.5
Minnesota Lakes (Moyle & Franklin)	3.0	1.4	—	3.1

THE HARVEST

Size and Composition

During the five-year period, the total harvest from Murphy Flowage and Escanaba Lake¹ was 369,000 fish, or about 150 fish per acre per year.

Season	Seasonal Distribution of the Catch		
	Thousands of Fish		
	Escanaba	Murphy	Total
Spring	45	56	101
Summer	113	67	180
Fall	8	6	14
Winter	13	61	74
Total	179	190	369

This distribution, of course, is related to fishing pressure, and reflects the differences already mentioned between the lakes. One additional difference, the disproportionately larger winter harvest on Murphy Flowage, is due to the nature of the fish populations. The most abundant fish in Murphy Flowage is the bluegill, which bites readily in winter, while the predominant species in Escanaba is the pumpkinseed which seldom is taken through the ice.

¹ The harvest from Escanaba Lake makes up 87 percent of the total from the Five Lakes project. For convenience, the harvest from the other four lakes is not considered in this section.



A good day on Murphy Flowage. Ice fishing is more attractive when you can drive right up to the fishing hole.

Most of the harvest from both lakes consisted of panfish, mainly perch, bluegill and pumpkinseed.

The higher percentage of gamefish in Escanaba is due to the greater variety of game species present, particularly a heavily exploited walleye population. The composition and distribution of the harvest is presented in Figure 7 and in detail in Table 5 of Appendix B.

Proportions of Game and Panfish

	Murphy	Escanaba	Total
Game Species	3%	9%	6%
Panfish	97%	91%	94%

Distribution Among Anglers

Percent success, as used here, means the percent of anglers in any category who caught one or more fish. The over-all rate of success on both areas was about 70 percent. The average catch for all anglers was 6.7 fish per trip. Individual catches ranged from 0, scored by 30 percent of the anglers, to over 100 in a few highly successful cases. The average for all anglers who caught any fish was 9.6 per trip. The largest single catch recorded was 272 from Murphy Flowage.

The great variation in success is not due entirely to luck or skill. Both lakes contain several species of panfish that are rather easily caught, even by amateurs. The unsuccessful angler is usually one who has confined himself to gear suitable only for the larger game species and ignored the easier harvest. The one- and two-fish catches are often northern pike, bass or walleye that the possessor considers more desirable than a long string of panfish. The number of fish caught is not necessarily a measure of success.

Fishing success and average catch were higher on Escanaba in the summer and on Murphy in the winter.

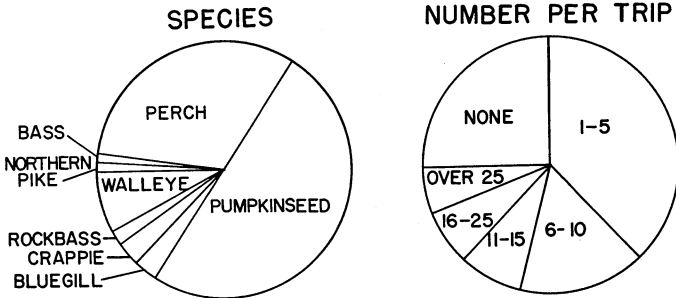
Fishing Success

	Percent Success	Average Catch (Fish per trip)
Open water		
Escanaba	74	6.8
Murphy	66	6.7
Ice fishing		
Escanaba	72	5.2
Murphy	75	15.2

A certain amount of inaccuracy is unavoidable in recording individual catches. More often than not, all anglers in a boat pooled their catch and were frequently unable to remember, when reporting, just what each one caught. In such cases the catch was recorded as being divided equally between all members of the party. Since this was especially true of family parties, no attempt is made here to compare the

WHAT DID THEY CATCH ?

ESCANABA LAKE



MURPHY FLOWAGE

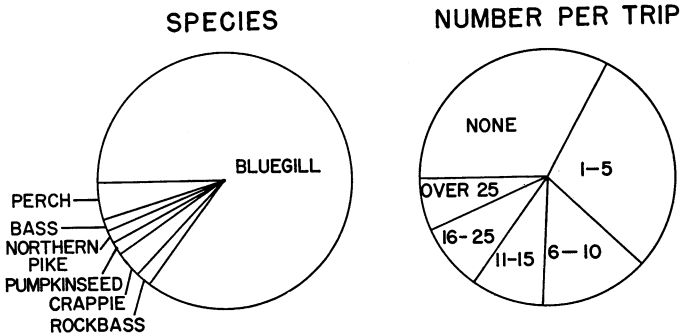


Figure 7. More than 90 percent of the catch on both lakes was panfish. Almost three anglers out of four caught one or more fish. Few anglers caught more than 25 panfish and still fewer caught more than the normal bag limits on game fish.

catches of men, women and children. Some very large and some zero catches may be concealed in this way. The application of these findings to other waters or to regulations is not affected, since this pooling of the catch is accepted practice among anglers, especially where bag limits are involved.

Only 16 percent of all anglers caught more than 15 fish on Murphy Flowage. This minority accounted for 65 percent of the total catch; however, there was considerable seasonal difference. Anglers catching over 15 fish accounted for 31 percent of the trips and 83 percent of the fish in winter. In summer they made 13 percent of the trips and caught

56 percent of the fish. In winter the total harvest was more evenly distributed among the anglers than in summer. A similar situation prevailed at the Five Lakes. Generally the most successful 10 percent of the anglers caught about 50 percent of the fish. This is illustrated in Figure 8, where percentage of trips, starting with the most successful, is plotted against percentage of catch. That is, if all catches could be arranged in order of size, starting with the largest, the first, or largest, 10 percent of the catches would include 50 percent of all fish caught. The next 10 percent of catches would include about another 20 percent of the fish and so on to the last 30 percent of anglers, who caught no fish.

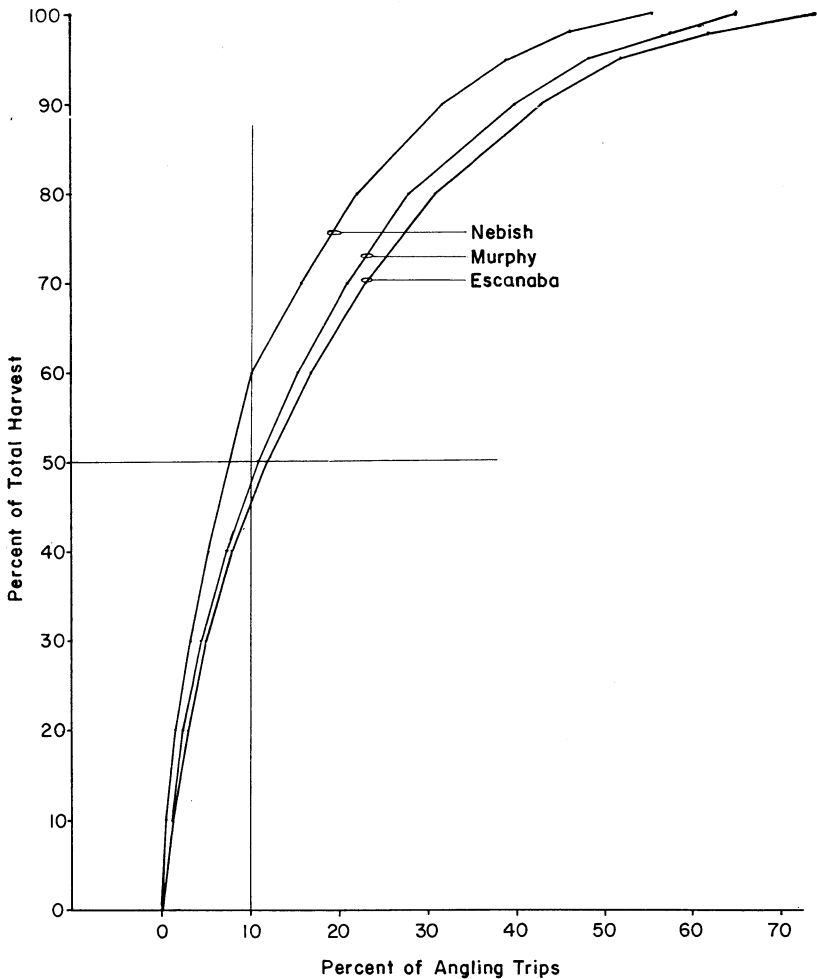


Figure 8. Distribution of the catch among anglers.

This extreme inequality of the catch seems to be characteristic of the sport fishery on most waters (McFadden, 1958, Wales & German, 1956). Some reasons for it will be discussed later. The fact that it exists leads to the much-disputed question of the efficacy and desirability of bag limits. There has been no restriction on the catch of any species from the lakes since their establishment as research projects. At the present time there is elsewhere in Wisconsin a bag limit of five on most game fish and no limit on panfishes. Formerly, and during much of the time covered by this report, there was a bag limit of 25 of each species on panfish. Analysis of the unrestricted catch from the project lakes indicates that a bag limit would have had very little effect on the total harvest. With the exception of winter fishing for bluegills, which are exceedingly abundant in Murphy Flowage, not more than 15 percent of the catch of any species was taken in excess of the former bag limits. A detailed analysis of the size of individual catches appears in Table 6 of Appendix B.

In a study of the harvest from Escanaba Lake in an earlier period, Churchill (1957) concluded that a bag limit of 5, without other restrictions, would have reduced the total catch of walleye by 13 percent and that of smallmouth bass by 8 percent.

Frequency of Trips

Familiarity breeds success in fishing. The more often an angler fished Murphy Flowage the more successful he was.

All success information discussed elsewhere in this paper is based only on the number of fishing trips or group of trips, not on success of different individual anglers, or groups of individuals. At Murphy Flowage individual anglers were grouped according to the number of trips made during a season, the assumption being that anglers who fish more often are more proficient. This assumption is well supported by the data collected and is illustrated in Figure 9 and Table 7.

The maximum number of trips made by any one angler was 56 during the open-water seasons and 36 during the winter seasons. Only 23 percent of all anglers made more than one fishing trip in the open-water season while 28 percent did in the winter. Anglers fishing more than five times during the open-water season caught fish on 79 percent of their trips compared to 60 percent for anglers who fished only one time. In winter anglers who made more than five trips caught fish on 92 percent of their trips compared to 61 percent for anglers who fished only one time. Fishing success in catch-per-hour was also higher for anglers who fished the same water more often.

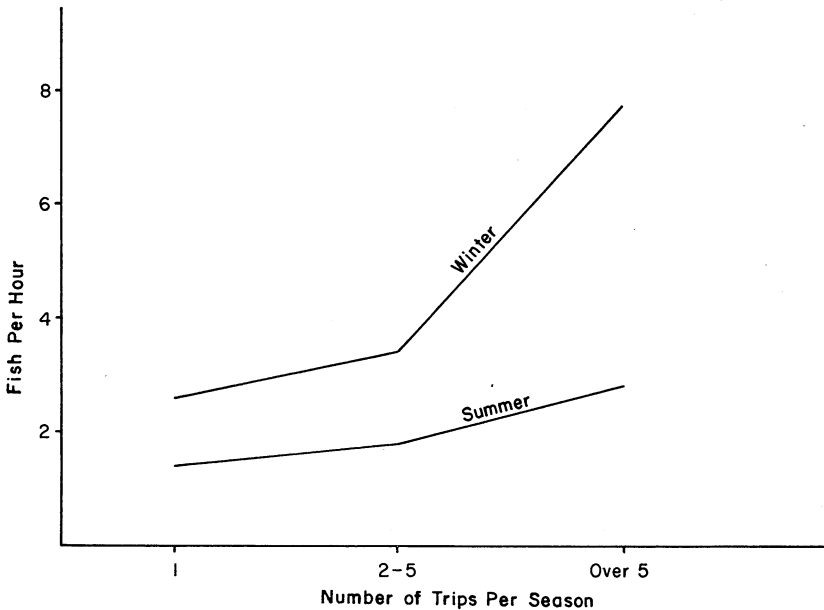


Figure 9. Catch rate of groups of anglers who made various numbers of trips to Murphy Flowage, 1957-61.

The maximum harvest during an open-water season was taken by a retired couple living about 50 miles from Murphy Flowage. They fished 22 times each and caught 1,714 panfish and 12 game fish. They averaged 7.1 fish per hour of effort and 78.5 fish per trip. Their efforts accounted for 1.3 percent of the total trips, 2.1 percent of the total hours, and 9.9 percent of the total number of fish caught. All their fishing was done from shore. The skill of the individual angler must be taken into consideration in evaluating some aspects of the fishery. In this case a comparison of boat and bank angling would be largely determined by the success of one fishing party.

Further evidence of the effect of experience on fishing success is furnished by the records of guided anglers on Escanaba Lake. During the summer and fall of 1961, separate records were kept of all fishing parties that included a licensed guide. These made up 8 percent of the fishing trips and caught 57 percent of all walleyes taken during this time. The average catch for guides and their patrons was 5.3 walleyes per trip. The average for unguided anglers who caught walleyes was 2.3 per trip, but the number who fished unsuccessfully for walleyes is not known. Lacking this information, it is still safe to assert that the success rate of guided walleye fishermen was at least three times that of unguided. Cope (1957) reports a similar disproportion among trout fishermen on Yellowstone Lake.

Fishing Site

During the five years of study, 78 percent of all anglers at Murphy Flowage fished from a boat, the remaining 22 percent from shore. Several interesting comparisons can be made. Only 53 percent of all bank anglers were successful compared to 69 percent of the boat anglers. Bank anglers fished 14 percent of the total hours and caught 16 percent of the panfish, but only 6 percent of all game fish. The average catch rate was 2.0 for bank anglers compared to 1.7 for boat anglers. Bank anglers are usually fishing for panfish and this is reflected in the higher catch rate for this group. Further details of boat and bank angling are illustrated in Table 8 in Appendix B.

Angling Methods and Baits

Inquiry into the methods and baits used by anglers revealed a strong inclination toward variety. About half the anglers on Murphy and a third of those on Escanaba reported using more than one method. Still fishing was by far the most popular technique on both lakes, with bait casting a rather poor second. Anglers who confined themselves to fly-casting, spinning and trolling, together accounted for only 4 percent of the total effort (Fig. 10 and Table 9).

Still fishing produced the highest percentage success on Escanaba Lake, and was exceeded in Murphy only by a few fly-casters. Trolling, though practiced by very few anglers, was the most successful method for game fish on Escanaba Lake. Fly fishing, also practiced by very few, was most successful for panfish on Murphy and only slightly less effective than still fishing on Escanaba.

Even more variety appears in the choice of baits. Since the question was usually answered before fishing, the answers reflected the intentions and desires of the anglers. More than half of those on Murphy, and a good percentage of those on Escanaba, expected to use both live and artificial baits on the same trip. These were fishermen that went out with an open mind to catch anything that might be biting.

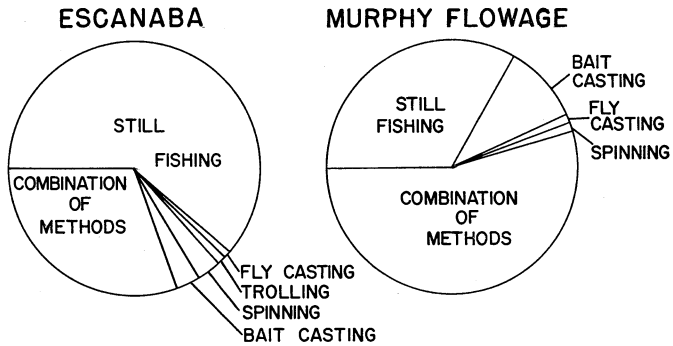
Among anglers who were more specific in their purpose, more than half on both lakes took worms for the capture of panfish. On Escanaba many of these carried minnows, which were seldom used on Murphy. About 15 percent of all Escanaba anglers used minnows only, indicating primary interest in game species though some panfish were also taken on minnows. Only a small percentage confined themselves to artificial baits.

As might be expected, minnows were the most successful bait for northern pike and walleye. Artificial baits were the most effective for bass and very successful for northern pike, though not for walleye.

In addition to recording the bait used on the fishing permit, infor-

HOW DID THEY FISH?

METHOD



BAIT

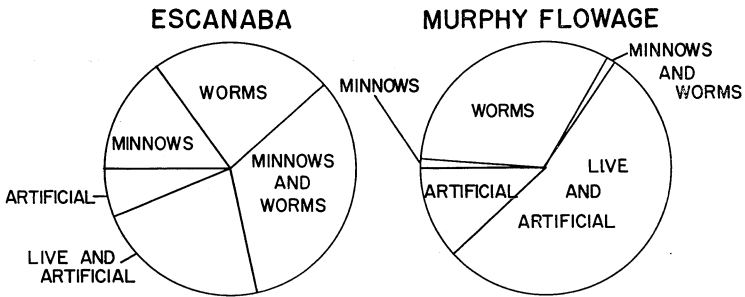


Figure 10. Fishermen like to mix their baits and their methods. However, on Escanaba Lake, which contains walleyes, anglers fished more with minnows and a cane pole than they did on Murphy Flowage. The angle worm is still the preferred bait on both lakes.

mation was also recorded on the actual bait game fish were caught on at Murphy Flowage (Table 12). Several interesting comparisons can be made. Sixty-six percent of all anglers used artificial bait (Table 10), while 66 percent of all northern pike and 72 percent of all bass were actually caught on artificial bait. There is a very close correlation between the bait recorded on an angler permit and the empirical data collected on the time each game fish was caught. However, the fact that 55 percent of all anglers used both live and artificial bait tends to make the success for game fish on the combination of live and artificial bait appear lower than it actually is (Table 10).

Thirty-four percent of all northern pike were caught on live bait compared to 28 percent of the largemouth bass. Of these, the majority

of the northern pike (29 percent) were caught on minnows while the majority of the largemouth bass (18 percent) were caught on worms. The main difference in the catch on artificial bait is the percentage taken on surface baits; 32 percent of all bass were caught on surface bait compared to 6 percent of the northern pike (Table 12). Anglers fishing Murphy Flowage have been most successful using spoons or spinners for northern pike and surface lures for largemouth bass.¹

The success rate of any particular group of anglers is related to their preference of bait and method and to the fish species present. This is why women and children, who normally prefer still fishing, have a higher success ratio than men on Escanaba Lake (Table 1), and also why men over 65 have a higher success rate than younger anglers on Murphy Flowage. In the same way, bait preferences of anglers from different localities result in a corresponding difference in the catch (Table 11).

Local anglers have habits and preferences different from those of the visiting fishermen. Residents of the vicinity of Escanaba Lake are mostly engaged in the tourist industry. Those that find time to fish in the summer season are usually acting as guides. They are after the "big ones," mostly walleye, and lean heavily toward the use of minnows. They catch fewer fish than others, but more game fish, especially walleyes.

At Murphy Flowage, local people are mostly farmers or townfolk from Rice Lake and Ladysmith. They are much more casual about their fishing and this is reflected in the heavy use of worms. They catch more panfish and consequently more total fish than others, but do no better than average on game species.

TIME OF CAPTURE

Season

It is proverbial among fishermen that fishing success is dependent in part on factors beyond the control of the angler. Even the most skillful sometimes return empty-handed. Since success depends on a voluntary action by the fish, it is affected by any external circumstances that modify his behavior. Analysis of the data from these projects show certain definite cyclical fluctuations in success that must be attributed to the seasonal or daily variation of environmental factors. Annual

¹ In 1960 at Murphy Flowage, 2 percent of all largemouth bass were taken on the artificial worm. In 1962 and 1963 this artificial bait took 20 percent and 26 percent respectively, accompanied by a decrease in the number taken on surface lures.

cycles of fishing success for various species in Escanaba Lake are illustrated in Figure 11. In this figure, the vertical scale (catch per trip) is different for each species to facilitate comparison of the curves.

Fishing success is usually expressed as catch per hour or per trip. This can be misleading in the case of a lake where a variety of species are fished by a variety of methods, since not all species are vulnerable to all anglers. Success for any species is better defined as catch per unit effort by anglers using methods appropriate to the species. Calculations in Figure 11 were based on the number of anglers in each period who were using bait suitable for a given species. "Combination" anglers were included in all calculations, with corresponding loss of precision.

Despite this difficulty, it is clear from the figure that the four species considered here differ in their vulnerability to angling according to a definite seasonal pattern which is different for each species. It is worth noting that three of the four species are least catchable during the summer season when fishing pressure is greatest. Also, northern pike are most vulnerable, and walleyes more so than average during the period from February 15 to early May, when the season on these species is closed elsewhere in Wisconsin.

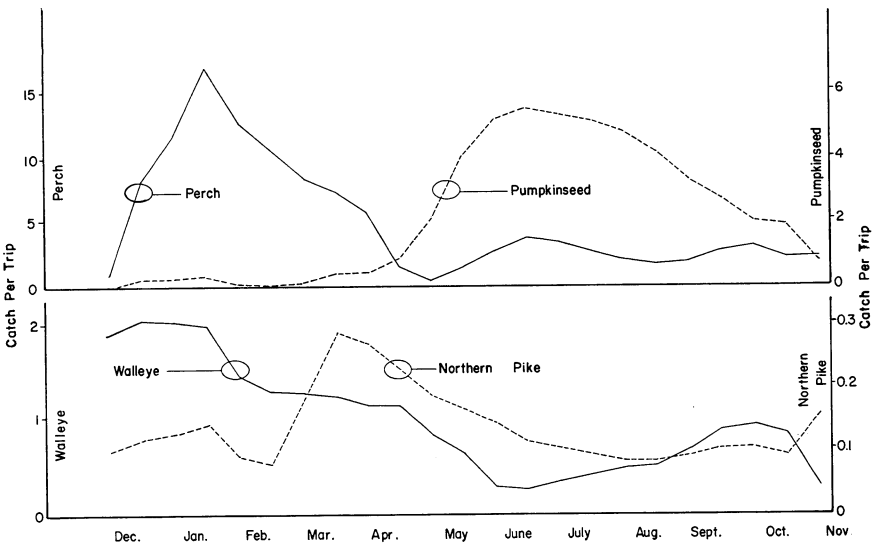


Figure 11. Seasonal variations in catch per trip, Escanaba Lake, 1957-64.

Time of Day

At Murphy Flowage the actual time of capture was recorded for largemouth bass from 1960-61 and for northern pike from 1956-62. Although the actual time was recorded in half-hour intervals, the data were summarized in two-hour time periods for this report. Machine tabulations of creel census data permit a comparison of the diurnal distribution of fishing pressure and time of capture of game fish during open-water fishing seasons (Fig. 12).

In proportion to the hours fished at Murphy Flowage, the most successful time of the day to catch largemouth bass is about 7:00 p.m., and for northern pike either 7:00 a.m. or 7:00 p.m. The time of capture of largemouth bass reached two peaks throughout the day; one between 8:00 and 10:00 a.m. when 14 percent of the bass were caught, and one between 6:00 and 8:00 p.m. when 20 percent of the bass were captured. The catch of northern pike reached three peaks throughout the day at approximately four-hour intervals. The first peak was between 10:00 a.m. and 12:00 noon when 14 percent of the northern pike were caught, the second at 3:00 p.m. with 18 percent being caught, and the third at 7:00 p.m. when 17 percent of the northern pike were caught.

Although the actual time of capture of panfish was not recorded, there is every indication from creel census data that the frequency of capture of most panfish was closely correlated with the diurnal distribution of fishing pressure.

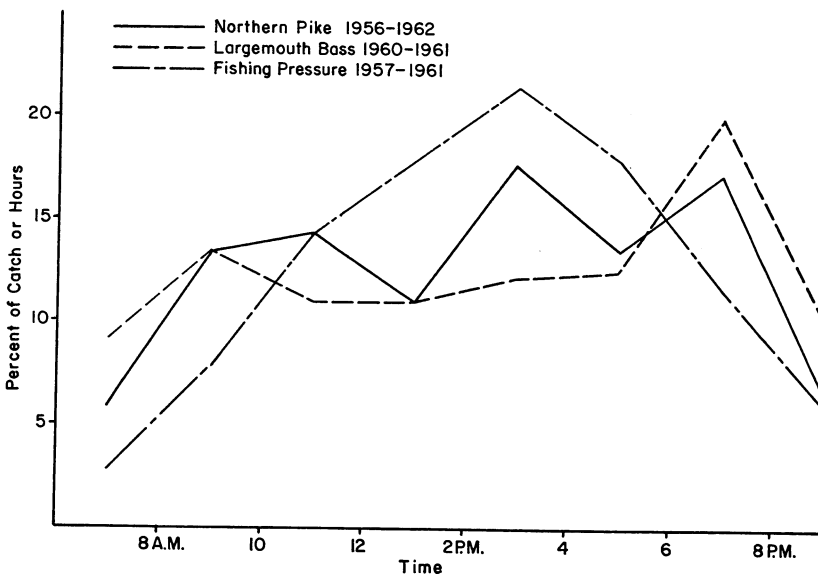


Figure 12. Diurnal distribution of fishing pressure and time of capture of northern pike and largemouth bass in Murphy Flowage during open-water seasons.

HEADQUARTERS MURPHY FLOWAGE PROJECT



CONCLUSIONS

On the assumption that the findings on these lakes are generally true throughout the north country, it is possible to draw certain conclusions for the guidance of anglers, managers and planners in Wisconsin.

FOR THE ANGLER:

1. The highest rate of catch of both game fish and panfish occurs in the winter, and the lowest for most species in the summer vacation season. This is partly due to the larger proportion of experienced anglers in the winter.
2. In open water, fly fishing and still fishing with worms are the most successful methods for panfish. Trolling is most successful for game fish.
3. Minnows are the most effective bait for walleyes and northern pike, artificial baits are best for bass. However, anglers appear to respond quickly and often successfully to new baits.
4. The most successful anglers are those that either fish the same lake a number of times or hire a guide. Skill is more important than luck.

5. Boat anglers are successful more often than those that fish from shore. They catch fewer panfish but more game fish.
6. The water is less crowded, and the fishing at least as good, in early morning and evening.

FOR THE MANAGER:

1. Most fish are caught by relatively few of the anglers.
2. A bag limit would have had little effect on the total catch of fish from these lakes because few anglers caught more than the usual limits. The principal exception would have been the catch of bluegills from Murphy Flowage, where these fish are exceedingly abundant. Information on this point from other lakes is needed.
3. Game fish bite readily during the period when the season on them is usually closed.
4. About one-fifth of the fishing is done by anglers who do not need a license under present regulations.
5. Panfish are the most sought after, and make up over 90 percent of the catch.
6. The average fishing trip lasts about 4 hours. Boat anglers fish longer hours than bank anglers.

FOR THE PLANNER:

1. Few anglers came to northern lakes from more than 500 miles away. Within this range, centers of population are represented more in proportion to their size than to their distance from the lakes.
2. Non-resident anglers do relatively little ice-fishing in Wisconsin. Few ice fishermen come from more than 100 miles away.
3. Over 20 percent of the fishing is done by women and girls.
4. More than half of the fishing is done in the short period between June 1 and September 15.
5. In resort country, fishing is fairly evenly distributed throughout the week; where there is a sizable local population, it is heavier on week ends.
6. Bluegill fishing is an excellent form of winter recreation that could be publicized extensively.

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APPENDIX A

Creel Census Methods

By order of the Wisconsin Conservation Commission, all anglers on the Five Lakes and Murphy Flowage must have a special permit in order to fish. The form used is in 2 parts; the second sheet is retained at the station and used as a record. When the angler checks in and returns his permit, the desired information is obtained and recorded in the second sheet. This is coded and transferred to a punch card for machine tabulation.

Age is recorded only with relation to ages 16 and 65, the ages between which a fishing license is required. Age and sex have been recorded only since 1958.

The lake name, date and day of week are recorded. Time is recorded to the nearest half hour. It includes all time on the lake, including any time out for lunch, but does not include time spent in loading and unloading the boat.

Other data are recorded in the following categories:

Site:	Boat	Bait: Minnows
	Bank	Other live bait
	Wade	Prepared bait
	Ice	Fly
	Raft	Spinner
Methods:	Bait cast	Plug
	Fly cast	Combination (line and artificial)
	Spin	Combination line
	Still	Combination artificial
	Troll	
	Combination	

Distance from the angler's home is recorded by circular zones, centered at each area. These zones are based on approximate road mileage rather than airline distance.

They are:	0- 10 miles	201-300 miles
	11- 25 miles	301-400 miles
	26- 50 miles	401-500 miles
	51-100 miles	over 500 miles
	101-200 miles	

At the close of fishing, each angler brings in his catch for inspection and measurement. The number of fish of each species taken by each angler is recorded on the second sheet of the permit.

WISCONSIN CONSERVATION DEPARTMENT
PERMIT

MURPHY FLOWAGE

..... Name Car License

..... Address City State

.....
Date

Angler's Sex: Male _____ Female _____

Angler's Age: Under 16 _____ 16 to 65 _____ Over 65 _____

is hereby authorized in accordance with Wisconsin Administrative Code Chapter 20.04 (4) (a) to fish Murphy Flowage. The following regulations apply:

1. A Wisconsin fishing license is required.
2. No size limit on all species.
3. No bag limit on all species.
4. No closed season on any species.
5. Fishing shall be done only with hook and line or rod and reel.

The permittee is required to exhibit all fish taken in these waters to the Conservation Department at the checking station when the station is open, and the permit, good for only one day, **must be returned** at the close of the day's fishing, **fish or no fish.**

When the checking station is closed each angler is required to report his catch below, and to put permit in box at checking station.

SPECIES	NUMBER	
Bluegill	_____	
Perch	_____	
Pumpkinseed	_____	Kept no fish _____
Rock bass	_____	
Black crappie	_____	How many hours did you
Bullhead	_____	fish? _____
Largemouth bass	_____	
Northern pike	_____	
Muskellunge	_____	
_____	_____	
_____	_____	

Issued by _____
Checking station attendant

WISCONSIN CONSERVATION DEPARTMENT

Fi-247a

CREEL CENSUS

Angler's Sex: (1) Male _____ (2) Female _____

Angler's Age: (1) Under 16 _____ (2) 16 to 65 _____ (3) Over 65 _____

Angler Identification No. _____

5 4 0 3 2

WATERS: _____

DATE: Month _____ Day _____ Year _____

Day of Week: 1S _____ 2M _____ 3T _____ 4W _____ 5T _____ 6F _____ 7S _____ 8H _____

HOURS: Total _____ In _____ Out _____

Site: 1 Boat _____ 2 Bank _____ 3 Wade _____ 4 Ice _____ 5 Raft _____

Method: 1 Bait Cast _____ 2 Fly _____ 3 Spin _____ 4 Still _____ 5 Troll _____ 6 Comb _____

Bait: 1 Minnows _____ 2 Other Live Bait _____ 3 Prepared Bait _____

4 Fly _____ 5 Spinner _____ 6 Plug _____ 7 Comb _____ 8 Comb. live _____ 9 Comb. art _____

Residence: State _____ Distance _____

SPECIES	NUMBER			SIZE
Bluegill	2	8	6	
Perch	2	5	0	
Pumpkinseed	2	8	4	
Rock bass	2	8	9	
Black crappie	2	9	1	
Bullhead (brown)	1	8	3	
Largemouth bass	2	8	1	
Northern pike	2	0	6	
Muskellunge	2	0	7	

REV. 3-61

APPENDIX B Supplementary Tables

TABLE 1
Age and Sex of Anglers (1958-61)

Age	Five Lakes						Murphy Flowage		
	Percent of Angling Trips			Percent Successful			Percent of Angling Trips		Percent Successful
	Male	Female	Total	Male	Female	Male	Female	Total	
OPEN WATER									
Under 16	15.2	4.8	20.0	76.2	16.8	5.8	22.6	63.9	
16 to 65	60.1	17.7	77.8	71.7	55.2	16.0	71.2	63.4	
Over 65	1.9	0.3	2.2	77.1	5.3	0.9	6.2	74.7	
Total	77.2	22.8	—	72.7	77.3	22.7	—	64.2	
Percent successful	72.5	73.4	72.7	—	64.0	64.8	64.2	—	
WINTER									
Under 16	4.9	0.3	5.2	58.1	12.2	1.8	14.0	76.3	
16 to 65	86.5	5.1	91.6	69.7	67.0	7.1	74.1	77.5	
Over 65	3.0	0.2	3.2	72.9	11.1	.8	11.9	85.5	
Total	94.4	5.6	—	69.2	90.3	9.7	—	78.3	
Percent successful	70.2	52.7	69.2	—	77.8	82.1	78.3	—	

TABLE 2
Sources of Fishing Pressure (1957-61)

Percent Anglers Residing in:	Five Lakes					Murphy Flowage				
	Spring	Summer	Fall	Open- Water Total	Year Total	Spring	Summer	Fall	Open- Water Total	Year Total
Wisconsin	73.1	59.8	65.9	63.6	67.3	82.8	69.9	77.0	75.0	78.8
Illinois	21.2	30.0	27.3	27.5	24.6	7.9	16.8	13.3	13.3	11.1
Indiana	2.7	3.1	3.5	3.0	2.8	3.7	5.4	5.6	4.8	4.0
Iowa	0.4	1.1	0.1	0.9	0.8	0.9	1.9	1.6	1.5	1.3
Michigan	0.4	0.5	0.3	0.4	0.4	0.3	0.6	.0	0.5	0.4
Minnesota	0.3	0.3	0.1	0.3	0.3	3.0	2.9	1.3	2.8	2.6
Ohio	0.9	2.3	0.8	1.8	1.6	0.3	0.6	0.2	0.4	0.4
Other	1.0	3.0	2.0	2.4	2.2	1.1	1.9	1.0	1.7	1.4
Percent Anglers Residing at a Distance of:										
0 - 10 miles	6.4	2.1	11.1	3.8	4.3	6.0	3.7	6.2	4.7	5.5
11 - 25 miles	3.7	1.9	4.7	2.6	3.1	27.7	13.7	19.3	19.1	22.5
26 - 50 miles	2.3	0.7	1.4	1.2	1.9	24.2	18.4	25.6	20.9	23.3
51 - 100 miles	21.0	10.1	10.9	13.0	18.9	10.0	10.8	5.8	10.3	10.8
101 - 200 miles	10.7	9.9	7.1	9.9	9.2	6.1	7.0	5.7	6.6	5.8
201 - 300 miles	28.8	35.1	30.2	33.1	29.8	4.6	7.0	3.2	5.9	5.0
301 - 400 miles	20.5	28.1	26.9	26.0	23.3	9.7	15.4	14.3	13.2	11.0
401 - 500 miles	1.9	3.7	2.7	3.2	2.9	7.1	17.4	14.3	13.5	11.3
Over 500 miles	4.6	8.3	4.9	7.1	6.4	4.6	6.6	5.6	5.8	4.8

TABLE 4
Weekly Distribution of Fishing Pressure and Distance Travelled (1957-61)

Day of Week	Percent of Total Anglers	Percent Residents	Percent of Anglers Residing at a Distance of:							Over 500 Miles
			0-50 Miles	51-100 Miles	101-200 Miles	201-300 Miles	301-400 Miles	401-500 Miles	500+ Miles	
FIVE LAKES										
OPEN WATER										
Sunday	14.7	77.1	11.5	26.6	12.0	26.5	17.9	1.3	4.2	
Monday - Friday	68.1	57.5	6.8	6.7	9.0	35.0	29.9	4.0	8.6	
Saturday	17.2	76.7	7.2	26.4	11.9	31.2	17.9	1.6	3.8	
WINTER										
Sunday	25.0	98.0	20.6	72.0	4.4	1.8	0.5	0.7	0.0	
Monday - Friday	36.4	96.0	37.2	52.5	3.1	3.0	1.3	2.4	0.5	
Saturday	38.6	99.0	16.0	77.2	3.4	1.9	0.5	0.7	0.3	
MURPHY FLOWAGE										
OPEN WATER										
Sunday	28.7	87.5	62.1	12.4	5.7	2.9	8.4	5.7	2.8	
Monday - Friday	54.0	66.2	37.2	7.9	6.0	7.0	15.3	18.5	8.1	
Saturday	17.3	77.4	39.4	14.0	9.8	7.5	14.5	10.9	3.9	
WINTER										
Sunday	32.1	97.6	82.2	14.9	1.8	0.0	0.4	0.6	0.5	
Monday - Friday	48.6	97.8	87.7	8.5	1.5	0.5	0.5	0.7	0.6	
Saturday	19.3	95.6	71.5	22.0	4.3	0.4	0.8	0.6	0.4	

TABLE 5
The Harvest from Escanaba Lake and Murphy Flowage
for the Fishing Years 1957-61

	Escanaba Lake					Murphy Flowage				
	Spring	Summer	Fall	Winter	Total	Spring	Summer	Fall	Winter	Total
Walleye	2,661	5,053	1,435	2,814	11,963	—	—	—	—	—
Northern pike	778	1,064	164	399	2,405	887	941	71	1,261	3,110
Muskellunge	38	31	6	12	82	10	13	—	—	23
Largemouth bass	244	511	25	25	805	1,119	1,136	101	51	2,407
Smallmouth bass	71	322	27	1	421	—	—	—	—	—
All game species	3,787	6,981	1,657	3,251	15,676	1,966	2,090	172	1,312	5,540
Perch	12,247	32,944	3,287	9,110	57,588	1,671	2,028	286	5,260	9,245
Pumpkinseed	23,405	63,716	2,249	332	89,702	1,693	1,433	26	114	3,266
Bluegill	1,754	3,894	28	20	5,696	46,027	58,237	5,029	53,075	162,368
Crappie	2,388	2,788	349	210	5,735	2,587	2,460	41	1,407	6,495
Rockbass	1,429	2,671	123	121	4,344	2,398	950	25	10	3,383
Bullhead	2	7	—	—	9	71	138	2	—	211
Other (sucker - trout)	3	—	—	—	3	4	1	—	—	5
All panfish	41,288	106,020	6,036	9,793	163,077	54,451	65,247	5,409	59,866	184,973
Total	45,015	113,001	7,693	13,044	178,753	56,417	67,337	5,581	61,178	190,513
Total hours	28,577	66,418	7,289	11,828	114,112	27,620	43,371	3,195	14,254	88,440
Fish per hour	1.58	1.70	1.06	1.10	1.57	2.04	1.55	1.75	4.29	2.15
Game fish per hour	0.13	0.10	0.23	0.27	0.14	0.07	0.05	0.05	0.09	0.06
Percent successful	68.9	77.7	61.8	71.6	74.0	68.7	65.0	52.9	75.0	67.2

TABLE 6
 Distribution Among Anglers of the Catch
 from Escanaba Lake and Murphy Flowage (1957-61)

	Total Anglers	Percent of Anglers Catching:				Total Fish	Percent of Fish Caught by Anglers Catching:				Fish Over Limit*
		1-5	6-25	26-50	Over 50		1-5	6-25	26-50	Over 50	
OPEN WATER											
Bullhead	147	97.3	2.7			219	84.0	16.0			
Perch	9,948	72.6	24.8	2.4	0.3	52,463	31.2	51.0	14.3	3.5	5.4
Pumpkinseed	11,486	55.2	39.5	4.4	1.0	92,528	17.7	56.4	18.2	7.7	9.2
Bluegill	12,264	49.0	43.5	6.5	0.9	114,969	13.9	55.3	24.0	6.8	11.0
Rockbass	3,751	95.2	4.8			7,595	80.6	19.0	0.4		0.0
Crappie	4,071	90.1	9.7	0.1		10,613	63.8	34.6	1.6		0.2
Northern pike	2,681	99.3	0.7			3,794	96.4	3.6			1.3
Largemouth bass	2,207	98.9	1.1			3,136	93.7	6.3			2.5
Muskellunge	93	100.0				93	100.0				0.0
Walleye	3,686	90.7	9.3			9,149	67.1	32.6	0.3		14.3
Smallmouth bass	355	100.0				420	100.0				0.0
WINTER											
Perch	1,636	56.5	35.8	6.7	0.9	14,370	15.8	51.2	26.1	6.9	11.2
Pumpkinseed	174	88.5	10.9	0.6		446	49.9	42.3	7.8		2.2
Bluegill	2,451	18.1	52.9	18.7	10.3	53,095	2.6	34.0	30.3	33.1	29.9
Rockbass	61	91.8	8.2			131	64.1	35.9			
Crappie	738	93.6	6.4			1,617	76.3	23.7			
Northern pike	1,040	99.6	0.4			1,660	98.3	1.7			0.5
Largemouth bass	73	100.0				74	100.0	0.0			
Walleye	1,225	95.4	4.6			2,764	85.6	14.4			6.1

* Percent of total catch taken in excess of 5 game fish or 25 panfish per angler.

TABLE 7
 Five-Year Distribution of Trips, Hours, Harvest, and Catch Rate Among Anglers
 Who Made Various Numbers of Trips to Murphy Flowage (April 1957 - April 1962)

Trips Per Season:	Open Water Season			Winter Season		
	1 Trip	2-5 Trips	Over 5 Trips	1 Trip	2-5 Trips	Over 5 Trips
Number of anglers	9,725	2,662	309	1,575	511	96
Percent total anglers	76.6	21.0	2.4	72.2	23.4	4.4
Percent total trips	50.3	35.0	14.7	39.2	34.6	26.2
Percent successful trips	60.1	68.9	78.6	60.8	78.8	91.7
Percent total hours	47.9	37.1	15.0	35.9	38.1	26.0
Percent total panfish	38.8	37.5	23.7	22.0	30.1	47.9
Percent total game fish	32.9	42.7	24.4	24.2	46.3	29.5
Fish per hour	1.4	1.8	2.8	2.6	3.4	7.8

TABLE 8
 Fishing Statistics Comparing Boat and Bank Angling
 at Murphy Flowage (1957-61)

	Boat Anglers	Bank Anglers
Number anglers	14,998	4,339
Percent of total	77.6	22.4
Percent successful	69.1	53.3
Percent total hours	85.8	14.2
Percent total game fish	94.5	5.5
Percent total panfish	83.6	16.4
Catch per hour	1.71	2.00

TABLE 9
 The Harvest from Escanaba Lake and Murphy Flowage by Anglers
 Using Various Methods During the Open-Water Seasons (1957-61)

Method	Number of Trips	Percent of Trips	Percent Successful	Number of Fish Caught in 100 Trips						Total
				Walleye	Northern Pike	Largemouth Bass	Game Fish	Pan-fish	Total	
ESCANABA LAKE										
Bait casting	704	2.9	41	33	13	10	57	123	180	
Fly casting	87	.4	56	5	3	8	16	690	706	
Spinning	769	3.2	57	36	16	5	59	182	241	
Still	14,979	61.6	79	39	8	3	52	709	761	
Trolling	285	1.2	68	127	23	3	156	94	250	
Combination	7,448	30.7	69	36	11	3	53	500	553	
Total	24,272	100.0	74	39	9	3	53	607	660	
MURPHY FLOWAGE										
Bait casting	1,862	9.6	45	—	23	33	56	107	163	
Fly casting	296	1.5	79	—	4	35	39	1,016	1,055	
Spinning	155	.8	42	—	21	26	47	173	220	
Still	6,467	33.5	75	—	3	5	8	853	861	
Combination	10,556	54.6	67	—	9	12	21	683	704	
Total	19,336	100.0	66	—	8	12	20	694	714	

TABLE 10
Harvest from Escanaba Lake and Murphy Flowage
for 1957-61 by Anglers Using Various Baits

Bait	Number of Trips	Percent Successful	Number of Fish Caught in 100 Trips					Total
			Wall-eye	Northern Pike	Largemouth Bass	Game Fish	Pan-fish	
OPEN WATER								
ESCANABA LAKE								
Minnows	3,714	64	124	12	3	140	189	
Other live	5,560	86	6	2	3	13	997	
All live	17,399	78	42	7	3	54	696	
All artificial	1,483	48	25	12	8	46	183	
Live and artificial	5,411	70	25	11	3	42	545	
Total	24,293	74	38	8	3	51	631	
WINTER								
Minnows	1,193	115	18	1	1	134	154	
Other live	93	30	4	—	—	34	741	
Combination live	1,212	116	15	1	1	133	601	
Total	2,498	113	16	1	1	130	392	
OPEN WATER								
MURPHY FLOWAGE								
Minnows	186	55	42	13	13	56	156	
Other live	6,116	72	2	5	7	7	822	
All live	6,531	71	3	5	8	798	806	
All artificial	2,263	49	21	33	54	287	341	
Live and artificial	10,542	65	11	12	23	631	654	
Total	19,336	66	10	12	22	647	669	
WINTER								
Minnows	615	54	89	—	—	89	96	
Other live	1,606	85	1	1	2	2	2,223	
Combination live	1,801	74	39	2	41	41	1,309	
Total	4,022	31	1	1	33	1,488	1,521	

TABLE 11
 Bait Used by Anglers Residing at Various Distances
 During Open Water Seasons (1957-61)

Bait	Percent of All Trips	Percent of All Anglers Residing at a Distance of:			
		0-50 Miles	51-100 Miles	101-300 Miles	Over 300 Miles
ESCANABA LAKE					
Minnows	15	41	14	9	18
Other live bait	23	10	14	30	21
All live bait	72	76	67	72	72
Artificial bait	6	8	5	7	6
Live and artificial	22	16	28	21	23
MURPY FLOWAGE					
Minnows	1	1	0	2	1
Other live bait	32	42	26	23	22
All live bait	34	44	28	26	25
Artificial bait	12	10	9	10	16
Live and artificial	55	46	64	64	59

TABLE 12
 Bait on Which Northern Pike and Largemouth Bass
 Were Captured in Murphy Flowage

	Largemouth Bass ¹		Northern Pike ²	
	No.	Percent Total	No.	Percent Total
Live bait				
Minnow	58	9.0	535	26.6
Worm	119	18.5	83	4.1
All live	177	27.5	618	30.7
Artificial Bait (Underwater)				
Spoons)			640	31.8
or)	136	21.1	+	+
Spinners)			277	13.8
Other (Plugs, etc.)	126	19.6	184	9.1
Surface				
Poppers	99	15.4	13	.6
Other	106	16.4	99	4.9
All Artificial	467	72.5	1,213	60.3
Unknown Baits	0		181	9.0
Total	644		2,012	

¹ Largemouth Bass data from 1960 & 1961.

² Northern Pike data from 1956-62.

TABLE 13
Harvest by Anglers from Various Distances,
Escanaba Lake and Murphy Flowage (1957-61)

Distance Miles	Escanaba Lake				Murphy Flowage				Total	
	0-50	51-100	101-300	Over 300	Total	0-50	51-100	101-300		Over 300
SUMMER										
Number of trips	1,783	3,148	10,492	8,875	24,298	8,640	1,987	2,418	6,292	19,337
Fish per 100 trips										
Walleye	101	55	22	37	38					
Northern pike	13	16	7	6	8	7	9	11	13	10
Largemouth bass	4	4	3	3	3	12	9	9	15	12
All game species	120	77	34	48	51	19	18	20	28	22
Panfish	427	866	744	454	617	860	570	436	460	647
Total	547	943	778	502	668	879	588	456	488	669
WINTER										
Number of trips	678	1,592	147	81	2,493	3,328	531	94	69	4,022
Fish per 100 trips										
Walleye	75	131	76	137	113					
Northern pike	8	20	11	11	16	33	24	12	26	31
Largemouth bass	1	1				1	1	1	4	1
All game species	85	152	88	148	130	34	25	13	30	32
Panfish	330	436	344	127	392	1,565	1,098	813	1,726	1,489
Total	415	588	432	275	522	1,599	1,123	826	1,756	1,521

APPENDIX C

List of Sport Fish Occurring in Escanaba Lake and Murphy Flowage

COMMON NAME	SCIENTIFIC NAME
Bluegill	<i>Lepomis macrochirus</i>
Black crappie	<i>Pomoxis nigromaculatus</i>
Pumpkinseed	<i>Lepomis gibbosus</i>
Rock bass	<i>Ambloplites rupestris</i>
Yellow perch	<i>Perca flavescens</i>
Largemouth bass	<i>Micropterus salmoides</i>
Northern pike	<i>Esox lucius</i>
Muskellunge	<i>Esox masquinongy</i>
Smallmouth bass	<i>Micropterus dolomieu</i>
Walleye	<i>Stizostedion v. vitreum</i>

APPENDIX D

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(Reporting findings from the research projects
at Five Lakes and Murphy Flowage)

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- *No. 2 *Pheasant Weights and Wing Molt in Relation to Reproduction with Survival Implications.*
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- *No. 3 *Improved Rations and Feeding Procedures for Pheasants.*
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- *No. 5 *Experimental Level Ditching for Muskrat Management.*
Harold A. Mathiak (1953)
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* Out of print.

