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Report No. 1486

A FISHERIES SURVEY OF TWIN FALLS FLOWAGE ON THE MENOMINEE RIVER, DICKINSON COUNTY, MICHIGAN, AND FLORENCE COUNTY, WISCONSIN[1]

A cooperative survey by the Fish Divisions of the
Michigan and Wisconsin Conservation Departments

By

Merle G. Galbraith, Jr.

Twin Falls Flowage is an impoundment on the Menominee River, located approximately four miles northwest of Iron Mountain, in Dickinson County, Michigan and also in Florence County, Wisconsin. Highways US-2 and US-141 border the southern shore of the flowage and Michigan County Road 607 borders the east shore. Twin Falls Dam, a concrete structure built to hold a normal operating head of 44 feet for generating electricity, was first put into operation by the Wisconsin Michigan Power Company in December of 1912. At the normal operating head the flooding level is 1114.4 feet above sea level. The area of that part of the impoundment which extends from the dam to the point where the boundary of Town 40 and 41 North (Michigan) intercepts the shoreline is 640 acres, exclusive of islands.

For recreational use, the greatest attraction of the impounded water is for fishing. There also is some swimming and boating. The power company

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[1]The field work and analysis of data performed by the Michigan Department of Conservation, including preparation of this report, were undertaken with Fish Restoration funds under Dingell-Johnson Project F-2-R.

owns approximately three-fourths of the land bordering the flowage and has flowage rights on the remainder. There is one resort, on the Wisconsin side, with cabins and boats for rent. Easy access to the flowage for fishermen and tourists is assured and encouraged by the Wisconsin Michigan Power Company. The company has designated areas as public fishing sites along the flowage, and has built and maintained roads to these access points, most of which are located on the east shore of the impoundment, off Michigan County Road 607. The Wisconsin Michigan Power Company is commended for its cooperative policy.

Acknowledgments

The fisheries survey was conducted jointly by crews from Michigan's Institute for Fisheries Research[2] and Wisconsin's Fish Management Division,[3] from July 12 to July 17, 1954. The scale samples taken by both survey parties were mounted and aged by Ludwig Frankenberger, Management Biologist in Area II, Woodruff, Wisconsin. Ages of northern pike were verified by John E. Williams.[4] Thanks are due the Wisconsin Michigan Power Company for their fine cooperation with the survey project and for providing a topographical map which proved an invaluable aid in studying the impoundment. Also appreciated was the assistance given by Florin Warren, District Fisheries Supervisor, Michigan Department of Conservation. Acknowledgment is also made to Mr. Frank Hermance, resort owner, for his services and helpful suggestions during the survey.

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[2] Merle G. Galbraith, leader; Donald Thomson and Harry Huizinga, assistants.

[3] Ludwig Frankenberger, leader; Louis Zdrazel, assistant.

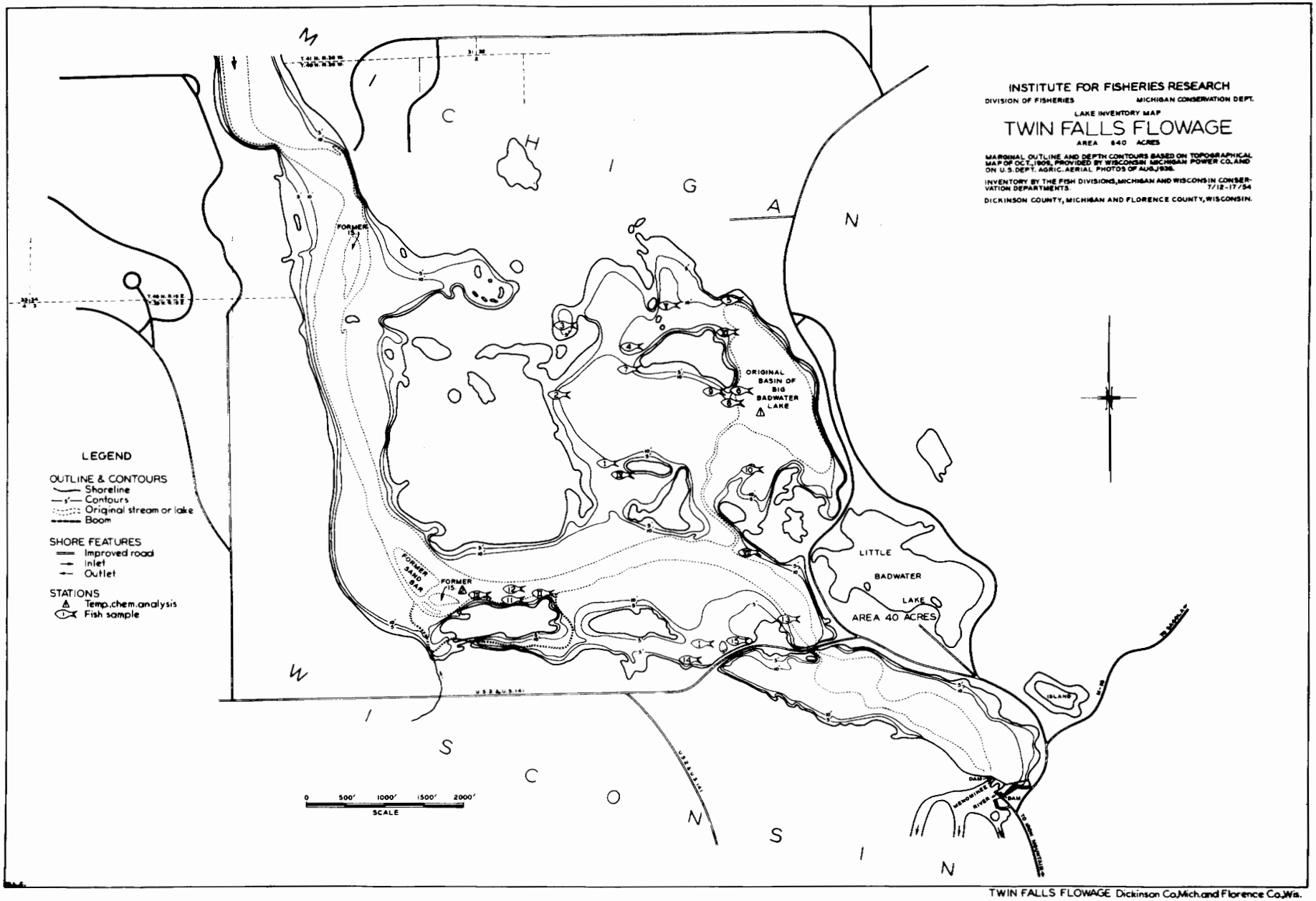
[4] Institute for Fisheries Research.

Physical Characteristics

Only that portion of the flowage which extends from the causeway to the prominent bend in the lake was surveyed. The area of this portion is approximately 350 acres. This area comprises the major volume of the impounded water, and includes the basin of former Big Badwater Lake. The impoundment is a little over a mile wide at its widest point. The greatest depth was found in the original basin of Big Badwater Lake, and measured 49 feet. Approximately 75 percent of the impounded water is 15 feet or less in depth.

Except for marshy shoreline on the extreme north end, the lake is bordered by banks of rubble, rocks and sand with slopes varying from gradual to steep. The surrounding country is characterized by rolling topography on which birch, aspen, cherry, and maple predominate. The slope of the lake bottom at the drop-off ranges from gradual to steep. Bottom soil types in shoal areas consist chiefly of sand and pulpy peat, with scattered areas of gravel and rubble. In the deeper areas the predominating soil types are fibrous peat and pulpy peat.

The color of the water is brown. Except in the river channel and the areas immediately adjacent to it, the water is relatively clear. In the channel a high degree of turbidity is caused by sand picked up and circulated by the current. Water transparency in the lake as measured by the Secchi disk was medium (to 7.5 feet). No doubt the normal transparency was reduced somewhat by the presence of a moderate algal bloom during the time of study. Transparency is significant in that it determines to what depths light will penetrate. If low, it reduces the over-all productivity of the lake by restricting the photosynthetic zone to shallow depths, thereby limiting the extent of vegetation. Aquatic vegetation in Twin Falls Flowage is restricted to depths of 10 feet or less.



TWIN FALLS FLOWAGE Dickinson Co.Mich.and Florence Co.Wis.

Drainage and Water Fluctuations

The Menominee River at Twin Falls Dam drains an area of about 1,800 square miles. Little Badwater Lake is connected with the impoundment but it discharges water into the flowage only when the water level of the impoundment is below that of the lake.

As is typical of impoundments, water levels in this flowage fluctuate. However, the fluctuations seldom exceed two feet, and during the period May 15 to July 1 an attempt is made not to draw the water down more than one foot. This arrangement is an outgrowth of a request by the members of the Dickinson County Sportsmen's Club in 1947 who believed that fluctuations in the water level were destroying the spawn of bass and pan fish. An agreement was reached between the sportsmen's club and the Wisconsin Michigan Power Company whereby the water level was to be lowered no more than a foot between May 15 and July 1. This agreement has been in effect since May of 1948.

The power company makes a drawdown every week-end beginning with Saturday evening and ending Monday morning. The water reaches its lowest level on Monday between 6 and 8 A.M. During the latter part of winter, the impounded water is drawn down not more than two feet in anticipation of excess water from spring runoff, and this drawdown lasts for only a brief period of time (from 8 to about 24 hours). The spring flood effect is usually not over until after the first of May, before which time the water level remains quite uniform due to the inflow of run-off water.

Temperature and Chemical Characteristics

Surface water temperatures varied from 70° to 76.5° F. during the time of survey. Bottom temperatures at the two chemistry stations were 70.2° F.

in the river channel at the head of the large flooded area and 42.1° F. in the deep area of the basin of former Big Badwater Lake. (See Table 1 for summary of temperature and chemical characteristics.)

Except for the flooded area over the original basin of Big Badwater Lake, the water of Twin Falls Flowage was not stratified, and temperatures were fairly uniform from top to bottom. In the basin of Big Badwater Lake, the water was stratified and a thermocline was located between depths of 10 to 32 feet; water temperatures between these depths ranged from 70° to 44° F. Dissolved oxygen varied from 7.2 to 0.2 parts per million from surface to 49 feet. Dissolved oxygen was adequate for fish down to approximately 35 feet in the old lake basin and at all depths in the remainder of the flowage.

The water of the lake is moderately hard. Methyl orange alkalinity tests (values expressed in terms of calcium carbonate) gave a range of 44 to 86 p.p.m. Lakes which have moderately hard water are usually more productive than soft-water lakes.

Free carbon dioxide values ranged from 0.7 at the surface to 5.0 p.p.m. at 49 feet. There was no evidence of pollution.

Biological Characteristics

Vegetation, which affords excellent cover for game fish, is abundant in Twin Falls Flowage. Although there were a few scattered beds of floating aquatics (yellow water lilies) along the south shores of the islands and in bays in the northwest end, submergent plants were by far the most abundant. Flooded areas 10 feet or less in depth were covered with vegetation. In some places it was so dense that it made angling difficult and in the future may present a problem. The most abundant species of plants were waterweed (Elodea canadensis), coontail (Ceratophyllum demersum), water milfoil,

Table 1

Summary of temperature and chemical data by depth, Twin Falls Flowage, July 15, 1954

	Depth (feet)								
	0.5	5.0	10.0	15.0	18.5	21.0	29.0	32.0	49.0
Station 1[1]									
Temperature (°F)	73.6	73.2	69.8	65.3	...	53.8	46.2	44.2	42.1
Dissolved oxygen (p.p.m.)	7.2	...	6.4	...	...	3.5	6.0	4.2	0.2
Free carbon dioxide (p.p.m.)	0.7	...	...	...	...	...	...	...	5.0
Methyl orange alkalinity (p.p.m.)	44.0	...	...	...	...	...	...	...	86.0
pH	7.5	...	...	...	...	...	...	...	7.3
Station 2[2]									
Temperature	76.5	71.2	70.9	70.2	21.2	...	...	...	...
Dissolved oxygen (p.p.m.)	7.4	...	...	...	6.0	...	...	...	...
Free carbon dioxide (p.p.m.)	1.0	...	...	...	3.0	...	...	...	...
Methyl orange alkalinity (p.p.m.)	49.0	...	...	...	50.0	...	...	...	...
pH	7.5	...	...	...	7.3	...	...	...	...

[1] In the basin of what was originally Big Badwater Lake.

[2] In the river channel toward the head of the flowage.

(Myriophyllum sp.) bushy pondweed (Najas flexilis), two species of narrow-leaf pondweed (Potamogeton), and bladderwort (Utricularia vulgaris).

Fish foods, including crayfish, mayflies, dragonflies, damsel flies, phytoplankton, and zooplankton were abundant at the time of survey. Mayfly hatches are very heavy during July. Once the hatch commences, local anglers give up fishing for the duration of the hatch because the impoundment reportedly affords poor fishing even though the surface of the lake at times appears to be boiling with rising fish. The presumption is that the majority of fish are satiated from feeding on the mayflies and refuse to take either artificial flies or live bait.

Fish collections were taken by both crews. Wisconsin's equipment consisted of the Wisconsin fyke net which was 6 feet wide by 5 feet high and of one-inch bar mesh. Michigan's equipment consisted of experimental gill nets (which contain five 25-foot lengths of 3/4-, 1-, 1 1/4-, 1 1/2-, and 2-inch bar mesh), a straight 1 1/4-inch bar mesh gill net 125 feet long, and a 30-foot bag seine, the latter for collecting forage fish and young of the year of game species.

Nine species of game fish were collected, of which bluegills and walleyes appeared to be the most abundant. The other species were northern pike, yellow perch, pumpkinseed sunfish, black crappie, smallmouth and largemouth bass, and rock bass. Brown trout were reported caught on occasion. Seining and shoreline observations revealed many young-of-the-year smallmouth bass and a moderate number of young-of-the-year largemouth bass. Forage fish appeared scarce. Only two species, the eastern mottled sculpin and northern creek chub, were collected. A seine haul made in 1936[5] took Johnny darters. Seining in 1954 was restricted to a few stations because most shoal areas

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[5] D. E. Miller and party, Institute for Fisheries Research, July 9, 1936.

Table 2

List of fish collected with seines, gill nets, and fyke nets

from Twin Falls Flowage, July, 1954

Common name	Scientific name	Abundance	Size range (inches)
Game fish			
Northern pike	Esox lucius	Common	8.9 - 30.0
Walleye	Stizostedion v. vitreum	Common	2.6 - 28.8
Yellow perch	Perca flavescens	Common	0.9 - 13.0
Bluegill	Lepomis machrochirus	Abundant	0.9 - 9.1
Rock bass	Ambloplites r. rupestris	Common	1.3 - 8.8
Black crappie	Pomoxis nigromaculatus	Common	3.6 - 15.2
Pumpkinseed	Lepomis gibbosus	Few	6.4 - 8.4
Smallmouth bass	Micropterus dolomieu	Few-Common	9.9 - 14.5
Largemouth bass	Micropterus s. salmoides	Few	1.0 - 1.6
Coarse fish			
White sucker	Catostomus commersoni	Common	1.0 - 22.5
Burbot	Lota lota	Rare[1]	...
Forage fish			
Mottled sculpin	Cottus bairdi	Few	0.9 - 1.2
Creek chub	Semotilus atromaculatus	Few	1.1 - 1.4

[1] One dead, mature specimen was found on the shoreline.

are either covered with submerged logs, debris, and dense growth of aquatic plants or else the bottom is extremely soft, making seining either impractical or impossible.

Coarse fish captured consisted of one species, the white sucker, of which only a few were collected. When suckers are found in other lakes they are generally collected in much greater number. Seine hauls at Twin Falls revealed many young suckers which indicates successful reproduction and rules out the possibility of adverse spawning conditions for this species. No obnoxious fish were collected in the nets. The remains of one burbot were found along the shoreline.

With the exception of an occasional trout, originating from plantings in tributary streams, the fish present in this body of water are propagated naturally. There is no record of any recent stocking of fish by either Michigan or Wisconsin.

Growth of Game Fish

All game fish caught in the gill nets were measured, scale-sampled, and aged. In order to expedite the lifting and setting of the fyke nets and to minimize netting mortality, scale samples were taken only from representative samples of game fish collected in fyke nets. (See map of impoundment for location of net sets.)

Table 3 lists the average length, age, and number of game fish for which ages were determined. The growth index for each species represents an average of the deviation values for all age groups (consisting of five or more fish). The deviation values express the difference between the average length of fish from Twin Falls Flowage and the state average (Beckman, 1948)—a minus value if less than average and plus if above. A range of +0.5 to -0.5

Table 3

Average total lengths in inches of game fish of different ages from Twin Falls Flowage, compared with the state average (number of fish in parentheses)

Species	Age								Growth index[1]
	I	II	III	IV	V	VI	VII	VIII	
Bluegill	3.7 (2)	4.2 (14)	5.4 (3)	6.8 (1)	7.0 (17)	7.5 (37)	8.2 (20)	8.7 (7)	-0.1
State average	3.1	4.3	5.4	6.6	7.3	7.7	8.2	8.4	...
Deviation	...	-0.1	...	...	-0.3	-0.2	0.0	+0.3	...
Walleye	7.9 (8)	10.6 (8)	12.7 (14)	14.8 (6)	16.9 (10)	17.5 (3)	22.3 (1)	25.9 (1)	...[2]
Average[3]	6.1	10.0	13.0	15.1	16.9	18.4	19.5	21.4	...
Yellow perch	3.7 (12)	5.1 (19)	5.9 (8)	7.6 (13)	8.6 (6)	9.9 (4)	10.5 (5)	11.7 (4)	-0.2
State average	4.1	5.8	6.4	7.5	8.5	9.5	10.4	...	...
Deviation	-0.4	-0.7	-0.5	+0.1	+0.1	...	+0.1	...	...
Black crappie	4.7 (9)	5.9 (6)	7.5 (4)	9.1 (3)	9.9 (9)	10.6 (7)	11.1 (9)	11.7 (6)	-0.03
State average	...	5.9	8.0	9.0	9.9	10.7	...	...	...
Deviation	...	0.0	...	...	0.0	-0.1	...	...	...
Northern pike	16.1 (42)	18.0 (15)	30.0 (1)	...	...	...	...	...	...[2]
Rock bass	2.4 (1)	3.7 (8)	5.2 (2)	6.7 (2)	7.0 (17)	7.5 (12)	8.6 (3)	9.0 (1)	-0.4
State average	...	4.3	5.2	6.2	7.3	7.9	8.8	9.0	...
Deviation	...	-0.6	...	...	-0.3	-0.4	...	...	...
Pumpkinseed	...	4.1 (1)	5.3 (1)	6.5 (2)	6.8 (8)	7.5 (5)	7.5 (1)	...	+0.6
State average	...	4.1	4.9	5.7	6.2	6.8	7.3	...	...
Deviation	...	...	...	...	+0.6	+0.7	...	...	...

[1] Calculated only for age groups with 5 or more fish.
[2] No state average available for this species.
[3] Average total lengths of walleyes from North America (Eschmeyer, 1950). Total lengths represent growth attained at the end of the year or at time of annulus formation.

of the growth index for bluegills, pumpkinseeds, and perch is regarded to be within the average. Roman numerals represent age in years.

Although state average lengths are available for black crappies under age-groups VII and VIII, these groups were omitted in calculation of the growth index because the samples from which they were derived for state averages were too small to be of significant value.

Examination of the scales revealed that most game species had growth rates similar to the state-wide averages. The pumpkinseed sunfish showed above-average growth rate but, in view of the small sample, significance of its growth index is questionable. Growth rates of walleyes and northern pike from other Michigan and Wisconsin lakes (Carlander, 1953 and Williams, 1956) and other northern waters (Eschmeyer, 1950) indicate that in comparison, walleyes in the Twin Falls impoundment were growing at roughly average and northern pike at better than average rates.

Smallmouth and largemouth bass were not included in Table 3 because only a couple of smallmouths and no largemouths other than young-of-the-year fish were collected. Failure to collect bass of larger size is thought to have been due more to limitations of the collecting gear rather than to a scarcity of bass. Gear selectivity may also have accounted for the relatively small collection of bluegills, rock bass, and pumpkinseed sunfish of age-groups I through IV.

Because impoundments usually become less productive with age, and since the Twin Falls impoundment is over 40 years old, it can be expected that its biological productivity has been decreasing. While it could not be determined from the survey data whether the available food supply meets all the requirements of the present fish population, it appears that the food supply is adequate for most species of fish.

Discussion

Anglers at Twin Falls fish mainly for northern pike, walleyes, and bluegills. Fishing success for the latter two species has been good, but the status of the pike population concerns local anglers. Their complaints stem from the apparent absence of large northern pike (over 20 inches). It is reported that during the past several years many pike were caught but most were small. This contention was corroborated by the size of the fish in the sample taken during the survey. The average size of the northern pike collected in 1954 was 16.9 inches. Periodic rise and decline of game fish populations is a common occurrence in most inland lakes, and possibly the pike population of Twin Falls has been in one of these temporary depressions.

Examination of this lake revealed adequate spawning areas for pike as well as for all other resident game fish. Management of the flowage for generation of electricity causes periodic fluctuation of the water level and this might conceivably have an adverse effect on spawning. However, as stated previously, the power company agreed with the sportsmen's association to regulate the water level so as not to lower it more than one foot during the time interval of May 15 to July 1. An inspection of the records at Twin Falls power plant showed that the company has abided by this agreement. However, from the limited amount of climatological data available, and from a few observed spawning runs recorded for the northern part of the Lower Peninsula between 1949-1954, it is suspected that pike generally spawn here before May 15.

Northern pike reportedly spawn in depths of approximately 7 to 20 inches. Clark (1950) reports, from observations made in northwestern Ohio, that the majority of pike spawn in less than 10 inches of water. Thus any

drop in water level at Twin Falls of more than approximately seven inches conceivably could by prolonged exposure result in the destruction of pike eggs. However, although water levels dropped lower than usual in April, 1950 (around the middle of the month) the records on elevation of head waters from 1949 to 1953 do not reveal any prolonged drop in water level nor any apparent correlation between water levels and the relative numbers of fish representing the 1949-1953 year classes. Other factors which might have adversely affected these year classes are cannibalism among yearling pike, heavy predation on eggs and/or pike fry by yellow perch, walleyes, and other predacious fish, competition for food, and over-exploitation by anglers. Although this impoundment does not appear to receive excessive fishing pressure, it would be possible to over-exploit the pike brood stock during years that spawning conditions are inadequate, thus resulting in small recruitment in subsequent years. Analysis of seven northern pike collections in northern and southern Wisconsin by Threinen (1951), and studies by Taube (1950), Moen and Lindquist (1954), and Christensen, Simonis and Williams (1956) indicate that it is not uncommon to find few pike older than three years (age-group III) in a specific population and that of these, the majority are comprised of fish of age-groups I and II. The average size of the pike in these studies ranged between 17 and 21 inches, which generally corresponds to the average length of pike taken in the Twin Falls collection.

In the survey collections there was only one pike larger than 21.2 inches. If this is a valid indication of the proportion of large pike (over 25 inches) to small pike occurring at Twin Falls, the possibilities are good that recruitment in the pike population over the past several years has been low. That poor recruitment was not due to over-fishing is a supposition drawn from the view that fishing pressure has been light compared to other pike lakes

(based on reports and observations during this and other lake surveys). As mentioned before, local reports indicate that for the past several years catches of small pike (20 inches or less in length) have been common, which affords good evidence of successful spawning. Although this impoundment is fished in winter, the fishing pressure is believed to be too low to have a detrimental effect on the pike population. Creel census checks show that little spearing is done.

It is difficult to determine from available data what factors limit occurrence of large pike in Twin Falls Flowage. The biological, physical, and chemical conditions in the impoundment appeared adequate for the present fish population. Growth rates are about equal to the average growth rates for Michigan waters in general. Predation and harvest by angling are apparently adequate to maintain good population balance among the game species.

Literature Cited

Beckman, Willima C.

1949. Rate of growth and sex ratio for seven Michigan fishes. Trans. Am. Fish. Soc., Vol. 76 (1946), pp. 63-81.

1950. Methods in fish growth analysis. Inst. Fish. Res., Methods Memo No. 8 (Mimeographed).

Carlander, Kenneth D.

1953. Handbook of freshwater fishery biology with the first supplement. Wm. C. Brown Co., Dubuque, Iowa, 429 pp.

Christensen, K. E., Floyd E. Simonis and John E. Williams

1956. 1955 winter creel census in Fletcher Floodwater, Alpena and Montmorency counties, and the status of the pike population. Inst. Fish. Res. Rept. No. 1463, January 17, 1956. (Unpublished)

Clark, Clarence F.

1950. Observations on the spawning habits of the northern pike (Esox lucius), in northwestern Ohio. Copeia, No. 4, Dec. 22, 1950, pp. 285-288.

Eschmeyer, Paul H.

1950. The life history of the walleye in Michigan. Inst. Fish. Res. Bull. No. 3, 99 pp.

Moen, Tom and Muhrl Lindquist

1954. The northern pike hatch at the Clear Lake (Iowa) hatchery. Prog. Fish-Culturist, Vol. 16, No. 2. April 1954, pp. 89.

Taube, Clarence M.

1950. A fisheries survey of Otsego Lake, Otsego County, Michigan. Inst. Fish. Res. Rept. No. 1255, May 3, 1950. (Mimeographed)

Threinen, C. W.

1951. Typical game fish population and their probable mortality rates. Abstract of paper presented at the 13th Midwest Wildlife Conf., Dec. 12-14, 1951. (Mimeographed)

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