2 copies to Mr. Joyce

Report 317 October 11, 1935

INVESTIGATION OF DANAHER LAKE ON THE PERE MARQUETTE ROD AND GUN CLUB

At the request of Mr. Frank H. Joyce and Mr. W. G. Arthur Reid of the Pere Marquette Rod and Gun Club, an investigation of Danaher Lake was undertaken by the Institute for Fisheries Research. The Institute is supported by the Fish Division of the Conservation Department to undertake investigations of fisheries problems for the Department. Investigation of private waters are made only when the clubs or individuals concerned are willing to bear the entire cost of the study and when the staff can be spared from their regular duties.

The following letter by Mr. Reid is quoted in order to present the history of the fishing at Danaher Lake.

August 28th, 1935

Conservation Department
Lansing, Michigan

Attention: Mr. Loutit

Dear Mr. Loutit:

You will probably remember meeting the writer at the Pere Marquette Rod & Gun Club, and also remember that we dammed up the Danaher Creek and made a 24 acre lake out of same.

My reason for writing you, is to see whether your Department would give us an opinion on what a good many of our members would like to do, or make a suggestion as to what would be the right thing to do.

The history of the lake is as follows:

The dam was completed in 1929, the lake flooded that winter and starting in the 1930 season, fishing was fairly good. The 1931 and 1932 season fishing was excellent. The 1933 season fishing started to drop off and 1934-35 has been very poor. In 1934 we planted 10,000 - 5 inch brook trout.

Now some of our members think that we ought to completely drain the lake and lose everything that we have done to date, allow the frost over this winter to

season the ground and flood it again either next spring or a year from next spring, with the thought in mind that the new flooding would give us the same results that we got when we originally built it.

The lake is open at both ends so that fish can migrate either way. The lake is filled up with millions of shiners and a few suckers have also gotten into the lake, but the fish that have been caught are trout of the three varieties.

The season of 1935 however produced very few fish.

We have a big investment in this lake and our membership is so interested in it that they are willing to do anything, if it is just the right thing and I surely would appreciate it, if you and your Department would give the subject a little thought and advise us what would be the best thing to do.

With kindest personal regards, I am

Yours very truly,

WGAR/b W. G. Arthur Reid

Dr. A. S. Hazzard, Director of the Institute and Mr. Justin Leonard, in charge of fish food studies, were detailed to this investigation. They arrived at the Pere Marquette Club late in the afternoon of September 27 and completed the study September 30. Comfortable living and laboratory quarters were provided at the clubhouse. The writer wishes to take this occasion to express our appreciation to the Club for the exceptional hospitality afforded us. The information and encouragement given by Mr. Frank H. Joyce and Mr. Victor C. Cramer were of great assistance to us in this study. Mr. A. W. Frehse also supplied much useful information relative to the history of trout fishing in Danaher Lake.

Physical and chemical condition.

The bottom composition, as revealed by several dredge samples, is dominantly sand over which has been deposited a layer of more or less decomposed organic material derived from leaves, drowned trees and brush and dead water plants. This layer varys in depth in different parts of the lake. Its further decomposition and deepening should increase the productivity of bottom food.

Since the maximum depth is reported to be less than 25 feet and the majority of the area is less than 15 feet, the entire lake may be considered shoal and therefore readily affected by temperature changes and subject to eventual filling by water plants if other factors do not operate to limit their growth.

During the days of the study the air temperature remained very low, being recorded as 42°F. at 9:30 A.M. on September 28. The surface at this time was 55°F. and at 12.9 feet, 54°F. At a depth of 7 feet, the temperature was 54°F. Considering the slight stratification at this time of year and the shallow, exposed character of the lake it seems likely that the water may warm up considerably during the summer, perhaps to a point which is not suitable to brook trout. However, this is a point which cannot be definitely determined without securing a series of temperatures during the hottest part of the year. Mr. A. H. Frehse reported that he had taken surface temperatures of 78°F. in Danaher Lake. The fact that brown trout have always been the dominant species in this lake, although not stocked by the Club, may be further evidence that temperatures here are more suitable to this species than to the brook trout.

A single sample of the water was taken for analysis just in front of the log boom in water 13.9 feet in depth. The sample was collected at one foot from the bottom by the use of the Kemmerer bottle. Analysis gave the following values: for dissolved oxygen, 10.2 parts per million; free carbon dioxide 6.0 p.p.m.; methyl orange alkalinity 110 p.p.m.; pH 8.0. This analysis indicates that the water of Danaher Lake is entirely suitable for fish culture, being relatively hard, alkaline in reaction and with an abundance of oxygen and a small amount of carbon dioxide. Since the deeper water near the dam is suitable it can be safely assumed that the entire lake is safe for trout. Apparently there is not enough decaying organic material in this lake to deplete the oxygen or to render the water acid. The alkaline reaction and the relatively high bicarbonate content should be conducive to the production of a good fish food supply if other conditions were suitable.

Biological condition

(a) Plant life

Water plants are becoming established in fair abundance in Danaher Lake. Scattered beds of Chara were evident at the upper end and a rather narrow zone of Elodea was found elsewhere mixed with some pondweeds. However, these plants did not appear to harbor any great number of fish food organisms.

Aquatic plants are of prime importance in an established trout lake. Since the best trout producing waters are either newly formed or older lakes containing a rich growth of water plants it is possible that Danaher Lake is passing from the first stage to the second. Unfortunately no one knows how long it takes for the permanent food supply of a new lake to become established.

Plants not only protect young and adult fish from their enemies but also furnish food and shelter to the scuds (freshwater shrimp) snails and insect larvae upon which trout feed. While most trout do not consume any appreciable amount of plants, rainbow trout apparently do feed on plants as all studies of the food of this species show from 20 to 30 percent of algae or higher plants.

Another important function of aquatic vegetation is the enrichment of the soil as the growth of successive seasons decay. Certain fish food organisms also feed on these decaying remains. Draining of Danaher Lake and the destruction of all plant life and fish food would therefore have no beneficial effect upon the trout but would be decidedly harmful since the programs toward establishment of a stable supply would be nullified. If in the future water plants should become so numerous as to seriously interfere with the fishing their numbers can be controlled by mechanical or chemical methods. At present it did not appear to us that sufficient water plants were present to insure maximum food production. Some control of the green scum algae which according to report is becoming troublesome might be effected by the careful use of copper sulphate at the point where the stream enter the lake or by spraying certain areas with a solution of this chemical.

(b) Fish food* (see table 1)

A vertical haul of 10 feet and a surface haul across the lake with the plankton net indicated a great scarcity of the tiny free floating or free swimming plants and animals called "plankton". Although this class of food fluctuates considerably during the season so that a single sampling does not always yield an accurate picture of the plankton production nevertheless from previous studies of trout lakes at this season the conclusion that Danaher Lake is not a rich plankton producer appears

Table. 1. Bottom and Plankton Samples from Damaher Lake, Pere Marquette Rod and Gun Club
September 29 & 30, 1935

Sample # 1. 1/4 sq. ft., 14 ft. deep

Name	Number
Annelida	1
Hydrachnidae	1
Ephemeridae (Caenis)	1
Chironomidae	4
Total volume	0.025 cc.

Sample # 2. 1/2 sq. ft., 5 ft. deep

Hydrachnidae	1
Ephemeridae (Caenis)	4
Culicidae (Corethra)	1
Chironomidae	10
Total volume	0.050 cc.

Sample # 3. 1/2 sq. ft., 8 ft. deep.

Hydrachnidae	1
Ephemeridae (Caenis)	1
Culicidae (Corethra)	1
Chironomidae (2 genera)	11
Total volume	0.050 cc.

Sample # 4. 1/4 sq. ft., 4 ft. deep.

Annelidae (Tubificidae)	1
Hydrachnidae	2
Culicidae (Corethra)	1
Chironomidae (3 spp.)	5
Total volume	0.025 cc.

Sample # 5. 1/4 sq. ft., 4 ft. deep. Off Chara bed, upper end of pond.

Invertebrates

Hydrachnidae	8	
Odonata (Enallagma sp.)	1	
Corixidae	8	0.10
Chironomidae	2	
Total volume		0.200 cc.

Vertebrates (Fishes)

Pimephales promelas	2	Combined volume, vertebrates and invertebrates, # 5, 2.40 cc.
Eucalia inconstans	4	
Total volume	2.200 cc.	

Plankton

Plankton, judged by one vertical haul and one surface haul, not present in sufficient quantity to measure. Qualitative examination reveals Asterionella, Polyarthra, Tabellaria, and Ceratium commonest forms.

justified. A qualitative examination (the amount taken was too little to measure quantitatively by our usual method) showed Asterionella, Polyarthra, Tabellaria and Ceratium to be the commonest forms. Possibly the great abundance of minnows which feed largely on the plant plankton may partly account for its scarcity.

Samples of the bottom food organisms (Table 1) taken with the Ekman dredge were secured from five scattered localities in the lake and at depths from 4 to 14 feet. These samples also indicated a relatively poor food supply in Danaher Lake. Chironomid larvae proved to be the most abundant of the foods in the bottom mud. These appear as small red worms which later transform into gray, mosquito-like flies. These midge larvae have been found to be of great value as trout food in lakes where they are abundant. A few larval mayflies (Ephemeridae) were also found in most samples as well as water mites (Hydrachnidae) tubificid worms and other miscellaneous forms. However none of these samples with the exception of sample 5, which was taken in the dense Chara weed bed at the upper end of the lake would be considered as of even average richness. This may suggest that as the weed beds become better established in Danaher Lake food conditions may improve.

Forage fish are exceptionally abundant in Danaher Lake. One sweep of a 20 foot minnow seine near the swimming beach yielded a gallon or more of minnows, young suckers and sticklebacks. So abundant were these fish that four sticklebacks and two fathead minnows were taken in sample 5 in the study of bottom fish food (Table 1). Since this dredge takes in only 1/4 square foot of bottom this indicates a very dense population at least in the weed beds.

Identification and count of a random sample of the seine haul by Mr. Gerald P. Cooper of the Institute staff yielded the following:

Eucalia inconstans, brook stickleback—31 yearling to adult.
Rhinichthys atronasus meleagris, blacknosed dace—21 yearling to adult.
Catostomus c. commersonnii, common sucker—108 young.
Chrosomus eos, northern dace—3 yearling to adult.
Pimephales promelas promelas, fathead minnow—1611 young to adult.

The dominant fish is thus shown to be the fathead minnow. According to Mr. Cooper studies of the food of this minnow have shown it to consume plant plankton

almost exclusively and not to be a direct competitor of trout. He also states that it seldom reaches a length of two and one half inches and that it is rarely abundant except in relatively warm ponds. The blacknosed dace and northern dace likewise are innocuous in their habits. The stickleback is no doubt a direct competitor of trout for food since it is highly rapacious and will eat insects and small fish almost as large as itself. Fortunately it rarely exceeds a length of two inches. Young suckers were second in abundance in the sample and it is possible that there may be a number of adults in the lake although none were taken in the gill net. The relationship between suckers and trout has never been satisfactorily worked out, but there have been frequent observations to the effect that some of the best trout lakes also contain an abundance of suckers.

Because of the non-competitive nature of the major portion of this forage fish population it does not appear to us to be desireable or necessary to attempt to reduce their number by draining. If the species were large predacious forms such as horned dace or yellow perch there would be a real argument in draining to remove them.

(c) The trout supply

Three hauls with a 75 foot bag seine were made which yielded only one five inch brown trout. An overnight set with about 200 feet of gill net with equal lengths of approximately 2 and 5 inch mesh (stretched measure) yielded one brown trout about eleven inches in length.

These findings are in agreement with the reports of poor fishing during the past year, and together with the great abundance of minnows indicate a very small trout population. The fact that no brook trout were taken even though half of the mesh used was of the proper size to take seven or eight inch trout (which size they should have attained since the 3 to 5 inch planting of 10,000 of this species was made last fall) confirms the opinion of the Club members that this planting was not successful in Danaher Lake. The reason for this failure is not evident from our findings. It is possible that summer temperatures in both stream and lake are too high for this species to endure. It is also possible that the brown trout may have eaten at least

a part of them but since the brown trout population also seems to be low and since there is an abundance of forage fish, much easier to catch than young trout, this does not seem a sufficient explanation. Time did not permit a thorough examination of the stream above the lake although no brook trout were observed in the sections examined. If, as some members suggest, the brook trout migrated up to the head of the stream, they should drop back into the lake during the winter and spring and should be caught by anglers at the lake.

Recommendations for management

1. After careful consideration of the data obtained it is our opinion that Danaher Lake should not be drained for the following reasons which have been elaborated in the report:

a) The "minnow" population is largely composed of non-competitive fish which are a valuable food resource. The food supply would not be improved by reducing their numbers since they do not compete directly with the trout. It is our belief that the introduction of an adequate trout stock would automatically reduce the minnow population.

b) Considerable damage would be done to the weed beds and to the stable food organisms which are apparently just becoming established.

c) There would be a great loss of organic material in the silt, decomposing leaves, etc., which would be washed out by opening the gates. Sand is the least productive of all types of bottom and there would be a distinct disadvantage to stripping off the relatively thin layer of detritus from any part of the bottom or in diminishing its depth. It is true that some ponds accumulate too much organic material for the well being of trout but this does not appear to be true for Danaher Lake.

d) There would be at least a partial loss of the trout population present in Danaher Lake since it would be impracticable to retain the smaller fish during the draining operation.

2. It is recommended that a planting be made this fall of 3600 rainbow or brown trout from 6 to 8 inches in length. This is based on an estimated carrying capacity

of 150 fish to the acre. These species are suggested because they endure warmer water than brook trout and because they (at least the brown trout) have thrived in the lake during the past.

3. It is urged that a record be kept by the Club of all fish removed from the lake. Only by such a record can the success of planting be scientifically determined. The results would also make it possible to estimate more accurately the annual stocking requirements of Danaher Lake. It is suggested that a book be kept at the boat dock or some other convenient place in which the caretaker may enter the catches made by members and their guests. The Institute for Fisheries Research would appreciate the use of the data if this plan is followed and would furnish in exchange further advice regarding management.

INSTITUTE FOR FISHERIES RESEARCH

A. S. Hazzard
Director