

Original: Fish Division

cc: Mr. Fortney

Mr. J. G. Marks

INSTITUTE FOR FISHERIES RESEARCH

DIVISION OF FISHERIES

MICHIGAN DEPARTMENT OF CONSERVATION

COOPERATING WITH THE

UNIVERSITY OF MICHIGAN

Education-Game

Institute for Fisheries Research

Waterloo Recreation Area

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OBSERVATIONS ON THE WATERLOO REARING POND
AND SUGGESTIONS FOR ITS USE IN FISHERIES EXPERIMENTS

by

Albert S. Hazzard and George N. Washburn

The Waterloo Rearing Pond lies within the Portage Lake drainage, located on one of the tributaries of Big Portage Lake in Waterloo Township (T. 2 S., R. 2 E., Sec. 8) of Jackson County. The stream is locally known as Portage Creek. The pond was formed by impounding spring and drainage waters by the construction of a dam across the stream bed. The water level is controlled by sluice boards installed at the outlet. Four streams and several springs entering the pond along the south and west shores constitute the source of water for the impoundment. On each of the streams was built a barrier dam, presumably to control the movements of fish held in the pond and to prevent the entrance of undesirable species of fish. The pond was constructed for the Michigan Department of Conservation by the Waterloo Project (National Parks Service) for the purpose of rearing bluegills or other fishes to be used as stock for planting in nearby lakes. The Jackson County Conservation League was instrumental in sponsoring this project.

J. G. Marks, District Supervisor of Fisheries Operations, reports that this pond was not considered successful for bluegill production during the two years of operation (1939, 1940) because it was impossible to control the water supply of the pond without a by-pass ditch. Rearing activities

were suspended in 1941. Flashboards were partially removed from the dam in 1941 and entirely removed during the season of 1942.

Since the Waterloo Area had been transferred to the Michigan Department of Conservation by the National Parks Service on July 1, 1943, it was considered desirable to learn more about the experimental possibilities of the waters in this region. As it was reported that this stream had furnished some trout fishing before construction of the rearing pond, we suspected that the pond might support trout. Accordingly on July 14, A. S. Hazzard and Louis Krumholz made a preliminary inspection of the stream system (no water was being impounded at that time). The stream was high and rather dark in color, due to the heavy rains of early summer. Much surface water was entering from temporary pools in marshes in the entire drainage area. As will be pointed out later, this condition masked to some extent the influence of the considerable spring water entering the stream. However, conditions seemed favorable enough to warrant the installation of the sluice boards in the dam and an investigation later in the summer to determine bottom temperatures. At our request the pond was brought up to the maximum safe level and was maintained at that level for surveys of outline, bottom temperatures, etc. as described below.*

* Since the Game Division has an interest in this pond because the Area is open to hunting and because ducks frequent the pond at certain times, a memorandum of agreement was drawn up by the two divisions concerned covering the operation of the pond, particularly as to maintaining water levels. This agreement is as follows:

"July 16, 1943

"Memorandum to Fish and Game Divisions:

Re: Waterloo Area rearing pond

"This memorandum is an agreement fixing within the Department of Conservation divisional responsibility for respective interests in the 17-acre Waterloo Area rearing pond, located in the NW 1/4 NW 1/4 Section 8, T 2 S, R 1 E, Leoni Township, Jackson County. This statement is desirable since the rearing pond, which was the responsibility of the Fish Division when the

Waterloo Area was administered by the National Park Service, lies in lands now administered by the Game Division.

- "1. Maintenance: The Fish Division will assume full responsibility for maintenance of the dam, spillways, flashboards, etc.
- "2. Water levels: The Fish Division will control water levels in accordance with requirements of fisheries investigations. If not incompatible with such investigations, minor changes in water levels shall be made in accordance with requirements of waterfowl management recommended by the Game Division. Marked reductions in water level or draining of the pond immediately before or during the duck hunting season are to be avoided if practicable.
- "3. Administration: The Fish Division will have jurisdiction over the pond itself and shoreline, including all types of public use. The Game Division will retain jurisdiction over the lands surrounding the pond and its shore including all types of public use.

Hunting and trapping fur bearers will be regulated by the Game Division.

In routine matters the Divisions will be represented by the Director of the Institute for Fisheries Research and the District Game Manager to whom the Waterloo Area is assigned.

F. A. WESTERMAN
In Charge, Fish Division

H. D. RUHL
In Charge, Game Division"

On July 23 the pond was visited and some temperatures were taken which further suggested that trout could be held here safely in summer. At 9:30 a.m., with an air temperature of 69°F., the surface temperature at the spillway was 71°. Seepage water through the control box into the seining basin was 68°. At 4:20 p.m. the air temperature had risen to 81°, the surface at the spill was 80° but water entering the seining basin was 69°. Since most of this water comes from near the bottom of the pond, we were sure that at least a part of the pond would hold trout in summer.

Twelve numbered posts were set up along the margin of the pond to facilitate mapping and to serve as permanent station markers for later studies.

On August 9 and 10, 1943 Dr. C. J. D. Brown, George Washburn and William Cristanelli prepared an outline, bottom contour map of the pond and took temperatures at various depths at four stations and of the tributary streams. (A copy of this map should be referred to in reading this report.)

The Waterloo pond is quite irregular in outline, following the course of the stream valley north and east. The surface area was found to be 12.6 acres. The greatest depth (8 feet) was immediately in front of the dam. About 38 per cent of the total area is two feet deep or less. With the exception of channels leading from the several inlets and seepage areas (probably opened up during construction to ensure complete drainage) and at the dam, the slope of the pond margin is quite gradual and roughly conforms with the slope of the immediate shoreline.

The bottom soil is dominantly peat except along the higher banks where it is of sand with small amounts of gravel. Marl and a mixture of the various bottom types were found in some areas.

Shelter is almost completely lacking as all of the brush and trees except for some of the bushes along the original stream channel were removed when the pond was made. However, it was noted that a rather dense growth of pondweeds had appeared over much of the area by August 10 and it is likely that some type of vegetation control may have to be practiced if desirable fishing conditions are to be maintained. This will be referred to later under the section on experiments suggested.

Temperatures. Water temperatures at various depths at four selected stations are given in the following table.

Table 1. Temperatures at various depths

in different areas of the Waterloo Rearing Pond - August 10, 1943

Approximate location of each series	Depth in feet	Temperature °F.
Midway between Stations 5 and 7	Surface 0	80
	2	76
	3	67
	6	63
Between west inlet and Station 8	0	80
	1	76
	2	72
	3	69
	5	64
	6	63
Between Stations 1 and 10	0	80
	2	73
	4	67
	6	65
	7	62
Near spillway of dam	0	81
	2	75
	4	73
	6	68

As shown by the table, the surface temperature was 80°F except near the spillway, where it reached 81°. Below the surface, however, temperatures dropped rapidly and at a depth of two or three feet were tolerable by trout. Near the bottom at each station temperatures were ideal for trout. Apparently cold water from the spring and from the spring-fed inlets "blankets" the bottom over much of the pond. This might be expected since this colder water is heavier and would tend to remain near the bottom. Since air temperatures ranged from 90° to 93° during the afternoon, it is likely that the water temperatures were close to maximum for the summer on this day.

No oxygen determinations were made, but considering the volume and well aerated condition of the principal tributaries, it is quite certain that the supply is adequate throughout the pond.

Examination of Tributaries

As shown by the map, a number of springs and tributary streams enter the Waterloo Rearing Pond. Observations on these were made during the several visits to the pond in summer and on November 17 this fall (Hazzard). These are tabulated for comparison. Tributaries to the pond are numbered in order as they enter the pond in counter-clockwise order from the dam.

Table 2. Observations on tributaries of the Waterloo Rearing Pond
(Temperatures taken in the afternoon each day near entrance to pond)

Tributary No.	Approximate length	Estimated volume, gals. per minute	Air temperature	Water temperature	Date
1	6'	2	90-93	67	8/10/43
2	400	20-25	82	65	6/14/43
			90-93	60	8/10/43
3	2	4-5	82	61	6/14/43
			90-93	64	8/10/43
4	800	50-75	82	65	6/14/43
			90-93	66	
5	100	5-10			10/17/43
6	300	20	82	66	6/14/43
		2-3	90-93	65	8/10/43
7 (main stream)	6,000	1500	82	74.5	6/14/43
			90-93	65	8/10/43
8	8,000	200	82	79	6/14/43

Tributary 1 drains a small spring seepage area about one hundred feet south of the dam along the west shore. It heads in a small cattail marsh within a few feet of the pond margin and has no well defined channel. The flow is slight (about 2 gallons per minute) and though cold (67°), probably has only local effect on the pond temperature.

Tributary 2 is a sizable stream (20-25 gallons per minute) originating in springs (temperature 53°) in the open meadow west of the road and flowing through a culvert under the road, and through the meadow to a tile just before entering the pond. It has a well defined stream bed. At present the water passes through the dike and not through the tile. Movement of fish is probably blocked at this point.

Tributary 3 is close to the pond margin and is a typical "boiling Spring" of rather small volume (4-5 gallons per minute) and a temperature of 61°. Its effect is probably localized.

Tributary 4 is similar in character to Tributary 2 except that it is about twice as long and has twice the volume of that stream. The stream bed is well defined until it enters the grassy bog near the pond. A barrier dam has been constructed on the stream about 150 feet from the mouth.

Tributary 5 is a small spring stream (5-10 gallons per minute) originating in the bog margin about one hundred feet from the pond. Its channel is poorly defined.

Tributary 6 heads in small springs (temperature 52°) in a well defined ditch (dredged ?) just below the gravel pit and follows a brushy channel to the bog margin, where its course is tortuous and uncertain. The volume at its entrance to the pond was estimated in June as 20 gallons per minute.

Tributary 7 is the most important inlet. It has a drainage area of a number of square miles including several small swamps and hollows which contain considerable water during a wet spring such as that in 1943. The most important source of water is, however, a series of springs scattered along the course for approximately a mile above the pond. The gradient is quite rapid in this section and the stream consists of a succession of small pools and riffles. The bottom is of fibrous peat for about one hundred feet above the pond; from that point to the road crossing considerable gravel is mixed with sand, peat and marl. The water is brownish in color but generally quite clear. Shade and shelter are excellent in this part of the stream and offer almost complete protection to fish at least during the summer months.

Permanent concrete bulkheads and spill are located on this tributary about 200 yards from the pond. Sufficient boards are in place at present to create a head of about 2 1/2 feet. Because of the steep gradient, the pond formed by this dam is not over fifty feet long. It is partially filled with sediment.

Probably the most significant feature of Table 2 is the difference in the water temperatures taken in this stream in June and August. Although secured earlier in the year, before any very high air temperatures had been recorded, the water temperature on June 14 was 74.5° with an air temperature of 82°, whereas on August 10 with an air temperature ranging between 90° and 93° the water was 65°. Undoubtedly the higher water temperature in June was caused by the heavy run-in of surface water mentioned earlier. This observation emphasizes the necessity for taking temperatures on trout streams, particularly in southern Michigan, during low water periods as well as when air temperatures are high.

Tributary 8 is a small stream (about 1 1/2 miles in length) which according to the county highway map heads in a small lake south and east of the pond. In June the stream where it joined Tributary 7 had an estimated flow of 200 gallons per minute and a temperature of 79°. Apparently it has a negative value to the pond in so far as trout are concerned but it should be investigated from its source. A permanent barrier dike with bulkheads and boards now separates the rearing pond from a small, marshy pool on the other side.

* * * * *

All tributaries except No. 8 help to maintain the favorable temperatures in the bottom water of the pond, as previously described. Some of them may also be of importance in providing spawning and nursery areas, especially if improved as suggested. Tributaries 1, 3, 5 are too small and Tributary 8 is thermally unsuited, but some spawning would undoubtedly occur in

Tributaries 2, 4, 6 and 7 if barriers were removed and if gravel were put in. A gravel pit is located on state property about one hundred yards south of the pond. While some gravel is present in Tributary 7, more might be added to good advantage, especially for a hundred yards on either side of the road crossing located about a half mile above the pond.

Observations on Trout Planting and on Subsequent Spawning

In accordance with the recommendation (to be discussed under experiments suggested), plantings of 300 each of brook, brown and rainbow trout were made in the Waterloo Rearing Pond by Fisheries District 11. These fish were legal-sized or nearly so and were transferred from the Harrietta hatchery. The following table (Table 3) gives the individual total length and the average length of a random sample of 30 of each species. Washburn accompanied the planting truck to the pond, took the measurements and made the following observations.

Table 3. Measurements of samples (total length in millimeters) of brook, brown and rainbow trout planted in the Waterloo Rearing Pond

November 11, 1943

Rainbow	Brown	Brook
190	197	192
181	194	195
191	193	206
203	174	181
181	172	180
212	182	195
172	170	206
183	178	157
200	238	185
103	206	206
195	220	196
190	172	190
194	204	170
187	178	209
198	182	175
179	172	157
183	215	191
136	211	164
191	181	201
191	206	192
196	220	186
220	191	175
185	158	186
202	186	200
170	202	164
165	164	174
172	180	186
191	187	209
213	221	193
168	218	190
Average 185 (7.3 inches)	192 (7.6 inches)	187 (7.4 inches)

Air 35°F, water 38°F. The sky was partly cloudy and there was some snow on the ground. The trout immediately began working the surface and spreading out from the original planting site. There was some shelf ice out 6 to 8 feet from shore along the northeast shore near the outlet.

The total stock appeared to be in a good, healthy condition. A few of the trout were examined for gill lice but none were found. Some of the brook trout (both sexes) were observed to be in a ripe condition. No ripe brown trout were observed.

Several weeks before planting at our request the pond was drawn down by Lyle Newton of Fisheries District 9 and flushed out to remove as many of the fish present as possible. Mr. Newton reports that he failed to see any great number of any kind of fish. He did note several small suckers, dace, shiners, darters and sticklebacks. As the water was very roily at the finish of draining, he thought it possible that a number of fish were not seen.

On the afternoon of November 17, Hazzard visited the pond to determine the dispersal of the trout and to observe if any spawning were taking place. The air temperature was about 30^o, patches of snow were still present, and some ice was noted along the margins of the pond in places. No trout were seen from the dam, in the stream immediately below the dam, or from the south and east shores of the pond. None were observed in any of the smaller tributaries or in the lower end of tributary 7 but as soon as the gravel-bottomed section of this stream was reached, cleaned gravel areas resembling trout redds were noted. Remaining quiet for a few minutes near one of these, trout were soon evident actively working the gravel areas in the places generally favored by brook trout, i.e. in the lower ends of pools just as the water breaks into riffles. By cruising the stream carefully about thirty brook trout and one brown trout were seen in various stages of nest building and courtship. The barrier dam was watched for about five minutes but no trout attempted to jump it.

As conditions were more favorable than heretofore for cruising the stream above the barrier, because leaves were off the streamside vegetation and weeds and grasses were partially flattened, this was done up to the road previously mentioned. It was not expected that any trout would be seen above the barrier as there is a vertical drop of about 2 1/2 feet followed by four feet of spill over which the water flows in a shallow

stream. However, cleaned areas resembling redds were noted shortly above the small pond formed by the dam and on one of these a sizable brown trout was observed. Upon waiting quietly near the nest, a second brown trout was seen. These fish were highly colored and about 12 to 13 inches in length. One of them bore a fresh wound on the back behind the dorsal fin with a vertical scratch extending down the side which could be observed. This might have been the work of a heron or a poacher's spear. We suspect the former.

Several other cleaned areas were noted with a pair of brown trout of the same approximate size and high coloration at one of them. Also on one occasion a small fish, four to five inches in length, was seen approaching the bed in customary fashion but it was quickly driven off and did not return. This appeared to be a young brown trout although the identity was not certain. Washburn reported that no brown trout of these sizes had been planted in the pond. It is therefore quite certain that the fish seen above the barrier were the survivors of an earlier planting or their progeny. This finding may somewhat affect the results of one of the proposed experiments since the trout planted November 11, 1943 were not marked as it was assumed that none were present in the stream system. A recent search of the planting record books since 1935 shows that Portage Creek (as the stream is apparently known) has received a number of plantings of brown trout as indicated by the following list.

Brown Trout Planted in Portage Creek,
Section 8, Waterloo Township, Jackson County

1935

1,500 5 mo.

1937

5,000 3 mo.

1938

6,000 2 mo.

250 6 mo.

1939

2,000 1 mo.

250 6 mo.

1940

2,000 2 mo.

1941

1,000 1 mo.

No other species than brown trout were planted
in this stream.

In addition to these small trout stocked in the stream over this period, 40 yearling brown trout were planted in Big Portage Lake in 1941. These fish might have ascended Portage Creek although it is questionable whether they could have surmounted the barrier dam. Probably the brown trout observed above the barrier dam originated from earlier plantings or from natural reproduction of an earlier established stock.

Suggested Experiments

(1) Management of Portage Creek for trout.

Purposes. To determine the value of an artificial impoundment on a small southern Michigan trout stream in providing limited trout fishing. To learn whether brook, brown or rainbow trout do best in such an un-screened impoundment.

Methods.

(a) The pond is to be stocked with equal numbers (300 each) of approximately legal-sized brook, brown and rainbow trout in the fall. (Accomplished)

(b) Special regulations should be enforced on the pond and inlet stream either by Commission order or by our authority as land-owner. The following are suggested:

1. Season for 1944 - same as for state.
2. Hours of fishing - 1 hour before sunrise to 1 hour after sunset.
3. Artificial flies only - possession of bait on premises illegal.
4. Daily limit 2 trout - 8 inch limit for 1944.
5. No boats allowed on pond.
6. Special permit and report of catch. Permit and report to be secured from Jackson Conservation Department Headquarters, from Lansing, or from Institute.
7. Maintain as complete a creel census at the pond as possible to determine number, size and condition of trout caught.

Supervision. A. S. Hazzard and George Washburn.

Comments. It is anticipated that this project may prove extremely popular with fly fishermen from Jackson, Ann Arbor and other nearby towns. The present set-up seems nearly ideal for finding out the value of an impoundment of this nature since a number of other similar sites have been examined and have been suggested for acquisition and development during the post-war period by the Department. It is believed that the key to success will be found in the special regulations designed to prevent rapid removal of the limited stock. Difficulties are anticipated in the proper operation of this project under present conditions. It may be impossible to prevent illegal fishing without having a responsible employee stationed there throughout the year; however it is believed that enough

can be learned through the proposed program for 1944 to determine how promising this development may be. Should this type of fishing prove to be in demand and should the trout remain in the pond and furnish good sport, enforcement of regulations and protection of the stock out of season might be accomplished by constructing a small checking station and residence overlooking the pond. A number of choice building sites with telephone, electricity and highway nearby are available. It is suggested that this project might be a unit of the southern Michigan fisheries experimental station, the establishment of which was authorized by the Conservation Commission in April 1942.

(2). Other possible experiments. If the Waterloo Rearing Pond does not prove to be successful in producing trout, or if it does, it should be well adapted to experiments bearing on management problems of warm-water fish since it can be drained and has a seining basin for recovery of the fish. Experiments to learn the maximum production of game fish by various combinations of fish species, proper balance between species and of age and size groups within a species might be undertaken here. The effect of removing size limits, protection during the breeding season and other regulations might also be tested. Further information of value could also be secured on the growth, breeding habits and other phases of the life history of bluegills, bass and other fishes. Checks on the method of population estimation by netting and marking could also be conducted. It is believed that this pond has almost unlimited possibilities for a number of important studies and experiments. Testing methods for a safe and effective method of vegetation control may also be feasible.

In order to safeguard the area against drainage, etc. and to remove any question as to our rights to manage the pond and inlet streams, the following description should be purchased or permanent easements of the water rights should be secured:

1 Copy

40 acres largely in N.W. of the S.W. quarter of Section 8, T. 2 S.,
R. 2 E. -- owner V. List.

26 acres in the S.E. of the S.E. of Section 7, T. 2 S., R. 2 E. --
owner Troeger.

47 acres in the south half of the S.E. quarter of Section 7, T. 2 S.,
R. 2 E. -- owner A. Fry.

42 acres largely in the N.E. of the N.W. of Section 18, T. 2 S.,
R. 2 E. -- owner E. List.

40 acres - the S.W. of the N.E. of Section 8, T. 2 S., R. 2 E. --
owner S. Dunbar.

80 acres - the S.E. of the N.E. quarter and the N.E. of the S.E.
quarter of Sec. 8, T. 2 S., R. 2 E. -- owner H. Stoker (80 acres
of 160).

40 acres - the S.W. of the S.W. of Section 9, T. 2 S., R. 2 E. --
owner Mrs. Stoker (40 acres of 120).

The above descriptions are taken from an undated property map of the
Waterloo Project of the National Parks Service and may not be up to date
as to ownership. Since the pond is in one of the public hunting areas,
the Game Division may also have an interest in the proposed acquisition
and in conducting certain experiments there.

INSTITUTE FOR FISHERIES RESEARCH

A. S. Hazzard and George N. Washburn

Report typed by V. M. Andres