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INSTITUTE FOR FISHERIES RESEARCH

Report 113

REPORT ON LITTLE MANISTEE RIVER IMPROVEMENT PROJECT

Active improvement work by the introduction of barriers and cover was begun on August 19th, 1930, and continued until September 20th, 1930. During this period of time, three to four men were engaged in the construction work done on eight sections of the river perceptably in need of improvement. The river in Lake County was well covered as the first section worked in was one mile west of Luther, and the last ended at Pomeroy Springs, near the Lake and Mason county lines. Portions of the river not in such great need of constructive work were not touched because of lack of time and funds.

In all, 304 barriers and covers were built at an average cost of slightly over a dollar per barrier. Because many barriers used required but a short time to build, the cost of each is low.

Since this was the first work of this type I had attempted, it necessarily had to be more or less experimental, so that many different styles of barriers were tried merely to test their effect. Some were put in with the sole purpose of determining whether or not they would be satisfactory or permanent. A few very small ones were built to see what small piles of stone would do toward making riffles, and to test their permanence. Methods of tracing and holding barriers were employed to find by actual experiment the best results. In some cases wire was used.

Complete notes were taken on each barrier; a separate card was allowed for every barrier. Beginning with a definite starting point, a bridge, for example, the first barrier was located by the number of paces downstream to it from the bridge, and each succeeding barrier was located by giving the number of paces it lay below the one above. The immediate locality in which the barrier was built or lay was

carefully noted for shade, types of bottom (whether sand; coarse, medium or fine gravel; muck; clay; rubble; marl, or boulders), size and position of bars and plant beds. Measurements of the width, depths taken across the stream at every yard, and depths of the pools below were recorded in conjunction with the type of barrier, the amount and kind of material used, the number and kind of stakes, and the dimensions of the barrier itself. Each barrier was tagged with two copper tags, two being used for a margin of safety in case one should be lost. Water marks were used in each section so that if the level of the water changed, it could be noted the following year.

Besides those barriers and covers built in 1930, I took notes on natural barriers found in the stream which were doing excellent work. It was thought advisable to put these under observation as many good ideas could be secured from them. 98 of these natural jams were examined, recorded, and tagged. It also seemed profitable to test the natural drift of material downstream, by tagging material found along the banks and in the stream. A good share of this material was water-logged. In this way, 47 logs were tagged and their positions taken. In addition, cover and pool-forming devices put in by cottage owners and clubs were tagged so they could be observed from year to year. Notes were taken on these just as they were on the barriers built by our crew. We found and tagged 22 of these. I also took notes for future checking on the 30 "jams" remaining of those put in by Dr. Metzelaar in 1927-1928. This brings the total number of items under observation to 501.

Materials used in construction consisted of stones, brush, dead trees cut down along the bank or hauled out from burned-over areas, deadheads found in the river bed, and stumps. 67 barriers were made of stone taken from the stream bed or brought to the stream, while the remaining 237 were built of wood. Most of the stakes were oak secured from a burned-over area north of Peacock.

Nine principle types of barriers were utilized. Of these the most common and frequent were "wings". A wing type consists of a log or logs wired to stakes, or a low stone wall built out from one bank perpendicular to the current or slanting downstream at an angle, the purpose of the wing being to accelerate the current, causing it to dig a hole in the stream bottom at the desired point below. This type is used in sand sections to make pools at bends and to remove sand from gravel; in gravel sections, to dig holes and to produce riffles. We built 165 wings of this type.

The V-type is a double wing, – that is, a wing jutting out from each bank and slanting downstream at an angle so that the water is directed through a narrow channel in the center and greatly accelerated. This type is used to remove sand from gravel or to direct the current to the point where a pool is desired. The V requires a minimum of 6 stakes to secure it in place. Thirteen V's were constructed.

Dead trees were felled into the stream and left attached to their stumps, or wired to them. They were felled upstream, perpendicular to the current, or slanting downstream at various angles for experimental reasons. These trees furnished cover and dug holes beneath themselves. Of this kind 46 were constructed.

In many cases there are good pools at bends but they are so exposed that the fish will not lie in them. In such situations, rafts were made by wiring dead trees together, and these rafts were wired to trees on the bank. 17 of these were built.

Dams of stone or wood were built across the stream in the upper reaches of the river. Stone ones were made in a sand stretch to test their effects. These were to make a pool on the upstream side of the dam, and to dig a hole on the downstream side. In some cases logs were laid across the stream from bank to bank and staked in place. 29 dams of this kind were used.

In sandy stretches stumps were introduced for shelter and to remove the sand

from the gravel. These stumps were staked in place (usually in the center of the stream) with the roots upstream. 13 stump types were made.

Some various other types which were introduced are the following:

1. The I-type is made by staking a log in the center of the stream so the current is forced around both ends. These I's are set in places where there are pools on each side and shallow water in the center. Only two like this were used.

2. The X-type is self-descriptive, since the logs are crossed to form an X and staked in place. A log is placed on the upstream side against the two upstream ends of the X for the purpose of digging. 2 of this sort were built.

3. The A-type is another one that was used. It represents the letter A with the apex pointing upstream. It's purpose is to divert the current to each side of it and form pools.

I have attempted to give each of the types a descriptive name, a letter if possible. There are, besides those enumerated above, 15 other devices which I have not yet given separate names.

Stakes used to hold the barriers were driven into the stream bottom from one to three feet, depending chiefly upon the type of bottom. The logs were wired to the stakes with No. 9 smooth wire. Deadhead material was used whenever possible as it withstands high water better than dry logs.

The work was done in 8 divisions of the stream. The first division begins at the bridge 1 mile west of Luther and extends a short distance downstream. This constitutes Section 14, South Newkirk Township. 14 were tagged in this division. Of these, 6 were natural jams, 2 were tagged to test natural drift, and 6 were built. Of those built 3 were wings, one was cover, and 2 were made of felled trees.

The second division of the work is located 1 1/2 miles west of Luther where the Consumer's Power line crosses the river. Barriers 15-26, inclusive, were

located in this division. Of these, 5 were natural jams, 2 were logs tagged for drift, and 5 were built. Of those constructed, there were 2 V-types, 2 dams, and 1 wing.

The third division is located about 2 miles west of Luther at Grey's Bridge. It is in Sections 14 and 15, of South Newkirk Township. In this division were barriers 27-79, inclusive. Of this number, 7 were logs tagged to test natural drift, 21 were natural jams, 1 was built by Metzelaar, and 24 were built by our crew. Of those built, 10 were wings, 2 were V-types, 4 were made of trees, 6 were dams, and 2 were T-types.

All three of these foregoing divisions are sand sections, but they all have good shade. The third division, in particular was found unproductive, having few trout, because it was sandy and supported little food.

The fourth division of the work is the largest. It begins at a point locally termed "The Boxcar" and extends through Sections 13, 14, 11, 10, 9, 4 and 5, of Peacock Township, and through Sections 32, 29, 30, 19, and 24 of Eden Township. There are 384 barriers in this division, numbers 80-463, inclusive. The sections in Peacock Township, Sections 13, 14, 11, 10, 9, 4, are the poorest of this fourth division, as here the stream is largely of sand bottom. They have better pools, however, and more food, because of more plant beds, than the three foregoing divisions. The Peacock Township Sections are not as well shaded, but the alders along the sides are growing so that shade conditions are improving. Pools, gravel areas, muck bars, plant beds, and cover are things these sections need, and it was to attempt to supply these needs that the barriers were introduced.

In sections 13, 14 and 11, Peacock Township, the stream is relatively narrow and deep. The bottom is sand and there are very few plant beds. Although the water is

deep there is very little good cover. 31 were built in these sections.

In Sections 10, 9, and 4, Peacock Township, character of the stream is quite different from that in the preceding Sections of the fourth division. The stream itself is wider, shallower, and swifter. There are some gravel bottom areas, but the greater share of the bottom is sand. 47 barriers were built in these sections.

In Section 5, after a short stretch of sand bottom usually omitted by fishermen by walking across a narrow neck of land, there is gravel. In this stretch of sand bottom, which is just below Spencer's Bridge, and is about 1 mile long by stream course, several wings were put in with the idea of forcing the current over to one side and accelerating it so it would uncover a gravel area on one side of the stream. 30 barriers and covers were built in this Section.

In Sections 32, 29, 30, 19, and 24 of Eden Township, the bottom is gravel with small areas of sand. We built 126 covers, wings, stone and felled-tree barriers here. These were for the purpose of digging, cleaning the gravel, improving pools, making riffles, and furnishing cover. Here the rainbow spawning beds first appear in abundance. The stream is fairly wide and swift. On the whole, the Eden Township Sections are richer in food than the Peacock Sections since the gravel bottom is more productive.

Of the total number of barriers tagged in the fourth division, 58 were natural jams, 21 were built by clubs and property owners, 36 were logs tagged to test drift, 29 were jams built by Metzelaar, and 240 were built by our crew. Of those built in 1930, 135 were wings, 9 were V-types, 2 were X-types, 16 were covers, 33 were trees, 17 were dam types, 11 were stumps, 2 were A-types, and 15 were miscellaneous unnamed types.

The fifth division of the work is in Section 16 of Elk Township. There are 17 barriers in this Section. Of these 4 are natural jams, and 13 are built. The ones built consist of 5 wings, 1 dam, 5 trees, and 2 stumps. The Section is an open

sandy one, and shade is poor, because the stream here flows through farm land. All pools here are poor.

Division six is in Section 9 of Elk Township. It covers a very short portion of the river, beginning a short distance below Lother's Bridge and extending down to a region where the stream was in better condition. The bottom here was sand. 6 barriers were tagged in division six: 1 natural jam, 3 wings, 1 dam, and 1 felled tree.

The seventh division of the work is located in Section 8 of Elk Township, and contains barriers 487-496, inclusive. These consist of 3 natural jams, 4 wings, 1 tree type, 1 stump, and 1 jam put in by the land owner. This Section is sandy, but there are fair pools, and some plant beds, but poor covers.

Division eight is near the Lake County line at Pomeroy Sorings in Section 6 of Elk Township. There were 4 wing type barriers put in here to accelerate the current and dig pools. The river is much larger here, as Stronach Creek comes in above where the work was done.

In 1931, the latter half of June was spent in a complete checking of this work done on the Little Manistee the previous year. Each barrier was examined and notes taken on its condition, with depths across the stream and depths of pools taken again.

Only 1/ of the natural jams was carried out, and 1 of Metzelaar's also went out. Of those built in 1930, 18 had gone out (2 having been cut out), and 19 had been damaged or partly carried out. Thus, of those built in 1930, 5.9% had been destroyed, and 6.2% had been damaged.

Of the 47 logs and poles tagged to test drift, 18 or 38% moved, and of these 18, 6 or 33% were recovered, only a short distance downstream. The water-logged logs lying in the stream had not moved downstream at all. They merely swung around parallel to the current and remained in place, showing the practicability of using

waterlogged material for barriers.

In the first division of the work, 1 jam had been cut loose, and another, made by felling in 2 trees, one from each side, was damaged. The trees had swung around toward the bank, one breaking off where it had been left attached to its stump. Here is a case where the double precaution of leaving the tree attached to the stump, and wiring it to the latter is wise. The branching end of the tree should also be staked and wired out in the stream to prevent it from swinging in to the bank.

Considering the good results found in the check-up, barrier No. 2 is a good example of the use of wings in sandy stretches. This one, in particular, had increased the average depth of the stream from 6 inches to 12 inches, and it had removed 17 inches of sand to make a fine gravel bottom pool with an area of 60 square feet. I saw a number of small trout in this pool, and a large trout in the pool under the barrier itself. In fact trout were seen around most of the barriers. Barrier No. 4 had increased the average depth from 3 to 7 inches and uncovered an area of gravel. Every gravel area is beneficial, especially in a sandy stretch, since gravel produces more food than sand.

A V-type in the second division had also done very good work. It had increased the average depth of the stream, at this point, from 4 inches to 9 inches, and had dug an 18 inch pool with an area of 72 square feet.

The stone dams that had been made from stones hauled to the stream in division two were not exceptionally successful since they tended to bury themselves in the sand.

Only 1 barrier in this second division was damaged and the reason is that the stones from which it was made were too small.

In the third section the barriers were very active in moving the sand from gravel areas and in piling it up in bars below the barriers. Barrier No. 34 removed

sand to a depth of 19 inches to expose gravel beneath. It is better to concentrate the sand in a deep bar than for it to be scattered thinly over a wide area, as 2 inches of sand is as destructive as a deep bar. Dark, mucky material collects on these bars in the shelter of the barriers, and is rich in food. In many cases plants had already started to grow on these bars and there were beginning plant beds in the sheltered areas.

Some deep pools have been made in the upper sandy stretches of the fourth division. Sand has been removed to a depth of 6 to 38 inches. Gravel is almost universally present under the sand, showing that the stream originally had a gravel bottom. The sand has been washed into the stream as a result of deforestation and the old practice of flooding for lumber drives. This ruinous, barren sand is advancing farther down the river each year carrying with it its destruction of insect and plant life. Without doubt, sand is the outstanding enemy of trout streams in the sand regions of Michigan. It is continuing, more and more, to be washed in each year from sand banks. In a place where the banks were high and of sand, large raft devices were put in at the bends to prevent the banks from eroding further. So far these have been quite successful.

A good habitat for insects is furnished by the barriers themselves. I found in 1931 that the wings and dams were literally covered with a mat of caddis and midge larvae, as well as thousands of black fly larvae. The floating covers at the bends also had their share. The barriers are excellent places for the transformation of aquatic insects, and for some species to lay their eggs upon.

The relatively still water behind the barriers provides a warm water nursery for food organisms and for young trout. At the time the checking work was done, all the young rainbows seen were in the protected areas close in to the banks, and behind the wings. Thousands of rainbow fry were observed in these habitats, and insects were laying eggs in the shallower water. I saw a dragonfly, for one, thrusting

her eggs through the slow, shallow water down into the dark muck.

One V-type barrier, No. 187 has removed 18 inches of sand to expose gravel over an area of 1,000 sq. feet. As well as being rich in food, gravel furnishes spawning places. Before improvement was begun the most extensive spawning area ended at the beginning of the sand in Section 5. As a result of improvement this active spawning area was extended up into Section 10, a distance of approximately 2 1/2 miles in a direct line, and perhaps 5 miles by river. Beginning in this section every barrier was surrounded by as many as 1 to 8 spawning beds. Thus, the rainbows were able to spawn in gravel areas, which, before the barriers were built, had been deeply covered with sand. And, incidentally, this sand section which fishermen formerly passed by without fishing, is now fished to advantage. The increase of the spawning area is beneficial since it relieves the congestion in the spawning beds, and prevents the destruction of eggs by the working over of the nests by other fish, which results from crowding the beds.

In the gravel areas the accelerated current caused by the barriers has sorted the gravel and built it up into bars which are excellent for spawning. The current also keeps the gravel clean, preventing silting of eggs.

Stone barriers were checked as being very stable. None were taken out by the current. The wings made of logs which went out under high water did so because the stakes were not driven deep enough into the bottom. It is quite necessary, besides to wire each log securely to its stakes since I found logs went out or were damaged when not wired.

In the last four divisions the entire number damaged was 2, and the total carried out was 2. Some of those built for cover had natural additions of drifted material, making even better hiding places. No. 467 - a tree - provided a deep pool and good cover over it by catching drift.

On the whole, since only 5.9% of all the barriers were destroyed and 6.2% were

damaged, it may be considered that they have held up well. Even this loss could probably have been avoided if the stakes had been driven in to a sufficient depth and the strength of the barriers made adequate to withstand natural forces. I found in checking for one years results, nevertheless, that the work as an entire project on the Little Manistee River proved successful and a conclusive benefit to the stream by furnishing cover and shelter, improving food conditions, producing gravel areas and providing plant beds.

During the fall of 1931 unusual flood conditions obtained in the Little Manistee River. This River was then over its banks and all the lowlands were flooded. The local residents report that this was the biggest flood in years. In late December a hasty examination of half of the work was made. A few of the barriers in the upper reaches had been destroyed, but farther down the barriers had not apparently been damaged. The flood has dug much deeper pools and has really helped the barriers to improve the stream. A report on the effect of these unusual floods will be furnished as soon as another complete recheck can be made.

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