Original: Fish Division ✓
cc: Institute for Fisheries Research
Education-Game
J. W. Leonard
B. P. Hunt
Rifle River Area file
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DIVISION OF FISHERIES
MICHIGAN DEPARTMENT OF CONSERVATION
COOPERATING WITH THE
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February 19, 1952

Report No. 1317

EXPERIMENTAL DEVELOPMENT OF HABITAT FOR BURROWING MAYFLIES (HEXAGENIA)

By

Burton P. Hunt

Abstract

The nymphs of large burrowing mayflies (Hexagenia) are restricted to mud bottom in streams, and only those streams with appreciable quantities of mud bottom contain populations of these insects large enough to produce "hatches" of adults of value to fishermen. Since mud deposition is largely a matter of current velocity, modification of the rate of flow to less than 0.4 foot-per-second should result in the formation of mud banks, thereby increasing the habitat. A short section of the Rifle River was modified on an experimental basis by installation of structures designed to cause mud deposition. Continued surveillance of this area is necessary to determine the effectiveness of the experiment. A brief discussion of the possibilities of experimental development of burrowing mayfly habitat in the Pigeon and Sturgeon rivers is included.

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The presence or absence of appreciable numbers of Hexagenia nymphs in Michigan trout streams is a matter of concern to trout fishermen since extensive "hatches" of these large insects produce excellent angling for large trout. The winged stages are known as fish fly, June fly, Canadian soldier, and quite erroneously as "caddis" and "Michigan caddis." The nymphs are known by the common name of "wiggler." Although it is true that enough adult hexagenids are present to cause large-scale rises of trout only for a short time--normally 2 to 3 weeks--ability of fishermen to take numbers of large trout by fly casting during that period establishes the Hexagenia "hatches" as the high point of the trout fishing season on the Au Sable, Manistee, Boardman, Pere Marquette and other streams. Investigations of the life history and ecology of Hexagenia, principally H. limbata, in streams (IFR Report No. 1240 and 1256) has shown that the nymphs require a firm mud bottom, 2 to 6 inches in depth in which to burrow and live through the nymphal stage. Streams which harbor large populations of nymphs therefore have a considerable amount (8 percent or more) of the bottom composed of mud. In streams, this mud is naturally located along the stream margins, on the inside of bends, above and below

obstructions of various kinds, and in other places where the current is slow enough to allow silt to settle. Current readings, using Midget Current Meter No. 70, indicate that silt will settle out of the water and mud banks will be formed when current velocity drops to about 0.4 foot-per-second or less.

With these facts in mind a project was undertaken in the summer of 1950 in an attempt to develop extensive mud deposits in streams which contain little mud naturally and have a very sparse population of Hexagenia nymphs. The object of this experiment was to so alter the direction and rate of current flow by installation of structures designed to slow the current that sizeable mud banks would form. Presumably an increase in the amount of mud habitat would result in an increase in the number of Hexagenia, principally H. limbata, nymphs present in the improved portion of the stream.

Rifle River

Burrowing Mayflies in Rifle River System

The upper part of the Rifle River, in contrast to the Au Sable River only a few miles away, contains very few of the larger burrowing mayflies. No "hatches" of these insects have been reported for the river at least as far south as Highway M-55 either by fishermen or by personnel of the Institute for Fisheries Research. Nevertheless, the three species commonly encountered in river systems famed for their burrowing mayfly "hatches" are present in the Rifle.

The most common species of burrowing mayfly found in Michigan streams, H. limbata, has been collected at the following locations.

Gamble Creek at Lupton. June 28, 1949, 1 female imago, 1 nymph, collected by B. P. Hunt.

Rifle River at the Area farm bridge. June 27, 1950, 2 nymphs, collected by B. P. Hunt.

Rifle River Area Checking Station. July 12 and 13, 1950, 1 female imago, 1 male subimago, collected by B. V. Hughes. August 9, 1950, 1 female imago, collected by L. H. Bush. These insects presumably came from Gamble Creek or other nearby streams.

The paucity of nymphs and scarcity of adults points to a very meager population of H. limbata in the upper reaches of the river system. It is this species which is of greatest value in most trout streams and which is primarily affected by the experimental project.

H. recurvata, apparently a cold-water hexagenid, occurs in Fontinalis Creek near the Rifle River Area checking station. This insect is undoubtedly absent from the Rifle River proper since the species has been collected throughout the state only in very cold creeks.

Nymphs of Ephemera simulans, a small burrower occupying a sandy-mud habitat, have been collected by the writer in Houghton and Gamble creeks. The species undoubtedly occurs in the Rifle River proper but is not common, for no flights have been reported by the Rifle River Area staff and nymphs are difficult to find. Probably this species would be little affected by an increase in Hexagenia habitat.

Experimental device installation

That portion of the Rifle River selected for this experiment is located in the Rifle River Recreation Area at the Ranch and extends from about 50 feet above the bridge to the bend downstream--a distance of about 310 feet. The area was first mapped on June 30, 1950, by the writer and Mr. Wayne Tody (Figure 1, left map). A double-wing, sheet-piling deflector was being installed about 50 feet below the bridge

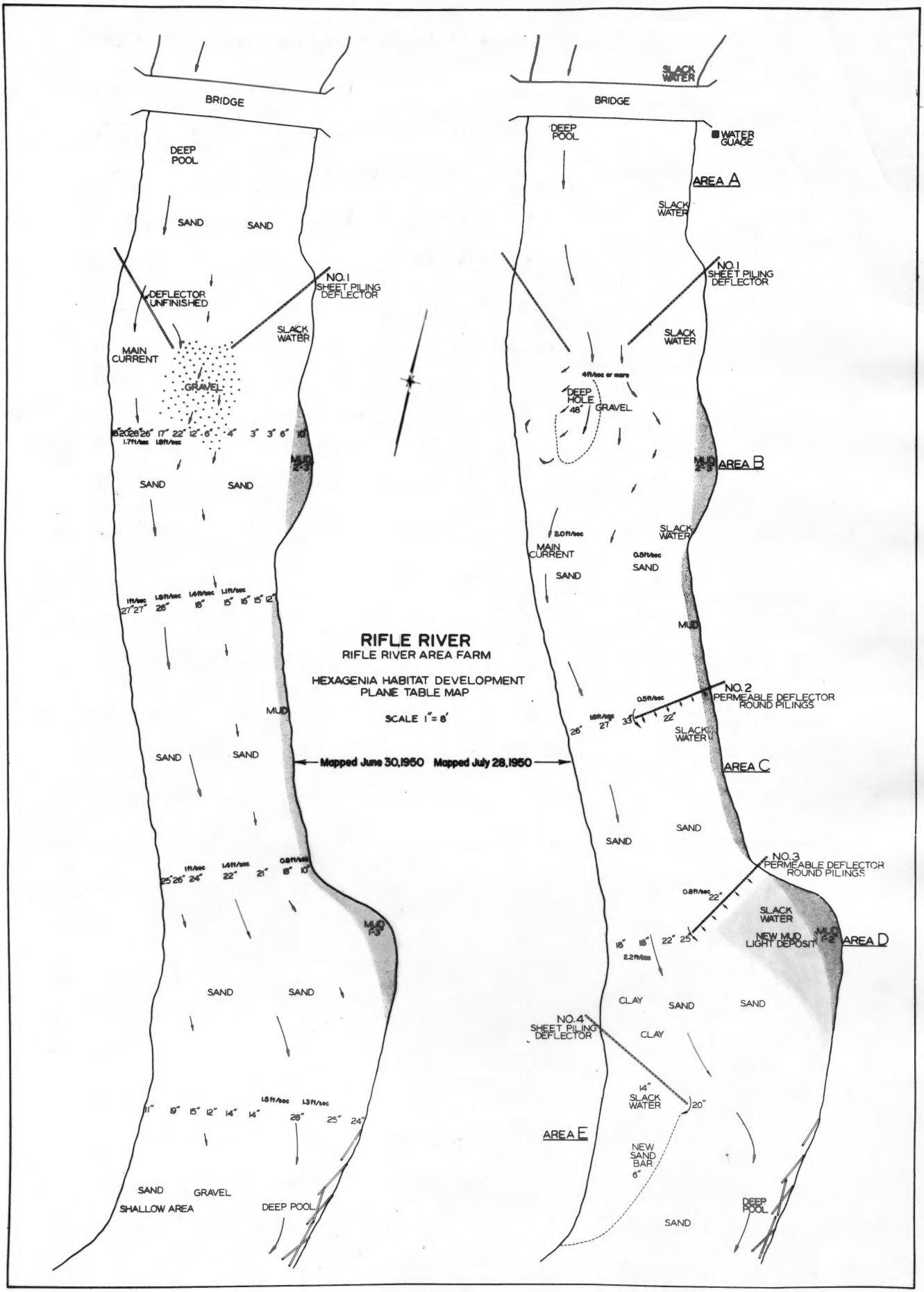
BRIDGE
DEEP POOL
SAND
SAND
NO.1 SHEET PILING DEFLECTOR
DEFLECTOR UNFINISHED
SLACK WATER
MAIN CURRENT
GRAVEL
MUD
SAND
SAND
SAND
SAND
MUD
SAND
SAND
MUD
SAND
SAND
SAND
GRAVEL
SHALLOW AREA
DEEP POOL
BRIDGE
SLACK WATER
DEEP POOL
WATER GUAGE
AREA A
SLACK WATER
NO.1 SHEET PILING DEFLECTOR
SLACK WATER
DEEP HOLE
GRAVEL
AREA B
MAIN CURRENT
SAND
SAND
MUD
NO.2 PERMEABLE DEFLECTOR ROUND PILINGS
SLACK WATER
AREA C
SAND
SAND
NO.3 PERMEABLE DEFLECTOR ROUND PILINGS
SLACK WATER
NEW MUD LIGHT DEPOSIT
AREA D
CLAY
SAND
SAND
NO.4 SHEET PILING DEFLECTOR
CLAY
SLACK WATER
AREA E
NEW SAND BAR
SAND
DEEP POOL
RIFLE RIVER
RIFLE RIVER AREA FARM
HEXAGENIA HABITAT DEVELOPMENT
PLANE TABLE MAP
SCALE 1"= 8'
Mapped June 30,1950
Mapped July 28,1950

Figure 1.

to deepen the large pool under the bridge and stabilize the water level for the installation of a water guage. At the time the area was mapped the deflector was incomplete and the main current was not altered appreciably. Completion of the deflector a few days later resulted in the outflow from the pool being centered in midstream for a short distance before it swung to the west bank into the main channel previously occupied. The original condition of the stream bed (Figure 1, left map) was such that the east side of the river bed was comparatively shallow and slow with very light mud deposits immediately along the bank. Even in this area current velocities ranged from 0.8 to 1.1 feet-per-second at a distance of 10 feet from shore. Theoretically, further slowing of the current along the east bank would cause silt deposition and result in a practically continuous mud bar being formed along the east bank for nearly the full length of the experimental area.

Accordingly, 2 piling deflectors (Figure 1, right map, Deflector Nos. 2 and 3) were installed along the east bank in order to slow the current. These deflectors were constructed of round pilings with tops 3 to 4 1/2 inches in diameter. Spaces between the pilings ranged from 1/4 to 3/4 inch. These filter deflectors effectively divert most of the water just as would a tighter structure. Enough water filters through the spaces between pilings to cause a slight current for a distance of 3 to 4 feet behind the structure. It was believed that the water passing through the deflector would prevent a strong back current--often observed behind tight structures, such as sheet piling deflectors--from developing. A conventional, single-wing sheet piling deflector was placed out from the west bank at the lower end of the experimental section to preserve the deep pool in the bend (Figure 1, right map,

Deflector No. 4). This area was remapped on July 28, 1950, after installation of the structures described above.

It is apparent that 5 areas were established in the experimental section of stream in which mud deposits are expected to form. These are as follows:

Area A - the eastern half of the pool under the bridge extending from the east wing Deflector No. 1 upstream to the gravel riffle entering the pool under the bridge.

Area B - the eastern half of the stream between Deflector Nos. 1 and 2.

Area C - the eastern half of the stream between Deflector Nos. 2 and 3.

Area D - the region behind Deflector No. 3 extending along the eastern bank to the head of the deep pool in the bend.

Area E - the area on the western side of the stream lying behind Deflector No. 4, and comprising a shallow sandy region on the inside of the bend at the lower end of the experimental section.

Results of device installation

Initial examination of the experimental devices installed was made on July 28, 1950, about 10 days after the work was completed. The over-all effect was to cause a general slowing down of the water except in the narrow channels around the ends of the deflectors. A considerable area of slack water (less than 0.2 foot-per-second) developed behind each deflector. In Area A the daming effect of Deflector No. 1 resulted in the eastern half of the pool being quite slow and still. Current velocity in the lower portion of Area B was altered from about 1 to 0.5 foot-per-second. In front of the outer third of Deflector No. 3,

velocity was reduced from about 1 to 0.8 foot-per-second. A decided decrease in the current in Area D was noted. In Area E, water depth had decreased from a maximum of about 19 inches to 14 inches because of the accumulation of sand behind Deflector No. 4. It appeared that a large sand bar might develop behind this structure. As a result of the stream modification considerable mud deposits should accumulate in Areas A, B, C, and D. Area E will probably become a sand bar above the water level and will not contribute to an increase in mud habitat. Sand and gravel were still being shifted, as evidenced by the cutting of a deep hole immediately below Deflector No. 1 and by the accumulating sand below Deflector No. 4. Evidence indicated that additional movement of material would occur before stabilization of the section had been completed.

The second examination of the experimental area was made on August 17, 1950, On that date the water level was somewhat lower than at the time the devices were installed. No current readings were made but inspection indicated a further reduction in current velocities, because of the lowered water level, around the experimental devices. Very little additional silt deposition was discernible, for the stream had been low and clear during the intervening period. The stream bed itself appeared to be little changed since the previous examination.

The ultimate result of the device installation will not be known until sufficient time has elapsed for the process of sedimentation and erosion to shape and stabilize the stream bed in the experimental area. Possibly the effectiveness of the structures may be adequately evaluated by midsummer of 1951. Continued checks should be made on this experimental section to determine the nature and cause of any changes which ensue.

Pigeon River

The experimental development of a short section of the Pigeon River at the Tin Bridge (T. 33 N., R. 1 W., Sec. 28) was proposed on July 5, 1950. Installation of the suggested devices had not been accomplished by July 31, 1950, and it is not known if they were placed in the stream later in the summer. The Pigeon River is similar to the Rifle River in that a small amount of suitable mud is present and a very limited population of Hexagenia limbata exists in the stream. Although occasional adults are seen, no "hatches" have been reported by the staff of the Institute for Fisheries Research. Presumably it is possible to increase the burrowing mayfly population by increasing the amount of habitat. If additional stream improvement work is scheduled for the Pigeon River, particularly within the Pigeon River Trout Experiment Area, it is suggested that some of it be directed towards the formation of mud deposits (H. limbata habitat). The devices or portions of stream involved should then be checked continuously by personnel of the Institute for Fisheries Research to determine their effectiveness.

Sturgeon River

The high gradient and resulting high water velocity of much of the Sturgeon River (Otsego and Cheboygan counties) precludes the presence of appreciable amounts of mud bottom and results in a very sparse or nonexistent Hexagenia population in much of the river. Thus far H. limbata has not been found in the river by the writer. Also no burrowing mayfly nymphs have been collected in the river below Wolverine. H. recurvata is commonly encountered, although not in abundance, in the West Branch of the Sturgeon River and in the main stream, at and above Wolverine. The author has located sizeable mud deposits only in the

neighborhood of the dams at Wolverine. It is probable that structures other than dams would be comparatively ineffective in causing mud banks to form in this river. Although a Hexagenia "hatch" would be desirable on the river and would certainly facilitate the capture of the large brown trout known to be in the stream, in the opinion of the writer, modification of existing conditions sufficient to produce appreciable amounts of mud habitat would involve undue effort and expense.

Conclusions

The successful modification of natural environments to produce a different but desired condition is dependent upon the control and thorough understanding of many factors. No doubt the production of mud habitat for the increase of certain species of burrowing mayflies can be accomplished by installation of devices, although the effect of such structures on current direction and velocity at different water levels cannot be predicted in advance with accuracy. Critical evaluation of the small experimental project under way and additional experiments may suggest methods and structures which may prove to be very effective in producing the desired habitat on an extensive basis. However, modification of rapid streams which contain little or no natural mud will probably prove to be impracticable. It appears to the writer that, although it may be possible to produce Hexagenia habitat as desired, the problem still remains of improving a sufficient amount of stream to be of value (probably involving miles of stream) in raising the nymphal population to such a level that successful and effective "hatches" would occur annually.

INSTITUTE FOR FISHERIES RESEARCH

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