Original: Fish Division
cc: Mr. Milton P. Adams
Education-Game
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DIVISION OF FISHERIES
MICHIGAN DEPARTMENT OF CONSERVATION
COOPERATING WITH THE
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PRELIMINARY INSPECTION OF MANSFIELD CREEK, ARENAC COUNTY, WITH RESPECT TO SALT-WATER POLLUTION

by

George Washburn and John Greenbank

A request was made by Milton P. Adams, director of the Stream Control Commission, to the Institute for Fisheries Research, that an investigation be conducted on the oil-well brine pollution in Mansfield Creek, a tributary of theRifle River, in Arenac County, Michigan. Mr. F. A. Westerman, Chief of the Fish Division approved the investigation. Accordingly, the area was visited, and a preliminary survey was conducted, on August 1, 1942, by the writers, accompanied by Lou Frost of the Stream Control Commission. The trip was made for the double purpose of the inspection and to secure a more adequate supply of brine and oil waste for fish toleration tests as requested by Mr. Westerman.

Mansfield Creek, a tributary of the Rifle River, flows through the northern part of Clayton Township, about 10 miles west of Standish, in Arenac County. The surrounding country is slightly rolling, with numerous small swamps. The top-soil is chiefly sand; and the area is moderately covered with brush and second-growth timber, mostly oak and pine, on the highlands. The main stream of Mansfield Creek flows from east to west, and travels a distance of approximately five miles before emptying into the Rifle River, in Moffet Township.

Two brine samples were secured. The first sample was taken from an oil-brine well at the Swanson Romoor Shephard lease in Section 4, T 20 N, R 4 E, about 100 feet from the west bank of the creek (see sketch map, Figure 1, for approximate location). This well is capped, and control valves can be opened to emit the brine. There are four producing oil wells within 1500 feet of this well; and the brine from these wells was being

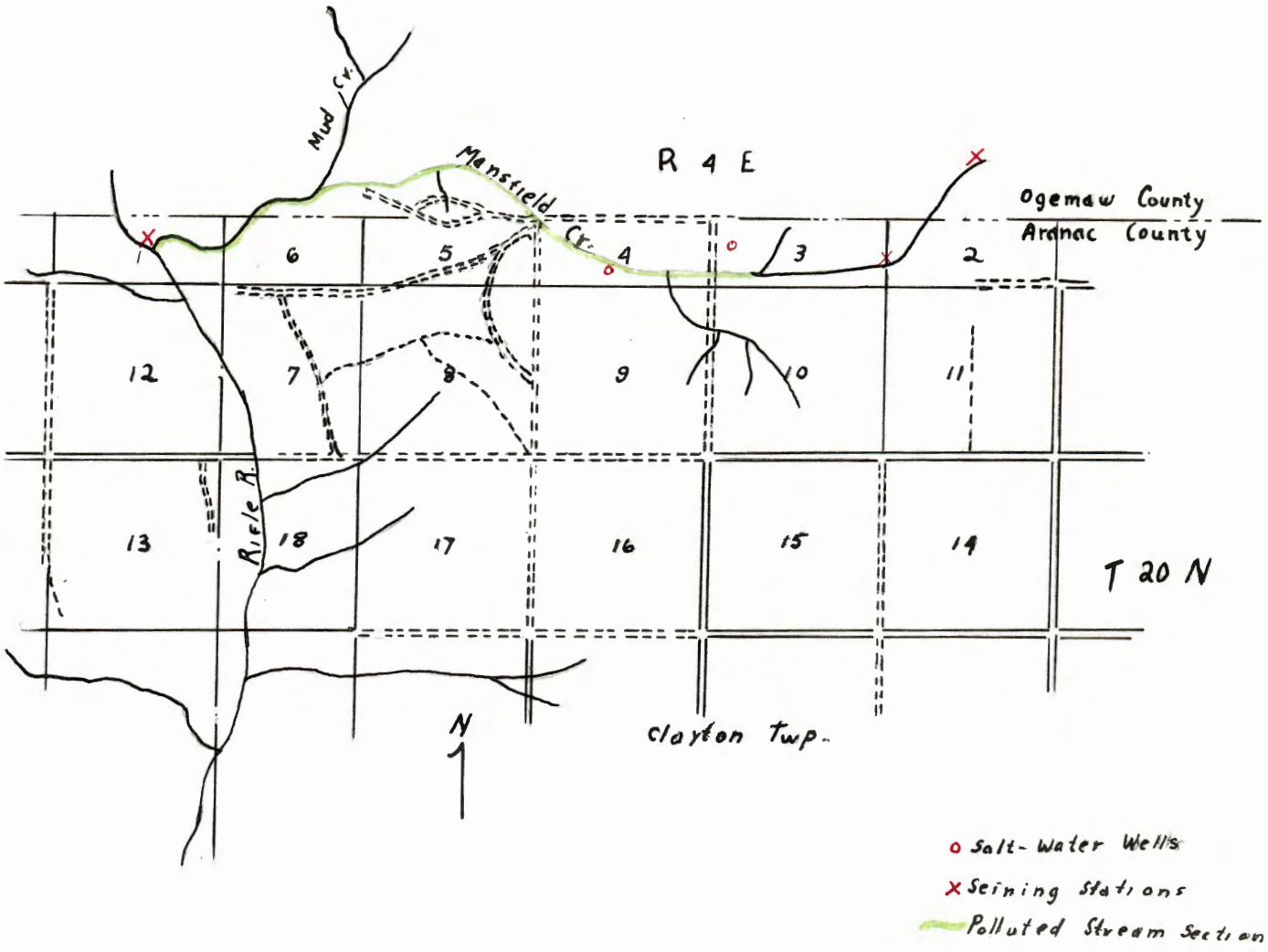

Figure 1. Sketch map, Mansfield Creek and vicinity, Arenac County, Michigan.

led to the well from which the sample was taken, and thence pumped into the Traverse formation, at a depth of about 1600 feet. The sample, therefore, was in a measure a composite one. The valve on the well was leaking a considerable quantity of brine, which was flowing toward, and probably into, Mansfield Creek. The presence of salt crystals, and the sand-washes from the well to the stream bed, gave evidence that this leakage had been going on for some time.

The other sample was taken from a flowing brine well (the Arenac Salt Company well) located about 600 feet east of Mansfield Creek, in Section 3 of the same township. At this well there was a pool about 30 feet in diameter, and a 6-inch casing in the middle of the pool, with a 2-inch reducer on the top of the 6-inch pipe. The brine solution was spraying into the air about 3 feet above the outlet. The estimated flow from the pool was about 100 gallons per minute. The temperature of the brine was 76°F. Although the well casing has been reduced and a valve inserted, the flow cannot be controlled, because the casing is rusted, and much of the brine escapes below the valve. After leaving the pool, the brine flows over a gently sloping field, and seeps into the ground, emerging along the bank of the creek.

Mansfield Creek was inspected at several points for visible effects of pollution. Three stations were sampled for fish. The first of these was at a county road culvert on the east line of Section 3, about 1500 feet above the brine well (see Figure 1). The water temperature was 58°F., the air temperature 78°F. The water was white, and clear. The stream at this point consisted of pools and rapids (there is a moderately steep gradient to the stream throughout its entire course); and the bottom was sand and fine gravel. The estimated flow was about 220 gallons per minute. Only one species of fish was taken - the brook stickleback, Eucalia inconstans. This fish was abundant. The only aquatic vegetation present was a green alga. The banks were well covered with vegetation; and there were no visible signs of pollution at this location.

The next region examined was downstream from the first one, and about 600 feet above the brine inlet. The stream here was inspected for several hundred feet. The upper part of the examined area was free from visible effects of pollution, and was somewhat comparable to that part of the stream described above. Quite a few sticklebacks were present. A few hundred feet downstream, however, the population of sticklebacks decreased abruptly, and several dead ones were observed on the bottom. Also found dead on the bottom were frogs and water beetles. The area on both sides of the stream, for 50 to 100 feet back, was devoid of all vegetation. About 200 feet above the brine inlet, no fish could be collected with the net, and none were observed in the stream. The water temperature was 55°F., and the stream bed was similar to that described above. The stream bed apparently was devoid of aquatic plants and insects. Since this area was at least 200 feet above the salt well inlet, its pollution presumably had been caused by the washings from the Arenac Salt Company

plant, which was located on the east bank of the stream, somewhat upstream from the well, and which is no longer in operation. Below the outfall from the salt-water well, the trees and shrubs had been destroyed in a strip 100 to 200 feet wide and about a quarter of a mile long.

The next site visited was the mouth of Mansfield Creek, where it empties into the Rifle River, in Section 1, T 20 N, R 3 E. Here the stream was considerably larger, flowing approximately 10 c.f.s. The water was white; the bottom was sand, gravel, and rubble. Small pools alternated with riffles. The water temperature was 68° F., the air temperature 78° F., and the pH of the water 7.6. The stream bed was covered with a dense growth of green and brown-colored algae. The bank vegetation was dense and green. Only two fish were taken in the stream, a 4-inch log perch, Percina caprodes, and a 3-inch pumpkinseed, Lepomis gibbosus. In the Rifle River, at the mouth of Mansfield Creek, four species of fish were taken: rosy-faced shiner, Notropis rubellus; spot-fin shiner, Notropis spilopterus; common shiner, Notropis cornutus; and common sucker, Catostomus commersonnii. A sample of the water from Mansfield Creek at its mouth was brought to the University of Michigan. A preliminary analysis, by Arnold Heine, of the University, showed this sample to have a specific gravity of 1.0074, and to contain 10,430 p.p.m. total solids, of which 5,755 p.p.m. was chlorides plus bromides.

The inspection here described was only of a preliminary nature; and it probably would be advisable to conduct a more detailed investigation of the area.

The two oil-brine samples which have been described above were taken for the purpose of running some toxicity thresh-hold experiments pertaining to fish life, which are now being conducted at the date of this writing.

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