

103.—EFFECT OF WASTE PRODUCTS FROM PAGE'S AMMONIACAL WORKS UPON YOUNG SHAD FRY.**By MARSHALL McDONALD.**

[Report to Prof. S. F. Baird for the District Commissioners.]

I respectfully transmit herewith a report of a series of experiments made in obedience to your instructions, with the object of determining the extent of the injurious or deleterious influences exerted upon young fish confined in water containing different proportions of the waste products from the ammonia works in West Washington.

The sample experimented with was furnished by the Board of Health, through Dr. J. H. Kidder, and was obtained from the Page ammonia works in Georgetown. A portion of the original solution has been retained for reference. The experiments were conducted by W. F. Page, superintendent of propagation at the Central Station, and the result shows that this waste product exerts a distinctly deleterious influence when present in water to the amount of one-fourth of 1 per cent. or in the proportion of 1 gallon to 400 gallons of Potomac River water. No experiments were made with solutions of less strength than one-fourth of 1 per cent. If we consider only the direct effect on young shad which have not yet begun to feed, it is probable that the area of injurious pollution in the case of the Potomac River does not extend very far from the point at which the waste products are discharged into the river.

Before coming to any definite conclusion, however, we must take into consideration the fact that very young shad, which have not yet begun feeding, are much less sensitive to injurious influences in the water in which they are than the same fish after their sacs have been absorbed and they have begun feeding. We must further consider that the minute food upon which the young shad feed is much more sensitive to injurious influences (especially those exerted by the presence of coal-tar products) than are the young fish which feed upon them.

RECORD OF EXPERIMENTS.

1.—One hundred newly-hatched shad were put in 20 ounces of the refuse, 100 per cent strength, at 9.40 a. m., May 21, 1885. In 40 minutes they were all weak, at the bottom of the dish, and barely moving; 12 m., all dead.

2.—One hundred newly-hatched shad were put in 20 ounces of mixture, 75 per cent strength (3 parts refuse, 1 part Potomac water), at 9.40 a. m., May 21; 11 a. m., commenced to weaken and go to the bottom; 12.30 p. m., very few alive; 1.30 p. m., all dead.

3.—One hundred newly-hatched shad were put in 20 ounces of mixture, 50 per cent strength (10 ounces of refuse, 10 ounces of Potomac

water) at 9.40 a. m., May 21; 11 a. m., showed signs of weakness, part going to the bottom; 12.30 p. m., few swimming, but majority were at the bottom and quiet; 1.30 p. m., all were at bottom, many dead; 2.15 p. m., all dead.

4.—One hundred newly hatched shad were put in 20 ounces of mixture, 25 per cent strength (5 ounces of refuse and 15 ounces of Potomac water) at 9.40 a. m., May 21, 11 a. m., all up and swimming, but a little weak; 12.30 p. m., about one-half on bottom, others weak and spasmodic in their movements; 1.30 p. m., half dead, others dying; 4 p. m., all dead.

5.—One hundred newly-hatched shad were put in 20 ounces of mixture, 10 per cent strength (2 ounces of refuse and 18 ounces of Potomac water) at 9.40 a. m., May 21; 12.30 p. m., but few were affected, majority up and swimming but showing slight signs of weakness; 6.30 p. m., 50 per cent dead; 8 p. m., 75 per cent dead; 7 a. m., 22d, 90 per cent dead; 4 a. m., 23d, all dead.

6.—One hundred newly-hatched shad were put in 20 ounces of Potomac water at 9.40 a. m., May 21. All were still alive when all were dead in the previous experiments. After the 27th of May, they began to die, and by the 30th none were alive.

7.—One hundred newly-hatched shad were put in 20 ounces of mixture, 5 per cent strength (1 ounce of refuse and 19 ounces of water) at 2 p. m., June 2; 6 p. m., 12 fish dead; 6 a. m., June 3, 30 fish dead, others weak; 6 a. m., June 4, 40 fish dead, others weaker; 6 a. m., June 5, 52 fish dead, remainder very weak and at the bottom; 6 a. m., June 6, all dead.

8.—One hundred newly-hatched shad were put in 20 ounces of mixture, 1 per cent strength (1 part of refuse and 99 parts of water) at 2 p. m., June 2; 6 p. m., 9 fish dead; 6 a. m., June 3, 16 fish dead, remainder all right; 6 a. m., June 4, 25 fish dead, remainder weak; 6 a. m., June 5, 31 fish dead; 6 p. m., 55 fish dead; 6 a. m., June 6, 73 fish dead; noon, June 6, all dead.

9.—One hundred newly-hatched shad were put in 20 ounces of mixture, .5 per cent strength ($\frac{1}{2}$ part refuse and $99\frac{1}{2}$ parts water), at 2 p. m., June 2; 6 p. m., all alive and strong; 6 a. m., June 3, three dead, remainder all right; 6 a. m., June 4, three dead, remainder well; 6 a. m., June 5, fourteen dead, remainder fair; 6 a. m., June 6, twenty-seven dead, remainder much weaker and suffering; 6 p. m., June 6, all dead.

10.—One hundred newly-hatched shad were put in 20 ounces of mixture, .25 per cent strength (.25 part of refuse and 99.75 parts water), at 2 p. m., June 2; 6 p. m., all well; 6 a. m., June 3, four fish dead, others better than in No. 9; 6 a. m., June 4, four fish dead; 6 a. m., June 5, sixteen fish dead; 6 a. m., June 6, twenty-three fish dead; 6 p. m., fifty-seven fish dead; 6 a. m., June 7, all dead.

11.—One hundred newly-hatched shad were put in 20 ounces of Potomac water at 2 p. m., June 2. But few are alive now (noon, June 8), and these have but little vitality.