

Toxicity of Methyl Mercury for Steelhead Trout Sperm

by J. D. McINTYRE
*Oregon Cooperative Fishery Unit
Oregon State University, Corvallis, Ore. 97331*

In one segment of a study designed to determine the genetic effects of mercury toxicity for steelhead trout (*Salmo gairdneri*), it became necessary to determine the concentrations of methylmercuric chloride that would reduce sperm viability. This report presents the results of a test that was performed to determine this concentration under laboratory conditions.

Methods

Sperm was obtained from five steelhead at the Game Commission of Oregon's Alsea Trout Hatchery. The sperm was combined into a common pool from which 1/10 ml aliquots were removed and inoculated into test tubes that contained a range of concentrations of methylmercuric chloride in 10 mls of 0.85 percent sodium chloride solution. These test solutions contained concentrations of mercury that ranged from 1 g/L to 10 mg/L and were maintained at 11 C. A control was treated likewise. The sperm was left in the test solutions for 30 minutes, and then each sperm-containing solution was combined with 100 steelhead eggs (all eggs were from a single female). After one minute, each group of eggs was washed several times with uncontaminated water and placed into separated compartments in an incubator tray. The percentage of fertilization for each group was determined on the 17th day following fertilization when the eye pigment of the developing embryos was clearly visible.

Results and Discussion

The percentages of eggs that were not fertilized at each concentration of mercury (Table 1) indicated that concentrations of 1.0 ppm and greater reduced sperm viability as compared to the control. Reductions in sperm viability increased sharply at concentrations greater than 1.0 ppm.

An assessment of the significance of these results in terms compatible with environmental concentrations of mercury is complicated in that amounts of methyl mercury concentrated by a fish is dependent on the type of mercury compound present in the water. Matida et al. (1971) did not find organic mercury compounds in trout kept in a solution of mercuric chloride. Most of the mercury found in fish held in a solution of methylmercuric chloride was measured as methyl mercury, but traces only of methyl mercury were found in fish held in phenylmercuric acetate.

TABLE 1

Percentages of non-fertilized eggs and concentrations (C) of mercury (ppm) to which sperm were exposed

C	Percent	C	Percent	C	Percent
Control	9.1	0.010	5.1	1.000	29.3
0.001	2.5	0.050	4.7	1.000	74.0
0.001	8.1	0.100	3.4	5.000	100.0
0.005	4.9	0.100	8.7	10.000	100.0
0.010	3.4	0.500	12.5	10.000	98.5

The relationship between amounts of methyl mercury concentrated in gonadal tissue and amounts in the water can be estimated with data of Hannerz(1968). He estimated a concentration factor (ratio of concentration in tissue and in water) of approximately 1300 for gonadal tissue from pike held in ponds that contained methylmercuric hydroxide. Accordingly, an equilibrium concentration of 1 ppm mercury in the gonad would result in environments that contained 0.769 ppb mercury in the methylated form. No precise estimate of the exposure time required to attain an equilibrium between concentrations in tissue and in water is presently possible; however, Hannerz's concentration factor was determined after the fish had been exposed to methyl mercury for one month, and any subsequent accumulation would tend to make the estimate conservative.

The present experimental design does not permit studies of the chronic effects on sperm of lower concentrations; however, the extreme sensitivity of steelhead sperm to a level of mercury that often is found in fish tissue was evident.

References

- Matida, Y., Kumada, H., Kimura, S., Saiga, Y., Nose, T., Yokote, M., and Kawatsu, H., Bull. Freshwater Fish. Res. Lab. 21(2), p 197-226, (1971).
- Hannerz, L., Fishery Board of Sweden, Institute of Freshwater Research, Drottningholm. Report 48, p 120-176, (1968).