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Multiple Sulfa Therapy of Kidney Disease Among Brook Trout

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Kidney disease was identified in 1955 for the first time in Michigan among brook trout at the Oden and Marquette hatcheries. The disease had been reported previously only from hatcheries in the states bordering the Atlantic and Pacific oceans. Kidney disease at the Oden hatchery developed only in a group of brook trout hatched at the U. S. Fish and Wildlife Service hatchery at Charlevoix. This hatchery received eggs from a hatchery in New England where kidney disease had been endemic for many years. Since some evidence has been found by researchers suggesting that the disease might be transmitted by the egg, it was assumed that the New England hatchery was the source of the infection at Oden. No such correlation could be found to account for the infection at Marquette. Brook trout there were hatched at the Thompson hatchery from eggs obtained from a hatchery in Pennsylvania, a source considered to be free of kidney disease. However, it is possible that the Pennsylvania hatchery had purchased eggs from an East Coast hatchery where kidney disease was present.

According to Snieszko and Griffin (1955) satisfactory control was obtained by treatment with sulfonamides; gantrisin and sulfamerazine were recommended because they had the least retarding effect on growth of brook trout. They reported that treatments with antibiotics (chloramphenicol, terramycin and aureomycin) failed to control kidney disease. They also suggested that multiple therapy with several sulfonamides might prove to be more effective than therapy with only one sulfonamide. Opportunity to explore

this suggestion came when ten cement tanks at the Marquette hatchery became available for a limited time for use in experimentation, and three sulfa drugs were on hand.

Treatment Experiments

The ten tanks were divided into five groups of two each and labelled A, B, C, D, and E. Each tank was stocked with 200 brook trout, 27 months old and averaging eight inches in length, chosen at random from the lot having kidney disease. Treatments were instituted as follows:

- A. Control. No treatment.
- B. Sulfamerazine.
- C. Sulfamerazine and sulfaguanadine.
- D. Sulfamerazine and sulfadiazine.
- E. Sulfamerazine, sulfaguanadine and sulfadiazine.

All drugs were fed at the rate of 12 grams per 100 pounds of fish per day, except to group E. This group received 12 grams sulfamerazine and eight grams of each other drug per 100 pounds of fish per day. Drugs were fed as above for four consecutive days, then with $\frac{2}{3}$ of this dose daily for the next 25 days, for a total of 29 days of treatment (March 12 to April 9, 1956). All groups were observed for 22 days following therapy.

The percentage mortality among all groups each week during the period of treatment did not demonstrate any particular trend, except in group E which received the three sulfas (Table 1). Increase in mortality among the fish in this group may have been due to the large dose of drugs; post-treatment loss among this group was less than during treatment. The post-treatment mortality among all groups was less than that during treatment, except among the control group where the mortality increased. The percentages given in Table 1 were computed on the number of fish remaining at the beginning of each week.

Table 1.—Weekly mortalities

During treatment:					
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>
1. Number	8	7	2	8	4
Percent	2.00	1.75	0.50	2.00	1.00
2. Number	4	3	7	4	9
Percent	1.02	0.76	1.76	1.02	2.27
3. Number	6	4	4	5	13
Percent	1.55	1.02	1.02	1.29	3.36
4. Number	5	5	9	3	9
Percent	1.31	1.29	2.32	0.78	2.41
Total -					
Number	23	19	22	20	35
Percent	5.70	4.75	5.50	5.00	8.75
Post-treatment:					
5. Number	12	1	4	0	4
Percent	3.18	0.26	1.06	0.00	1.09
6. Number	18	3	7	0	5
Percent	4.93	0.79	1.87	0.00	1.38
7. Number	14	4	3	11	3
Percent	4.03	1.06	0.82	2.89	0.84
Total -					
Number	44	8	14	11	12
Percent	11.67	2.10	3.70	2.89	3.29

Snieszko and Griffin (1955) reported that mortality from kidney disease began in April or May and reached a peak in June. The tanks were available for the present experiments only from March to May, which may account for the low mortality in the control group during March and the increase in mortality in this group in April.

Since mortality among all groups was comparatively low, Chi-square tests were made to show whether or not the differences in mortality could be just the result of chance variations. The P values of these tests must be at a 95 percent or higher level to indicate significance. The higher mortality among group E during treatment was significant only when compared with group B and possibly group D, but all values in group E were considerably higher than any other group (Table 2). The P values of group A during the post-treatment period indicate that there was a significant difference in mortality compared to all other groups.

The Chi-square tests also show that there was no significant difference between the mortalities of all treated groups. This indicates that treatment with sulfamerazine alone was just as effective as treatment with various combinations of the three sulfas, and that all combinations of sulfa drugs employed here were equally effective in controlling the disease. Furthermore, since some post-treatment mortality still persisted and kidney disease was present among all groups twenty-two days after treatment was terminated, it is evident that none of the treatments given were successful in completely eradicating kidney disease.

Table 2.—Chi-square and P values
of total mortalities

		<u>E</u>	<u>C</u>	<u>D</u>	<u>E</u>
During treatment:					
A	X ²	0.23	0.023	0.22	2.25
	P	35.4	11.5	34.7	85.7
B	X ²	...	0.23	0.27	4.47
	P	...	35.4	38.0	96.2
C	X ²	...	...	0.10	2.72
	P	...	...	24.3	90.1
D	X ²	...	...	...	3.83
	P	...	...	...	94.9
Post-treatment:					
A	X ²	25.7	15.8	17.0	17.5
	P	99+	99+	99+	99+
B	X ²	...	1.14	0.49	0.59
	P	...	71.2	51.1	54.4
C	X ²	...	...	0.16	0.09
	P	...	...	30.8	23.1
D	X ²	...	...	...	0.13
	P	...	...	...	27.9

Summary

1. Kidney disease, known previously only from hatcheries bordering the Atlantic and Pacific oceans, was identified among brook trout in Michigan.
2. Experiments on kidney disease in brook trout were made at the State Fish Hatchery, Marquette, Michigan.
3. The effect on kidney disease of sulfamerazine alone and in combination with sulfaguanadine and sulfadiazine was tested.
4. Kidney disease was controlled with all combinations of the three sulfa drugs. Sulfamerazine alone was just as effective as it was in combination with sulfaguanadine and sulfadiazine.
5. None of the treatments effected a complete cure.

Acknowledgments

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Literature Cited

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MICHIGAN DEPARTMENT OF CONSERVATION

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MULTIPLE SULFA THERAPY OF KIDNEY DISEASE AMONG BROOK-TROUT

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April 23, 1957

Kidney disease was identified for the first time in Michigan among brook trout at two state fish hatcheries (Oden and Marquette). Snieszko and Griffin (1955) achieved satisfactory control, but not complete elimination of the disease, by treatment with gantrisin and sulfamerazine, and suggested that multiple therapy with several sulfonamides might be more effective.

From one lot of brook trout infected with kidney disease, four groups of 400 fish each were treated with various combinations of sulfamerazine, sulfaguanadine and sulfadiazine, with one group receiving all three drugs and a fifth group of 400 fish held without treatment for control. All treated groups demonstrated significantly less post-treatment mortality than the untreated control group. Sulfamerazine alone was equally as effective as any combination of sulfas, but none of the treatments completely eliminated the disease. These tests were made at the Marquette Hatchery, March 12 to May 1, 1956.

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