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COMPETITION BETWEEN COHO SALMON AND RAINBOW TROUT
IN THE LABORATORY¹

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Abstract

Competition between coho salmon and rainbow trout was studied by comparing growth of the two species when held together in a laboratory raceway. Fish (5 inches long) were fed the Oregon moist pellet for 28 days at the daily rate of 2.5% of body weight. The rainbow controls, rainbow experimentals, and coho controls increased in weight an average of 8.1, 3.4 and 4.1 grams respectively. Coho experimentals lost an average of 1 gram per fish. The conclusion is that rainbow trout were dominant over coho salmon in getting food, with the result that the salmon made no growth.

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The introduction of coho salmon, Oncorhynchus kisutch (Walbaum), into Michigan waters presents many questions and problems for fish management. One of these problem areas is the competition for food that may exist between fingerling coho salmon and native trout in streams. The purpose of this experiment was to investigate possible competition between coho salmon and rainbow trout, Salmo gairdneri Richardson, by comparing growth of the two species held under controlled conditions.

Kalleberg (1958) reported that brown trout parr, Salmo trutta L., were more aggressive and grew faster than juvenile Atlantic salmon, Salmo salar L., on natural foods available in a stream tank. Le Cren (1965) found that trout fry dominated salmon fry (species not given) in a small experiment which involved planting different proportions of salmon and trout eggs in the same section of stream.

Methods and equipment

At the Saline Fisheries Research Station, one tank (15 feet long x 28 inches wide x 28 inches high) was partitioned lengthwise to provide two identical compartments for holding fish. Screens were placed one foot from each end of the tank for water intake and discharge areas. Water was recirculated by pumping from the discharge area into the intake area. Capacity of the pump was about 90 gallons per minute, and there was about 70 gallons of water in each compartment. A standpipe at one end of the tank held the water level constant. The bottom of the tank was covered with varying thicknesses of coarse

gravel over which the water ranged from 2 to 13 inches deep. Temperature was regulated by a continuous small flow of aerated well water. Water temperatures ranged from 55 F to 70 F except for a two-day period when a faulty water pump caused a temporary range of 47 to 75 F. The average temperature was 62.2 F and oxygen was 7 ppm.

On 10 April 1967, 36 trout were put in compartment A and designated as controls. Eighteen trout and 18 salmon were placed together in compartment B and were used as test fish. This phase of the study was terminated after 28 days. On 10 May, 36 salmon were substituted for the rainbows in compartment A (control); these salmon were fed at the same rate and held under the same conditions as the 36 control rainbow trout.

The Oregon moist pellet (Hublou, 1963) was fed at the daily rate of 2.5% of body weight. This rate was considerably below the level needed for maximum growth but was used to promote competition for food. No compensation was made in the daily ration for a change in body weight during the experiment, and the fish were fed twice daily at irregular hours.

Growth was measured by determining the differences in the average length and weight of each group of fish at the beginning and end of the study period.

Results

The average total lengths in inches and weights in grams of the control and experimental fish at the beginning and end of the study are

given in Table 1. The fish in each group increased in weight except the coho experimentals. The rainbow controls gained an average of 8.1 grams; and the rainbow experimentals an average of 8.4 grams. These gains represented increases of 50% and 46%, respectively. Coho controls gained an average of 4.1 grams (31% increase in weight), but the experimental cohos lost an average of 1.0 gram per fish during the 28 days.

These differences in weight increments were subjected to a t test of significance. The loss of 1.0 gram per fish for the experimental cohos was not a significant change, but the increases of 8.1 grams (rainbow experimentals), 8.4 grams (rainbow controls) and 4.1 grams (coho controls) were highly significant ($p < 0.01$). Thus, there is evidence that the trout were more aggressive than the salmon.

Further evidence of the aggressive behavior of trout was the frayed caudal fins found on the salmon experimentals. Frayed fins were not found on the salmon controls or on any of the rainbows.

The two species could not be distinguished in compartment B at feeding time. At other times both species appeared to occupy the same areas of the tank. Fish seldom were seen in the shallowest water but were usually confined to the pool areas, although not necessarily on the bottom.

The rainbow trout were produced from hatchery brood stock and it is possible that this gave them an advantage of being well adapted to laboratory conditions. Therefore we will repeat the study and this time use coho salmon with wild rainbow trout (steelheads from a Great Lakes spawning run).

Acknowledgments

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Table 1. --Average total lengths (inches) and weights (grams) of four groups of fish at the beginning and end of the experiment. Number of fish in parentheses.

Date	Experimental				Control			
	Rainbow trout		Coho salmon		Rainbow trout		Coho salmon	
	Length	Weight	Length	Weight	Length	Weight	Length	Weight
	(18)	(18)	(18)	(18)	(36)	(36)	(36)	(36)
April 10	4.9	18.4	4.8	15.4	4.7	16.1	-	-
May 8	5.4	26.8	4.9	14.4	5.2	24.2	-	-
May 10	-	-	-	-	-	-	4.8	13.3
June 7	-	-	-	-	-	-	5.1	17.4
Difference	+0.5	+8.4	+0.1	-1.0	+0.5	+8.1	+0.3	+4.1