ARE UPRIVER STOCKS OF COLUMBIA RIVER SALMON DOOMED?

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Many people in Washington and Oregon have said, "Why not forget the upstream stocks of Columbia River salmon? The dams and reservoirs on the Columbia and Snake Rivers will eventually destroy these fish; we should direct all our effort toward increasing the production of salmon from hatcheries on the lower part of the river." Recent information from studies being conducted on the Columbia by the Bureau of Commercial Fisheries (BCF) says, "NO!" These studies show that downstream survival of wild juvenile fall and spring chinook salmon can be increased by transporting the migrating juveniles around certain dams and reservoirs.

In one experiment 200,000 young wild spring chinook salmon were collected and marked (Fig. 1) at Ice Harbor Dam. About half of these fish were released at Ice Harbor Dam, and the other half were transported downstream by truck and released below John Day and Bonneville Dams (Figs. 2 and 3). Next, the BCF sampled the downstream migration at The Dalles Dam and in the estuary near Astoria, Oregon, for marked fish; the number of recaptured fish that were released at Ice Harbor Dam were then compared with the numbers of recaptured fish that were transported. Twice as many transported fish reached The Dalles Dam and Astoria. Evidently large numbers of juveniles released at Ice Harbor failed to reach the lower part of the river.
The number of wild chinook salmon available to the commercial and sport fishery could be substantially increased if sufficient numbers of migrating juveniles were collected and transported around some of the dams and reservoirs. For example, about 12 million juvenile chinook were estimated to have passed Ice Harbor and Priest Rapids Dams in 1967; from our data, we believe that 50 percent of the run failed to reach John Day Dam. Assuming that 25 percent of the 12 million fish could have been transported below John Day, an additional 150,000 chinook would have been available to the commercial and sports fishery if only 10 percent of the transported fish had survived their early life in the ocean.

Experiments with hatchery reared salmon also show that transporting migrating juvenile fish may be beneficial. Results of one study with fall chinook salmon migrating from Little White Salmon National Hatchery indicate that survival in that part of the river between the hatchery and Bonneville Dam could be tripled if the fish were released below Bonneville Dam rather than at the hatchery.

Information on survival to the estuary is being obtained from the BCF research station at Astoria, Oregon. Mr. Carl Sims, Project Leader at Astoria, developed a sampling system in which large numbers of wild and hatchery salmon could be captured near the end of their downstream migration. This system enables biologists to evaluate experiments on downstream survival of different stocks of fish. In the past this evaluation could only be made 2 or 3 years after the downstream migration; estimates of survival had to be based on the number of marked adults returning to the river to spawn.
It is possible to easily capture large numbers of downstream migrating salmon at the dams on the Columbia; each dam has a built-in collector in the turbine intake gatewells (Fig. 4). Studies at North Bonneville and Pasco, Washington, indicate that a majority of the migrating juvenile salmon can be diverted into gatewells during periods when the dams are not spilling. If these devices are implemented to catch juvenile salmon, sufficient numbers of migrating fish could be collected to make a transportation system economically feasible. An increase of 10,000 chinook salmon in the commercial and sport fishery would more than compensate for the cost of a transportation system.

The results of all these studies—the collection of juvenile salmon in gatewells, transportation experiments, and the development of a method to evaluate the transportation experiments in the estuary—provide fishery biologists a new optimism concerning the potential of increasing the numbers of salmon from the upper and lower parts of the Columbia River. BCF biologists feel that the stocks of salmon in the upper river may not be doomed; the runs can be maintained, or in some cases increased, if the knowledge presently being gained on collecting and transporting juvenile salmon is implemented. Of course, we do not know whether the homing ability of salmon will be impaired by the act of transporting them past parts of the river. Continued evaluation of numbers of marked adult salmon returned to Ice Harbor Dam in future years will answer this question.
FIGURE LEGENDS

Figure 1.--Juvenile salmon with the type of mark (a thermal brand) that was placed on the juvenile fish. This method of marking salmon was perfected by BCF biologists and is now in wide use throughout the Pacific Northwest.

Figure 2.--Map of the Columbia River showing the location of release sites, dams, and recovery sites.

Figure 3.--A 5,000-gallon tank truck used by the BCF to transport juvenile salmon down the Columbia River. The truck carried about 4,000 lbs. of fish (400,000 fish that are $2\frac{1}{2}$ inches long).

Figure 4.--Location of the turbine intake gatewells in a typical Columbia River dam.
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Figure 3.--A 5,000-gallon tank truck used by the BCF to transport juvenile salmon down the Columbia River. The truck carried about 4,000 lbs. of fish (400,000 fish that are 2½ inches long).
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