# SUMMARY--PROTECTION OF FINGERLING SALMONIDS AT LOW HEAD DAMS ON THE COLUMBIA AND SNAKE RIVERS

by

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An increasing number of fingerling salmonids are being forced through Kaplan turbines in dams on the Columbia and Snake Rivers. This is due to expanding upstream storage as new dams are constructed and to greater demands for water to generate power. Specific techniques to protect these fingerlings are being considered. They include guiding devices to divert fish into safe areas and modification of turbine operation to eliminate or neutralize lethal zones.

Among the new tools being used in this program of research are: (1) A funnel net to screen the entire discharge of a single turbine and to guide migrants into a fish sanctuary; (2) an intake frame for deploying equipment in a turbine intake to examine fish behavior patterns; (3) a fish-release capsule for releasing groups of marked fish in specific areas within turbine intakes or draft tubes; (4) acoustic and electronic equipment for examining noise associated with cavitation; and (5) techniques for separating, transporting, and transferring fingerlings with a minimum of stress.

Experiments on the timing of migrant passage at The Dalles Dam indicated that more fingerling salmonids over a year old passed through turbines between 7 p.m. and 7 a.m. (85 to 95 percent) than between 7 a.m. and 7 p.m. However, the passage of 0-age fingerlings and lamprey ammocoetes was less disproportionate, being 34 and 66 percent for day and night periods respectively.

Vertical distribution studies in the turbine intakes at The Dalles and McNary Dams showed that about 70 percent of the fingerlings over a year old were traveling in a zone within 15 feet of the intake ceiling, whereas about 50 percent of the 0-age salmonids at The Dalles were found in this zone. Lamprey ammocoetes at The Dalles were found concentrated in the lower half of the intakes.

Significant numbers of fingerling salmonids have been removed from intake gatewells. At Bonneville Dam fingerlings tended to accumulate in gatewell 3-B but not in gatewell 3-C. At McNary Dam fish accumulated in the B gatewells, and most fish were concentrated in the center section of the powerhouse. The B wells with steel grill covers appeared to contain more fish than adjacent A and C wells with solid concrete covers. Thin and apparently starved fish were found in the B wells, but none were found in A or C wells. However, at Bonneville Dam exit rate tests indicated that most chinook and coho salmon sounded and left the gatewells within 2 days.

An orifice installed in one of the gatewells at Bonneville Dam passed fish from the gatewell into the ice and trash sluiceway. Steelhead trout appeared to pass better than chinook migrants.

Tests with standard, black louvers in a horizontal array in near-total darkness (similar to that found in turbine intakes) indicated that fingerlings utilize vision, in part at least, to avoid this guiding device. A method of enhancing the visibility of louvers may be required.

Evaluation of recovery equipment used to collect fish passed through turbine number 9 at Bonneville indicated that fish mortalities were related to position of entrance into the funnel net mouth. Yearling coho salmon released at nine positions in the net mouth during six tests sustained a consistent mortality by release point but varied according to release point. The mortalities to fish from individual releases into the net ranged from 0.0 to 60.4 percent, and the higher mortalities appeared to be associated with the upper left ceiling area of the net mouth where high water velocities and turbulences occurred.

The similarity of mortalities in relation to the position of fish release within turbine intakes A, B, and C suggests that fish pass through the turbines along definite routes. Combined net and turbine mortalities of three groups of fish released near the ceiling in intake A were 9.0, 12.8, and 15 percent; in intake B, 33.3 and 26.0 percent; and in intake C, 5.6 and 7.2 percent. Mortalities to fish released deep in the intakes were: A, 4.3 percent; B, 1.3 percent; and C, 29.2 percent. Because of the variation in mortality created by the recovery equipment, precise measures of turbine losses cannot be made by direct comparison at this time.