New Screen Diverts Juveniles From Turbines

A BCF RESEARCH REPORT

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Young Pacific salmon and steelhead trout from the upper Snake and Columbia Rivers must now pass through six to nine low-head dams (such as Bonneville) on their journey to the sea. Although these dams are equipped with ladders to aid adult fish migrating upstream to spawn, facilities for safeguarding juvenile fish migrating downstream to the sea have only recently begun to receive attention. Methods of passing juvenile fish around dams must be found to reduce mortalities from injuries in turbines and from predation immediately downstream of the dams.

The Bureau of Commercial Fisheries and the U.S. Army Corps of Engineers are now developing a new system for protecting juvenile fish. Fish that enter turbine intakes will be diverted into a bypass, which will route the fish around the dam. Adequacy of the system will depend, among other things, on the percentage of fish that can be diverted. A new fish-guiding device is now undergoing preliminary trials at Ice Harbor Dam on the Snake River near Pasco, Washington. When development of this device and the bypass is completed, we will have a system that we believe will protect a majority of the fish (up to 80%) now destined for passage through turbines.

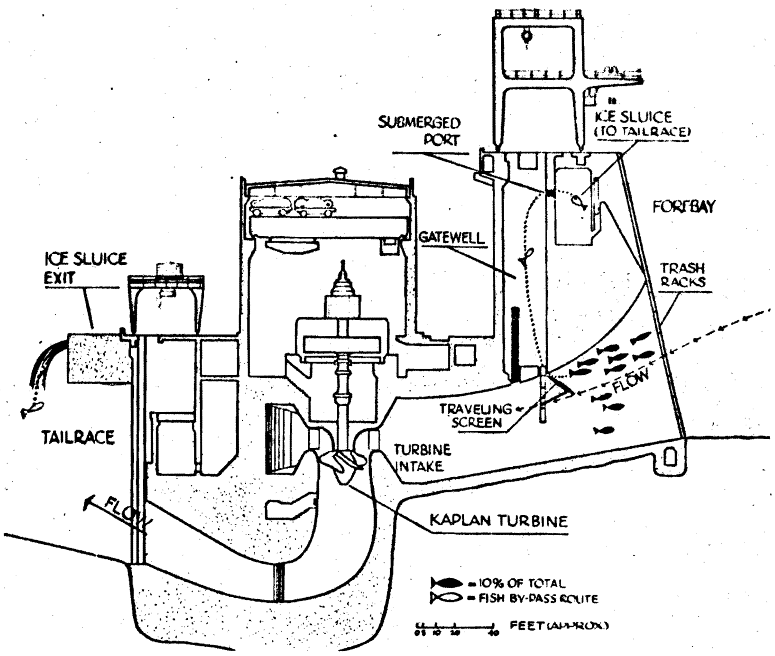

Figure 1.—About 70% to 80% of the salmon and trout smolts entering turbine intakes are expected to be diverted into gatewells with a traveling screen. (Screens intercept about 30% of flow.) The fish will pass into the ice sluice by means of submerged ports for transport around the turbines to the tailrace.

The system can be employed in either of two basic ways. One way would be to equip all dams with the system. A less expensive way, however, would be to equip one or two of the uppermost dams to collect the fish for transport (by truck or barge) around the remaining dams. The latter approach, to work successfully, depends upon the ability of adult fish to find their way back to spawn in their home streams through the stretch of river around which they were transported as juveniles. Research is underway to obtain an answer to this vital question (see Fish Business, November 1968).

The fish-protection system is shown in Figure 1, which presents a view of a typical low-head dam cut through the center of a turbine. Fish entering a turbine intake are diverted upward into an open shaft called a gatewell. The fish then pass through a submerged port (Figs. 1 and 2) into the ice and trash sluiceway, which carries them around the dam to the tailrace. The gatewell and ice sluice are existing structures, incorporated in the dam at time of construction for other purposes. Utilization of existing structures in building this new fish-protection system could save considerable expense. The ice and trash sluiceway was not included in more recently constructed dams; the Corps built special bypasses for fish in place of the sluiceways.)

The key to adequate protection of fish is to ensure that a suitably large percentage of migrants are guided into the bypass. To locate a fish-guiding device within turbine intakes offers distinct advantages, but the engineering problems are increased.

The advantages:

1. About 70% to 80% of the fish should be diverted by intercepting only 33% of the flow.

2. Protection of the guiding device from large logs is afforded by the trash racks that now protect the turbines (Fig. 1).

3. The walls of the intake will minimize escapement of fish around the guiding device. Although fish could sound to escape, their normal reaction to the increased pressure in the intake should be to swim up, where the only available route is into the gatewell.

The disadvantages:

1. Any device placed in an intake endangers the turbine; in the event of a failure a part of the structure could be swept into the turbine by the high water velocities.

2. Loss of pressure head, a function of the resistance of the device, should be as small as possible; head loss means reduced capacity for generation of electricity.

The guiding device we chose to develop for turbine intakes employs an endless conveyor screen of small mesh size traveling continuously (Fig. 3). The small meshes prevent escapement. Fish that impinge on the traveling screen are carried up into a region of low velocity within the gatewell where they may swim free. Impingement for brief periods causes no harm. Debris clinging to the traveling screen is washed off at the downstream side of the device. This self-cleaning principle is of the greatest importance.

Initial tests of the first prototype were conducted at Ice Harbor Dam in early June. Several design changes are contemplated. Engineering studies, modification of the traveling screen, and further testing are to be followed by fish-guiding tests in the spring of 1970.

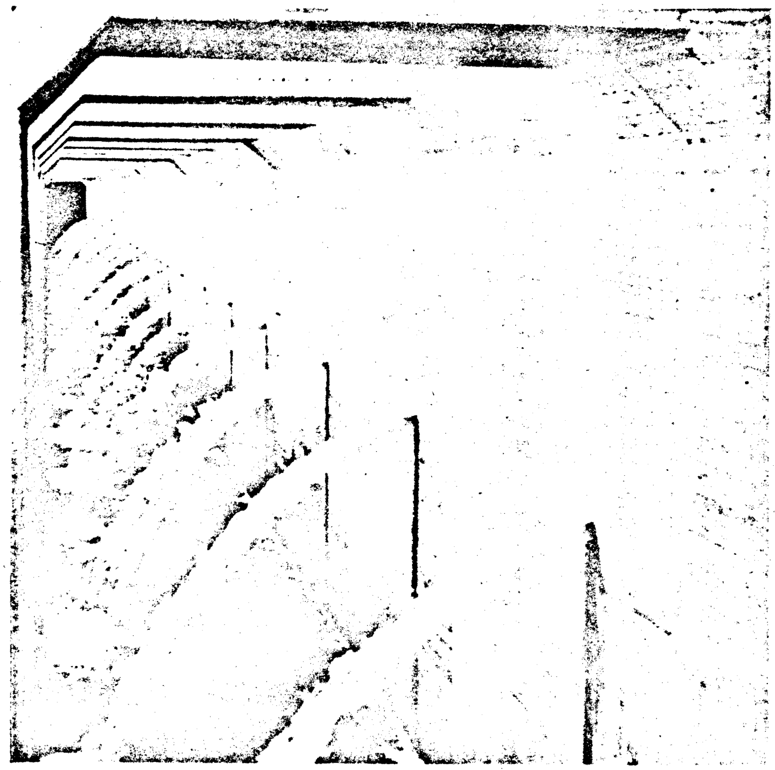

Figure 2.—The U.S. Army Corps of Engineers has equipped all 44 gatewells at McNary Dam with submerged ports to provide fish with passage from gatewells (behind wall) to ice sluice. This part of the bypass is being evaluated by the Bureau under contract to the Corps of Engineers.

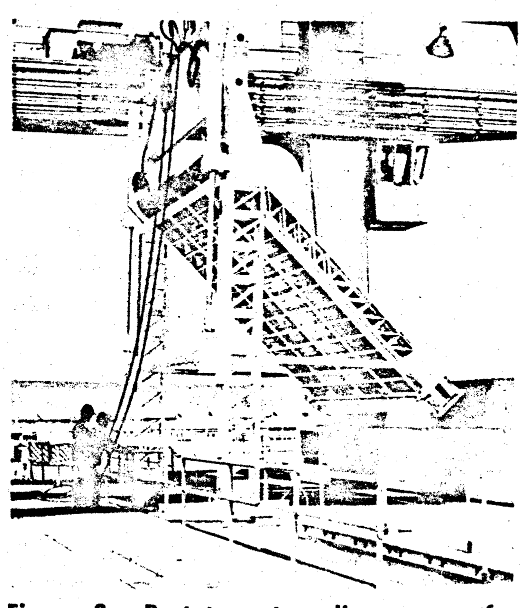

Figure 3.—Prototype traveling-screen, for diverting up to 80% of the young salmon and trout from turbine intakes into gatewells; screen is shown suspended from a gantry crane and projecting into a gatewell opening at Ice Harbor Dam.