FISH HANDLING METHODS EMPLOYED FOR FINGERLING MORTALITY STUDIES IN KAPLAN TURBINES

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INTRODUCTION

In conducting fingerling mortality studies in Kaplan turbines it is necessary to utilize large numbers of fish in each test. Large groups of fish must be separated into numerous small groups, marked, and transported to turbine areas where they are transferred to special devices for release into turbine intakes. After these fish have passed through the turbines and have been collected with special recovery equipment, they must again be transported to holding areas for subsequent observation. As this amount of handling could produce mortalities not associated with the turbines, special equipment and procedures were developed to minimize the stresses to fingerling salmonids used for the experiments.

This report describes the methods for handling large numbers of fish. With this system fingerling salmonids can be separated, transported and transferred into release devices without being removed from the water. This equipment and the operational techniques have been tested and is being used in turbine experiments at Bonneville Dam.

EQUIPMENT

Siphon System

This system was developed to randomly separate a primary group of fish into sub-groups for marking and subsequent release. The equipment includes (1) a 3-inch siphon (fig. 1) which picks up the fish and transfers them to small receiving pens and (2) a specially designed holding or "donor" pen from which the fish are removed. Two men are required for its operation; one man controls the rate at which fish are picked up, and one man controls the discharge of fish into each receiving pen. Large groups of fish can be quickly and easily separated in this manner.

The siphon consists of a 3-inch flexible hose with 3-foot sections of clear plastic pipe on each end. The clear plastic intake of the siphon allows the pick-up operator to view the fish as they enter the siphon and helps him to maintain a desired rate of transfer. A clear plastic funnel at the intake of the siphon provides a transition zone of velocities to minimize avoidance of the intake by the fish. The clear plastic pipe at the discharge end allows a second operator to anticipate the exit of fish so that he can move the siphon discharge to an adjacent receiving pen. The flexible hose was 30 feet long and was operated under a hydraulic head of about 6 feet. To aid in handling the water-filled hose, a support was provided at a convenient point.

The donor pen was designed with a fish-holding section, in which fish were initially placed, and a siphon section, from which the fish were removed (fig. 1). A baffle containing an

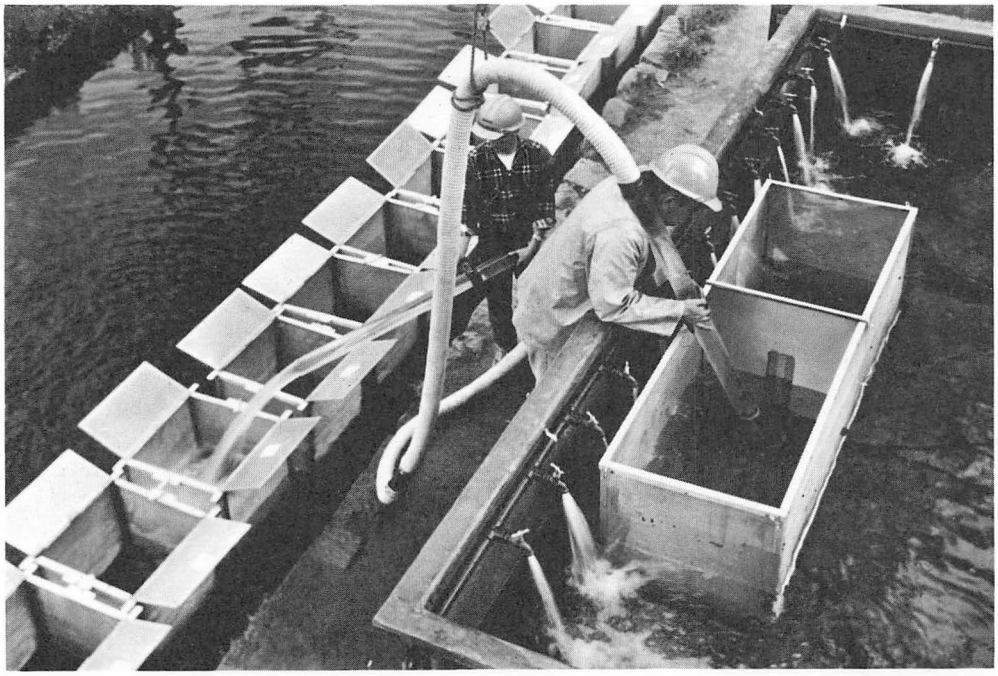

Figure 1.--Siphon system transfers fish from donor pens to smaller holding pens.

adjustable orifice was used to separate the two sections. The orifice could be adjusted so that fish continuously entered the siphon section at a rate that maintained an optimum population density for the rate of transfer desired. The baffle could be moved to control the population density in either section.

For continuous operation of the siphon, it was necessary to maintain a supply of water to the donor pen equal to that removed. To provide this, a donor pen with perforated sides was placed inside a larger tank of water. The greater water volume and surface area of the large tank provided a suitable water level in the donor pen when minor variations in inflow and outflow occurred. In addition, turbulence within the donor pen was reduced by this technique and maximum visibility was provided for the operator.

Transport and Holding Pens

To maintain the identity of sub-groups of fish during a test, a special holding pen with a solid funnel-shaped bottom and with perforated sides was devised (fig. 2). After separation but before transferral to the release site, the pens containing the fish were held in a holding pond. Here the water circulated through the perforations to keep the fish in good condition. When a pen was lifted from the pond for transport much of the water drained through the perforations but a sufficient amount was retained by the solid bottom to accommodate the fish. The fish and water were released where desired through a 3-inch funnel opening in the bottom by removing a soft-rubber plug.

The funnel bottom was molded from inert fiberglass for ease of construction and to provide a waterproof container. The perforated sides were constructed from aluminum plate containing 3/16-inch holes on 1/4-inch centers. All seams within the pen were covered with fiberglass.

The size of the holding pens used during the fingerling mortality studies depended on the number of fish to be held. The fish holding capacity was based on the total volume of the pen, and at least 1 cubic foot of water was provided for each pound of fish.

EXPERIMENTAL RESULTS

This system has been successfully used at Bonneville Dam during fingerling mortality studies within turbines. Over 25,000 fish have been separated, held and transported with no mortalities attributable to the experiment or technique of operation. The transport pen has also been successfully employed in the Snake River to transport fish to shore from fingerling trapping devices and for holding until transfer into tank trucks for downriver release.

Figure 2.--Holding pen used to transport and transfer fingerling salmonids.