# EXIT RATE OF CHINOOK AND COHO SALMON YEARLINGS FROM TURBINE INTAKE GATEWELLS AT BONNEVILLE DAM

by

George R. Snyder

October 1964

FISH-PASSAGE RESEARCH PROGRAM
U.S. Bureau of Commercial Fisheries
Seattle, Washington

# INTRODUCTION

Research on fingerling passage through turbine areas at Columbia River Dams has revealed concentrations of fingerling salmonid migrants in turbine intake gatewells. Some of the fish that were removed from these gatewells appeared to be emaciated and starved, suggesting that they may have been in the wells for an extended period of time.

As intake gatewells may be a source of potential losses to downstream migrants, exploratory experiments were conducted to investigate the length of time that fish remain in gatewells. This was examined by observing the exit rate of known numbers of marked yearling chinook (Oncorhynchus tshawytscha) and coho (O. kisutch) salmon from gatewells of turbine no. 5 and 6 at Bonneville Dam in early July of 1962. This paper briefly summarizes these tests.

## MATERIALS AND METHODS

The chinook and coho salmon used in this experiment were obtained from the Little White Salmon Hatchery, Washington, and were held at the Oregon State Game Commission Bonneville Dam Hatchery facility. Approximately 8,000 fish were utilized.

The fish were taken from the hatchery holding ponds, marked by tattooing, and transported by tank-truck to the gatewell area. Here they were introduced into the wells through a gravity-fed 7-inch hose from tank-truck. For each test, 300 chinook and 300 coho salmon were released in a well.

To determine the number of fish remaining in a gatewell after predetermined periods, a special dip net was used. This gatewell dip net was 19 feet long by 9 feet wide by 4 feet deep and was of 1/4-inch knotless nylon webbing mounted on a 1-1/4 inch pipe frame. The frame of the net was hinged longitudinally at the center so that it could be folded for raising and lowering through a 4-foot wide deck opening (fig. 1). To remove fish, the net was lowered to the bottom of the well, opened, and withdrawn to the intake deck. This operation was repeated until no fish were captured. Preliminary tests showed that in three separate periods this net removed 95, 96 and 99 percent of known numbers of marked fish in the gatewell.

This experiment consisted of a series of successive tests, from 1 to 6 days' duration. Each test was repeated once. At the beginning of a test, the gatewell cover was removed, marked fish were introduced into the well, and the cover was replaced. The fish released were then in a darkened gatewell and were free to leave the area by sounding about 30 feet to the turbine intake. At the end of the test period, the gatewells were repeatedly fished to remove all fish remaining in the area. After enumeration and examination, the fish were released below the dam.

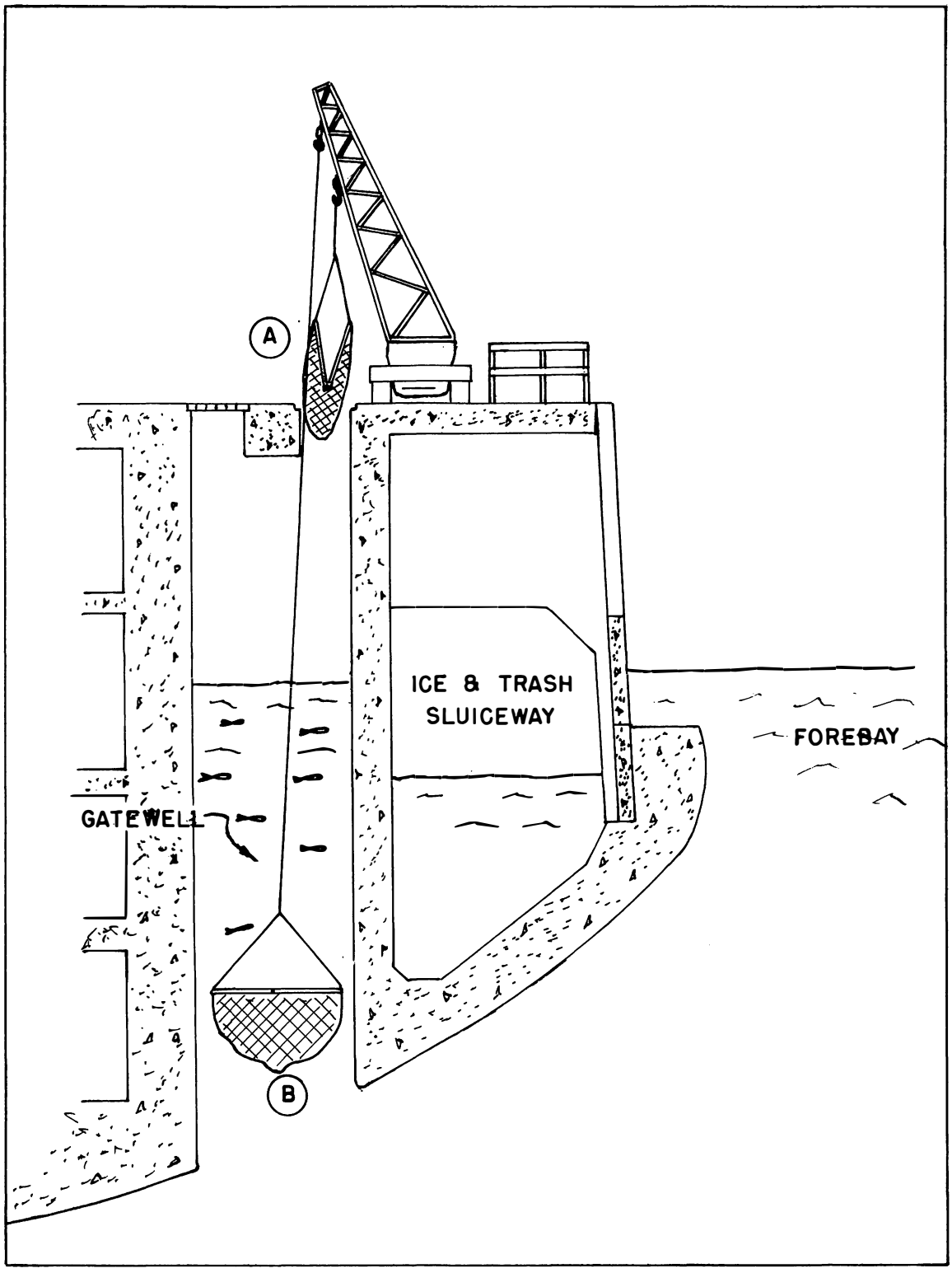


Figure 1.--Operation of gatewell dip net--(A) folded for introduction and removal through gatewell deck opening; (B) opened for withdrawal through gatewell to remove fish.

## RESULTS AND DISCUSSION

The number of fish removed from the gatewells 1 day after they were released indicated that the majority of chinook (80.6 to 86.0 percent) had left the area (table 1), but that less than half of the coho salmon (30.6 to 42.6 percent) had exited in the same time period (table 2). After 6 days in the gatewells, however, practically all of the fish of both species had left. There was a consistently high exit rate from all gatewells used in these tests.

The results of these tests indicate that yearling salmonids can sound 30 feet to the turbine intake and leave the gatewell. The data also suggest that chinook fingerlings may exit at a slightly faster rate than coho salmon. However, these exit rates were obtained with hatchery fish introduced into the top of the gatewell and may not necessarily be indicative of exit rates of downstream migrants entering the well from the turbine intake.

Table 1. --Number and percentage of chinook salmon (Oncorhynchus tshawytscha) exiting from gatewells at Bonneville Dam, July 1962.

| Days in gatewell | Turbine intake gatewell | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 A | | | 5 B | | | 5 C | | | 6A | | | 6B | | | 6C | | |
| | Number released | No. exit | % exit | Number released | No. exit | % exit | Number released | No. exit | % exit | Number released | No. exit | % exit | Number released | No. exit | % exit | Number released | No. exit | % exit |
| | 300 | 242 | 80.6 | | | | | | | | | | | | | | | |
| 1 | 300 | | | 258 | 86.0 | | | | | | | | | | | | | |
| | 300 | | | | | | 291 | 97.0 | | | | | | | | | | |
| 2 | 300 | | | | | | | | | 274 | 91.3 | | | | | | | |
| | 300 | 270 | 90.0 | | | | | | | | | | | | | | | |
| 3 | 300 | | | 275 | 91.6 | | | | | | | | | | | | | |
| | 300 | | | | | | 283 | 94.3 | | | | | | | | | | |
| 4 | 300 | | | | | | | | | 293 | 97.6 | | | | | | | |
| | 300 | 294 | 98.0 | | | | | | | | | | | | | | | |
| 5 | 300 | | | 287 | 95.6 | | | | | | | | | | | | | |
| | 300 | | | | | | | | | | | | 296 | 98.6 | | | | |
| 6 | 300 | | | | | | | | | | | | | | | 297 | | 99.0 |

Table 2. --Number and percentage of coho salmon (O. kisutch) exiting from gatewells at Bonneville Dam, July 1962.

| Days in gatewell | Turbine intake gatewell | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 A | | | 5 B | | | 5 C | | | 6 A | | | 6 B | | | 6 C | | |
| | Number released | No. exit | % exit | Number released | No. exit | % exit | Number released | No. exit | % exit | Number released | No. exit | % exit | Number released | No. exit | % exit | Number released | No. exit | % exit |
| | 300 | 172 | 42.6 | | | | | | | | | | | | | | | |
| 1 | 300 | | | 208 | 30.6 | | | | | | | | | | | | | |
| | 300 | | | | | | 272 | 90.6 | | | | | | | | | | |
| 2 | 300 | | | | | | | | | 255 | 85.0 | | | | | | | |
| | 300 | 257 | 85.6 | | | | | | | | | | | | | | | |
| 3 | 300 | | | 260 | 86.6 | | | | | | | | | | | | | |
| | 300 | | | | | | 286 | 95.3 | | | | | | | | | | |
| 4 | 300 | | | | | | | | | 278 | 92.6 | | | | | | | |
| | 300 | 277 | 92.3 | | | | | | | | | | | | | | | |
| 5 | 300 | | | 276 | 92.0 | | | | | | | | | | | | | |
| | 300 | | | | | | | | | | | | 290 | 96.0 | | | | |
| 6 | 300 | | | | | | | | | | | | | | | 294 | | 98.0 |