AN ALTERNATIVE HATCHERY CONCEPT

FOR WILD-LIKE COHO SALMON

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EXTENDED ABSTRACT ONLY– DO NOT CITE

Introduction

Hatcheries are an established technique for salmonid population management that has remained essentially unchanged for over a century. There is a growing body of evidence that hatchery-rearing techniques may contribute to behavioral differences observed between hatchery and wild salmonids. If true, then hatcheries need to expand the techniques used to rear fish such that negative behavior associated with rearing in a hatchery are minimized.

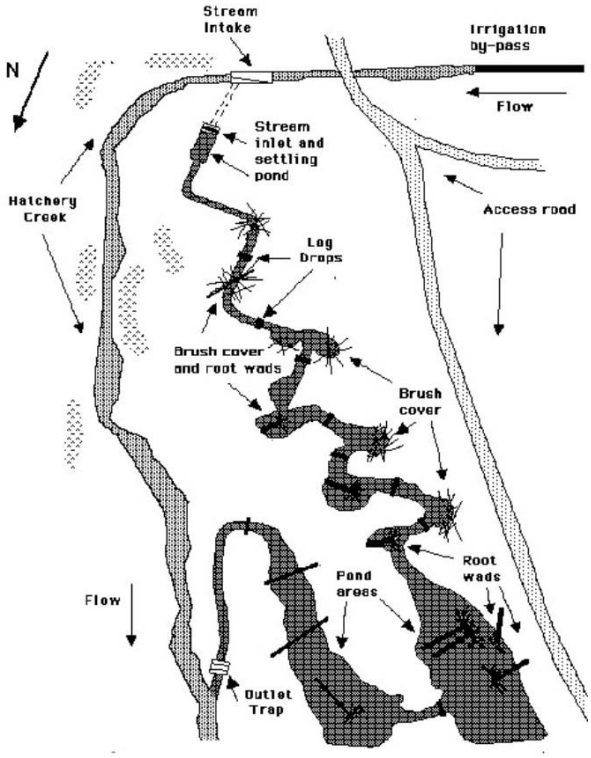

Figure 1. Rearing channel schematic.

This extended abstract describes the development and evaluation of a natural rearing channel for coho salmon intended to provide a controlled rearing environment comparable to natural habitat.

Construction and Habitat Characteristics

Construction occurred at the Dungeness River salmon hatchery in Sequim, WA. Water was diverted from Hatchery Creek, itself a diversion from the Dungeness River. The channel consists of a diversion structure, settling basin, and tail works (Figure 1). Both the inlet and outlet are screened to minimize the presence of non-study fish. Channel discharge can be regulated from 0 to 0.3 m^3/s and was typically 0.1 m^3/s. The channel had a length of 284 m, average top width of 1.2 m, and had a total surface area of 803 m^2. Depths of approximately 2 m are available, with an average depth of 0.3 m. Velocities and substrate are diverse. Habitat consisted of (by length and area) pools (12.4%, 19.8%), runs (31.4%, 21.1%), riffles (17.1%, 10.3%), alcoves (20.5%, 7.3%) and ponds (18.5%, 41.5%). Large woody debris and overhead cover are abundant.

Fish placement and Channel Monitoring

Adult coho were collected and spawned in November 2000 at the Dungeness hatchery. A total of fifty thousand eggs were collected during this period. Incubation was done in the hatchery and included three days at an elevated temperature intended to produce a mark on the otilith bones. In addition, fish used in this project did not have their adipose fin removed while fish produced in the hatchery did. The otilith mark and presence of an adipose fin will be used to verify the origin of returning adults. Eyed eggs were incubated in the channel starting March 2001. Free-swimming fry emerged beginning May 1, 2001. The first ten days after emergence fry that were captured at the tail works trap were transported back to the top of the channel. After ten days, fish captured at the channel outlet were counted and allowed to leave the channel. Invertebrate drift was supplemented with a prepared diet supplied at five locations over a twelve-hour period at a nominal rate 1% body weight per day as estimated from monthly monitoring activities. Daily out migration, and monthly length and weight were collected throughout the study period and were used to calculate condition factors per Brannon (1991). Fish in the outlet trap, from the hatchery and from the Dungeness River were also weighed and measured. Rearing

density estimates were made in August using direct observation methodologies (Thurow 1994).

Results

Daily out-migration varied considerably over the course of the experiment (Figure 2). A total of 35,867 fish were enumerated at the outlet trap. Of these, 23,983 left May and June 2001 (66.7%), July, August, September, and October accounted for 2,307 (6.4%), November accounted for 7,819 (21.8%), December, January and February accounted for 765 (2.1%) and March and April 2002 accounted for 993 (2.8%). Smolt production (March and April) was therefore 1.24 fish/m^2 compared to 0.24 to 0.73 fish/m^2 for natural rivers, and 0.85 fish/m^2 for enhanced side channels (Mundie and Traber 1983). The total number of fish leaving the channel from November to April was 9,577 (26.7%).

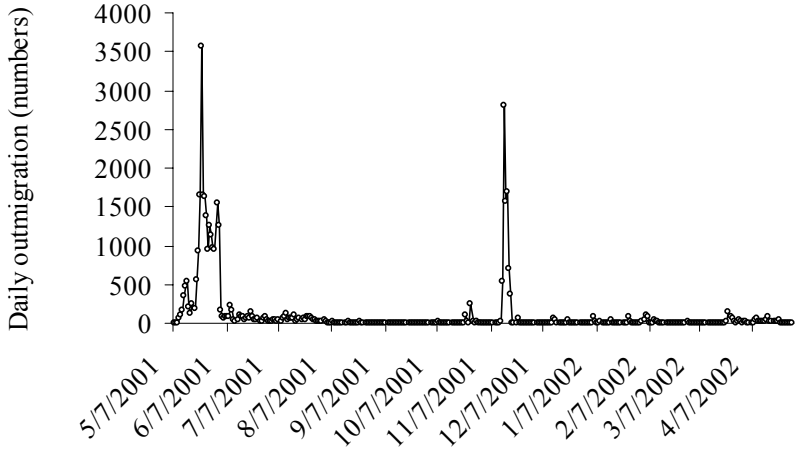

Figure 2. Daily out migration from the Dungeness rearing channel.

Condition factors measured in the channel, hatchery, tail works trap, and river were 1.31, 1.27, 1.20, and 1.08 respectively. The hatchery fish were, however, 40% larger in terms of length or weight than rearing channel fish. Alcove, pool, riffle, run, and pond summer average rearing densities were 4.8, 2.8, 2.3, 6.6, and 20.1 fish/m^2 respectively compared to a maximum summer average rearing density of approximately 1.6 fish/m^2 for natural habitat (Nickelson et al. 1992).

Conclusions

Out migration patterns were typical of wild coho salmon populations (see Kahler et al. 2001) with large numbers of fish migrating following emergence, and another large movement of fish in the fall. Of the fifty thousand eyed eggs placed in the channel, 2.8% survived to smolt equating to 1.24 fish/m^2, a level that is higher than comparable natural habitat. Condition factors were comparable between the rearing channel and hatchery-produced fish. Condition factors were higher for rearing channel fish than for either wild coho or for rearing channel fish captured in the tail works trap. The channel-produced fish, however, are on average 40% smaller than hatchery produced fish. Finally, summer rearing densities were higher than comparable natural habitat. This study has demonstrated that engineered habitat can produce coho salmon juveniles that behave as wild fish, but at numbers greater than comparable natural habitat.

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