

Techniques for Evaluating a Fry Release Strategy for Tule Fall Chinook Salmon at Spring Creek National Fish Hatchery

Rod Engle¹, Larry Marchant², and Mark Ahrens²
U.S. Fish and Wildlife Service

¹Columbia River Fisheries Program Office
1211 SE Cardinal Court, Suite 100
Vancouver, WA 98683
rod_engle@fws.gov
360-604-2500

²Spring Creek National Fish Hatchery
61552 SR 14
Underwood, WA 98651
larry_marchant@fws.gov, mark_ahrens@fws.gov
509-493-1730

Introduction

Since its inception in 1901 and through the 1970's Spring Creek National Fish Hatchery (NFH) performed tule fall Chinook salmon (*Oncorhynchus tshawytscha*) fry releases which usually occurred during February in the Columbia River. The practice was curtailed in 1974 due to inadequate adult returns and reinstated in the 1990's when the hatchery again experienced surplus returns. Past evaluations suggested that the fry releases from Spring Creek NFH survived at a rate of 0.0022% during a study in the late 1950's and early 1960's (unpublished U.S. Fish and Wildlife Service data). The addition of a warm water well in the early 1990's provided the ability to manipulate incubation water temperature and use otolith-based marking methods to assess survival of this early release. With fry releases marked, managers would be able to measure their contribution to adult returns to the hatchery.

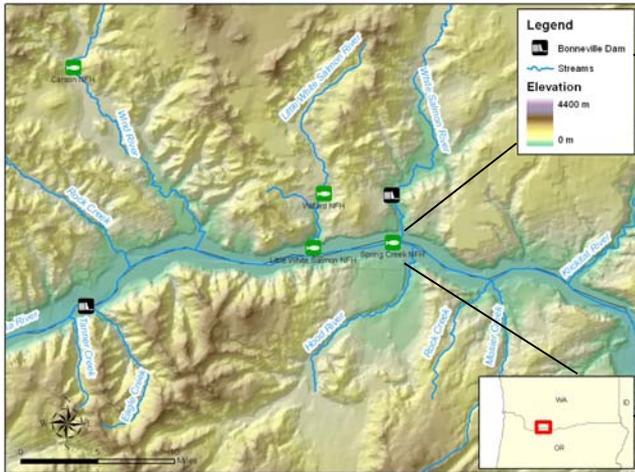


Figure 1. Map of the Columbia River Gorge and locations of National Fish Hatcheries in the area. Bonneville Dam, Condit Dam and tributaries are also noted.

Spring Creek NFH in Underwood, Washington. Spring Creek NFH is operated by the U.S. Fish and Wildlife Service with funding from the Army Corps of Engineers and NOAA-Fisheries. Annual production is approximately 15.1 million tule fall Chinook salmon. The facility is 90% reuse with a water source of spring and well water used for incubation and production.

Methods

Otolith-Based Marking

During 1999, 2001 and 2002, at least 3.0 million tule fall Chinook fry were otolith-marked by temperature manipulations during incubation. Alevin were incubated in 52°F and then exposed to 8 hour periods of 47°F spring water to form dense bands on the otolith. Each brood year had a specific banding pattern (Table 1) and releases occurred during early December. Standard production at Spring Creek NFH is 15.1 million fish of which 7.5 million are released in March with the remaining releases occurring in April (4.3 million) and May (3.5 million).

Table 1. Otolith pattern, description and number of tule fall Chinook salmon fry released from Spring Creek NFH during three brood years. Number of fish released is in millions

Brood Year	Band Pattern on Otoliths	Description of Band Pattern	Number of Fish Marked
1999	IIIII IIIII IIIII	3 groups of 5 bands separated by five-day intervals	3,116,000
2001	IIIII IIIII	2 groups of five bands separated by eight days	3,041,000
2002	IIIII IIIII IIIII IIIII	4 groups of five bands serrated by five days	3,008,000

Methods (Continued)

Recovery of Marked Adults

During 2001-2005, a portion of the adult tule fall Chinook salmon brood stock had their otoliths removed and scales taken for age verification by U.S. Fish and Wildlife Staff. Otoliths removed were sent to the Washington Department of Fish and Wildlife Otolith Laboratory in Olympia, Washington to determine if fish were from a fry release.



Individual tule fall Chinook salmon that belonged to cohorts from fry release years were randomly sampled during brood stock collection at Spring Creek NFH. Scales were collected on each fish to verify age (1). Otoliths were removed by cutting the head vertically (2) and removing otoliths located ventrally from the forebrain (3,4). Once removed from the sacculus (5), the otoliths were placed in a vial of 100% ethyl alcohol. All otoliths were shipped to and analyzed for band patterns by Washington Department of Fish and Wildlife Otolith Laboratory in Olympia, Washington.

Results

Results to date suggest that fry release survival rates for the 1999 brood year are much lower than standard production releases at Spring Creek NFH (Table 2). Analysis for the 2001 brood year is partially completed (Table 3) and suggest a lower fry survival rate than brood year 1999. As with the 1999 brood year, survival of standard production is much higher than the fry release for brood year 2001. Analysis for brood year 2002 survival of fry releases are not yet complete due to funding shortfalls. Fry releases of tule fall Chinook salmon at Spring Creek NFH do contribute to adult returns but at a much lower rate than the standard production releases.

Table 2. Return of adults by age from a 1999 brood year fry release at Spring Creek National Fish Hatchery. Adult tule fall Chinook salmon return to Spring Creek NFH during August and September. Brood year 1999 survival of standard juvenile production is given for comparison. Standard production releases occur during March, April and May whereas the fry release occurs in December.

Brood Year 1999							
Total Fry Release = 3,116,000							
Standard Production Release = 16,065,000							
Age at Return	Return Years	Samples Collected	Fry Release Returns	Total Adult Return	Estimated Fry Release Returns	Survival Rate of Fry Release	Survival of Standard Production
Age 2	2001	998	4	12,037	47	0.0015%	0.0749%
Age 3	2002	2,106	17	60,634	476	0.0153%	0.3774%
Age 4	2003	635	3	28,719	132	0.0042%	0.1788%

Table 3. Return of adults by age from a 2001 brood year fry release at Spring Creek National Fish Hatchery. Adult tule fall Chinook salmon return to Spring Creek NFH during August and September. Brood year 2001 survival of standard juvenile production is given for comparison. Standard production releases occur during March, April and May whereas the fry release occurs in December. Data for Age 4 adult returns is not yet determined (NYD).

Brood Year 2001							
Total Fry Release 3,041,000							
Standard Production Release = 16,117,000							
Age at Return	Return Years	Samples Collected	Fry Release Returns	Total Adult Return	Estimated Fry Release Returns	Survival Rate of Fry Release	Survival of Standard Production
Age 2	2003	710	1	7,605	10	0.0003%	0.0472%
Age 3	2004	1409	4	54,282	150	0.0049%	0.3368%
Age 4	2005	NYD	NYD	15,129	NYD	NYD	0.0950%



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