

# **Southern Boundary Restoration and Enhancement Fund**

Final Report

June 1, 2016 through May 31, 2017



*Washington  
Department of*  
**FISH and  
WILDLIFE**

Submitted by  
**Fish Program**  
**Washington Department of Fish and Wildlife**

**June 1, 2016 through May 31, 2017**  
**Report for the South Fork Nooksack Chinook Captive Broodstock Implementation**

**TECHNICAL IMPLEMENTATION DETAILS**

**Approach:** Continue to develop, culture, and implement a captive adult broodstock program using juvenile Chinook recruited from the South Fork of the Nooksack River. Activities include feeding and monitoring of fish, tracking of growth rates, PIT tagging, calculating flow and density indexes to provide healthy rearing environments, observing fish health, and administering drug therapies as prescribed. It also includes providing detailed summaries and reports to the South Fork Nooksack Chinook Advisory Committee. During the summer months developing adults are examined for signs of maturation. Mature adults are transferred from the NOAA Manchester Research Facility to Kendall Creek Hatchery. All mature adults are spawned at Kendall Creek Hatchery and the resulting eggs are transferred to Skookum Creek Hatchery when they are at eyed stage of development. The eggs and resulting fry are incubated and reared at Skookum Creek Hatchery. All fish are coded-wire tagged prior to their release into the South Fork of the Nooksack River in the spring of the following year.

The 12 months of staff funding is to support the increasing burden and complexity of fish culture, DNA sampling, PIT tagging, fish health monitoring, data entry, and technical reports associated with the program.

**Schedule:**

July and August 2016 – Evaluate developing fish for maturation and segregate candidate adults by sex at Kendall Creek Hatchery. Assist with the transfer of mature adult transfer from Manchester Research Facility to Kendall Creek Hatchery for spawning.

September to December 2016 – Spawn fish on a weekly basis starting in late September. Rear eggs until they are eyed, then shock and pick each egg take. Transfer eggs to Skookum Creek Hatchery.

June 1, 2016 to May 31, 2017 – Use of funding to staff Fish Hatchery Specialist 2 position that will support all aspects of fish culture, monitoring and reporting associated with the program.

**Accomplishments:**

The focus of the work associated with this grant is on the culturing and development of the multiple year classes of juvenile fish from the south fork of the Nooksack River. A total of 5 different brood years of fish are currently rearing in the program as depicted in the chart below.

Provisional Data  
 South Fork Nooksack Chinook  
 Summary  
**Captive Brood Program**  
 Juvenile Brood Record  
 5/31/2017

Group	Kendall	Manchester	Brood Total
Juveniles BY07 to BY10	25	7	32
Juveniles BY11	117	19	136
<b>Totals =</b>	<b>142</b>	<b>26</b>	<b>168</b>





The progeny of the South Fork Spring Chinook adults spawned in 2015 were released into the South Fork of the Nooksack in June of 2016. There were a total of 361,880 fish in the group, all of which were coded-wire tagged.

During the summer of 2015 Skookum Creek (the main water source for Skookum Creek Hatchery) experienced unusually low flows and high temperatures. Due to concerns that transferring maturing South Fork Nooksack captive brood fish to Skookum Creek Hatchery would result in high mortality rates, it was decided that the fish should be held at Kendall Creek Hatchery. Similar environmental conditions occurred in the summer of 2016 prompting staff hold and spawn mature adults at Kendall Creek hatchery.

On July 27, 2016 the 30 maturing females and 17 maturing males from Manchester Research Facility were transferred to Kendall Creek Hatchery. In August 2016 a total of 161 maturing females and 108 maturing males were identified in the captive brood fish reared at Kendall Creek Hatchery. The table below includes the spawning details for the 2016 season.

Date	Total take	Eggs/pound	Egg loss	Percent loss	Total live
9/27/16	209,580	1,870	32,200	15.4	177,380
10/4/16	215,370	1,940	20,400	9.5	194,970
10/11/16	33,970	1,790	3,900	11.5	49,080
<b>Total</b>	<b>458,920</b>	<b>Avg. 1,866</b>	<b>56,500</b>	<b>12.3</b>	<b>402,420</b>

The eggs were transferred to the Skookum Creek Hatchery at the eyed-egg stage beginning on November 9<sup>th</sup> and ending on December 5<sup>th</sup>, 2016. The eggs were hatched and the resultant fry reared and coded-wire tagged at Skookum Creek Hatchery. A total of 355,060 captive brood progeny smolts were released into the South Fork of the Nooksack on May 31<sup>st</sup>, 2017.

## **Background:**

The South Fork Nooksack Chinook population is one of the 22 populations in the Threatened Puget Sound Chinook salmon ESU. Currently at critically low abundance, it is one of the two populations in the Georgia Strait biogeographical region that must attain a low extinction risk status before the ESU can be delisted. The Puget Sound TRT acknowledged the short term extinction risk for the population as habitat restoration needed to recover the stock were being implemented and recommended establishing a hatchery-based supplementation, gene bank program to preserve the stock, similar to the successful Kendall Creek program established to rebuild the North Middle Fork Nooksack Chinook population.

An ad hoc Technical Advisory Team of biologists, fisheries managers, geneticists, pathologists, and hatchery managers representing Lummi Natural Resources, Nooksack Natural Resources, WDFW, NOAA and NWIFC was assembled to provide oversight for the stock preservation effort. The genetic baseline for Chinook stocks in the Nooksack Basin was first reviewed and improved to guide the recovery effort. The initial design included use of a weir in the SF Nooksack River to collect adult fish for broodstock. Adult fish would be held at Skookum Creek Hatchery while stock identity was confirmed, and mature adults would then be spawned under the watchful eye of the geneticists to ensure maximum diversity. A weir installed in 2006 was unsuccessful in collecting any SF Chinook. In 2007, the weir was improved and relocated, and an aggressive program was also implemented to collect adult Chinook throughout the basin. A juvenile Chinook collection program was also initiated as an alternative means to collect broodstock. The result of the 2007 effort was collection of three hundred eggs from a spawned out SF female fertilized by a SF male, SF sperm for cryo-preservation and a small number of SF juveniles. To provide an outline for recovery, a ten-year plan was developed for a revised gene bank and supplementation program, based on captive broodstock based programs successfully implemented for other Chinook stocks at the NOAA Manchester Laboratory and the WDFW Hurd Creek Hatchery. The plan includes a Monitoring and Evaluation Program needed to monitor the effects of the program and its success in meeting recovery objectives.

The initial plan proposed by the Team was based on the assumption that adult capture would provide the brood stock for supplementation for a 200,000 sub-yearling release and initiation of a captive brood program at WDFW Kendall Creek Hatchery (fresh water) and Manchester (sea water), with a small contingency for juvenile capture and weir improvement. Despite the increased efforts to improve adult capture in 2007 and 2008 the results of the program as initially planned were disappointing. In response, in 2009 the SF Nooksack Chinook program was shifted from adult brood stock collection to juvenile collection to develop a captive brood. The transition to a juvenile collection program

required revision of the captive brood program, and a change in the supplementation target from 200,000 sub-yearlings per year to the full production from the captive brood of up to 1,000,000 sub-yearlings per year. These changes significantly increased the capital and operating costs from those estimated for the initial adult collection based effort budget, with a 10 fold annual increase to accommodate required DNA stock assignment work, year round juvenile collection crews, and additional spawning and rearing capacity at the captive brood and supplementation rearing facilities.

**Key Personnel:**

Edward Eleazer, Region 4 Hatchery Operations Manager, has 22 years of WDFW hatchery experience throughout Western Washington. The WDFW lead for the project.

Kevin Clark, Hatchery Specialist 4, has a B.S. in Environmental Science from Western Washington and is qualified to supervise all staff in the appropriate culture of captive brood fish. He has 17 years of experience in fish culture, 7 years as a supervisor at Kendall Creek Hatchery.

Josh Lewis, Fish Hatchery Specialist 3, has an A.A.S. in Fisheries Technology from Bellingham Technical College. He will act as the lead worker responsible for carrying out the day to day activities associated with captive brood program.

Crystal Salmon, Fish Hatchery Specialist 2, has a M.S. in Sustainable Aquaculture from the University of St. Andrews in Scotland. She will be responsible for record keeping, preparing and administering therapeutic treatments, feeding and monitoring the fish, and coordinating transfers and handling events.