Completion Report to: Oregon Watershed Enhancement Board
775 Summer Street NE, Ste 366
Salem OR 97301-1290

Submitting by: Michael A. Banks and Veronique Theriault
Marine Fisheries Genetics
Coastal Oregon Marine Experiment Station
Hatfield Marine Science Center
2030 Marine Science Drive
Newport, OREGON 97365

OWEB 608 Banks Genetic Pedigree – Nonpareil Dam Adult Trap
FINAL REPORT Contract 207-907

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Principal Investigator:

Dr. Michael A. Banks Address above
Fax: (541) 867 0345
Office: (541) 867 0420
Michael.Banks@oergonstate.edu

OSU Component for Nonpareil Dam Adult Trap and Genetic Pedigree
2007 – 2008

The CHIP Project Proposal Narrative detailed the following 8 primary tasks:

Task 1. What is the relative success of using a first generation, wild-type broodstock in a supplementation program compared to a broodstock that has been captive for multiple generations?

Task 2. What is the relative success of unfed fry releases compared to smolt releases in producing returning adults?

Task 3. What is the reproductive success in the wild of adult fish from the following treatments:

- ***a.*** First-generation hatchery fish from unfed fry releases;
- ***b.*** First-generation hatchery fish from smolt releases;
- ***c.*** Multi-generation hatchery fish from unfed fry releases;
- ***d.*** Multi-generation hatchery fish from smolt relases; and
- ***e.*** Wild fish.

Task 4: How does the supplementation program modify the effective population size of the population in the Calapooya (termed the "Ryman-Laikre Effect" (Ryman and Laikre 1991, Ryman et al 1995)

Task 5: What is the level of inbreeding that results from the supplementation program?

Task 6: What is the incidence of natural crossing between adults from the different treatment groups while on the natural spawning grounds and the consequences of mate choice to the relative production of offspring by individuals;

Task 7: What differences in reproductive success occur by treatment by age (males), by gender, by adult run time, and by adult body size (length)?

Task 8: Does the size of the naturally-produced population increase due to successful natural reproduction by hatchery fish? Does the contribution to this increase vary by treatment group?

Post Doctorate Véronique Thériault began work on October 15th, 2007 and she focused in the last year on analyzing data related to the F1 returns (3 cohorts completely genotyped) as well as working on the first estimate of reproductive success in the wild of hatchery versus wild fish (F2 returns, 1 cohort completely genotyped). She presented her findings at the National Meeting of the American Fisheries Society in Ottawa, Canada, August 17-21, 2008 focusing on task 2,3 and 7, and prepared a manuscript that is submitted to CJFAS (attached). Her results are summarized below:

<u>F1 returns</u>

- Fish released as smolts have a survival rate 25 to 75 times higher than fish released as unfed fry. Fish released as smolts represented – on average over 3 years - 63% of the hatchery returns. The remaining (37%) were fish released as fry.
- Fish released as smolts had a smaller body size as returning adults than fish released as fry and wild fish.
- Fish released as smolts entered the spawning grounds 5 to 13 days earlier than fish

released as fry or wild fish. The consequences of early return timing on reproductive success and mate choice are currently being addressed.

F2 returns

- For females, there is no difference in reproductive success (number of offspring produced per individual) regardless as to whether the fish was released as smolt or unfed fry, or between hatchery and wild fish.
- For males (excluding jacks), hatchery fish have a lower reproductive success in the wild than wild fish.
- Males released as fry showed a higher reproductive success than males released as smolts, however this tendency is not significant

These data on fitness in the wild of hatchery coho are the first, to our knowledge, to find such discrepancies between the sexes, and to evaluate the value of unfed fry releases. We are expecting to add two replicates (F2 returns in fall 2008 and 2009 from parental generations 2002 and 2003) that will allow us to assess differences or similarities in results over a temporal scale and rigorously evaluate our conclusions.

Over the past year, PhD student, Marc Johnson, has developed and tested a suite of quantitative PCR assays. These novel assays are designed to measure the degree to which olfactory receptor genes are being expressed in coho salmon, and can be used to test for the influence of environment, developmental stage and genetic background over gene expression. Ultimately, this information will be used to develop a better model for salmonid olfactory imprinting, which may help to explain factors involved in homing and straying patterns among salmon populations.

Marc is currently preparing two manuscripts for publication, both of which examine patterns of diversity associated with salmonid olfactory receptor genes. The results discussed in these two papers provide new insight toward the evolutionary processes acting over a diverse family of genes, within and among salmon species.

Johnson M.A., Banks, M.A. Positive Darwinian selection operating on paralogous main olfactory receptors and an *ora1* gene in salmonid fishes. S*ubmitted to Journal of Molecular Biology and Evolution.*

Johnson M.A., Banks, M.A. Interlocus variance of F_{ST} provides evidence for selection over an olfactory receptor gene in coho salmon (*Oncorhychus kisutch*) populations. *In preparation*.

A manuscript related to his first thesis chapter was also published in 2008, entitled (and attached): “Genetic structure, migration and patterns of allelic richness among coho salmon (*Oncorhynchus kisutch*) populations of the Oregon Coast”.