Progress Report to: Oregon Watershed Enhancement Board
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OSU Component for Nonpareil Dam Adult Trap and Genetic Pedigree PROGRESS REPORT for Contract 207-907 (K9495A)

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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?

The attached manuscript which focuses primarily on task 1,4 and 5 presents our first primary peer review derivable from this research:

G. R. Moyer, M. S. Blouin, and M. A. Banks. 2007. The influence of family-correlated survival on *Nb/N* for progeny from integrated multi- and single-generation hatchery stocks of coho salmon (*Oncorhynchus kisutch*). *Canadian Journal of Fisheries and Aquatic Science.*64:1258-1265.

Given that Post Doctorate Greg Moyer secured a full time position with the USFWS in 2007, he was replaced by Véronique Thériault from Laval University, Québec, Canada who began work on October 15th, 2007.

Véronique has focused on tasks 2 and 3 as her primary areas of research since joining us. Towards this end, all 2001 parents (both wild and hatchery fish bred in hatchery), 2002 and 2003 parents (both wild and hatchery fish bred in hatchery as well as those that bred in nature) have been genotyped as well as their returns (jacks and adults) from 2003, 2004, 2005 & 2006. Thus, the F1 genotyping is complete, and thorough analyses of these findings are in process right now. We have 3 replicates that enable us to compare success of first-generation (wild) versus multi-generation hatchery fish. We also have 2 replicates that enable us to compare returns of fish bred in the hatchery versus fish bred in the wild (Tasks 5&6).

Veronique will present these findings at the National Meeting of the American Fisheries Society in Ottawa, Canada August 17-21, 2008:

> **Fitness of Hatchery Coho in the Wild: Discerning the Effect of Alternate Captive Breeding Histories**
>
> **Véronique Thériault, Gregory R. Moyer, Laura Jackson, Greg Huchko and Michael A. Banks**
>
> **The use of hatchery fish to increase the size of extant wild populations is a common management strategy. However, in most cases the value of such programs are untested. Fish raised in the hatchery and subsequently released in the wild must reproduce successfully and produce viable offspring in order for such an approach to succeed. Accumulating evidence suggests that hatchery fish typically have lower fitness in the wild than wild fish, and that this decline can occur very quickly, following only a few generations in the hatchery. Here we present preliminary results of an experimental supplementation program for coho salmon, *Oncorhynchus kisutch*, on the Calapooya River, a tributary of the Umpqua River on the Oregon Coast. By reconstructing a 3-generation pedigree using molecular markers, we compare reproductive success in the wild (number of wild-born adults produced per parent) of fish raised in the hatchery. Our subjects have different histories in terms of their captive breeding: 1) captive-reared fish from two wild-born parents and 2) captive-reared fish from multi-generation hatchery parents. Moreover, we compare the relative success of unfed fry releases compared to smolt releases in producing returning adults for both histories. Results presented here address important questions that currently undermine our understanding of the usefulness of hatchery supplementation for conservation and recovery. Although this project is specific to one hatchery program for coho in the Umpqua River, results will likely be of value in the design and application of supplementation programs across other species and further afield.**

Genotyping is also currently underway to test the first results of reproductive success of hatchery fish in the wild (task 7)

Véronique will assist to the AFS Western division in Portland in May and help with a workshop on hatchery next year's regional AFS meeting (Oregon Chapter, Bend in 2009).

Marc A Johnson, a PhD graduate student on this project has completed the first chapter of his thesis entitled:

> **'Genetic structure, migration and patterns of allelic richness among coho salmon (*Oncorhynchus kisutch*) populations of the Oregon Coast'.**

A related article is currently in press for publication in the *Canadian Journal of Fisheries and Aquatic Sciences*

Research for Marc's 2nd and 3rd chapters is currently in progress as indicated by a poster that he presented at the 41st PopGroup2007 meeting (December 17-20th) at the University of Warwick, UK, under the title:

> **"Testing for a signal of selection at olfactory receptor gene-linked markers in coho salmon (*Oncorhynchus kisutch*)' (attached).**

Note that the olfactory receptor (OR) markers that Marc has isolated originate from five different OR gene families presenting significant new genomic resources for the study of salmon behavior.

We are discouraged to report that Marc has had difficulty in locating sufficient numbers of DNA samples from 'known' coho strays in order to utilize these markers in a test of his hypotheses concerning the genetic basis of homing and straying. We are currently pursuing availability of samples from other states and may even need to consider moving to alternate salmon species to provide sufficient numbers of known homers and strayers. We are also considering utilizing a microsatellite pedigree analysis of coho smolts to determine if expression patterns for these markers differ among families.

Several other manuscripts are under consideration for both Veronique's and Marc's current research.