

Hatchery Reform Project Annual Progress Report - August 2005

Contract period: July 1, 2004 to June 30, 2005

Project Title: Difference in Natural production of Coho (IAC# 04-1019N)

Agency: Washington Department of Fish and Wildlife, NOAA Fisheries

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HSRG Funding Amount:

WDFW \$60,181 (in-kind match: \$12,085)

NOAA \$29,630 (in-kind match: \$42,116)

Project Goals (long-term):

- 1) Measure relative mating success and survival in the wild of hatchery-origin and natural-origin coho salmon
- 2) Determine how selection differs in the natural and hatchery environments
- 3) Observe the rate that hatchery-origin coho readapt to the wild

Project objectives (annual):

- 1) During summer 2004, capture, sample and apply passive integrated transponder (PIT) tags to juvenile (2003 brood year) natural-origin coho throughout Minter Creek basin
- 2) Sample returning natural-origin and project-specific hatchery-origin coho trapped at Minter Creek hatchery facilities in fall/winter 2004
- 3) After trapping and sampling, pass upstream into Minter Creek only presumed-natural origin coho (2004 brood year potential parents)
- 4) Analyze scale patterns of all sampled adults to determine age and hatchery or wild origin, and enter and manage all non-genetic data for project fish in spreadsheet files
- 5) During spring 2005, trap, sample and apply coded-wire-tags (CWT) to out-migrating natural-origin Minter coho smolts (most will be 2003 brood year)
- 6) During summer 2005, capture, sample and apply PIT tags to juvenile (2004 brood year) natural-origin coho throughout Minter Creek basin
- 7) Continue genetic parentage (pedigree) analysis for adults and smolts sampled in 2004 and previous years
- 8) Continue statistical analyses to estimate relative reproductive success
- 9) Continue to measure or estimate biological parameters for project coho (e.g., survival rates through life stages, comparative return-timing for natural and hatchery origin fish, effects of different traits on offspring production)

Summary of annual project activities and results:

We completed sampling and tagging wild coho juveniles throughout Minter Creek basin during July 2004, sampling 1950 fry and tagging 1146 of them. We also sampled wild coho juveniles in

Rocky Creek, an adjacent drainage, to evaluate relative productivity and provide a comparative population genetic sample. It appears that many natural-origin adult coho trapped at Minter Creek in 2003 and 2004 originated elsewhere and genetic analyses may help us determine their most likely source.

From September 9 to December 23, 2004, we sampled returning project coho at Minter Creek Hatchery trap. Our primary target was naturally produced coho identified by presence of the adipose fin (“un-clipped”), and, in some of these, presence of CWT or PIT tags (detected electronically). Target coho were sorted from known (clipped) hatchery-origin coho, measured, genetic tissue sampled, and transported upstream of the trap. We also measured and sampled some returning hatchery-origin coho to provide for statistical comparisons. We collected data on the following number of project coho per month: Sept. - 570; Oct. - 1142; Nov. – 690; Dec. – 77, for a total of 2,479. A temporary WDFW Scientific Technician was hired to work throughout this period. The career seasonal WDFW Fish Biologist 1 assigned to this project ended his 9-month appointment in mid-December.

Scales taken from sampled fish were aged and analyzed for hatchery and wild origin growth patterns by John Sneva, WDFW. Data collected per day’s sampling were routinely entered in a spreadsheet database. The 2004 sampled adults database was provided to NOAA Fisheries project staff. We used the field sampling database to determine the number and origins of Coho passed upstream of the barrier dam at Minter Creek Hatchery in 2004 (Table 1) for project purposes and to meet data needs of WDFW Fish Management and Hatcheries divisions.

Table 1 -- Coho passed upstream at Minter Creek and associated escapement mortalities, 2004

<i>Number and origin of Coho upstream in Minter Creek 2004 (research project)</i>				
<u>Scale pattern origin</u>	<u>Unclipped+CWT</u>	<u>Unclipped No Tag</u>	<u>Clipped No Tag</u>	<u>Total</u>
Wild	288	1553 ¹		1841
Hatchery	29	203	1	233
Unknown	11	86		97
Totals	328	1842	1	2171

<i>Number and origin of unclipped Coho mortalities in 2004 escapement²</i>				
<u>Scale pattern origin</u>	<u>Unclipped+CWT</u>	<u>Unclipped No Tag</u>	<u>Clipped No Tag</u>	<u>Total</u>
Wild	5	17		22
Hatchery		1		1
Totals	5	18		23

¹ 16 may be re-captures due to high flows that allowed them to pass downstream of barrier dam.

² these fish were handled by research project staff and may not have been included in hatchery escapement enumeration.

The data in Table 1 indicate that we generally met our goal of passing mostly natural origin coho salmon above the Minter weir in 2004, although some hatchery-origin coho, both unclipped/no CWT and unclipped/with CWT, were also passed. Scale analysis was done after fish were passed upstream, so the unclipped hatchery-origin coho could not be distinguished from project fish at the time of handling. The most surprising result from the 2004 adult samples is the large

proportion (~85%) of the natural coho without a project CWT that were captured at Minter trap. This large proportion of non-CWT coho was surprising because we estimated that we tagged >95% of the natural smolts outmigrating from Minter Creek in 2003. The discrepancy between the estimated mark proportion in smolts and the observed mark proportion in adults suggests that either a significant number of smolts in 2003 were not sampled and marked at the trap, that the fish experienced an unusually high rate of tag loss, that there are large numbers of natural origin stray coho entering Minter Creek, or some combination of the above. The preliminary genetic analysis of the 2004 adults provides some insight into this issue, and is discussed below. In 2004 and 2005 we also sampled coho from nearby creeks, collecting tissue for genetic analysis, in order to help determine origins of potential strays.

In late March 2005 WDFW staff began installation of the outmigrant (smolt) trap in Minter Creek in the vicinity of the hatchery and downstream of all mainstem tributaries. The goal is to trap, sample, and CWT all juvenile coho leaving Minter Creek. In 2005, most of these will be offspring of adults passed upstream for the project in 2003. Trapping and sampling of juveniles commenced in early April, and was accomplished by WDFW Fish Biologist (career seasonal), a temporary Scientific Technician, and occasionally available Minter Hatchery or other research project staff, and NOAA Fisheries staff. The trap was operated on two shifts, early morning and late evening, seven days a week. We took fin clips for DNA analysis from approximately every 5th fish, and collected biological data for and coded-wire tagged all trapped fish. The total number of coho trapped, sampled, and tagged per month was as follows: April – 968; May - 12,566; June – 881; for a total of 14,415. Outmigrant trapping ended on June 20. Overall, 87.2% of sampled coho smolts were captured in May.

As time allowed in 2005, we did genetic sampling of tissue from CWT hatchery-origin adults taken in at Minter Hatchery in 2004. Heads had been removed from these fish and stored frozen, prior to CWT extraction at WDFW Tag Lab. We needed to sample project fish, which had unique tag codes compared to other hatchery production fish, so as tags were extracted and read, tissue samples were taken and stored in ethanol.

Genetic analysis

During the project period, we genotyped and analyzed 677 smolts (2003 migrant year), 812 adults (2002 return year) and 1564 adults (2004 return year). The 2003 smolts and 2004 adults are progeny of adults that spawned in 2001. Assignment of progeny to parents was conducted using maximum likelihood methods implemented in the program FaMoz (Gerber, Chabrier et al. 2003). One notable result from the assignment analysis is that fry and smolts from both the 2000 and 2001 brood years assign at approximately the rate expected based on computer simulations, but adult progeny from both of these brood years assign successfully to parents at a far lower rate (Table 2). By comparing observed assignment success to expected success, the estimated fraction of strays among natural origin adults trapped at Minter Creek in 2003 and 2004 was 54% and 56%, respectively (Table 2). Although these stray rates are quite high, they are nonetheless lower than expected based on the fraction of the run that did not have a CWT (see above). We are still in the process of analyzing these data, and will provide updates in future reports.

Table 2 -- Summary of genetic assignment success for 2000 and 2001 brood years. Abbreviations: n=number analyzed; Obs=observed; Exp=expected; Est.=estimated; BY=brood year

Lifestage	n	Obs	Exp	Est. Fraction immigrants
BY 2000				
Fry	517	0.60	0.55	
Smolt	783	0.57	0.55	
Adult	899	0.24	0.46	0.54
BY 2001				
Fry	1070	0.72	0.76	
Smolt	677	0.66	0.76	
Adult	1565	0.33	0.70	0.56

Project personnel

Besides the report authors, the following personnel worked and/or provided assistance on this project – Brant Boelts, Sarah Lukas, John Lovrak, Denis Popochock, Chris Rockwell, Chris Waldbillig, John Sneva, WDFW; Jason Miller, Jeff Hard, Eric LaHood, NOAA Fisheries. Their skill, expertise and cooperation made this project possible. Although Howard Fuss, WDFW, left us in January 2004, his leadership and years of work on the project still inspire our efforts.

References

Gerber, S., P. Chabrier, and A. Kremer. 2003. FaMoz: a software for parentage analysis using dominant, codominant and uniparentally inherited markers. *Molecular Ecology Notes* 3 (3): 479-481.