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MID-COLUMBIA COHO REINTRODUCTION FEASIBILITY STUDY:

2007 ANNUAL REPORT
October 1, 2006 through September 30, 2007

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1.0 INTRODUCTION

Wild stocks of coho salmon *Oncorhynchus kisutch* were once widely distributed within the Columbia River Basin (Fulton 1970; Chapman 1986). Since the early 1900s, the native stock of coho has been extirpated from the tributaries of the middle reach of the Columbia River (the Wenatchee, Entiat, and Methow rivers; Mullan 1983). Efforts to restore coho within the mid and upper Columbia Basin rely upon releases of hatchery coho. The feasibility of reestablishing coho in the tributaries of the mid-Columbia River initially depended upon the resolution of two central issues: the adaptability of domesticated lower Columbia coho stocks used in the re-introduction efforts and their associated survival rates; and the ecological risk to other species of concern. To date, these two issues have been resolved in a positive sense therefore allowing the project to continue forward in achieving its ultimate goal of coho restoration.

If coho re-introduction efforts in the mid-Columbia tributaries are to succeed, parent stocks must possess sufficient genetic variability to allow phenotypic plasticity to respond to differing selective pressures between the environments of the lower Columbia River and mid-Columbia tributaries. The mid-Columbia Coho Hatchery and Genetic Management Plan (HGMP 2002) and Master Plan for Coho Restoration (Murdoch et. al. 2005) outlines strategies to track the local adaptation process.

We are optimistic that the project will observe positive trends in hatchery coho survival as the program transitions from the exclusive use of lower Columbia River hatchery coho to the exclusive use of in-basin locally adapted broodstock. Therefore, it is important to measure hatchery fish performance not only to use as an indicator of project performance but to track potential short- and long-term program benefits from the outlined strategies.

Additionally, if the re-introduction effort is to be successful in the long term when habitat and hydro impacts might be reduced, adult returns must be sufficient to meet replacement levels.

This report documents coho restoration activities and results from fall 2006 through the summer 2007, including broodstock collection, spawning, egg incubation, spawning ground surveys, acclimation, and survival. In addition, the Yakama Nation (YN) operated a 5-foot rotary smolt trap to estimate the number of naturally produced coho emigrating from Nason Creek in 2007. This trap is operated with funding from Grant County Public Utility District (GCPUD) and two BPA projects (#2003-017-00, and #1996-040-00); therefore detailed smolt trapping results are not included in the body of this report but in a separate document (Murdoch and Collins, 2007) and provided in Appendix A.

2.0 BROODSTOCK COLLECTION AND SPAWNING

2.1 WENATCHEE RIVER

2.1.1 Broodstock Collection

Broodstock collection occurred primarily at Dryden Dam between September 5 and November 3, 2006. Coho returning to the Wenatchee River in 2006 were brood year (BY) 2003 adults and BY2004 jacks from mid-Columbia brood hatchery origin returns and natural origin returns. The Dryden Dam fish traps were passively operated five days per week, 24-hours per day. On Saturdays and Sundays, both left and right bank collection/holding chambers were closed while the fish bypass was opened, allowing unimpeded upstream passage. Coho trapping at Dryden Dam occurred concurrently with the Washington Department of Fish and Wildlife's (WDFW) steelhead broodstock collection until November 3. Both YN's and WDFW's broodstock collection at Dryden Dam concluded on November 3 due to high flows that left both the left and right bank traps inoperable. We supplemented the Wenatchee broodstock collection with additional trapping efforts at Tumwater Dam, Dam 5 adult weirs (located on the Icicle Creek side channel), and the Leavenworth NFH (LNFH) ladder trap. We collected broodstock at Tumwater Dam no more than three days per week, up to 8 hours per day, between September 18 and November 2, 2006. Sporadically operated between October 16 and November 2, the Dam 5 weirs did not contribute much to broodstock collection in 2006. Both Tumwater Dam and Dam 5 were inoperable after November 2 due to extremely high flows resulting in damage to the trapping facilities. New in 2006, a v-trap weir was installed in the upper portion of the LNFH ladder. The trap was operated between October 26 and November 16. Approximately 7.5% of our total broodstock was collected in the LNFH ladder trap during the high stream discharge that rendered Dryden Dam, Tumwater Dam, and Dam 5 trapping facilities inoperable. A summary of broodstock collection and fish handled at all trapping sites can be found in Table 1. All coho broodstock were transported to Entiat National Fish Hatchery (ENFH) for holding and spawning.

Table 1. Coho salmon and incidentals handled during trapping, 2006.

Location	**Coho (*broodstock*)**	**Steelhead**	**Sockeye**	**Chinook**	**Bull Trout**
Dryden Dam	1,473* (*1,229*)	141	10	410	2
Tumwater Dam	4* (*1*)	24	1	5	0
Dam 5 weir	1* (*0*)	0	0	0	0
LNFH ladder trap	277* (*99*)	2	0	0	0

*Actual number of coho handled during trapping at Dryden Dam, Dam 5 weir, Tumwater Dam, and LNFH during broodstock collection efforts for 2006.

2.1.2 Spawning

Of the 1,329 coho collected, 47.9% were females (n=636) and 52.1% were males (n=693). While in the holding pond, the pre-spawn mortality rate was 4.0%; a decrease of 0.8% compared to the previous years' spawning activities. This increased holding survival represented the lowest observed pre-spawn mortality rate since the programs inception. Use of MS-222 and NaCl to decrease stress during transport, combined with segregated holding to minimize handling stress (use of two holding ponds to separate the males from the females), may have contributed to the reduced pre-spawn mortality.

A total of 1,198 coho adults (584 females and 614 males) were spawned between October 11 and November 21, 2006. Peak spawn occurred on October 24 with 179 ripe females (Figure 1). Spawn timing for the 2006 brood was similar when compared to previous years' data (Figure 2).

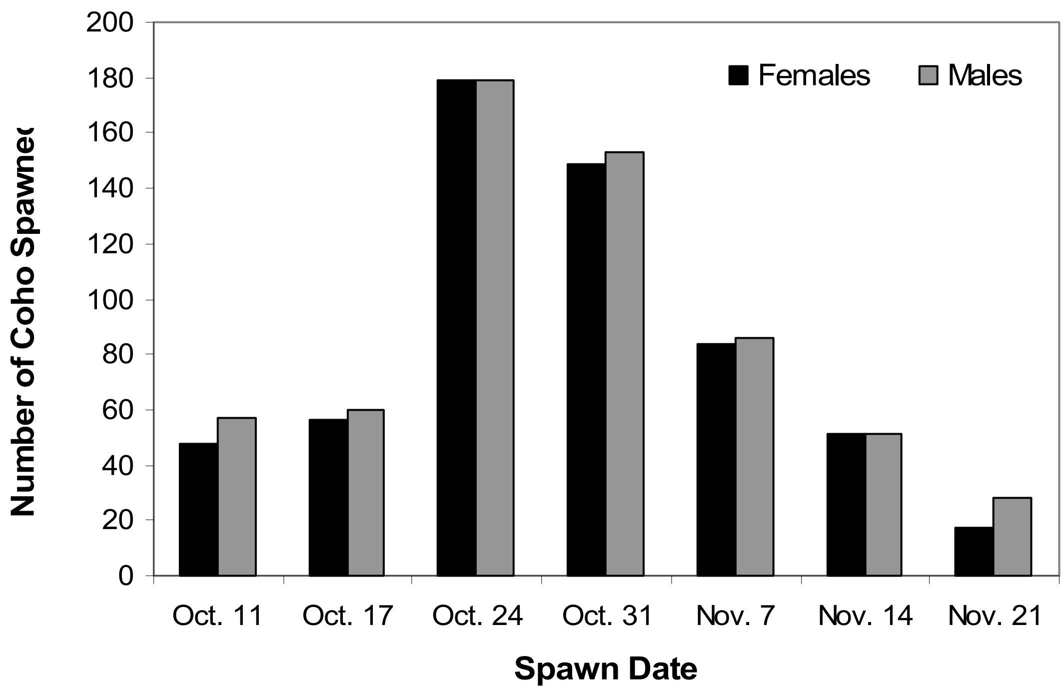

Figure 1. Number of coho spawned at Entiat National Fish Hatchery, 2006.

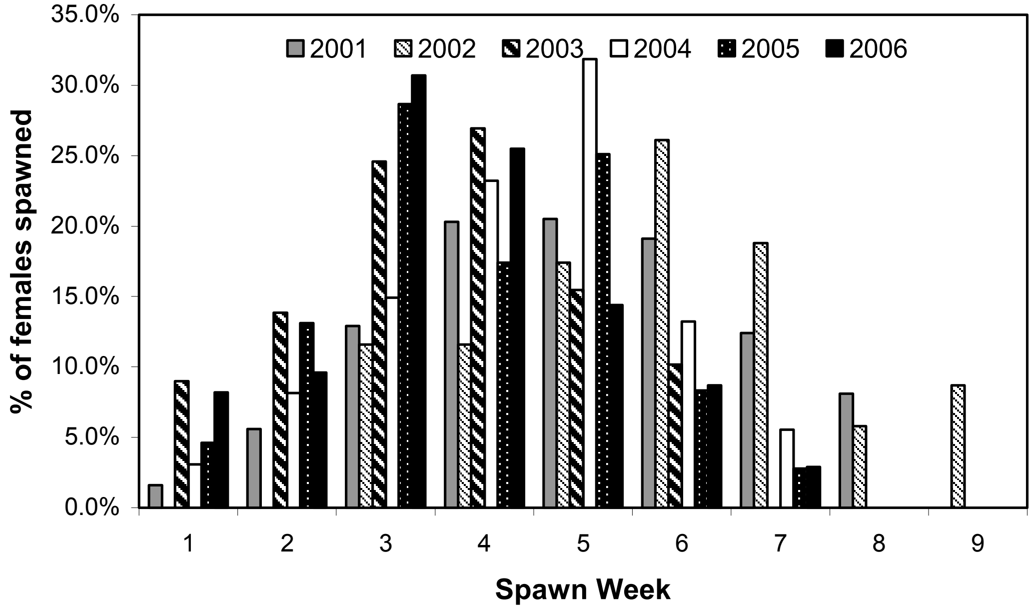

Figure 2. Temporal spawning distribution: brood years 2001 through 2006.

2.1.3 Incubation

A total of 1,785,062 green eggs were collected from the 2006 coho broodstock. Of the total green eggs, 1,018,788 were incubated at ENFH while the remaining 766,274 were transported to YN's Peshastin Incubation Facility (PIF). Both facilities incubated the coho eggs in a deep trough, bulk incubation system, supplied with 4-5 gal/minute chilled well water. This bulk incubation system has been effective for the coho in that it allows for a relative large volume of eggs to be incubated in a cost-effective manner while providing a high level of success for the program.

At both facilities (ENFH and PIF), standard protocols were followed allowing for eggs from each female to be mated with one primary and one back-up male. During fertilization, a 1% saline solution was used to increase sperm motility. After 2-3 minutes to allow for complete fertilization, excess ovarian fluid, milt, and other organics were strained from the eggs. The eggs were then soaked in a 75 ppm iodine treatment for 30 minutes prior to being rinsed and placed in the incubator.

Eyed-egg totals for Entiat NFH and the PIF were 900,663 and 676,877, respectively. Average eye-up rate for the 2006 brood was 88.4%. The 2006 eye-up was the highest observed since the program began. Eyed-eggs were transported to Cascade FH and Willard NFH for hatching and rearing. A summary of spawn dates, number of green eggs collected, eye-up rate at ENFH and PIF, and transport to the rearing facility can be found in Table 2. Transportation from the incubation facility to the rearing facility occurred between 550 and 600 temperature units (F).

Table 2. Spawn dates, number of eggs collected, and eye-up rate at ENFH and Peshastin Incubation Facility, 2006.

Incubation Location	Spawn Date	Trans. Date	Number of Females	Number eyed eggs	Number dead eggs	Total green eggs	Eggs per Female	Eyed eggs per female	% Eye-up	Receiving/ rearing hatchery
Peshastin	11-Oct	21-Nov	48	128,712	24,451	153,163	3,190.9	2,681.5	84.0	Cascade FH
Peshastin	18-Oct	30-Nov	58	133,272	20,033	153,306	2,948.2	2,562.9	87.0	Cascade FH
ENFH	24-Oct	27-Nov	179	499,201	70,664	569,865	3,275.1	2,869.0	87.6	Cascade FH
ENFH	31-Oct	6-Dec	149	401,462	47,462	448,923	3,033.3	2,712.6	89.4	Willard NFH and Cascade FH
Peshastin	07-Nov	26-Dec	84	222,315	22,697	245,012	2,952.0	2,678.5	90.7	Willard NFH
Peshastin	14-Nov	01-Jan	51	153,972	15,225	169,197	3,317.6	3,019.0	91.0	Willard NFH
Peshastin	21-Nov	10-Jan	16	36,606	6,990	45,595	3,039.7	2,573.7	84.7	Willard NFH
Totals			**585**	**1,577,540**	**207,523**	**1,785,062**	**3,126.2**	**2,762.8**	**88.4**	

2.2 METHOW RIVER BASIN

2.2.1 Broodstock Collection

Coho broodstock were collected at the Winthrop National Fish Hatchery (WNFH) and at two passage ladder traps on Wells Dam. Returning adults in 2006 originated from a composite 2003 brood which consisted of 48% MCR brood (both WEN and MET origin), 52% LCR brood, and natural origin fish. Coho returning to WNFH were allowed to volitionally swim into the hatchery holding pond. The WNFH ladder was opened on September 25 and remained open until November 28. A total of 223 coho (98 females and 128 males) entered the hatchery. This was the largest number of swim-in coho to WNFH since the program began in 1996.

Supplemental collection occurred concurrently at Wells Dam on both the west and east fish ladders between September 25 and November 16. A total of 108 coho (49 males and 59 females) were trapped, tagged with sequential numbered floy tags, and transported from Wells Dam to WNFH. These tags were used to differentiate broodstock collected at Wells Dam from the volitional swim-ins at WNFH. Both ladder traps were actively operated by YN and WDFW staff. These traps were operated no more than three days per week, up to eight hours per day simultaneously with WDFW's steelhead collection until October 10. After October 10, trapping activities were expanded to 7 days a week through November 16. Eleven coho males were passed upstream of Wells Dam during the last week of trapping since a sufficient number of males had been retained at WNFH via swim-ins. Non-target species were recorded and diverted back into the adult ladders without handling. No bull trout were observed during trapping at Wells Dam or WNFH. Trappable coho and non-target species diverted back to the adult ladders can be found in Table 3.

A total of the 342 coho were collected as swim-ins to WNFH, trapped and transported from Wells Dam, or passed at Wells Dam. Eighty-five percent (*n=291*) of the handled adults were used for broodstock. Of these broodstock adults, 6.0% (*n=21*) were surplus and released back into the river to spawn naturally while the total pre-spawn mortality was 5.7% (*n=19*; Table 3).

Table 3. Methow Basin coho salmon trapped and incidentals diverted back to the river, 2006.

Location	Coho (*broodstock*)	Steelhead	Chinook	Bull Trout
WNFH	223	0	0	0
Wells Dam East Ladder Trap	86*(*78*)	133	143	0
Wells Dam West Ladder Trap	33*(*30*)	52	38	0

*Actual trappable coho numbers during broodstock collection efforts for 2006. Passed coho were males that were recorded and allowed to migrate upstream

2.2.2 Spawning

Coho broodstock collected at Wells Dam and WNFH were spawned weekly at WNFH, between October 16 and November 20. A total of 291 (141 females and 150 males) were spawned during a six week period. Peak spawn occurred on November 13 with 47 females and 49 males (Figure 3). Sixty-seven percent (*n=197*; 95 females and 102 males) of the broodstock were volitional swim-ins to WNFH while the remaining 33% (*n=94*; 43 females and 50 males) were fish intercepted at Wells Dam and transported to WNFH. Twenty-one fish (19 males and 2 females) were program excess and, because of limited incubation space, were out-planted into Spring Creek (WNFH hatchery outfall) to spawn naturally.

Pre-spawn mortalities increased slightly from 5.2% in 2005 to 5.7% in 2006. To further decrease pre-spawn mortality, a reduction in handling during pre-spawn sorting would be beneficial. This could be accomplished by building subdivided sections within the hatchery holding pond allowing staff to segregate ripe from green males and females while reducing stress prior to spawning activities. This segregation of potential spawners is currently being done for the Wenatchee broodstock at ENFH. This pond segregation is being looked into by WNFH hatchery personnel and should be implemented in the near future.

Results from recovered CWT's show that 93.7 % of fish spawned were released from WNFH in 2005; both on-station and the back-channel. One jack was incorporated into the 2006 brood and was released from Wells FH in 2006. This jack comprised 0.3% of the total broodstock while the remaining 6.0% were either lost tags during extraction, unreadable, or not present. Scale analysis will be used to determine origin (hatchery vs. wild) for coho without CWTs.

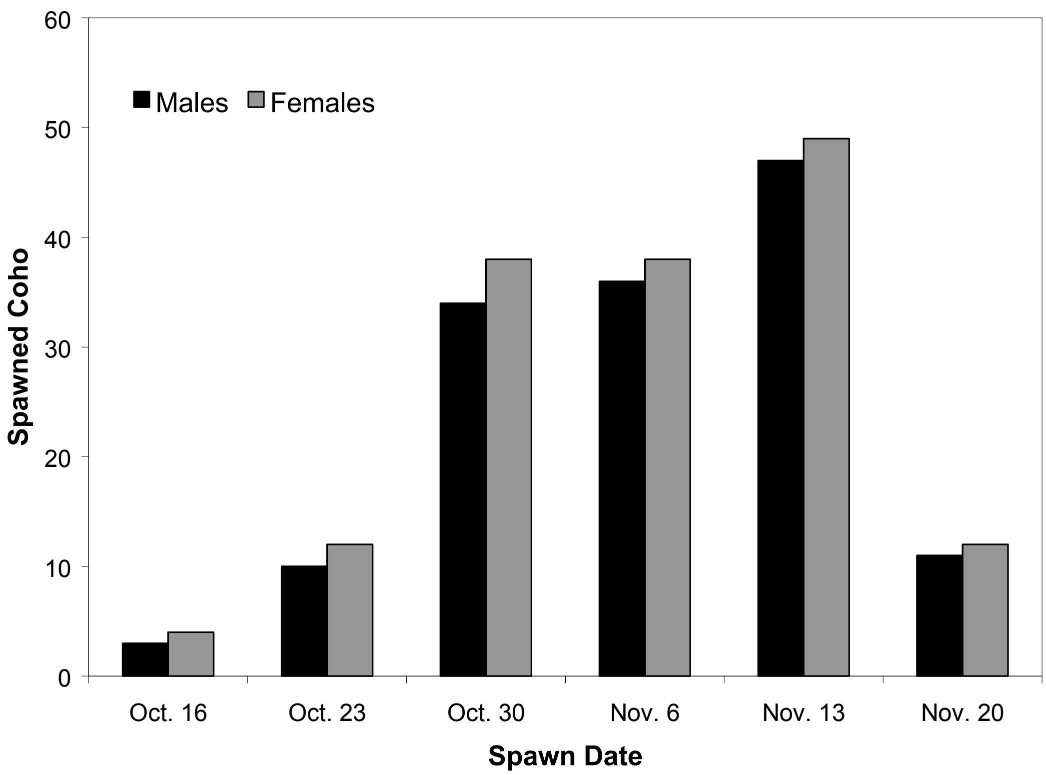

Figure 2. Number of coho spawned at Winthrop National Fish Hatchery, 2006.

2.2.3 Incubation

A total of 422,265 green eggs were collected from the 2006 coho broodstock. Eyed-egg totals for WNFH incubation facility totaled 363,647 eggs, equaling a green-to-eyed egg loss of 13.9%. Of these, 267,942 eyed eggs were incubated at WNFH while the remaining 95,000 eyed eggs were transported to Willard Fish Hatchery for hatch and rearing. Eggs that remained on-station at WNFH were removed from incubation trays to rearing troughs at 1500 temperature units (F). Average eye-up rate for the 2006 brood was 86.1%, an increase of 1.5% over the previous years' brood. A summary of spawn dates, number of green eggs collected, eye-up rate at WNFH can be found in Table 4.

At WNFH, eggs from each female were mated with one primary male. During fertilization, a 1% saline solution was used to increase sperm motility. After fertilization, all excess liquid was strained from the eggs and then rinsed, soaked, placed in the incubation trays containing 75 ppm iodine and water-hardened for 30 minutes.

Table 4. Spawn dates, number of eggs collected, and eye-up rate at Winthrop NFH, 2006.

Spawn Date	Number of females	Number of eyed eggs	Number of dead eggs	Total green eggs	Eggs per female	Eyed eggs per female	% eye-up
16-Oct	3	10,843	2,622	13,465	4,498	3,614	80.5
23-Oct	10	27,755	2,060	29,815	2,982	2,776	93.1
30-Oct	34	83,586	19,579	103,435	3,042	2,458	80.8
6-Nov	36	95,463	15,571	111,034	3,084	2,652	86.0
13-Nov	47	121,000	16,376	137,376	2,923	2,574	88.1
20-Nov	11	25,000	2,140	27,140	2,467	2,273	92.1
Totals	141	363,647	58,348	422,265	2,995	2,579	86.7

3.0 SPAWNING GROUND SURVEYS

As in previous years, Wenatchee Basin spawning ground survey efforts focused on Nason Creek, Icicle Creek, and the Wenatchee River. Surveys also included other tributaries where coho had not been released such as the Chiwawa River, Mission, and Peshastin creeks. Methow River survey efforts concentrated on the mainstem Methow River and lower portions of select tributaries which YN had previously identified coho spawning activity.

In the Wenatchee Basin, we surveyed Nason and Icicle creeks weekly. Frequent surveys allowed us to measure spawn timing as well as the number of redds. In high spawner density areas, such as Icicle Creek, weekly surveys were required to obtain clear and distinct redd identification. The mainstem Wenatchee River and tributaries (Beaver, Brender, Chiwaukum, Peshastin, and Mission creeks) were surveyed as often as possible, but at a minimum twice following peak spawn. Infrequent surveys after peak spawn allowed us to evaluate the distribution and number of naturally spawning coho in each basin, but did not allow a measure of spawn timing.

The mainstem Methow River was surveyed as often as possible, with the entire river being surveyed at least once during the spawning season. Other tributaries were surveyed as time allowed. Survey reaches for both basins are identified in Table 5. Complete survey records can be found in Appendix B.

We conducted the spawning ground surveys by either foot or raft, depending upon the size of the river/creek and the terrain. Surveys were completed by one- or two-person teams. Individual redds were marked and cataloged to get precise redd counts and timing. Coho redds were flagged with surveyor's tape tied to riparian vegetation. Each flag was marked with the date, approximate redd location, and redd number. The number of new redds, live and dead fish, time required to complete the survey, and the stream temperature were recorded. Surveyors checked all flags from previous surveys as they searched for new redds. Global positioning (GPS) was used to record the exact location of individual redds on all surveys.

During the surveys, coho carcasses were recovered. From the carcasses, we measured fork length (FL) and post-orbital hypural length (POH) to the nearest centimeter. Snouts were collected from all carcasses. The snouts were scanned for the presence of coded wire tags (CWT) in the laboratory; all snouts containing CWTs were dissected, recovered, and read. Carcass gender was recorded. Female carcasses were checked for egg retention by visual estimation of the number of eggs present in the body cavity. Egg voidance was calculated by subtracting the known eggs of an individual female from the average fecundity of the current years' broodstock. Egg voidance was expressed as a percentage of void eggs from the total fecundity. The caudal fin was removed from sampled carcasses to prevent re-sampling during later surveys.

The 2006 adult coho returns to the Wenatchee River Basin were lower than the past three years with an observation of only 110 redds. In addition to the low returns, most of the coho passing over Tumwater Dam were unaccounted for during spawning ground surveys. A couple of predictive variables may have contributed to the escapement numbers observed in 2006 (Murdoch et.al. 2006). Less than average snow pack levels encountered in 2005 resulted in unfavorable spring migratory conditions for this particular brood, especially in the upper watershed. Release numbers from all upper basin sites were reduced and redirected to Icicle Creek to maximize overall population survival. In addition to the poor emigration conditions experienced by the juveniles, the fall of 2006 had one of the worse high water events that had been encountered in years, with flows peaking at over 25,000 cubic feet per second (cfs), 6-times the average flow conditions during that time of year. The combination of these two factors likely resulted in lower an underestimate in the spawning escapement due to inability to conduct successful surveys. Coho redd identification on the Wenatchee and Methow rivers can be difficult because spawn timing overlaps with summer chinook. Coho redds located in heavily used summer chinook spawning areas cannot be positively identified without seeing individual fish on these redds. In addition to the species overlap.

Table 5. Spawning ground reaches for the Wenatchee and Methow river basins, 2006.

Reach Designation	Reach Description	Reach Location (RK)
	Icicle Creek	
I1	Mouth to E. Leavenworth Br.	0.0-3.7
I2	E. Leavenworth Br. to Hatchery	3.7-4.5
I3	Hatchery to Dam 5	4.5-4.7
I4	Dam 5 to headgate	4.7-6.2
I5	Headgate to LNFH intake	6.2-8.0
	Nason Creek	
N1	Mouth to Kahler Cr. Br.	0.0-6.3
N2	Kahler Cr. Br. to High Voltage Lines	6.3-10.3
N3	High Voltage Lines to Old Wood Br.	10.3-13.3
N4	Old Wood Br. to Rayrock	13.3-20.9
N5	Rayrock to Whitepine Cr.	20.9-25.4
	Chiwaukum Creek	
CH1	Highway 2 Bridge to Mouth	0.0-0.8
	Chumstick Creek	
CS1	Mouth to North Rd culvert	0.0-1.6
	Peshastin Creek	
P1	Mouth to RM 4.0	0.0-6.4
	Mission Creek	
M1	Mouth to Brender Creek	0.0-0.8
M2	Brender Creek to RM 2.0	0.8-3.2
	Brender Creek	
BR1	Mouth to Mill Rd.	0.0-0.3
	Beaver Creek (WEN)	
BW1	Mouth to Acclimation Pond	0.0-2.4
	Little Wenatchee River	
LW1	Mouth to Log Jam	0.0-3.2
	Wenatchee River	
W1	Mouth to Sleepy Hollow Br.	0.0-5.6
W2	Sleepy Hollow Br. to Monitor Br.	5.6-9.3
W3	Monitor Br. to lower Cashmere Br.	9.3-15.3
W4	Lower Cashmere Br. to Dryden Dam	15.3-28.2
W5	Dryden Dam to Leavenworth Br.	28.2-38.5
W6	Leavenworth Br. to Icicle Rd. Br.	38.5-42.5
W7	Icicle Rd. Br. to Tumwater Br.	42.5-57.3
W8	Tumwater Br. to Lake Wenatchee	57.3-86.3
	Wolf Creek	
WF1	Mouth to RM 1.6	0.0-2.6

	Beaver Creek (MET)	
BM1	Mouth to RM 1.6	0.0-2.6
	Libby Creek	
L1	Mouth to RM 1.0	0.0-1.6
	Gold Creek	
G1	Mouth to RM 1.5	0.0-2.4
	Chewuch River	
CR1	Mouth to RM 1.0	0.0-1.6
	Twisp River	
T1	Mouth to RM 2.0	0.0-3.2
	Spring Creek	
S1	Mouth to WNFH	0.0-0.4
	Methow River	
M1	Mouth to Steel Br.	0.0-8.1
M2	Steel Br. to Methow	8.1-23.8
M3	Methow to Lower Gold Cr. Br.	23.8-34.3
M4	Lower Gold Cr. Br. to Carlton	34.3-44.4
M5	Carlton to Twisp	44.4-63.7
M6	Twisp to Winthrop	63.7-80.2
M7	Winthrop to Wolf Cr.	80.2-85.0

3.1 WENATCHEE BASIN REDD COUNTS

Icicle Creek

We conducted spawning ground surveys in Icicle Creek between September 29 and December 20. Eighty-eight coho redds were counted and recorded in 2006. The first redd was observed on October 18. Surveys within Icicle Creek were expanded in 2006 to include above the Icicle side-channel headgate up to the Leavenworth NFH intake water supply (Reach I5; Table 5). The headgate consists of a water regulatory structure at the upper end of the historic Icicle River channel which was used for hatchery activities until 1979. In 2006 the headgate remained open to allow for upstream and downstream fish passage.

Peak spawn occurred during the first two weeks of November, which coincided with the mean 2000-2005 returns (Figure 4). Thirty-two coho carcasses were recovered and sampled by YN personnel; 22 females and 10 males. Of the thirty-two carcasses recovered, 31.3% (*n= 10*) were recovered following a three-week high flow event in Mountain Home Creek. This was the first encounter of coho in this particular tributary. Although not many redds were identified in Mountain Home Creek, it was assumed that during the high flows, these adults that had spawned in the side-channel were escaping the high flows experienced during November. The overall sample rate for Icicle Creek was 14.8%, which was slightly lower than the 2005 season (15.7%) but under the targeted 20% rate for any given system. The low sample rate was again correlated to high flow events encountered during the recovery period on Icicle Creek. All thirty two coho carcasses sampled had an intact snout for CWT analysis. Mean POH for both male and female coho, to include both 2 and 3-year old life histories, was 47.4 cm (SD = 11.4) and 55.9 cm (SD = 1.4), respectively. Excluding the 2 year-old jacks found within the male population, mean POH was 54.0 (SD= 5.0). All females with intact body cavities were examined for the presence of eggs. Mean egg voidance was 99.5% (*n=7*) and ranged between 98.6% and 100%. Coded wire tag analysis determined that 77.3% of the tags recovered originated from Icicle Creek releases. Butcher Creek and Rolfing's Pond comprised 9.0% of the total tags found and represented the only strays to the system. The remaining three coho had either lost tags or no tag present (Table 6). These "no-tag" fish were important to note considering that 2006 consisted of the second consecutive year that naturally produced coho were returning to the Wenatchee River Basin. Pending scale analysis will determine the origin of these unknown adults (Table 6). Redds were distributed more heavily in the upper Icicle reaches than seen in past years with the highest proportion of redds being located in the new side-channel reach (*n=46*; I4). Although this reach encompassed 52.3% of the total spawning within the Icicle, egg-to-emigrant survival is expected to be low because of the limited habitat available for both adult spawning and subsequent juvenile rearing. Eighty percent of the coho redds found in the Wenatchee River Basin were located in Icicle Creek (Table 7). Complete survey records can be found in Appendix B.

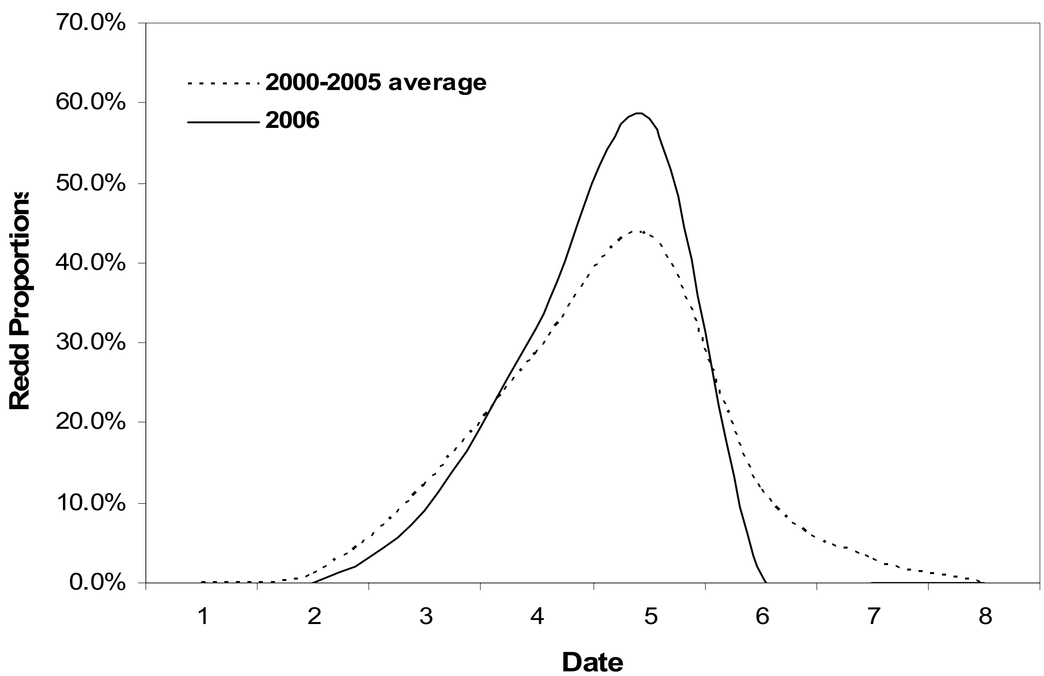

Figure 3. Coho spawn timing in Icicle Creek, 2006.

Table 6. Coded-wire tag (CWT) analysis from carcasses recovered on Icicle Creek, 2006.

Tagcode		Release origin	Number of recoveries (%)
052099 052169 052192 052194 052196	052190 052191 052193 052195 054856	Icicle Creek SFL's and LFL's- 2005 release	14 (63.6%)
052669 052698	052682	Icicle Creek SFL's- 2006 release	3 (13.6%)
052167		Butcher Creek	1 (4.6%)
052172		Rolfing's Pond	1 (4.6%)
No Tag		Unknown Origin	3 (13.6%)
Total			**22 (100%)**

Nason Creek

Spawning ground surveys were conducted on Nason Creek between September 26 and December 5 (Appendix B). Nason Creek survey reaches can be found in Table 5. Four redds were identified in Nason Creek, with all spawning occurring during the last two weeks of October. No carcasses were recovered in Nason Creek during 2006. Determining temporal distribution based on the limited number of redds (*n=4*) identified in Nason Creek for 2006 is questionable due to the small sample size. The four redds were distributed throughout all three reaches surveyed. No carcasses were recovered. Nason Creek redds represented 3.6% of the coho redds identified in the Wenatchee River Basin (Table 7).

Wenatchee River

Wenatchee River surveys were conducted primarily to determine distribution and redd counts but also an attempt to determine spawn timing. Wenatchee River reaches surveyed can be found in Table 5. A total of 6 redds were identified in the Wenatchee River (Table 7) all within the lowermost reaches (W1-W3). YN personnel found five carcasses on the Wenatchee River, all of which were female. Mean POH for females was 56.0 cm (SD=3.5). Egg voidance was 86.6% (*n=3*). Of the five carcasses recovered, four had CWT's. Two of the tags were lost during dissection, one originated from the 2005 Icicle Creek release and one from the 2005 Butcher Creek acclimation pond release.

Scale analysis is pending but will be used to verify origin of fish without CWTs. Additionally, WDFW recovered two coho carcasses in the Wenatchee River during summer chinook spawning ground/carcass surveys. Both of the carcasses recovered by WDFW were located below Icicle Creek. Scale analysis determined that all of the carcasses recovered by WDFW were hatchery origin, three-year-old coho. Snouts were not taken. Redds located on the Wenatchee River accounted for 5.5% of the total observed coho redds in the Wenatchee Basin (Table 7).

Other Tributaries

On tributaries associated with the Wenatchee River, we surveyed to determine spawning distribution and counts rather than spawn timing. Survey areas included the lower reach of Beaver Creek, Brender Creek, Chiwawa River (lower), Chiwaukum Creek, Chumstick Creek, Peshastin Creek, and Mission Creek (Table 7). No redds were located in Beaver Creek, Chiwawa River (lower), Chiwaukum Creek, or Chumstick Creek. A total of 12 redds were found in Brender, Mission, and Peshastin creeks (Table 7).

Mission Creek/Brender Creek

Mission Creek survey reaches can be found in Table 5. Five coho redds were identified in Mission Creek between September 28 and December 21. An additional redd was located in Brender Creek during this same time period and was approximately 100 meters upstream from the Mission Creek confluence. All five redds identified in Mission Creek were in the lowest reach (M1). We recovered 3 carcasses—2 females and 1 male. We were able to collect snouts for CWT analysis on all of the carcasses. Mean POH for males and females was 49.0 cm (SD=0.0) and 50.0 cm (SD=7.1), respectively. Egg voidance was 100.0% (*n=1*). CWT recovery and analysis demonstrated that all three tags recovered from carcasses originated from the 2005 Icicle Creek release, both Small Foster Lucas (SFL) and Large Foster Lucas (LFL) located at LNFH. Thirty one carcasses were recovered in Brender Creek; the second highest carcass recovery total for the Wenatchee River Basin; second only to Icicle Creek for the highest recovery in the basin. Of the carcasses sampled, we were unable to determine sex on 96.7% (*n=30*) of the individuals. The lone POH for the one female identified was 49.0 cm (SD=0.0). The overall POH for the remaining population was 56.7 cm (SD=3.8). The majority of coho carcasses (*n=29*) observed in Brender Creek occurred after a multiple week, high flow event that seemingly encouraged these coho into this forth-order tributary. These data suggest that small tributaries (such as Brender Creek and Mountain Home Creek) which typically see very little spawning activity may provide alternate spawning habitat in years with sustained high flows or high water events. Of the carcasses sampled, 18 of the 31 adults had some remnant of a snout to collect for CWT analysis. Coded wire tag analysis determined that 16 of the 18 snouts recovered had tags; fourteen originated from 2005 Icicle Creek releases (SFL's and LFL's), two originated from the 2005 Rolfing's Pond release, while the remaining two did not have CWT's. Scale analysis for these two non-tagged coho and the remaining unknowns (*n=13*) is pending. Redds located in Mission and Brender creeks represented 5.5% of the coho redds in the Wenatchee River basin (Table 7).

Peshastin Creek

Peshastin Creek was divided into three reaches for spawning ground surveys (Table 5). Six coho redds were identified between October 26 and December 18. Two carcasses were recovered; both females. Although the recovery rate (15.9%) was lower than expected due to sustained high flows, the proportion of fish recovered in Peshastin Creek was comparable to other surveys locations within the Wenatchee Basin. Mean POH for female coho was 46.5 cm (SD = 3.5). Mean egg voidance was unavailable for the two carcasses encountered because the body cavities had been exposed prior to sampling. Coded wire tag analysis determined that both of the carcasses recovered originated from 2005 Icicle Creek SFL releases. Redds located in Peshastin Creek represented 5.5% of the coho redds in the Wenatchee River basin.

Table 7. Summary of coho redd counts and distribution in the Wenatchee River Basin, 2006.

River	No. of Redds	% Of Redds
Icicle Creek	88	80.0%
Nason Creek	4	3.6%
Peshastin Creek	6	5.5%
Mission Creek	5	4.5%
Brender Creek	1	0.9%
Wenatchee River	6	5.5%
Total	**110**	**100%**

3.1 METHOW BASIN REDD COUNTS

Methow River

Spawning ground surveys were conducted between October 31 and December 20, primarily to determine spawning escapement and to identify distribution. Mainstem Methow River surveys were conducted from the mouth to the confluence of Wolf Creek (RM 54.0) by raft. Each section was surveyed on 10-14 day interval period. Redds identified within the mainstem Methow River comprised 36.3% of all redds found within the basin. A total of 28 coho redds and 3 carcasses were found on mainstem spawning ground surveys with 93% (*n=26*) of the distribution located from the mouth to the Winthrop Bridge at RK 80.2. The remaining two redds were found between the town of Winthrop at RK 80.2 and the confluence of Wolf Creek at RK 80.5. Three female carcasses were found on mainstem surveys with a mean POH of 51cm (SD=2.0). Coded wire tags recovered from two of the carcasses indicated WNFH on-site release origin, while the third was unknown. The sample rate was 4.8% and can be attributed to the low frequencies of repeat surveys within each reach. Redd numbers, basin proportions, and locations can be found in Tables 9; Appendix B).

Table 8. Coded-wire tag (cWT) analysis from carcasses recoved within the Methow Basin and Upper Columbia Tributaries, 2006.

Tagcode	Release origin	Number of recoveries (%)
051580 051581 051582 051583 052572 052666	WNFH on-station and Back Channel-Release 2005	10 (83.3%)
52665	Wells- Release 2005	1 (8.3%0
No Tag	Unknown Origin	1 (8.3%0
Total		**12 (100%)**

Table 9. Summary of coho redds counts and distribution in the Methow Basin, 2006.

River	No. of Redds	% Of Redds
WNFH Spring Creek	29	37.7%
WDFW Hatchery Outfall	15	19.5%
Chewuch River	0	0.0%
Libby Creek	1	1.3%
Wolf Creek	0	0.0%
Beaver Creek	1	1.3%
Twisp River	2	2.6%
Methow River	28	36.4%
Foster Creek	0	0.0%
Chelan FH Outfall	1	1.3%
Chelan Falls	0	0.0%

Other Tributaries

On other tributaries associated with the Methow River, we surveyed to determine spawning distribution and total counts. Survey areas included the WNFH and WDFW hatchery outfalls, the Twisp and Chewuch River and the lower reaches of Beaver, Libby, Gold and Wolf creeks. Columbia River tributaries, which included Foster Creek, Chelan Falls and Chelan Fish Hatchery outfall (Beebee Springs), were also surveyed.

Spring Creek (WNFH) and Methow FH (WDFW) Outfalls

WNFH and Methow FH (operated by WDFW) outfalls (Table 5) were surveyed weekly, beginning on October 30 and concluding on December 20. Frequent surveys allowed us to determine distribution, spawn timing and approximate numbers of naturally spawning adults. Combined, both outfalls comprised 57.1% of the total number of redds (*n=44*) identified in the Methow River Basin (Tables 9).

The first redd identified in Spring Creek was found on October 30. Redds located within Spring Creek comprised 37.6% (*n=29*) of all coho redds in the basin. Five carcasses were recovered, 3 males and 2 females, a recovery rate of 7.8%. Predation marks were observed on recovered carcasses and thought to be a possible reason for the low sample rate. Mean POH for both males and females was 46cm (SD=15.5) and 51.5cm (SD=0.7), respectively. One of the males sampled was a 2-year old jack and accounted for the POH variation. Based on recovery of CWTs, three of the fish were released on-station while the remaining two were released from the ‘back-channel’. The “back-channel” is a constructed holding area in the Spring Creek outflow that was used to collect steelhead in past years.

The first redds identified in the Methow FH outfall were also found on October 30. Redds located within the outfall comprised 19.5% (*n=15*; Table 9) of all redds found in the basin. Three male carcasses were sampled with a mean POH of 38.3cm (SD=15.8); which including one jack. Coded wire tag analysis determined that two of the males originated from 2005 WNFH on-site releases while the third, a jack, was from the 2006 back-channel release. The overall sample rate was 9.0% for the Methow FH outfall. Similar to Spring Creek at WNFH, the low sampling rate can presumably be attributed to high predation rates on carcasses by wildlife.

Winthrop NFH is currently the only coho release site within the Methow River Basin, resulting in unnaturally high spawners densities surrounding the hatchery outfall. Similarly high spawner densities are seen around the outfall to the Methow FH. Although coho are not released from the Methow FH, the facilities’ close proximity to one another (less than 2 RK) and use of the same surface water source (Spring Creek) may produce very similar imprinting signatures. Limited spawning habitat within these outfalls likely contributes low egg-to-immigrant survival.

Beaver Creek

Beaver Creek surveys were conducted as one reach (approximately 2.6 kilometers; Table 5). One coho redd was identified within the lower reach of Beaver Creek on November 14. No carcasses were recovered. The Beaver Creek redd represented 1.3% of the total coho redds located in the Methow River Basin (Table 9).

Libby Creek

Libby Creek surveys were conducted as one reach. One coho redd was identified with in the lower reach of Libby Creek on November 15. No carcasses were found. Libby Creek redds represented 1.3% of the total coho redds located in the Methow River Basin (Table 9).

Twisp River

Twisp River reaches were surveyed on November 15 and December 5-6. Due to ice accumulation the surveys concluded earlier than in other locations. Both redds were found on December 5, the last survey. . No carcasses were recovered. Twisp River redds represented 2.5% of the total redds located in the Methow River Basin (Table 9).

Chelan Falls Hatchery Outfall and Chelan Falls

The Chelan Fish Hatchery (FH) outfall (Beebe Springs) and Chelan Falls, downstream of Wells Dam, were surveyed after peak spawn to assess spawning distribution. Radio telemetry surveys conducted in previous years indicated the presence of adult coho within or in close proximity to these locations. High abundance of spawning summer Chinook made identifying coho redds difficult. Spot checks after peak summer Chinook spawn allowed a higher probability of discerning coho redds from Chinook redds. One redd was located in the Chelan FH outfall on December 12 (Table 9).

SUMMARY

• During spawning ground surveys in Icicle Creek, we observed 88 coho redds and recovered 32 coho carcasses. The mean egg voidance was of 99.5% (*n=7*).

• During spawning ground surveys in Nason Creek, we counted four coho redds and recovered no carcasses.

• We found 6 coho redds in the mainstem Wenatchee River and a combined 24 redds in Brender, Mission, and Peshastin creeks. A total of seven carcasses were recovered in the Wenatchee River by WDFW and YN personnel. A total of 41 carcasses were recovered on Mission (*n=3*), Brender (*n=31)* and Peshastin (*n=2*).

• A total of seventy-seven redds were identified and 12 carcasses recovered in the Methow River and associated tributaries in 2006.

4.0 SMOLT ACCLIMATION: WENATCHEE AND METHOW

4.1 ACCLIMATION SITES

In 2007, within the Wenatchee River Basin, YN acclimated coho pre-smolts at the Leavenworth National Fish Hatchery (LNFH), Beaver Creek, and three sites on Nason Creek. For the Methow River broodstock development program, YN acclimated coho pre-smolts at Winthrop National Fish Hatchery (WNFH), both on-station and in the Spring Creek back-channel, as well as at Wells Fish Hatchery. A description of these acclimation sites follows.

4.1.1 Leavenworth National Fish Hatchery

The Leavenworth NFH is located at river kilometer (RK) 4.5 on Icicle Creek. Coho smolts were acclimated in refurbished raceways, also known as small and large Foster-Lucas (SFL & LFL) ponds. Originally, these Foster-Lucas ponds were designed for rearing steelhead, sockeye, and spring Chinook. The intent of the oval-shape design of these ponds was to create a low-maintenance raceway that could produce quality salmonids. These ponds were discontinued due to insufficient turnover rates and maintenance difficulties in favor of more widely used 8x100 and 10x100-foot raceways. Both the small and large Foster-Lucas ponds were partially refurbished by Yakama Nation Fisheries and supplied with second-use water for coho acclimation. The water source for the large ponds originates from first-pass effluent from the hatchery's 10x100 juvenile spring Chinook raceways. Second-use water supplied to the small Foster-Lucas ponds is pumped from a sump area below the adult holding ponds, which doubles as a rearing/acclimation pond for juvenile spring Chinook until release in mid-April. Water to each Foster-Lucas pond is manually adjusted to achieve flow requirements for the coho densities on-hand. Beginning in 2008, YN and USFWS will extend juvenile acclimation for both coho and spring Chinook until the end of April. This extended rearing was, in part, due to the inability to achieve release criteria of 15 fish per pound (fpp) for both species.

4.1.2 Beaver Creek

The Beaver Creek acclimation pond is located at RK 2.4 on Beaver Creek. Beaver Creek enters the Wenatchee River near Plain, Washington at RK 74.4. The acclimation pond was constructed in the mid 1980's and is located behind Mountain Springs Lodge. Originally, the property owner stocked the pond with Kamloops rainbow trout for aesthetic purposes. River otter predation on the year-round resident trout became too problematic and the stocking was discontinued in the early 1990's. Since then, the pond had been void of salmonids until YN began using the pond to acclimate coho salmon in 2002. Prior to fish arriving at the acclimation site, YN installed containment structures at the ponds' inlet and outlet. PIT tag detection systems were installed in 2007 to monitor emigration timing and in-pond survival (Section 4.4). We expect that returning adults not captured for broodstock will spawn in Beaver Creek or in the upper Wenatchee River.

4.1.3 Nason Creek

In 2007, coho pre-smolts were acclimated at three sites on Nason Creek: Butcher Creek Pond, Coulter Creek Pond and Rolfing's Pond. All acclimation sites in Nason Creek are natural or semi-natural earthen ponds. Natural and earthen ponds may have advantages over conventional hatchery raceways such as lower rearing densities, supplemental natural food sources, and other environmental conditions such and natural temperature and flow regimes.

Coulter Pond

The Coulter Pond acclimation site is located at RK 1.6 on Coulter Creek. Fish released from Coulter Pond emigrate through the Nason Creek Wetlands and enter Nason Creek at RK 13.7. This natural beaver pond is composed of multiple braided channels which coalesce into a large, widened waterway. We used a large net to encircle the majority of the channel to try and ensure containment during acclimation. PIT tag detection systems were installed in 2007 to monitor emigration timing and in-pond survival (Section 4.4).

The release was closely monitored to ensure fish could pass through the multiple beaver dams into Nason Creek.

Rolfing's Pond

Rolfing's Pond acclimation site is located on an unnamed seasonal creek which connects to the lower end of Mahar Creek before reaching Nason Creek at RK 20.3. The earthen pond was constructed and developed by the property owner. In 2003, to create a more suitable acclimation environment, we enlarged the pond and planted native riparian vegetation. We used a barrier net at the outlet of the pond to contain the fish until release.

Butcher Creek

The Butcher Creek acclimation site is located at RK 13.2 on Nason Creek. This site, historically a channel of Nason Creek, is now a beaver pond at the mouth of Butcher Creek. Coho smolts were volitionally released directly into Nason Creek from the pond. Prior to transportation, a net was placed upstream of the beaver's natural barrier to contain coho during acclimation. Floating structures were installed to provide shade and protection from predators.

Nason Creek Wetlands

The Nason Creek Wetlands site was used 'experimentally' for the first time in 2006 and scheduled for use in 2007. Unfortunately, fish were not released from the Nason Creek Wetlands in 2007 due to logistical constraints in accessing the site. The Nason Creek Wetlands is part of a wetland complex that included the lower portion of Coulter Pond. The 26-acre wetland complex encompasses the lower portions of Roaring and Coulter creeks. These creeks converge to form a complex series of natural beaver ponds that eventually empty into Nason Creek at RK 13.7. In 2006, coho smolts were released directly into the wetlands without containment or feeding. The fish released into the complex were allowed to volitionally immigrate into Nason Creek. Returning survival for this release was minimal and alterations are being discussed for 2008.

4.1.4 Winthrop National Fish Hatchery (WNFH)

Coho smolts released into the Methow River in were reared and acclimated at the WNFH, located at RK 80.6. Both on-station raceways and the 'back-channel' were used for coho acclimation. The back-channel is a portion of the hatchery outfall, also known as Spring Creek. Prior to acclimating fish in Spring Creek, predation netting and containment screens were installed.

4.1.5 Wells Fish Hatchery

In 2007, coho were acclimated at Wells Fish Hatchery located at RK 829.0 on the Columbia River. Wells Fish Hatchery is funded by Douglas Public Utility District (PUD) and operated by WDFW. Under contract with YN, WDFW acclimated coho pre-smolts in a 2.2 acre earthen pond historically used to raise summer steelhead. Coho acclimation at Wells Dam will aid in achieving 'Broodstock Development Phase I' goals (Murdoch et. al. 2005).

4.2 TRANSPORTATION AND VOLITIONAL RELEASE

4.2.1 Wenatchee River Basin

Mid-Columbia coho pre-smolts (BY2005) were transported to the Wenatchee basin from program rearing facilities at Willard NFH and Cascade FH between December 13 and April 5, 2007. Coho were acclimated between 3 and 17 weeks at five acclimation sites within the Wenatchee River Basin (Table 10). The 3-week acclimation occurred at Coulter Creek; the fish were volitionally released so the actual acclimation duration extended up to 10 weeks for late migrating smolts. The 13-week acclimation occurred at Leavenworth NFH (LNFH). Fish were transported to LNFH between December 13 and 18, 2006 into six experimental test ponds. These coho were part of an ongoing study to determine whether an extended acclimation on a local water source would result in increased smolt-to-adult survival. Two of the six over-winter experimental test ponds were only intermediately reared at LNFH before being transported on April 4-5 to their final acclimation and release site at Rolfing's Pond.

All coho smolts acclimated in SFL's or LFL's at LNFH were force-released April 16-17, 2007. During 2007 coho acclimated at Leavenworth NFH presented several fish health challenges. Select ponds in both the over-winter and short-term rearing groups were infected with *Trichodina sp.* and *Flavobacterium psychrophilum* (coldwater disease). These two outbreaks created considerable mortality, reducing release numbers from both the Leavenworth NFH LFL's and SFL's.

Coho acclimated at Nason and Beaver creek ponds were volitionally released with start dates between April 27 and May 8 (Table 10). Volitional releases were complete by June 21, 2007.

All coho released in 2007 were coded-wire tagged with retentions ranging from 95.8-99.4%. In addition to CWT's, 93.6% (*n= 458,466*) of the upper Wenatchee Basin release coho had a blank wire body tag (BT) in their adipose fin. BT's provide the means to implement the "Broodstock Development Phase II" (Murdoch et. al. 2005) by allowing YN staff to identify coho released in the upper Wenatchee basin as returning adults. Adult coho returning to the upper basin may be selectively passed at the Dryden Dam broodstock collection site and recaptured at Tumwater Dam. Recapture at Tumwater Dam focuses broodstock development on those coho with the correct run timing, spawn timing, and or stamina to ascend Tumwater Canyon, During 2007, 30,099 smolts were marked with passive integrated transponder tags (PIT tags). PIT tagged fish were released from LNFH, Beaver Creek, Coulter Creek, and Rolfing's pond (Table 10). The PIT tagged fish were used to measure survival from release to McNary Dam and to measure in-pond survival at select acclimation ponds (see Section 4.4). PIT tag detection systems were installed at Beaver Creek and Coulter Creek.

A total of 1,084,080 hatchery produced coho smolts were released in the Wenatchee River basin in 2007. Release numbers, size at release, and release locations can be found in Table 10. For detailed mark information see Appendix C.

4.2.2 Methow River Basin

In the Methow Basin, 100% MCR progeny coho were acclimated at WNFH. These MCR juveniles were progeny from both Methow (79%) and Wenatchee (21%) 2005 BY adults. ODFW transported a total of 69,406 pre-smolts from Cascade FH to WNFH on March 29, 2007. These fish were reared in an existing back-channel until release while approximately 268,150 coho juveniles were reared full-term on-station at WNFH. Improvements were made to the back-channel acclimation pond in 2007 and focused on minimizing natural predation from birds and small mammals. A new self cleaning fish screen (at the outlet of the pond) was installed, bird netting deployed and additional floating structures aided in improved rearing quality, minimized predation and provided shade.

Approximately 139,152 coho pre-smolts were transported by ODFW to Wells FH on March 28, 2007 for acclimation. These MCR juveniles were progeny from Wenatchee adult returns (100%) in 2005. The Wells FH coho were acclimated in a 2.2 acre pond that had historically been used for summer Chinook and steelhead.

Volitional releases at WNFH began on April 19 and concluded with a forced release on April 30. Coho acclimated at Wells FH were volitionally released on May 1 (Table 10). All coho released were CWT'ed with no additional marks. A combined total of 477,688 coho juveniles were released from Winthrop NFH and Wells FH (Table 10). For detailed mark information, see Appendix C.

Table 10. Mid-Columbia coho smolt release summary, 2007.

Location	Release Date	Release Number	Size @ release (FPP)	No. PIT Tags
Beaver Pond	May 8	96,639	13.0	6,993
Coulter Creek	April 27	99,380	15.6	7,025
Rolfing's Pond	May 7	161,477	16.8	4,003
Butcher Pond	May 6	132,473	16.5	
Leavenworth NFH LFL's (large Foster-Lucas Ponds)	April 16	300,856	20.7	6,014

Leavenworth NFH SFL's (small Foster-Lucas Ponds)	April 17	293,255	17.2	6,064
Wenatchee Total		**1,084,080**		**30,099**
Winthrop NFH (on-station)	April 19	268,150	19.6	0
Winthrop NFH back-channel (Spring Creek)	April 25	69,381	19.7	0
Wells FH	May 1	140,157	11.6	0
Methow Total		**477,688**		0
Wenatchee/Methow Totals		**1,561,768**		**30,099**

4.3 FISH CONDITION ASSESSMENT

At all Wenatchee basin acclimation sites, coho were sampled weekly to measure growth and degree of smoltification (*n=100*). Prior to release, fish condition was assessed (*n=20*) to estimate overall health by evaluating the normality of external features (eyes, fins, opercules, etc.) as well as internal organs and blood components. The purpose of the fish condition assessment was to note gross abnormalities, not to diagnose the cause of certain conditions. All Wenatchee basin 2007 pre-release growth and condition assessments demonstrated that the smolts were in good condition (Table 11).

At WNFH and Wells FH, coho were sampled pre-release for growth and fish condition. All of the pre-release growth and condition assessments demonstrated that the smolts were in good condition, with the exception of coho reared in the WNFH back-channel.

Coho reared in the WNFH back-channel had a condition factor (measure of relative robustness or degree of well-being) of 0.96 in comparison to all other release sites that ranged from 1.04 to 1.16; 1.0 being the optimum "state of well-being" (Williams 1951). Condition factors are used primarily to reflect state of sexual maturity and degree of nourishment (Williams 1951). WNFH back-channel releases exhibited the highest mesenteric fat measurements (3.3) recorded in 2007 but some of the lowest condition factors (Table 11). Certain studies have shown that fish can exhibit a high mesenteric fat level while, in fact being forced to fast, as a means of survival. During periods of extremely low metabolic rates, energy levels decrease and fat reserves are concentrated to the pyloric ceaca region of the organism. It is assumed that the fish in the WNFH back-channel were exhibiting this survival strategy as their condition factor and over all health assessment shows that they had a decreased fitness and were malnourished when compared to the WNFH on-station 2007 coho release. It is unknown at this time the reason for the low condition factor found in the WNFH back-channel pre-release assessment but that it may have stemmed from a culmination of factors. Poor water quality, excessive environmental stresses (predation and high densities), and underfeeding may have contributed to these findings. In the future, YN staff will provide enhanced protection from predators through use of bird netting and covers in and over the pond, providing refuge and protection for these juveniles in hopes of reducing stress. Future pre-release condition assessment results will hopefully show improvement in the overall condition of the smolts reared in the WNFH back-channel.

Table 11. Pre-release fish condition assessment, 2007.

Acclimation Location	Cond. Facto	Eyes[1]	Gill[1]	Psuedo-branchs[1]	Thymus[1]	Mes. Fat[2]	Spleen[1]	Hind Gut[1]	Kidney[1]	Liver[1]	Gender M/F	Fin Cond.[1]	Opercle[1]
LNFH- LFL's Short-term rearing	1.08	99	99	99	100	1.9	100	100	100	100	48/52	99	100
LNFH-SFL's Short-term rearing	1.15	100	100	100	100	2.3	100	100	100	100	55/45	100	100
LNFH- SFL's Over-winter groups	1.14	98	100	100	100	2.1	100	100	100	100	50/50	100	100
Beaver Creek	1.05	100	100	100	95	2.9	100	100	100	100	50/50	100	100
Coulter Creek	1.15	100	100	100	100	2.3	100	100	100	100	55/45	95	100
Rolfing's pond	1.09	100	100	100	100	2.6	100	100	100	100	60/40	100	100
Butcher pond	1.12	100	100	100	100	3.0	100	100	100	100	60/40	100	100
Winthrop NFH (on-station)	1.09	100	100	100	100	2.1	100	100	100	100	55/45	100	100
Winthrop NFH (back-channel)	0.96	100	100	100	70	3.3	100	100	100	100	80/20	70	100
Wells FH	1.16	100	100	100	85	2.6	100	100	100	100	50/50	100	100

1- *All components were based on a normality index (% norm). Variance in organ color and size was not looked at.*
2- *Mesenteric fat was based on a 0-3 numerical system average. A value of 2 equals more than 50% of the ceaca covered with fat, which is healthy.*

4.4 PREDATION ASSESSMENT

As standard practice of good fish husbandry and fish health, moribund coho were recovered from all site locations daily until the end of release to determine known mortality during this rearing period. Although known, natural mortality is relatively low (avg. < 2%), it is assumed that the majority of loss occurs through predation, both unobserved and observed throughout the duration of juvenile rearing and acclimation. This loss can have a significant impact on acclimation rearing, not only directly but also indirectly through elevated and repeated stress. Unusually high densities of fish can create an optimal situation for predation while delaying coho stimuli for flight response through prolonged exposure to this predation. Below is a consumption model derived from the various predators observed during acclimation and how this model compares to another method of determining in-pond loss.

4.4.1 Estimated Mortality-Predator Consumption Model versus PIT tag Detection

Predation Model

Primary predators observed were the North American river otter (*Lutra canadensis*) and the common merganser (*Mergus merganser*). Adult river otters can consume as much as 20% of their body weight in the natural environment (Beckel 1982). Average weights used for male and female river otters were 25 and 19 pounds, respectively. Common mergansers can consume upwards of one pound of fish per day (Stephenson 2004). In addition to these key predators, mink, belted kingfishers, great blue herons, and hooded mergansers have all been documented throughout the basin. Mallards and other "dabbler" types of ducks have recently also been identified as opportunistic, piscivorous predators if ideal conditions present themselves. Although these opportunistic bird species persist, literature determining their consumption is difficult to attain. Based on limited observation, an estimated consumption for dabblers has been estimated to be one-third that of the common merganser. Since both species are similar in body weight, the dabbler ducks likelihood of success assumes that they are only 1/3 as likely to successfully prey on coho juveniles as a merganser is. In the past couple of years, estimated predation numbers have decreased in part to the extended hazing efforts conducted by YN personnel during this period. Staff was stationed at these sites from dawn until dusk, seven days a week. This tactic was particularly effective against sight-feeding avian predators such as mergansers. Once hazing pressure was applied, mammalian feeders, primarily North American river otter, tended to shift toward a nocturnal feeding pattern. This behavior limited the effectiveness of hazing efforts by YN. Although hazing efforts were very beneficial, predation still occurred at these locations. To determine the final numbers of juvenile coho released from natural acclimation ponds, daily documentation of predator abundance was used to estimate predation mortality using the following equation.

$$Ec = Ct*FPP*Ni*Cd$$

Ec= Estimated consumption for an individual predator

Ct= Consumption total per day in kilograms for an individual predator

FPP= Fish per pound

Ni= Number of same species predators observed during time interval i

Cd= Duration of same species predators observed

The estimated predation mortality varies between acclimation ponds (Table 12). Pond shape, pond size, numbers of coho, geographic location, and riparian and aquatic vegetation all effect the predator abundance and predation mortality.

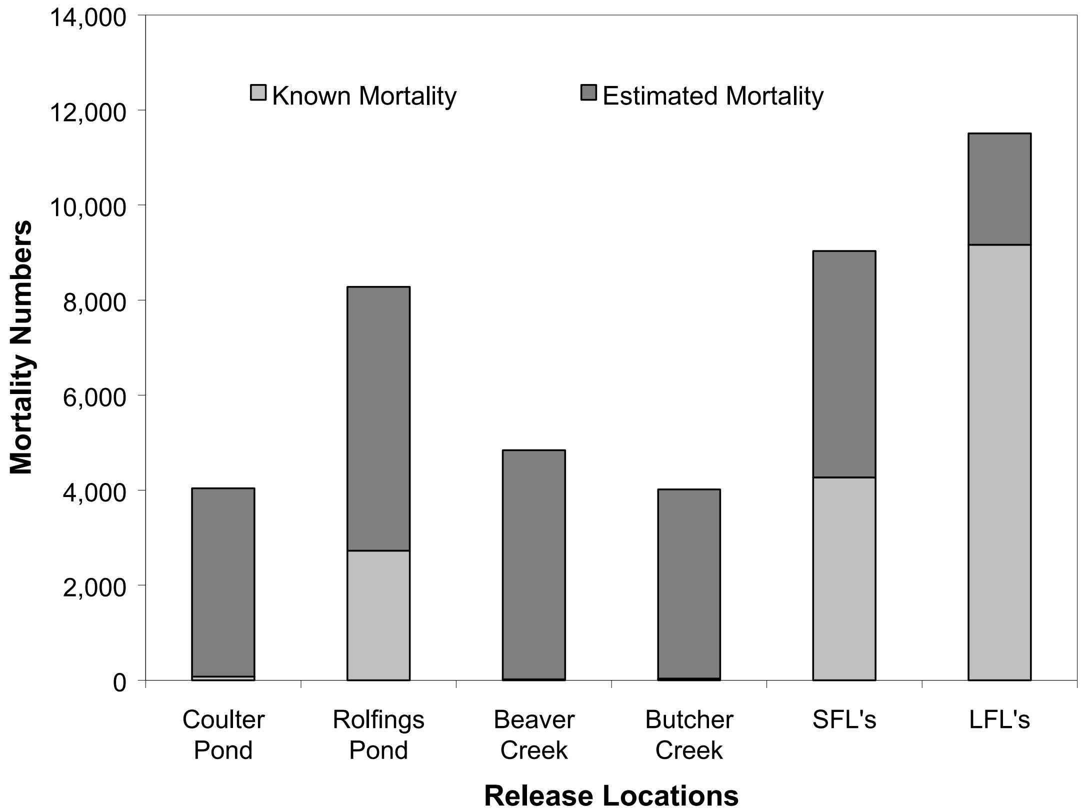

Figure 4. Known and estimated mortality at all acclimation sites in the Wenatchee River Basin, 2007.

PIT tag Detection

In addition to documenting predator abundance and estimating mortality, select locations had in-pond survival was measured with PIT tags. Each selected group that was tagged varied in proportion of PIT tagged fish, but a minimum of 6,000 tags were designated for target acclimation ponds to provide sound statistical analysis for calculating smolt-to-smolt survival. Sites selected for PIT tag comparisons were on a rotational schedule that will be implemented over multiple years to determine if mortality trends at any one particular location are observed. These trends will assist in determining which sites are suited for coho acclimation. Due to their relatively low water volume discharge, upper basin acclimation sites were utilized for PIT tag detection comparisons because detection systems could be installed in a repetitive manner to encapsulate the entire downstream migration. By having repeat, serial detections, this maximizes detection efficiency for any given site. During 2007, Beaver Creek and Coulter Creek were selected within the upper basin for this comparison. In-pond mortality comparison between these two methods can be observed for multiple years of acclimation at select locations from 2004-2007 (Table 13). Note that only sites with maintained detection systems could be utilized for this comparison. Variation in data sets can be attributed to unobserved predation (i.e. nocturnal predation) creating an underestimate in predator consumption loss while undetected PIT tags, through low detection efficiencies, would artificially inflate the PIT tag loss estimate.

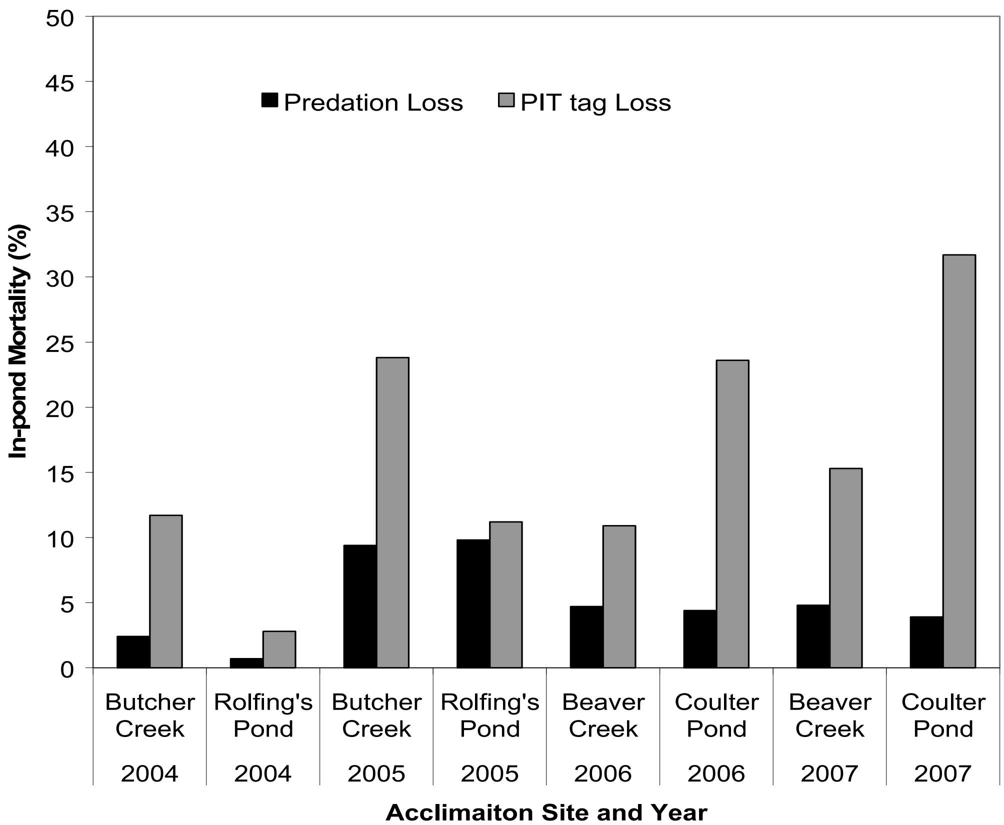

Figure 5. Comparison of in-pond mortality rates, PIT tag versus estimated loss, 2004-2007.

5.0 SURVIVAL RATES

5.1 Smolt Survival Rates – Release to McNary Dam

To obtain a McNary passage index of PIT-tagged fish released into the Wenatchee and Methow basins, the number of McNary Dam PIT tag detections were expanded by dividing by an estimate of the McNary detection-rate (efficiency). The McNary detection rate is the proportion of total PIT-tagged fish passing the dam that are detected by the dam's PIT tag detectors. McNary passage is stratified into sequential days having similar detection rates. The estimate of a stratum's passage is given in Neeley (2007; Appendix D). The McNary detection rate was calculated by summing the number of PIT-tagged fish detected at McNary and at a downstream dam and dividing by the total number detected at the downstream dam. An index of survival to McNary Dam is the estimated total passage (stratum passage estimates added over all the strata) divided by either the number of tagged fish or the number of fish detected leaving the acclimation pond (number released). Release-to-McNary Survival rates for the 2007 release (BY2005) was not available at the time of this writing and will be included in future drafts. PIT tag release numbers and locations for the 2007 release can be found in Table 14.

Table 12. PIT tag release numbers and locations, 2007.

Basin	Release Tributary	Release Location	Rearing Facility	Brood Origin	n	Survival to McNary[a]
Wenatchee	Nason Creek	Coulter Creek	Willard NFH	MCR	3513	N/A
		Coulter Creek	Cascade FH	MCR	3512	N/A
		Rolfings Pond	Willard NFH	MCR	4003	N/A
	Wenatchee River	Beaver Creek	Willard NFH	MCR	3502	N/A
		Beaver Creek	Cascade FH	MCR	3491	N/A
	Icicle Creek	SFL	Willard NFH	MCR	6021	N/A[1]
		LFL	Cascade FH	MCR	3002	N/A
		LFL	Willard NFH	MCR	3055	N/A

[a]Release-to-McNary Dam survival rates are not available at the time of this writing. Results will be included in future drafts.

5.2 Smolt-to-Adult Survival Rates for Brood Year 2003

For coho returning to the Wenatchee River, we calculated the number of coho returning to the basin using four equations:

1) Dryden Dam counts expanded by linear regression for non-trapping days, plus redd counts downstream from Dryden Dam[2]
2) Broodstock collected at Dryden Dam plus all redd counts[5]
3) Broodstock collected at Dryden Dam, Tumwater Dam counts, and redds counted downstream of Tumwater Dam[5]
3) Mainstem dam counts (Rock Island Dam – Rocky Reach Dam).

[1] All Icicle Creek release-to-McNary survival rates are based upon the total number of fish tagged minus known and recovered mortalities. Detection during release was not possible.

Method one may underestimate the total number of coho returning to the basin if the trapping efficiency of Dryden Dam is low (due to fall freshets) or may overestimate the number of coho returning if fallback rates of fish not collected in the broodstock are high. Method two and three may also underestimate the number of coho to return to the Wenatchee River because it does not take pre-spawn mortalities, or unidentified coho redds into account. Method four is likely an overestimate, as it assumes no fallbacks or drop-outs occurred between Rock Island and Rocky Reach Dams. SARs calculated from methods one and two have been very similar in previous years. Smolt to adult survival rates for the Wenatchee and Methow Basins is summarized in Tables 15 and 16.

In the Methow River, the number of coho returning to the basin was calculated using two methods:

1) Redd counts plus broodstock collected[3],
2) Wells Dam counts plus broodstock collected at Wells Dam.

Table 13. Esimtated coho run size to the Wenatchee River, 2006.

Method	Est. Run Size
1) Dryden Dam counts expanded for non-trapping days plus redds located below Dryden Dam[1]	2099 (1772 adults & 327 jacks)
2) Redd counts plus broodstock collected[1]	1601 (1436 adults & 165 jacks)
3)Tumwater Dam counts, redds below Tumwater Dam, and broodstock collected[1]	1630 (1460 adults & 170 jacks)
4) Mainstem Dam Counts	4074 (3441 adults & 633 jacks)

[1] Each redd count was expanded by 2.1 fish per redd based on the sex ratio of coho observed at Dryden Dam, 1.1M:1.F.

Table 14. Estimated ocho run size to the Methow River, 2006.

Method	Est. Run Size
1) Redd counts plus broodstock collected[1]	481 (467 adults & 18 jacks)
2) Wells Dam Counts plus Wells Dam broodstock collected**	517 (498 adults & 19 jacks)

[1] Each redd count was expanded by 2.2 fish per redd based on the sex ratio of coho observed at Wells Dam, 1.2M:1.F

**Coho collected at Wells Dam were not incorporated into daily fish passage counts for 2005. Broodstock collected only reflects the proportion of fish taken at Wells Dam and not volunteer swim-ins at Winthrop NFH.

Estimation of SARs for hatchery fish were based on CWT recovery which allows for a comparison of survival between brood origins, rearing hatchery and release sites (Table 17 and 18). In both basins, coded wire tags (CWTs) and analysis of scale samples from non-CWT fish were used to distinguish naturally produced fish from hatchery fish. The population estimate of naturally produced coho smolts used in the SAR calculations was provided by WDFW based upon data collected at smolt traps in the Wenatchee and Methow rivers.

Table 15. Wenatchee River brood year 2003 SARs by release site, brood origin, and rearing facility.

Release Site	Minimum Acclimation Duration[a]	Brood Origin	Rearing Facility	n (Adult and Jack Returns)	N (CWT Release Number)	SAR[b]
Beaver Creek Pond	5 weeks	MCR	Willard NFH	32	23,406	0.14%
Butcher Ck. Pond	6 weeks	MCR	Willard NFH	52	61,160	0.08%
Coulter Ck. Pond	3 weeks	MCR	Willard NFH	20	28,923	0.07%
Rolfing's Pond	6 weeks	MCR	Willard NFH	79	63,463	0.12%
Leavenworth NFH: Large Foster Lucas Ponds	3 weeks	MCR	Cascade FH	179	68,482	0.26%
	3 weeks	MCR	Willard NFH	324	204,109	0.16%
Leavenworth NFH: Small Foster Lucas Ponds	3 weeks	MCR	Cascade FH	564	260253	0.22%
	3 weeks	MCR	Willard NFH	115	86,858	0.13%
LNFH: Small Foster Lucas Pond	12 weeks	MCR	Cascade FH	318	129,715	0.25%
TOTAL		**MCR**		**1683**	**926,369**	**0.18%**
Naturally Produced Coho		**MCR**	**N/A**	**60**	**41,208**	**0.15%**

[a] Minimum acclimation duration is based on transport to release dates and does not account time required for all volitionally released fish to leave the acclimation pond.

[b] A estimated return to the basin of 2099 fish (method 1) was used in the calculation of BY2003 SARs.

Table 16. Methow River brood year 2003 SARs by release site, brood origin, and rearing facility.

Release Site	Minimum Acclimation Duration[a]	Brood Origin	Rearing Facility	N Adult Return	N Released	SAR[b]
WNFH	N/A reared on-station	MCR (Wenatchee)	Winthrop NFH	184	70,235	0.26%
	N/A reared on -station	MCR (Methow)	Winthrop NFH	192	64539	0.30%
WNFH Back Channel	4 weeks	LCR	Willard NFH	121	146,563	0.09%
Total				**497**	**281,337**	**0.18%**
Naturally Produced Coho[c]			**N/A**	**N/A**	**990**	**N/A**

[a] Minimum acclimation duration is based on transport to release dates and does not account time required for all volitionally released fish to leave the acclimation pond.
[b] A estimated return to the basin of 517 fish (method 1) was used in the calculation of BY2003 SARs.
[c] SARs for naturally produced coho are not available at this time. Result will be included in future drafts.

A comparison of smolt-smolt survival and smolt-to-adult survival across years (1999 through 2006) can be found in Table 19.

Table 17. Comparison of smolt-smolt and smolt-to-adult survival rates, brood years 1997-2003.

Brood Year	Methow R. Smolt Survival	Methow R. Smolt-Adult Survival	Icicle Creek Smolt Survival*	Nason Creek Smolt Survival*	Wenatchee R. Smolt-Adult Survival
1997	N/A	N/A	53.9%	N/A	0.21% - 0.38%
1998	33.3%	0.17% - 0.27%	63.0%	N/A	0.17% - 0.86%
1999	9.9%	0.03%	21.6%	N/A	0.03%- .13%
2000	N/A	0.15%	87.4% - 78.5%	39.3%	0.32%- 0.51%
2001	N/A	0.16%	62.8%	37.2%	0.33% - 0.55%
2002	26.1% - 29.5%	0.19%	56.3% - 60.8%	30.5%- 36.2%	0.29%- 0.47%
2003	N/A	0.18%	34%- 44%	16%- 18%	0.15% - 0.37%

6.0 SUMMARY

The long-term vision for the mid-Columbia coho reintroduction project is to reestablish naturally reproducing coho salmon populations in mid-Columbia river basins at biologically sustainable levels which will provide opportunities for harvest for tribal and non-tribal fishers. The feasibility of reestablishing coho in mid-Columbia tributaries has always initially relied on resolving two central issues: the adaptability of a domesticated lower river coho stock used in the re-introduction efforts and associated survival rates, and the ecological risks to other species associated with coho re-introduction efforts. At this point in time, we feel confident the direction the program has taken in resolving these key issues through further development of our long term plan.

We are optimistic that the project will continue to observe positive trends in hatchery coho survival as developing local broodstock continues to adapt to conditions in mid-Columbia tributaries. Therefore it is important to measure hatchery fish performance not only to use as an indicator of project performance but to track potential short-and long-term program benefits. This document reports the coho restoration activities completed in 2006-2007; results are briefly summarized below.

- Between September 5 and November 3, we collected 1,329 coho at Dryden Dam, Leavenworth NFH, and Tumwater Dam on the Wenatchee River. At Winthrop NFH and Wells Dam, 331 coho were collected for the Methow River program between September 25 and November 28. Broodstock goals for both basins were to collect enough females to fulfill future acclimation release needs of 500,000 juveniles in the Methow River and 1,000,000 juveniles in the Wenatchee River.

- We spawned 1,198 coho at Entiat NFH and 291 at Winthrop NFH. An eye-up rate of 88.4% was calculated for the Wenatchee program and 86.7% for the Methow program. Increased eye-up rates and improved eyed-egg quality should lead to improved survival from the eyed stage to smolt release.

- During spawning ground surveys in the Wenatchee Basin for 2006, we found a total of 110 coho redds: 88 redds in Icicle Creek, 4 redds in Nason Creek, 6 redds in the Wenatchee River and a combined 24 redds in Brender, Mission, and Peshastin creeks. In the Methow Basin we located a total of 77 redds.

- Acclimating pre-smolts on local waters is an essential component to the restoration program. Smolt release numbers for the Methow and Wenatchee rivers in 2007 were 477,688 and 1,084,080 fish, respectively. Coho within the Methow program were released from Winthrop NFH (on-station raceways and the outfall channel) and achieved an estimated 99.6% transport-to-release survival for the on-station releases. This was similar to the previous year's survival but is likely to be an overestimate because predation observations were not conducted or documented at Winthrop NFH for acclimation in the outfall channel or at Wells Dam. In the Wenatchee basin, overall survival was 96.3% from transport to release (Appendix C).

- The presence of *Trichodina* and *Flavobacterium psychrophilum* (coldwater disease) in select ponds at LNFH increased overall mortality for this release group in 2007. At release, both outbreaks had been treated with no deleterious, long-term effects expected post-release.

- Based on PIT-tag detections, we estimate that 34%-44% of brood year 2003 mid-Columbia River brood coho survived from release in Icicle Creek to McNary Dam. We estimated that 16%-18% of fish released into Nason Creek (Butcher Creek Pond and Rolfing's Pond) survived to McNary Dam. No PIT tagged fish were released in the Methow River in 2007.

- We estimate that the overall smolt-to-adult survival rate (SAR) for brood year 2003 hatchery coho smolts released in the Wenatchee River basin is 0.18% (1,683 adults and jacks) for all release groups. However, the smolt-to-adult survival rate varied between release groups (range 0.07% - 0.26%). Using scale analysis for verification of fish origin, we estimated the SAR for naturally produced coho to be 0.15%.

- In the Methow River, we estimate that the overall smolt-to-adult survival rate (SAR) for brood year 2003 hatchery coho is 0.18%. The SARs for each release group ranged from 0.09% to 0.30%. Scale analysis verification of potential natural origin fish has not been completed but will be available in future analyses.

7.0 ACKNOWLEDGEMENTS

We are thankful to the many people involved in the coho reintroduction feasibility study. Bonneville Power Administration funded the study. Roy Beaty administered funding and contracting. Tom Scribner, project manager, provided program oversight and direction for the Mid-Columbia Coho Project. Louis Sweowat, Taylor Rains, Garrett Rains, Lily Sampson-Ohms, Matt Clubb, Krista Ervin, Barry Hodges, and Kraig Mott, assisted with field data collection. Debbie Azure, Monica Clark, and Louiza Umtuch provided much needed administrative support for this program. Doug Neeley (International Statistical Training and Technical Services) provided statistical consultation for survival estimates of PIT-tagged fish. Several employees at WDFW provided assistance throughout the year, including Rick Stillwater and his crew during broodstock collection; Todd Miller and Charlie Snow provided the population estimates of naturally produced coho emigrating from the Wenatchee and Methow rivers as well as adult coho carcass information.

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APPENDIX A: 2007 NASON CREEK SMOLT TRAP REPORT

Population Estimates for Juvenile Salmonids in Nason Creek, WA

2007 Annual Report Draft

January 2008

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Project No. 2003-017-00 and No. 1996-040-00
Contract No. 33338 and No. 31633

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ABSTRACT

This report summarizes juvenile coho salmon, spring Chinook salmon, and steelhead migration data collected in Nason Creek during 2007; providing abundance and freshwater productivity estimates. We used species enumeration at the trap and efficiency trials to describe emigration timing and to estimate the number of emigrants. Trapping began on March 1, 2007 and was suspended on December 1, 2007 when snow and ice accumulation prevented operation.

During 2007, 44 brood year (BY) 2005 coho, 1 BY 2006 coho, 691 BY 2005 spring Chinook salmon, 103 BY06 Chinook fry, 626 BY06 subyearling Chinook, 117 steelhead smolts, 53 steelhead fry and 1488 steelhead parr were trapped.

Mark-recapture trap efficiency trials were performed over a range of stream discharge stages. A total of 1071 spring Chinook and 1312 steelhead were implanted with Passive Integrated Transponder (PIT) tags. Most PIT tagged fish were used for trap efficiency trials. We were unable to identify a statically significant relationship between stream discharge and trap efficiency; We used pooled efficiency estimates, specific to species and trap position to estimate the number of fish emigrating past the trap. We estimate that 557 BY05 coho, 5 BY06 coho, 7893 BY05 Chinook, 5294 BY06 Chinook, and 25,108 steelhead parr and smolts emigrated from Nason Creek in 2007.

1.0 Introduction

Beginning in the fall of 2004, the Integrated Status & Effectiveness Monitoring Program (ISEMP, BPA project #2003-017-000), began sharing the cost of operating a rotary smolt trap in Nason Creek, with the mid-Columbia Coho Reintroduction Feasibility Study (BPA project #1996-040-00). This cost-share extended previous trap operations from three months per year to nine months per year. In 2007 Grant County Public Utility District (GCPUD) also began funding this ongoing study. The objectives of these projects are to:

1) Estimate the juvenile production and productivity of spring Chinook , steelhead (BPA #2007-017-00, and GCPUD), and coho salmon (BPA #1996-040-00) in Nason Creek.

2) Describe the temporal variability of spring Chinook, steelhead (BPA #2003-017-00, GCPUD), and coho salmon (BPA #1996-040-00) emigrating from Nason Creek.

The data generated from this project will be used to calculate annual population estimates, egg-to-emigrant survival, and emigrant-to-adult survival rates. Combined with other monitoring and evaluation (M&E) data, population estimates may be used to evaluate the effects of supplementation programs in the Wenatchee River Basin as well as provide data to develop a spawner-recruit relationship in Nason Creek. Tissue samples are collected from Chinook and bull trout captured in the trap to supply DNA for ongoing studies in the basin. Passive integrated transponder (PIT) tags are implanted into juvenile naturally produced Chinook and steelhead under the ISEMP program to determine if smolt traps in collaboration with other monitoring activities can provide the necessary data to resolve uncertainties regarding life history, growth, an survival in the Wenatchee Basin (Murdoch et al. 2005)

The work captured in this report is one component of three monitoring programs (ISEMP, GCPUD, and YN's mid-Columbia coho reintroduction project), and while it stands alone as an important contribution to the management of anadromous salmonids and their habitat, it also plays a key role within each of these monitoring programs. Each component of work within ISEMP is reported on individually, as is done so here, and in annual and triennial summary reports that present all of the overall project components in their programmatic context and shows how the data and tools developed can be applied to the development of regionally consistent, efficient and effective Research, Monitoring and Evaluation.

This document reports data collected from the Nason Creek smolt trap between March 1 and December 1 , 2007. Data collected during fall of 2006 is presented with the spring 2007 data to produce a complete population estimate for the BY 2005 spring Chinook salmon and an estimate of egg-to-emigrant survival. Emigration estimates are also provided for steelhead and coho salmon.

1.1 Watershed Description

The Nason Creek watershed drains 65,600 acres of alpine glaciated landscape where high precipitation and moderate rain on snow recurrence control the hydrology and aquatic communities (USFS et al. 1996). Nason Creek originates near the Cascade crest at Stevens Pass and flows approximately 37 river kilometers (RK) until joining the Wenatchee River at RK 86.3 just below Lake Wenatchee. The smolt trap is located below the majority of spring Chinook and steelhead spawning grounds at RK 0.8 (Figure 1). There are 26.4 mainstem RKs accessible to anadromous fish in Nason Creek. Private land ownership comprises 52,300 acres (79.7%) of the watershed while 12,800 acres (19.5%) are federal and 480 acres (0.1%) are state owned (USFS et al. 1996).

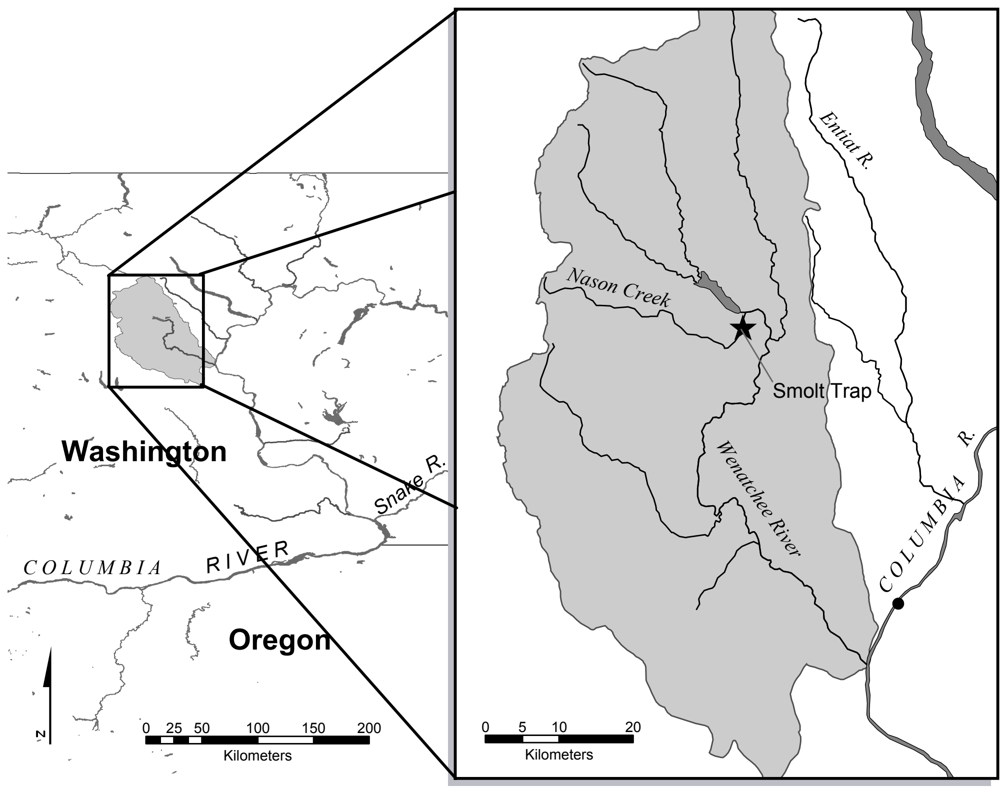

Figure 1. Nason Creek Smolt trap location.

The channel morphology of the lower 25 kilometers of Nason Creek has been impacted by development of highways, railroads, power lines, and residential development resulting in channel confinement and reduced side-channel habitat. The present condition is a low gradient (<= 1.1%), low sinuosity (1.2 to 2.0 channel length to valley length ratio), and mainly depositional channel (USFS et al. 1996).

The Washington State Department of Ecology (DOE) began operating a stream monitoring station at RK 1.0 of Nason Creek in May of 2002. The mean daily discharge during the 2007 trapping season (March 1, 2007 through December 1, 2007) was 450 cfs

(Figure 2 and Appendix A). The discharge data provided by DOE should be considered provisional. Peak runoff typically occurs in May and June with occasional high water produced by rain on snow events in October and November.

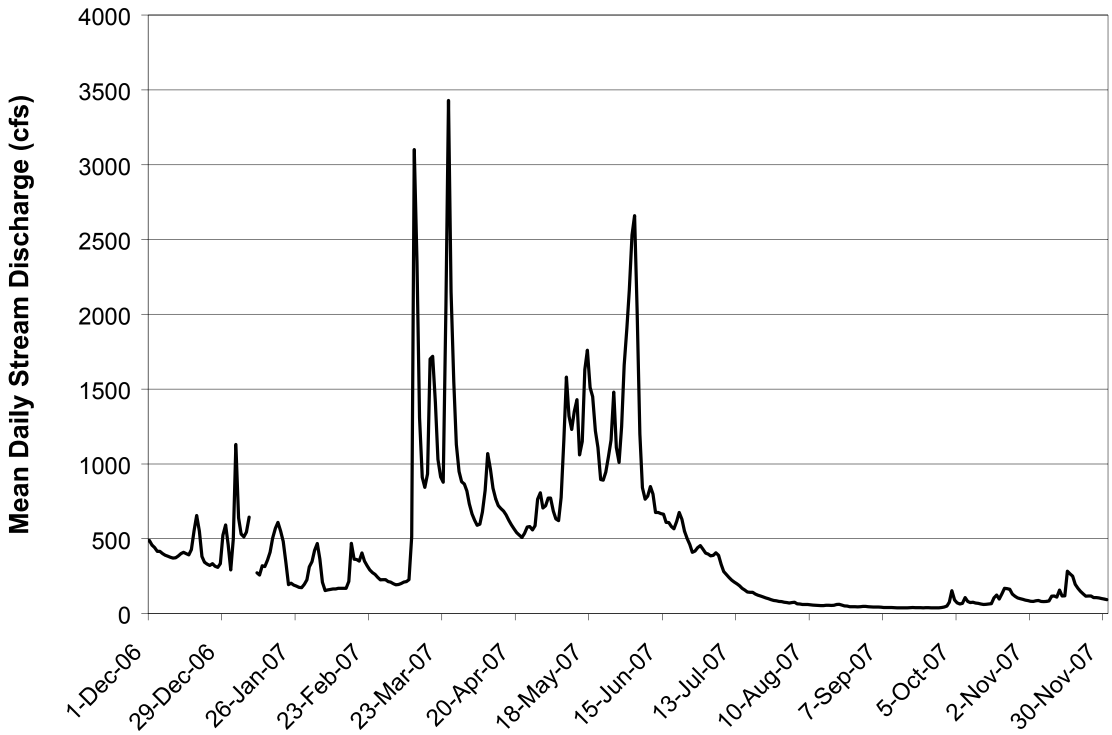

Figure 2. Mean daily stream discharge at the Nason Creek DOE stream monitoring station, RK 1, December 1, 2006 through December 1, 2007.

During the months we operated the trap, the mean daily water temperatures recorded at the DOE monitoring station ranged from a low of 0.04 °C to a high of 16.6°C (Figure 3). Daily mean stream temperature measurements taken by the Washington State DOE during water years 2007 and 2008 are provided in Appendix A. Water temperature data provided by DOE should be considered provisional.

The maximum safe fish handling temperature (as defined in Section 10 Permit # 1493) is 21° C. Fish were handled in the morning when temperatures were at a minimum. The water temperatures did not reach 21° C in 2007 (Figure 3).

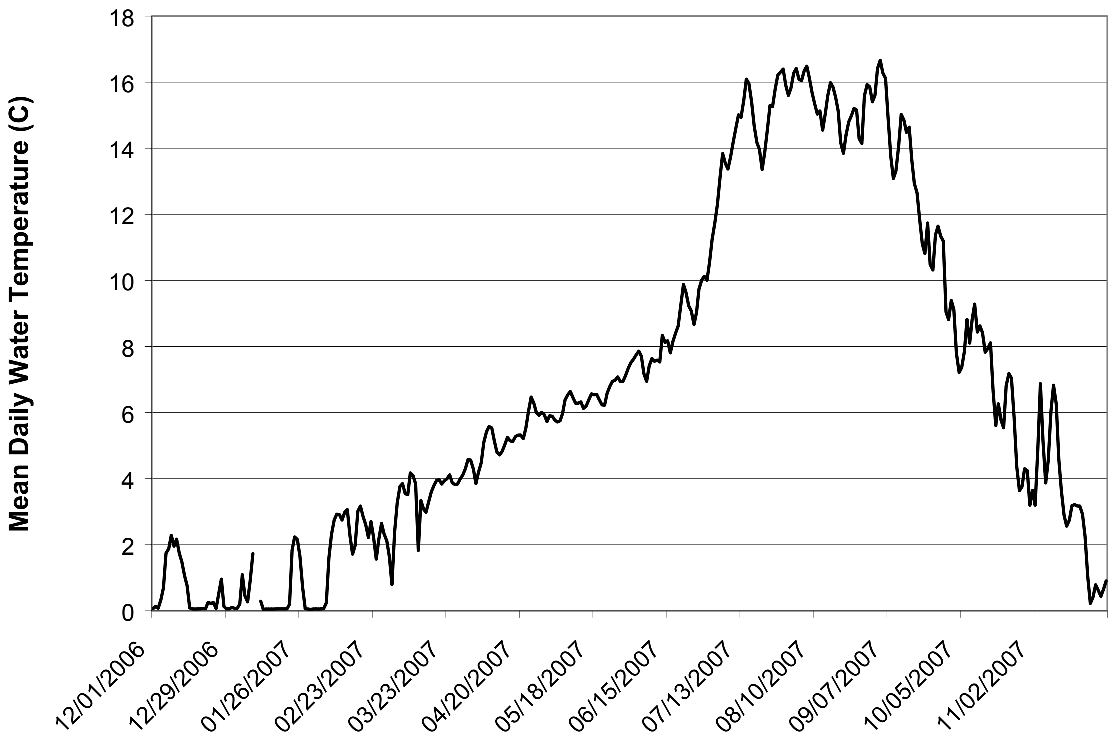

Figure 3. Mean daily water temperature at the Nason Creek DOE stream monitoring station, RK 1, December 1, 2006 through December 1, 2007.

2.0 Methods

2.1 Trapping Equipment and Operation

A floating rotary smolt trap with a 5-foot diameter cone, manufactured by EG Solutions of Eugene, OR, was used to capture fish moving downstream. The trap retains live fish in a holding box until they are removed. A rotating drum screen constantly removes small debris from the live box. The trap was suspended with wire rope from a snatch block connected to a stream spanning cable and was positioned laterally in the thalweg with a 'come-along' type puller. We used two main trap positions during 2007; a 'back' position during high water (~150 to 1750 cfs) in the spring and 'forward' position located 10 meters upstream during low water (~ 40 to 150 cfs) in the summer/fall. When discharge exceeded 1000 cfs we positioned the trap half-way between the streambank and thalweg. Stream discharge lower than 40 cfs necessitated raising the cone slightly to avoid touching the streambed. Trap operating positions and discharge range can be found in Table 1.

Table 1. Nason Creek smolt trap operating positions and generalized discharge range.

Trap Position	CFS Range	2007 Operational Dates
Back	150 to 1750	March 1 – July 17; October 3 – December 1
Forward	40 to 150	July 18 – October 2
Pulled	> 1750	March 13-14; March 25; June 3-6

2.2 Biological Sampling

Trap operating procedures and techniques followed a standardized basin-wide monitoring plan developed by the Upper Columbia Regional Technical Team (RTT) for the Upper Columbia Salmon Recovery Board (UCSRB; Hillman 2004), which was adapted from Murdoch et al. (2000).

All fish were enumerated by species and size class. Fish to be sampled were anesthetized in a solution of MS-222, weighed with a portable electronic scale, and measured in a trough type measuring board. Scale samples were collected from steelhead measuring ≥ 100 mm FL to facilitate assigning these fish to age-classes and brood years. The scale samples were provided to WDFW for analysis. Anesthetized fish received oxygen through a portable aquarium bubbler and were allowed to fully recover before being released downstream from the trap.

Length and weight were recorded for all fish except on days when large numbers of a single species were collected, and then a sub-sample 25 of each species and size/age class) were measured and weighed. Fork length (FL) was recorded to the nearest millimeter and weight to the nearest 0.1 gram. We used these data to calculate a Fulton-type condition factor (Kfactor) using the formula:

$$K = (W/L^3) \times 100{,}000$$

Where K = Fulton-type condition metric, W = weight in grams, L = fork length in millimeters and 100,000 is a scaling constant.

During periods when the trap was not operating (e.g. high discharge, high debris, mechanical problems) the number of target species captured was estimated. The estimated number of fish captured was calculated using the average number of fish captured two days prior and two days after the break in operation.

2.3 Mark-Recapture Trials

Groups of marked salmonids were used for trap efficiency trials. Marked groups of fish were released over the greatest range of discharge possible in order to increase the efficacy of the efficiency-discharge regression model used to estimate the daily trap efficiency (See '**data analysis**'). Mark-recaptured trials followed the protocol described in Hillman (2004). The protocol suggests a minimum sample size of 100 fish for each mark-recapture trial. Due to the limited number of fish caught in the trap, mark-recapture trials were often completed with smaller sample sizes.

We typically combined the catch over a maximum of 3 days to provide the largest mark group possible within ESA section 10 permit limitations (#1493). Fish being held for mark-recapture trials were kept in auxiliary live boxes attached to the end of each pontoon. Mark groups were released regardless of sample size but only those groups counting ≥25 fish of a single size class and species were used in the linear regression model (See '**Emigration Estimate and Expansion of Daily Catch'**). Mark groups consisting of less than 25 fish were used to support a pooled estimate if needed.

2.3.1 Marking and PIT tagging

Fish used in efficiency trials were marked with an upper or lower caudal fin clip, a PIT tag, or both. PIT tags were only included as a mark for naturally produced spring Chinook and steelhead measuring 60 mm FL and greater. Fin clips were used for efficiency trials with hatchery coho salmon. Fin clips of naturally produced spring Chinook and steelhead were retained for genetics research and reproductive success evaluation being conducted be WDFW and NMFS.

Fish to be PIT tagged were handled as described above (See '**Biological Sampling'**). Once anesthetized, each fish was examined for any wounds or descaling and then scanned for the presence of a previously implanted PIT tag. A 12mm Digital Angel 134.2 kHz type TX 1411ST PIT tag was inserted into the body cavity using a 12-gauge hypodermic needle. To prevent disease transmission, each hypodermic needle was soaked in ethyl alcohol for approximately 10 minutes prior to use and re-use. Each unique tag code was recorded along with date of tag implantation, date of fish release, tagging personnel, fork length, weight, and water temperature. These data were entered into a data base and submitted to the PIT Tag Information System (PTAGIS). PIT tagging methods were consistent with methodology described in the PIT Tag Marking Procedures Manual (CBFWA 1999).

After marking and/or PIT tagging, fish were transported in 5-gallon buckets 1.4 km upstream to the release site. At the release site the marked and/or PIT tagged fish were held for a minimum of 24-hours in a large (1.0 m^2) live box to ensure complete recovery, assess tagging mortality and to recover any shed tags.

Marked fish were released directly from the live box at sunset. The live box was located on the right bank which was accessible by vehicle. The left bank is not accessible, and we were unable to cross the creek at higher flows. During 2004 we compared marked groups released from the right bank, stream center, and both banks and found no difference in the recovery rate (Prevatte and Murdoch 2004); We are confident that the stream hydraulics between the release site and the smolt trap facilitate adequate fish dispersal when released exclusively from the right bank.

2.4 Data Analysis

2.4.1 Trap Efficiency

Trap efficiency was calculated with the following formula:

$$\text{Trap efficiency} = E_i = R_i / M_i$$

Where E_i is the trap efficiency during time period i; M_i is the number of marked fish released during time period i; and R_i is the number of marked fish recaptured during time period i.

2.4.1.1 Emigration Estimate and Expansion of Daily Catch

The daily emigration estimate was calculated by expanding the catch at the trap by trap efficiency using the following formula:

$$\text{Estimated daily migration} = \hat{N}_i = C_i / \hat{e}_i$$

Where N_i is the estimated number of fish passing the trap during time period i; C_i is the number of unmarked fish captured during time period i; and e_i is the estimated trap efficiency for time period i.

A linear regression was used to correlate trap efficiency from individual efficiency trials (dependant variable) with discharge (cfs; independent variable). If the results of the regression were significant (p<0.05; r^2 >0.50) the regression equation was used to estimate daily trap efficiency. Mark-recapture data from years 2005 through 2007 was used in the analysis.

The variance for the total daily number of fish traveling downstream past the trap was calculated form the following formulas:

$$\text{Variance of daily migration estimate} = \text{var}\left[\hat{N}_i\right] = \hat{N}_i^2 \frac{\text{MSE}\left(1 + \frac{1}{n} + \frac{\left(X_i - \overline{X}\right)^2}{\left(n-1\right)s_X^2}\right)}{\hat{e}_i^2}$$

Where X_i is the discharge for time period i, and n is the sample size.

If a relationship between discharge and trap efficiency was not present (i.e., $p > 0.05$; $r^2 < 0.5$), a pooled trap efficiency was used to estimate daily emigration. Only data from 2007, stratified by species and trap position was used in the analysis.

$$\text{Pooled trap efficiency} = E_p = \sum R / \sum M$$

The variance for daily emigration estimates using the pooled trap efficiency was calculated using the formula:

$$\text{Variance for daily emigration estimate} = \text{var}\left[\hat{N}_i\right] = \hat{N}_i^2 \frac{E_p(1 - E_p) / \sum M}{E_p^2}$$

The total emigration estimate and confidence interval were calculated using the following formulas:

$$\text{Total emigration estimate} = \sum \hat{N}_i$$

$$\text{95\% confidence interval} = 1.96 \times \sqrt{\sum \text{var}}\left[\hat{N}_i\right]$$

The following assumptions must be made for the population estimated to be valid (Everhart and Youngs 1953):

1) All marked fish passed the trap or were recaptures during time period i.
2) The probability of capturing a marked or unmarked fish is equal.
3) All marked fish recaptured were identified.

3. Results

3.1 Dates of Operation

We deployed the trap and began operating on March 1. We fished the trap continuously 24 hours a day 7 days per week, except during periods of extreme high flows or large hatchery smolt releases upstream of the trap (Table 2). Detailed documentation of operating dates can be found in Appendix B.

Table 2. Nason Creek smolt trap operating days, 2007.

Trap Status	Description	Days Operating	Days Not Operating
Operating	Continuous	253	
Interrupted	Stopped by Debris		9
Not Operating	High Flow		7
Not Operating/ Interrupted	Low Flow		5
Not Operating/ Interrupted	Hatchery Release		4
	Total Days	**251 (90.9%)**	**25 (9.1%)**

3.2 Emigration Timing

3.2.1 Coho Yearlings (BY 2005)

We collected 44 yearling coho during 2007. The first coho was trapped on March 12. Peak catch (49%) occurred between March 12 and April 2 (Figure 4). The trap did not cause any mortality to yearling coho. Mean fork length (mm), weight (g), and K-factor can be found in Table 3.

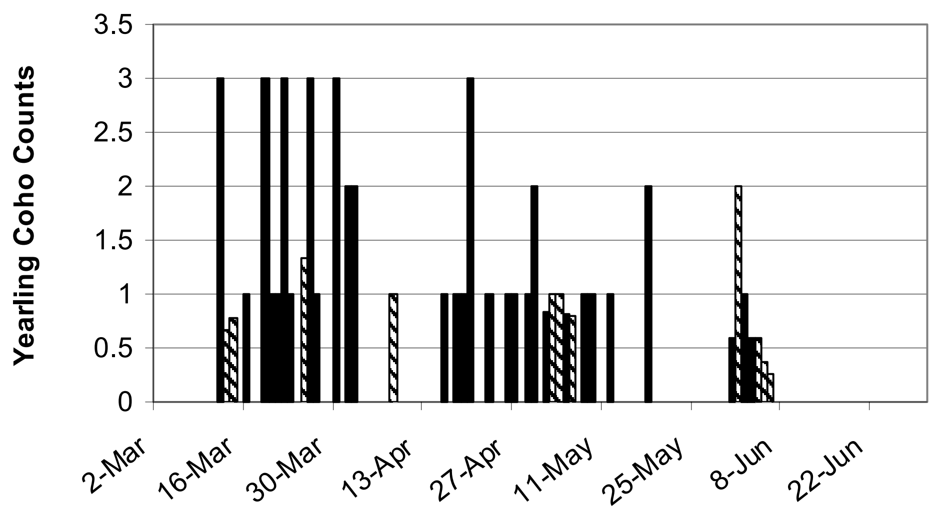

Figure 4. Coho yearling counts (black bars), run timing, and estimated catch (striped bars) for days not trapping at the Nason Creek smolt trap, March 2 through June 30, 2007.

Table 3. Summary of length and weight sampling conducted on BY05 and BY06 wild coho captured at the Nason Creek smolt trap in 2007.

Brood	Stage	Fork length (mm)			Weight (g)			K-
		Mean	N	SD	Mean	N	SD	factor
2005	Smolt	92.9	36	12.5	8.7	36	4.0	1.03
2006	Parr	83.0	1	n/a	6.2	1	n/a	1.08

3.2.2 Coho Subyearlings (BY 2006)

We collected one subyearling coho on October 8, 2007. The trap did not cause any mortality to subyearling coho. Fork length (mm), weight (g), and K-factor can be found in Table 3.

3.2.3 Spring Chinook Yearlings (BY 2005)

We collected 691 BY 2005 yearling spring Chinook smolts during 2007. The first smolt was trapped on March 2, the first night of operation. Peak catch occurred on March 19 with 91 yearlings (Figure 5). Nine Chinook yearling mortalities were found in the trap (see '**3.6 ESA Compliance**'). Fork Length (mm), weight (g), and K-factor at the time of migration can be found in Table 4.

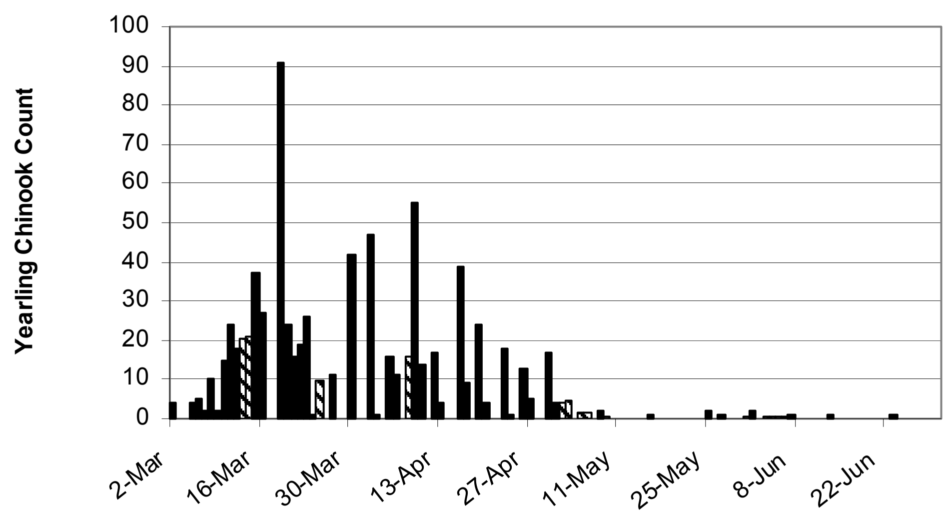

Figure 5. Yearling spring Chinook smolt counts (black bars), run timing, and estimated catch (striped bars), for days not trapping at the Nason Creek smolt trap, March 1 through June 30, 2007.

Table 4. Summary of length and weight sampling conducted on BY05 and BY06 Chinook captured at the Nason Creek smolt trap in 2007.

Brood	Stage	Fork length (mm)			Weight (g)			K-factor
		Mean	N	SD	Mean	N	SD	
2005	Smolt	89.0	676	8.2	8.0	675	6.1	1.12
2006	Parr	79.5	686	13.8	6.1	685	2.6	1.14

3.2.4 Spring Chinook Fry (BY2006)

We collected 103 BY 2006 spring Chinook fry during 2006. The first fry was trapped on March 10 (Figure 6). Spring Chinook fry continued to be trapped through mid-June. Spring chinook fry were not included in population estimates. After July 1, BY2006 spring Chinook were considered sub-yearling parr. One spring Chinook fry mortality occurred on April 24 (see '**3.6 ESA compliance**').

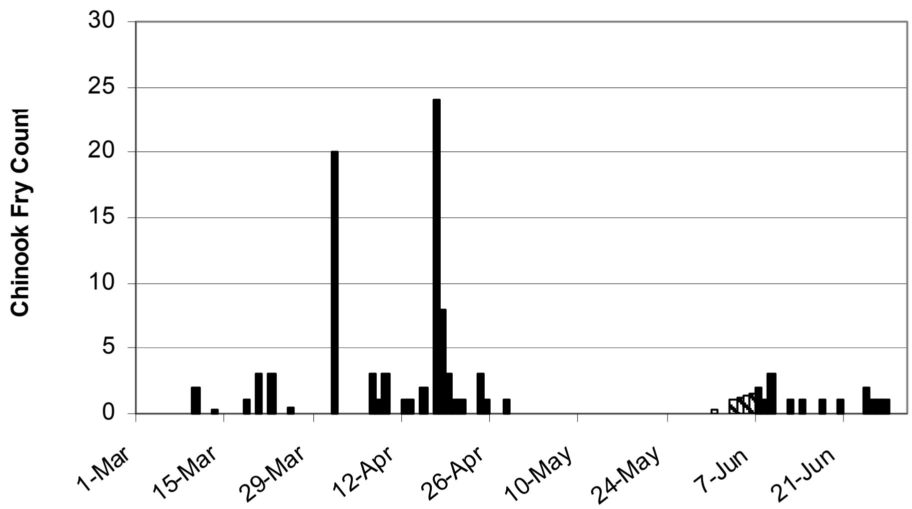

Figure 6. Spring Chinook fry counts (black bars), run-timing, and estimated catch (striped bars) for days not trapping at the Nason Creek smolt trap, March 1 through June 30, 2007.

3.2.5 Spring Chinook Subyearling (BY 2006)

We collected 626 BY 2006 subyearling spring Chinook between July 1 and December 1, 2007. Peak catch (64%) occurred during fall months; October 20 through December 1 (Figure 7). One subyearling Chinook mortality occurred on October 28 (see '**3.6 ESA compliance**'). Fork Length (mm), weight (g), and K-factor at the time of migration can be found in Table 4.

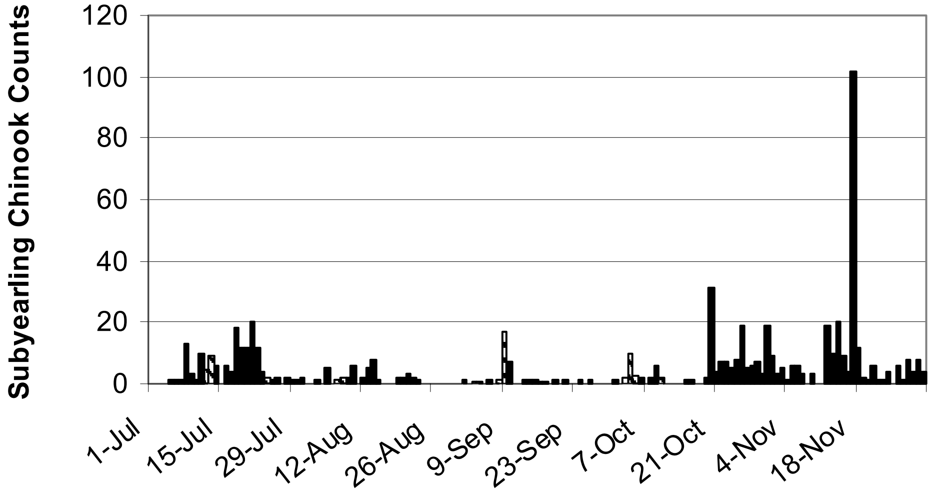

Figure 7. Subyearling spring Chinook counts (black bars), run-timing, and estimated catch (striped bars) for days not trapping at the Nason Creek smolt trap, June 25 through December 1, 2007.

3.2.6 Steelhead/Rainbow Trout Smolts

We collected 117 steelhead smolts and transitional smolts during 2007. The first smolt was trapped on March 16. Smolts and transitional smolts were captured regularly through early May (Figure 8). No steelhead smolts were captured after June 12. No steelhead smolt mortalities occurred due to trapping. Additionally, 2,717 hatchery steelhead smolts were captured between March 15 and October 4. At the time of this draft, length-at-age data from scale analysis was not yet available. Table 5 provides the mean length and K-factor for emigrating steelhead. This report will be revised when scale/age data becomes available.

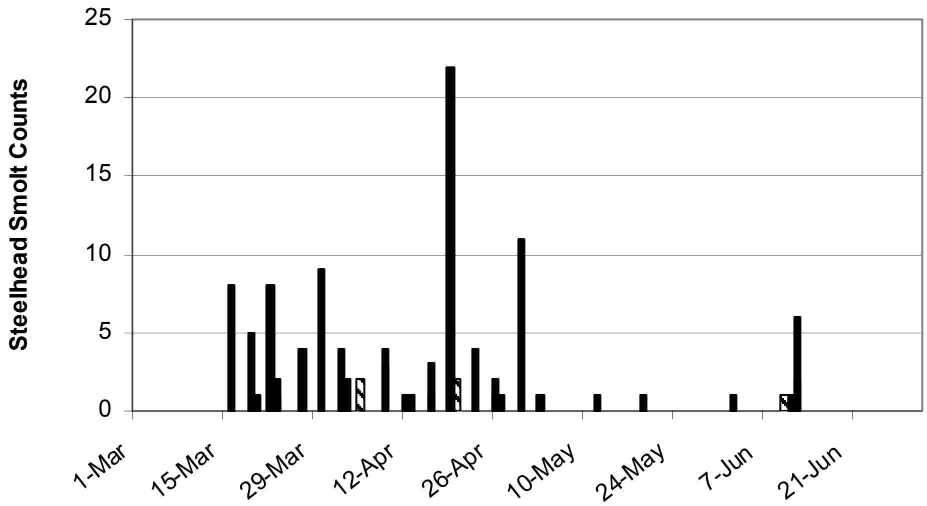

Figure 8. Steelhead smolt counts (black bars), run-timing, and estimated catch (striped bars) for days not trapping at the Nason Creek smolt trap, March 1 through June 30, 2007.

Table 5. Summary of length and weight sampling conducted on multiple year class steelhead smolts and parr at the Nason Creek smolt trap in 2007.

Brood[1]	Stage	Fork length (mm)			Weight (g)			K-
		Mean	N	SD	Mean	N	SD	factor
N/A	Smolt	121.9	120	37.5	23.0	120	15.8	1.01
N/A	Parr	80.2	1173	16.1	6.3	1171	5.4	1.07

[1]Year-class size data is pending scale analysis

3.2.7 Steelhead/Rainbow Trout Fry

We collected 186 BY 2007 steelhead/rainbow trout fry during 2007. The first fry was trapped on July 12. Peak catch (75%) occurred between August 10 and August 30 (Figure 9). Five steelhead fry mortalities were found in the trap (see '**3.6 ESA Compliance**').

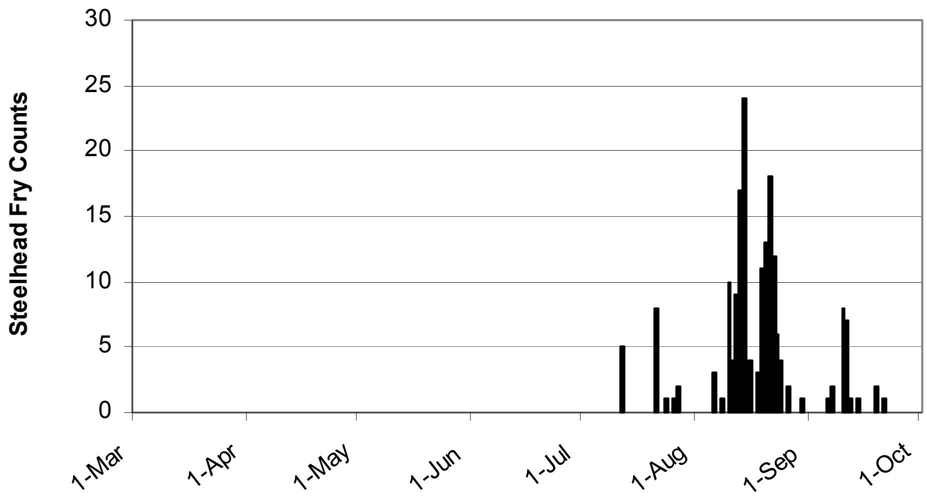

Figure 9. Steelhead/rainbow trout fry counts, run-timing, and estimated catch for days not trapping at the Nason Creek smolt trap from March 1 through October 1, 2007.

3.2.8 Steelhead/Rainbow Trout Parr

We collected 1488 steelhead parr from multiple age classes during 2007. The first parr was trapped on March 2, with a bimodal distribution of peak emigration occurring from March to April and again in June. Steelhead parr continued to be trapped until the last day of operation on December 1. Three steelhead parr mortalities were found in the trap (see **'3.6 ESA compliance'**). Table 5 provides the mean length and K-factor for emigrating steelhead.

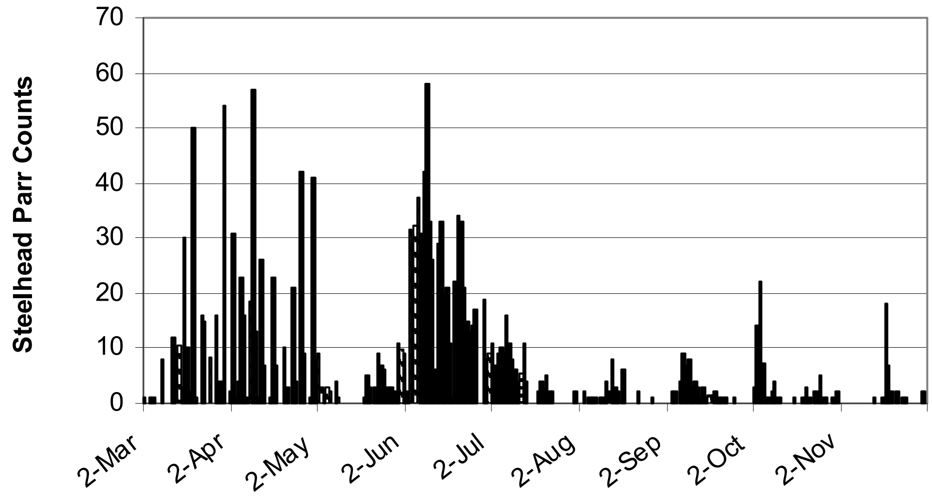

Figure 10. Steelhead parr counts (black bars), run-timing, and estimated catch (striped bars) for days not trapping at the Nason Creek smolt trap, March 1 through December 1, 2007.

3.3 Trap Efficiency Calibration and Population Estimates

3.3.1 Coho Yearlings (BY 2005)

No mark group releases were performed with yearling coho due to insufficient numbers collected at the trap. Spring Chinook yearlings were used as surrogates for trap efficiency for the following population estimate. A pooled trap efficiency of 9.81% (Table 7) was used to estimate yearling coho (smolt) production in Nason Creek. We estimate that 557 (± 26 95% CI) yearling BY05 coho emigrated from Nason Creek (Table 6). During 2006 we estimated that 88 (± 3 95% CI) subyearling coho emigrated from Nason Creek resulting in a total population estimate of 645 emigrants (Table 6).

Table 6. Estimated egg-to-emigrant survival and smolts per redd for Nason Creek coho. Emigrant-per-redd values were not calculated for incomplete brood years.

Brood Year	Number of Redds	Estimated number of Eggs[a]	Number of Emigrants			Egg-to-Emigrant (%)	Emigrants per redd
			Age-0[b]	Age-1	Total		
2003	6	12543	0	120	120	0.96%	20
2004	35	107,940	224	431	655	0.61%	18.7
2005	41	117,547	88	557	645	0.55%	15.7
2006	4	12,504	5		5	--	--

[a] Mean annual fecundity based on hatchery egg counts was used to estimate the number of eggs.

[b] Estimate is based on capture of summer/fall parr and does not include captures of fry prior to July 1.

3.3.2 Spring Chinook Yearlings (BY 2005)

We completed 25 marked group releases for yearling Chinook smolts in 2007. Of these releases six had sample sizes greater than 25 and were included in the linear regression analysis (Table 7). Releases in 2007 were combined with previously collected mark recapture data to increase the sample size and statistical power. The results of the linear regression was not significant (p=0.45, r^2=0.03). A pooled trap efficiency of 9.8% (Table 7) was used to estimate yearling spring Chinook (smolt) production in Nason Creek. We estimate that 7,893 (± 422 95% CI) yearling spring Chinook emigrated from Nason Creek from March 1 through June 23 (Table 8). During 2006 we estimated that 24,348 (32,241 ± 410 95% CI) subyearling spring Chinook emigrated from Nason Creek (Table 8).

Table 7. Mark/recapture efficiency trials used to estimate emigration of BY05 spring Chinook in Nason Creek. All releases were used for a pooled estimate; only releases with >25 fish were used in the regression analysis. (YC = yearling Chinook)

Species	Date	Trap Position	Number Released	Number Recaptured	Efficiency (%)	Discharge (m^3/s)
YC	3 March	BACK	4	1	25.0	210
YC	6 March	BACK	4	2	50.0	194
YC	17 March	BACK	64	7	10.9	933
YC	20 March	BACK	91	13	14.3	1410
YC	23 March	BACK	59	7	11.9	878
YC	26 March	BACK	12	0	0.0	2150
YC	31 March	BACK	40	2	5.0	866
YC	3 April	BACK	46	1	2.2	666
YC	6 April	BACK	16	0	0.0	598
YC	10 April	BACK	53	4	7.5	965
YC	13 April	BACK	17	1	5.9	721
YC	16 April	BACK	36	3	8.3	660
YC	20 April	BACK	23	8	34.8	541
YC	23 April	BACK	18	1	5.5	536
YC	27 April	BACK	13	1	7.7	586
YC	1 May	BACK	16	1	6.3	720
YC	8 May	BACK	2	0	0.0	1160
YC	25 May	BACK	2	0	0.0	1050
YC	27 May	BACK	1	0	0.0	1480
YC	1 June	BACK	1	0	0.0	1910
YC	9 June	BACK	3	0	0.0	785
YC	12 June	BACK	1	0	0.0	676
YC	13 June	BACK	1	0	0.0	675

Table 8. Estimated egg-to-emigrant survival and smolts per redd for Nason Creek spring Chinook. Emigrant-per-redd values were not calculated for incomplete brood years.

Brood Year	Number of Redds	Estimated number of Eggs[a]	Number of Emigrants			Egg-to-Emigrant (%)	Emigrants per redd
			Age-0[b]	Age-1	Total		
2002	294	1,477,056	DNOT[c]	9084	9084	--	--
2003	111	484,515	7,899	2,096	9995	2.06%	90
2004	159	770,514	12,569	3267	15,836	2.05%	100
2005	186	811,890	24,348	7,893	32,241	4.0%	173
2006	152	726,256	5295			--	--

[a] Mean annual fecundity based on Chiwawa River hatchery egg counts from wild broodstock to estimate the number of eggs.
[b] Estimate is based on capture of summer/fall parr and does not include captures of fry prior to July
[c] Data not collected

3.3.3 Spring Chinook Subyearlings (BY 2006)

We completed 29 marked group releases for subyearling Chinook in 2007. Of these releases 4 had sample sizes greater than 25 and were included in the linear regression analysis (Appendix E). Releases in 2006 were combined with 11 releases in 2005 to increase the sample size and statistical power. The result of the regression analysis was not significant (p = 0.45; r^2 = 0.02). A pooled trap efficiency of 18.7% ('back' trap position) and 6.1% ('upper' trap position; Table 9) was used to estimate the production of subyearling Chinook (BY 2006) in Nason Creek. We estimate that 5295 (± 930 95% CI) subyearling spring Chinook emigrated from Nason Creek in 2007.

Table 9. Mark/recapture efficiency trials used to estimate emigration of BY06 subyearling spring Chinook in Nason Creek. All releases were used for a pooled estimate; only releases with >25 fish were used in the regression analysis. (SBC= subyearling Chinook).

Species	Date	Trap Position	Number Released	Number Recaptured	Efficiency (%)	Discharge (m^3/s)
SBC	20 Aug	UPPER	4	0	0.00	60.2
SBC	23 Aug	UPPER	6	0	0.0	51.8
SBC	10 Sept	UPPER	18	2	11.1	39.8
SBC	17 Sept	UPPER	1	0	0.0	39.2
SBC	20 Sept	UPPER	2	0	0.0	39.4
SBC	24 Sept	UPPER	1	0	0.0	39.0
SBC	1 Oct	UPPER	1	0	0.0	50.2
SBC	3 Oct	BACK	2	0	0.0	153
SBC	4 Oct	BACK	10	2	20.0	90.4
SBC	6 Oct	BACK	2	0	0.0	62.9

SBC	8 Oct	BACK	2	0	0.0	106
SBC	11 Oct	BACK	8	0	0.0	74.9
SBC	15 Oct	BACK	2	0	0.0	60.9
SBC	18 Oct	BACK	1	1	100.0	66.2
SBC	22 Oct	BACK	42	8	19.0	132
SBC	25 Oct	BACK	19	5	26.3	162
SBC	29 Oct	BACK	17	1	5.9	98.1
SBC	1 Nov	BACK	31	6	19.3	86.4
SBC	5 Nov	BACK	12	2	16.7	88
SBC	8 No	BACK	6	1	16.7	80.9
SBC	12 Nov	BACK	19	5	26.3	109
SBC	13 Nov	BACK	10	0	0.0	156
SBC	15 Nov	BACK	29	4	13.8	119
SBC	19 Nov	BACK	115	26	22.6	195
SBC	20 Nov	BACK	1	0	0.0	169
SBC	22 Nov	BACK	7	2	28.6	131
SBC	24 Nov	BACK	4	0	0.0	118
SBC	26 Nov	BACK	6	1	16.7	106
SBC	29 Nov	BACK	13	3	23.1	99.2

3.3.5 Steelhead/Rainbow Trout Smolts and Parr

We completed 72 marked group releases for emigrating steelhead in 2007. Of the releases, only 8 met the criteria to be included in the analysis (n≥25). The results of the regression were not significant (p = 0.12; r^2 = 0.10). A pooled trap efficiencies of 6.8% (March-July; 'back' position), 6.9% (August – September; 'upper' position), and 5.1% (October –December; 'back' position; Table 10) was used to estimate the production of emigrating steelhead in Nason Creek. We estimate that 25108 (± 991 95% CI) steelhead emigrated from Nason Creek in 2007. At the time of this draft, scale analysis data was not available to calculate brood year emigration estimate.

Table 10. Mark/recapture efficiency trials used to estimate emigration of steelhead in Nason Creek. All releases were used for a pooled estimate; Only releases with >25 fish were used in the regression analysis. (SST = summer steelhead trout)

Species	Date	Trap Position	Number Released	Number Recaptured	Efficiency (%)	Discharge (m^3/s)
SST	3 March	BACK	1	0	0.00	210
SST	6 March	BACK	1	0	0.0	194
SST	9 March	BACK	7	1	14.3	213
SST	17 March	BACK	17	0	0.0	933
SST	20 March	BACK	55	1	1.82	1410
SST	23 March	BACK	21	0	0.0	878
SST	26 March	BACK	13	0	0.0	2150
SST	31 March	BACK	56	4	7.1	866
SST	3 April	BACK	35	1	2.9	666
SST	6 April	BACK	25	1	4.0	598

SST	10 April	BACK	60	8	13.3	965
SST	13 April	BACK	23	2	8.7	721
SST	17 April	BACK	26	2	7.7	623
SST	20 April	BACK	22	6	27.3	541
SST	24 April	BACK	24	1	41.7	578
SST	27 April	BACK	43	2	4.6	586
SST	1 May	BACK	52	2	3.8	720
SST	8 May	BACK	4	0	0.0	1160
SST	19 May	BACK	6	0	0.0	1450
SST	20 May	BACK	3	0	0.0	1220
SST	22 May	BACK	3	0	0.0	895
SST	23 May	BACK	10	0	0.0	891
SST	24 May	BACK	7	0	0.0	946
SST	25 May	BACK	6	0	0.0	1050
SST	26 May	BACK	3	0	0.0	1160
SST	27 May	BACK	3	0	0.0	1480
SST	28 May	BACK	3	0	0.0	1110
SST	29 May	BACK	2	0	0.0	1010
SST	30 May	BACK	11	0	0.0	1250
SST	31 May	BACK	5	0	0.0	1660
SST	1 June	BACK	8	0	0.0	765
SST	2 June	BACK	3	0	0.0	2530
SST	9 June	BACK	151	17	11.3	785
SST	12 June	BACK	65	8	12.3	676
SST	14 June	BACK	61	5	8.2	765
SST	15 June	BACK	21	0	0.0	663
SST	17 June	BACK	11	2	18.2	608
SST	18 June	BACK	21	2	9.5	581
SST	19 June	BACK	22	0	0.0	567
SST	21 June	BACK	67	4	6.0	675
SST	22 June	BACK	63	5	7.9	630
SST	26 June	BACK	16	3	18.7	408
SST	27 June	BACK	13	0	0.0	418
SST	28 June	BACK	31	4	30.8	439
SST	29 June	BACK	19	0	23.1	454
SST	2 July	BACK	11	2	18.1	222
SST	5 July	BACK	26	1	3.8	406
SST	6 July	BACK	8	0	0.0	389
SST	7 July	BACK	16	0	0.0	329
SST	8 July	BACK	11	1	9.1	281
SST	9 July	BACK	27	1	3.7	260
SST	13 August	UPPER	6	1	16.7	54.5
SST	20 August	UPPER	1	0	0.0	60.2
SST	23 August	UPPER	2	0	0.0	51.8
SST	27 August	UPPER	1	0	0.0	46.5
SST	6 Sept	UPPER	3	0	0.0	41.6
SST	10 Sept	UPPER	7	1	14.2	39.8

SST	13 Sep	UPPER	3	0	0.0	43.5
SST	17 Sept	UPPER	1	0	0.0	39.5
SST	20 Sept	UPPER	2	0	0.0	39.4
SST	4 Oct	BACK	11	1	9.1	90.4
SST	5 Oct	BACK	16	0	0.0	72
SST	8 Oct	BACK	4	0	0.0	106
SST	11 Oct	BACK	3	0	0.0	74.9
SST	18 Oct	BACK	1	0	0.0	66.2
SST	22 Oct	BACK	4	0	0.0	132
SST	25 Oct	BACK	7	0	0.0	162
SST	29 Oct	BACK	2	0	0.0	98.1
SST	1 Nov	BACK	1	0	0.0	86.4
SST	13 Nov	BACK	1	0	0.0	156
SST	19 Nov	BACK	26	3	11.5	195
SST	22 Nov	BACK	2	0	0.0	131
SST	24 Nov	BACK	1	0	0.0	118

3.4 PIT Tagging

During the 2007 trapping season we PIT tagged 1,071 spring Chinook, 1,312 steelhead, and 28 wild coho (Table 15). This equates to 67.4% of the Chinook, 74.0% of steelhead, and 63.6% of all wild coho salmon captured at the trap. All tagging files have been reported to the PTAGIS database.

3.5 Incidental Species

All of the known fish species present in Nason Creek were represented in the trap catch: Chinook salmon *Oncorhynchus tshawytscha*, steelhead trout and rainbow trout *Oncorhynchus mykiss*, coho salmon *Oncorhynchus kisutch*, cutthroat trout *Oncorhynchus clarki lewisi*, bull trout *Salvelinus confluentus*, mountain whitefish *Prosopium williamsoni*, redside shiner *Richardsonius balteatus*, sucker *Catostomus sp*, sculpin *Cottus sp*, dace *Rhinichthys sp* and northern pikeminnow *Ptychocheilus oregonensis.* Hatchery steelhead and coho were also caught. Incidental species were enumerated and sampled for length and weight (Table 11).

Table 11. Number and mean fork length of incidental species collected in Nason Creek, 2007.

Species	Captured	Fork Length (mm)			Weight (g)		
		Mean	N	SD	Mean	N	SD
Dace *Rhinichthys sp.*	180	82.1	175	26.1	8.4	175	6.1
Whitefish *Prosopium sp.*	166	67.5	164	23.9	4.4	164	15.6
Sculpin *Cottus sp.*	92	102.5	89	38.3	21.7	88	20.7
Sucker *Catostomas sp.*	85	109.4	85	30.9	20.1	85	28.0
Bull Trout *Salvelinus confluentus*	17	167.1	16	72.1	25.7	14	5.9
Northern Pikeminnow *Ptychocheilus oregonensis*	7	192.6	7	100.4	118.3	7	188.1
Cutthroat Trout *Oncorhynchus clarki lewisi*	4	159.7	4	20.0	40.7	4	14.2
Hatchery Steelhead *Oncorhynchus mykiss*	2717	n/a	n/a	n/a	n/a	n/a	n/a
Hatchery Coho *Oncorhynchus kisutch*	13650	n/a	n/a	n/a	n/a	n/a	n/a

3.6 ESA Compliance

The Nason Creek smolt trap is operated under consultation with the NMFS (permit no. 1493) and under consultation with the USFWS (permit no. TE037151-3). In 2007, we remained in compliance with all permits. The observed trap efficiencies were well within the acceptable level of the ESA permit conditions (i.e., <20%). Numbers of mortalities for each species and life stage are listed in Table 12 and were within acceptable limits (<2% for Chinook and steelhead; <2 individuals for bull trout).

Table 12. 2007 Nason Creek ESA listed species handling and mortality summary.

Species	Total Collected	Total Mortality	% Handled Mortality
Spring Chinook Fry and Subyearlings (BY 2006)	764	8	1.0%
Spring Chinook Yearling (BY 05)	691	9	1.3%
Steelhead Fry and Parr	1674	8	0.5%
Steelhead Smolt	117	0	0.0%
Bull Trout	17	0	0.0%

4. Discussion

The trap location appears appropriate for the target species. The Nason Creek smolt trap is intentionally positioned as low as possible in the Nason Creek watershed to ensure that the majority of spawning occurs upstream of the trap. Located at RK 0.8, very limited production occurs downstream from the trap. Low efficiencies and low juvenile abundance limited our ability to conduct trap efficiency trials over a broad range of river conditions. As a result, inadequate trap efficiency-to-discharge regression models forced the use of pooled trap efficiencies. Once regression models have been developed, population estimates will be recalculated. Currently, observed pooled trap efficiencies are within the acceptable level of the ESA permit conditions (i.e., <20%). In recent years, summer Chinook have occasionally been observed spawning in Nason Creek. Results of genetic analysis may differentiate spring runs from summer Chinook runs.

A retrospective analysis of data from previous years will be necessary, pending establishment of a trap efficiency-discharge regression model and genetic data differentiating spring chinook emigrants from summer Chinook emigrants. This retrospective analysis should provide more robust smolt estimates. Until such time, all results in this report should be considered provisional.

We have operated the Nason Creek smolt trap for the calculation of spring Chinook, steelhead, and coho salmon population estimates since 2004. Early indicators imply that productivity of spring Chinook in Nason Creek is lower that values reported for the Chiwawa River (Hillman et al. 2007). However, the mean productivity for spring Chinook in Nason Creek appears higher than Chinook productivity estimates collected in the Twisp and Methow Rivers (Snow et al. 2007). These early comparisons with results from other smolt traps in the Wenatchee and Methow Basins will help researchers and fish managers understand the reproductive success and carrying capacity of spring Chinook and steelhead in Nason Creek. Currently, the reasons for differences in productivity between populations and overall juvenile production are not known.

Beginning in 2007 we operated a smolt trap in the White River with the same objectives as the Nason Creek smolt trap. To date we are not able to report productivity estimates for a complete brood year but future analyses should provide estimates for smolt production and egg-to-emigrant survival (productivity) that may be compared with those values in Nason Creek.

Steelhead emigrate at different life stages, some as smolts in the spring and others as parr throughout the year. With multiple age classes of steelhead emigrating as both parr and smolt, scale sample analysis is necessary to calculate brood year population estimates. Scale sampling of steelhead smolts began in spring of 2005. Scales were taken from all steelhead parr >100 mm. Results from 2007 are not yet available. Therefore it was not possible to calculate brood year based emigration estimates and measures of productivity at the time of this draft. As results become available, brood year survival and productivity estimates will be provided reported in future documents.

Preliminary conclusions can be made regarding emigration timing of spring Chinook and steelhead within Nason Creek. There appear to be two distinct emigrations of spring Chinook, a group of yearlings which over wintered and emigrated in the spring and a subyearling group of migrants during summer and fall. This pattern is typical of those observed in other upper Columbia tributaries (Hillman et al. 2007). Whereas steelhead parr, in 2007, emigrated from Nason Creek throughout the trapping season with only one distinct peak emigration period in the spring.

5. Literature Cited

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US Forest Service 1996. Nason Creek Stream Survey Report

APPENDIX A: Nason Creek Temperature and Discharge Data

APPENDIX A: Nason Creek Temperature and Discharge Data

DATE	Mean Daily Discharge (CFS)	Mean Daily Temp C
1-Jan-07	291	0.071
2-Jan-07	498	0.068
3-Jan-07	1130	0.203
4-Jan-07	639	1.092
5-Jan-07	531	0.455
6-Jan-07	513	0.27
7-Jan-07	543	0.91
8-Jan-07	644	1.727
9-Jan-07	[]	
10-Jan-07	[]	
11-Jan-07	273	0.285
12-Jan-07	258	0.044
13-Jan-07	320	0.05
14-Jan-07	314	0.051
15-Jan-07	357	0.051
16-Jan-07	410	0.051
17-Jan-07	505	0.052
18-Jan-07	569	0.052
19-Jan-07	610	0.053
20-Jan-07	550	0.053
21-Jan-07	481	0.054
22-Jan-07	338	0.195
23-Jan-07	193	1.831
24-Jan-07	202	2.234
25-Jan-07	190	2.157
26-Jan-07	183	1.649
27-Jan-07	175	0.701
28-Jan-07	172	0.066
29-Jan-07	195	0.05
30-Jan-07	225	0.044
31-Jan-07	311	0.049

Data provided by DOE and should be considered provisional

APPENDIX A: Nason Creek Temperature and Discharge Data

DATE	Mean Daily Discharge (CFS)	Mean Daily Temp C
1-Feb-07	347	0.053
2-Feb-07	422	0.051
3-Feb-07	468	0.053
4-Feb-07	364	0.061
5-Feb-07	209	0.239
6-Feb-07	154	1.595
7-Feb-07	158	2.303
8-Feb-07	161	2.744
9-Feb-07	164	2.926
10-Feb-07	164	2.907
11-Feb-07	169	2.743
12-Feb-07	169	2.978
13-Feb-07	168	3.067
14-Feb-07	169	2.261
15-Feb-07	215	1.709
16-Feb-07	469	1.975
17-Feb-07	363	3.018
18-Feb-07	362	3.171
19-Feb-07	351	2.849
20-Feb-07	404	2.61
21-Feb-07	350	2.215
22-Feb-07	318	2.698
23-Feb-07	291	2.227
24-Feb-07	274	1.563
25-Feb-07	261	2.165
26-Feb-07	241	2.644
27-Feb-07	225	2.323
28-Feb-07	227	2.115

Data provided by DOE and should be considered provisional

APPENDIX A: Nason Creek Temperature and Discharge Data

DATE	Mean Daily Discharge (CFS)	Mean Daily Temp C
1-Mar-07	226	1.636
2-Mar-07	213	0.797
3-Mar-07	210	2.401
4-Mar-07	200	3.26
5-Mar-07	191	3.764
6-Mar-07	194	3.851
7-Mar-07	201	3.544
8-Mar-07	210	3.509
9-Mar-07	213	4.172
10-Mar-07	227	4.093
11-Mar-07	514	3.841
12-Mar-07	3100	1.825
13-Mar-07	2350	3.333
14-Mar-07	1310	3.074
15-Mar-07	910	2.978
16-Mar-07	843	3.289
17-Mar-07	933	3.596
18-Mar-07	1700	3.785
19-Mar-07	1720	3.944
20-Mar-07	1410	3.972
21-Mar-07	1030	3.836
22-Mar-07	913	3.936
23-Mar-07	878	3.997
24-Mar-07	2060	4.118
25-Mar-07	3430	3.871
26-Mar-07	2150	3.819
27-Mar-07	1550	3.836
28-Mar-07	1130	3.982
29-Mar-07	950	4.109
30-Mar-07	881	4.297
31-Mar-07	866	4.59

Data provided by DOE and should be considered provisional

APPENDIX A: Nason Creek Temperature and Discharge Data

DATE	Mean Daily Discharge (CFS)	Mean Daily Temp C
1-Apr-07	818	4.56
2-Apr-07	734	4.285
3-Apr-07	666	3.848
4-Apr-07	624	4.189
5-Apr-07	589	4.477
6-Apr-07	598	5.092
7-Apr-07	679	5.42
8-Apr-07	823	5.574
9-Apr-07	1070	5.536
10-Apr-07	965	5.142
11-Apr-07	838	4.801
12-Apr-07	766	4.713
13-Apr-07	721	4.828
14-Apr-07	703	5.033
15-Apr-07	685	5.246
16-Apr-07	660	5.14
17-Apr-07	623	5.124
18-Apr-07	594	5.274
19-Apr-07	565	5.312
20-Apr-07	541	5.323
21-Apr-07	525	5.213
22-Apr-07	509	5.53
23-Apr-07	536	6.051
24-Apr-07	578	6.467
25-Apr-07	581	6.276
26-Apr-07	558	5.989
27-Apr-07	586	5.92
28-Apr-07	765	6.012
29-Apr-07	807	5.934
30-Apr-07	705	5.723

Data provided by DOE and should be considered provisional

APPENDIX A: Nason Creek Temperature and Discharge Data

DATE	Mean Daily Discharge (CFS)	Mean Daily Temp C
1-May-07	720	5.903
2-May-07	771	5.888
3-May-07	772	5.774
4-May-07	685	5.713
5-May-07	633	5.756
6-May-07	621	5.962
7-May-07	775	6.382
8-May-07	1160	6.533
9-May-07	1580	6.641
10-May-07	1320	6.445
11-May-07	1230	6.278
12-May-07	1350	6.287
13-May-07	1430	6.324
14-May-07	1060	6.126
15-May-07	1150	6.202
16-May-07	1630	6.38
17-May-07	1760	6.567
18-May-07	1510	6.538
19-May-07	1450	6.55
20-May-07	1220	6.39
21-May-07	1110	6.228
22-May-07	895	6.227
23-May-07	891	6.584
24-May-07	946	6.789
25-May-07	1050	6.944
26-May-07	1160	6.973
27-May-07	1480	7.079
28-May-07	1110	6.935
29-May-07	1010	6.943
30-May-07	1250	7.118
31-May-07	1660	7.34

Data provided by DOE and should be considered provisional

APPENDIX A: Nason Creek Temperature and Discharge Data

DATE	Mean Daily Discharge (CFS)	Mean Daily Temp C
1-Jun-07	1910	7.509
2-Jun-07	2160	7.619
3-Jun-07	2530	7.746
4-Jun-07	2660	7.858
5-Jun-07	2020	7.705
6-Jun-07	1200	7.168
7-Jun-07	841	6.945
8-Jun-07	765	7.416
9-Jun-07	785	7.636
10-Jun-07	848	7.555
11-Jun-07	798	7.587
12-Jun-07	676	7.531
13-Jun-07	675	8.335
14-Jun-07	668	8.124
15-Jun-07	663	8.175
16-Jun-07	610	7.804
17-Jun-07	608	8.148
18-Jun-07	581	8.402
19-Jun-07	567	8.616
20-Jun-07	615	9.273
21-Jun-07	675	9.874
22-Jun-07	630	9.634
23-Jun-07	550	9.226
24-Jun-07	501	9.079
25-Jun-07	461	8.663
26-Jun-07	408	9.037
27-Jun-07	418	9.738
28-Jun-07	439	10.012
29-Jun-07	454	10.129
30-Jun-07	430	10.004

Data provided by DOE and should be considered provisional

APPENDIX A: Nason Creek Temperature and Discharge Data

DATE	Mean Daily Discharge (CFS)	Mean Daily Temp C
1-Jul-07	403	10.54
2-Jul-07	398	11.235
3-Jul-07	386	11.741
4-Jul-07	388	12.287
5-Jul-07	406	13.135
6-Jul-07	389	13.839
7-Jul-07	329	13.539
8-Jul-07	281	13.371
9-Jul-07	260	13.727
10-Jul-07	241	14.186
11-Jul-07	222	14.599
12-Jul-07	210	15.012
13-Jul-07	198	14.936
14-Jul-07	186	15.454
15-Jul-07	169	16.092
16-Jul-07	157	15.961
17-Jul-07	144	15.403
18-Jul-07	141	14.678
19-Jul-07	141	14.175
20-Jul-07	129	13.961
21-Jul-07	123	13.36
22-Jul-07	117	13.877
23-Jul-07	110	14.58
24-Jul-07	104	15.3
25-Jul-07	97.9	15.264
26-Jul-07	92.8	15.815
27-Jul-07	88.2	16.217
28-Jul-07	84.3	16.307
29-Jul-07	80.9	16.397
30-Jul-07	79	15.894
31-Jul-07	75.7	15.599

Data provided by DOE and should be considered provisional

APPENDIX A: Nason Creek Temperature and Discharge Data

DATE	Mean Daily Discharge (CFS)	Mean Daily Temp C
1-Aug-07	73.1	15.826
2-Aug-07	70	16.269
3-Aug-07	72.9	16.42
4-Aug-07	75.3	16.086
5-Aug-07	64.5	16.045
6-Aug-07	63.2	16.35
7-Aug-07	60.8	16.487
8-Aug-07	60.6	16.123
9-Aug-07	60.5	15.681
10-Aug-07	58.1	15.349
11-Aug-07	56.9	15.032
12-Aug-07	55	15.131
13-Aug-07	54.5	14.552
14-Aug-07	52.9	15.029
15-Aug-07	52.9	15.596
16-Aug-07	54.7	15.982
17-Aug-07	55.5	15.844
18-Aug-07	54.4	15.543
19-Aug-07	55.3	15.138
20-Aug-07	60.2	14.167
21-Aug-07	62.6	13.849
22-Aug-07	57.2	14.398
23-Aug-07	51.8	14.799
24-Aug-07	49.3	14.975
25-Aug-07	46.3	15.208
26-Aug-07	45.5	15.157
27-Aug-07	46.5	14.295
28-Aug-07	44.1	14.145
29-Aug-07	45.5	15.59
30-Aug-07	47.5	15.928
31-Aug-07	46.6	15.865

Data provided by DOE and should be considered provisional

APPENDIX A: Nason Creek Temperature and Discharge Data

DATE	Mean Daily Discharge (CFS)	Mean Daily Temp C
1-Sep-07	45.9	15.403
2-Sep-07	45	15.604
3-Sep-07	43.5	16.421
4-Sep-07	43	16.665
5-Sep-07	42.6	16.282
6-Sep-07	41.6	16.121
7-Sep-07	40.7	14.924
8-Sep-07	41	13.745
9-Sep-07	40.8	13.083
10-Sep-07	39.8	13.318
11-Sep-07	39.2	14.066
12-Sep-07	38.3	15.024
13-Sep-07	38.4	14.85
14-Sep-07	38.4	14.479
15-Sep-07	37.8	14.642
16-Sep-07	37.5	13.65
17-Sep-07	39.2	12.935
18-Sep-07	40.6	12.652
19-Sep-07	39.6	11.864
20-Sep-07	39.4	11.105
21-Sep-07	38.8	10.81
22-Sep-07	37.8	11.742
23-Sep-07	39.1	10.483
24-Sep-07	39	10.314
25-Sep-07	37.7	11.371
26-Sep-07	37.5	11.64
27-Sep-07	37.6	11.336
28-Sep-07	37.2	11.187
29-Sep-07	40.7	9.045
30-Sep-07	43.8	8.811

Data provided by DOE and should be considered provisional

APPENDIX A: Nason Creek Temperature and Discharge Data

DATE	Mean Daily Discharge (CFS)	Mean Daily Temp C
1-Oct-07	50.2	9.397
2-Oct-07	75.8	9.115
3-Oct-07	153	7.796
4-Oct-07	90.4	7.213
5-Oct-07	72	7.369
6-Oct-07	62.9	7.848
7-Oct-07	67.3	8.82
8-Oct-07	106	8.1
9-Oct-07	81.3	8.803
10-Oct-07	72.4	9.284
11-Oct-07	74.9	8.434
12-Oct-07	70.4	8.624
13-Oct-07	66.9	8.414
14-Oct-07	63.1	7.822
15-Oct-07	60.9	7.932
16-Oct-07	61.5	8.113
17-Oct-07	62.9	6.677
18-Oct-07	66.2	5.605
19-Oct-07	104	6.267
20-Oct-07	124	5.767
21-Oct-07	97.3	5.541
22-Oct-07	132	6.813
23-Oct-07	169	7.18
24-Oct-07	166	7.045
25-Oct-07	162	5.828
26-Oct-07	129	4.368
27-Oct-07	114	3.637
28-Oct-07	104	3.754
29-Oct-07	98.1	4.3
30-Oct-07	94.5	4.239
31-Oct-07	89.2	3.192

Data provided by DOE and should be considered provisional

APPENDIX A: Nason Creek Temperature and Discharge Data

DATE	Mean Daily Discharge (CFS)	Mean Daily Temp C
1-Nov-07	86.4	3.645
2-Nov-07	82.2	3.192
3-Nov-07	80.7	4.926
4-Nov-07	85.3	6.877
5-Nov-07	88	5.153
6-Nov-07	81.3	3.869
7-Nov-07	78.9	4.549
8-Nov-07	80.9	6.043
9-Nov-07	83.4	6.83
10-Nov-07	116	6.263
11-Nov-07	118	4.584
12-Nov-07	109	3.636
13-Nov-07	156	2.882
14-Nov-07	118	2.561
15-Nov-07	119	2.741
16-Nov-07	283	3.18
17-Nov-07	265	3.213
18-Nov-07	249	3.167
19-Nov-07	195	3.167
20-Nov-07	169	2.926
21-Nov-07	148	2.254
22-Nov-07	131	1.029
23-Nov-07	116	0.22
24-Nov-07	118	0.415
25-Nov-07	117	0.785
26-Nov-07	106	0.608
27-Nov-07	107	0.433
28-Nov-07	104	0.649
29-Nov-07	99.2	0.902
30-Nov-07	96.7	

Data provided by DOE and should be considered provisional

APPENDIX A: Nason Creek Temperature and Discharge Data

DATE	Mean Daily Discharge (CFS)	Mean Daily Temp C
1-Dec-07	93.3	
2-Dec-07	89.4	
3-Dec-07	178	
4-Dec-07	1340	
5-Dec-07	1260	
6-Dec-07	574	
7-Dec-07	406	
8-Dec-07	324	
9-Dec-07	291	
10-Dec-07	260	
11-Dec-07	251	
12-Dec-07	217	
13-Dec-07	202	
14-Dec-07	[]	
15-Dec-07	185	
16-Dec-07	176	
17-Dec-07	168	
18-Dec-07	161	
19-Dec-07		
20-Dec-07		
21-Dec-07		
22-Dec-07		
23-Dec-07		
24-Dec-07		
25-Dec-07		
26-Dec-07		
27-Dec-07		
28-Dec-07		
29-Dec-07		
30-Dec-07		
31-Dec-07		

Data provided by DOE and should be considered provisional

APPENDIX B: Daily Trap Operating Status

APPENDIX B: Daily Trap Operating Status

Date	Status	Comments
1-Mar-07	Operating	
2-Mar-07	Operating	
3-Mar-07	Operating	
4-Mar-07	Operating	
5-Mar-07	Operating	
6-Mar-07	Operating	
7-Mar-07	Operating	
8-Mar-07	Operating	
9-Mar-07	Operating	
10-Mar-07	Operating	
11-Mar-07	Operating	
12-Mar-07	Operating	
13-Mar-07	Not Operating	High Water
14-Mar-07	Not Operating	High Water
15-Mar-07	Operating	
16-Mar-07	Operating	
17-Mar-07	Operating	
18-Mar-07	Operating	
19-Mar-07	Operating	
20-Mar-07	Operating	
21-Mar-07	Operating	
22-Mar-07	Operating	
23-Mar-07	Operating	
24-Mar-07	Operating	
25-Mar-07	Incomplete	Trap Stopped - Debris
26-Mar-07	Not Operating	High Water
27-Mar-07	Operating	
28-Mar-07	Operating	
29-Mar-07	Operating	
30-Mar-07	Operating	
31-Mar-07	Operating	

APPENDIX B: Daily Trap Operating Status

Date	Status	Comments
1-Apr-07	Operating	
2-Apr-07	Operating	
3-Apr-07	Operating	
4-Apr-07	Operating	
5-Apr-07	Operating	
6-Apr-07	Operating	
7-Apr-07	Operating	
8-Apr-07	Incomplete	Trap Stopped - Debris
9-Apr-07	Operating	
10-Apr-07	Operating	
11-Apr-07	Operating	
12-Apr-07	Operating	
13-Apr-07	Operating	
14-Apr-07	Operating	
15-Apr-07	Operating	
16-Apr-07	Operating	
17-Apr-07	Operating	
18-Apr-07	Operating	
19-Apr-07	Operating	
20-Apr-07	Operating	
21-Apr-07	Operating	
22-Apr-07	Operating	
23-Apr-07	Operating	
24-Apr-07	Operating	
25-Apr-07	Operating	
26-Apr-07	Operating	
27-Apr-07	Operating	
28-Apr-07	Operating	
29-Apr-07	Operating	
30-Apr-07	Operating	

APPENDIX B: Daily Trap Operating Status

Date	Status	Comments
1-May-07	Operating	
2-May-07	Not Operating	Hatchery Steelhead Release
3-May-07	Incomplete	Hatchery Steelhead Release
4-May-07	Incomplete	Hatchery Steelhead Release
5-May-07	Not Operating	Hatchery Steelhead Release
6-May-07	Operating	
7-May-07	Operating	
8-May-07	Operating	
9-May-07	Incomplete	
10-May-07	Operating	
11-May-07	Operating	
12-May-07	Operating	
13-May-07	Operating	
14-May-07	Operating	
15-May-07	Operating	
16-May-07	Operating	
17-May-07	Operating	
18-May-07	Operating	
19-May-07	Operating	
20-May-07	Operating	
21-May-07	Operating	
22-May-07	Operating	
23-May-07	Operating	
24-May-07	Operating	
25-May-07	Operating	
26-May-07	Operating	
27-May-07	Operating	
28-May-07	Operating	
29-May-07	Operating	
30-May-07	Operating	
31-May-07	Incomplete	Trap Stopped - Debris

APPENDIX B: Daily Trap Operating Status

Date	Status	Comments
1-Jun-07	Operating	
2-Jun-07	Operating	
3-Jun-07	Not Operating	High Water
4-Jun-07	Not Operating	High Water
5-Jun-07	Not Operating	High Water
6-Jun-07	Not Operating	High Water
7-Jun-07	Operating	
8-Jun-07	Operating	
9-Jun-07	Operating	
10-Jun-07	Operating	
11-Jun-07	Operating	
12-Jun-07	Operating	
13-Jun-07	Operating	
14-Jun-07	Operating	
15-Jun-07	Operating	
16-Jun-07	Operating	
17-Jun-07	Operating	
18-Jun-07	Operating	
19-Jun-07	Operating	
20-Jun-07	Operating	
21-Jun-07	Operating	
22-Jun-07	Operating	
23-Jun-07	Operating	
24-Jun-07	Operating	
25-Jun-07	Operating	
26-Jun-07	Operating	
27-Jun-07	Operating	
28-Jun-07	Operating	
29-Jun-07	Operating	
30-Jun-07	Operating	

APPENDIX B: Daily Trap Operating Status

Date	Status	Comments
1-Jul-07	Incomplete	Trap Stopped - Debris
2-Jul-07	Operating	
3-Jul-07	Operating	
4-Jul-07	Operating	
5-Jul-07	Operating	
6-Jul-07	Operating	
7-Jul-07	Operating	
8-Jul-07	Operating	
9-Jul-07	Operating	
10-Jul-07	Operating	
11-Jul-07	Operating	
12-Jul-07	Incomplete	Trap Stopped - Debris
13-Jul-07	Operating	
14-Jul-07	Operating	
15-Jul-07	Operating	
16-Jul-07	Operating	
17-Jul-07	Operating	
18-Jul-07	Operating	
19-Jul-07	Operating	
20-Jul-07	Incomplete	Trap Stopped - Debris
21-Jul-07	Operating	
22-Jul-07	Operating	
23-Jul-07	Operating	
24-Jul-07	Operating	
25-Jul-07	Operating	
26-Jul-07	Operating	
27-Jul-07	Operating	
28-Jul-07	Operating	
29-Jul-07	Operating	
30-Jul-07	Operating	
31-Jul-07	Operating	

APPENDIX B: Daily Trap Operating Status

Date	Status	Comments
1-Aug-07	Operating	
2-Aug-07	Operating	
3-Aug-07	Incomplete	Trap Stopped - Debris
4-Aug-07	Operating	
5-Aug-07	Operating	
6-Aug-07	Operating	
7-Aug-07	Operating	
8-Aug-07	Operating	
9-Aug-07	Operating	
10-Aug-07	Operating	
11-Aug-07	Operating	
12-Aug-07	Operating	
13-Aug-07	Operating	
14-Aug-07	Operating	
15-Aug-07	Operating	
16-Aug-07	Operating	
17-Aug-07	Operating	
18-Aug-07	Operating	
19-Aug-07	Operating	
20-Aug-07	Operating	
21-Aug-07	Operating	
22-Aug-07	Operating	
23-Aug-07	Operating	
24-Aug-07	Operating	
25-Aug-07	Operating	
26-Aug-07	Operating	
27-Aug-07	Operating	
28-Aug-07	Operating	
29-Aug-07	Operating	
30-Aug-07	Operating	
31-Aug-07	Operating	

APPENDIX B: Daily Trap Operating Status

Date	Status	Comments
1-Sep-07	Operating	
2-Sep-07	Operating	
3-Sep-07	Incomplete	Low Water
4-Sep-07	Not Operating	Low Water
5-Sep-07	Not Operating	Low Water
6-Sep-07	Operating	
7-Sep-07	Operating	
8-Sep-07	Operating	
9-Sep-07	Operating	
10-Sep-07	Operating	
11-Sep-07	Operating	
12-Sep-07	Operating	
13-Sep-07	Operating	
14-Sep-07	Operating	
15-Sep-07	Operating	
16-Sep-07	Incomplete	Low Water
17-Sep-07	Incomplete	Low Water
18-Sep-07	Operating	
19-Sep-07	Operating	
20-Sep-07	Operating	
21-Sep-07	Operating	
22-Sep-07	Operating	
23-Sep-07	Operating	
24-Sep-07	Operating	
25-Sep-07	Operating	
26-Sep-07	Operating	
27-Sep-07	Operating	
28-Sep-07	Operating	
29-Sep-07	Operating	
30-Sep-07	Operating	

APPENDIX B: Daily Trap Operating Status

Date	Status	Comments
1-Oct-07	Operating	
2-Oct-07	Operating	
3-Oct-07	Operating	
4-Oct-07	Operating	
5-Oct-07	Incomplete	
6-Oct-07	Operating	
7-Oct-07	Operating	
8-Oct-07	Operating	
9-Oct-07	Operating	
10-Oct-07	Operating	
11-Oct-07	Operating	
12-Oct-07	Operating	
13-Oct-07	Operating	
14-Oct-07	Operating	
15-Oct-07	Operating	
16-Oct-07	Operating	
17-Oct-07	Operating	
18-Oct-07	Operating	
19-Oct-07	Operating	
20-Oct-07	Operating	
21-Oct-07	Operating	
22-Oct-07	Operating	
23-Oct-07	Operating	
24-Oct-07	Operating	
25-Oct-07	Operating	
26-Oct-07	Operating	
27-Oct-07	Operating	
28-Oct-07	Operating	
29-Oct-07	Operating	
30-Oct-07	Operating	
31-Oct-07	Operating	

APPENDIX B: Daily Trap Operating Status

Date	Status	Comments
1-Nov-07	Operating	
2-Nov-07	Operating	
3-Nov-07	Operating	
4-Nov-07	Operating	
5-Nov-07	Operating	
6-Nov-07	Operating	
7-Nov-07	Operating	
8-Nov-07	Operating	
9-Nov-07	Operating	
10-Nov-07	Operating	
11-Nov-07	Operating	
12-Nov-07	Operating	
13-Nov-07	Operating	
14-Nov-07	Operating	
15-Nov-07	Operating	
16-Nov-07	Operating	
17-Nov-07	Operating	
18-Nov-07	Operating	
19-Nov-07	Operating	
20-Nov-07	Operating	
21-Nov-07	Operating	
22-Nov-07	Operating	
23-Nov-07	Operating	
24-Nov-07	Operating	
25-Nov-07	Operating	
26-Nov-07	Operating	
27-Nov-07	Operating	
28-Nov-07	Operating	
29-Nov-07	Operating	
30-Nov-07	Operating	
1-Dec-07	Operating	Trap Removed for Winter

APPENDIX B: SPAWNING GROUND SURVEY RECORDS FOR THE WENATCHEE AND METHOW RIVERS, 2007

APPENDIX B: Spawning ground survey records for the Wenatchee and Methow Rivers, 2007

Stream	Reach Description	Date	Surveyors	New Redds	Live Fish	Dead Fish
Nason	White Pine to Ray Rock	10/16/06	MC	0	0	0
		Total		**0**	**0**	**0**
	Ray Rock to Wood Bridge	9/26/06	MC, TR	0	0	0
		10/24/06	TR	0	0	0
		10/30/06	MC	2	1	0
		Total		**2**	**1**	**0**
	Wood Bridge to Old Kahler Bridge	9/26/06	SP	0	0	0
		10/2/06	TR	0	0	0
		10/16/06	MC	0	0	0
		10/23/06	TR, GR	1	2	0
		10/30/06	MC, TR	0	0	0
		Total		**1**	**2**	**0**
	Old Kahler Bridge to Mouth	10/2/06	MC	0	0	0
		10/16/06	TR	0	0	0
		10/23/06	MC	1	1	0
		10/30/06	TR	0	0	0
		11/21/06	MC, SP	0	0	0
		12/5/06	MC, TR	0	0	0
		Total		**1**	**1**	**0**
	Nason Creek Total			**4**	**4**	**0**
Butcher	Pond to Culvert	12/5/06	SP	0	0	0
		Total		**0**	**0**	**0**
Coulter	Wetlands to Road	12/5/06	SP	0	0	0
		Total		**0**	**0**	**0**
Chiwawa	1st Bridge to Mouth	10/26/06	MC, GR	0	0	0
		Total		**0**	**0**	**0**
Beaver	Pond to Mouth	11/21/06	MC, SP	0	0	0
		Total		**0**	**0**	**0**
Chumstick	North Rd. Culvert to Mouth	12/4/06	MC, TR	0	0	0
		Total		**0**	**0**	**0**
Chiwaukum	Campground to Mouth	10/30/06	MC, TR	0	0	0
		Total		**0**	**0**	**0**

Icicle	Dam 5 to Hatchery Boat Launch	10/27/06	MW,GR	1	8	4
		Total		**1**	**8**	**4**
	Dam 5 to Mouth	9/27/2006	CK, LSO, LS	0	0	0
		10/4/06	CK, GR	0	16	0
		10/10/06	CK, MC	0	52	0
		10/18/06	CK, TR	0	5	1
		10/25/2006	CK, MW	3	108	3
		11/1/2006	CK, LS	28	140	4
		11/20/2006	CK, LSO	4	9	0
		11/29/2006	CK, GR	5	6	3
		12/12/2006	CK	1	1	0
		12/20/2006	CK	0	2	5
		Total		**41**	**339**	**16**
	Mountain Home Creek	11/16/06	SP, CK	3	11	10
		Total		**3**	**11**	**10**
	Original Channel (Head Gate to Dam 5)	10/12/06	CS, LSO	0	0	0
		10/18/06	SP	4	22	0
		11/16/06	SP, CK	39	179	0
		11/29/06	SP	0	0	1
		12/20/06	MC	0	3	0
		Total		**43**	**204**	**1**
	Snow Creek Parking to Head Gate	10/18/06	MC	0	0	0
		Total		**0**	**0**	**0**
	Icicle Creek Total			**88**	**562**	**31**
Ingalls		10/6/06	CS	0	0	0
		10/12/06	LS	0	0	0
		Total		**0**	**0**	**0**
Mill		11/20/06	MC, TR	1	2	0
		11/29/06	CS	0	0	0
		Total		**1**	**2**	**0**
Peshastin	Confluence w/ Ingalls to Canyon	10/6/06	CS	0	0	0
		10/12/06	LS	0	0	0
		Total		**0**	**0**	**0**
	Mill Creek to Office	9/3/06	MW	0	0	0
		9/26/06	CS, GR	0	0	0
		10/3/06	CK, LS	0	0	0
		10/17/06	MC, TR	0	0	0
		10/27/06	CS	1	0	0

		11/1/06	CS, LSO, GR	0	0	0
		11/29/06	CS	0	0	0
		12/6/06	MW	0	0	0
		Total		**1**	**0**	**0**
	Office to Mouth	9/27/06	CS, LSO, MW	0	1	0
		10/3/06	MW	0	0	0
		10/12/06	MW, GR	0	0	0
		10/20/06	CS	0	2	0
		10/26/06	CS	1	3	1
		11/1/06	CS, LSO, GR	0	1	0
		11/28/06	CS	3	5	0
		12/8/06	MC, TR	0	1	2
		12/18/06	MC, MW	0	0	0
		Total		**4**	**13**	**3**
	Peshastin Creek Total			**5**	**13**	**3**
Brender	1st House to Mouth	9/28/06	CS, LSO	0	0	0
		10/4/06	LSO, LS	0	0	0
		10/9/06	MW, LS	0	0	0
		10/20/06	LSO, LS	0	1	0
		10/27/07	LS	0	0	2
		11/5/06	MW, GR	0	0	4
		12/21/06	CS	1	0	0
		Total		**1**	**1**	**6**
Mission	Pioneer Street to Mouth	9/28/06	CS, LSO	0	0	0
		10/4/06	LSO, LS	0	0	0
		10/9/06	MW, LS	0	0	0
		10/27/06	LS	0	2	0
		11/2/06	CS	4	0	1
		11/29/06	TR,LSO,LS	0	0	31
		12/5/06	MW, GR	1	0	0
		12/21/06	CS	0	0	0
		Total		**5**	**2**	**32**
	Mission/Brender Total			**6**	**3**	**38**
Wenatchee	Lake to Plain (Upper)	9/27/06	MC, TR	0	0	0
		10/12/06	MC, TR	0	0	0
		10/26/06	MC, GR	0	0	0
		12/6/06	MC, TR	0	0	0
		Total		**0**	**0**	**0**
	Plain to Tumwater Bridge (Upper)	9/28/06	MC, TR	0	0	0
		10/13/06	MC, GR	0	0	0

		Total		**0**	**0**	**0**
	Tumwater Bridge to Icicle Road Bridge (Upper)	9/26/06	MC,TR	0	0	0
		10/16/06	MC,TR	0	0	0
		Total		**0**	**0**	**0**
	Icicle Road to Public Boat Launch (includes Blackbird Isl. - Middle)	9/25/06	MC, TR	0	0	0
		10/11/06	MC, TR	0	3	0
		10/19/06	MC, TR	0	3	0
		10/25/06	MC, TR	0	1	0
		11/1/06	MC, TR	0	8	0
		11/8/06	MC, TR	0	0	0
		11/15/06	MC, TR	0	0	0
		11/30/06	MC, TR	0	0	1
		Total		**0**	**15**	**1**
	Icicle Confluence to Public Boat Launch (Middle)	9/27/06	CK, LSO, LS	0	7	0
		10/4/06	CK, GR	0	4	0
		10/10/06	CK, MC	0	0	0
		10/18/06	CK, TR	0	5	0
		10/25/06	CK, MW	0	4	0
		11/1/06	CK, LS	0	0	0
		11/20/06	CK, LSO	0	0	0
		11/29/06	CK, GR	0	0	0
		12/12/06	CK	0	0	0
		12/20/06	CK	0	0	1
		Total		**0**	**20**	**1**
	Leavenworth to Dryden (Middle)	10/11/2006	MC, TR	0	0	0
		Total		**0**	**0**	**0**
	Dryden to Cashmere (Lower)	10/23/2006	CS	0	0	1
		11/7/2006	CS	0	0	1
		Total		**0**	**0**	**2**
	Cashmere to Mouth (Lower)	10/5/06	CK,CS, TR, LSO	0	7	0
		10/27/06	MC, TR	6	16	0
		11/11/06	MC,TR,LSO,GR	0	2	0
		Total		**6**	**25**	**0**
	Wenatchee River Total			**6**	**60**	**4**
	Wenatchee Basin Total			**110**	**644**	**77**

APPENDIX C: Wenatchee and Methow Basin Coho Release Numbers and Mark Groups, 2007

APPENDIX C: Wenatchee and Methow Basin Coho Release Numbers and Mark Groups, 2007.

Basin	River	Acclimation Site	Rearing Hatchery	Brood Source	Release Date	CWT Code	Retention	Total Smolts Received	Total Smolts Released *	CWTs Released	PIT tags
Wenatchee	Nason Cr	Coulter Pond	Willard NFH	MCR-WEN	4/27/2007	**052964+BT**	na	34545	33212	33212	3513
Wenatchee	Nason Cr	Coulter Pond	Cascade FH	MCR-WEN	4/27/2007	**053184+BT**	na	68875	66168	66168	3512
							Total	**103420**	**99380**	**99380**	7025
Wenatchee	Nason Cr	Rolfing's Pond	Willard NFH	MCR-WEN	5/7/2007	**053269+BT**	na	32331	32073	32073	4003
Wenatchee	Nason Cr	Rolfing's Pond	Willard NFH	MCR-WEN	5/7/2007	**053270+BT**	na	35957	35867	35867	0
Wenatchee	Nason Cr	Rolfing's Pond	Willard NFH	MCR-WEN	5/7/2007	**053199**	95.8%	31602	31523	30199	0
Wenatchee	Nason Cr	Rolfing's Pond	Cascade FH	MCR-WEN	5/7/2007	**053182+BT**	na	69864	62014**	62014	0
							Total	**169754**	**161477**	**160153**	4003
Wenatchee	Beaver Cr	Beaver Creek	Willard NFH	MCR-WEN	5/8/2007	**053268+BT**	na	33192	31594	31594	3502
Wenatchee	Beaver Cr	Beaver Creek	Cascade FH	MCR-WEN	5/8/2007	**053183+BT**	na	68290	65045	65045	3491
							Total	**101482**	**96639**	**96639**	6993
Wenatchee	Nason Cr.	Butcher Creek	Willard NFH	MCR-WEN	5/6/2007	**053264+BT**	na	33319	32315	32315	0
Wenatchee	Nason Cr.	Butcher Creek	Willard NFH	MCR-WEN	5/6/2007	**053265+BT**	na	34221	33217	33217	0
Wenatchee	Nason Cr.	Butcher Creek	Willard NFH	MCR-WEN	5/6/2007	**053266+BT**	na	34716	33712	33712	0
Wenatchee	Nason Cr.	Butcher Creek	Willard NFH	MCR-WEN	5/6/2007	**053267+BT**	na	34234	33229	33229	0
							Total	**136490**	**132473**	**132473**	0
Wenatchee	Icicle Cr	LNFH SFL 25	Willard NFH	MCR-WEN	4/17/2007	**053271**	97.4%	34194	32407	31564	0
Wenatchee	Icicle Cr	LNFH SFL 24	Willard NFH	MCR-WEN	4/17/2007	**053272**	99.2%	33200	31459	31207	0
Wenatchee	Icicle Cr	LNFH SFL 23	Willard NFH	MCR-WEN	4/17/2007	**053191**	99.4%	33444	33309	33109	0
Wenatchee	Icicle Cr	LNFH SFL 22	Willard NFH	MCR-WEN	4/17/2007	**053192**	97.0%	32708	32597	31619	0
Wenatchee	Icicle Cr	LNFH SFL 21	Willard NFH	MCR-WEN	4/17/2007	**053193**	98.4%	32960	32804	32279	0
Wenatchee	Icicle Cr	LNFH SFL 20	Willard NFH	MCR-WEN	4/17/2007	**053194**	97.2%	33065	32946	32024	3009

Wenatchee	Icicle Cr	LNFH SFL 10	Willard NFH	MCR-WEN	4/17/2007	**053197**	98.2%	32925	32743	32154	3055
Wenatchee	Icicle Cr	LNFH SFL 11&12	Cascade FH	MCR-WEN	4/17/2007	**053188**	99.0%	69790	64990	64340	0
							Total	**302286**	**293255**	**288296**	6064

Wenatchee	Icicle Cr	LNFH LFL #2	Willard NFH	MCR-WEN	4/16/2007	**053195**	98.4%	32667	32394	31876	3012
Wenatchee	Icicle Cr	LNFH LFL #2	Willard NFH	MCR-WEN	4/16/2007	**053196**	97.0%	33477	33196	32200	0
Wenatchee	Icicle Cr	LNFH LFL #2	Willard NFH	MCR-WEN	4/16/2007	**053165**	97.4%	36469	36171	35231	0
Wenatchee	Icicle Cr	LNFH LFL #3	Cascade FH	MCR-WEN	4/16/2007	**053189**	99.4%	69360	63037	62659	3002
Wenatchee	Icicle Cr	LNFH LFL #1	Cascade FH	MCR-WEN	4/16/2007	**053190**	98.6%	69596	68713	67751	0
Wenatchee	Icicle Cr	LNFH LFL #1	Cascade FH	MCR-WEN	4/16/2007	**052976**	99.0%	37571	37096	36725	0
Wenatchee	Icicle Cr	LNFH LFL #3	Willard NFH	MCR-WEN	4/16/2007	**053198**	96.8%	33224	30249	29281	
							Total	**312364**	**300856**	**266441**	6014

Methow	Methow	Winthrop NFH	Winthrop NFH	MCR-MET	4/19/2007	**053168**	99.2%	103778	103321	102948	0
Methow	Methow	Winthrop NFH	Winthrop NFH	MCR-MET	4/19/2007	**053167**	97.4%	51869	51647	50520	0
Methow	Methow	Winthrop NFH	Winthrop NFH	MCR-MET	4/19/2007	**053169**	98.9%	113674	113182	112424	0
Methow	Methow	Winthrop NFH BC	Cascade FH	MCR-WEN	4/25/2007	**053185**	98.5%	70015	69381	68965	0
							Total	**339336**	**337531**	**334857**	0

Methow	Columbia	Wells FH	Cascade FH	MCR-WEN	5/1/2007	**053186**	98.8%	70070	70070	69229	0
Methow	Columbia	Wells FH	Cascade FH	MCR-WEN	5/1/2007	**053187**	99.4%	70087	70087	69666	0
							Total	**140157**	**140157**	**138896**	0

	Total Coho	**Total CWTs**
Wenatchee Basin	1,084,080	1,043,383
Methow Basin (Wells FH)	477,688	473,752