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MID-COLUMBIA COHO REINTRODUCTION FEASIBILITY STUDY:

2008 ANNUAL REPORT
October 1, 2007 through September 30, 2008

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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 re-establishing coho within the tributaries of the mid-Columbia initially depended upon the resolution of two central issues: the adaptability of domesticated lower Columbia coho stocks used in the re-introduction efforts measured by their associated survival rates; and the ecological risk to other species of concern, such as ESA listed spring Chinook, steelhead, and bull trout. To date, these two key 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 mid-Columbia tributaries are to succeed, parent stocks must possess sufficient genetic variability to allow phenotypic plasticity to respond to differing selective pressures between environmental conditions of the lower Columbia River and mid-Columbia tributaries. Both the Mid-Columbia Coho Hatchery and Genetic Management Plan (HGMP 2002) and Master Plan for Coho Restoration (YN FRM 2008) describe strategies that will be implemented to facilitate the local adaptation process.

We are optimistic that the project will observe positive trends in hatchery coho survival as the transition is made from exclusively utilizing 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 as an indicator of project performance, but to track potential short- and long-term program benefits from the outlined strategies.

If the re-introduction effort is to be successful long term, adult returns must be sufficient to meet replacement levels without adversely affecting other fish populations. Additionally, minimizing hydro impacts, compensating for habitat loss, and providing additional harvest opportunities will ultimately play a role in the coho re-introduction program.

This report documents coho restoration activities and results for the performance period of fall 2007 through the summer 2008, to include broodstock collection, spawning, egg incubation and transportation, 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 2008. This trap is operated with joint funding from Grant County Public Utility District (GCPUD, #430-2365) 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 included as a supplemental document (Murdoch and Collins, 2008) and provided in Appendix A.

2.0 BROODSTOCK COLLECTION AND SPAWNING

2.1 WENATCHEE RIVER BASIN

2.1.1 Broodstock Collection

Broodstock collection occurred primarily at Dryden Dam between September 3 and November 14, 2007. Although Dryden was the primary source of brood collection, Tumwater Dam has become increasingly significant as program collections shift towards incorporating more upper basin returning adults, which have successfully ascended Tumwater Canyon to Tumwater Dam. The emphasis on collecting coho salmon at Tumwater Dam is described in the Mid-Columbia Coho Restoration Master Plan (Broodstock Development Phase II; YN FRM 2008).

Coho returning to the Wenatchee River in 2007 were comprised of brood year (BY) 2004 adults and BY 2005 jacks from mid-Columbia hatchery and natural origin returns. These returns constituted a 100%, 2nd generation, Mid-Columbia return (MCR) for the Wenatchee program. The Dryden Dam fish traps were passively operated five days per week, 24-hours per day. On Saturdays and Sundays, both facilities were 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 October 24, when WDFW's broodstock collection quota was met.

Coho broodstock were collected at Tumwater Dam no more than four days per week, up to 8 hours per day, between October 1 and November 5, 2007. All coho collected at Tumwater Dam and incorporated into the broodstock were externally marked with a green floy tag and left opercle punch for later identification during spawning and post-spawn data collection. The opercle punch served as secondary mark in the event that a floy tag became dislodged.

A v-trap weir in the upper portion of the LNFH ladder was installed the first week of October and was operational between November 1 and November 13. This site has been and will continue to be utilized as a back-up broodstock collection site, ensuring that bi-weekly broodstock collection quotas are met. Each coho collected at LNFH had an orange floy tag injected in the right dorsal sinus and was right-side opercle punched to allow for later identification during spawning and post-spawn data collection.

The differential marking at multiple trap locations provided the necessary evaluation tools to parse out supplemental collections when evaluating smolt-to-adult survival rates as well as determine migratory success for coho. Approximately 5.1% and 23.2 % of the total broodstock were collected in the LNFH ladder trap and Tumwater Dam, respectively.

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) and held until spawning.

Table 1. Coho salmon and incidentals handled during trapping, 2007.

Location	Coho (*broodstock*)	Steelhead	Sockeye	Chinook	Bull Trout
Dryden Dam	2,262* (*728*)	269	1	282	0
Tumwater Dam	442* (*235*)	NA	NA	NA	NA
LNFH ladder trap	155* (*52*)	0	0	0	0

**Actual number of coho handled during trapping at Dryden Dam, Tumwater Dam, and LNFH during broodstock collection efforts for 2007.*

2.1.2 Spawning

Of the 1,015 coho collected, 48.2% were females (*n*=489) and 51.8% were males; both three-year olds and jacks were included (*n*=526). The pre-spawn mortality rate at ENFH was 2.0% in 2007; a decrease of 2.0% compared to the previous year. This increased holding survival represented the lowest observed pre-spawn mortality rate since the inception of the coho program. The use of MS-222 and NaCl to decrease stress during transport, combined with segregated holding areas to minimize handling stress (use of two holding ponds to separate males from females), may have contributed towards reducing pre-spawn mortality.

A total of 984 coho adults (487 females and 497 males) were spawned between October 16 and November 20, 2007. Of the 487 total female coho spawned, 478 (98.2%) were considered viable. Non-viable females were either over-ripe or green at the time of spawning. Peak spawn occurred on November 6 with 112 viable females (Figure 1). Spawn timing for the 2007 brood was similar when compared to the program average from 2000-2006 (Figure 2).

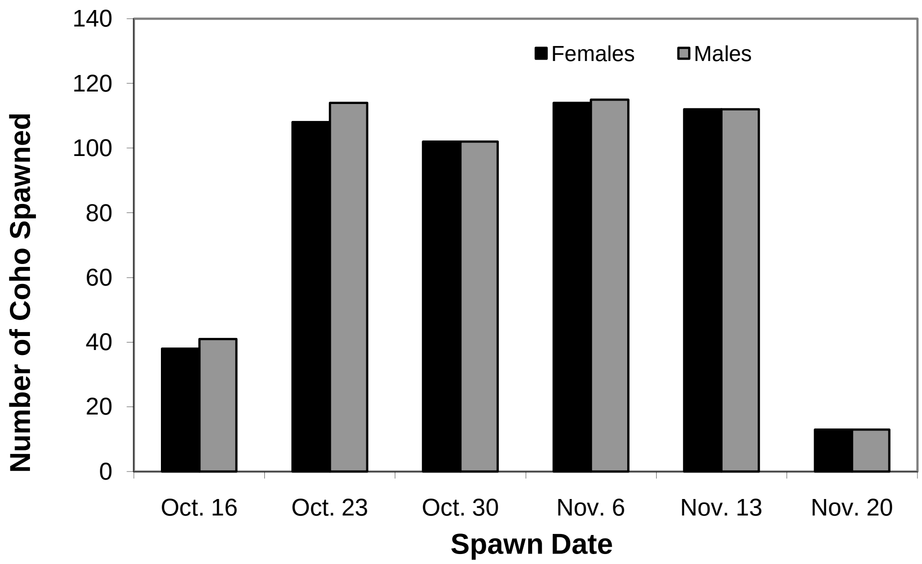

Figure 1. Number of coho spawned at Entiat National Fish Hatchery, 2007.

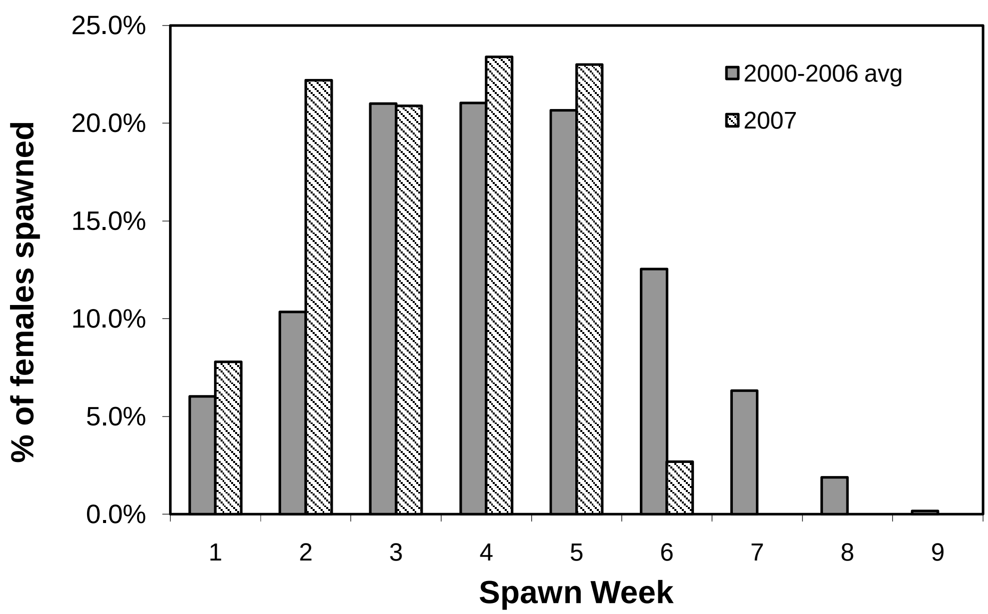

Figure 2. Temporal spawning distribution: brood years 2000-2006 and 2007.

2.1.3 Incubation

A total of 1,253,363 green eggs were collected from the 2007 coho broodstock. Of the total green eggs, 891,680 (71.1%) were incubated at ENFH while the remaining 361,684 (28.9%) 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 water. Coho eggs were incubated on 100% groundwater at ENFH, while non-chlorinated city water with groundwater as a backup was used at PIF. This bulk incubation system has been effective for the coho in that it allows for a relative large number of eggs to be successfully incubated in a cost-effective manner with a low volume of water.

At both the ENFH and PIF facilities, eggs from each female were fertilized with one primary and one back-up male. During fertilization, a 1.0% saline solution was used to increase sperm motility. The eggs were allowed to stand for a minimum of 2-3 minutes until fertilization was complete. Once fertilized, excess milt, ovarian fluid, and other organics were strained from the eggs and then soaked in a 75 (part-per-million) ppm concentration of iodine. This disinfectant treatment occurred for 30 minutes followed by a freshwater rinse and placement in the incubator.

Eyed-egg totals for ENFH and the PIF were 808,425 (90.7%) and 310,464 (85.8%), respectively. Average eye-up rate for the 2007 brood was 89.3%. The 2007 eye-up was the highest observed since the program began.

Approximately 22.0% (*n* =245,933 eyed eggs) of the 2007 brood remained at ENFH for hatching and rearing prior to being transported back to the Wenatchee basin as pre-smolts. Juvenile coho rearing at ENFH has been an opportunistic arrangement for the YN coho program as USFWS is in the process of transitioning from spring Chinook to a summer Chinook program. Until this program transition is finalized, the USFWS and ENFH have agreed to rear coho in the interim. Of the aforementioned on-station coho, 36,922 were used by USFWS Olympia Fish Health Center to test for the presence and potential effects of a documented parasite (*Myxobolus sp.)* within the Entiat River's surface water at various rearing stages.

The remaining 2007 brood coho eyed-eggs (*n* =871,022) were transported to Cascade FH and Willard NFH for hatching and rearing between mid-November to late December. 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 facilities to the rearing facilities occurred between 550 and 600 temperature units (°F).

Table 2. Spawn dates, number of eggs collected, and eye-up rate at ENFH and PIF, 2007.

Incubation Location	Spawn Date	Trans. Date	Number of Viable Females	Number eyed eggs	Number dead eggs	Total green eggs	Avg. Eggs per Female	Avg. Eyed eggs per female	Avg. % Eye-up	Receiving/ rearing hatchery
PIF	16-Oct	5-Dec	37	78,915	16,219	95,134	2,571.19	2,132.83	83.0	Willard NFH
PIF	23-Oct	12-Dec	104	231,549	35,000	266,549	2,562.98	2,226.44	86.9	Willard NFH
ENFH	30-Oct	14-Dec	101	240,735	23,124	263,859	2,612.47	2,383.52	91.2	Willard NFH/ Cascade FH
ENFH	6-Nov	21-Dec	112	269,822	25,770	295,592	2,639.22	2,409.13	91.3	Cascade FH
ENFH	13-Nov	28-Dec	111	266,615	32,300	298,915	2,692.92	2,401.93	89.2	ENFH/Cascade FH
ENFH	20-Nov	N/A	13	31,253	2,061	33,314	2,562.60	2,404.04	93.8	ENFH
Total			**478**	**1,118,889**	**134,474**	**1,253,363**	**2,622.1**	**2,340.8**	**89.3**	

2.2 METHOW RIVER BASIN

2.2.1 Broodstock Collection

Coho broodstock were collected at Winthrop National Fish Hatchery (WNFH) and Wells Dam. Fish returning to WNFH were collected volitionally as swim-ins into the hatchery holding pond. The WNFH ladder was opened on September 28 and remained open until program goals were met on November 15. A total of 590 adult coho entered the hatchery volitionally (225 females and 365 males). Additional collection occurred concurrently at Wells Dam on both the west and east fish ladders between September 25 and October 23. Collection of broodstock at the Wells FH adult trap was not needed due to the high escapement numbers observed over Wells Dam.

At Wells Dam, a total of 369 (141 males and 228 females) coho were trapped, tagged with sequentially-numbered floy tags in the dorsal sinus and marked with an opercule punch prior to transport from Wells Dam to WNFH. The marks were used to differentiate fish that were collected at Wells Dam from volitional swim-ins to WNFH during spawning and post-spawn data collection. The Wells Dam fishway traps were operated no more than three days per week concurrently with WDFW's steelhead collection until October 10. After October 10, trapping activities increased to seven days a week through October 23. We discontinued broodstock collection at Wells Dam earlier than expected due to the high proportion of coho arriving at WNFH. Fish returning to WNFH were prioritized in broodstock collection and spawning over fish collected at Wells Dam since they have demonstrated that they have the stamina and/or run timing necessary to complete the migration up the Methow River. All fish encountered during trapping efforts at Wells Dam are listed in Table 3.

Of the 959 coho encountered at WNFH and Wells Dam, 57.3% (*n*=550) were used for broodstock, 38.7% (*n*=371) were released into the river to spawn naturally, and 4.0% (*n*=38) were pre-spawn mortality. Passed coho and non-target species diverted back to the adult ladders can be found in Table 3.

Table 3. Methow Basin coho salmon trapped and incidentals diverted back to the river, 2007.

Location	Coho (*broodstock*)	Steelhead	Sockeye	Chinook	Bull Trout
WNFH	590* (369)	0	0	0	0
Wells Dam East ladder	124* (82)	44	0	17	0
Wells Dam West ladder	369* (287)	88	0	83	0
Wells FH ladder	N/A	N/A	N/A	N/A	N/A

**Total number of coho encountered during broodstock collection efforts for 2007. Passed coho were recorded and allowed to migrate upstream.*

2.2.2 Spawning

Coho broodstock collected from Wells Dam and WNFH were spawned at WNFH. We spawned 550 coho (273 females and 277 males) between October 17 and November 14 (Figure 3). Of the 273 females, 268 (98%) were considered viable. Peak spawn occurred on November 7, with 103 females. Spawn timing for the 2007 brood occurred slightly earlier when compared to the 2000-2006 average (Figure 4). Sixty-seven percent (*n*=370; 131 females and 239 males) of the broodstock were volitional swim-ins to WNFH while the remaining thirty-three percent (*n*=180; 142 females and 38 males) were fish intercepted at Wells Dam and transported to WNFH. Pre-spawn mortalities totaled 38 fish (24 females and 14 males). Pre-spawn mortality was reduced from 5.4% in 2006 to 4.0% in 2007; a 1.4% decrease from the previous years' mortality and the lowest since the inception of the Methow River coho program. The decrease in mortality may be attributed to stress reduction during transportation (use of MS-222 and NaCl). On November 15, three hundred and seventy-one fish collected in excess of program needs were returned to the Methow River to spawn naturally. Of the 371 excess coho, two hundred and fourteen (92 females and 122 males) swim-ins were out-planted into Spring Creek (hatchery outfall), while the remaining one hundred and fifty-seven (54 females and 103 males) Wells Dam collected coho were transported down to the mouth of the Methow River and released.

Based on CWT recoveries, 73.5% (*n* = 404) percent of fish spawned were WNFH origin adults returning from the (BY2004) 2006 release, while 12.5% (*n* = 69) percent were fish acclimated and released from Wells FH in 2006. The remaining 14.0% (*n* =77) of the broodstock were unknown hatchery adults (CWTs were determined to be unreadable or accidentally lost during extraction) or unknown origin (no CWT present). Pending scale analysis will determine age class and origin for the unknown portion of the broodstock. In the future, increased training and planned workspace modifications will reduce accidental tag loss.

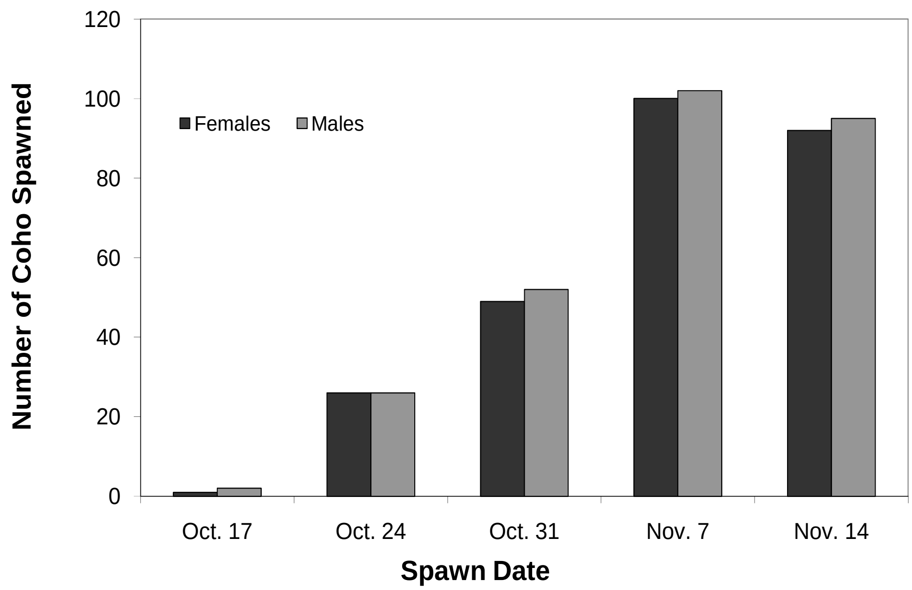

Figure 3. Number of coho spawned at Winthrop National Fish Hatchery, 2007.

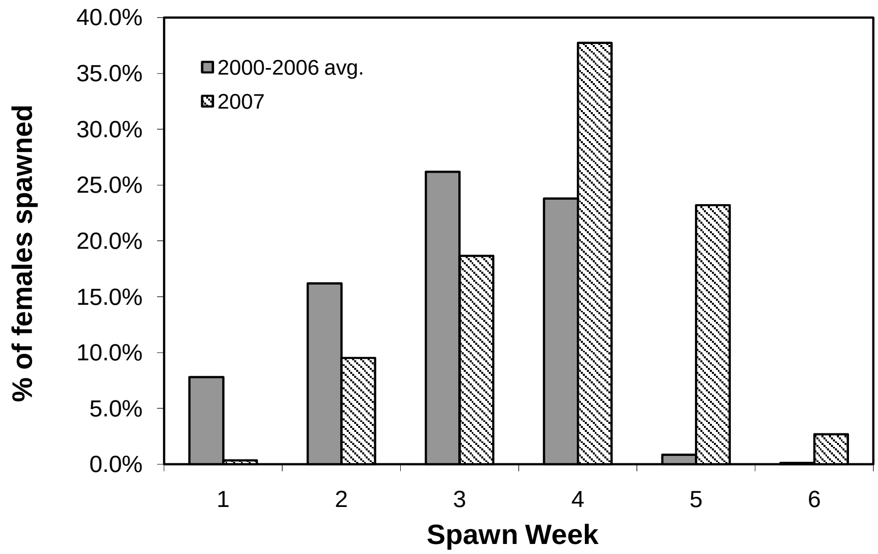

Figure 4. Temporal spawning distribution: brood years 2000-2006 and 2007 at WNFH.

2.2.3 Incubation

During spawning, eggs from each female were mated with one primary male and one back-up male. Females were "bled out" prior to extracting gametes from the body cavity. Bleeding out the females reduced the amount of excess organic matter which could fall into the fertilization buckets causing a potential obstruction of the egg's micropyle and prohibiting fertilization. During fertilization, a 1.0% 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.

A total of 654,457 green eggs were collected from the 2007 Methow broodstock. The average eye up rate was 90.6 % (592,731 eyed eggs). Since WNFH has limited full-term rearing capabilities for the coho program, approximately 100,000 eyed eggs were transferred to Willard NFH on December 18 for hatching and rearing. Transportation of these eggs from WNFH to Willard NFH occurred at 600 temperature units (°F). The total number of eggs hatched at WNFH was 474,906.

A summary of spawn dates, number of eggs collected, fecundity and the eye-up rate at WNFH can be found in Table 4.

Table 4. Spawn dates, number of eggs collected, and eye-up rate at Winthrop NFH, 2007.

Incubation Location	Spawn Date	Trans. Date	Number of Females	Number eyed eggs	Number dead eggs	Total green eggs	Avg. Eggs per Female	Avg. Eyed eggs per female	Avg. % Eye-up	Receiving/ rearing hatchery
WNFH	17 Oct	N/A	1	2,373	325	2,698	2,698	2,373	88.0	WNFH
WNFH	24 Oct	N/A	26	49,721	6,934	56,655	2,179	1,912	87.8	WNFH
WNFH	31 Oct	N/A	49	115,737	13,398	129,135	2,635	2,362	89.6	WNFH
WNFH	07 Nov	N/A	100	219,900	22,855	242,755	2,428	2,199	90.6	WNFH
WNFH	14-Nov	N/A	92	305,000	18,214	223,214	2,426	2,228	91.8	WNFH/Willard NFH
Totals			**268**	**592,731**	**61,726**	**654,457**	**2,442**	**2,221**	**90.6**	

3.0 SPAWNING GROUND SURVEYS

Spawning ground surveys for the mid-Columbia coho program were conducted in the Methow and Wenatchee river basins. Wenatchee River Basin spawning ground survey efforts focused on tributaries where hatchery releases occurred (i.e. Nason, Icicle and Beaver creeks) and included mainstem reaches downstream of release points (i.e. Wenatchee River) . Surveys also included non-target tributaries such as Chiwawa River, Chiwaukum, Mission, and Peshastin creeks; where coho had not been released but have been observed in previous years. Methow River Basin survey efforts concentrated on the lower Chewuch, Methow, and lower Twisp rivers. Lower reaches of smaller tributaries (Table 5) were also surveyed. Additionally, we surveyed areas above and below Wells Dam. In 2007, we increased the survey effort near Wells Dam due to the number of fish acclimated and released from Wells FH in 2006. A complete list of survey reaches can be found in Table 5.

Spawning ground surveys for both basins were conducted either by foot or raft, depending upon the size of the stream and the terrain. Foot surveys were conducted by a single person. Raft surveys were performed by two people: one person rowing while the other person surveyed. In most areas, individual redds were flagged in the field by tying surveyors tape to nearby riparian vegetation. Each marker identified the date, redd location and number, agency, and the surveyor's initials. A global positioning system (GPS) was used to record the exact location of individual redds on all surveys. In areas of dense coho spawning (i.e., Icicle Creek, WNFH Spring Creek), mapping was used to document redd locations to reduce excessive flagging and account for individual redds. A GPS location was used to position mass spawning events and not individual redds. After each survey, we recorded the number of new redds, live and dead fish, time required to complete the survey, and stream temperature.

Carcasses were recovered during spawning ground surveys. A suite of biological information was collected from each carcass, to include fork length (FL), post-orbital-tohypural (POH) length (both measured to the nearest centimeter), snout removal for potential CWT recovery, and sex determination. Females were checked for egg retention and the number of remaining eggs was estimated by enumerating a sub-sample of eggs present in the body cavity and visually expanding the known value by volume. To prevent re-sampling, the caudal fin was removed before discarding the carcass along the stream bank.

Table 5. Spawning ground reaches for the Wenatchee and Methow river basins in 2007.

Reach Designation	Reach Description	Reach Location (RK)
	Wenatchee River Basin	
	Icicle Creek	
I1	Mouth to Hatchery	0.0 - 4.5
I2	Hatchery to Head Gate	4.5 – 6.2
I3	Headgate to LNFH intake	6.2 – 8.0
	Nason Creek	
N1	Mouth to Coles Corner	0.0 - 7.0
N2	Coles Corner to Butcher Pond	7.0 - 14.3
N3	Butcher Pond to Rayrock	14.3 – 20.0
N4	Rayrock to Whitepine Creek	20.0 – 22.0
	Wenatchee River	
W1	Mouth to Cashmere Park	0.0 – 13.4
W2	Cashmere to Dryden Dam	13.4 – 28.0
W3	Dryden Dam to Boat Ramp	28.0 – 38.0
W4	Boat Ramp to Leavenworth Bridge	38.0 – 41.7
W5	Leavenworth Br. to Tumwater Bridge	41.7 – 56.2
W6	Tumwater Bridge to Plain Bridge	56.2 – 69.2
W7	Plain to Lake Wenatchee	69.2 – 86.0
	Beaver Creek (WEN)	
BV1	Mouth to Acclimation Pond	0.0-2.4
	Brender Creek	
BR1	Mouth to Mill Road	0.0 - 0.3
	Chiwaukum Creek	
C1	Mouth to Hwy 2 Bridge	0.0 – 1.0
	Chiwawa River	
CH1	Mouth to Weir	0.0 – 1.0
	Chumstick Creek	
CS1	Mouth to North Road	0.0 – 0.5
	Mission Creek	
M1	Mouth to Residential Area	0.0 – 1.0
	Peshastin Creek	
P1	Mouth to YN Office	0.0 – 3.5
P2	YN Office to Mountain Home Road	3.5 – 8.0
P3	Mountain Home Rd. to Valley High Bridge	8.0 – 13.3

Methow River Basin		
	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.	0.0-9.3
M2	Steel Br. to Lower Burma Br.	9.3-16.1
M3	Lower Burma Br. To Upper Burma Br.	16.1-31.8
M4	Upper Burma Br. to Lower Gold Cr.	31.8-33.9
M5	Lower Gold Cr. To Carlton	33.9-43.6
M6	Carlton to Twisp	43.6-63.4
M7	Twisp to MVID Irrigation Diversion	63.4-71.0
M8	MVID Irrigation Diversion to Winthrop	71.0-80.0
M9	Winthrop to Wolf Cr.	80.0-84.4

3.1 WENATCHEE BASIN REDD COUNTS

3.1.1 Icicle Creek

We conducted 13 weekly spawning ground surveys in the lower portion (hatchery to mouth; RK 0.0-4.5) of Icicle Creek between October 3 and January 16. During this same time period we also surveyed the historic channel (hatchery to headgate) eight times, surveyed upstream of the historic channel (headgate to the LNFH intake) four times. We recorded 888 redds in the main channel of Icicle Creek, 360 redds in the historic channel, and 19 redds upstream of the historic channel (Icicle Creek total = 1,267). Redds counts in Icicle Creek represented 75.8% of the total number of redds found in the Wenatchee River Basin (Table 6). Peak spawn occurred during the first two weeks of November.

We recovered 337 coho carcasses for a sample rate of 12.8%. Carcass sample rate was calculated by taking the total number of carcasses recovered and divided by the total escapement. Total escapement was derived from the total number of redds multiplied by an estimate of the number of fish per redd (FPR); The FPR was estimated based on the sex ratios observed at Dryden Dam and the assumption that each female constructs on ly one redd. The carcass sample rate of 12.8% was lower than the target rate of 20.0% in part due to high river discharge just after peak spawning that flushed many carcasses downstream (Figure 5).

The mean POH lengths for male (including jacks) and female carcasses were 51.4 cm (*n* = 95; SD = 5.7) and 53.4 cm (*n* = 232; SD = 4.3), respectively. We were unable to determine the sex of ten carcasses. All females with intact body cavities were examined for the presence of eggs. Mean egg voidance was 94.6% (*n* = 225). Coded-wire-tag analysis revealed that of the 282 tagged fish recovered in Icicle Creek, 159 (56.4%) females and 78 (27.7%) males were originally released from LNFH; the remaining 37 (13.1%) females and 8 (2.8%) males were released from upper Wenatchee basin acclimation ponds (Table 7). Scale analysis will be used to verify the origin of 34 recovered carcasses without CWTs. Icicle Creek survey reaches can be found in Table 5.

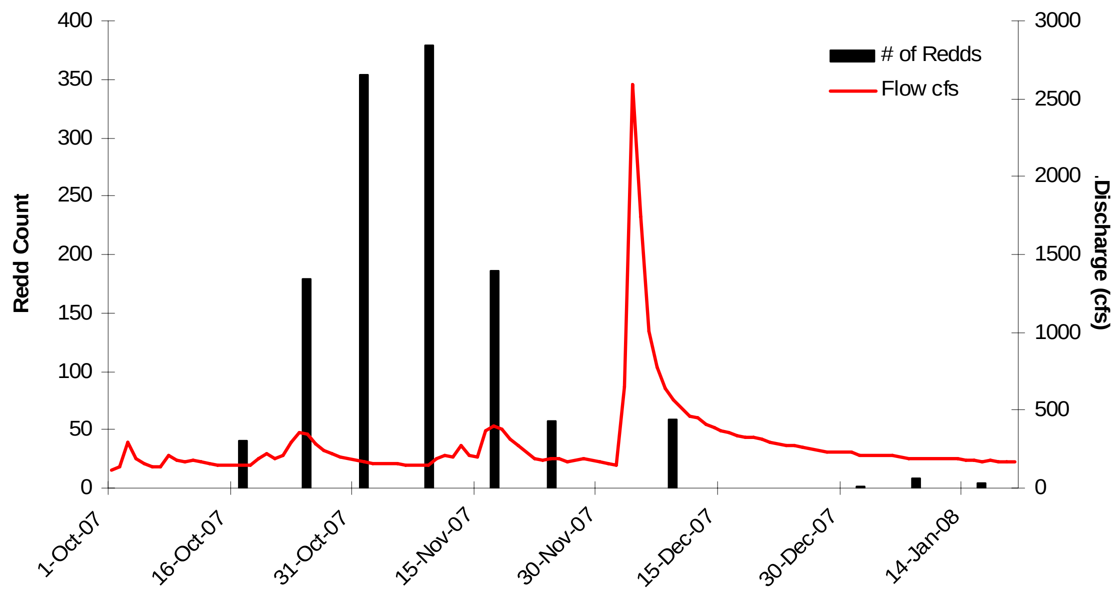

Figure 5. Number of redds found in Icicle Creek in 2007.

3.1.2 Nason Creek

Spawning ground surveys were conducted on nine occasions in Nason Creek between October 11 and December 28. A total of 10 redds were recorded in Nason Creek; all were found within Reaches 1 & 2. A single male carcass was recovered with a POH of 51 cm. Nason Creek redds represented 0.6% of the coho redds identified in the Wenatchee River Basin (Table 6). Nason Creek survey reaches can be found in Table 5.

3.1.3 Wenatchee River

A total of 259 redds were counted during 46 surveys of the mainstem Wenatchee River from Lake Wenatchee to the Columbia River between October 2 and January 17 (Table 6; Appendix B). Redds located on the mainstem Wenatchee River accounted for 15.5% of the total observed coho redds in the Wenatchee River Basin (Table 6). The majority of redds located on the mainstem Wenatchee River were found in Reach 4. We recovered 73 carcasses along the mainstem Wenatchee for a sample rate of 13.5%. Coded-wire-tags were extracted from 54 (74.3%) of these carcasses; all tagged fish originated from acclimation sites located within the Wenatchee River Basin (Table 7). Scale analysis is pending but will be used to verify origin of 19 fish without CWTs. The mean POH lengths for male (including jacks) and female carcasses were 49.9cm (n = 26: SD = 4.7) and 52.4cm (n = 43; SD = 4.8), respectively. Egg voidance was 94.1% (n = 36) among females; 6 pre-spawn mortalities were also found. Wenatchee River survey reaches can be found in Table 5.

3.1.4 Mission Creek/Brender Creek

We conducted nine surveys of Mission and Brender creeks between October 17 and January 4 and recorded 47 redds. Redds located in Mission and Brender creeks represented 2.8% of the total number of coho redds recorded in the Wenatchee River Basin (Table 6). We recovered 30 carcasses for a sample rate of 30.6%. The mean POH lengths for males (including jacks) and females were 45.2 cm (n = 8; SD = 5.7) and 51.2 cm (n = 22; SD = 3.5), respectively. Coded-wire-tag analysis of 19 tags revealed that 52.3% (n = 12) of tagged fish came from Icicle Creek releases, 37.4% (n = 6) from upper Wenatchee basin ponds and 5.2% (n = 1) from the Methow basin. Egg voidance was 98.9% (n = 19). Scale analysis to verify origin is pending. Mission/Brender Creek survey reaches can be found in Table 5.

3.1.5 Peshastin Creek

We conducted nine surveys on Peshastin Creek and identified 88 coho redds between October 15 and January 2 (Table 6). A single carcass was recovered for a sample rate of <1%. High river discharge near the end of peak spawning flushed many carcasses from the system before they could be recovered. Redds located in Peshastin Creek represented 5.3% of the coho redds recorded in the Wenatchee River Basin (Table 6). The POH length for the female carcass was 53 cm. Peshastin Creek survey reaches can be found in Table 5.

3.1.6 Other Tributaries

Surveys were also conducted on Beaver Creek, Chiwaukum Creek, and Chiwawa River; no coho redds were observed. Survey reaches within these tributaries can be found in Table 5.

Table 6. Summary of coho redd counts, distribution in the Wenatchee River Basin, and carcass recovery in 2007. Sample rate based on sex ratio of 1:1.1.

River	Number of Redds	% of Redds in Wenatchee Basin	Recovered Carcasses	Sample Rate %
Icicle Creek	1267	75.8	337	12.7
Nason Creek	10	0.6	0	0.0
Wenatchee River	259	15.5	73	13.4
Brender/Mission Creeks	47	2.8	30	30.4
Peshastin Creek	88	5.3	1	0.5
Total	**1671**	**100.0**	**441**	**12.6**

Table 7. Summary of coded-wire-tag analysis from coho carcasses recovered throughout the Wenatchee River Basin in 2007.

Juvenile Release Location	# of CWTs Recovered	Adult Recovery Location	# of CWTs Recovered
Upper Wenatchee Basin (Female)*	57	Icicle	37
		Wenatchee	14
		Mission	4
		Brender	2
Upper Wenatchee Basin (Male)*	13	Icicle	8
		Wenatchee	3
		Nason	1
		Mission	1
Leavenworth NFH Female	188	Icicle	159
		Wenatchee	19
		Mission	8
		Brender	1
		Peshastin	1
Leavenworth NFH Male	97	Icicle	78
		Wenatchee	18

		Mission	1

*** Includes Beaver Creek, Butcher Creek, Coulter Creek, and Rohlfing's acclimation sites as well as Nason Creek wetlands (direct release)**

3.2 METHOW BASIN REDD COUNTS

3.2.1 Methow River

Methow River surveys in 2007 were conducted to document the spawning distribution, spawn timing and estimated escapement. All surveys occurred between October 30 and December 15, 2007. The surveys included nine reaches (M1-M9) of the Methow River extending from the mouth of Wolf Creek (RK 86.9) to the Columbia River confluence (RK 0.0).

Within the Methow River Basin, a total of 306 coho redds were identified. Of these redds, 57.5% (*n*=176) were located within the Methow River mainstem while the remaining 42.5% (*n*= 130) were located in tributaries, including WNFH and Methow FH outfalls. Most coho redds (67.1%; n=118) identified in the mainstem Methow River were found in reaches M1-M3 (RK 0.0-26.87); while 32.5% (*n*=58) of redds were observed within the middle and upper reaches (RK 26.87-96.56, M4-M9).

Sixty-eight carcasses were recovered within the Methow River mainstem. Of these, 55.9% (*n*=38) were females and 42.6% (*n*=29) were males. The mean fork length for male and female carcasses were 66.5 cm (SD=6.4) and 64.8 cm (SD=4.6), respectively. The mean POH for both male and female carcasses were 48.9 cm (SD=4.0) and 50.6 cm (SD=3.6), respectively. All females (*n*=59) with intact body cavities were examined for the presence of eggs (Section 3.1). Mean egg voidance for carcasses was 60.4%. Nine of these females, 31.0% of female carcasses found had intact egg skeins and did not spawn.

Coded-wire tag analysis indicated that of the 68 carcasses recovered from the mainstem Methow River, 41.2% (*n*=28) originated from the 2006 WNFH on-station release, 8.8% (*n*=6) originated from the 2006 WNFH, back-channel (Spring Creek) release and 50.0% (*n*=34) originated from the 2006 Wells FH release. The sample rate for the mainstem Methow River was 17.9%. For a summary of coded-wire-tag analysis from coho carcasses recovered throughout the Methow River Basin in 2007, please refer to Table 9.

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

The WNFH and Methow FH outfalls were surveyed weekly, beginning October 30 and ending December 4. Weekly surveys allowed us to determine distribution, spawn timing, and approximate numbers of naturally spawning adults.

The first redd identified in Spring Creek (WNFH outfall) was found on November 6. Redds located within Spring Creek comprised 18.7% (*n*=73) of all coho redds in the basin and 56.2% of redds found within Methow basin tributaries (Table 8). The carcass sample rate was 8.2% (5 males and 8 females). Mean POH for both males and females was 46 cm (SD=15.5) and 51.5 cm (SD=0.7), respectively. Mean egg voidance was 66.7%.

Four redds were identified in the Methow FH outfall on October 30. Redds located within the outfall comprised 16.0% (*n*=49; Table 8) of all redds found in the basin and 37.7% found within Methow basin tributaries. One male carcass was sampled with a POH of 55 cm, and no coded-wire tag was present. Seven female carcasses were sampled with a mean POH of 49 cm (SD=3.2). Mean egg voidance was 75.0%. Coded wire tag analysis indicated that three females originated from the 2006 WNFH on-station release, one female originated from the 2006 WNFH back-channel release, and three females were found to be CWT absent. Future scale analysis will be used to verify origin for the three, unknown females. The overall carcass sample rate was 8.5% for the Methow FH outfall.

3.2.3 Beaver Creek

Beaver Creek surveys were conducted as one reach (RK 2.6 – confluence of Methow River; Table 5). Eight coho redds were identified within Beaver Creek. No carcasses were recovered. Redds located within Beaver Creek comprised of 2.6% of total redds found in the Methow basin and 6.2% found within tributaries (Table 8).

3.2.4 Chelan Falls Hatchery Outfall and Chelan Falls

In 2007 we increased our survey efforts in areas downstream of Wells Dam to account for fish returning from Wells FH smolt releases. Areas surveyed included Chelan FH outfall (RK 808; Beebee Springs), Chelan Falls (RK 806) and Foster Creek (RK 870). High abundance of spawning summer Chinook made identifying coho redds difficult at the Chelan Falls location. Surveys conducted after peak summer Chinook spawning allowed for a higher probability of discerning coho redds but still likely underestimate the total count.

Seventy-one redds and 112 carcasses were found within the Chelan FH outfall (Beebee Springs Creek; Table 8). Redds were distributed throughout Beebee Springs Creek. Mean egg voidance was 73.0%. The carcass sample rate was 73.0%. The high sample rate could be attributed to the constant flow of this natural spring/hatchery discharge which helped to retain carcasses within the system.

The Chelan River is a fast flowing, large stream connecting Lake Chelan to the Columbia River. Chelan Falls is the lowermost portion of this river where summer Chinook and coho spawn concurrently. Thirteen redds were identified and three carcasses were recovered in Chelan Falls. The carcass sample rate was 10.7% (Table 8). One male and two female carcasses were sampled with a POH of 47 cm (SD=0.0) and 53.5 (SD=3.5), respectively. Mean egg voidance was 100%.

3.2.5 Foster Creek

One redd was located in Foster Creek at RK 0.8. There were no live fish or carcasses observed. Foster Creek is located at the base of Chief Joe Dam.

3.2.6 Other Tributaries

Surveys were also conducted on Hancock Springs, Libby Creek, Wolf Creek, and the Chewuch and Twisp rivers; no coho redds were observed. Survey reaches within these tributaries can be found in Table 5.

Table 8. Summary of coho redd counts, distribution in the Methow River Basin and adjacent tributaries, and carcass recovery in 2007. Sample rate based on sex ratio of 1:1.16.

River	Number of Redds	% of Redds in Methow Basin	Recovered Carcasses	Sample Rate %
Methow River	176	45.0%	68	17.9
WNFH Spring creek	73	18.7%	13	8.2
WDFW Outfall	49	12.5%	9	8.5
Beaver Creek	8	2.0%	0	0
Beebee Springs	71	18.2%	112	73.0
Chelan River	13	3.3%	3	10.7
Foster Creek	1	0.3%	0	0
Total	**391**	**100**	**206**	**23.7**

Table 9. Summary of coded-wire-tag analysis from coho carcasses recovered throughout the Methow River Basin in 2007.

Juvenile Release Location	# of CWTs	Adult Recovery Location	# of CWTs
Winthrop NFH Female	16	WNFH Spring creek	3
		WDFW outfall	3
		Methow	7
		Out of basin*	3
Winthrop NFH Male	16	WNFH Spring creek	6
		WDFW outfall	0
		Methow	8
		Out of basin*	2
Winthrop NFH back-channel Female	8	WNFH Spring creek	1
		WDFW outfall	1
		Methow	4
		Out of basin*	2
Winthrop NFH back-channel Male	1	WNFH Spring creek	0
		WDFW outfall	0
		Out of basin*	1
Wells NFH Female	69	Methow	16
		Out of basin*	53
Wells NFH Male	59	WNFH Spring creek	1
		Methow	17
		Out of basin*	41

*- *Out of basin recovery location include Chelan Falls and Beebee Springs.*

SUMMARY

• During spawning ground surveys in Icicle Creek, we observed 1,267 coho redds and recovered 337 coho carcasses. The mean egg voidance was of 94.6% (*n*=225).

• During spawning ground surveys in Nason Creek, we counted 10 coho redds and recovered one male carcass.

• We found 259 coho redds in the mainstem Wenatchee River and a combined 135 redds in Brender, Mission, and Peshastin creeks. A total of 73 carcasses were recovered in the Wenatchee River by WDFW and YN personnel. A total of 31 carcasses were recovered on Mission/Brender (*n*=30*)* and Peshastin (*n*=1).

• A total of 391 redds were identified and 206 carcasses were recovered in the Methow River Basin and upper Columbia tributaries for 2007, of which, 78.3% (*n*=306) were located within the Methow River basin while the remaining 21.7% (*n*=85) were identified outside of the target basin.

• Total redd counts were the highest since the inception of the coho program in the Methow River Basin; to include both in-basin and out of basin surveys. The previous high mark was established in 2006 with a total of 77 redds.

• Returning adults to the Methow basin showed an expansion in spawning distribution with 67.1% (*n*=118) of the redds observed within the lower reaches (RK 0.0-26.87; M1-M3); while 33.0% (n=58) of redds were observed within the upper reaches (RK 26.87-96.56, M4-M9).

4.0 SMOLT ACCLIMATION: WENATCHEE AND METHOW

4.1 ACCLIMATION SITES

In 2008, 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 (FH).

4.1.1 Leavenworth National Fish Hatchery

LNFH 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. These ponds were discontinued by USFWS staff 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 the hatchery's 10x100 meter juvenile spring Chinook raceway effluent. 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 needed for coho densities on-hand. In 2008, acclimation for both coho and spring Chinook extended until the end of April.

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 1980s and located behind Mountain Springs Lodge. Originally, the property owner stocked the pond with Kamloops rainbow trout for aesthetic purposes. River otter predation on these year-round resident trout became too problematic and the stocking was discontinued in the early 1990s. After the stocking ceased, Beaver Creek pond had been void of salmonids 2002 when YN began using the pond to acclimate coho salmon prior to release. Prior to fish arriving to the acclimation site, we installed containment structures at the pond's inlet and outlet. The expectation is that returning adults from the Beaver Creek release which are not captured for broodstock will spawn in Beaver Creek or in the upper Wenatchee River.

4.1.3 Nason Creek

In 2008, coho pre-smolts were acclimated at three sites on Nason Creek; Butcher Creek, Coulter Creek, and Rolfing's Pond. Coho smolts were also released at the Nason Wetlands direct-release site. 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.

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

4.1.3.2 Rohlfing's Pond

Rohlfing'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, YN 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. Two PIT tag detection systems were installed in 2008 to monitor emigration timing, in-pond survival, and a start point for analyzing smolt-to-smolt survival for this particular site (Section 4.4).

4.1.3.3 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 and submerged structures were installed to provide protection from predators and reduce in-pond stress. PIT tag detection systems were installed in 2008 to monitor emigration timing, in-pond survival, and a start point for analyzing smolt-to-smolt survival for this particular site (Section 4.4).

4.1.3.4 Nason Creek Wetlands

The Nason Creek Wetlands is part of a wetland complex that includes the lower portion of Coulter Pond. The 26-acre wetland complex encompasses the downstream 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 2008, coho smolts were released directly into the wetlands without containment or feeding (Table 10). 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 to include a more conventional acclimation program.

4.1.4 Winthrop National Fish Hatchery (WNFH)

Coho smolts released into the Methow River were acclimated at WNFH, located at RK 80.6 Five 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. The source of the creek is a combination of natural spring water and an irrigated surface diversion (Foghorn ditch) located approximately 3.3 kilometers upstream from the Spring Creek confluence. Prior to acclimating fish in the back-channel in 2008, we installed predation netting and shade covers to reduce predation.

4.1.5 Wells Fish Hatchery

In 2008, coho were acclimated at Wells Fish Hatchery (FH) located at RK 829.0 on the Columbia River. Wells FH is funded by Douglas County PUD and operated by Washington Department of Fish and Wildlife (WDFW**)**. Under contract with YN, WDFW acclimated coho pre-smolts in a 2.2 acre earthen pond historically used to raise summer steelhead. Coho acclimated and released at Wells FH in 2008 are intended to help reach phased restoration goals (YN FRM 2008) until further development of acclimation facilities occurs within the Methow River Basin.

4.2 TRANSPORTATION AND VOLITIONAL RELEASE

4.2.1 Wenatchee River Basin

Mid-Columbia coho pre-smolts (BY 2006) were transported to the Wenatchee basin from rearing facilities at Willard NFH and Cascade FH between January 22 and April 3, 2008. Coho were acclimated between 7 and 16 weeks at five acclimation sites (including LNFH) within the Wenatchee River Basin (Table 10). Because snow and ice at Nason Creek acclimation sites in early spring limits the duration of acclimation, LNFH served as an intermediate in-basin rearing location for eight to twelve weeks prior to being transferred to Coulter Creek and Rohlfing's ponds for final acclimation. These fish were part of an ongoing study to determine whether an extended imprinting period on basin-specific water, albeit not the final acclimated source, would result in improved return rates to the Wenatchee Basin. Transportation from LNFH to the upper basin sites occurred between March 25 and April 17.

All coho smolts acclimated in both the SFL's and LFL's at LNFH were force-released April 22 and 23, 2008. During 2008, coho acclimated at LNFH 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 groups.

Coho acclimated at Butcher Creek Pond, Coulter Creek Pond, Rohlfing's Pond, Nason Wetlands, and Beaver Creek Pond were volitionally released with start dates between April 3 and May 13 (Table 10). Volitional releases began at Nason Wetlands on April 3, and the remaining ponds were released on May 12 and 13. All acclimation facilities were deemed empty by June 19.

All coho released in 2008 were coded-wire tagged with retentions ranging from 97.2-100%. In addition to CWTs, all of the upper Wenatchee Basin released coho (*n*= 415,651; retentions unavailable) had a blank wire body tag (BT) inserted into the adipose fin. This secondary mark provides the means to implement "Broodstock Development Phase II" (YN FRM 2008). By selectively passing returning adult coho destined for the upper basin at the Dryden Dam broodstock collection facility for potential recapture at Tumwater Dam. By collecting broodstock at Tumwater Dam we hope to select for those individuals with the correct run timing, spawn timing, and/or stamina needed to ascend Tumwater Canyon.

During 2008, 24,709 juveniles were marked with passive integrated transponder tags (PIT tags). Of this total, 11,697 PIT tagged fish were released from LNFH, 6,005 from Butcher Creek Pond, and 6,007 from Rohlfing's Pond (Table 10). The PIT tagged fish were used to measure survival from release to McNary Dam and in-pond survival at select acclimation sites (see Section 4.4). Two PIT tag detection systems were installed in series at each acclimation site, Butcher Pond and Rohlfing's Pond, to ensure maximum detection efficiency.

A total of 989,508 hatchery produced coho smolts were released in the Wenatchee River Basin in 2008. 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, coho pre-smolts were acclimated within five, on-station raceways and a "back-channel" at WNFH. The back-channel is a semi-natural channel on Spring Creek located on the hatchery grounds. Juvenile releases in 2008 marked the first year that 100% of the smolts were progeny from adults that returned to the Methow basin. The development of a local broodstock is critical for achieving program goals within the Methow River Basin (YN FRM 2008).

A total of 83,790 pre-smolts, at an average weight of 25.3 FPP, were transported by ODFW from Willard FH to WNFH on March 11. The fish were acclimated for approximately eight weeks in the back-channel while approximately 267,001 coho juveniles were reared full-term and on-station at WNFH. An additional 211,434 coho pre-smolts were transported by ODFW to Wells FH on March 10, 2008 for acclimation. The fish acclimated at Wells FH were progeny of Wenatchee adult returns in 2006 and provide a back-up broodstock source, if needed. The Wells FH coho were acclimated for approximately eight weeks in a 2.2 acre pond that had historically been used for summer Chinook and steelhead and released at 15.2 fish per pound (Table 10).

The back channel release began on May 5 and was intended to be volitional. However, hatchery personnel removed dam boards, effectively lowering the water level and encouraging the fish to leave quickly. The back channel was visually determined to be empty by May 15. Smolts acclimated on-station were force released on April 29 (Table 10). Coho acclimated at Wells FH were volitionally released on May 5 (Table 10). All releases were CWT'ed. Coded-wire tag retentions for WNFH on-station and back-channel releases combined were 99.4%, while retentions at Well FH were 99.6%.

In 2008, 9.0% (*n*=7,504) of smolts released from the WNFH back channel were marked with PIT tags. The PIT tagged fish were used to measure survival from release to McNary Dam and to measure in-pond survival within the back-channel. Two PIT tag detection systems were installed downstream of the back-channel pond (see Section 4.4).

A combined total of 519,585 coho juveniles were released from WNFH and Wells FH (Table 10). For detailed mark information, see Appendix C.

Table 10. Mid-Columbia coho smolt release summary, 2008.

Location	Release Date	Release Number	Size @ release (FPP)	No. PIT Tags
Beaver Pond	May 13	86,699	17.8	0
Coulter Creek	May 12	64,246	18.6	0
Rolfing's Pond	May 13	94,739	17.9	6,007
Butcher Pond	May 12	140,379	17.9	6,005
Nason Creek Wetlands	April 3	32.253	24.0	0
Leavenworth NFH LFL's (large Foster-Lucas Ponds)	April 22	217,561	17.9	6,004
Leavenworth NFH SFL's (small Foster-Lucas Ponds)	April 23	353,631	19.3	5,693
Wenatchee Total		**989,508**		**24,709**
Winthrop NFH (on-station)	April 29	232,259	16.0	0
Winthrop NFH back-channel (Spring Creek)	May 5	76,949	17.6	7,504
Wells FH	May 5	210,377	15.2	0
Methow Total		**519,585**		0

Wenatchee/Methow Totals		1,509,093		32,213

4.3 FISH CONDITION ASSESSMENT

At all Wenatchee and Methow basin acclimation sites, coho were sampled weekly to measure growth and estimate the degree of smoltification (n=*100*). Prior to release, fish condition was assessed (n=*20*) to establish 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, rather than diagnose the cause of certain conditions. If abnormalities were observed, USFWS fish health staff was notified so that additional testing could be conducted. All Wenatchee and Methow basin 2008 pre-release growth and condition assessments demonstrated that the smolts were in good condition (Table 11).

Coho reared in the WNFH back-channel had a mean condition factor (measure of relative robustness or degree of well-being) of 1.05 in 2008, higher than observed in 2007 (0.96). This increase was presumably due to increased efforts to reduce predation related stress and mortality. Increased hazing efforts and rearing condition improvements in the WNFH back-channel and on-station raceways may have contributed to the increased condition factor of the coho in 2008.

Table 11. Pre-release fish condition assessment, 2008.

Acclimation Location	Cond. Factor	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	1.15	97.5	100	100	92.5	2.1	100	100	100	100	21/19	97.5	100
LNFH-SFL's	1.11	100	100	100	100	2.4	100	100	100	9.5	21/19	92.5	100
Beaver Creek	1.12	95	100	100	100	2.2	100	100	100	90	12/8	95	100
Coulter Creek	1.10	85	95	100	100	2.2	100	100	100	100	8/12	85	90
Rolfing's pond	1.09	100	100	100	100	1.8	100	100	100	70	8/12	85	100
Butcher pond	1.09	100	100	95	100	1.8	100	100	100	100	7/13	90	100
Winthrop NFH (on-station)	1.06	93	95	100	100	2.2	99	98	100	86	50/50	94	100
Winthrop NFH (back-channel)	1.05	92	97	100	97	3.7	98	100	100	97	30/70	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 and deceased coho were recovered from all site locations daily until the end of release to determine known mortality during this rearing period. The number of observed mortalities is typically low (avg. < 2%), however we assume that the majority of loss occurs through predation, and precluding enumeration. This unaccounted for 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 consistent stress events can delay coho stimuli for flight response through this prolonged predation exposure. We used both a predator consumption model, and PIT tag detection (where applicable) to estimate in-pond loss to predation.

4.4.1 Estimated Mortality-Predator Consumption Model versus PIT tag Detection

4.4.1.1 Predation Model

Primary predators observed during the acclimation period 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 body weights for male and female river otters used in this model, derived from multiple sources of documentation, were 25 and 19 pounds, respectively. Common mergansers can consume upwards of one pound of fish per day and can congregate in large numbers (Stephenson 2004). In addition to these key predators, mink, belted kingfishers, great blue herons, and hooded mergansers have all been documented throughout the basin and observed in small numbers at some of the sites. Mallards and other "dabbler" types of ducks have recently also been identified as opportunistic, piscivorous predators if ideal conditions are present. 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-type ducks likelihood of success assumes that they are only 1/3 as likely to 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 and mallards. Once hazing pressure was applied, mammalian feeders, primarily North American river otter, tended to shift toward nocturnal feeding. This behavior limited the effectiveness of hazing efforts by YN. Although hazing efforts were very beneficial, predation still occurred at these locations. To try and 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 (kg) 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 predator consumption varied between acclimation ponds (Figure 7). Pond shape, pond size, numbers of coho, geographic location, riparian area, and aquatic vegetation all affect the predator abundance and predation mortality.

Various predators were observed at all of the upper basin acclimation locations. Piscivorous avian and mammalian predators at Butcher Pond included hooded mergansers, belted kingfishers, blue herons, and two North American river otters. Coulter Creek Pond had the second highest number of predator sightings. Observed avian piscivorous predators include hooded mergansers, blue herons, and mallards. Although the mallard piscivorous dietary intake is relatively unknown, these opportunistic individuals have been observed occasionally feeding on coho pre-smolts. Predator sightings at Rohlfing's pond included hooded mergansers, belted kingfishers, mallards, and otter. Beaver Creek Pond had the lowest number of predator sightings. Common avian piscivorous predators sighted include blue herons, hooded mergansers, and otter. Although the lowest number of individual predators occurred at Beaver, the mortality accrued was consistent with other sites.

In the Methow basin, the 2008 acclimation season was the first year that the aforementioned predation assessment model was employed at WNFH. Although there was no data from previous years to cross-reference, results from observations in 2008 underlined the importance of the information this model provides in accounting for both observed and unobserved predation. At WNFH in 2008, estimated predation on MCR juveniles reared within the on-station raceways was significantly higher (9.9%; *n*=26,700) than all other Upper Columbia acclimation locations (Figure 6). In comparison, known predation (deceased smolts extracted by hatchery staff) on these MCR juveniles accounted for just 3.0% (*n*=8,042). Although an increased effort in predation control was exercised in 2008, large concentrations of avian predators were observed preying on coho juveniles with an assumed high rate of success. The hatchery facility is surrounded by a densely wooded area that provides year-round habitat for a wide variety of piscivorous predators. In addition, dabbling duck species such as the Mallard (*Anas Platyrhynchos*) have, presumably, learned over the years to congregate within the facility grounds in order feed on vulnerable smolts in preparation for pair bonding and migration. This has been a serious problem in previous years and continues to be a priority issue. As of this reporting period, new predation netting with lead-lined edges was being placed on each individual raceway. In addition, WNFH staff has installed several electronic, rotating predator deterrents. In the future, YN staff will continue to work with WNFH staff to increase hazing efforts in hopes of reducing these losses.

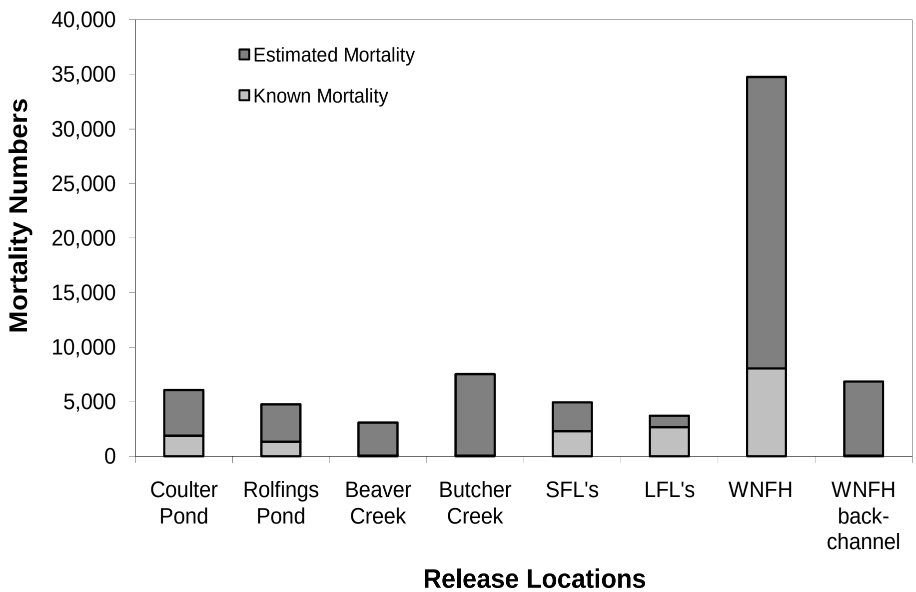

Figure 6. Known and estimated mortality at all acclimation sites in the Wenatchee River Basin, 2008.

4.4.1.2 PIT tag Detection

In addition to documenting predator abundance and estimating mortality, select locations had an in-pond survival estimate measured with the use of PIT tags. Each selected group that was tagged varied in the proportion of PIT tagged fish, but a minimum of 6,000 tags were designated for target acclimation ponds to provide for both estimates of in-pond survival and release-to-McNary Dam survival.

During 2008, we installed PIT tag antenna arrays at Rohlfing’s Pond and Butcher Pond in Nason Creek, and in the WNFH Spring Creek back channel.   These sites will be repeated in 2009 to provide multiple years of data. Only sites with maintained outlet detection systems could be used for measuring in-pond survival with PIT tags and for a comparison of methods to measure in-pond survival (PIT tag vs. predation model).

In-pond survival was estimated by the following formula:

$$S_{ip} = \frac{(D_{outlet} / E_{detection})}{PIT_{total}}$$

Where S_{ip} = in-pond survival, D_{outlet} = unique detections at the pond outlet, $E_{detection}$ = estimated PIT detection efficiency at the outlet, and PIT_{total} = the total number of PIT tagged fish released into the pond.

We estimated the efficiency of the PIT tag arrays installed at the outlets with the following formula.

$$E_{detection} = \frac{\text{\# unique outlet detections that were also detected downstream}}{\text{Total number of downstream detections}}$$

By querying the PTAGIS database for downstream PIT tag detections for fish released from a given acclimation pond we able to estimate the efficiency of our antennas by determining the proportion of the fish detected downstream that were also detected exiting the pond. Estimates of detection efficiency and in-pond survival for each site with PIT tag arrays can be found in Table 12.

Table 12. Estimates of in-pond survival and PIT tag detection efficiency.

	Butcher Creek Pond	Rohlfing's Pond	WNFH Spring Creek Channel
Total PIT tags	5742	5892	6723
Unique Detections at Outlet	4717	4357	2563
Proportion of Tags detected at Outlet	0.821	0.739	0.381
Total Unique Downstream Detections	1297	1069	713
Downstream Detections also Detected at Pond Outlet	1215	802	364
Est. Detection Efficiency	**0.937**	**0.750**	**0.510**
Est. Total Tags Exiting the Pond	5035	5807	5020
Est. In-Pond Survival	**0.877**	**.986**	**0.747**

A comparison of in-pond mortality estimates based upon PIT tags and the predator consumption model can be found in Figure 7. Typically, the predator consumption model underestimates the in-pond mortality rate as measured with PIT tags, however, since it is not possible to install PIT tag detection capabilities at all release locations, we will continue to estimate in-pond mortality using both methods.

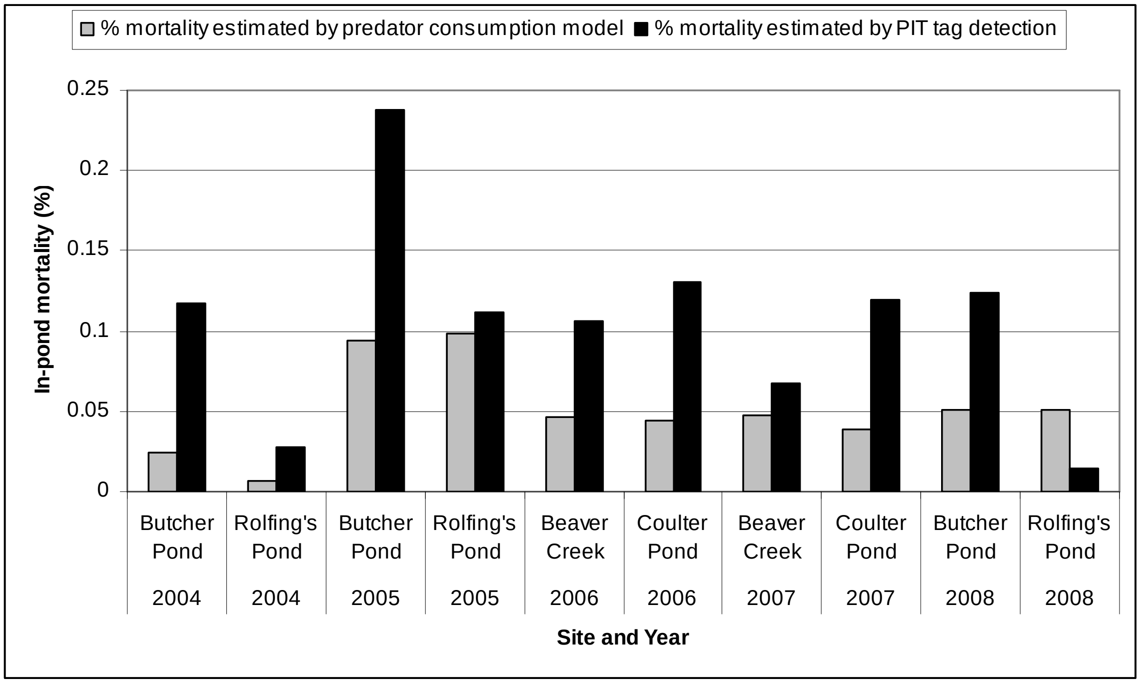

Figure 7. Comparison of in-pond mortality estimation methods; PIT tag versus a predator consumption model (2004-2008).

5.0 SURVIVAL RATES

5.1 Smolt Survival Rates – Release to McNary Dam

5.1.1 2007 Wenatchee Smolt Survival

As mentioned in the 2007 annual report, analyses of previous years' (BY2005) migratory releases would be incorporated into this document. 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 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 of the 2007 releases (BY2005) in the Wenatchee River Basin can be found in Table 13.

Table 13. PIT tag release numbers and locations, 2007.

Basin	Release Tributary	Release Location	Rearing Facility	Brood Origin	n	Survival to McNary
Wenatchee	Beaver Creek	Beaver Creek Pond	Cascade FH	MCR	3,491	47.4%
		Beaver Creek Pond	Willard NFH	MCR	3,396	70.2%
	Nason Creek	Rohlfing's Pond	Willard NFH	MCR	3,993	45.0%
		Coulter Creek Pond	Cascade FH	MCR	3,408	55.5%
		Coulter Creek Pond	Willard NFH	MCR	3,495	53.5%
	Icicle Creek	SFL	Willard NFH	MCR	4,982	73.1%
		SFL 17*	Willard NFH	MCR	1,985	39.4%
		LFL	Willard NFH	MCR	2,879	86.4%
		LFL	Cascade FH	MCR	2,993	86.7%

* Although SFL 17 was released from the same location at the remaining SFLs, the release-to-McNary survival estimate substantially lower than the rest of the raceways; for this reason data for SFL 17 is reported independently from the othr SFLs. Other on-station variables (disease, problematic release, etc.) may have contributed to this skewed result (Neeley 2007).

5.1.2 2008 Methow and Wenatchee Smolt Survival

Release-to-McNary survival rates for the 2008 release (BY2006) was not available at the time the report was being written and will be included in the 2009 annual report. PIT tag release numbers and locations for the 2008 releases can be found in Table 14.

Table 14. PIT tag release numbers and locations, 2008.

Basin	Release Tributary	Release Location	Rearing Facility	Brood Origin	n	Survival to McNary[a]
Wenatchee	Nason Creek	Rohlfing's Pond	Willard NFH	MCR	3,003	N/A
		Rohlfing's Pond	Cascade FH	MCR	3,004	N/A
		Butcher Pond	Cascade NFH	MCR	6,005	N/A
	Icicle Creek	SFL	Willard NFH	MCR	3,006	N/A
		SFL	Cascade FH	MCR	2,687	N/A
		LFL	Willard NFH	MCR	3,002	N/A
		LFL	Cascade FH	MCR	3,002	N/A
Methow	Methow River	WNFH back-channel	Willard NFH	MCR	7,504	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 (SAR) for Brood Year 2004

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

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

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 using methods one, two, and three for total escapement have been consistent in previous years.

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

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

Estimated run size for the Wenatchee and Methow basins in 2007, using the aforementioned methods, can be found in Tables 14 and 15. Smolt-to-adult survival rates for the Wenatchee and Methow basins are summarized in Tables 16 and 17.

Table 15. Estimated coho run size to the Wenatchee River, 2007.

Method	Est. Run Size
1) Dryden Dam counts expanded for non-trapping days plus redds located below Dryden Dam[1]	4,269 (3,942 adults & 327 jacks)
2) Redd counts plus broodstock collected[1]	4,712 (4,547 adults & 165 jacks)
3)Tumwater Dam counts, redds below Tumwater Dam, and broodstock collected[1]	5,031 (4,861 adults & 170 jacks)
4) Mainstem Dam Counts	12,603 (11,970 adults & 633 jacks)

[1]Each redd count was expanded by 2.12 fish per redd based on the sex ratio of coho observed at Dryden Dam, 1.12M:1F.

Table 16. Estimated coho run size to the Methow River, 2007.

Method	Est. Run Size
1) Redd counts plus broodstock collected [1]	1,601 (1,583 adults & 18 jacks)
2) Wells Dam Counts plus Wells Dam broodstock collected[2]	2,820 (2,801 adults & 19 jacks)

[1] Each redd count was expanded by 2.16 fish per redd based on the sex ratio of coho observed at Wells Dam, 1.16M:1.F

[2] Coho collected for broodstock at Wells Dam were not incorporated into daily fish passage counts for 2007. 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 the Wenatchee Basin, we used scale analysis to verify the origin of any coho without CWTs. SARs for naturally produced coho were based on an estimate of the number of natural origin adults returning to the basin and an estimate of smolt emigration from the basin for the same brood year. The smolt emigration estimate was provided by WDFW from data collected at smolt trap in the lower Wenatchee River.

SARs for natural origin fish in the Methow are pending completion of scale analysis for fish origin verification. All SARs reported for hatchery origin returns to the Methow River should be considered provisional until scale analysis and a complete estimate of run composition (numbers of hatchery origin and natural origin returns) can be completed.

Table 17. Wenatchee River brood year 2004 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	6 weeks	MCR	Willard NFH	611	82,688	0.74%
Coulter Ck. Pond	3 weeks	MCR	Cascade FH	259	78,295	0.33%
	3 weeks	MCR	Willard NFH	71	31,918	0.22%
Rolfing's Pond	6 weeks	MCR	Cascade FH	285	73,316	0.39%
	6 weeks	MCR	Willard NFH	36	31,931	0.11%
Nason Ck. Wetlands	direct release	MCR	Willard NFH	36	34,088	0.11%
Leavenworth NFH: Large Foster Lucas Ponds	7 weeks	MCR	Cascade FH	961	143,818	0.67%
	7 weeks	MCR	Willard NFH	453	113,599	0.40%
Leavenworth NFH: Small Foster Lucas Ponds	7 weeks	MCR	Cascade FH	975	185,598	0.53%
	7 weeks	MCR	Willard NFH	945	170,796	0.55%
	13 weeks	MCR	Willard NFH	506	112,871	0.45%
TOTAL		**MCR**		**5138**	**1,058,918**	**0.49%**
Naturally Produced Coho[c]		**MCR**	**N/A**	**231**	**14,106**	**1.64%**

[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] An estimated return to the basin of 5,031 fish (method 3) was used in the calculation of BY2004 SARs.
[c] Naturally produced coho were positively identified through scale analysis.

A comparison of smolt-smolt survival and smolt-to-adult survival across years (1999 through 2005) can be found in Table 19.

Table 18. Methow River brood year 2004 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)	Cascade FH	821	174,601	0.47%
	N/A reared on -station	MCR (Methow)	Winthrop NFH	50	34,477	0.13%
WNFH Back Channel	8 weeks	MCR (Wenatchee)	Cascade FH	180	74,259	0.24%
Wells FH	6 weeks	MCR (Wenatchee)	Cascade FH	550	145,835	0.38%
Total				**1601**	**286,337**	**0.37%**
Naturally Produced Coho[c]			**N/A**	**N/A**	**N/A**	**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 1,601 fish (method 1) was used in the calculation of BY2004 SARs. All SARs should be considered provisional until the natural origin run component is determined.
[c] SARs for naturally produced coho are not available at this time. Result will be included in future drafts a will likely decrease hatchery survivals.

Table 19. Hatchery comparison of smolt-to-smolt and smolt-to-adult survival rates, brood years 1997-2004.

Brood Year	Release Year	Methow R. Smolt Survival	Icicle Creek Smolt Survival	Nason Creek Smolt Survival	Return Year	Methow R. Smolt-Adult Survival	Wenatchee R. Smolt-Adult Survival
1997	1999	N/A	53.9%	N/A	2000	N/A	0.21% - 0.38%
1998	2000	33.3%	63.0%	N/A	2001	0.17% - 0.27%	0.17% - 0.86%
1999	2001	9.9%	21.6%	N/A	2002	0.03%	0.03%-0.13%
2000	2002	N/A	87.4% - 78.5%	39.3%	2003	0.15%	0.32%-0.51%
2001	2003	N/A	62.8%	37.2%	2004	0.16%	0.33% - 0.55%
2002	2004	26.1% - 29.5%	56.3% - 60.8%	30.5%-36.2%	2005	0.19%	0.29%-0.47%
2003	2005	N/A	34% - 44%	16%-18%	2006	0.18%	0.15% - 0.37%
2004	2006	N/A	37% - 51%	16% - 47%	2007	0.13%-0.47%	0.11% - 0.74%
2005	2007	N/A	39.4% -	45.0% -	2008	N/A	N/A

			86.7%	53.5%			

6.0 SUMMARY

The long-term vision for the mid-Columbia coho reintroduction project is to re-establish 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.

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 2007-2008; results are briefly summarized below.

- Between September 3 and November 14, we collected 1,015 coho at Dryden Dam, Leavenworth NFH, and Tumwater Dam on the Wenatchee River. At Winthrop NFH and Wells Dam, 738 coho were collected for the Methow River program between September 23 and November 25. Excess coho for the Methow program were returned to the river to naturally spawn. 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 984 coho at Entiat NFH and 550 at Winthrop NFH. An eye-up rate of 89.3% was calculated for the Wenatchee program and 90.6% 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 2007, we found a total of 1,671 coho redds: 1,267 redds in Icicle Creek, 10 redds in Nason Creek, 259 redds in the Wenatchee River and a combined 135 redds in Brender, Mission, and Peshastin creeks.

- During spawning ground surveys in the Methow Basin for 2007, we found a total of 391 coho redds, of which, 306 were identified in-basin. Of the total in-basin redds, 176 were on the Methow River, 73 in Spring Creek (WNFH back-channel), 49 in the WDFW Methow FH outfall, and 8 in Beaver Creek. Out-of-basin totals were as follows: 71 redds in Beebee Springs (Chelan FH outfall), 13 in Chelan Falls, and 1 in Foster Creek.

- Acclimating pre-smolts on local waters is an essential component to the restoration program. Smolt release numbers for the Methow and Wenatchee rivers in 2008 were 519,585 and 989,508 fish, respectively. Coho within the Methow program were released from Winthrop NFH (on-station raceways and the outfall channel) and Wells FH and achieved an estimated 92.4% transport-to-release survival for the on-station releases. This was lower than previous year's survival but was likely because predation observations were conducted and documented at Winthrop NFH and Wells FH. In the Wenatchee basin, overall survival was 97.0% from transport to release, a slight increase from 2007 (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 in 2007, we estimate that 39.4%-86.4% of brood year 2004 mid-Columbia River brood coho survived from release in Icicle Creek to McNary Dam. We estimated that 45.0%-55.5% of fish released into Nason Creek (Coulter Creek Pond and Rolfing's Pond) survived to McNary Dam. In addition to the Nason Creek releases, PIT tagged fish were released in Beaver Creek (upper Wenatchee River site) in 2007. Estimated survival form release to McNary ranges from 47.4%-70.2%. The 2008 PIT tag releases occurred at LNFH, Butcher Creek Pond, Rohlfing's Pond, and WNFH back-channel. Results are pending.

- We estimate that the overall smolt-to-adult survival rate (SAR) for brood year 2004 hatchery coho smolts released in the Wenatchee River basin is 0.49% (5,031 adults and jacks) for all release groups. However, the smolt-to-adult survival rate varied between release groups (range 0.11% - 0.74%). Using scale analysis for verification of fish origin, we estimated the SAR for naturally produced coho to be 1.64%.

- In the Methow River, we estimate that the overall smolt-to-adult survival rate (SAR) for brood year 2004 hatchery coho is 0.37%. The SARs for each release group ranged from 0.13% to 0.47%. Scale analysis verification of potential natural origin fish has not been completed but will be available in future analyses and reports.

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, Dan Mellenberger, and Kraig Mott, assisted with field data collection. Debbie Azure, Loverne George, 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 the Eastbank FH 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: 2008 NASON CREEK SMOLT TRAP REPORT

Integrated Status & Effectiveness Monitoring Program

Population Estimates for Juvenile Salmonids in Nason Creek, WA

2008 Annual Report

March 2009

Prepared by:
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Project No. 2003-017-00 and No. 1996-040-00
Contract No. 38410 and No. 38968

ABSTRACT

This report summarizes juvenile coho, spring Chinook, and steelhead salmon migration data collected at a 1.5m diameter cone rotary fish trap on Nason Creek during 2008; 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 2, 2008 and was suspended on December 11, 2008 when snow and ice accumulation prevented operation.

During 2008, 0 brood year (BY) 2006 coho, 1 BY2007 coho, 906 BY2006 spring Chinook, 323 BY2007 fry Chinook, 2,077 BY2007 subyearling Chinook, 169 steelhead smolts, 414 steelhead fry and 2,390 steelhead parr were trapped.

Mark-recapture trap efficiency trials were performed over a range of stream discharge stages. A total of 2,639 spring Chinook, 2,154 steelhead and 12 bull trout were implanted with Passive Integrated Transponder (PIT) tags. Most PIT tagged fish were used for trap efficiency trials. We were unable to identify a statistically significant relationship between stream discharge and trap efficiency, thus, pooled efficiency estimates specific to species and trap size/position were used to estimate the number of fish emigrating past the trap. We estimate that 5,259 (± 359; 95% CI) BY2006 Chinook, 16,816 (± 731; 95% CI) BY2007 Chinook, and 47,868 (± 3,780; 95% CI) steelhead parr and smolts emigrated from Nason Creek in 2008.

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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), extending 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. Trap operation was conducted in compliance with ESA consultation. 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 providing data to develop a spawner-recruit relationship in Nason Creek. Tissue samples are collected from Chinook, steelhead smolts 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, and survival of juvenile spring Chinook and steelhead in the Wenatchee Basin (Murdoch et al. 2005). Beginning in 2008, PIT tags were also implanted into bull trout >70mm in length to support GCPUD's bull trout planning and monitoring.

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 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 2 and December 11, 2008. Data collected during fall of 2007 is presented with the spring 2008 data to produce a complete population estimate for the BY 2006 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 RK along the mainstem 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).

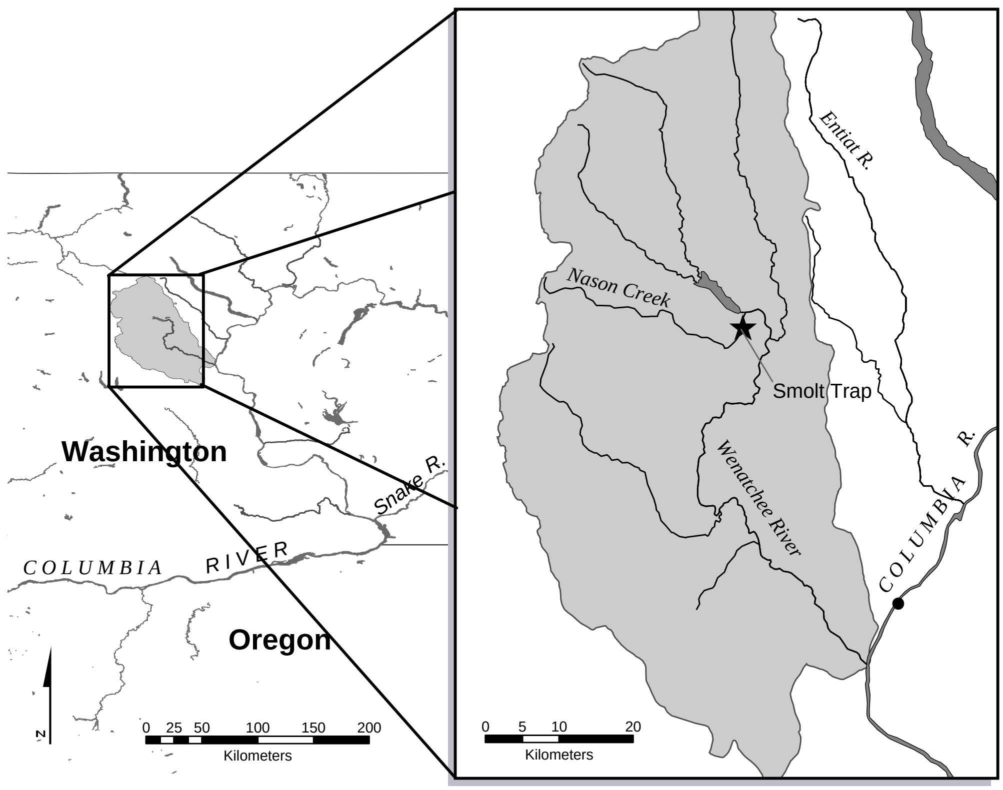

Figure 1. Nason Creek Smolt trap location.

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 2008 trapping season (March 2, 2008 through December 12, 2008) was 410 cfs (Figure 2 and Appendix A). The discharge and temperature 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.

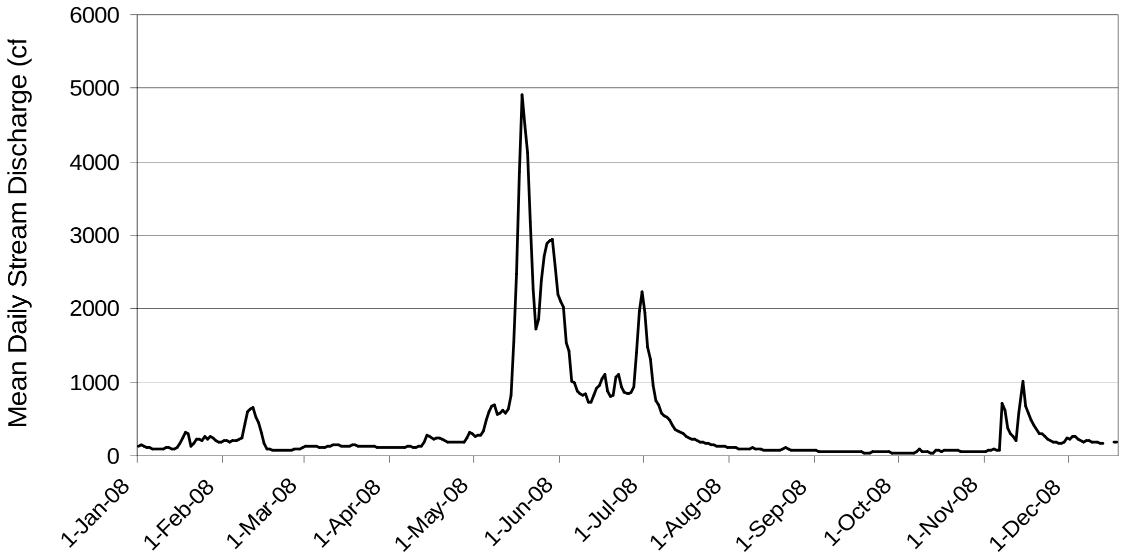

Figure 2. Mean daily stream discharge at the Nason Creek DOE stream monitoring station, RK 1, January 1, 2008 through December 18, 2008.

During the months we operated the trap, the mean daily water temperatures recorded at the DOE monitoring station ranged from a low of 0.01 °C to a high of 18.2°C (Figure 3). Daily mean stream temperature measurements taken by the Washington State DOE during water years 2008 are provided in Appendix A.

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 mean daily water temperatures did not reach 21° C in 2008 (Figure 3).

Figure 3. Mean daily water temperature at the Nason Creek DOE stream monitoring station, RK 1, January 1, 2008 through December 18, 2008.

2.0 Methods

2.1 Trapping Equipment and Operation

A floating rotary smolt trap with a 1.5m 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 pulley connected to a river-spanning cable and was positioned laterally in the thalweg with a 'come-along' type puller. We used two main trap positions during 2008; a 'back' position during high water (~110 to 2720 cfs) in the spring and 'forward' position located10 meters upstream during low water (~ 30 to 110 cfs) in the summer/fall. Trap operation was suspended occasionally due to both high and low stream flows, debris, or hatchery releases. Stream discharge lower than 40 cfs necessitated raising the cone slightly to avoid touching the streambed and trap operations were generally suspended when stream discharge approached ~2000 cfs to avoid the influx of potentially hazardous debris (See '**Appendix B: Daily Trap Operating Status'**).

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 ≥ 90 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 aquarium bubblers and were allowed to fully recover before being released downstream from the trap.

Fin clips of naturally produced spring Chinook, steelhead, and bull trout were retained for genetics research and reproductive success evaluation being conducted by WDFW, NMFS and GDPUD. Fin clips from Chinook and steelhead also facilitated trap efficiency trials (See '**Mark-Recapture Trials'**).

Length and weight were recorded for all fish except on days when large numbers of fry from a single species were collected; a sub-sample 25 fry of each species were measured and weighed while the rest were tallied. 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 (K-factor) 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 three days prior and three 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 discharges 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'**). All marked groups 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 included as a marks for naturally produced spring Chinook, steelhead and coho measuring 60 mm FL and greater. Fin clips of naturally produced spring Chinook and steelhead were retained for genetics research and reproductive success evaluation being conducted by WDFW and NMFS. Bull trout were PIT tagged to support GCPUD bull trout monitoring and planning efforts.

Fish to be PIT tagged were handled as described above (See '**Biological Sampling'**). Once anesthetized, each fish was examined for any wounds or descaling, 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 electronically 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) as well as with 2008 ISEMP protocols.

After marking and/or PIT tagging, fish were held for a minimum of 24-hours in holding boxes at the trap to ensure complete recovery, assess tagging mortality and to recover any shed tags. Fish were then transported in 5-gallon buckets 1.4 km upstream to the release site. At the release site, marked and/or PIT tagged fish were held until dark in an automated-mechanical release box.

A timer on the box was set to release marked fish directly from the box between 10pm and 12am. 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.

2.4.2 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:

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.

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

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

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:

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:

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

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

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

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

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.

3.0 Results

3.1 Dates of Operation

We deployed the trap and began operating on March 2. 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 1). Detailed documentation of operating dates can be found in Appendix B.

Table 1. Summary of Nason Creek rotary trap operation, 2008.

Trap Status	Description	Days Operating	Days Not Operating
Operating	Continuous	263	
Interrupted	Stopped by Debris		11
Not Operating	High Flow		19
Not Operating/ Interrupted	Low Flow		0
Not Operating	Hatchery Release		3
	Total Days 290	**257 (88.6%)**	**33 (11.4%)**

3.2 Emigration Timing

3.2.1 Coho Yearlings (BY 2006)

No yearling coho were captured at the Nason Creek trap in 2008.

3.2.2 Coho Subyearlings (BY 2007)

We collected one subyearling coho on October 13, 2008. There were no mortalities for this species. Fork length (mm), weight (g), and K-factor can be found in Table 2.

Table 2. Summary of length and weight sampling conducted on subyearling coho captured at the Nason Creek rotary trap in 2008.

Brood	Origin/Stage	Fork length (mm)			Weight (g)			K-factor
		Mean	N	Mean	Mean	N	SD	
2007	Wild Parr	87	—	—	6.4	—	—	1.0

3.2.3 Spring Chinook Yearlings (BY 2006)

We collected 906 yearling Chinook between March 2 and May 30. Peak catch occurred on April 29 (n = 77; Figure 5). We estimate that an additional 12 yearlings would have been captured if the trap had operated without interruption during the entire period. Four 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 3.

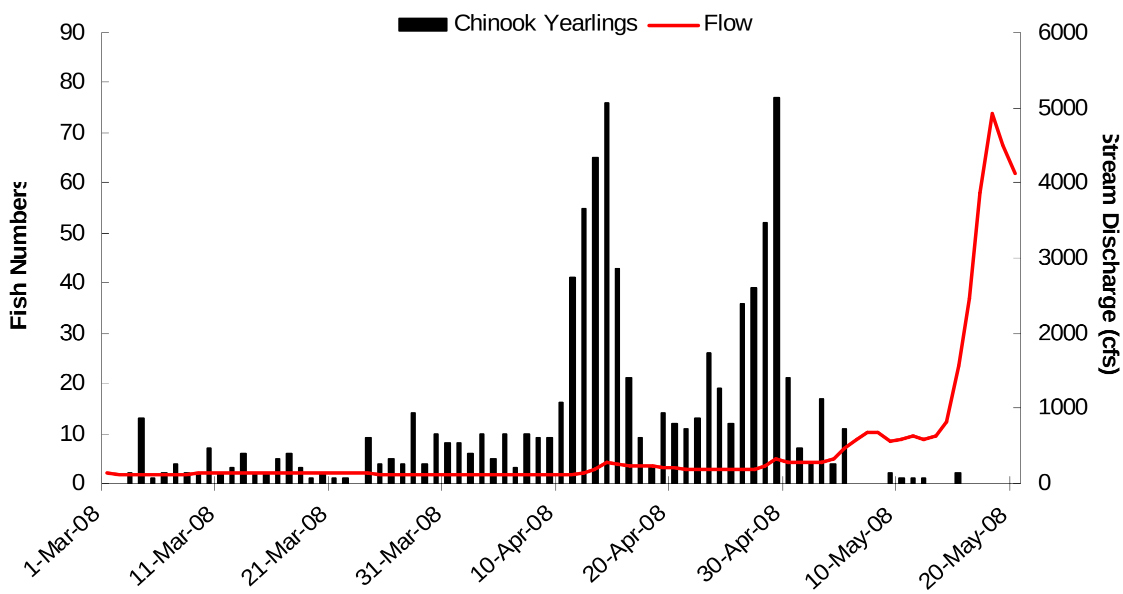

Figure 4. Spring Chinook yearling counts, run timing, and mean daily stream discharge at the Nason Creek rotary trap, March 1 through May 20, 2008.

Table 3. Summary of length and weight sampling conducted on spring Chinook captured at the Nason Creek rotary trap in 2008.

Brood	Origin/Stage	Fork Length (mm)			Weight (g)			K-Factor
		Mean	N	SD	Mean	N	SD	
2006	Wild Yearling	96.1	904	6.6	9.5	904	2.1	1.1
2007	Wild Fry	42.8	127	4.6	0.8	127	0.4	1.0
2007	Wild Parr	75.8	2049	12.5	5.2	2049	2.4	1.2

3.2.4 Spring Chinook Fry (BY2007)

We collected 323 fry Chinook during 2008 between March 3 and June 30. Peak capture occurred on June 8 (n = 16). We estimated that an additional 19 fry would have been captured if the trap had been operated without operation for the duration of this period. Spring chinook fry were not included in population estimates. After July 1, all BY2006 spring Chinook were considered subyearling parr. There were 11 fry mortalities; these were likely caused by woody debris collected by the cone and inadvertently circulated with trapped fish (see '**3.6 ESA compliance**'). Fork Length (mm), weight (g), and K-factor at the time of migration can be found in Table 3.

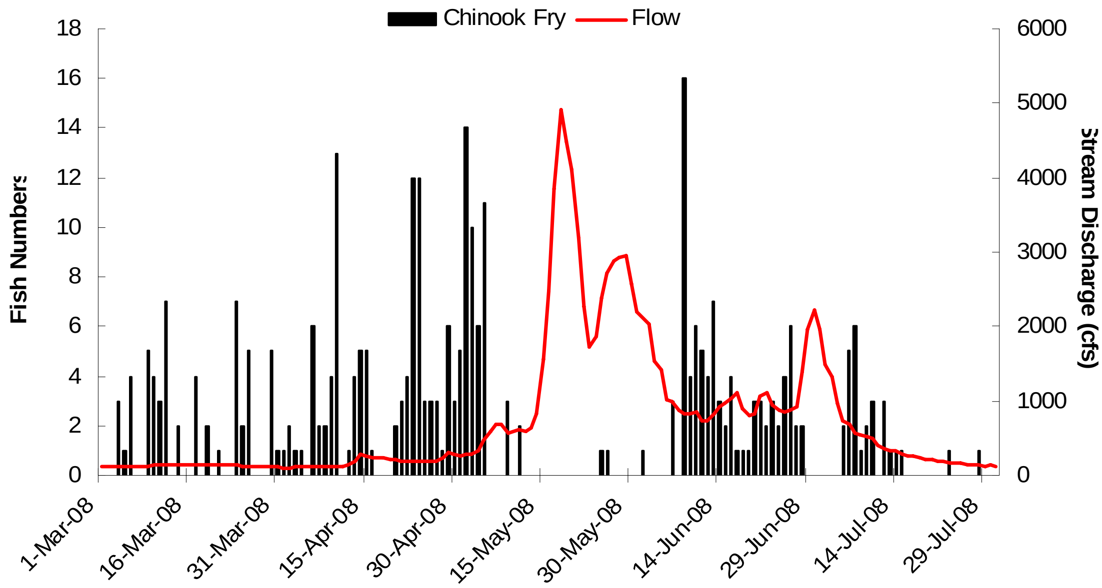

Figure 5. Spring Chinook fry counts, run-timing, and mean daily stream discharge at the Nason Creek rotary trap, March 1 through July 30, 2008.

3.2.5 Spring Chinook Subyearling (BY 2007)

We collected 2077 subyearling Chinook between May 31 and December 12, 2008 (Figure 6). The distribution of the subyearling Chinook catch was somewhat bimodal with the first peak occurring on Aug 9 (n = 60) and the second peak occurring on November 10 (n = 89). We estimate that an additional 290 subyearlings would have been captured if the trap had been operated without interruption during this period. There were 16 spring Chinook subyearling mortalities; these were likely caused by woody debris collected by the cone and inadvertently circulated with trapped fish (see '**3.6 ESA compliance**'). Fork length (mm), weight (g), and K-factor at the time of migration can be found in Table 3.

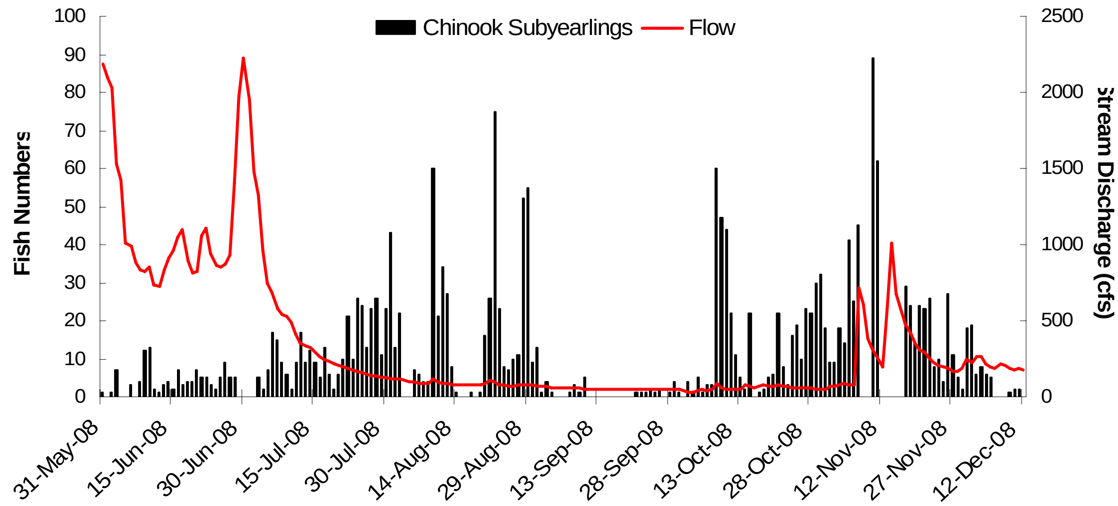

Figure 6. Spring Chinook subyearling counts, run-timing, and mean daily stream discharge at the Nason Creek rotary trap, May 31 through December 12, 2008.

3.2.6 Steelhead/Rainbow Trout Smolts

We collected 169 steelhead smolts and transitional smolts between March 2 and June 30 (Figure 7). Peak capture occurred on May 5 (n = 18). We estimated that an additional 24 smolts would have been captured if the trap had been operated without interruptions during this period. No steelhead smolt mortalities occurred due to trapping. Additionally, 2,036 hatchery steelhead smolts were captured between April 12 and December 4. At the time of this draft, length at age data from scale analysis was not yet available. Table 4 provides the mean length and k-factor for emigrating steelhead. This report will be revised when scale/age data becomes available.

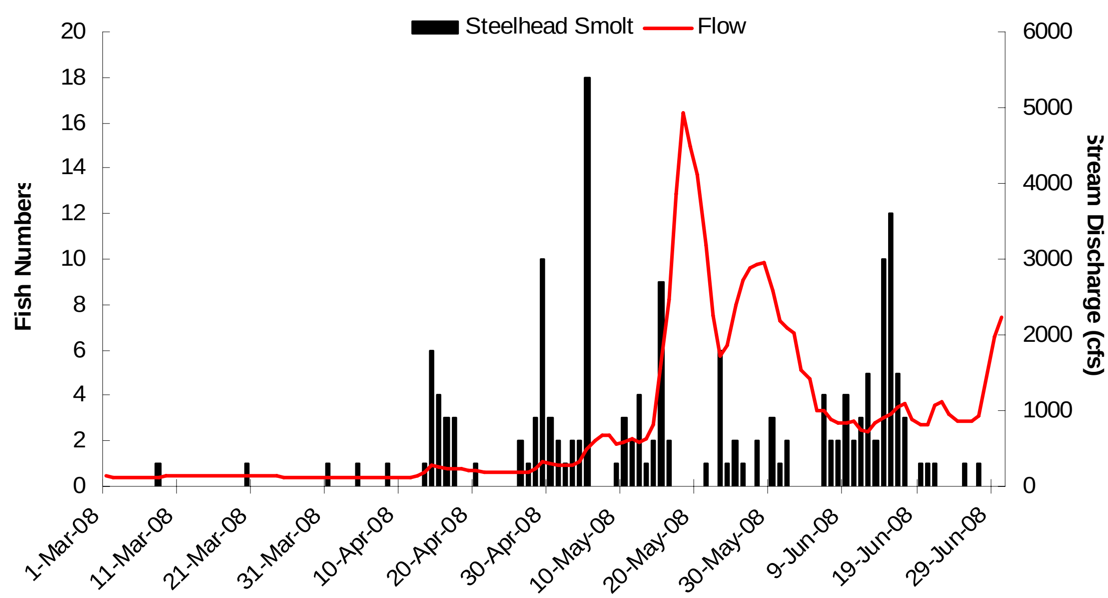

Figure 7. Steelhead smolt counts, run-timing, and mean daily stream discharge at the Nason Creek rotary trap, March 1 through June 30, 2008.

Table 4. Summary of length and weight sampling conducted on multiple year class steelhead at the Nason Creek rotary trap in 2008.

Brood Year[1]	Origin/Stage	Fork Length (mm)			Weight (g)			K-Factor
		Mean	N	SD	Mean	N	SD	
N/A	Wild Smolt	128.5	169	33	25.3	169	18.3	1.2
N/A	Wild Fry	42.7	390	5.0	0.8	390	0.5	1.0
N/A	Wild Parr	79.8	2380	21.0	6.7	2380	7.9	1.3

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

3.2.7 Steelhead/Rainbow Trout Fry

We collected 414 BY 2007 steelhead/rainbow trout fry between July 1 and December 11 (Figure 8). The first fry was trapped on July 25. Peak capture occurred on August 28 (n = 46). We estimated that and additional 7 fry would have been captured if there had been no interruption to trapping during this period. There were no mortalities. Fork length (mm), weight (g), and K-factor at the time of migration can be found in Table 4.

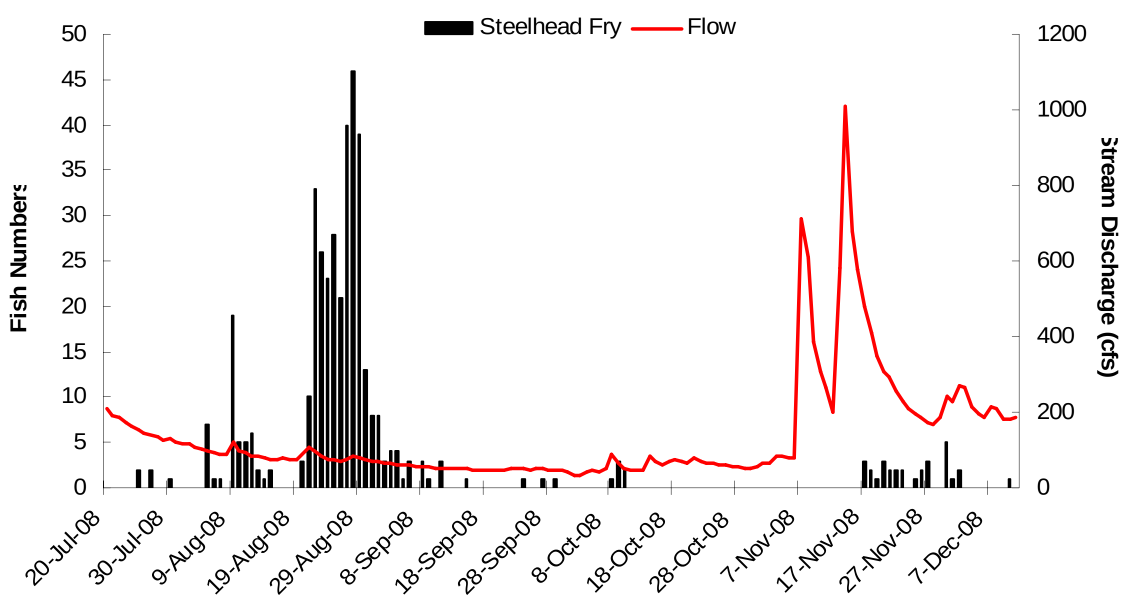

Figure 8. Steelhead/rainbow trout fry counts, run-timing, and mean daily stream discharge at the Nason Creek smolt trap, July 20 through December 12, 2008.

3.2.8 Steelhead/Rainbow Trout Parr

We collected 2390 steelhead parr from multiple age classes between March 2 and December 11 (Figure 9). The first parr was trapped on March 2, with peak emigration occurring on April 29 (n = 119) with relatively moderate numbers trapped throughout the trapping season. We estimated that an additional 326 parr would have captured if there had been no interruptions to trapping during this period. There were 21 summer steelhead parr mortalities; these were likely caused by woody debris collected by the cone and inadvertently circulated with trapped fish (see '**3.6 ESA compliance**'). Fork Length (mm), weight (g), and K-factor at the time of migration can be found in Table 4.

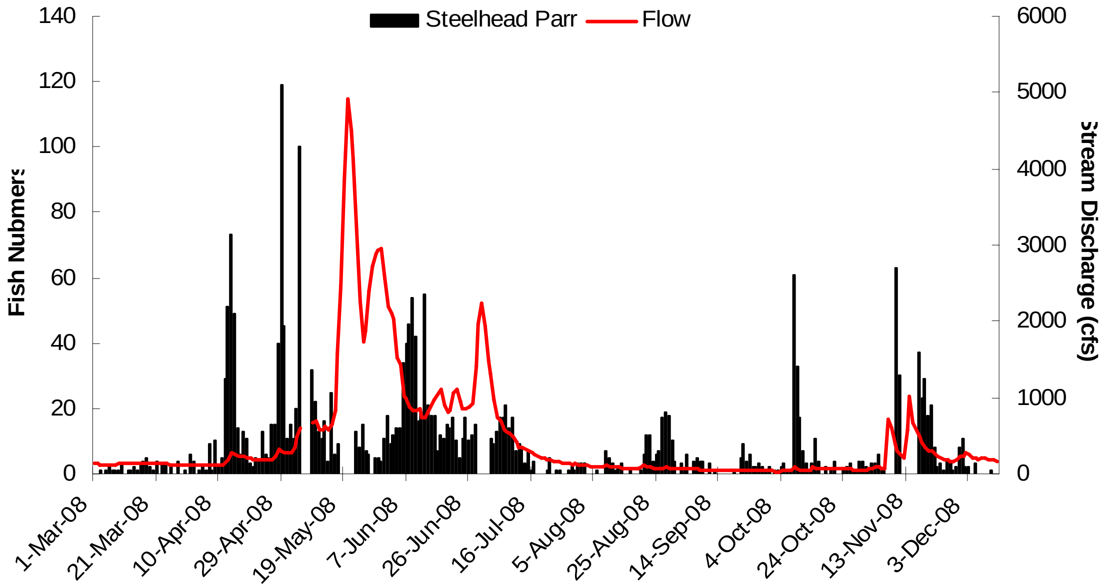

Figure 9. Steelhead parr counts, run-timing, and mean daily stream discharge at the Nason Creek rotary trap, March 1 through December 12, 2008.

3.3 Trap Efficiency Calibration and Population Estimates

3.3.1 Coho Yearlings (BY 2006)

No yearling coho were trapped in 2008. Brood year population estimates and estimated egg-to-emigrant survival rates can be found in Table 5. .

Table 5. 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	12,543	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	0	5	0.04	1.3
2007	3	9,669	1	—	—	—	—

[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 2006)

We completed 24 marked group releases using 759 yearling Chinook in 2008 (Table 6). Of these releases six had sample sizes greater than 25 and were included in the linear regression analysis. Releases in 2007 were combined with previously collected mark recapture data to increase the sample size and statistical power. The result of the linear regression was not significant (p=0.80, r^2=0.001). A pooled trap efficiency of 17.4% (Table 7) was used to estimate yearling Chinook production in Nason Creek. From July through November 2007, we estimated that 5,295 (± 930 95% CI) BY2006 subyearling Chinook emigrated from Nason Creek. In spring of 2008, we estimate that 5,259 (± 359; 95% CI) BY2006 yearling Chinook emigrated from Nason Creek from March 1 through May 30 (Table 7). The total population estimate for BY2006 juvenile Chinook emigrants is 10,554 (± 597; 95% CI) (Table 8).

Table 6. Mark/recapture efficiency trials used to estimate emigration of yearling Chinook in Nason Creek. All releases were used for a pooled estimate; Only releases with >25 fish were used in the regression analysis.

Date	Trap Position	Yearling Chinook Released	Yearling Chinook Recaptured	Yearling Chinook Efficiency (%)	Nason Creek Discharge (cfs)
4-Mar	Back	2	0	0.0	125
5-Mar	Back	13	3	23.1	123
6-Mar	Back	1	1	100.0	120
7-Mar	Back	2	0	0.0	117
8-Mar	Back	2	1	50.0	120
9-Mar	Back	2	0	0.0	129
10-Mar	Back	2	0	0.0	130
12-Mar	Back	11	4	36.4	145
17-Mar	Back	12	3	25.0	137
20-Mar	Back	6	1	16.7	140
24-Mar	Back	10	3	30.0	131
27-Mar	Back	13	2	15.4	120
31-Mar	Back	23	3	13.0	108
3-Apr	Back	24	4	16.7	109
7-Apr	Back	23	0	0.0	123
10-Apr	Back	18	8	44.4	118
14-Apr	Back	195	40	20.5	282
17-Apr	Back	72	13	18.1	235
21-Apr	Back	36	3	8.3	194
24-Apr	Back	57	8	14.0	186
28-Apr	Back	127	19	15.0	235

1-May	Back	102	16	15.7	271
12-May	Back	4	0	0.0	582
15-May	Back	2	0	0.0	1560

Table 7. 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]	9,084	9,084	--	--
2003	111	484,515	7,899	2,096	9,995	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	3.97	173
2006	152	726,256	5,295	5,259	10,554	1.45	69
2007	101	476,922	16,279	--	--	--	--

[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 parr collected during summer/fall and does not include captures of fry prior to July
[c] Data not collected

3.3.3 Spring Chinook Subyearlings (BY 2007)

We completed 44 marked group releases using 1,406 subyearling Chinook in 2008. Of these releases, 22 had sample sizes greater than 25 and were included in the linear regression analysis (Appendix E). These trial were combined with past year's trials to increase the sample size and statistical power. The result of the linear regression was significant (p = 0.03), how ever an r^2 value of 0.09 did not sufficiently explain the relationship between efficiency and discharge. A pooled trap efficiency of 11.9% ('back' trap position) and 14.5% ('forward' trap position; Table 8) was used to estimate the production of subyearling Chinook (BY 2007) in Nason Creek. We estimate that 16,816 (± 533; 95% CI) subyearling spring Chinook emigrated from Nason Creek in 2008.

Table 8. Mark/recapture efficiency trials used to estimate emigration of subyearling Chinook in Nason Creek. All releases were used for a pooled estimate; Only releases with >25 fish were used in the regression analysis.

Date	Trap Position	Subyearling Chinook Released	Subyearling Chinook Recaptured	Subyearling Chinook Efficiency (%)	Nason Creek Discharge (cfs)
9-Jun	Back	3	2	66.7	826
16-Jun	Back	3	0	0	1050

7-Jul	Back	1	0	0	576
10-Jul	Back	4	0	0	488
14-Jul	Back	10	3	30	320
17-Jul	Back	12	1	8.3	250
21-Jul	Back	12	0	0	193
24-Jul	Back	43	0	0	163
28-Jul	Back	54	8	14.8	134
31-Jul	Forward	60	15	25	121
4-Aug	Forward	16	0	0	101
7-Aug	Forward	14	2	14.3	89.4
12-Aug	Forward	103	2	1.9	85.6
14-Aug	Forward	31	2	6.5	79.6
21-Aug	Forward	42	8	19	107
22-Aug	Forward	75	11	14.7	97
25-Aug	Forward	33	2	6.1	73.5
28-Aug	Forward	72	7	9.7	81.9
1-Sep	Forward	23	4	17.4	68
4-Sep	Forward	3	1	33.3	61.3
8-Sep	Forward	2	0	0	56.2
11-Sep	Forward	5	0	0	52.3
22-Sep	Forward	1	0	0	51.3
25-Sep	Forward	4	1	25	47.9
29-Sep	Forward	4	1	25	45.7
2-Oct	Forward	5	2	40	33.3
6-Oct	Forward	7	2	28.6	42.3
9-Oct	Forward	110	22	20	63.5
13-Oct	Forward	36	3	8.3	46.6
16-Oct	Forward	24	2	8.3	62.6
20-Oct	Forward	12	3	25	65.7
23-Oct	Forward	33	5	15.2	65
27-Oct	Forward	51	12	23.5	56.1
30-Oct	Forward	84	15	17.9	53
3-Nov	Forward	35	10	28.6	82.1
6-Nov	Forward	78	8	10.3	77.7
13-Nov	Back	62	0	0	581
17-Nov	Back	29	8	27.6	480
20-Nov	Back	60	7	11.7	305
24-Nov	Back	43	9	20.9	210
27-Nov	Back	46	2	4.3	171
1-Dec	Back	38	10	26.3	226
4-Dec	Back	20	3	15	216
8-Dec	Back	3	0	0	207

3.3.5 Steelhead/Rainbow Trout Smolts and Parr

We completed 82 marked group releases for emigrating steelhead in 2008. Of the releases only 19 met the criteria to be included in the analysis (n≥25). The results of the regression were not significant (p = 0.08; r^2 = 0.28); pooled trap efficiencies of 1.8% ('upper' position), and 11.6% ('back' position; Table 9) were used to estimate the production of emigrating steelhead in Nason Creek. We estimate that 47,868 (± 3,780; 95% CI) steelhead emigrated from Nason Creek in 2008. At the time of this draft, scale analysis data was not available to calculate a brood year emigration estimate.

Table 9. 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.

Date	Trap Position	Steelhead Released	Steelhead Recaptured	Steelhead Efficiency (%)	Discharge (cfs)
4-Mar	Back	1	1	100	125
6-Mar	Back	1	0	0	120
7-Mar	Back	2	0	0	117
8-Mar	Back	1	0	0	120
9-Mar	Back	2	0	0	129
10-Mar	Back	1	0	0	130
12-Mar	Back	2	0	0	145
17-Mar	Back	6	1	16.7	137
20-Mar	Back	9	0	0	140
24-Mar	Back	6	0	0	131
27-Mar	Back	2	0	0	120
31-Mar	Back	2	1	50	108
3-Apr	Back	10	3	30	109
7-Apr	Back	11	1	9.1	123
10-Apr	Back	10	1	10	118
14-Apr	Back	149	46	30.9	282
17-Apr	Back	75	3	4	235
21-Apr	Back	17	1	5.9	194
24-Apr	Back	18	4	22.2	186
28-Apr	Back	74	11	14.9	235
1-May	Back	176	29	16.5	271
12-May	Back	55	8	14.5	582
15-May	Back	57	1	1.8	1560
26-May	Back	33	1	3	2720
29-May	Back	18	0	0	2950
2-Jun	Back	39	4	10.3	2030
5-Jun	Back	39	6	15.4	1010
9-Jun	Back	142	20	14.1	826
12-Jun	Back	83	10	12	727

16-Jun	Back	81	8	9.9	1050
19-Jun	Back	33	0	0	811
23-Jun	Back	34	3	8.8	943
26-Jun	Back	42	3	7.1	870
30-Jun	Back	17	0	0	2230
4-Jul	Back	9	2	22.2	961
7-Jul	Back	45	1	2.2	576
10-Jul	Back	49	2	4.1	488
14-Jul	Back	20	0	0	320
17-Jul	Back	12	0	0	250
21-Jul	Back	1	0	0	193
24-Jul	Back	6	0	0	163
28-Jul	Back	1	0	0	134
13-Nov	Back	24	0	0	581
17-Nov	Back	28	2	7.1	480
20-Nov	Back	47	1	2.1	305
24-Nov	Back	8	1	12.5	210
27-Nov	Back	6	0	0	171
1-Dec	Back	10	1	10	226
4-Dec	Back	3	0	0	216
31-Jul	Forward	6	0	0	121
4-Aug	Forward	3	0	0	101
7-Aug	Forward	1	0	0	89.4
12-Aug	Forward	15	0	0	85.6
14-Aug	Forward	5	0	0	79.6
18-Aug	Forward	2	0	0	75.8
21-Aug	Forward	1	1	100	107
25-Aug	Forward	5	0	0	73.5
28-Aug	Forward	4	0	0	81.9
1-Sep	Forward	3	0	0	68
4-Sep	Forward	1	0	0	61.3
8-Sep	Forward	2	0	0	56.2
15-Sep	Forward	1	0	0	49.1
22-Sep	Forward	5	0	0	51.3
25-Sep	Forward	6	0	0	47.9
29-Sep	Forward	3	1	33.3	45.7
2-Oct	Forward	2	0	0	33.3
6-Oct	Forward	1	0	0	42.3
9-Oct	Forward	54	2	3.7	63.5
13-Oct	Forward	5	0	0	46.6
16-Oct	Forward	15	0	0	62.6
20-Oct	Forward	2	0	0	65.7
23-Oct	Forward	3	0	0	65
27-Oct	Forward	6	0	0	56.1
30-Oct	Forward	7	0	0	53

3-Nov	Forward	6	0	0	82.1
6-Nov	Forward	6	0	0	77.7
10-Nov	Forward	43	0	0	309

3.4 PIT Tagging

During the 2008 trapping season we PIT tagged 2,639 spring Chinook, 2,154 steelhead,1 wild coho and 12 bull trout. This equates to 88.5% of Chinook, 84.2% of steelhead, 100% of wild coho and 80% of bull trout captured at the trap. All tagging files have been reported to the PTAGIS database. There were no mortalities associated with tagging operations. Tag loss during the first 24 hours per holding period was limited to 6 tags (0.1%) for all species during the 2008 trapping season.

3.5 Incidental Species

Along with Chinook, coho and steelhead/rainbow trout, all other known fish species present in Nason Creek were represented in the trap catch: hatchery coho salmon *Oncorhynchus kisutch,* bull trout *Salvelinus confluentus*, cutthroat trout *Oncorhynchus clarki lewisi*, longnose dace *Rhinichthys sp.,* northern pikeminnow *Ptychocheilus oregonensis,* red-sided shiner *Richardsonius balteatus,* sculpin *Cottus sp., sucker Catostomus sp.,* and mountain whitefish *Prosopium williamsoni*. Incidental species were enumerated and sampled for length and weight (Table 10).

Table 10. Summary of length and weight sampling conducted on incidental species captured at the Nason Creek rotary trap in 2008.

Species	Total Count	Length (mm)			Weight (g)		
		Mean	N	SD	Mean	N	SD
Hatchery Coho Salmon *Oncorhynchus kisutch*	3947	130.2	843	10.4	23.6	843	6.2
Bull Trout *Salvelinus confluentus*	15	155.7	15	20.9	39.5	15	21.9
Cutthroat Trout *Oncorhynchus clarki*	2	152	2	—	42.3	2	—
Longnose Dace *Rhinichthys sp.*	222	71.2	218	29.6	6.6	218	6.6
Northern Pikeminnow *Ptychocheilus oregonensis*	6	153.2	6	78.9	73.7	6	100.8
Redsided Shiner *Richardsonius balteatus*	57	54.9	56	22.1	3.2	56	3.9
Sculpin *Cottus sp.*	150	104.9	149	38.4	23.3	149	22.5
Sucker *Catostomas sp.*	230	77.5	225	40.1	11.2	225	26.5

Whitefish *Prosopium sp.*	384	63.6	316	21.0	3.2	316	6.4

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 2008 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 11. Nason Creek ESA listed species handling and mortality summary.

Species	Total Collected	Total Mortality	% Handled Mortality
Spring Chinook Subyearlings/Fry (BY 2007)	3000	27	0.9%
Spring Chinook Yearling (BY 2006)	906	4	0.4%
Steelhead Fry and Parr	2804	23	0.8%
Steelhead Smolt	169	0	0.0%
Hatchery Steelhead	2036	2	0.0%
Bull Trout	12	0	0.0%

4.0 Discussion

The trap location on Nason Creek appears appropriate for the target species and anticipated environmental conditions. At RK 8.0, the trap has been positioned as low as possible in the watershed to ensure that the majority of spawning occurs upstream of the trap. Low juvenile abundance continues to limit our ability to conduct trap efficiency trials over a broad range of river conditions. As a result, inadequate trap efficiency-to-discharge regression models require the use of pooled trap efficiencies to generate population estimates for this watershed. Once regression models have been developed, population estimates may be recalculated. Until such time, all estimates of salmon and steelhead production estimates should be considered provisional. Observed pooled trap efficiencies continue to be within the acceptable level of the ESA permit conditions (i.e., <20%).

Within the Wenatchee River basin, comparisons between Nason Creek and White River can be made regarding BY2006 spring Chinook production. In both streams, there appears 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 emigrants during summer and fall. While the overall emigration estimate for Nason Creek (10,554) was greater than for the White River (2,200), egg-to-emigrant survival (Nason =1.4; White =1.5) and the number of emigrants per redd (Nason = 69; White = 71) were quite similar. More data is needed to better understand the differences in productivity between populations and overall juvenile production in these streams.

Currently, population estimates for Chinook in Nason Creek assume that the population is entirely comprised of spring Chinook. In recent years, summer Chinook have been observed spawning upstream of the trap in Nason Creek. Although there have been no observations of summer Chinook subyearlings emigrating in the spring, the extent to which this population contributes to overall Chinook numbers in Nason Creek is unknown. Likewise, the proportion of hatchery spring Chinook that spawn in Nason Creek is also unknown. Results of ongoing studies (DNA analysis) may help to differentiate spring Chinook from summer Chinook parr and smolt. In such a case, retrospective analysis of data from previous years will be necessary to correct population estimates for spring Chinook and establish estimates for summer Chinook.

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 ≥90 mm. Results from 2006-2008 have not yet been analyzed. Therefore it was not possible to calculate brood years based on emigration estimates and measures of productivity at the time of this draft. As results become available, brood year survival and productivity estimates will be reported in future documents.

5.0 Literature Cited

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APPENDIX A: Nason Creek Temperature and Discharge Data

APPENDIX A: 2008 Nason Creek Discharge and TemperatureData

Date	Mean Daily Discharge (cfs)	Mean Daily Water Temp (°C)
1-Jan-08	140	0.23
2-Jan-08	153	0.24
3-Jan-08	131	0.24
4-Jan-08	120	0.23
5-Jan-08	110	0.25
6-Jan-08	101	0.27
7-Jan-08	92.8	0.36
8-Jan-08	94	0.30
9-Jan-08	95.2	0.30
10-Jan-08	94.9	0.31
11-Jan-08	108	0.31
12-Jan-08	107	0.53
13-Jan-08	102	0.84
14-Jan-08	102	0.92
15-Jan-08	107	0.40
16-Jan-08	174	0.32
17-Jan-08	244	0.31
18-Jan-08	311	0.31
19-Jan-08	294	0.31
20-Jan-08	137	0.30
21-Jan-08	176	0.25
22-Jan-08	223	0.21
23-Jan-08	224	0.21
24-Jan-08	215	0.21
25-Jan-08	262	0.15
26-Jan-08	231	0.11
27-Jan-08	270	0.15
28-Jan-08	250	0.16
29-Jan-08	201	0.15
30-Jan-08	191	0.15
31-Jan-08	196	0.14
1-Feb-08	198	0.12
2-Feb-08	199	0.10
3-Feb-08	196	0.10
4-Feb-08	197	0.09
5-Feb-08	212	0.07
6-Feb-08	231	0.06
7-Feb-08	240	0.06
8-Feb-08	439	0.06
9-Feb-08	598	0.05
10-Feb-08	629	0.05
11-Feb-08	657	0.06
12-Feb-08	532	0.06
13-Feb-08	441	0.06
14-Feb-08	315	0.08

Date	Mean Daily Discharge (cfs)	Mean Daily Water Temp (°C)
15-Feb-08	164	0.51
16-Feb-08	92.5	1.53
17-Feb-08	86.6	1.40
18-Feb-08	84.2	1.01
19-Feb-08	83.1	0.87
20-Feb-08	81.7	1.41
21-Feb-08	82.2	1.83
22-Feb-08	81.8	2.50
23-Feb-08	81.4	2.28
24-Feb-08	82.2	2.60
25-Feb-08	83	3.29
26-Feb-08	85.8	3.26
27-Feb-08	89.7	3.49
28-Feb-08	103	3.69
29-Feb-08	115	3.52
1-Mar-08	129	3.38
2-Mar-08	127	3.03
3-Mar-08	123	2.95
4-Mar-08	125	3.22
5-Mar-08	123	2.69
6-Mar-08	120	2.73
7-Mar-08	117	3.36
8-Mar-08	120	3.98
9-Mar-08	129	3.79
10-Mar-08	130	4.06
11-Mar-08	141	3.99
12-Mar-08	145	3.63
13-Mar-08	143	3.43
14-Mar-08	140	3.80
15-Mar-08	139	3.95
16-Mar-08	138	3.81
17-Mar-08	137	4.02
18-Mar-08	143	4.27
19-Mar-08	142	4.00
20-Mar-08	140	3.87
21-Mar-08	135	3.80
22-Mar-08	132	3.50
23-Mar-08	135	3.01
24-Mar-08	131	2.84
25-Mar-08	126	3.24
26-Mar-08	124	3.64
27-Mar-08	120	3.58
28-Mar-08	119	2.16
29-Mar-08	115	2.64
30-Mar-08	111	2.91

Data provided by DOE and should be considered provisional.

Date	Mean Daily Discharge (cfs)	Mean Daily Water Temp (°C)	Date	Mean Daily Discharge (cfs)	Mean Daily Water Temp (°C)
31-Mar-08	108	3.62	21-Apr-08	194	3.92
1-Apr-08	106	3.85	22-Apr-08	187	3.82
2-Apr-08	106	4.59	23-Apr-08	187	4.82
3-Apr-08	109	4.81	24-Apr-08	186	5.50
4-Apr-08	114	4.56	25-Apr-08	184	5.79
5-Apr-08	115	5.00	26-Apr-08	183	6.05
6-Apr-08	118	5.20	27-Apr-08	194	6.70
7-Apr-08	123	5.13	28-Apr-08	235	6.82
8-Apr-08	123	4.65	29-Apr-08	318	6.28
9-Apr-08	118	4.90	30-Apr-08	292	5.37
10-Apr-08	118	6.05	1-May-08	271	5.48
11-Apr-08	123	6.45	2-May-08	272	5.75
12-Apr-08	140	6.81	3-May-08	279	6.01
13-Apr-08	187	6.61	4-May-08	336	6.95
14-Apr-08	282	5.95	5-May-08	480	6.63
15-Apr-08	261	4.77	6-May-08	596	6.12
16-Apr-08	232	5.20	7-May-08	680	5.85
17-Apr-08	237	6.02	8-May-08	686	5.61
18-Apr-08	235	5.35	9-May-08	566	5.54
19-Apr-08	218	3.97	10-May-08	579	5.72
20-Apr-08	205	4.01	11-May-08	623	5.53
21-Apr-08	194	3.92	12-May-08	582	5.63
22-Apr-08	187	3.82	13-May-08	636	5.75
23-Apr-08	187	4.82	14-May-08	825	6.34
24-Apr-08	186	5.50	15-May-08	1560	6.06
25-Apr-08	184	5.79	16-May-08	2470	5.11
31-Mar-08	108	3.62	17-May-08	3860	4.93
1-Apr-08	106	3.85	18-May-08	4920	5.07
2-Apr-08	106	4.59	19-May-08	4500	5.24
3-Apr-08	109	4.81	20-May-08	4120	4.90
4-Apr-08	114	4.56	21-May-08	3190	5.08
5-Apr-08	115	5.00	22-May-08	2260	5.49
6-Apr-08	118	5.20	23-May-08	1720	4.83
7-Apr-08	123	5.13	24-May-08	1860	5.93
8-Apr-08	123	4.65	25-May-08	2390	5.89
9-Apr-08	118	4.90	26-May-08	2720	5.63
10-Apr-08	118	6.05	27-May-08	2880	5.98
11-Apr-08	123	6.45	27-May-08	2880	5.98
12-Apr-08	140	6.81	28-May-08	2930	5.83
13-Apr-08	187	6.61	29-May-08	2950	6.27
14-Apr-08	282	5.95	30-May-08	2570	6.03
15-Apr-08	261	4.77	31-May-08	2190	6.27
16-Apr-08	232	5.20	1-Jun-08	2100	6.40
17-Apr-08	237	6.02	2-Jun-08	2030	6.27
18-Apr-08	235	5.35	3-Jun-08	1530	5.45
19-Apr-08	218	3.97	4-Jun-08	1420	5.39
20-Apr-08	205	4.01	5-Jun-08	1010	5.40

Data provided by DOE and should be considered provisional.

Date	Mean Daily Discharge (cfs)	Mean Daily Water Temp (°C)
6-Jun-08	994	5.75
7-Jun-08	882	6.33
8-Jun-08	835	6.67
9-Jun-08	826	6.18
10-Jun-08	851	5.81
11-Jun-08	739	6.60
12-Jun-08	727	7.40
13-Jun-08	831	7.87
14-Jun-08	915	7.45
15-Jun-08	965	7.50
16-Jun-08	1050	7.63
17-Jun-08	1100	7.40
18-Jun-08	890	7.09
19-Jun-08	811	7.06
20-Jun-08	825	7.88
21-Jun-08	1060	6.97
22-Jun-08	1110	7.44
23-Jun-08	943	7.01
24-Jun-08	863	7.98
25-Jun-08	849	8.20
26-Jun-08	870	8.52
27-Jun-08	933	9.00
28-Jun-08	1400	9.25
29-Jun-08	1970	9.10
30-Jun-08	2230	9.24
1-Jul-08	1950	9.44
2-Jul-08	1480	9.78
3-Jul-08	1320	10.09
4-Jul-08	961	10.30
5-Jul-08	743	9.87
6-Jul-08	690	10.12
7-Jul-08	576	10.31
8-Jul-08	543	11.29
9-Jul-08	529	11.96
10-Jul-08	488	11.65
11-Jul-08	407	10.55
12-Jul-08	355	11.53
13-Jul-08	337	12.44
14-Jul-08	320	13.06
15-Jul-08	294	13.04
16-Jul-08	269	13.26
17-Jul-08	250	13.48
18-Jul-08	231	13.55
19-Jul-08	218	13.67
20-Jul-08	207	14.24
21-Jul-08	193	14.92

Date	Mean Daily Discharge (cfs)	Mean Daily Water Temp (°C)
22-Jul-08	184	15.16
23-Jul-08	173	13.83
24-Jul-08	163	13.61
25-Jul-08	154	13.95
26-Jul-08	146	14.57
27-Jul-08	139	15.24
28-Jul-08	134	14.76
29-Jul-08	126	14.12
30-Jul-08	131	13.83
31-Jul-08	121	13.38
1-Aug-08	118	14.51
2-Aug-08	114	14.08
3-Aug-08	106	14.34
4-Aug-08	101	15.32
5-Aug-08	96	15.83
6-Aug-08	92.3	15.61
7-Aug-08	89.4	15.81
8-Aug-08	90.4	16.22
9-Aug-08	120	14.92
10-Aug-08	98.6	14.53
11-Aug-08	91.5	14.16
12-Aug-08	85.6	14.89
13-Aug-08	81.9	16.24
14-Aug-08	79.6	17.30
15-Aug-08	76.4	17.63
16-Aug-08	76.2	18.20
17-Aug-08	77.7	18.00
18-Aug-08	75.8	17.43
19-Aug-08	74.6	16.77
20-Aug-08	86.4	15.83
21-Aug-08	107	13.53
22-Aug-08	97	12.73
23-Aug-08	82.7	13.91
24-Aug-08	75.8	14.24
25-Aug-08	73.5	14.30
26-Aug-08	71.2	13.40
27-Aug-08	75.8	13.31
28-Aug-08	81.9	13.01
29-Aug-08	77.7	14.67
30-Aug-08	73.7	13.89
31-Aug-08	70.7	12.03
1-Sep-08	68	12.06
2-Sep-08	65	12.16
3-Sep-08	63	12.69
4-Sep-08	61.3	13.32
5-Sep-08	59.3	13.81
6-Sep-08	58.9	13.65

Date	Mean Daily Discharge (cfs)	Mean Daily Water Temp (°C)	Date	Mean Daily Discharge (cfs)	Mean Daily Water Temp (°C)
7-Sep-08	57.9	14.00	24-Oct-08	63.2	4.87
8-Sep-08	56.2	13.26	25-Oct-08	60	5.84
9-Sep-08	55.1	13.64	26-Oct-08	58.5	4.76
10-Sep-08	53.3	13.31	27-Oct-08	56.1	4.02
11-Sep-08	52.3	13.36	28-Oct-08	54.4	3.90
12-Sep-08	51.2	13.40	29-Oct-08	53.2	4.93
13-Sep-08	50.3	13.46	30-Oct-08	53	4.62
14-Sep-08	50	12.88	31-Oct-08	53.5	5.86
15-Sep-08	49.1	12.51	1-Nov-08	63.8	6.45
16-Sep-08	48.1	12.53	2-Nov-08	65.9	6.98
17-Sep-08	47.3	12.85	3-Nov-08	82.1	6.20
18-Sep-08	46.3	13.09	4-Nov-08	85.4	5.77
19-Sep-08	45.2	13.41	5-Nov-08	77.8	4.40
20-Sep-08	44.4	13.17	6-Nov-08	77.7	3.45
21-Sep-08	48.5	12.29	7-Nov-08	712	2.83
22-Sep-08	51.3	11.16	8-Nov-08	611	3.76
23-Sep-08	53.2	9.34	9-Nov-08	384	4.61
24-Sep-08	49.3	9.58	10-Nov-08	309	4.85
25-Sep-08	47.9	10.19	11-Nov-08	265	4.33
26-Sep-08	50.3	9.75	12-Nov-08	198	4.34
27-Sep-08	49.3	10.01	13-Nov-08	581	4.15
28-Sep-08	46.7	9.94	14-Nov-08	1010	3.56
29-Sep-08	45.7	9.79	15-Nov-08	679	4.08
30-Sep-08	44.8	9.59	16-Nov-08	575	4.36
1-Oct-08	43.5	10.06	17-Nov-08	480	4.18
2-Oct-08	33.3	10.42	18-Nov-08	410	4.37
3-Oct-08	34.2	10.65	19-Nov-08	348	3.69
4-Oct-08	41.1	11.13	20-Nov-08	305	3.87
5-Oct-08	46.7	9.95	21-Nov-08	291	3.69
6-Oct-08	42.3	9.25	22-Nov-08	258	3.56
7-Oct-08	52.2	8.67	23-Nov-08	230	2.76
8-Oct-08	90.4	7.24	24-Nov-08	210	2.37
9-Oct-08	63.5	6.78	25-Nov-08	196	2.32
10-Oct-08	53	6.16	26-Nov-08	185	2.14
11-Oct-08	48.2	5.63	27-Nov-08	171	1.78
12-Oct-08	46.1	7.00	28-Nov-08	166	2.38
13-Oct-08	46.6	8.33	29-Nov-08	184	3.11
14-Oct-08	82.7	8.06	30-Nov-08	242	3.97
15-Oct-08	67.6	6.10	1-Dec-08	226	3.81
16-Oct-08	62.6	6.88	2-Dec-08	268	4.34
17-Oct-08	70.3	8.03	3-Dec-08	263	3.97
18-Oct-08	76.2	8.27	4-Dec-08	216	2.44
19-Oct-08	70.8	6.26	5-Dec-08	197	1.82
20-Oct-08	65.7	6.28	6-Dec-08	187	2.65
21-Oct-08	78.5	5.74	7-Dec-08	212	3.68
22-Oct-08	69.9	5.23	8-Dec-08	207	2.76
23-Oct-08	65	5.06	9-Dec-08	182	3.00

Data provided by DOE and should be considered provisional.

Date	Mean Daily Discharge (cfs)	Mean Daily Water Temp (°C)
10-Dec-08	181	3.74
11-Dec-08	184	2.83
12-Dec-08	173	1.27
13-Dec-08	165	0.53
14-Dec-08	--	0.07
15-Dec-08	--	0.04
16-Dec-08	--	0.04
17-Dec-08	183	0.04
18-Dec-08	186	0.04

Data provided by DOE and should be considered provisional.

APPENDIX B: Daily Trap Operating Status

APPENDIX B: Daily Operating Status

Date	Trap Status	Comments
3-Mar-08	Operating	
4-Mar-08	Operating	
5-Mar-08	Operating	
6-Mar-08	Operating	
7-Mar-08	Operating	
8-Mar-08	Operating	
9-Mar-08	Operating	
10-Mar-08	Operating	
11-Mar-08	Operating	
12-Mar-08	Operating	
13-Mar-08	Operating	
14-Mar-08	Operating	
15-Mar-08	Operating	
16-Mar-08	Interrupted	Debris Stop
17-Mar-08	Operating	
18-Mar-08	Operating	
19-Mar-08	Operating	
20-Mar-08	Operating	
21-Mar-08	Operating	
22-Mar-08	Operating	
23-Mar-08	Operating	
24-Mar-08	Operating	
25-Mar-08	Operating	
26-Mar-08	Operating	
27-Mar-08	Operating	
28-Mar-08	Operating	
29-Mar-08	Operating	
30-Mar-08	Operating	
31-Mar-08	Operating	
1-Apr-08	Operating	
2-Apr-08	Operating	
3-Apr-08	Operating	
4-Apr-08	Operating	
5-Apr-08	Operating	
6-Apr-08	Operating	
7-Apr-08	Operating	
8-Apr-08	Operating	
9-Apr-08	Operating	
10-Apr-08	Operating	
11-Apr-08	Operating	
12-Apr-08	Operating	
13-Apr-08	Operating	
14-Apr-08	Operating	
15-Apr-08	Operating	
16-Apr-08	Operating	
17-Apr-08	Operating	

Date	Trap Status	Comments
18-Apr-08	Operating	
19-Apr-08	Operating	
20-Apr-08	Operating	
21-Apr-08	Operating	
22-Apr-08	Operating	
23-Apr-08	Operating	
24-Apr-08	Operating	
25-Apr-08	Operating	
26-Apr-08	Operating	
27-Apr-08	Operating	
28-Apr-08	Operating	
29-Apr-08	Operating	
30-Apr-08	Operating	
1-May-08	Operating	
2-May-08	Operating	
3-May-08	Operating	
4-May-08	Operating	
5-May-08	Pulled	Hatch. Release
6-May-08	Pulled	Hatch. Release
7-May-08	Pulled	Hatch. Release
8-May-08	Operating	
9-May-08	Operating	
10-May-08	Operating	
11-May-08	Operating	
12-May-08	Operating	
13-May-08	Operating	
14-May-08	Operating	
15-May-08	Pulled	High Flows
16-May-08	Pulled	High Flows
17-May-08	Pulled	High Flows
18-May-08	Pulled	High Flows
19-May-08	Pulled	High Flows
20-May-08	Pulled	High Flows
21-May-08	Pulled	High Flows
22-May-08	Pulled	High Flows
23-May-08	Operating	
24-May-08	Operating	
25-May-08	Operating	
26-May-08	Operating	
27-May-08	Operating	
28-May-08	Operating	
29-May-08	Operating	
30-May-08	Operating	
31-May-08	Operating	
1-Jun-08	Operating	
2-Jun-08	Operating	

Date	Trap Status	Comments
3-Jun-08	Operating	
4-Jun-08	Operating	
5-Jun-08	Operating	
6-Jun-08	Operating	
7-Jun-08	Operating	
8-Jun-08	Operating	
9-Jun-08	Operating	
10-Jun-08	Operating	
11-Jun-08	Operating	
12-Jun-08	Operating	
13-Jun-08	Operating	
14-Jun-08	Operating	
15-Jun-08	Operating	
16-Jun-08	Operating	
17-Jun-08	Operating	
18-Jun-08	Operating	
19-Jun-08	Operating	
20-Jun-08	Operating	
21-Jun-08	Operating	
22-Jun-08	Operating	
23-Jun-08	Operating	
24-Jun-08	Operating	
25-Jun-08	Operating	
26-Jun-08	Operating	
27-Jun-08	Operating	
28-Jun-08	Operating	
29-Jun-08	Pulled	High Flows
30-Jun-08	Pulled	High Flows
1-Jul-08	Pulled	High Flows
2-Jul-08	Pulled	High Flows
3-Jul-08	Operating	
4-Jul-08	Operating	
5-Jul-08	Operating	
6-Jul-08	Operating	
7-Jul-08	Operating	
8-Jul-08	Operating	
9-Jul-08	Operating	
10-Jul-08	Operating	
11-Jul-08	Operating	
12-Jul-08	Operating	
13-Jul-08	Operating	
14-Jul-08	Operating	
15-Jul-08	Operating	
16-Jul-08	Operating	
17-Jul-08	Operating	
18-Jul-08	Operating	
19-Jul-08	Operating	
20-Jul-08	Operating	

Date	Trap Status	Comments
21-Jul-08	Operating	
22-Jul-08	Operating	
23-Jul-08	Operating	
24-Jul-08	Operating	
25-Jul-08	Operating	
26-Jul-08	Operating	
27-Jul-08	Operating	
28-Jul-08	Operating	
29-Jul-08	Operating	
30-Jul-08	Operating	
31-Jul-08	Operating	
1-Aug-08	Operating	
2-Aug-08	Operating	
3-Aug-08	Interrupted	Debris Stop
4-Aug-08	Interrupted	Debris Stop
5-Aug-08	Operating	
6-Aug-08	Operating	
7-Aug-08	Operating	
8-Aug-08	Operating	
9-Aug-08	Operating	
10-Aug-08	Operating	
11-Aug-08	Operating	
12-Aug-08	Operating	
13-Aug-08	Operating	
14-Aug-08	Operating	
15-Aug-08	Operating	
16-Aug-08	Operating	
17-Aug-08	Operating	
18-Aug-08	Operating	
19-Aug-08	Operating	
20-Aug-08	Operating	
21-Aug-08	Operating	
22-Aug-08	Operating	
23-Aug-08	Operating	
24-Aug-08	Operating	
25-Aug-08	Operating	
26-Aug-08	Operating	
27-Aug-08	Operating	
28-Aug-08	Operating	
29-Aug-08	Operating	
30-Aug-08	Operating	
31-Aug-08	Operating	
1-Sep-08	Operating	
2-Sep-08	Operating	
3-Sep-08	Operating	
4-Sep-08	Operating	
5-Sep-08	Operating	
6-Sep-08	Operating	

Date	Trap Status	Comments
7-Sep-08	Operating	
10-Sep-08	Operating	
11-Sep-08	Operating	
12-Sep-08	Operating	
13-Sep-08	Operating	
14-Sep-08	Operating	
15-Sep-08	Operating	
16-Sep-08	Operating	
17-Sep-08	Operating	
18-Sep-08	Operating	
19-Sep-08	Operating	
20-Sep-08	Interrupted	Debris Stop
21-Sep-08	Operating	
22-Sep-08	Operating	
23-Sep-08	Operating	
24-Sep-08	Operating	
25-Sep-08	Operating	
26-Sep-08	Operating	
27-Sep-08	Operating	
28-Sep-08	Operating	
29-Sep-08	Operating	
30-Sep-08	Operating	
1-Oct-08	Operating	
2-Oct-08	Operating	
3-Oct-08	Operating	
4-Oct-08	Operating	
5-Oct-08	Operating	
6-Oct-08	Operating	
7-Oct-08	Operating	
8-Oct-08	Operating	
9-Oct-08	Operating	
10-Oct-08	Operating	
11-Oct-08	Operating	
12-Oct-08	Operating	
13-Oct-08	Operating	
14-Oct-08	Operating	
15-Oct-08	Operating	
16-Oct-08	Operating	
17-Oct-08	Operating	
18-Oct-08	Operating	
19-Oct-08	Operating	
20-Oct-08	Operating	
21-Oct-08	Operating	
22-Oct-08	Operating	
23-Oct-08	Operating	
24-Oct-08	Operating	
25-Oct-08	Operating	
26-Oct-08	Operating	

Date	Trap Status	Comments
27-Oct-08	Operating	
28-Oct-08	Operating	
29-Oct-08	Operating	
30-Oct-08	Operating	
31-Oct-08	Operating	
1-Nov-08	Operating	
2-Nov-08	Operating	
3-Nov-08	Operating	
4-Nov-08	Operating	
5-Nov-08	Operating	
6-Nov-08	Operating	
7-Nov-08	Interrupted	Debris Stop
8-Nov-08	Pulled	High Flows
9-Nov-08	Pulled	High Flows
10-Nov-08	Operating	
11-Nov-08	Operating	
12-Nov-08	Pulled	High Flows
13-Nov-08	Pulled	High Flows
14-Nov-08	Pulled	High Flows
15-Nov-08	Pulled	High Flows
16-Nov-08	Pulled	High Flows
17-Nov-08	Operating	
18-Nov-08	Operating	
19-Nov-08	Operating	
20-Nov-08	Operating	
21-Nov-08	Operating	
22-Nov-08	Operating	
23-Nov-08	Operating	
24-Nov-08	Operating	
25-Nov-08	Operating	
26-Nov-08	Operating	
27-Nov-08	Operating	
28-Nov-08	Operating	
29-Nov-08	Operating	
30-Nov-08	Operating	
1-Dec-08	Operating	
2-Dec-08	Operating	
3-Dec-08	Operating	
4-Dec-08	Operating	
5-Dec-08	Operating	
6-Dec-08	Operating	
7-Dec-08	Interrupted	Debris Stop
8-Dec-08	Operating	
9-Dec-08	Operating	
10-Dec-08	Operating	
11-Dec-08	Operating	
12-Dec-08	Operating	

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 in 2007

Stream	Reach Description	Date	Temp °C	Surveyors	New Redds	Live Fish	Dead Fish
Nason 4	Upper Whitepine Road to Ray Rock	11/7/2007	4	KE, Clubb	0	0	0
		11/28/2007	1.5	KE	0	0	0
	Total				0	0	0
Nason 3	Ray Rock to Wood Bridge	10/25/2007	6	MC, KE, MWC	0	0	0
		11/1/2007	4.5	KE MWC	1	1	0
		11/8/2007	7	KE Clubb	0	1	0
		11/14/2007		KE, Clubb	0	0	0
		11/21/2007	3	KE, Clubb	1	4	0
		11/28/2007	1.5	Clubb	0	0	0
	Total				2	6	0
Nason 3	Wood Bridge to Old Kahler Bridge	10/11/2007	7	TR	0	0	0
		10/18/2007	8	TR	0	0	0
		10/25/2007	6	TR	0	0	0
		11/1/2007	8	TR, BH	3	2	0
		11/6/2007	6	TR, BH	5	4	0
		11/15/2007	6	GR, BC	0	0	0
		11/21/2007	4.5	BC	0	0	0
		11/28/2007	1.5	BC	0	0	0
		12/28/2007	1	TR, MWC	0	0	0
	Total				8	6	0
Nason 1	Old Kahler Bridge to Mouth	10/11/2007	7	BH	0	0	0
		10/18/2007	8	BH	0	0	0
		10/25/2007	8	BH GR	0	0	0
		11/1/2007	8	BH	0	0	0
		11/6/2007		BH	0	0	0
		11/15/2007	6	CS	0	0	0
		11/21/2007	4.5	GR	0	0	0
		11/28/2007	1.5	GR	0	0	0
		12/28/2007	1	GR, BH	0	0	0
	Total				0	0	0
Wenatchee 7	Lake to Plain	10/2/2007	10	TR, BH	0	0	0
		10/16/2007	10	TR, BH	0	0	0
		10/30/2007	8.5	TR, BH	0	1	0
		11/26/2007	7	TR, BH	0	1	0
	Total				0	2	0
Wenatchee 6	Plain to Tumwater Bridge	10/9/2007	10	TR, BH	0	0	0
		10/23/2007	9	TR, BH	0	1	0
		11/8/2007	8	TR, BH	3	0	0
		11/19/2007	6.5	TR, BH	2	0	0
	Total				5	1	0
Wenatchee 5	Tumwater Bridge to Icicle Road	11/30/2007	3	KE, Clubb	0	0	0

	Bridge	11/19/2007		KE, Clubb	0	0	0
	Total				0	0	0
		10/3/2007	7	TR, BH	0	0	0
		10/4/2007		TR, BH	0	0	0
		10/10/2007	7	TR, BH	0	0	0
		10/15/2007	6	TR, BH	0	18	4
		10/17/2007	7	TR, BH	0	10	0
		10/20/2007		TR, BH	0	10	4
		10/22/2007	7.5	TR, BH	0	20	0
		10/24/2007		TR, BH	0	5	0
		10/31/2007		TR, BH	7	20	0
		11/7/2007		TR, BH	11	35	4
		11/14/2007		TR, BH	37	50	11
		11/15/2007	5	TR, BH	42	100	6
		11/21/2007		TR, BH	20	50	6
		11/27/2007	3	TR, BH	30	42	4
		11/28/2007		TR, BH	3	50	9
		12/12/2007	6	BH, BC	21	55	1
		12/28/2007	3	BH, MWC	2	15	3
		1/3/2008		TR, BH	0	0	0
		1/9/2008	1	TR, BH	5	4	1
		1/17/2008	1	TR, BH	0	0	0
	Total				178	484	53
Wenatchee 3	Boat Launch below Icicle to Dryden	10/4/2007	9	TR, BH	0	0	0
		10/15/2007	5	TR, BH	0	18	4
		11/20/2007	6	TR, BH	15	37	4
		11/27/2007	1	TR, BH	2	2	9
		12/12/2007	6	BH, BC	27	55	1
	Total				44	112	18
Wenatchee 2	Dryden to Cashmere	10/19/2007	7.5	TR, BH	0	0	2
		10/22/2007	-	TR, BH	0	0	0
			na	CK	4	6	0
			na	CK	7	5	0
		11/2/2007	7	TR, BH	2	0	1
		11/19/2007	7.5	TR, BH	0	12	2
		11/29/2007	3	TR, BH	4	3	2
		1/10/2008	1	GR, BH	1	2	0
	Total				18	28	7
Wenatchee 1	Cashmere to Mouth	10/26/2007	8.5	TR, BH, GR, BC	0	1	0
		11/9/2007	7	TR, BH	6	0	0
		11/16/2007	7	TR, BH	3	2	5
		11/30/2007	3	TR, BH, BC	5	5	5
		1/4/2008	1	TR, BH, GR	0	0	1
	Total				14	8	11
Icicle 3	Intake to head gate	11/2/2007	3	KE, MWC	6	1	0
		11/15/2007	4	KE, Clubb	5	6	0

		11/19/2007	7	Clubb	8	9	0
		11/20/2007	2.5	GR, BC	0	1	0
	Total				19	17	0
Icicle 2	Side Channel head gate to Hatchery Pool	10/17/2007	7	TR, BH	3	5	0
		10/24/2007	8	TR	8	200	0
		10/31/2007	7	TR, BH	59	200	0
		11/7/2007	7.5	BH	100	200	0
		11/14/2007	3	TR, BH	131	100	6
		11/20/2007	6	TR, BH	36	50	5
		11/27/2007	3	GR, BH	23	10	4
		1/3/2008	1	TR, BH	0	0	0
	Total				360	765	15
Icicle 1	Hatchery Pool to Mouth	10/3/2007	9	TR, BH	0	0	0
		10/10/2007	9	TR, BH	0	0	0
		10/17/2007	7	TR, BH	1	38	0
		10/24/2007	9.5	TR, BH	27	500	1
		10/31/2007	7	TR, BH	120	500	7
		11/7/2007	8	TR, BH	248	500	42
		11/14/2007	6	TR, BH	243	250	89
		11/21/2007		TR, BH	142	100	90
		11/28/2007		TR, BH	35	150	64
		12/13/2007	1.5	TR, BH	59	100+	6
		1/3/2008	1	TR, BH	1	8	5
		1/9/2008	1	TR, BH	8	23	7
		1/16/2008	0.5	TR, BH	4	20	3
	Total				888	2089	314
Peshastin	to Mill Creek	11/16/2007	5	BC	0	0	0
		11/19/2007	3	LSO	0	0	0
	Total				0	0	0
Peshastin	Mill Creek to Office	10/15/2007	7	TR, GR	0	0	0
		10/29/2007	8	BH	1	1	0
		11/5/2007	7	BH	11	2	0
		11/13/2007	3	BH	12	2	0
		11/19/2007	5	BC	4	2	0
		11/26/2007	1	BC	2	0	0
		12/11/2007	0	BC	0	0	0
		1/2/2008	0	GR	0	0	0
	Total				30	7	0
		10/15/2007	7	TR, GR	0	0	0
		10/22/2007	7	TR	1	4	0
		10/29/2007	8	TR	1	1	0
		11/5/2007	7	TR	28	30	0
		11/13/2007	3	TR	19	30	0
		11/19/2007	4.5	GR	6	3	1
		11/26/2007	1.5	KE	2	3	0
		12/11/2007	0	BH	1	2	0
		1/2/2008	0	BH	0	0	0
	Total				58	73	1

Brender	1st House to Mouth	10/17/2007		MC, KE, MWC	0	0	0
		10/24/2007		MC, KE, MWC	0	0	0
		10/31/2007		KE, MWC	7	8	3
		11/10/2007	7	MWC	2	5	0
		11/16/2007	7	MC, MWC	1	3	0
		11/20/2007	6	KE, MWC	2	4	2
		11/29/2007	3	KE, MWC	3	2	9
		12/10/2007	0	TR, BH	0	1	0
		12/26/2007	1	MWC	0	0	0
		1/4/2008	0.5	KE, MWC	0	0	0
	Total				15	23	14
Mission	Pioneer Street to Mouth	10/17/2007	8	MC, KE, MWC	4	7	1
		10/24/2007	8	MC, KE, MWC	5	5	2
		11/10/2007	7	Clubb	5	8	3
		11/16/2007	7	MC, MWC	1	8	4
		11/20/2007	6	KE, MWC	1	6	1
		11/29/2007	3	KE, MWC	0	0	1
		12/10/2007	0	TR, BH	9	9	0
		12/26/2007	1	MWC	7	3	3
		1/4/2008	0.5	KE, MWC	0	0	1
	Total				32	46	16
		10/2/2007		TR, BH	0	0	0
		10/16/2007		TR, BH	0	0	0
		10/30/2007		TR, BH	0	0	0
		11/26/2007		TR, BH	0	0	0
	Total				0	0	0
Beaver	Pond to Mouth	11/15/2007	3	KE, Clubb	0	0	0
		11/9/2007	7	Clubb, KE	0	0	0
		11/20/2007	5	KE, Clubb	0	1	0
		11/30/2007	1.5	KE, Clubb	0	0	0
	Total				0	0	0
Chiwaukum	Campground to Mouth	10/16/2007	7	MC, KE	0	0	0
		10/22/2007	7	MC, KE	0	0	0
		10/31/2007	7	MC	0	0	0
		11/5/2007	3.5	MC, KE	0	1	0
		11/19/2007	5	TR, BH	0	0	0
	Total				0	1	0

Stream	Reach Description	Date	Surveyors	New Redds	Live Fish	Dead Fish
Methow River M 1	RK 0.0 – 9.49	11/1/2007	KM, RF	3	0	0
		11/12/2007	KM, RF	0	0	8
		11/19/2007	KM, RF	20	0	17
		11/28/2007	KM, RF	12	0	2
	Total			35	0	27
Methow River M 2	RK 9.49 – 17.54	11/5/2007	KM, LB	16	9	1
		11/9/2007	KM, LB	0	0	2
		11/20/2007	KM, LB	31	3	11
	Total			47	12	14
Methow River M 3	RK 17.54 – 26.87	11/6/2007	LB, RF	8	4	2
		11/20/2007	LB, RF	22	4	6
		11/28/2007	LB, RF	6	0	1
	Total			36	8	9
Methow River M 4	RK 26.87 – 38.94	11/5/2007	JF, JP	0	0	1
		11/8/2007	JF, JP	9	10	0
		11/27/2007	KM, JF	7	0	1
	Total			16	10	2
Methow River M 5	RK 38.97 – 44.25	11/8/2007	LB, JF, KM	9	0	3
		11/27/2007	JP, JF, LB	8	0	0
	Total			17	0	3
Methow River M 6	RK 44.42 – 52.62	11/15/2007	LB, KM, JP	4	0	0
		11/26/2007	LB, KM, JP	6	0	0
	Total			10	0	0
Methow River M 7	RK 52.62 – 76.28	11/13/2007	KM, LB,PH	1	0	0
	Total			1	0	0
Methow River M 8	RK 76.28 – 86.42	11/13/2007	PH, JP, KM	0	0	2
		11/26/2007	LB, JP	5	0	6
	Total			5	0	8
Methow River M 9	RK 86.42 – 96.56	10/30/2007	KM, LB, JP	0	0	0
		11/27/2007	PH, RF	9	9	2
		11/29/2007	PH, JP	0	0	3
	Total			9	9	5
WNFH Spring Creek	Mouth to fish ladder	10/30/2007	KM, LB,PH	0	13	0
		11/6/2007	KM, LB,RF	2	35	0
		11/13/2007	KM, LB, JP	0	0	1
		11/19/2007	KM, LB, JF	32	168	3
		11/27/2007	PH, JP	7	60	1
		12/4/2007	PH, JF	32	15	8
	Total			73	291	13

WDFW Outfall	Mouth to fish ladder	10/30/2007	KM, LB, JP	4	4	1
		11/6/2007	LB, PH	6	7	2
		11/13/2007	PH, LB	7	21	1
		11/19/2007	JP, PH	22	43	1
		11/27/2007	RF, PH	7	35	1
		12/4/2007	KM, LB,PH	3	14	3
	Total			49	124	9
Twisp River	Mouth to RK 9.1	11/6/2007	LB, PH	0	0	0
	Total			0	0	0
Libby Creek	Mouth to RK 2.7	11/1/2007	KM	0	0	0
		12/5/2007	LB	0	0	0
	Total			0	0	0
Beaver Creek	Mouth to RK 3.8	11/5/2007	PH, JP	6	6	0
		11/26/2007	JP, RF	2	1	0
	Total			8	7	0
Wolf Creek	Mouth to RK 1.4	11/29/2007	RF, PH	0	0	0
	Total			0	0	0
Hancock Springs	Entire system	12/5/2007	KM, LB	0	0	0
	Total			0	0	0
Chewuch River	Mouth to Fulton Dam	11/29/2007	PH, JP	0	0	0
	Total			0	0	0
Chelan FH Outfall Beebee Springs	Entire system	10/30/2007	RF, RA	35	60	8
		11/1/2007	RF, LB	12	25	14
		11/6/2007	RF, PH	14	78	66
		11/13/2007	RF, JP	9	15	26
		11/19/2007	RF, JF	0	2	55
		11/26/2007	RF, LB	0	6	1
		12/5/2007	RF, LB	0	0	0
		12/13/2007	RF, LB, KM	0	1	1
	Total			71	187	112
Chelan River Outfall	Mouth to 800m upstream	10/26/2007	KM, LB	0	0	3
		10/31/2007	PH, RF	0	0	0
		11/1/2007	JP, JF	13	13	0
	Total			13	13	3
Foster Creek	Mouth to RK 1.9	11/1/2007	RA, RF	1	0	0
	Total			1	0	0

APPENDIX C: Wenatchee and Methow Basin Coho Release Numbers and Mark Groups, 2008

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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	5/12/2008	**190125+BT**	100.0%	70299	64246	64246	0
							Total	**70299**	**64246**	**64246**	**0**
Wenatchee	Nason Cr	Nason Wetlands	Willard NFH	MCR-WEN	4/03/2008	**190123+BT**	100.0%	32253	32073	32073	0
							Total	**32253**	**32073**	**32070**	**0**
Wenatchee	Nason Cr	Rolfing's Pond	Willard NFH	MCR-WEN	5/13/2008	**190122+BT**	100%	30425	29470	29470	3003
Wenatchee	Nason Cr	Rolfing's Pond	Cascade FH	MCR-WEN	5/13/2008	**190130+BT**	99.6%	69402	65269	62014	3004
							Total	**99827**	**94739**	**94478**	**6007**
Wenatchee	Beaver Cr	Beaver Creek	Willard NFH	MCR-WEN	5/13/2008	**190121+BT**	100.0%	27570	26627	26627	0
Wenatchee	Beaver Cr	Beaver Creek	Cascade FH	MCR-WEN	5/13/2008	**190129+BT**	97.4%	62201	60072	58510	0
							Total	**89771**	**86699**	**85137**	**0**
Wenatchee	Nason Cr	Butcher Creek	Cascade FH	MCR-WEN	5/12/2008	**190131+BT**	99.4%	147905	140379	139537	6005
							Total	**147905**	**140379**	**139537**	**6005**
Wenatchee	Icicle Cr	LNFH SFL 20-23	Willard NFH	MCR-WEN	4/23/2008	**190127**	98.7%	133793	131694	129982	3006
Wenatchee	Icicle Cr	LNFH SFL 9 & 10	Cascade FH	MCR-WEN	4/23/2008	**190132**	97.6%	74947	73608	71841	0
Wenatchee	Icicle Cr	LNFH SFL 23	Willard NFH	MCR-WEN	4/23/2008	**190134**	97.2%	149826	148329	144176	2687
							Total	**358566**	**353631**	**345999**	**5693**
Wenatchee	Icicle Cr	LNFH LFL 1 & 2	Willard NFH	MCR-WEN	4/22/2008	**190124**	99.2%	71946	70834	70267	3002
Wenatchee	Icicle Cr	LNFH LFL 1 & 2	Cascade FH	MCR-WEN	4/22/2008	**190133**	99.6%	149312	146727	146140	3002
							Total	**221258**	**217561**	**216407**	**6004**

Methow	Methow	Winthrop NFH	Winthrop NFH C12, C13	MCR-MET	4/29/2008	**053868**	100.0%	100622	87100	87100	0
Methow	Methow	Winthrop NFH	Winthrop NFH C14, C15, C16	MCR-MET	4/29/2008	**053478**	99.5%	166379	145159	144433	0
Methow	Methow	Winthrop NFH BC	Cascade FH	MCR-WEN	5/05/2008	**190126**	98.8%	83790	76949	76026	7504
							Total	**350791**	**309208**	**307559**	**7504**

Methow	Columbia	Wells FH	Cascade FH	MCR-WEN	5/05/2008	**190128**	99.6%	211434	210377	209535	0
							Total	**211434**	**210377**	**209535**	**0**

	Total Coho	**Total CWTs**
Wenatchee Basin	989,508	978,057
Methow Basin (Wells FH)	519,585	517,094