**Integrated Status & Effectiveness Monitoring Program
Population Estimates for Juvenile Salmonids in Nason Creek,
WA**

2008 Annual Report

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Prepared by:
Matthew Collins
Keely Murdoch

YAKAMA NATION
FISHERIES RESOURCE MANAGEMENT
Toppenish, WA 98948

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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 ($\pm 3,780$; 95% CI) steelhead parr and smolts emigrated from Nason Creek in 2008.

Table of Contents

1.0 INTRODUCTION	1
1.1 Watershed Description	3
2.0 METHODS	5
2.1 Trapping Equipment and Operation	5
2.2 Biological Sampling.....	5
2.3 Mark-Recapture Trials	6
2.4 Data Analysis	7
3.0 RESULTS	9
3.1 Dates of Operation	9
3.2 Emigration Timing	9
3.3 Trap Efficiency Calibration and Population Estimates	14
3.4 PIT Tagging	20
3.5 Incidental Species.....	20
3.6 ESA Compliance	20
4.0 DISCUSSION.....	22
5.0 LITERATURE CITED	23
APPENDIX A: NASON CREEK TEMPERATURE AND DISCHARGE DATA .	A-1
APPENDIX B: DAILY TRAP OPERATING STATUS.....	B-1

List of Figures

Figure 1. Nason Creek Smolt trap location.....	3
Figure 2. Mean daily stream discharge at the Nason Creek DOE stream monitoring station, RK 1, January 1, 2008 through December 18, 2008.....	4
Figure 3. Mean daily water temperature at the Nason Creek DOE stream monitoring station, RK 1, January 1, 2008 through December 18, 2008.....	5
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.....	10
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.	11
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.....	12
Figure 7. Steelhead smolt counts, run-timing, and mean daily stream discharge at the Nason Creek rotary trap, March 1 through June 30, 2008.....	12
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.....	13
Figure 9. Steelhead parr counts, run-timing, and mean daily stream discharge at the Nason Creek rotary trap, March 1 through December 12, 2008.....	14

List of Tables

Table 1. Summary of Nason Creek rotary trap operation, 2008.....	9
Table 2. Summary of length and weight sampling conducted on subyearling coho captured at the Nason Creek rotary trap in 2008.	10
Table 3. Summary of length and weight sampling conducted on spring Chinook captured at the Nason Creek rotary trap in 2008.	10
Table 4. Summary of length and weight sampling conducted on multiple year class steelhead at the Nason Creek rotary trap in 2008.	13
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.	14
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.	15
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.	16
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.	16
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.	18
Table 10. Summary of length and weight sampling conducted on incidental species captured at the Nason Creek rotary trap in 2008.	20
Table 11. Nason Creek ESA listed species handling and mortality summary.....	21

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 bulltrout >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 ($\leq 1.1\%$), 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 located 10 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:

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

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 from the following formulas:

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

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:

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

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

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

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

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

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

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

¹Year-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 an 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 ($n \geq 25$). 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 ($\pm$ 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 <i>Oncorhynchus kisutch</i>	3947	130.2	843	10.4	23.6	843	6.2
Bull Trout <i>Salvelinus confluentus</i>	15	155.7	15	20.9	39.5	15	21.9
Cutthroat Trout <i>Oncorhynchus clarki</i>	2	152	2	—	42.3	2	—
Longnose Dace <i>Rhinichthys sp.</i>	222	71.2	218	29.6	6.6	218	6.6
Northern Pikeminnow <i>Ptychocheilus oregonensis</i>	6	153.2	6	78.9	73.7	6	100.8
Redsided Shiner <i>Richardsonius balteatus</i>	57	54.9	56	22.1	3.2	56	3.9
Sculpin <i>Cottus sp.</i>	150	104.9	149	38.4	23.3	149	22.5
Sucker <i>Catostomus sp.</i>	230	77.5	225	40.1	11.2	225	26.5
Whitefish <i>Prosopium sp.</i>	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 overwintered 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)	Date	Mean Daily Discharge (cfs)	Mean Daily Water Temp (°C)
1-Jan-08	140	0.23	15-Feb-08	164	0.51
2-Jan-08	153	0.24	16-Feb-08	92.5	1.53
3-Jan-08	131	0.24	17-Feb-08	86.6	1.40
4-Jan-08	120	0.23	18-Feb-08	84.2	1.01
5-Jan-08	110	0.25	19-Feb-08	83.1	0.87
6-Jan-08	101	0.27	20-Feb-08	81.7	1.41
7-Jan-08	92.8	0.36	21-Feb-08	82.2	1.83
8-Jan-08	94	0.30	22-Feb-08	81.8	2.50
9-Jan-08	95.2	0.30	23-Feb-08	81.4	2.28
10-Jan-08	94.9	0.31	24-Feb-08	82.2	2.60
11-Jan-08	108	0.31	25-Feb-08	83	3.29
12-Jan-08	107	0.53	26-Feb-08	85.8	3.26
13-Jan-08	102	0.84	27-Feb-08	89.7	3.49
14-Jan-08	102	0.92	28-Feb-08	103	3.69
15-Jan-08	107	0.40	29-Feb-08	115	3.52
16-Jan-08	174	0.32	1-Mar-08	129	3.38
17-Jan-08	244	0.31	2-Mar-08	127	3.03
18-Jan-08	311	0.31	3-Mar-08	123	2.95
19-Jan-08	294	0.31	4-Mar-08	125	3.22
20-Jan-08	137	0.30	5-Mar-08	123	2.69
21-Jan-08	176	0.25	6-Mar-08	120	2.73
22-Jan-08	223	0.21	7-Mar-08	117	3.36
23-Jan-08	224	0.21	8-Mar-08	120	3.98
24-Jan-08	215	0.21	9-Mar-08	129	3.79
25-Jan-08	262	0.15	10-Mar-08	130	4.06
26-Jan-08	231	0.11	11-Mar-08	141	3.99
27-Jan-08	270	0.15	12-Mar-08	145	3.63
28-Jan-08	250	0.16	13-Mar-08	143	3.43
29-Jan-08	201	0.15	14-Mar-08	140	3.80
30-Jan-08	191	0.15	15-Mar-08	139	3.95
31-Jan-08	196	0.14	16-Mar-08	138	3.81
1-Feb-08	198	0.12	17-Mar-08	137	4.02
2-Feb-08	199	0.10	18-Mar-08	143	4.27
3-Feb-08	196	0.10	19-Mar-08	142	4.00
4-Feb-08	197	0.09	20-Mar-08	140	3.87
5-Feb-08	212	0.07	21-Mar-08	135	3.80
6-Feb-08	231	0.06	22-Mar-08	132	3.50
7-Feb-08	240	0.06	23-Mar-08	135	3.01
8-Feb-08	439	0.06	24-Mar-08	131	2.84
9-Feb-08	598	0.05	25-Mar-08	126	3.24
10-Feb-08	629	0.05	26-Mar-08	124	3.64
11-Feb-08	657	0.06	27-Mar-08	120	3.58
12-Feb-08	532	0.06	28-Mar-08	119	2.16
13-Feb-08	441	0.06	29-Mar-08	115	2.64
14-Feb-08	315	0.08	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)	Date	Mean Daily Discharge (cfs)	Mean Daily Water Temp (°C)
6-Jun-08	994	5.75	22-Jul-08	184	15.16
7-Jun-08	882	6.33	23-Jul-08	173	13.83
8-Jun-08	835	6.67	24-Jul-08	163	13.61
9-Jun-08	826	6.18	25-Jul-08	154	13.95
10-Jun-08	851	5.81	26-Jul-08	146	14.57
11-Jun-08	739	6.60	27-Jul-08	139	15.24
12-Jun-08	727	7.40	28-Jul-08	134	14.76
13-Jun-08	831	7.87	29-Jul-08	126	14.12
14-Jun-08	915	7.45	30-Jul-08	131	13.83
15-Jun-08	965	7.50	31-Jul-08	121	13.38
16-Jun-08	1050	7.63	1-Aug-08	118	14.51
17-Jun-08	1100	7.40	2-Aug-08	114	14.08
18-Jun-08	890	7.09	3-Aug-08	106	14.34
19-Jun-08	811	7.06	4-Aug-08	101	15.32
20-Jun-08	825	7.88	5-Aug-08	96	15.83
21-Jun-08	1060	6.97	6-Aug-08	92.3	15.61
22-Jun-08	1110	7.44	7-Aug-08	89.4	15.81
23-Jun-08	943	7.01	8-Aug-08	90.4	16.22
24-Jun-08	863	7.98	9-Aug-08	120	14.92
25-Jun-08	849	8.20	10-Aug-08	98.6	14.53
26-Jun-08	870	8.52	11-Aug-08	91.5	14.16
27-Jun-08	933	9.00	12-Aug-08	85.6	14.89
28-Jun-08	1400	9.25	13-Aug-08	81.9	16.24
29-Jun-08	1970	9.10	14-Aug-08	79.6	17.30
30-Jun-08	2230	9.24	15-Aug-08	76.4	17.63
1-Jul-08	1950	9.44	16-Aug-08	76.2	18.20
2-Jul-08	1480	9.78	17-Aug-08	77.7	18.00
3-Jul-08	1320	10.09	18-Aug-08	75.8	17.43
4-Jul-08	961	10.30	19-Aug-08	74.6	16.77
5-Jul-08	743	9.87	20-Aug-08	86.4	15.83
6-Jul-08	690	10.12	21-Aug-08	107	13.53
7-Jul-08	576	10.31	22-Aug-08	97	12.73
8-Jul-08	543	11.29	23-Aug-08	82.7	13.91
9-Jul-08	529	11.96	24-Aug-08	75.8	14.24
10-Jul-08	488	11.65	25-Aug-08	73.5	14.30
11-Jul-08	407	10.55	26-Aug-08	71.2	13.40
12-Jul-08	355	11.53	27-Aug-08	75.8	13.31
13-Jul-08	337	12.44	28-Aug-08	81.9	13.01
14-Jul-08	320	13.06	29-Aug-08	77.7	14.67
15-Jul-08	294	13.04	30-Aug-08	73.7	13.89
16-Jul-08	269	13.26	31-Aug-08	70.7	12.03
17-Jul-08	250	13.48	1-Sep-08	68	12.06
18-Jul-08	231	13.55	2-Sep-08	65	12.16
19-Jul-08	218	13.67	3-Sep-08	63	12.69
20-Jul-08	207	14.24	4-Sep-08	61.3	13.32
21-Jul-08	193	14.92	5-Sep-08	59.3	13.81
			6-Sep-08	58.9	13.65

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)
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

APPENDIX B: Daily Trap Operating Status

APPENDIX B: Daily Operating Status

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

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

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