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DEPARTMENT OF FISH AND WILDLIFE

Annual Report

2007 Skagit River Salmon Production Evaluation

Funded by Salmon Recovery Funding Board

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Table of Contents

List of Tables

List of Figures

Acknowledgements

Evaluating juvenile salmon production on the largest river in Washington State's Puget Sound Basin is an enormous undertaking. Dangerous work conditions and inclement weather are the norm and this work simply couldn't be done without our experienced field crew. Scientific Technicians Jim Repoz, Dean Toba and Eric Kummerow worked long hours around the clock operating and maintaining the traps, and enumerating and sampling the catches. Scientific Technician Karla VanLeaven operated the coho smolt trap on Mannser Creek and tagged smolts at the Baker River Dam. Fish Biologist Mike Ackley and Scientific Technician Mat Gillum provided valuable logistical support during trap installation and removal. Mark Hino developed the database that helped analyze much of the trap data in this report. Matthew Klungle provided with statistical assistance for length analysis and production data. We would also like to thank Brett Barkdull and the Region 4 staff for their diligent work on the adult spawner surveys and Chinook escapement estimates. Thanks also goes out to Kye Iris for her help in obtaining permits from the City of Mount Vernon, and for the additional support provided by Bob Everitt and Pat Frazier.

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Funding

The Skagit River juvenile salmonid trapping project was funded byWashington State legislature-appointed state general funds and by the Salmon Recovery Funding Board in 2007. These data build on ten years of support provided by the Skagit Non-Flow Plan Coordinating Committee (NCC) between 1997 and 2006. NCC funding supported the expansion of our trapping operation from its original coho focus and the improved estimates of Skagit River natural-origin Chinook 0+ production. The NCC was created by Seattle City Light (operators of several dams on the Skagit) through a fisheries settlement agreement with Washington Department of Fish and Wildlife (WDFW), the Skagit System Cooperative (SSC) and Federal agencies, including NOAA Fisheries, US Fish & Wildlife Service (USFWS), US Forest Service (USFS), and National Park Service (NPS).

Executive Summary

The Skagit River juvenile salmon trapping project, initiated by the Washington Department of Fish and Wildlife in 1990, began with the goal of estimating natural coho smolt production and was later expanded to estimate production of natural-origin juvenile Chinook and to enumerate other juvenile salmonid migrants. Results from this project contribute to the fishery management of coho and provide information on the recovery status of Puget Sound Chinook and steelhead, both listed under the Endangered Species Act.

Scoop and screw traps operated on the Skagit River are located 17-miles upstream of the river mouth. Traps were operated from January 19 through July 25, 2007. The study objectives were to estimate migration abundance and associated confidence intervals for sub-yearling Chinook and yearling coho, investigate the relationship between environmental variables and inter-annual variation in egg-to-migrant survival of sub-yearling Chinook, and document juveniles of additional salmonid species migrating from the Skagit River.

Chinook production estimates were made using a stratified mark-recapture approach. Coho production estimates were made using a pooled mark-recapture approach. For each time strata, juvenile migration and associated variance is based on a Petersen estimator calculated from the number of fish that were marked and released, the number of unmarked fish that were recaptured, and the number of marked fish that were recaptured. Catches of unmarked fish included estimated catch during trap outage periods.

An estimated 2.2 million ± 0.27 million (95% C.I.) natural-origin sub-yearling Chinook migrated during the trapping period, with an additional 4,661 Chinook estimated to have migrated prior to the start of trap operation. Egg-to-migrant survival of the 2006 brood of Skagit River Chinook was estimated to be 3.9%.

The 2007 outmigration of juvenile salmonids included 747,490 ±78,324 (95% C.I.) natural-origin coho smolts as well as catches of 137,829 natural-origin chum fry, 3 pink fry, 925 natural-origin steelhead smolts, and 232 Dolly Varden/bull trout smolts. Catches also included Chinook yearlings, coho fry, sockeye fry and smolts, steelhead adults, cutthroat smolts and adults, and trout fry and parr.

Egg-to-migrant survival of Chinook was among the three lowest survivals observed in eighteen years of data compiled from the Skagit River. This trend was attributed to high flows during vulnerable egg incubation periods in fall 2006.

Introduction

Understanding the major sources of inter-annual variation in salmon run sizes is critical to informing salmon recovery efforts and to improving harvest and habitat management. Production in the freshwater habitat is a key component of this variation influenced by density-dependent variables such as spawner and juvenile abundances and by density-independent variables such as water flow. The Skagit River juvenile salmon trapping project directly assesses salmonid production attributable to the freshwater environment and independent of marine survival and harvest. The long-term nature of this study describes the watershed's natural production potential (capacity) under variable spawner escapements and environmental conditions.

The Skagit River juvenile salmon trapping project, initiated by the Washington Department of Fish and Wildlife in 1990, began with the goal of estimating natural coho smolt production. This program involves trapping and marking natural-origin coho smolts emigrating from a lower river tributary, Mannser Creek (river mile 35) and sampling a portion of the entire population via floating traps in the lower mainstem (river mile 17, Burlington Northern railroad bridge). Coho production estimates are used to improve forecasted adult returns, thus contributing to management of marine harvest of this species (Zimmerman *et al.* 2009). Coho production estimates were also used to resolve discrepancies in escapement estimates (Conrad *et al.* 1997).

The trapping project has subsequently expanded its focus to estimate production of juvenile natural-origin Chinook and to enumerate capture of all juvenile salmonids. Returns of natural-origin Chinook (spring and summer/fall combined) to the Skagit River have declined over the last fifty years (PSSSRG 1992, 1997). In 1994, status of these stocks was designated as "not rebuilding" by the Joint Chinook Technical Committee of the Pacific Salmon Commission. Restoration and monitoring programs associated with Chinook salmon recovery are recommended and coordinated by the Skagit River Chinook work group, formed in 1995. A major goal of this work group is to determine the factors limiting Chinook production. Assessment of juvenile Chinook production, provided by the Skagit River juvenile trapping project, will contribute to this goal by providing a direct measure of freshwater survival. Further information on biological attributes, such as the outmigration timing and outmigrant body sizes, will be useful for flow management (dams and other flow controls), habitat protection, and designs for hatchery programs that minimize interactions between hatchery-origin and natural-origin juvenile Chinook.

In the eighteen years the Skagit River juvenile trapping project has been conducted, Chinook production estimates have been improved by changes to the existing study design. Two major changes have been the length of the trapping season and method used to calculate trap efficiencies associated with migration estimates. For the first seven years (1990-1996), our mainstem Skagit traps targeted the migration of coho smolts (April through June operation). Natural Chinook production was also estimated during these years; however, accuracy of these estimates relies on a series of assumption about the timing of Chinook migration relative to October flows. An expanded trapping season (late January through July), initiated in 1997 and continued through the present, has trapped the majority of the juvenile Chinook migration. Prior to 2006, a seasonal average trap efficiency (or multi-year average) was used to estimate total migration from the catch (e.g. Seiler et al. 2004). This study design did not incorporate seasonal

variation in trap efficiencies associated with environmental variables such as flow or turbidity. In 2006, production estimates were improved by a time-stratified mark and recapture design described in Volkhardt et al. (2007). This method incorporates temporal variation in trap efficiencies associated with different components of the Chinook migration and improves precision of confidence intervals associated with the production estimates.

While time-stratified trap efficiencies should improve production estimates, seasonal-average trap efficiencies have provided a reasonably accurate estimate of natural juvenile Chinook production from broods between 1997 and 2006. We base this contention on the use of existing data to demonstrate biological processes affecting Chinook survival. Chinook freshwater survival estimates, based on seasonal-average trap efficiencies, trap catch, and spawner abundance for each brood year (Pete Castle pers. comm.), are negatively correlated with the severity of flow during the period that the eggs were incubating in the gravel. This relationship indicates that overall egg-to-migrant survival for Skagit River Chinook has varied nearly fifteen-fold within just the first seven broods, almost entirely as a function of flow during egg incubation.

Study Plan for 2007

Our three study objectives were to 1) estimate abundance and associated confidence intervals of sub-yearling Chinook and yearling coho outmigration in 2007, 2) investigate relationship between environmental variables and inter-annual variation in egg-to-migrant survival of sub-yearling Chinook, and 3) document additional juvenile salmonids migrating from the Skagit River. In order to accomplish these objectives, the following seven operational elements were included in the 2007 work plan.

1. **Trapping season**. Scoop and screw traps were operated from mid-January through July, a period encompassing the majority of the coho and Chinook outmigration.

2. **Nightly trap operation**. Scoop and screw traps were operated nightly throughout the season.

3. **Daytime trap operation**. Traps were operated every third day. Day and night catches were separated by enumerating catches at dawn and dusk.

4. **Pooled-sample mark and recapture for coho.** Captured coho smolts were enumerated, marked (left-ventral fin clip), and released from a 100%-capture smolt trap in Mannser Creek, a tributary to the lower river. Recapture rates of these marked fish in the mainstem traps provide season-specific measures of trap efficiency used to estimate total abundance of juvenile coho migrants.

5. **Time-stratified mark and recapture for Chinook.** Over the trapping season, sub-yearling Chinook were marked at the mainstem trap, released upstream, and recaptured in a series of discrete temporal strata.

6. **Environmental Parameters**. Turbidity data, taken at the water withdrawal plant at Mount Vernon, and flow data, provided by USGS gage #12200500 (Skagit River Near Mount Vernon, WA), were compared with variation in day:night catch rate ratios.

7. **Assess Hatchery Chinook Survival.** In-river survival of hatchery Chinook was examined separately from natural-origin Chinook using the number of ad-marked/coded-wire tagged hatchery Chinook fingerlings passing the trap relative to the number released from three upstream locations (Countyline Ponds, Baker River, Marblemount Hatchery).

Methods

Trapping Gear and Operation

Mainstem Traps

Juvenile salmonids were caught with two types of traps: a floating inclined-plane screen trap (scoop trap) (Seiler *et al.* 1981, Volkhardt et al. 2007) and a screw trap (Busack *et al.* 1991, Volkhardt et al. 2007). Both traps are contained between steel pontoon barges, outfitted with two five-ton, bow-mounted anchor winches loaded with up to 600 ft of $^{3}/_{8}$-inch aircraft cable. Overall, the scoop trap barge measures 13-ft x 44-ft, while the screw trap barge is 15-ft x 30-ft. The scoop trap has a 6-foot wide inclined screen and is fished 3.5-feet deep to maintain an oblique angle to the flow. We have found that the angle formed by the 16 ft-long screen, set 3.5-ft deep at the entrance, precludes impinging migrants as small as pink and chum fry, as there is sufficient sweep velocity across the surface relative to the direction of river flow. At this depth, the scoop trap screens a rectangular cross-sectional area of 21-ft^2. The 8-ft diameter screw trap screens a cross-sectional area of 25-ft^2, in the shape of a semi-circle.

The traps were placed in the lower Skagit River at river mile (R.M.) 17 (Figure 1). Four anchor lines were attached to railway bridge support structures after obtaining permission from Burlington Northern-Santa Fe (BNSF) Railroad. Traps were positioned side by side in the zone of highest water velocity, which occurs just south of the southernmost pier and approximately 70-ft from the south bank. Velocity at this site varies as a function of discharge. At low flows it averages around 5 feet per second (fps), and increases to around 9 fps at high flows.

Traps were fished every night and every third day. All captured fish were enumerated by species and examined for external marks. Lengths (fork length, FL) of natural-origin Chinook, coho, steelhead, and char were measured over the season. We used the nonparametric Kolmogorov-Smirnov (K-S) two-sample test (Sokal and Rohlf 1981) to compare fork length differences between scoop and screw trap catches ($\alpha = 0.05$).

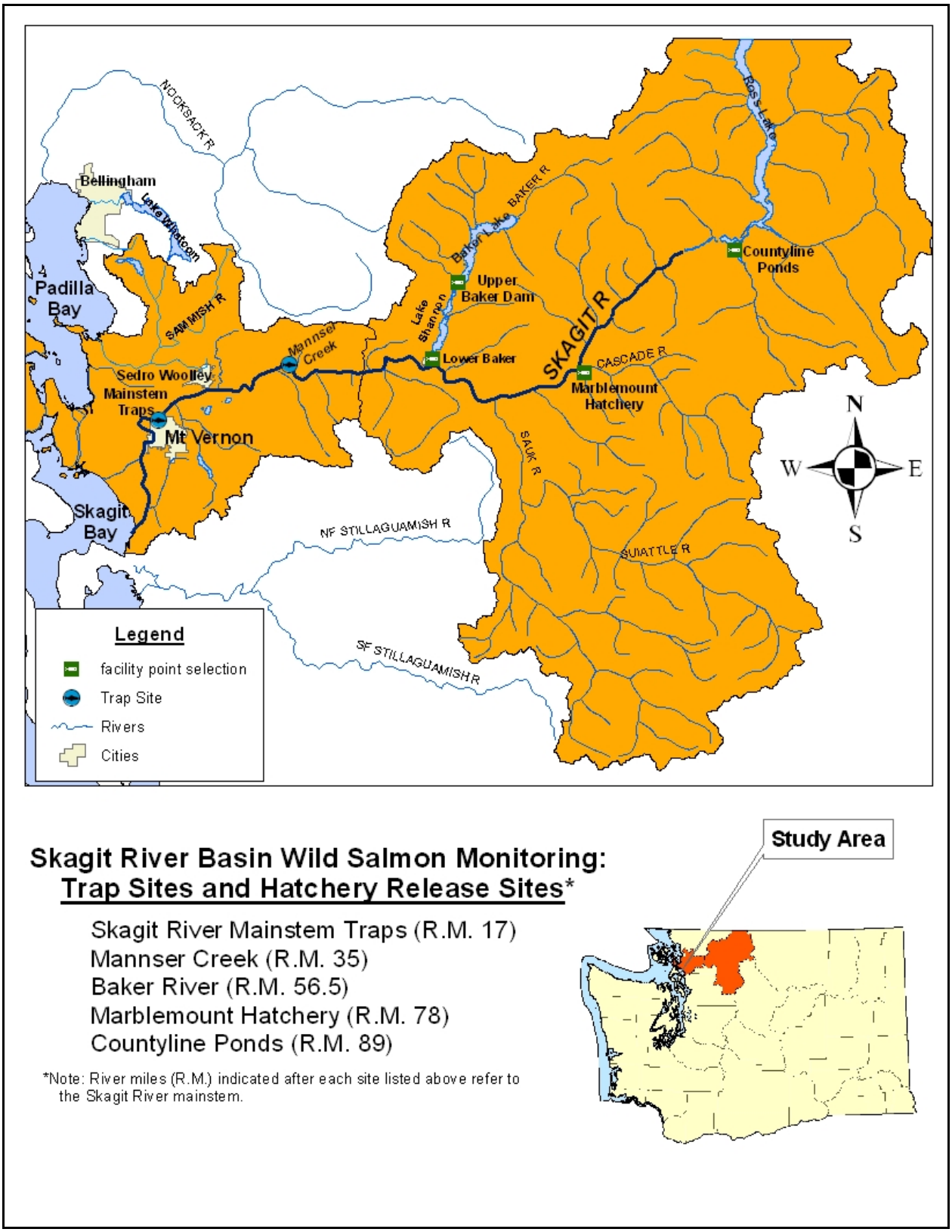

Figure 1. Map of tributary and mainstem trap sites and hatchery release sites related to the Skagit River juvenile salmonid trapping project in 2007.

Environmental Parameters

Water flow, temperature, and turbidity are important environmental variables affecting survival of juvenile salmonids as well as downstream migrant trapping operations. Information on the timing and magnitude of high flow events was obtained from daily mean flows at USGS gage #12200500, located at Mount Vernon. Daily water temperatures and turbidity data were obtained from the Anacortes Water Treatment Facility in Mount Vernon, located just below the trap site at R.M.16.

Production Estimate

Total production of Chinook and coho in the Skagit River was estimated from the number of migrants passing the mainstem traps and a measure of trap efficiency. Trap efficiency is the percent of the total migration sampled by the trap and is measured from recapture rates of a known number of marked and released fish. Scoop and screw traps were operated in parallel; therefore, capture and efficiency data were pooled across the two trap types to generate production estimates.

Analytical methods used to estimate Chinook and coho migrations differed based on study designs. Migration estimate of natural-origin sub-yearling Chinook was based on a time-stratified mark-recapture sampling design. Chinook were caught, marked, and recaptured at the same location. Releases of these groups occurred in the evening and traps were fished continuously over the night or over night-day-night fishing periods. Migration estimate of natural-origin yearling coho was based on a pooled mark-recapture sampling design. In this case, coho were marked and released from an upstream weir (100% capture of coho smolts). Marked coho were recaptured in downstream mainstem traps. Operation of the upstream weir and formulas used to estimate migration of Chinook and coho are provided below.

Natural-Origin Chinook 0+

Time-Stratified Trap Efficiencies

Twenty-six efficiency groups of marked natural-origin sub-yearling Chinook were released approximately 1 mile upstream of the trap. Groups were anesthetized with tricaine methanesulfonate (MS-222) and marked with either a partial upper or lower caudal clip or Bismarck brown dye (14 ppm for 1.5 hours). Dye was used earlier in the season when Chinook were small and water temperatures were cool. Adjacent efficiency groups were pooled when release groups did not differ in the ratio of marked fish that were recaptured to those that were not recaptured. Differences among ratios were tested with a G-test ($\alpha = 0.05$).

Migration Estimate

Abundance of migrating natural-origin Chinook was estimated using a stratified mark-recapture sampling design and the Petersen estimator, modified by Chapman (1951). Smolt abundance during each time stratum *i* is estimated by:

$$\hat{U}_i = \frac{(u_i + 1)(M_i + 1)}{(m_i + 1)} - 1 \qquad \textbf{Equation 1}$$

where: $\hat{U}_i$ = Total migration of unmarked fish passing the trap during time period *i*

u_i = Unmarked fish caught during time period *i*

M_i = Marked fish released above the trap during time period *i*

m_i = Marked fish recaptured in the trap during time period *i*

Seber (1982) provides an approximate unbiased estimate of the variance:

$$V(\hat{U}_i) = \frac{(M+1)(u+1)(M-m)(u-m)}{(m+1)^2(m+2)} \quad \textbf{Equation 2}$$

Total migration of juvenile salmonids is:

$$\hat{N} = \sum_{i=1}^{n} \hat{U}_i \quad \textbf{Equation 3}$$

Similarly, the variance of *N* is estimated by the sum of the variances for U_i. The normal confidence interval about *N* was calculated using:

$$\hat{N}_{95\%ci} = \hat{N} \pm 1.96\sqrt{V(\hat{N})} \quad \textbf{Equation 4}$$

The Petersen method for making a population estimate is based on assumptions that (1) the population is geographically closed with no immigration or emigration, (2) the population is demographically closed with no births or deaths, (3) marking does not change fish behavior or vulnerability to capture, (4) marked fish mix randomly with unmarked fish, (5) no marks are lost or missed, and (6) all fish have an equal probability of capture during the fishing period (Seber 1982). The geographically closed population assumption is violated at some level as all fish are emigrating; however, a temporal closure is obtained because the trap operates over the entire outmigration and outmigrants must pass a fixed point (i.e., the trap). Assumptions 2-5 were reasonably met by our study design; assumption 6 is discussed below.

We address two additional issues in our analytical approach. First, our study design violates the assumption that marked fish and unmarked fish have the same probability of capture during each fishing period. Second, traps did not fish 24-hours a day; trap outages occurred every second and third day as well as during trap checks and high water events. Accommodations for these issues are discussed below.

Unequal Probability of Capture

Our sampling approach assumes that marked fish and unmarked fish have the same probability of capture during each fishing period. However, recaptures of marked Chinook at the Skagit River mainstem traps occurred during a relatively short period (e.g., a few hours after release), whereas the unmarked catches they represent occurred over a longer period. Furthermore, since trapping was suspended during periods when only unmarked fish were passing the trap, catch of unmarked fish must be estimated for the abundance estimator to be valid. In this case $\hat{u}_i$ is

substituted for u_i in Equation 1. Variance, $V(\hat{U}_i)$, is now estimated using the following (see Appendix A for derivation):

$$V(\hat{U}_i) = V(\hat{u}_i)\left(\frac{(M_i+1)(M_i m_i + 3M_i + 2)}{(m_i+1)^2(m_i+2)}\right) + \left(\frac{(M_i+1)(M_i - m_i)\hat{u}_i(\hat{u}_i + m_i + 1)}{(m_i+1)^2(m_i+2)}\right) \quad \textbf{Equation 5}$$

where:

$V(\hat{u}_i)$ = Variance of the estimated unmarked catch.

Catch Expansion During Trap Outages

For each time stratum, total catch of natural-origin sub-yearling Chinook included actual catch and an estimate of catch if no trap outages had occurred. Trap outages occurred every second and third day as well as during trap checks and periods of high river discharge and debris loading. Actual and estimated catches for the various night, transitional, and day periods were summed within each time stratum to estimate $\hat{u}_i$. Similarly, $V(\hat{u}_i)$ was the sum of the estimated catch variances.

To estimate missed catch for nights that the traps did not fish, we used the average catch rate from the night prior to and after the trap outage and applied this rate to number of night time hours not fished.

Variance of estimated night catch is:

$$V(\hat{u}_n) = h_n^2\left(\frac{\left(\frac{u_{n-1}}{h_{n-1}} - \left(\frac{u_{n-1}+u_{n+1}}{h_{n-1}+h_{n+1}}\right)\right)^2 + \left(\frac{u_{n+1}}{h_{n+1}} - \left(\frac{u_{n-1}+u_{n+1}}{h_{n-1}+h_{n+1}}\right)\right)^2}{2}\right) \quad \textbf{Equation 6}$$

where:

$V(\hat{u}_n)$ = Variance of the estimated catch of unmarked natural-origin fish on night *n*

h = Hours during the night for period (*n-1, n, n+1)*

u_{n-1} = Catch of natural-origin fish during the night for period (*n-1, n, n+1)*

We also calculated missed catch for the transitional periods during trap checks. This missed catch was estimated by applying average catch rate for the period surrounding the trap outage to the amount of time trap did not fish. Variance was estimated using Equation 6 substituting transitional values for the night values.

Catch during non-fished daytime periods was estimated using a day to night catch ratio (*R*), an average nighttime catch (prior to and following the particular day), and daytime hours not fished:

$$\hat{u}_d = R\left(\frac{u_{n-1} + u_n}{h_{n-1} + h_n}\right)h_d = R\bar{Z}h_d \qquad \textbf{Equation 7}$$

where:

R	=	Day:night catch ratio calculated as $\bar{R}$ (described below)
$\bar{Z}$	=	Average catch rate for the night prior to and following day period *d*
h_d	=	Daytime hours not fished

Variance of estimated daytime catch was calculated using the delta method (Goodman 1960);

$$V(\hat{u}_d) = h_d^2\left[V(R)\bar{Z}^2 + V(\bar{Z})R^2 - V(R)V(\bar{Z})\right] \qquad \textbf{Equation 8}$$

where:

$$V(\bar{Z}) = \left(\frac{\left(\frac{u_{n-1}}{h_{n-1}} - \left(\frac{u_{n-1} + u_n}{h_{n-1} + h_n}\right)\right)^2 + \left(\frac{u_n}{h_n} - \left(\frac{u_{n-1} + u_n}{h_{n-1} + h_n}\right)\right)^2}{2}\right) \qquad \textbf{Equation 9}$$

Day to night ratio, *R*, and its associated variance, *V(R)*was calculated from a central tendency ($\bar{R}$). Day:night ratio ($\bar{R}$) was the mean or median day to night ratio, depending on whether the data are normally distributed. Variance of the seasonal average day:night ratio is:

$$V(\bar{R}) = \frac{\sum(R_j - \bar{R})^2}{k(k-1)} \qquad \textbf{Equation 10}$$

where *k* is the total number of day:night ratios and R_j is the ratio of day to night catch rates for a 36 hour period *j*:

$$R_j = \frac{C_d}{h_d}\left(\frac{h_{n-1} + h_n}{C_{n-1} + C_n}\right) \qquad \textbf{Equation 11}$$

where:

R_j	=	Ratio of day to night catch rates for 36 hour period j;
C_d	=	Catch during daylight period *d*;
C_{n-1}	=	Catch during the night before period *n*;
C_n	=	Catch during night period *n*;
h_{n-1}	=	Hours during the night before period *n*;
h_n	=	Hours during night period *n*; and
h_d	=	Hours during day period *d*.

Egg-to-Migrant Survival

Survival from egg deposition to outmigration of natural-origin sub-yearling Chinook was calculated as:

$$\hat{S} = \frac{\hat{N}_{i+1}}{\hat{G}_i \hat{E}_i \hat{F}_i} \qquad \textbf{Equation 12}$$

Where:
- $\hat{N}_{i+1}$ = Estimated age-0+ Chinook migration in year *i+1*
- $\hat{G}_i$ = Estimated proportion of females in Chinook spawning population in year *i*
- $\hat{E}_i$ = Estimated Chinook escapement in year *i*
- $\hat{F}_i$ = Estimated Chinook fecundity in year *i*

To estimate $\hat{G}$ and $\hat{F}$, we assumed females comprised 45% of the adult escapement and had a fecundity of 5,500 eggs/female (Pete Castle, pers. comm.). Escapement data were based on spawner surveys conducted by WDFW Region 4 staff.

Hatchery-Origin Chinook 0+

Three groups of ad-marked and coded-wire tagged (ad/CWT) hatchery Chinook fingerlings were released from production facilities in Spring 2007. Locations of these releases are shown in Figure 1:

- May 25: two different groups of summer Chinook (232,150) released from Countyline Ponds (R.M. 89);
- June 11: two different groups of fall Chinook (162,772) released from the lower Baker River (Baker R.M 1.0, Skagit River R.M. 56.5);
- June 15: 255,685 spring Chinook released from Marblemount Hatchery (R.M. 78).

In addition, WDFW rearing facilities released two small groups of unmarked/untagged hatchery Chinook 0+, the first occurred on May 25 (15,897 fingerlings from Countyline Ponds) and the second occurred on June 11 (20,178 fingerlings from the lower Baker River) (Table 1). These unmarked fish were not distinguished from natural-origin Chinook in our analysis.

Estimated hatchery migrations passing the trap were calculated using the approach described for natural-origin fish, substituting the unmarked catch of hatchery fish for natural-origin fish in all equations. To make this estimate, we used natural-origin efficiency groups as a measure of trap efficiency.

Survival of hatchery fish to the trap was estimated by dividing the migration of hatchery-origin chinook passing the trap by the number released from the hatcheries. Survival estimates for hatchery migrants from each facility were complicated by the release of three different groups/stocks with the same external mark. Beginning with the release of the summer Chinook from Countyline Ponds on May 25, we systematically sacrificed a sample of ad-marked age
0+ Chinook over the entire migration period to recover tags and thereby estimate catches of each group. These results were used to apportion the catches and catch expansions of hatchery migrants among the three release groups.

Table 1. Efficiency groups of Chinook, coho, and chum juveniles marked, released, and recovered at the mainstem traps in the Skagit River, 2007.

	Stock	Species/ Age	Mark Type	Marked Releases		Recapture Date	Recaptures			Capture Rate		
				Date	Number		Scoop	Screw	Total	Scoop	Screw	Total
	Natural-origin (Mannser Creek)	Coho 1+	LV	4/11-6/18	19,047	4/22-6/17	183	150	333	0.96%	0.79%	1.75%
Calibration Groups	Natural-origin	Chin 0+	Dye	02/21	379	22-Feb	7	1	8	1.85%	0.26%	2.11%
	Natural-origin	Chin 0+	Dye	02/24	427	25-Feb	4	3	7	0.94%	0.70%	1.64%
	Natural-origin	Chin 0+	Dye	02/28	386	01-Mar	2	0	2	0.52%	0.00%	0.52%
	Natural-origin	Chin 0+	Dye	03/03	380	04-Mar	3	5	8	0.79%	1.32%	2.11%
	Natural-origin	Chin 0+	Dye	03/06	222	07-Mar	1	2	3	0.45%	0.90%	1.35%
	Natural-origin	Chin 0+	Dye	03/09	883	10-Mar	11	8	19	1.25%	0.91%	2.15%
	Natural-origin	Chin 0+	Dye	03/18	1,052	19-Mar	17	9	26	1.62%	0.86%	2.47%
	Natural-origin	Chin 0+	Dye	03/23	809	24-Mar	6	4	10	0.74%	0.49%	1.24%
	Natural-origin	Chin 0+	Dye	03/30	461	31-Mar	11	9	20	2.39%	1.95%	4.34%
	Natural-origin	Chin 0+	Dye	04/02	1,007	03-Apr	36	13	49	3.57%	1.29%	4.87%
	Natural-origin	Chin 0+	Dye	04/06	786	07-Apr	51	14	65	6.49%	1.78%	8.27%
	Natural-origin	Chin 0+	Dye	04/09	954	10-Apr	71	23	94	7.44%	2.41%	9.85%
	Natural-origin	Chin 0+	Dye	04/12	540	13-Apr	13	5	18	2.41%	0.93%	3.33%
	Natural-origin	Chin 0+	Dye	04/15	734	16-Apr	60	18	78	8.17%	2.45%	10.63%
	Natural-origin	Chin 0+	Dye	04/19	800	20-Apr	67	12	79	8.38%	1.50%	9.88%
	Natural-origin	Chin 0+	Dye	04/23	1,093	24-Apr	82	8	90	7.50%	0.73%	8.23%
	Natural-origin	Chin 0+	Dye	04/27	1,027	28-Apr	32	14	46	3.12%	1.36%	4.48%
	Natural-origin	Chin 0+	Dye	05/03	798	04-May	29	2	31	3.63%	0.25%	3.88%
	Natural-origin	Chin 0+	Dye	05/10	487	11-May	28	3	31	5.75%	0.62%	6.37%
	Natural-origin	Chin 0+	Dye	05/15	617	16-May	16	6	22	2.59%	0.97%	3.57%
	Natural-origin	Chin 0+	UC	05/22	340	23-May	23	10	33	6.76%	2.94%	9.71%
	Natural-origin	Chin 0+	LC	05/28	488	29-May	36	9	45	7.38%	1.84%	9.22%
	Natural-origin	Chin 0+	UC	06/11	379	12-Jun	9	8	17	2.37%	2.11%	4.49%
	Natural-origin	Chin 0+	UC	06/16	445	17-Jun	7	17	24	1.57%	3.82%	5.39%
	Hatchery-origin	Chin 0+	LC	06/16	489	17-Jun	3	3	6	0.61%	0.61%	1.23%
	Natural-origin	Chin 0+	UC	06/19	95	20-Jun	1	0	1	1.05%	0.00%	1.05%
	Hatchery-origin	Chin 0+	LC	06/19	345	20-Jun	4	3	7	1.16%	0.87%	2.03%
	Hatchery-origin	Chin 0+	UC	06/28	135	29-Jun	2	1	3	1.48%	0.74%	2.22%
	Natural-origin	Chin 0+	UC	06/28	219	29-Jun	5	8	13	2.28%	3.65%	5.94%
	Natural-origin	Chum 0+	Dye	03/18	1,503	19-Mar	21	10	31	1.40%	0.67%	2.06%
	Natural-origin	Chum 0+	Dye	03/23	1,000	24-Mar	16	7	23	1.60%	0.70%	2.30%
	Natural-origin	Chum 0+	Dye	03/30	710	31-Mar	34	16	50	4.79%	2.25%	7.04%
	Natural-origin	Chum 0+	Dye	04/12	803	13-Apr	14	12	26	1.74%	1.49%	3.24%
	Natural-origin	Chum 0+	Dye	04/15	763	16-Apr	52	16	68	6.82%	2.10%	8.91%
	Natural-origin	Chum 0+	Dye	04/19	994	20-Apr	29	4	33	2.92%	0.40%	3.32%
Hatchery	County Line Ponds/ summer	Chin 0+	Ad/CWT	05/25	232,150	(see Table 11)						
	County Line Ponds/ summer	Chin 0+	Unmk	05/25	15,897							
	Baker River/ fall	Chin 0+	Ad/CWT	06/11	162,772							
	Baker River/ fall	Chin 0+	Unmk	06/11	20,178							
	Marblemount/ spring	Chin 0+	Ad/CWT	06/15	255,685							

Natural-Origin Coho

We estimate coho smolt production from the Skagit River with the pooled Petersen mark and recapture design developed and used in a number of large watersheds throughout the state. This method, described in Volkhardt et al. (2007), uses two traps and involves the following components:

1. Trapping all the natural-origin coho smolts emigrating from a selected tributary
2. Identifying each of these smolts with an external mark
3. Capturing a portion of the smolt population migrating through the lower mainstem and examining each fish for the mark

Coho smolts were marked upon capture and released from the Mannser Creek trap. Mannser Creek, a small tributary that joins the Skagit River at R.M. 35.1, provides excellent over-winter rearing habitat and is heavily utilized by juvenile coho. The Mannser creek trap, which captures 100% of migrants passing the weir (Blankenship and Tivel 1980), was operated for the duration of the coho smolt migration (mid April through late June). Captured coho smolts were enumerated, sub-sampled for fork lengths (±1mm), marked with a ventral-fin clip (vent-clipped), and released. Coho in poor condition were not clipped to avoid confounding trap efficiency and mortality information. Coho captured in the two mainstem traps were examined for fin clips.

This design produces relatively precise and unbiased production estimates, because a temporal representation of the coho migration is marked via 100% trapping at an upstream tributary. Therefore, trapping in the mainstem does not have to be continuous or even representative with respect to timing (Seber 1982). We explicitly developed this design to avoid the requirement of estimating gear efficiency.

This approach uses a simple pooled Petersen estimator; the entire trapping season is represented by a single time period *i* in Equation 1. Variance is calculated from Equation 2.

Size selectivity of the mainstem trap was evaluated using a two-sample Kolmogorov-Smirnov test that compared length distributions between the coho smolts released from the Mannser trap and the marked coho recaptured in the mainstem traps ($\alpha = 0.05$). Size selectivity is expected to be associated with water flows. At low flow velocities, large smolts can avoid capture by swimming away from the trap entrance or out of the traps. This avoidance behavior is reduced at high flows.

Hatchery-Origin Coho

Hatchery coho smolts captured in the mainstem traps were visually distinguished from natural-origin coho based on detection of coded-wire tags and adipose marks.

Results

Trap Operation

Traps operated between January 19 and July 25, 2007. In total, the scoop trap fished 2,475.9 of a possible 4,482.5 hours, 55.2% of the total season; the screw trap operated for 2,424.0 hours, 54.1 % of the total season (Table 2). Over the 188-day season, the scoop trap was operated all but 14 of the nights; trap operation on nine of these nights was interrupted due to mechanical problems, high flows, and high debris loads. The scoop trap was also fished throughout the daytime on 51 days, usually every third day. Between July 16 and June 25, traps were operated for three consecutive nights and then removed from the water for two nights as Chinook catches had significantly declined during this period.

Table 2. Operation periods of Skagit River downstream migrant traps, 1990-2007.

Year	Gear Type	TRAPPING INTERVAL										
		Date		Season Total Days	Number of Days Fished				Trap Out	Hours		
					Nighttime		Daytime					
		Start	End		Full	Partial	Full	Partial		Total	Trapped	Percent Fished
1990	Scp/Scr	04/13	06/19	66	50	1	5	10	11	1,602.5	590.5	36.8%
1991	Scoop	04/08	06/20	73	72	1	4	18	0	1,741.5	858.0	49.3%
1992	Scoop	04/10	06/21	72	65		3	5	7	1,717.0	667.0	38.8%
1993	Scoop	04/11	06/07	57	53	2	0	8	2	1,355.5	539.5	39.8%
	Screw	04/22	06/07	46	32	0	4	5	14	1,095.0	366.5	33.5%
1994	Scoop	04/09	06/29	81	78	3	5	4	0	1,931.0	828.0	42.9%
	Screw	04/09	06/29	81	78	1	10	6	2	1,931.0	917.0	47.5%
1995	Scoop	03/25	07/15	112	112	0	5	8	0	2,724.0	1,189.0	43.6%
	Screw	03/25	07/17	114	110	2	8	8	2	2,729.5	1,207.0	44.2%
1996	Scoop	04/12	07/18	97	95	0	6	28	2	2,321.5	1,110.5	47.8%
	Screw	04/12	07/18	97	91	3	7	25	3	2,321.5	1,112.0	47.9%
1997	Scoop	02/14	09/10	208	182	9	58	53	17	4,996.0	2,719.0	54.4%
	Screw	02/14	09/10	208	174	11	56	21	23	4,996.0	2,667.0	53.4%
1998	Scoop	01/18	09/11	236	231	0	85	3	5	5,640.0	3,599.0	63.8%
	Screw	01/18	09/11	236	188	0	69	1	48	5,640.0	2,992.0	53.0%
1999	Scoop	01/16	09/06	234	223	0	72	3	11	5,595.3	3,326.9	59.5%
	Screw	01/16	09/06	234	215	0	70	1	19	5,594.8	2,353.2	42.1%
2000	Scoop	01/15	08/18	216	205	0	62	0	11	5,206.0	3,042.1	58.6%
	Screw	01/15	10/27	286	209	0	65	0	77	6,860.5	3,116.1	45.6%
2001	Scoop	01/16	07/30	195	191	1	57	3	4	4,648.7	2,701.2	58.1%
	Screw	01/16	07/30	195	184	6	53	6	5	4,648.7	2,712.8	58.4%
2002	Scoop	01/16	07/30	197	175	7	57	3	15	4,728.0	2,665.0	56.4%
	Screw	01/16	07/30	197	174	4	53	4	19	4,728.0	2,631.0	55.7%
2003	Scoop	01/15	07/30	198	180	5	56	0	13	4,693.0	2,658.0	56.6%
	Screw	01/15	07/30	198	181	2	58	2	15	4,693.0	2,651.0	56.5%
2004	Scoop	01/23	07/28	187	181	6	52	7	17	4,484.5	2,475.7	55.2%
	Screw	01/23	07/28	187	183	4	52	7	15	4,484.5	2,492.8	55.6%
2005	Scoop	01/21	07/25	185	171	5	54	14	9	4,451.7	2,567.0	57.7%
	Screw	01/21	07/25	185	170	7	56	13	8	4.451.7	2,574.9	57.8%
2006	Scoop	01/18	07/31	195	170	7	54	5	21	4,646.3	2,603.7	56.0%
	Screw	01/18	07/31	195	174	4	55	7	21	4,646.3	2,604.8	56.1%
2007	Scoop	01/19	07/25	188	157	31	51	8	11	4,482.5	2,475.9	55.2%
	Screw	01/19	07/25	188	154	34	52	6	21	4,482.2	2,424.0	54.1%

River Flow

2007 flows were comparable to the 66-year mean daily stream flow (Figure 2). Durign the egg incubation period, daily mean flow, measured at the Skagit River gauging station near Mount Vernon (USGS #12200500), ranged between 3,600 cfs (October 14) to 125,000 cfs (November 8). Egg incubation period for Chinook spans mid-October through January for spring, summer, and fall-run Chinook in the Skagit River. Daily mean flow during the trapping period averaged 21,703 cfs and was slightly higher than the 66-year average of 18,480 cfs for this same period.

Prior to trap installation, a high flow event occurred on January 3 (49,900 cfs). Flows generally declined through the month of January and averaged 16,518 cfs in February, similar to the long-term average for this month (16,721 cfs). Average flows in March (29,939 cfs) were over twice that of the long-term average (14,319 cfs). Two high peak flow events occurred in March: 61,100 cfs on March 13 and 74,200 cfs on March 25. Trapping was suspended during both these peaks due to unsafe conditions and heavy debris. Flows declined following these peaks but rose again during spring runoff in April.

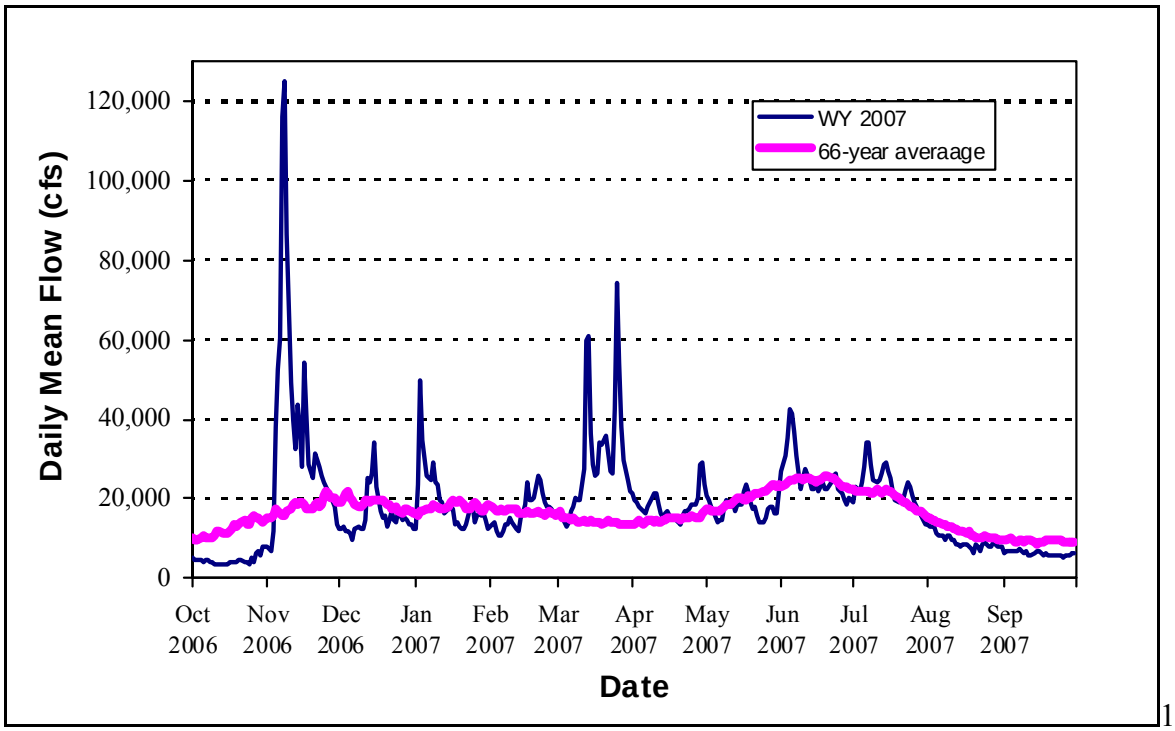

Figure 2. Daily mean flows in year 2007 compared with 66-year average flow (1940-2006) of the Skagit River near Mount Vernon (USGS data).

Chinook 0+

Chinook 0+ Catch

Chinook fry were already moving downstream when trapping began on January 19. Nightly catch rates rose to 20 fish/hour on March 10. The timing of this increase in catch was nearly a month later than 2006. Catch rates peaked on April 7 for the scoop trap (105.8 fish/hour) and April 8 for the screw trap (58.6 fish/hour). Day-to-day variation in natural-origin Chinook catch rates was nearly identical between traps; however, the scoop trap consistently out-fished the screw trap. Through the season, scoop and screw traps captured natural-origin Chinook 0+ at average rates of 12.9 and 7.1 fish/hour, respectively.

Catch over the season was 49,271 natural-origin and 13,612 hatchery-origin sub-yearling Chinook (Table 3). Natural and hatchery 0+ Chinook catches do not include recaptures of fish used in trap efficiency groups. Catches of natural-origin Chinook 0+ have ranged between 1,700 and 101,260 outmigrants over the previous seventeen years (Table 3, Table 4). Catches of juvenile hatchery-origin Chinook have ranged between 1,097 and 19,474 outmigrants over the previous ten years (Table 3, Table 4).

Catch of hatchery-origin 0+ Chinook was apportioned among three release groups through CWT recovery at the mainstem traps. Between May 27 and July 22, 1,359 hatchery-origin Chinook were sacrificed to recover CWT information; a total of 1,336 tags were recovered from zero-age Chinook (Table 5). Three CWT Chinook were captured before reported 2007 release dates. Two of the recovered tags were from last year's hatchery Chinook 0+ release groups: one Marblemount spring, and one Countyline summer. The other captured fish was not sacrificed for tag removal.

Chinook 0+ Day:Night Catch Ratios

Day to night catch ratios were compared for natural-origin Chinook 0+ for 53 days of scoop trap operation and 50 days of screw trap operation. Day:night catch rate ratios (d:n ratios) varied from 8.9% to 198.0% for the scoop trap and from 12.3% to 325.3% for the screw trap (Table 6, Table 7).

A seasonal value of this ratio was used to estimate catch during daytime trap outages. Median day to night catch ratio was used for natural-origin Chinook (seasonal data were not normally distributed, Shapiro-Wilk test: scoop $p = 0.0002$, screw $p = 3.817e\text{-}06$). Average day to night catch ratio was used for hatchery-origin Chinook (day to night catch rate ratios were normally distributed, Shapiro-Wilk test: scoop $p = 0.07$, screw $p = 0.99$) (Table 6, Table 7). No strong relationship existed between day to night catch ratios and flow or turbidity (Table 8, Table 9).

Table 3. Juvenile salmonid migrants captured in the Skagit River mainstem scoop (scp) and screw (scr) traps between 1998 and 2007.

Species	1998		1999		2000		2001		2002		2003		2004		2005		2006		2007	
	Scp	Scr	Scp	Scr	Scp	Scr	Scp	Scr	Scp	Scr	Scp	Scr	Scp	Scr	Scp	Scr	Scp	Scr	Scp	Scr
Coho 1+																				
Natural	13879	9076	4904	3314	13449	14861	2581	4354	8807	9347	6236	7537	10440	6615	4589	3794	4576	5098	7582	5524
Hatchery	623	1028	673	635	624	946	103	398	453	668	447	1229	647	1511	119	246	365	1034	571	605
Coho 0+	1216	409	744	311	115	27	2604	871	1896	435	1303	366	2786	510	1453	420	209	75	30	14
Chinook 1+																				
Natural	876	350	198	87	129	105	32	26	199	228	95	94	342	205	59	57	51	42	364	296
Hatchery	24	12	201	41	511	360	26	50	177	161	170	122	172	212	33	24	158	108	604	390
Chinook 0+																				
Natural	33698	20001	55254	41492	23289	14944	54762	40180	35332	24908	51316	34498	13009	6694	44737	34470	61493	39767	32058	17213
Hatchery	5837	2127	3449	2213	2554	2152	1667	1354	3310	2726	2033	1611	[a]12874	[b]6600	657	440	8294	8129	8202	5410
Sockeye 1+	111	84	72	23	9	11	5	1	27	35	1	7	88	83	17	4	45	72	166	213
Chum 0+	37162	18498	172774	108730	39608	40234	133890	105200	16526	16664	82668	70059	66739	58488	47439	34087	44269	34767	80724	57105
Pink 0+	338520	102338	476	265	207530	198015	2644	1350	104782	153668	1604	1731	113975	99507	26	18	178987	127908	1	2
Steelhead 1+																				
Natural	389	1100	99	334	95	597	32	317	118	437	32	366	337	1287	45	289	36	293	179	746
Hatchery	446	2325	122	511	75	736	23	465	75	534	26	474	213	2401	16	183	17	624	114	1932
Steelhead Adult	1	3	11	1	1	2	0	0	1	2	0	0	0	0	2	0	0	0	0	3
Cutthroat 1+	98	401	30	150	51	248	11	318	53	196	32	151	34	233	19	279	17	169	18	136
Cutthroat adult	2	5	4	0	0	7	0	0	0	7	0	0	0	18	0	21	0	0	0	3
Native char 1+	153	206	101	98	109	138	20	125	74	115	81	73	91	101	10	21	31	59	121	111
Trout Parr	90	83	42	57	116	155	86	123	31	44	83	102	64	61	19	13	53	59	15	14

[a] Includes 690 unmarked hatchery Chinook.

[b] Includes 341 unmarked hatchery Chinook.

Table 4. Juvenile salmonid migrants captured in the Skagit River mainstem traps between 1990 and 1997.

Species	1990	1991	1992	1993		1994		1995		1996		1997	
	Scoop	Scoop	Scoop	Scoop	Screw	Scoop	Screw	Scoop	Screw	Scoop	Screw	Scoop	Screw
Coho 1+													
Natural origin	10,204	6,904	8,620	3,636	3,690	10,767	10,211	8,661	8,824	11,520	9,134	6,437	5,975
Hatchery origin	234	382	596	[a]714	[a]723	1,880	1,873	4,800	5,274	973	1,208	334	362
Coho 0+	48	22	64	79	4	57	5	204	57	246	50	364	220
Chinook 1+													
Natural origin	[b]45	[b]1,132	[b]299	[b]3,567	[b]262	308	212	184	112	80	32	46	52
Hatchery origin	---	---	---	---	---	---	---	1,754	570	415	117	376	249
Chinook 0+													
Natural origin	[c]8,528	[d]1,706	[e]8,812	[f]7,463	[f]3,415	9,721	4,743	10,536	5,767	2,834	1,731	26,798	20,780
Hatchery origin	---	---	---	---	---	2,320	1,098	6,083	2,022	4,165	2,888	1,163	684
Sockeye 1+	2	21	2	32	16	108	45	31	17	36	56	59	48
Chum 0+	617	48,505	3,081	66,790	13,939	5,113	7,689	66,139	55,824	10,578	5,384	38,243	39,174
Pink 0+	697	0	18,682	0	0	48,532	22,952	0	0	27,482	9,778	9	17
Steelhead 1+													
Natural origin	198	301	332	304	663	601	1,297	532	1,184	364	778	319	531
Hatchery origin	223	66	124	658	2,381	670	3,107	1,282	4,579	751	1,751	982	2,401
Steelhead Adult	0	0	0	0	0	0	0	4	1	1	0	3	4
Cutthroat 1+	117	60	153	45	91	198	437	107	263	165	332	58	89
Cutthroat adult	0	0	0	0	0	0	0	1	0	0	2	2	13
Native char 1+	130	112	132	76	74	197	255	189	179	142	102	65	77
Trout Parr	N/A	N/A	N/A	12	7	47	69	56	47	110	68	40	61

[a] Estimated by proportion of total catch.
[b] Includes both hatchery and wild.
[c] 1989 brood released from Clark Creek = 1,728,100: falls = 1,170,800 Samish stock + 236,000 Clark Creek stock, released on June 8, 1990; and summers = 73,800 + 246,900 Clark Creek stock released on June 28, 1990.
[d] Clark Creek stock released on June 18, 1991: 1,144,500 falls and 111,120 summers.
[e] Clark Creek stock: 786,100 falls released February 25, 1992; 483,280 summers released on April 20, 1992; and 120,000 released on May 21, 1992.
[f] Clark Creek stock: 1,588,800 falls released in February 1993; 250,000 falls released on March 16, 1993; and 160,000 summers released on May 16, 1993.

Table 5. Results of CWTs recovered from ad-marked/CWT hatchery 0+ Chinook sampled at the Skagit River mainstem traps 2007.

Date	H-Admk Catch			Number Sampled				County Line-Summer 21-07/35		Baker River-Fall 21-07/45		Mablemount-Spr 63-38/67	
	Scp	Scr	Tot	Scp	Scr	Sac	Smpl	Total	%	Total	%	Total	%
05/26/07	2		2			0	0		0.0%		0.00%		0.00%
05/27/07	251	119	370	25	11	36	36	36	100.0%		0.00%		0.00%
05/28/07	350	215	565	35	22	57	56	56	100.0%		0.00%		0.00%
05/29/07	408	217	625	41	22	63	63	63	100.0%		0.00%		0.00%
05/30/07	299	158	457	30	16	46	44	44	100.0%		0.00%		0.00%
05/31/07	420	275	695	42	28	70	70	70	100.0%		0.00%		0.00%
06/01/07	368	9	377	37		37	35	35	100.0%		0.00%		0.00%
06/02/07	178		178	17		17	17	17	100.0%		0.00%		0.00%
06/03/07	148		148	15		15	15	15	100.0%		0.00%		0.00%
06/04/07			0			0	0		0.0%		0.00%		0.00%
06/05/07			0			0	0		0.0%		0.00%		0.00%
06/06/07			0			0	0		0.0%		0.00%		0.00%
06/07/07			0			0	0		0.0%		0.00%		0.00%
06/08/07	23		23	2		2	2	2	100.0%		0.00%		0.00%
06/09/07	11	20	31	1	2	3	3	3	100.0%		0.00%		0.00%
06/10/07	9	2	11	1		1	1	1	100.0%		0.00%		0.00%
06/11/07	21	19	40	2	2	4	4	3	75.0%	1	25.00%		0.00%
06/12/07	41	28	69	4	3	7	7		0.0%	7	100.00%		0.00%
06/13/07	82	130	212	8	13	21	21	3	14.3%	18	85.71%		0.00%
06/14/07	201	193	394	21	19	40	40	5	12.5%	35	87.50%		0.00%
06/15/07	70	102	172	7	10	17	17		0.0%	17	100.00%		0.00%
06/16/07	867	728	1,595	86	73	159	159	5	3.1%	22	13.84%	132	83.02%
06/17/07	2,277	1,591	3,868	228	159	387	386	5	1.3%	42	10.88%	339	87.82%
06/18/07	466		466	47		47	47	1	2.1%	4	8.51%	42	89.36%
06/19/07	242	168	410	24	17	41	40	4	10.0%	1	2.50%	35	87.50%
06/20/07	341	269	610	34	27	61	61	1	1.6%	13	21.31%	47	77.05%
06/21/07	66	69	135	6	7	13	15		0.0%	5	33.33%	10	66.67%
06/22/07	90	128	218	9	12	21	21	1	4.8%	4	19.05%	16	76.19%
06/23/07	176	236	412	18	24	42	41	1	2.4%	14	34.15%	26	63.41%
06/24/07	43	56	99	4	6	10	9	1	11.1%	4	44.44%	4	44.44%
06/25/07	19	18	37	2	1	3	2		0.0%		0.00%	2	100.00%
06/26/07	96	69	165	10	7	17	17		0.0%	11	64.71%	6	35.29%
06/27/07	11	22	33	1	2	3	1		0.0%		0.00%	1	100.00%
06/28/07	29	14	43	3	2	5	5		0.0%	5	100.00%		0.00%
06/29/07	73	47	120	7	5	12	12	2	16.7%	7	58.33%	3	25.00%
06/30/07	19	12	31	2	1	3	0		0.0%		0.00%		0.00%
07/01/07	30	32	62	3	3	6	5	1	20.0%	3	60.00%	1	20.00%
07/02/07	7	8	15	1	1	2	2	1	50.0%	1	50.00%		0.00%
07/03/07	37	14	51	3	1	4	4		0.0%	3	75.00%	1	25.00%
07/04/07	3	5	8		1	1	0		0.0%		0.00%		0.00%
07/05/07			0			0			0.0%		0.00%		0.00%
07/06/07	27	36	63	2	3	5	5	1	20.0%	2	40.00%	2	40.00%
07/07/07	42	71	113	5	7	12	5		0.0%	3	60.00%	2	40.00%
07/08/07	43	90	133	4	9	13	13	1	7.7%	8	61.54%	4	30.77%
07/09/07	32	42	74	3	5	8	8		0.0%	4	50.00%	4	50.00%
07/10/07	15	9	24	2		2	2		0.0%	2	100.00%		0.00%
07/11/07	24	27	51	2	3	5	5		0.0%	3	60.00%	2	40.00%
07/12/07	6	8	14	1	1	2	2		0.0%	2	100.00%		0.00%
07/13/07	4	5	9	0		0	0		0.0%		0.00%		0.00%
07/14/07	6	6	12	1	1	2	2		0.0%	2	100.00%		0.00%
07/15/07	40	43	83	4	4	8	8		0.0%	5	62.50%	3	37.50%
07/16/07	16	9	25	1	1	2	2	1	50.0%	1	50.00%		0.00%
07/17/07			0			0	0		0.0%		0.00%		0.00%
07/18/07			0			0	0		0.0%		0.00%		0.00%
07/19/07	57	20	77	6	2	8	8		0.0%	3	37.50%	5	62.50%
07/20/07	21	7	28	2	1	3	3		0.0%	3	100.00%		0.00%
07/21/07	5	5	10	1	1	2	2		0.0%	1	50.00%	1	50.00%
07/22/07			0			0	0		0.0%		0.00%		0.00%
07/23/07			0			0	0		0.0%		0.00%		0.00%
07/24/07	43	38	81	4	3	7	6		0.0%	4	66.67%	2	33.33%
07/25/07	47	20	67	5	2	7	7	1	14.3%	4	57.14%	2	28.57%
	8,202	5,409	13,611	819	540	1,359	1,336	380		264		692	

Table 6. Scoop trap catch rates and day:night catch ratios for natural-origin 0+ Chinook and corresponding flow and turbidity measurements in the Skagit River in 2007.

NIGHT TIME							DAY TIME									
Trap Down		Trap Up		Hours	Chin	Catch	Date	Time		Hours	Chin	Catch	D:N	Flow	Turbidity
Date	Time	Date	Time	Fished	0+	Rate		Down	Up	Fished	0+	Rate	Ratio	cfs	NTU
01/21/07	17.50	01/23/07	6.50	27.58	19	0.69	01/22/07	8.17	17.25	9.08	2	0.22	32.0%	13,800	7.1
01/23/07	17.00	01/25/07	7.75	29.42	39	1.33	01/24/07	8.25	17.17	8.92	7	0.79	59.2%	18,300	11.7
01/26/07	17.50	01/28/07	8.00	28.58	34	1.19	01/27/07	8.00	17.50	9.50	6	0.63	53.1%	16,500	7
01/29/07	17.75	01/31/07	7.75	28.33	39	1.38	01/30/07	8.17	17.50	9.33	3	0.32	23.4%	14,500	6.1
02/01/07	17.50	02/03/07	7.50	28.00	61	2.18	02/02/07	8.00	17.25	9.25	5	0.54	24.8%	14,200	6.4
02/04/07	19.00	02/06/07	8.00	27.33	18	0.66	02/05/07	8.25	17.50	9.25	1	0.11	16.4%	10,900	3.2
02/07/07	17.75	02/09/07	7.75	28.08	56	1.99	02/08/07	8.17	17.75	9.58	6	0.63	31.4%	13,300	4.3
02/10/07	17.50	02/12/07	8.00	28.50	29	1.02	02/11/07	8.25	17.75	9.50	8	0.84	82.8%	12,200	3.3
02/13/07	18.00	02/15/07	7.75	27.50	189	6.87	02/14/07	7.92	17.75	9.83	6	0.61	8.9%	16,200	5.6
02/16/07	18.00	02/18/07	7.75	27.00	166	6.15	02/17/07	7.75	18.00	10.25	110	10.73	174.6%	19,600	17.5
02/22/07	18.50	02/24/07	7.75	26.58	219	8.24	02/23/07	7.75	18.00	10.25	39	3.80	46.2%	18,900	8.4
02/25/07	18.25	02/27/07	7.25	26.33	149	5.66	02/26/07	7.67	18.00	10.33	13	1.26	22.2%	17,200	6.6
02/28/07	18.25	03/02/07	7.00	26.00	181	6.96	03/01/07	7.75	18.00	10.25	40	3.90	56.1%	15,900	6.2
03/03/07	18.50	03/05/07	7.25	25.83	132	5.11	03/04/07	7.42	18.00	10.58	18	1.70	33.3%	13,100	5.9
03/06/07	18.25	03/08/07	6.50	24.58	303	12.33	03/07/07	7.25	18.50	11.25	28	2.49	20.2%	18,100	5.4
03/09/07	18.25	03/11/07	7.25	25.75	728	28.27	03/10/07	7.25	18.00	10.75	50	4.65	16.5%	19,900	7.6
03/21/07	19.75	03/23/07	7.50	23.33	346	14.83	03/22/07	7.67	19.75	12.08	94	7.78	52.5%	26,700	22.4
03/27/07	20.02	03/29/07	7.25	17.75	142	8.00	03/28/07	10.50	19.83	9.33	148	15.86	198.2%	29,500	30.3
03/30/07	20.00	04/01/07	7.00	21.83	526	24.09	03/31/07	7.25	20.00	12.75	254	19.92	82.7%	21,400	17.4
04/02/07	20.00	04/04/07	7.00	21.75	608	27.95	04/03/07	7.25	20.00	12.75	190	14.90	53.3%	18,100	16.4
04/06/07	20.00	04/08/07	7.50	22.17	1688	76.15	04/07/07	7.00	20.00	13.00	322	24.77	32.5%	17,700	10.1
04/08/07	20.50	04/10/07	2.00	16.50	1422	86.18	04/09/07	7.75	19.75	12.00	665	55.42	64.3%	21,100	16
04/11/07	20.25	04/13/07	7.00	22.00	888	40.36	04/12/07	7.75	20.00	12.25	406	33.14	82.1%	16,400	11
04/14/07	20.50	04/16/07	7.50	22.00	1166	53.00	04/15/07	7.67	20.00	12.33	368	29.84	56.3%	17,100	7.8
04/17/07	20.50	04/19/07	7.25	22.00	663	30.14	04/18/07	7.75	20.00	12.25	153	12.49	41.4%	14,600	5.7
04/20/07	20.50	04/22/07	7.25	21.25	1159	54.54	04/21/07	7.75	20.50	12.75	305	23.92	43.9%	15,900	6
04/23/07	20.50	04/25/07	7.25	20.75	764	36.82	04/24/07	7.00	20.50	13.50	49	3.63	9.9%	17,500	7
04/26/07	20.50	04/28/07	5.50	18.83	847	44.97	04/27/07	6.75	20.50	13.75	116	8.44	18.8%	20,000	7.3
04/29/07	20.50	05/01/07	6.50	19.83	406	20.47	04/30/07	6.75	20.50	13.75	201	14.62	71.4%	23,600	12.2
05/02/07	20.75	05/04/07	6.25	19.08	223	11.69	05/03/07	6.67	20.75	14.08	117	8.31	71.1%	17,900	7.3
05/05/07	20.75	05/07/07	6.25	18.58	223	12.00	05/06/07	6.50	21.00	14.50	40	2.76	23.0%	14,600	5.6
05/08/07	20.75	05/10/07	6.25	19.00	408	21.47	05/09/07	6.75	16.00	9.25	101	10.92	50.8%	19,700	9
05/11/07	21.00	05/13/07	6.25	18.50	372	20.11	05/12/07	6.50	20.83	14.33	128	8.93	44.4%	19,200	10.7
05/14/07	21.00	05/16/07	6.00	17.75	308	17.35	05/15/07	6.33	21.00	14.67	48	3.27	18.9%	18,600	9
05/17/07	21.50	05/19/07	6.00	17.58	205	11.66	05/18/07	6.50	21.00	14.50	93	6.41	55.0%	22,200	13.7
05/20/07	21.50	05/22/07	6.25	17.75	205	11.55	05/21/07	6.75	21.25	14.50	112	7.72	66.9%	18,000	6.6
05/23/07	21.50	05/25/07	6.00	17.50	167	9.54	05/24/07	6.67	21.25	14.58	62	4.25	44.6%	14,200	4.7
05/26/07	21.50	05/28/07	6.50	17.33	348	20.08	05/27/07	6.25	21.50	15.25	119	7.80	38.9%	18,000	5.7
05/29/07	21.50	05/31/07	6.00	17.00	251	14.76	05/30/07	6.25	21.25	15.00	51	3.40	23.0%	16,500	5.3
06/07/07	21.50	06/09/07	5.75	16.25	113	6.95	06/08/07	6.00	21.50	15.50	122	7.87	113.2%	26,500	31
06/10/07	21.75	06/10/07	21.75	16.00	113	7.06	06/11/07	6.75	21.50	14.75	92	6.24	88.3%	27,300	29.3
06/13/07	21.75	06/15/07	6.00	16.25	172	10.58	06/14/07	6.25	21.75	15.50	157	10.13	95.7%	22,400	12.8
06/16/07	21.50	06/18/07	5.75	16.00	189	11.81	06/17/07	6.00	21.50	15.50	201	12.97	109.8%	23,000	11.8
06/19/07	21.50	06/21/07	6.00	16.75	71	4.24	06/20/07	6.25	21.50	15.25	62	4.07	95.9%	22,600	5.2
06/22/07	21.75	06/24/07	6.00	16.58	98	5.91	06/23/07	6.25	21.50	15.25	68	4.46	75.5%	26,600	14.2
06/25/07	21.75	02/27/07	5.75	16.00	50	3.13	06/26/07	6.00	21.50	15.50	40	2.58	82.6%	21,200	8.6
06/28/07	21.50	06/30/07	6.00	16.83	45	2.67	06/29/07	6.17	21.50	15.33	32	2.09	78.1%	20,300	9.4
07/02/07	21.50	07/04/07	6.00	16.75	39	2.33	07/03/07	6.25	21.50	15.25	47	3.08	132.4%	22,200	6.1
07/07/07	21.75	07/09/07	6.00	16.58	65	3.92	07/08/07	6.25	21.50	15.25	45	2.95	75.3%	28,800	20.5
07/10/07	21.50	07/12/07	6.75	18.08	30	1.66	07/11/07	6.67	21.50	14.83	18	1.21	73.1%	24,700	15.2
07/14/07	22.00	07/16/07	6.75	17.83	45	2.52	07/15/07	6.92	21.50	14.58	23	1.58	62.5%	26,900	18.7
07/18/07	21.75	07/20/07	6.75	18.08	88	4.87	07/19/07	6.92	21.50	14.58	70	4.80	98.6%	19,000	8.8
07/23/07	21.25	07/25/07	6.50	18.83	111	5.89	07/24/07	7.17	21.25	14.08	49	3.48	59.0%	23,100	2.9
			SEASON TOTAL	1,122.33	16,926	15.08				672.25	5,510	8.20	54.3%		
			SEASON AVERAGE										60.1%		
			SEASON MEDIAN										55.0%		

Table 7. Screw trap catch rates and day:night catch ratios for natural-origin 0+ Chinook and corresponding flow and turbidity measurements in the Skagit River in 2007.

NIGHT TIME							DAY TIME									
Trap Down		Trap Up		Hours	Chin	Catch	Date	Time		Hours	Chin	Catch	D:N	Flow	Turbidity
Date	Time	Date	Time	Fished	0+	Rate		Down	Up	Fished	0+	Rate	Ratio	cfs	NTU
01/21/07	17.50	01/23/07	6.50	27.75	29	1.05	01/22/07	8.50	17.25	8.75	2	0.23	21.9%	13,800	7.1
01/23/07	17.00	01/25/07	7.75	29.75	31	1.04	01/24/07	8.00	17.00	9.00	4	0.44	42.7%	18,300	11.7
01/26/07	17.50	01/28/07	8.00	28.75	17	0.59	01/27/07	7.75	17.50	9.75	4	0.41	69.4%	16,500	7
01/29/07	17.50	01/31/07	7.75	28.75	25	0.87	01/30/07	8.00	17.50	9.50	8	0.84	96.8%	14,500	6.1
02/01/07	17.50	02/03/07	7.50	28.00	23	0.82	02/02/07	8.00	17.25	9.25	4	0.43	52.6%	14,200	6.4
02/04/07	19.00	02/06/07	8.00	27.50	22	0.80	02/05/07	8.25	17.50	9.25	3	0.32	40.5%	10,900	3.2
02/07/07	17.75	02/09/07	7.75	28.00	41	1.46	02/08/07	8.00	17.75	9.75	3	0.31	21.0%	13,300	4.3
02/10/07	17.50	02/12/07	8.00	28.75	25	0.87	02/11/07	8.25	17.75	9.50	4	0.42	48.4%	12,200	3.3
02/13/07	18.00	02/15/07	7.75	27.75	113	4.07	02/14/07	7.75	17.75	10.00	5	0.50	12.3%	16,200	5.6
02/16/07	18.00	02/18/07	7.75	27.25	217	7.96	02/17/07	7.67	18.00	10.33	60	5.81	72.9%	19,600	17.5
02/22/07	18.50	02/24/07	7.75	26.75	154	5.76	02/23/07	7.50	18.00	10.50	27	2.57	44.7%	18,900	8.4
02/25/07	18.25	02/27/07	7.25	26.50	83	3.13	02/26/07	7.50	18.00	10.50	9	0.86	27.4%	17,200	6.6
02/28/07	18.25	03/02/07	7.00	26.00	129	4.96	03/01/07	7.75	18.00	10.25	36	3.51	70.8%	15,900	6.2
03/03/07	18.50	03/05/07	7.25	25.92	58	2.24	03/04/07	7.42	18.00	10.58	13	1.23	54.9%	13,100	5.9
03/06/07	18.25	03/08/07	6.50	24.75	187	7.56	03/07/07	7.25	18.50	11.25	19	1.69	22.4%	18,100	5.4
03/09/07	18.25	03/11/07	7.25	25.75	510	19.81	03/10/07	7.17	18.00	10.83	53	4.89	24.7%	19,900	7.6
03/18/07	19.50	03/20/07	5.50	21.67	379	17.49	03/19/07	7.50	19.50	12.00	147	12.25	70.0%	33,400	34.5
03/21/07	19.75	03/23/07	7.50	23.50	254	10.81	03/22/07	7.50	19.75	12.25	75	6.12	56.6%	26,700	22.4
03/30/07	20.00	04/01/07	7.00	22.00	454	20.64	03/31/07	7.00	20.00	13.00	283	21.77	105.5%	21,400	17.4
04/02/07	20.00	04/04/07	7.00	21.83	302	13.83	04/03/07	7.17	20.00	12.83	128	9.97	72.1%	18,100	16.4
04/06/07	20.00	04/08/07	4.00	18.00	284	15.78	04/07/07	6.83	20.00	13.17	275	20.89	132.4%	17,700	10.1
04/11/07	20.25	04/13/07	7.00	22.25	322	14.47	04/12/07	7.50	20.00	12.50	227	18.16	125.5%	16,400	11
04/14/07	20.50	04/16/07	7.50	22.00	567	25.77	04/15/07	7.67	20.00	12.33	265	21.49	83.4%	17,100	7.8
04/17/07	20.50	04/19/07	7.25	22.08	112	5.07	04/18/07	8.50	20.00	11.50	105	9.13	180.0%	14,600	5.7
04/20/07	20.50	04/22/07	7.25	21.33	292	13.69	04/21/07	7.50	20.50	13.00	289	22.23	162.4%	15,900	6
04/23/07	20.50	04/25/07	7.25	20.75	185	8.92	04/24/07	7.00	20.67	13.67	28	2.05	23.0%	17,500	7
04/26/07	20.50	04/28/07	5.00	18.50	191	10.32	04/27/07	6.50	20.50	14.00	89	6.36	61.6%	20,000	7.3
04/29/07	20.50	05/01/07	6.50	19.75	182	9.22	04/30/07	6.75	20.50	13.75	183	13.31	144.4%	23,600	12.2
05/02/07	20.75	05/04/07	6.25	19.17	41	2.14	05/03/07	6.67	20.75	14.08	98	6.96	325.3%	17,900	7.3
05/05/07	20.75	05/07/07	6.25	18.75	38	2.03	05/06/07	6.50	21.00	14.50	23	1.59	78.3%	14,600	5.6
05/08/07	20.75	05/10/07	6.25	18.83	203	10.78	05/09/07	7.00	16.00	9.00	86	9.56	88.7%	19,700	9
05/11/07	21.00	05/13/07	6.25	18.50	63	3.41	05/12/07	6.75	21.00	14.25	76	5.33	156.6%	19,200	10.7
05/14/07	21.00	05/16/07	6.00	18.00	48	2.67	05/15/07	6.17	21.00	14.83	36	2.43	91.0%	18,600	9
05/17/07	21.50	05/19/07	6.00	17.00	38	2.24	05/18/07	6.75	21.00	14.25	74	5.19	232.3%	22,200	13.7
05/20/07	21.50	05/22/07	6.25	17.75	53	2.99	05/21/07	6.67	21.25	14.58	67	4.59	153.9%	18,000	6.6
05/23/07	21.50	05/25/07	6.00	17.50	44	2.51	05/24/07	6.75	21.25	14.50	14	0.97	38.4%	14,200	4.7
05/26/07	21.50	05/28/07	6.50	17.17	156	9.09	05/27/07	6.17	21.50	15.33	90	5.87	64.6%	18,000	5.7
05/29/07	21.50	05/31/07	6.00	17.00	131	7.71	05/30/07	6.25	21.25	15.00	28	1.87	24.2%	16,500	5.3
06/10/07	21.75	06/12/07	5.00	16.00	135	8.44	06/11/07	6.75	21.75	15.00	92	6.13	72.7%	27,300	29.3
06/13/07	21.75	06/15/07	6.00	16.25	187	11.51	06/14/07	6.17	21.75	15.58	150	9.63	83.6%	22,400	12.8
06/19/07	21.50	06/21/07	6.00	16.50	101	6.12	06/20/07	6.17	21.75	15.58	62	3.98	65.0%	22,600	5.2
06/22/07	21.75	06/24/07	6.00	16.50	126	7.64	06/23/07	6.17	21.50	15.33	76	4.96	64.9%	26,600	14.2
06/25/07	21.75	06/27/07	5.75	16.00	51	3.19	06/26/07	6.00	21.50	15.50	41	2.65	83.0%	21,200	8.6
06/28/07	21.50	06/30/07	6.00	16.83	50	2.97	06/29/07	6.17	21.50	15.33	32	2.09	70.3%	20,300	9.4
07/02/07	21.50	07/04/07	6.00	16.83	18	1.07	07/03/07	6.17	21.50	15.33	26	1.70	158.6%	22,200	6.1
07/07/07	21.75	07/09/07	6.00	16.58	126	7.60	07/08/07	6.17	21.50	15.33	80	5.22	68.7%	28,800	20.5
07/10/07	21.50	07/12/07	6.75	18.08	29	1.60	07/11/07	6.67	21.50	14.83	13	0.88	54.6%	24,700	15.2
07/14/07	22.00	07/16/07	6.75	17.83	35	1.96	07/15/07	6.92	21.50	14.58	15	1.03	52.4%	26,900	18.7
07/18/07	21.75	07/20/07	6.75	18.08	51	2.82	07/19/07	6.92	21.50	14.58	40	2.74	97.3%	19,000	8.8
07/23/07	21.25	07/25/07	6.50	18.83	93	4.94	07/24/07	7.17	21.25	14.08	51	3.62	73.3%	23,100	2.9
		SEASON TOTAL		1,075.58	7,005	6.51				634.42	3,618	5.70	87.6%		
		SEASON AVERAGE											82.8%		
		SEASON MEDIAN											70.1%		

Table 8. Scoop trap catch rates and day:night catch ratios for hatchery-origin 0+ Chinook and corresponding flow and turbidity measurements in the Skagit River in 2007.

NIGHT TIME							DAY TIME								
Trap Down		Trap Up		Hours	Chin	Catch	Date	Time		Hours	Chin	Catch	D:N	Flow	Turbidity
Date	Time	Date	Time	Fished	0+	Rate		Down	Up	Fished	0+	Rate	Ratio	cfs	NTU
05/26/07	21.50	05/28/07	6.50	17.33	415	23.94	05/27/07	6.25	21.50	15.25	186	12.20	50.9%	18,000	5.7
05/29/07	21.50	05/31/07	6.00	17.00	677	39.82	05/30/07	6.25	21.25	15.00	42	2.80	7.0%	16,500	5.3
06/07/07	21.50	06/09/07	5.75	16.25	18	1.11	06/08/07	6.00	21.50	15.50	16	1.03	93.2%	26,500	31.0
06/10/07	21.75	06/10/07	21.75	16.00	49	3.06	06/11/07	6.75	21.50	14.75	13	0.88	28.8%	27,300	29.3
06/13/07	21.75	06/15/07	6.00	16.25	163	10.03	06/14/07	6.25	21.75	15.50	108	6.97	69.5%	22,400	12.8
06/16/07	21.50	06/18/07	5.75	16.00	1615	100.94	06/17/07	6.00	21.50	15.50	1128	72.77	72.1%	23,000	11.8
06/19/07	21.50	06/21/07	6.00	16.75	180	10.75	06/20/07	6.25	21.50	15.25	227	14.89	138.5%	22,600	5.2
06/22/07	21.75	06/24/07	6.00	16.58	132	7.96	06/23/07	6.25	21.50	15.25	87	5.70	71.7%	26,600	14.2
06/25/07	21.75	02/27/07	5.75	16.00	55	3.44	06/26/07	6.00	21.50	15.50	52	3.35	97.6%	21,200	8.6
06/28/07	21.50	06/30/07	6.00	16.83	34	2.02	06/29/07	6.17	21.50	15.33	58	3.78	187.3%	20,300	9.4
07/02/07	21.50	07/04/07	6.00	16.75	11	0.66	07/03/07	6.25	21.50	15.25	29	1.90	289.6%	22,200	6.1
07/07/07	21.75	07/09/07	6.00	16.58	40	2.41	07/08/07	6.25	21.50	15.25	35	2.30	95.2%	28,800	20.5
07/10/07	21.50	07/12/07	6.75	18.08	15	0.83	07/11/07	6.67	21.50	14.83	15	1.01	121.9%	24,700	15.2
07/14/07	22.00	07/16/07	6.75	17.83	43	2.41	07/15/07	6.92	21.50	14.58	13	0.89	37.0%	26,900	18.7
07/18/07	21.75	07/20/07	6.75	18.08	31	1.71	07/19/07	6.92	21.50	14.58	47	3.22	188.0%	19,000	8.8
07/23/07	21.25	07/25/07	6.50	18.83	64	3.40	07/24/07	7.17	21.25	14.08	26	1.85	54.3%	23,100	2.9
SEASON TOTAL				271.17	3,542	13.06				241.42	2,082	8.62	66.0%		
SEASON AVERAGE													100.2%		
SEASON MEDIAN													82.6%		

Table 9. Screw trap catch rates and day:night catch ratios for hatchery-origin 0+ Chinook and corresponding flow and turbidity measurements in the Skagit River in 2007.

NIGHT TIME							DAY TIME								
Trap Down		Trap Up		Hours	Chin	Catch	Date	Time		Hours	Chin	Catch	D:N	Flow	Turbidity
Date	Time	Date	Time	Fished	0+	Rate		Down	Up	Fished	0+	Rate	Ratio	cfs	NTU
05/29/07	21.50	05/31/07	6.00	17.00	426	25.06	05/30/07	6.25	21.25	15.00	7	0.47	1.9%	16,200	10.5
06/10/07	21.75	06/12/07	5.00	16.00	34	2.13	06/11/07	6.75	21.75	15.00	13	0.87	40.8%	25,300	15
06/13/07	21.75	06/15/07	6.00	16.25	183	11.26	06/14/07	6.17	21.75	15.58	112	7.19	63.8%	20,800	8
06/19/07	21.50	06/21/07	6.00	16.50	177	10.73	06/20/07	6.17	21.75	15.58	161	10.33	96.3%	26,800	28.1
06/22/07	21.75	06/24/07	6.00	16.50	172	10.42	06/23/07	6.17	21.50	15.33	120	7.83	75.1%	25,200	8.6
06/25/07	21.75	06/27/07	5.75	16.00	58	3.63	06/26/07	6.00	21.50	15.50	33	2.13	58.7%	18,200	6.6
06/28/07	21.50	06/30/07	6.00	16.83	24	1.43	06/29/07	6.17	21.50	15.33	35	2.28	160.1%	15,100	5.3
07/02/07	21.50	07/04/07	6.00	16.83	9	0.53	07/03/07	6.17	21.50	15.33	10	0.65	122.0%	20,700	17.1
07/07/07	21.75	07/09/07	6.00	16.58	80	4.82	07/08/07	6.17	21.50	15.33	52	3.39	70.3%	19,200	7.4
07/10/07	21.50	07/12/07	6.75	18.08	19	1.05	07/11/07	6.67	21.50	14.83	16	1.08	102.7%	19,100	13.8
07/14/07	22.00	07/16/07	6.75	17.83	25	1.40	07/15/07	6.92	21.50	14.58	27	1.85	132.1%	17,900	8.4
07/18/07	21.75	07/20/07	6.75	18.08	13	0.72	07/19/07	6.92	21.50	14.58	14	0.96	133.5%	18,000	8.8
07/23/07	21.25	07/25/07	6.50	18.83	36	1.91	07/24/07	7.17	21.25	14.08	22	1.56	81.7%	11,900	6.2
SEASON TOTAL				221.33	1,256	5.67				196.08	622	3.17	55.9%		
SEASON AVERAGE													87.6%		
SEASON MEDIAN													81.7%		

Chinook 0+ Total Catch

An estimated 81,776 natural-origin 0+ Chinook should have been captured had the traps operated continuously from January 19 through July 25 (Figure 3). Actual catch represented 60.2% of the total estimated catch (Table 10). Total catch in the scoop trap (51,229) included an actual catch of 32,058 migrants and an estimated catch of 19,171 out-migrants for periods of trap outages. Total catch in the screw trap (30,547) included an actual catch of 17,213 and an estimated catch of 13,334 Chinook for periods of trap outages.

An estimated 30,034 hatchery-origin 0+ Chinook should have been captured had the traps operated continuously. Actual catch represented 45.3% of the total projected hatchery Chinook catch (Table 10). Total catch in the scoop trap (17,223) included an actual catch of 8,202 and an estimated catch of 9,021 for periods of trap outages. Total catch in the screw trap (12,811) included an actual catch of 5,410 and an estimated catch of 7,401 for periods of trap outages.

A total of 9,734 Countyline Pond summer Chinook, 13,618 Marblemount Hatchery spring Chinook, and 6,618 Baker River fall Chinook should have been caught had the traps operated continuously (Table 11). Relating estimated catches to reported hatchery releases yields trap efficiencies of 4.19%, 5.33%, and 4.10% for summer, spring and fall 0+ Chinook, respectively. However, these trap efficiencies are likely lower than the actual efficiencies as they do not accommodate for mortality and residualism among hatchery-origin Chinook following each release.

Table 10. Actual, estimated and total catches of natural and hatchery-origin 0+ Chinook in the Skagit River mainstem traps 2007.

Group	Scoop Trap			Screw Trap			Total		
	Actual	Estimated	Total	Actual	Estimated	Total	Actual	Estimated	Total
Natural	32,058	19,171	51,229	17,213	13,334	30,547	49,271	32,505	81,776
Hatchery	8,202	9,021	17,223	5,410	7,401	12,811	13,612	16,422	30,034

Table 11. Estimated 24-hour hatchery-origin 0+ Chinook catches by tag group in the Skagit River mainstem traps 2007.

Release Site/Stock	Tag Code	Number Released	Recovery Period	Estimated 24-Hour Catch [a]	Catch Rate
Countyline Ponds/ summer	21-03/35	232,150	May 27-July 25	9,734	4.19%
Marblemount/ spring	63-38/67	255,685	June 16-July 25	13,618	5.33%
Baker River/ fall	21-07/45	162,772	June 11-July 25	6,618	4.10%
	Total	650,607	May 27-July 25	30,033[b]	4.62%

[a] Estimated by applying the proportion of CWT recoveries to projected 24-hour hatchery-origin catch (Table 5).
[b] One ad-marked CWT 0+ Chinook was captured on May 11 and was not included in this estimate.

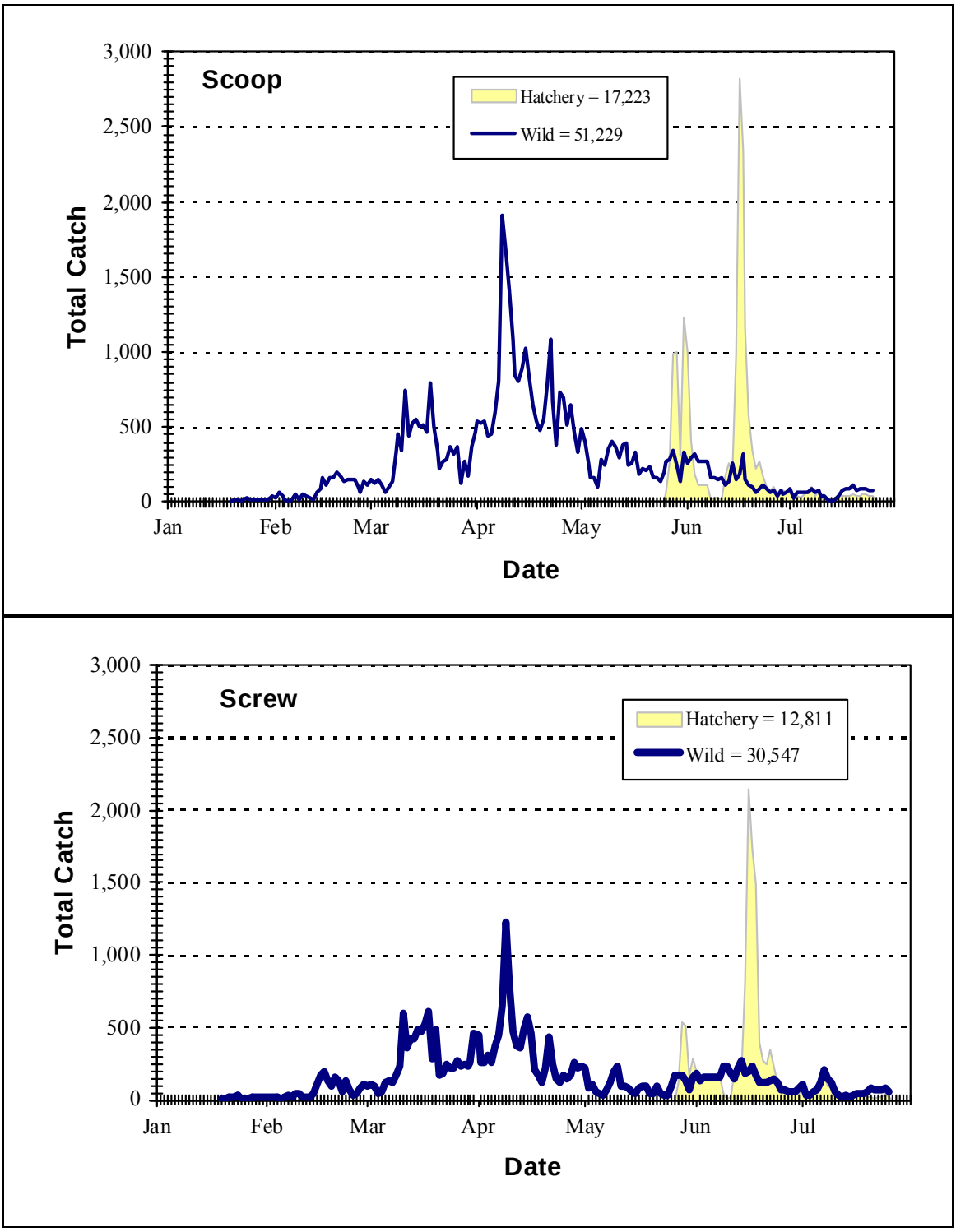

Figure 3. Total catch of natural and hatchery-origin 0+ Chinook in Skagit River mainstem traps in 2007. Total catch includes actual catch and catch estimated for trap outage periods.

Chinook 0+ Trap Efficiency

Recapture rates for natural-origin 0+ Chinook ranged from 0.53% to 10.63% among the 26 efficiency groups and averaged 5.31% (Table 1). Recaptures of marked 0+ Chinook in 2007 were observed the evening following each release but not observed during other periods. Twenty-six efficiency groups were pooled into eight strata. Capture rates for the pooled strata ranged from 1.83% to 9.42% (Table 12).

Three paired releases of hatchery and natural-origin 0+ Chinook efficiency groups were released on the evenings of June 16, 19, and 28. Hatchery Chinook were captured at a lower efficiency (1.83%) than their natural-origin counterparts (4.13%).

Six natural-origin efficiency groups, occurring during the period of hatchery releases, were grouped into two catch-period strata. Efficiencies applied to hatchery catches were 9.42% and 4.83% respectively (Table 13). Hatchery Chinook migration was estimated using efficiency data from natural-origin fish because natural-origin efficiency groups better represented the entire hatchery Chinook migration period than hatchery-origin efficiency groups. Of note, mean trap efficiency for hatchery Chinook was lower than that for natural-origin efficiency groups during the hatchery outmigration period. Use of the lower (1.83%) efficiency calculation was unlikely in two regards. First, trap efficiencies for natural and hatchery migrants are not expected to differ so greatly based on data from previous years of trapping. Second, use of the 1.83% efficiency yields an estimated hatchery migration (≅1.6 million) that is nearly double the reported number of marked fish released.

Chinook 0+ Production

A total migration of 2.2 million ± 0.27 million (95% C.I.) natural-origin 0+ Chinook is estimated to have passed the trap between January 19 and July 25, 2007 (Table 12, Figure 4).

An additional 4,661 natural-origin Chinook are estimated to have outmigrated prior to trap installation. Natural-origin Chinook were captured on the first night of trapping (January 19), indicating that the migration had already begun. A migration start date of January 1 was selected and a logarithmic extrapolation was conducted for migration between January 1 to January 19. The extrapolated portion of the migration accounts for only 0.21% of the total migration.

Using the chosen calibration data from natural-origin migrants yields an estimated migration of 531,406 hatchery-origin sub-yearling Chinook (Table 13, Figure 4).

Chinook 0+ Egg-to-Migrant Survival

Egg-to-migrant survival of natural-origin 0+ Chinook was 3.9%. This estimate was calculated using 2.2 million 0+ Chinook outmigrants and a potential deposition of 56.1 million eggs. Potential egg deposition (P.E.D.) is the product of 10,199 females and a fecundity of 5,500 eggs/female (Table 14).

Survival-to-migration rate is biased low because not all juvenile Chinook captured are zero-age migrants. A small but measurable component of the 2006 brood Chinook will migrate in 2008 as

yearlings. In 2007, we captured 660 natural-origin Chinook 1+ migrants, approximately 0.5% of the 2005 brood outmigration.

If hatchery release numbers were accurate (650,607 marked 0+ Chinook), survival of hatchery release groups to the trap site was 81.7%.

Table 12. Estimated catch, trap efficiency (capture rate) and migration by strata for natural-origin 0+ Chinook in the Skagit River 2007.

Strata	Date		Total Estimated Catch	Capture Rate	Migration	Variance
	Begin	End				
1	01/19/07	03/29/07	22,558	1.83%	1,233,352	1.72E+10
2	03/30/07	04/06/07	6,553	4.70%	139,417	2.56E+08
3	04/07/07	04/12/07	11,662	9.14%	127,622	9.22E+07
4	04/13/07	04/15/07	4,143	3.33%	124,290	6.74E+08
5	04/16/07	04/27/07	10,539	9.40%	112,089	4.65E+07
6	04/28/07	05/22/07	10,439	4.44%	235,199	4.00E+08
7	05/23/07	06/11/07	7,661	9.42%	81,324	7.42E+07
8	06/12/07	07/25/07	8,222	4.83%	170,121	4.70E+08
		Total	**81,776**		**2,223,414**	**1.92E+10**
					Standard Deviation	138,689
					C.V.	6.24%
					C.I. +/-	271,831

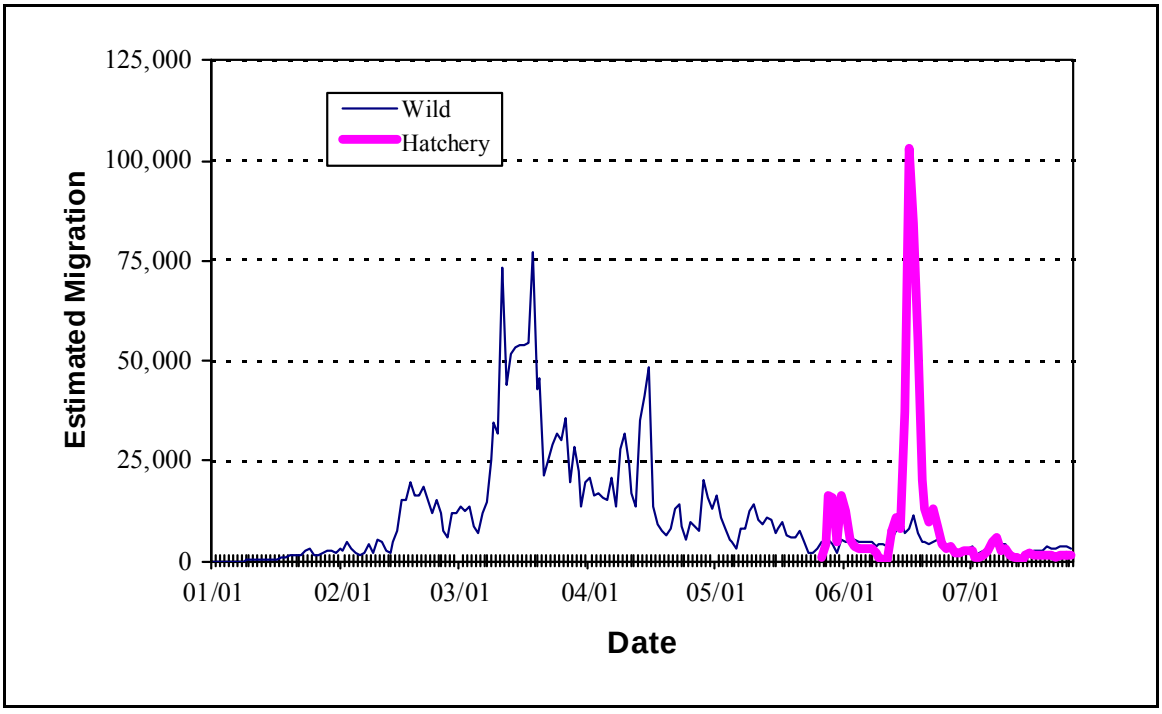

Figure 4. Daily migration of natural and hatchery-origin 0+ Chinook passing the Skagit River mainstem traps in 2007. Daily migration is estimated using daily catches apportioned among total catch within each efficiency strata.

Table 13. Estimated catch, trap efficiency (capture rate) and migration by strata for hatchery-origin 0+ Chinook in the Skagit River, 2007

Strata	Date		Total Estimated Catch	Capture Rate	Migration	Variance
	Begin	End				
1	05/23/07	06/11/07	8,935	9.42%	94,848	1.01E+08
2	06/12/07	07/25/07	21,099	4.83%	436,557	3.08E+09
		Total	**30,034**		**531,406**	**3.18E+09**
					Standard Deviation	56,432
					C.V.	10.62%
					C.I. +/-	110,606

Table 14. Egg-to-migrant survival of natural-origin 0+ Chinook in the Skagit River for 1989 to 2006 brood years (includes spring, summer, and fall-run Chinook).

Brood Year (i)	Migr Year (i+1)	Estimated Escapement		PED @ 5,500[a] (millions)	Natural Smolts (millions)[b]	Survival to Migration	Peak Flow[c] Oct 22 – Feb 15	
		Total[d]	Females (@45%)				cfs	Date
1989	1990	9,484	3,638	20	1.8	9.00%	88,200	12/05
1990	1991	19,814	8,236	45.3	0.5	1.20%	142,000	11/25
1991	1992	8,296	3,178	17.5	2.4	13.70%	40,100	02/01
1992	1993	9,320	3,750	20.6	3.0	14.40%	27,600	01/26
1993	1994	7,366	2,963	16.3	2.7	16.70%	32,100	12/11
1994	1995	6,489	2,709	14.9	1.5	10.20%	55,700	12/28
1995	1996	8,587	3,569	19.6	0.7	3.80%	132,000	11/30
1996	1997	12,715	5,249	28.9	4.5	15.60%	47,600	01/20
1997	1998	6,954	2,661	14.6	2.4	16.40%	60,600	10/05
1998	1999	16,781	7,063	38.8	6.4	16.50%	51,900	12/14
1999	2000	5,866	2,428	13.4	1.7	12.70%	76,800	11/13
2000	2001	18,972	8,078	44.4	6.0	13.50%	19,300	01/06
2001	2002	15,649	7,042	38.7	5.0	12.90%	73,700	01/08
2002	2003	20,656	9,295	51.1	5.5	10.80%	53,000	01/27
2003	2004	10,329	4,770	26.2	1.8	7.00%	115,000	10/22
2004	2005	25,128	11,329	62.3	4.6	7.40%	66,800	12/11
2005	2006	22,049	9,922	54.6	6.2	11.40%	57,400	01/11
2006	2007	22,714	10,199	56.1	2.2	3.90%	125,000	11/08

[a] Personal communication, Pete Castle, WDFW.

[b] Prior to the 1996 brood, estimates were based on trapping during the coho migration period (April-June). Full-season trapping commenced in 1997.

[c] Mean daily flow at USGS gauge #12200500 in Mt Vernon.

[d] Spawner escapement data from WDFW Salmonid Stock Inventory (SaSI) database as of September 30, 2008.

Chinook 0+ Migration Timing

Migration from January through late April accounted for 75% of the total migration. Fifty percent of the migration had passed the mainstem traps on March 25 (Figure 5), a result comparable to the observed long-term average. Between 1997 and 2006, median migration dates have ranged from March 10 (1999) to May 2 (1998), with an average of March 27 (Figure 6).

Time for hatchery-origin Chinook to arrive at the juvenile traps was not correlated with travel distance. Baker River fall Chinook were released lowest in the watershed (R.M. 57 on June 11) and had a 6-day median migration timing to the traps. Marblemount Hatchery spring Chinook were released further upriver (R.M. 78) but had a 2-day median migration timing to the traps. Countyline summer Chinook were released highest in the watershed (R.M. 89) and had a 7-day median migration timing to the traps (Figure 7). While most of the hatchery migration was assumed to be completed by the end of our field season, one hatchery-origin Chinook from each release was caught on the last day of trap operation. Migration timing for juvenile hatchery Chinook may have been influenced by stock differences, fish condition, size at release, flow, turbidity, release date, and release site.

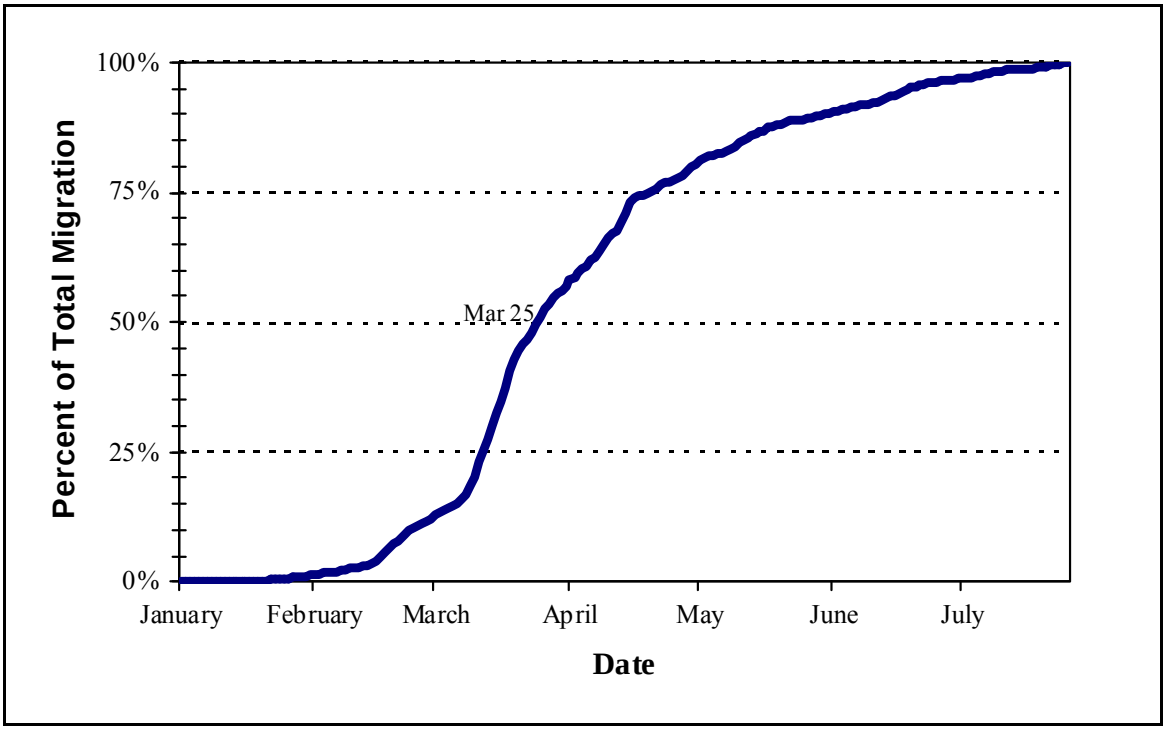

Figure 5. Migration timing of natural-origin 0+ Chinook passing the Skagit River mainstem traps in 2007.

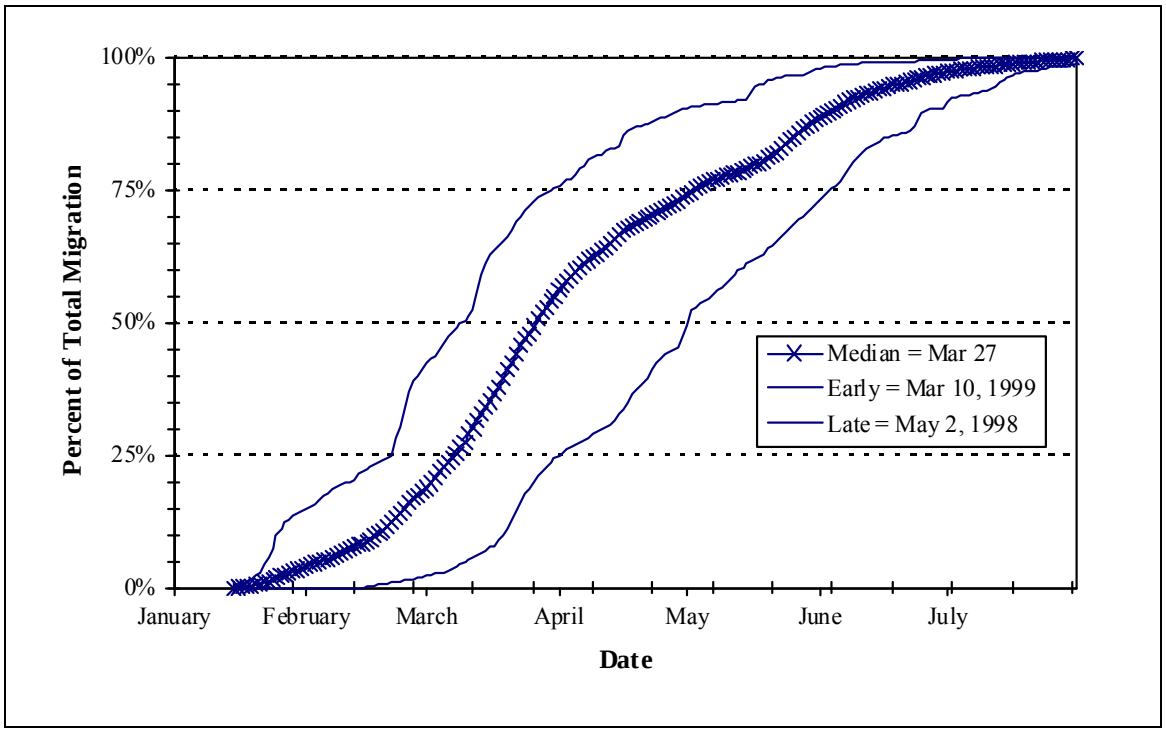

Figure 6. Variation in migration timing of natural-origin 0+ Chinook passing the Skagit River mainstem traps, 1997-2007. Median, early, and late dates reflect date at which 50% of the migration has occurred.

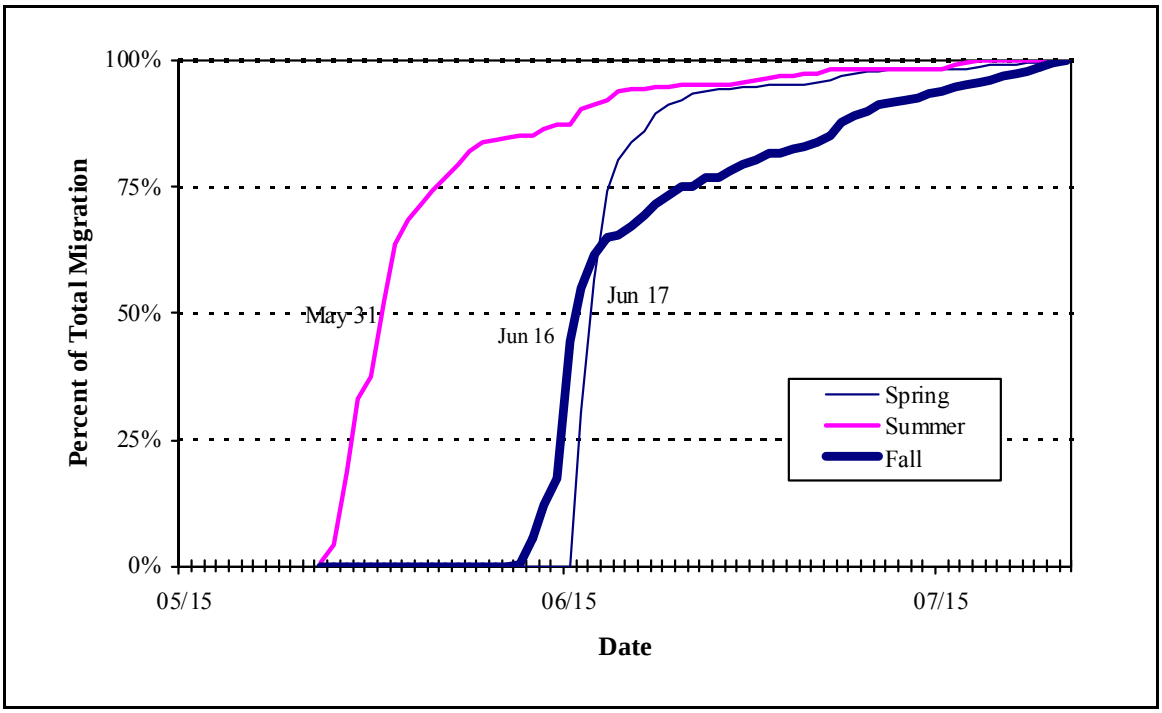

Figure 7. Migration timing of three releases of hatchery-origin 0+ Chinook passing the Skagit River mainstem traps in 2007. Spring Chinook were released from Marblemount hatchery, summer Chinook were released from Countyline hatchery, and fall Chinook were released from Baker River hatchery.

Natural-Origin 0+ Chinook Size

Over the season, natural-origin juvenile 0+ Chinook captured in the traps increased in size from an average of 38-mm FL in late January to 76-mm FL by the end of July (Table 15, Figure 8). Minimum lengths exceeded 40-mm FL by early April and reached mean length for the season (50-mm FL) by early May. Chinook fork lengths did not differ between scoop and screw trap catches (Kolmogorov Smirnov test: $p = 0.45$, Figure 9).

Table 15. Mean, standard deviation (s.d.), and range of fork lengths of sampled (n) natural-origin 0+ Chinook in the Skagit River mainstem traps, 2007.

STAT WEEK			SCOOP TRAP						SCREW TRAP					
			Mean	s.d.	Range		n	Catch	Mean	s.d.	Range		n	Catch
No.	Begin	End			Min	Max					Min	Max		
3	01/15/07	01/21/07	38.8	1.56	37	41	9	23	38.3	1.80	36	41	9	18
4	01/22/07	01/28/07	39.6	2.17	36	44	10	124	39.8	2.23	37	43	6	89
5	01/29/07	02/04/07	39.5	1.46	37	42	15	155	39.9	1.54	37	44	22	105
6	02/05/07	02/11/07	39.6	1.32	37	42	20	181	40.3	1.59	37	44	20	143
7	02/12/07	02/18/07	----	----	----	----	----	543	----	----	----	----	----	418
8	02/19/07	02/25/07	40.9	1.14	38	43	20	866	40.0	1.95	37	45	20	542
9	02/26/07	03/04/07	40.6	1.60	36	44	20	677	40.7	1.23	38	43	20	428
10	03/05/07	03/11/07	40.7	1.34	38	43	20	1,569	40.3	1.71	36	43	20	980
11	03/12/07	03/18/07	43.1	1.52	41	46	10	923	42.1	2.13	39	45	10	874
12	03/19/07	03/25/07	41.7	2.23	38	46	20	1,300	42.6	2.54	39	50	20	1,030
13	03/26/07	04/01/07	42.8	2.24	39	48	20	1,307	42.4	1.73	40	46	20	1,165
14	04/02/07	04/08/07	44.4	4.15	40	56	20	3,712	43.4	2.52	40	48	20	1,470
15	04/09/07	04/15/07	43.1	3.63	40	53	20	5,611	45.2	4.57	41	56	20	3,126
16	04/16/07	04/22/07	43.2	3.75	39	55	30	3,503	44.5	6.23	37	63	30	1,306
17	04/23/07	04/29/07	42.2	2.20	39	46	10	2,594	45.0	4.64	41	57	10	632
18	04/30/07	05/06/07	42.8	4.92	40	61	30	1,396	48.3	7.16	39	64	29	613
19	05/07/07	05/13/07	45.0	5.91	39	58	20	1,495	50.0	11.04	38	80	20	554
20	05/14/07	05/20/07	46.4	4.69	40	57	20	1,166	55.7	9.28	38	71	20	296
21	05/21/07	05/27/07	52.9	7.85	41	65	20	1,041	59.1	8.25	44	76	20	434
22	05/28/07	06/03/07	57.1	6.85	43	70	20	1,049	59.6	8.68	49	76	10	315
23	06/04/07	06/10/07	57.3	9.12	47	79	20	313	56.4	7.24	43	65	10	201
24	06/11/07	06/17/07	----	----	----	----	----	981	----	----	----	----	----	948
25	06/18/07	06/24/07	57.1	4.67	48	66	20	477	62.2	5.05	54	71	10	472
26	06/25/07	07/01/07	60.2	7.80	49	76	10	293	61.0	8.47	51	74	10	284
27	07/02/07	07/08/07	66.7	9.79	54	83	9	223	66.4	7.96	56	78	10	317
28	07/09/07	07/15/07	76.6	9.50	64	93	10	164	76.1	10.96	62	93	10	187
29	07/16/07	07/22/07	----	----	----	----	----	212	----	----	----	----	----	122
30	07/23/07	07/29/07	78.3	4.76	69	84	10	160	72.4	6.59	60	81	10	144
Season Total					36	93	433	32,058			36	93	406	17,213

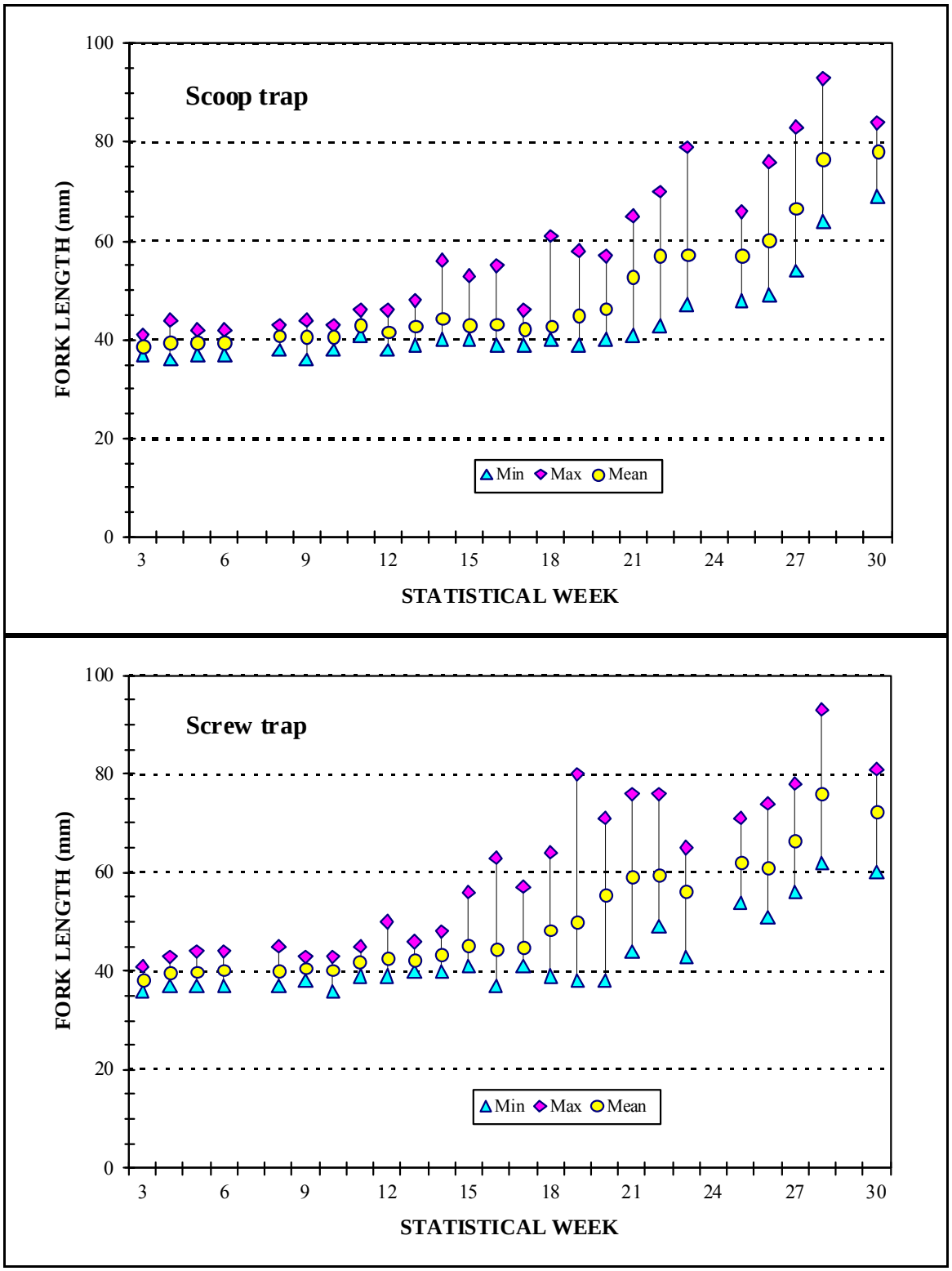

Figure 8. Fork lengths of natural-origin 0+ Chinook measured at the Skagit River mainstem traps, 2007. Data are mean and range values.

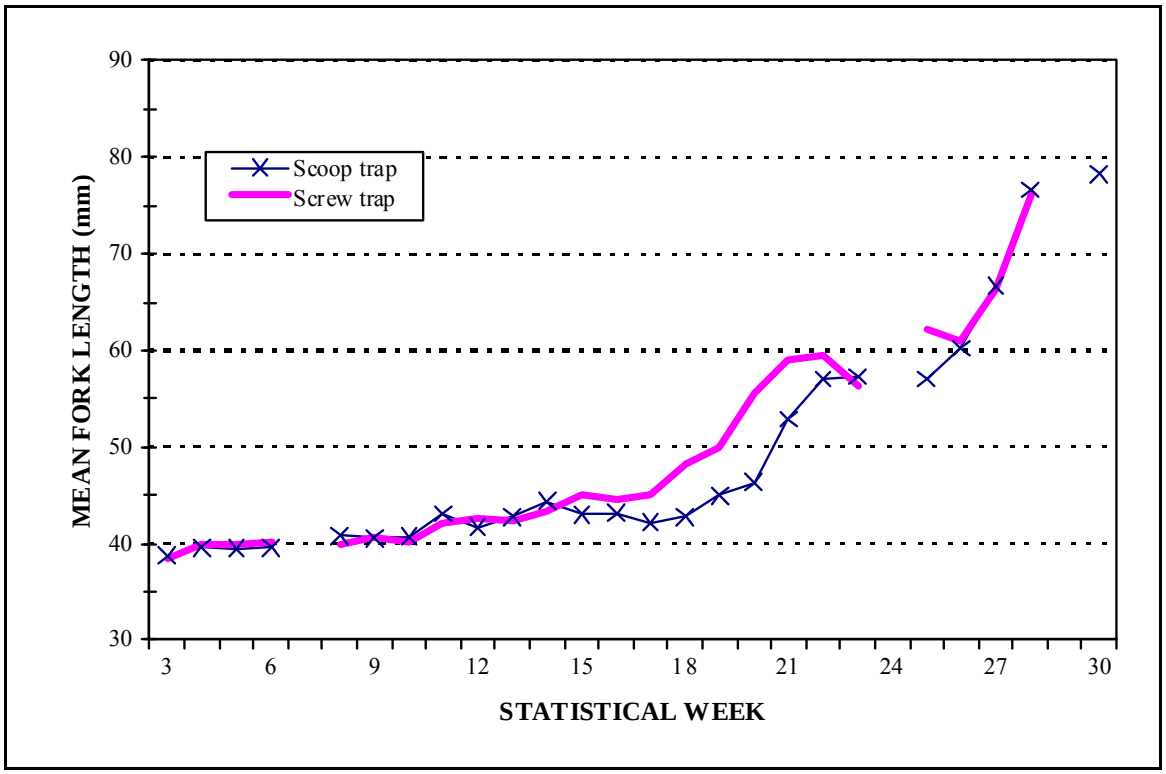

Figure 9. Fork lengths of natural-origin 0+Chinook caught in the scoop and screw traps in the Skagit River, 2007. Data are mean values.

Coho

Mannser Creek

A total of 19,162 natural-origin coho smolts were captured over the season in the Mannser Creek trap. A majority of this catch (19,047 smolts; 99.3%) was left ventral (LV) fin-clipped and released below the weir.

Mannser Creek weir was installed on April 11 and the first coho smolts were captured on April 12 (14 smolts). Most of the migration (94%) occurred during May, with two peak catches of coho smolts. The first peak (833 smolts) occurred on April 22 and the second peak (1,233 smolts) occurred on May 8. Catches generally declined thereafter. Forty smolts were captured on the last day of trap operations, indicating the migration was nearly over (Figure 10).

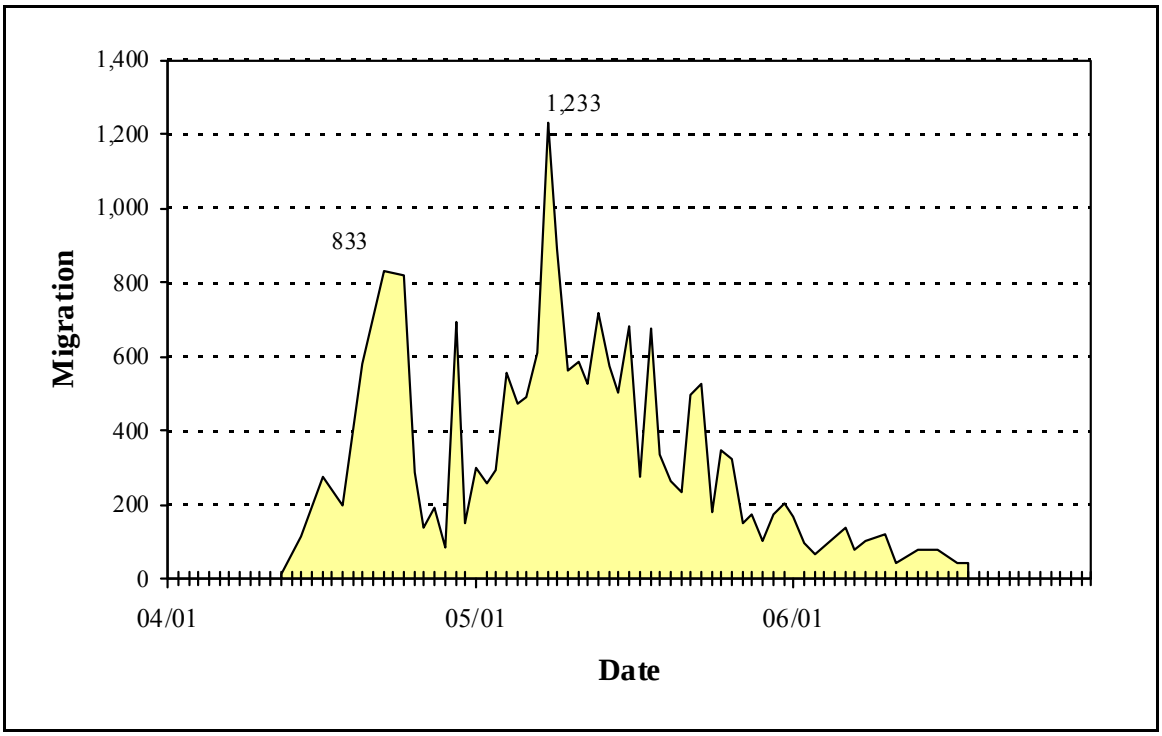

Figure 10. Natural-origin coho smolt migration from Mannser Creek in 2007.

Mainstem Traps

Catch

A total of 13,106 natural-origin smolts were captured in the mainstem traps (7,582 smolts in the scoop and 5,524 smolts in the screw), including 333 LV-marked smolts released from Mannser Creek (Table 16). The migration of natural-origin coho generally coincided with rising flows associated with spring runoff (Figure 11). Catches of natural-origin coho smolts first occurred in early-April, peaked on May 12 (n = 718), and declined through late June and into July. Half of the migration occurred by May 13.

A total of 1,176 hatchery-origin coho smolts were captured over the season. The scoop trap caught 571 smolts and the screw trap caught 605 smolts (Table 16). Hatchery-origin coho were released on May 19 from Marblemount Hatchery and between April 10 and May 3 into the Baker River Basin. Catches of hatchery-origin coho peaked on May 5 (n = 128), followed by two smaller peaks on June 3 (n = 94) and June 11 (n = 88) (Figure 11).

A total of 259,770 hatchery coho were released from Marblemount Hatchery, and included three groups: ad/CWT; unmarked/CWT; and ad-marked/untagged. In addition, Puget Sound Energy (PSE) released 61,155 hatchery coho: 16,073 smolts released into Baker Lake and Lake Shannon, and 45,082 smolts released into the Baker River near its confluence with the Skagit River (Table 17).

Table 16. Composition of natural and hatchery-origin coho smolts captured in the mainstem scoop and screw traps, Skagit River 2007.

Gear	Natural-Origin			Hatchery[a]					
	Unmk	LV clip	Total	Admk	Admk/ Brand	Unmk/ CWT	Admk/ CWT	Unmk	Total
Scoop Trap	7,399	183	7,582	523	0	20	27	1	571
Screw Trap	5,374	150	5,524	531	0	43	31	0	605
Total	12,773	333	13,106	1,054	0	63	58	1	1,176

[a] Unmarked hatchery coho were identified by general appearance which differs from natural-origin coho, and by presence of CWT.

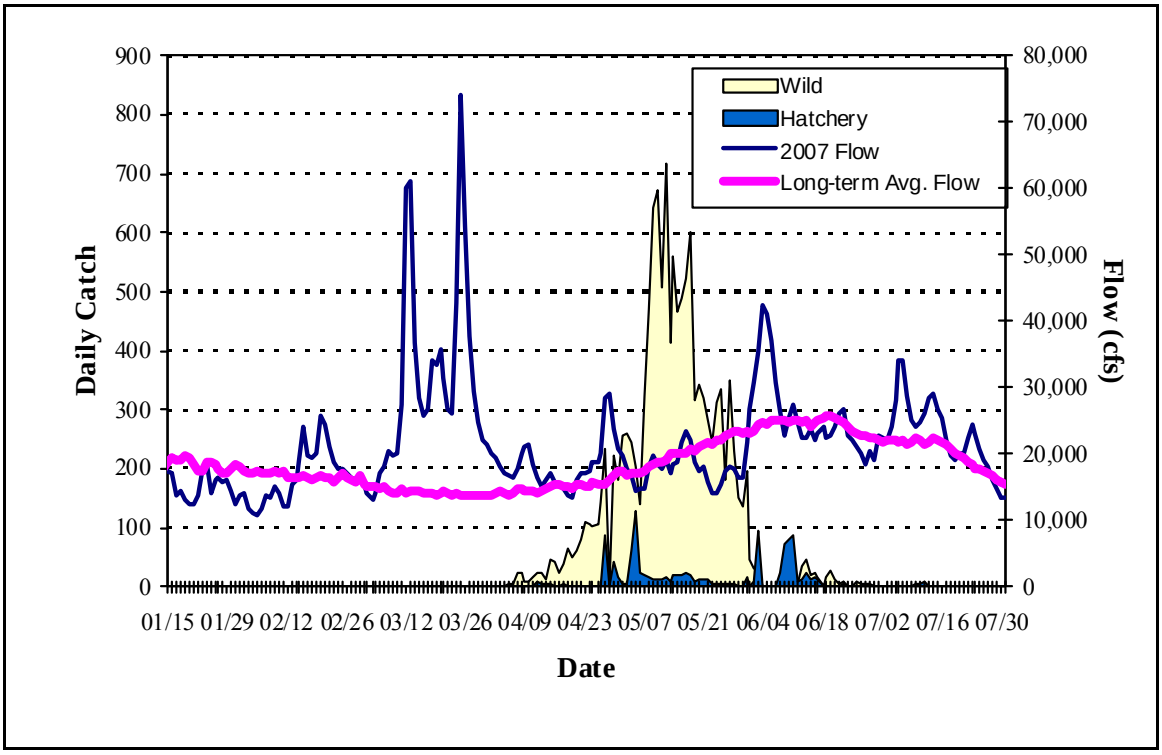

Figure 11. Daily catch of natural and hatchery-origin coho smolts in the Skagit River mainstem traps with 2007 daily mean stream flow and long-term average daily mean flows (USGS gauge#12200500, near Mt. Vernon).

Table 17. Hatchery-origin coho smolts (2005 brood) released into the Skagit River in 2007.

Hatchery/Release Location	Stock	Release Date(s)	Tag Code	Coho Smolt Release Groups					
				Tagged (CWT)		Untagged		PIT-Tagged	Total Released
				Admk	Unmk	Admk	Ad/ Brand	Admk	
(PSE) Baker Lake/Lake Shannon[a]	Baker River	04/10-04/13	n/a				15,570		15,570
(PSE) Baker River @ Skagit[a]	Baker River	04/11/07	n/a					503	503
		04/27/07	n/a			15,036			15,036
		05/03/07	n/a			15,070			15,070
		05/03/07	n/a			14,976			14,976
Skagit Hatchery (Marblemount)[b]	Skagit River	06/01-06/04	n/a			172,348			172,348
			63-35/71	43,672					43,672
			63-35/72		43,750				43,750
			Total	43,672	43,750	217,430	15,570	503	320,925

[a] Puget Sound Energy, information available from Doug Bruland
[b] Washington Department of Fish and Wildlife, information available from Steve Stout (WDFW).

Mark-Recapture Rates

Natural-Origin Coho

LV-marked coho smolts represented 2.54% of the total natural-origin coho caught in the mainstem trap. Recapture of LV-marked coho released from Mannser Creek was 1.75% (Table 18).

Hatchery-Origin Coho

Recapture rate of hatchery-origin coho smolts was 0.4% of the total hatchery releases. Hatchery recapture rates were four times lower than recapture natural-origin coho released from Mannser Creek (Table 18).

Table 18. Estimated capture rates of natural-origin and hatchery-origin coho smolts at the Skagit River Traps in 2007.

Stock	Number Released	Scoop		Screw		Total	
		Number Recap	Catch Rate	Number Recap	Catch Rate	Number Recap	Catch Rate
Wild Mannser Creek (LV marked)	19,047	183	1.0%	150	0.8%	333	1.7%
Marblemount/ Baker Hatcheries (WDFW/ PSE)	320,925	571	0.2%	605	0.2%	1,176	0.4%

Natural-Origin Coho Production

A total migration of 747,191 ±78,324 (95% C.I.) natural-origin coho smolts are estimated to have passed the mainstem traps in the Skagit River in 2007 (Table 19).

Table 19. Estimated migration of natural-origin coho smolts in the Skagit River, 2007.

	Number	Formula
Total mainstem trap catches	14,282	
Marblemount/Baker River Hatchery	-1,176	
Wild coho captured (u)	**13,106**	
LVs recaptured (m)	333	$N = \frac{(M+1)(u+1)}{(m+1)}$
LVs released (M)	19,047	
Total production (U)	**747,491**	
Variance (Var)	1.60E+09	$Var = \frac{(M+1)(u+1)(M-m)(u-m)}{(m+1)^2(m+2)}$
Standard Deviation (sd)	39,961	
Coefficient of Var (CV)	5.35%	CV = sd/U
Confindence Interval (CI)	78,324	CI = +/- 1.96(sd)
Estimated coho production		
Skagit River	747,491	
Upper CI (95%)	825,815	
Lower CI (95%)	669,168	

Notes: Baker River smolts are included in the total mainstem trap catches (110 total recaptured). Skagit Hatchery (ad-marked and unmarked) counts are by visual identification and tag detection at the mainstem traps.

Length Analysis and Size Selectivity

Size selectivity of the traps, relative to the entire coho migration, was minimal. Lengths of LV-marked coho smolts recaptured in the scoop and screw traps were 2 mm shorter (mean length = 97.3-mm FL) from those released at Mannser Creek (mean length = 99.0-mm FL, $p = 0.007$, (Table 20).

Lengths of Mannser Creek coho were a representative sample of the total natural-origin coho migration in the Skagit River. Lengths of unmarked natural-origin smolts captured in the mainstem traps (mean length = 97.4-mm FL) did not differ from lengths of LV-marked smolts (mean length = 97.4-mm FL) recaptured in the mainstem traps (Wilcoxon rank sum test: $p = 0.17$, Table 20).

Size selectivity between the scoop and screw trap was observed yet small in magnitude. Lengths of unmarked coho captured in the screw trap (mean length = 99.7-mm FL) were longer than those captured in the scoop trap (mean length = 95.3-mm FL, $p = 0.03$). Lengths of LV-marked coho captured in the scoop and screw traps did not differ ($p = 0.46$).

Table 20. Summary statistics for fork length data (mm) sampled from natural-origin coho smolts captured in the mainstem Skagit (scoop and screw) and Mannser Creek traps in 2007

Mark Group	Trap	Mean	S.D.	Min.	Max	Number Sampled	Catch	Percent Sampled
LV Marked	Mannser (release site)	99.0	10.54	56	174	1,768	18,145	9.2%
	Scoop (recapture)	96.8	7.69	79	123	182	183	99.4%
	Screw (recapture)	98.1	7.93	72	121	150	150	100.0%
Unmarked	Scoop	95.3	10.39	70	140	222	7,399	3.0%
	Screw	99.7	12.98	60	198	203	5,374	3.8%

Other Species

In addition to 0+ Chinook and coho smolts, catches included Chinook yearlings, coho fry, sockeye fry and smolts, pink and chum fry, hatchery and natural-origin steelhead smolts and adults, cutthroat smolts and adults, trout fry and parr, and Dolly Varden/bull trout (native char) smolts (Table 3). Spring 2007 was not a pink salmon outmigration year (3 fry captured), as adult pinks spawn in fall of odd-numbered years. Chum fry were the most abundant downstream migrant during the 2007 season, with a combined total catch of 137,829 fry from both traps. Catch of chum fry peaked in the mainstem traps on April 7 at 11,379 fry (Figure 12).

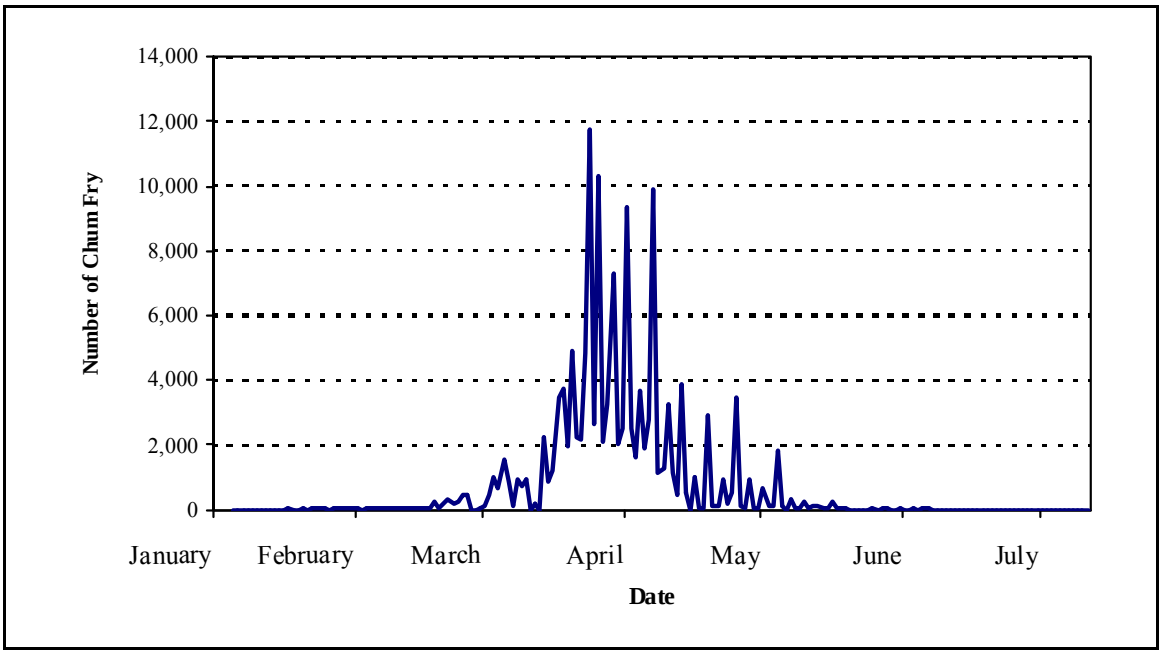

Figure 12. Chum fry catch in the Skagit River mainstem traps, 2007. Data are summed catch from scoop and screw traps.

A total of 925 natural-origin steelhead smolts were captured in the mainstem scoop and screw traps (Table 3, Appendix B 1 and Appendix B 2). Fork lengths, measured from a random sample, averaged 159.5-mm over the season. Due to their larger size and stronger swimming ability, steelhead smolts are more difficult to catch than other species. In large rivers like the Skagit, this issue is accentuated because a large percentage of water does not flow through the trap. In addition, steelhead outmigration includes multiple age classes, complicating migration estimates when compared to coho, which primarily migrate as yearlings, and Chinook, which primarily migrate as sub-yearlings.

A total of 232 native char smolts were captured, with an average fork length of 127.9 mm. Catch totals for all other salmonids are listed in Table 3.

Assumptions

Chinook 0+

Every estimate relies on a set of assumptions. We know that trap efficiency varies over time and assume it is the end product of smolt abundance and environmental conditions. To minimize problems associated with using a small number of trap efficiency tests to represent catch rates over a variety of conditions, we elected to use a stratified mark-recapture approach, releasing many smaller groups of natural-origin 0+ Chinook across different flow levels over the season. This stratified approach better represents the variability of trap efficiency throughout the season, as it is a product of environmental conditions and fish abundance. In addition, we made the following assumptions to estimate the numbers of natural-origin 0+ Chinook migrating from the Skagit River in 2007.

1. **Catch Expansion**. Expansion of catch to the standard of continuous trap operation involved estimating the number of fish passing the traps on the nights and daytime periods when trapping was suspended.

2. **Trap Efficiency**. Trap efficiency is estimated by stratifying mark-recapture data over the duration of the trapping season.

   Every trap efficiency group of marked fish includes the following basic assumptions:
   a. The number passing the gear is known (survival from release to the trap is 100%).
   b. All marked fish captured are identified and enumerated.
   c. Instantaneous trap efficiency is not a function of ambient light.

3. **Equal Probability of Capture**. Marked fish are captured within hours of release, but are used to estimate efficiency over a longer period (few days). We assume the probability of capture remains constant over this longer period.

Discussion of Assumptions

Although direct assessment of the above assumptions is not possible, we have some intuition as to how important they are and in which direction some of them may be violated. Effects of each assumption on our estimate of the zero-age Chinook production from the Skagit River are as follows:

Assumption #1: Catch Expansion
We have no reason to believe that catch projections using expansions of the day/night ratios for the daylight periods not fished are biased. Catch projection for the season is a reasonable estimate of the numbers of natural-origin zero-age Chinook that we would have caught in both traps had they operated continuously from January 18 to July 25.

Assumption #2a: 100% Survival of Calibration Fish
It is unlikely that all of the calibration fish in each group survived to pass the trap. However, we expect high survival to the traps given the short distance from the Chinook release site to the traps (about one mile) and recovery time prior to release.

Assumption # 2b: Complete Identification/Enumeration of Captured and Marked Fish
We are confident that virtually every marked fish captured was identified and recorded. The 2007 trapping crew was comprised of trained and dedicated scientific technicians with many years of experience at this site. Consequently, we don't consider this to be a significant potential bias.

Assumption #2c: Trap Efficiency Is Not Affected by Light
If this assumption is not correct, then efficiency during the day is likely lower than that at night due to trap avoidance enhanced by daylight. Another factor that might lower trap efficiency during the daylight would be a shifting in the migration path to deeper water under higher ambient light levels.

In an attempt to measure trap efficiency during the day and night, paired groups of hatchery Chinook were released in Spring 1999. As these fish did not pass the gear within their release strata (catches occurred primarily at night), these tests provided no insight into the question of day versus night trap efficiency. If hatchery calibration groups have the same diel migration behavior as natural-origin fish, different capture rates for day and night would not constitute a source of bias.

Assumption #3: Equal Probably of Capture
The stratified mark-recapture design used reduces the period that a mark group represents unmarked fish over a few days. While the accuracy of any one efficiency experiment is variable, we expect the error about the true efficiency is reduced to near zero given the number of final efficiency strata used (8).

Conclusion

The critical issue contributing to estimates of natural 0+ Chinook production is the estimate of trap efficiency. Bias in the production estimate largely results from variation in this critical parameter. Trap efficiency in 2007 was estimated based on 26 release groups that spanned the entire Chinook migration and associated environmental fluctuations.

Trap efficiencies for natural-origin release groups ranged from 1.83% to 9.42%. The estimated migration of 2.2 million natural-origin 0+ Chinook is likely biased high because all marked Chinook are unlikely to have survived to pass the traps. Therefore, actual capture rates may be somewhat higher than what is projected by using mark groups.

Coho Smolts

The coho smolt migration estimate is achieved by marking 100% of migrants from Mannser Creek, a tributary to the Skagit River. Since the Mannser trap operated for the duration of the coho migration, it provides a known continuous mark group enabling us to forgo expanding coho smolt catches at the mainstem traps to the standard of continuous trapping as we do with Chinook. An equal proportion of marked fish from Mannser to the total unmarked coho would be captured whether the traps were operated 24 hours a day for the entire migration or just a portion of the time. This approach also relies on several assumptions.

1. **Closed Population**. No fish migrating in from other systems below the traps.
2. **Mark Group Representation**. The mark group must be composed of a representative sample of coho (size, migration timing) from the entire Skagit system and have an equal chance of being captured for both marking and recapture at the mainstem traps.
3. **Basic Assumptions**.
    a. All fish in mark groups must be marked clearly, enumerated correctly before release, and all marks must be noticed and properly enumerated upon recapture.
    b. Marking does not affect catch ability.
    c. The number of marks passing the gear is known (survival from release to the trap is 100%) and fish do not lose marks.

Assumption #1: Closed Population
Coho have a very defined migration period observed in many systems in Washington State (Seiler et al 2005). Coho smolts are active downstream-migrants; we have assumed that no smolts would be migrating up the Skagit River from other systems.

Assumption #2: Mark Group Representation
We technically violate this assumption in that we only mark the fish that emigrate from Mannser Creek and not from the rest of the Skagit system. However, timing of the Mannser Creek mark group is nearly identical in timing to the rest of the Skagit coho, and these fish mix thoroughly with the unmarked migrants in the 18 miles between the Mannser Creek and the mainstem Skagit traps. The coho outmigration from Mannser Creek also contains progeny from coho spawned outside of Mannser Creek. Lower Mannser is low gradient, off-channel rearing habitat from the mainstem Skagit River. Coho parr migrate into Mannser Creek for over-winter rearing and to escape high water events in the mainstem Skagit. We therefore believe that the mark group from Mannser Creek to be a fairly good representation of coho from the entire system. Fork length averages for coho released from Mannser were slightly longer (98.9-mm FL) than those recaptured (97.4-mm FL) and the unmarked coho (97.4-mm FL) caught at the mainstem traps. This suggests slight size selectivity this year at the mainstem trap sites. As a result of size selectivity, LV-marked large coho were recaptured at a lower rate than LV-marked small coho. A low bias in the recapture of large coho means that natural-origin coho production may have been underestimated.

Assumption #3a: Complete identification/enumeration of all fish marked and recaptured
We are confident that every marked fish was handled and clipped according to procedure and were properly identified and recorded upon recapture by our experienced trapping crew. As with the Chinook estimate, we don't consider this potential bias to be significant.

Assumption #3b: Catchability
Mannser Creek coho were anesthetized and marked with a left ventral (LV) fin-clip and were allowed to recover fully before release. Clipping and handling should have little impact on fish survival and swimming performance.

Assumption #3c: Number of marks passing the gear is known
All the Mannser Creek mark group are unlikely to have survived to pass or be captured in the mainstem traps. The Mannser Creek release site is 18 R.M. upstream of the mainstem recapture

site. Therefore, true trap efficiency is likely higher than that calculated and our migration estimate is likely biased low.

Conclusion

We believe our coho production estimate to be biased slightly low, based on the rationale described above. It is believed, however, in-river survival rates for coho smolts are typically high and we do not expect large bias in our estimate (Seiler et. al 2004, p 101).

Discussion

Chinook Production

The 2006 spawning escapement, 22,714 adult Chinook (WDFW SaSI, December 2008), was the second highest estimated since trapping operations began on the Skagit River in 1990. A strong relationship exists between incubation flow (November 1 through January 31) and egg-to-migrant survival (r^2=0.80, Figure 13). The peak flow event for the 2006 brood Chinook was very large and timed during a vulnerable incubation period for Chinook salmon (125,000 cfs on November 8). Low stream flows prior to this high flow event probably magnified the effects. Low water conditions force Chinook to spawn deeper in the stream channel, making redds more vulnerable to scour caused by high flows. This flood event led to the third lowest egg-to-migrant survival rate (3.9%) that we have estimated since 1990. A total of 49,271 natural-origin 0+ Chinook were captured during in 2007, less than half of the 101,260 outmigrants captured during the 2006 season. Escapement was similar for the 2006 outmigration (22,049 spawner in 2005) and the 2007 outmigration (22,714 spawners in 2006 (Table 14). In comparison, fall 2006 flows during fall 2005 were much more benign and conducive to stable gravel and egg incubation.

Flows during the 2007 outmigration were moderate to slightly above average and provided conditions that are favorable to juvenile salmonids. However, the estimate of 2.2 million natural-origin 0+ Chinook is well below the average production (4.4 million) previously estimated from the Skagit River in 1997-2006 (Table 14). We are very confident of this production estimate as it closely fits the developed egg-to-migrant survival relationship (Figure 13). In addition, increased numbers of efficiency groups for natural-origin Chinook have improved our estimate by more accurately reflecting the dynamic relationship between environmental conditions and trap efficiency.

Our survival estimate for hatchery-origin 0+ Chinook indicates that in-river survival was high among hatchery groups. The 2007 outmigration of hatchery-origin 0+ Chinook experienced average flow conditions during their release period and a high estimated survival rate (81.7%) from release sites to the mainstem traps. However, estimates of hatchery migrations relied on efficiency measures for natural-origin 0+ Chinook and capture rate of natural-origin and hatchery-origin Chinook are not necessarily equivalent. For example, paired trials natural-origin and hatchery-origin mark groups were recaptured at an average of 4.13% and 1.83%, respectively. If efficiency measures applied to hatchery catches were indeed too high, then in-river survival of hatchery-origin Chinook may be even higher than that reported here.

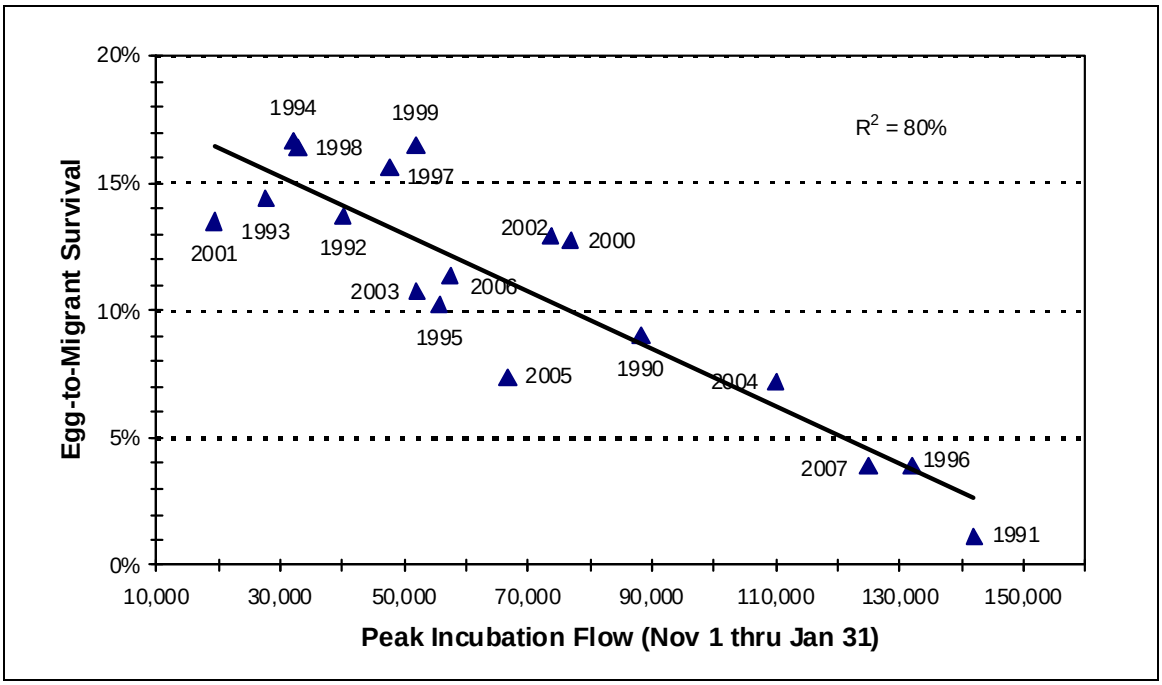

Figure 13. Natural-origin 0+ Chinook egg-to-migrant survival and peak incubation flow for migration years 1990-2007 in the Skagit River.

Coho Production

Coho production in 2007 was lower than the average production observed for odd-numbered years in the Skagit River (average 912,920 smolts based on estimates from 1990-2005). Coho smolt migrations during even-numbered years are typically larger than in those occurring in odd-numbered years. We hypothesize that this results from a positive interaction between coho parr and pink salmon fry, which generally only spawn in odd-numbered years.

Recapture rate of marked coho was higher in 2007 (1.75%) than the long-term average observed for the Skagit River (1990-2005 average = 1.33%). High capture rate in 2007 was likely a result of high flows throughout the migration period. High flow is likely to decrease coho ability to avoid and detect the trap.

Recommendations

The following recommendations, compiled from the previous years' work, are listed to can assess progress during the 2007 season. As noted in last year's report, these measures include actions that are reasonable and cost-effective to implement within the current scope and funding level of our trapping program in the lower Skagit River.

1. Continue to assess relationship of flow and turbidity, with migration rates.

2. Continue with increased number of marked natural-origin Chinook release groups to assess recapture rates at various flow levels throughout the season.

3. When possible, conduct paired releases of hatchery-origin and natural-origin Chinook groups to test the assumption of similar capture rates.

4. Explore options for estimating Chinook 1+ production.

5. Given the proposed listing of Puget Sound steelhead, consider developing new approaches for estimating natural-origin steelhead production.

6. Continue estimating production for natural-origin coho smolts from Skagit River by using smolt captured at Mannser Creek trap site.

Progress:

1. **Accomplished**. We looked at the relationships between flow, turbidity and migration rates. In 2007, relationship between flows, turbidity and day to night catch rate ratios to were not strong enough to predict missed catches.

2. **Accomplished**. In 2007 we released 26 groups of natural origin 0+ Chinook trap efficiency groups. Releases occurred at various flow levels. This did not represent an increase from 2006 because catches of natural-origin 0+ Chinook in 2007 were lower than 2006.

3. **Accomplished**. We released three paired natural and hatchery-origin calibration groups to assess differences in recapture rates of hatchery and natural-origin fish.

4. **Not accomplished.** This was not a focus for the 2007 trapping season.

5. **Not accomplished.** Trapping options were considered and discussed, but no viable option has been identified.

6. **Accomplished.** Coho smolt production was estimated in 2007 based on Mannser Creek mark and release group and mainstem recaptures.

Recommendations for 2008

Our study plan for the 2008 season will continue to follow the above recommendations:

1. Continue to assess relationship of flow and turbidity, with migration rates.

2. Continue to maximize the number of efficiency groups for natural-origin and hatchery-origin Chinook. Hatchery-origin should be paired with natural-origin efficiency groups.

3. Conduct efficiency group releases for chum and pink fry. Chum and pink fry should be paired with natural-origin 0+ Chinook efficiency groups.

4. Explore options for estimating Chinook 1+ production.

5. Consider developing new approaches for estimating natural steelhead production.

6. Continue estimating production for natural-origin coho smolts from the Skagit River by using smolt captured at the Mannser Creek trap site.

Appendix A:

Variance of total unmarked smolt numbers,
when the number of unmarked smolts, is estimated.

Kristen Ryding
WDFW Biometrician

Appendix A. Variance of total unmarked smolt numbers when the number of unmarked smolts, is estimated. Variance formula was derived by Kristen Ryding, WDFW Biometrician.

The estimator for $\hat{U}_i$ is,

$$\hat{U}_i = \frac{\hat{u}_i\left(M_i+1\right)}{\left(m_i+1\right)}$$

the estimated variance of $\hat{U}_i$, $Var\left(U_i\right)$ is as follows,

$$Var\left(\hat{U}_i\right) = Var\left(\hat{u}_i\right)\left(\frac{\left(M_i+1\right)\left(M_i m_i+3M_i+2\right)}{\left(m_i+1\right)^2\left(m_i+2\right)}\right) + Var\left(\hat{U}_i\middle|E\left(\hat{u}\right)\right)$$

$$\text{where } Var\left(\hat{U}_i\middle|E\left(\hat{u}\right)\right) = \frac{\left(M_i+1\right)\left(M_i-m_i\right)E\left(\hat{u}_i\right)\left(E\left(\hat{u}_i\right)+m_i+1\right)}{\left(m_i+1\right)^2\left(m_i+2\right)},$$

$E\left(\hat{u}_i\right)$ = the expected value of $\hat{u}_i$ either in terms of the estimator (equation for $\hat{u}_i$) or just substitute in the estimated value and, $Var\left(\hat{u}_i\right)$ depends on the sampling method used to estimate $\hat{u}_i$.

Derivation:

Ignoring the subscript i for simplicity, the derivation of the variance estimator is based on the following unconditional variance expression,

$$Var\left(\hat{U}\right) = Var\left(E\left(\hat{U}\middle|u\right)\right) + E\left(Var\left(\hat{U}\middle|u\right)\right).$$

The expected value and variance $\hat{U}$ given u is as before, respectively,

$$E\left(\hat{U}_i\middle|u\right) = \frac{u_i\left(M_i+1\right)}{\left(m_i+1\right)} \text{ and,}$$

$$Var\left(\hat{U}\middle|u\right) = \frac{u\left(u+m+1\right)\left(M+1\right)\left(M-m\right)}{\left(m+1\right)^2\left(m+2\right)}.$$

Substituting in $\hat{u}$ for u gives the following,

$$Var\left(\hat{U}\right) = Var\left(\frac{\hat{u}\left(M+1\right)}{\left(m+1\right)}\right) + E\left[\frac{\left(M+1\right)\left(M-m\right)\hat{u}\left(\hat{u}+m+1\right)}{\left(m+1\right)^2\left(m+2\right)}\right]$$

$$Var\left(\hat{U}\right) = \left(\frac{\left(M+1\right)}{\left(m+1\right)}\right)^2 Var\left(\hat{u}\right) + \frac{\left(M+1\right)\left(M-m\right)}{\left(m+1\right)^2\left(m+2\right)}\left[E\left(\hat{u}^2\right)+E\left(\hat{u}\right)\left(m+1\right)\right]$$

Note that,

$$E\left(\hat{u}^2\right) = Var\left(\hat{u}\right) + \left(E\hat{u}\right)^2$$

Substituting in this value for $E\left(\hat{u}^2\right)$,

$$Var\left(\hat{U}\right) = \left(\frac{(M+1)}{(m+1)}\right)^2 Var\left(\hat{u}\right) + \frac{(M+1)(M-m)}{(m+1)^2(m+2)}\left[Var\left(\hat{u}\right) + \left(E\left(\hat{u}\right)\right)^2 + E\left(\hat{u}\right)(m+1)\right]$$

$$= \left(\frac{(M+1)}{(m+1)}\right)^2 Var\left(\hat{u}\right) + \frac{(M+1)(M-m)}{(m+1)^2(m+2)}\left[Var\left(\hat{u}\right) + E\left(\hat{u}\right)\left[E\left(\hat{u}\right) + m + 1\right]\right]$$

$$Var\left(\hat{U}\right) = \left(\frac{(M+1)}{(m+1)}\right)^2 Var\left(\hat{u}\right) + \frac{(M+1)(M-m)}{(m+1)^2(m+2)} Var\left(\hat{u}\right) + \frac{(M+1)(M-m)E\left(\hat{u}\right)\left[E\left(\hat{u}\right) + m + 1\right]}{(m+1)^2(m+2)}$$

$$Var\left(\hat{U}\right) = Var\left(\hat{u}\right)\left(\frac{(M+1)^2}{(m+1)^2} + \frac{(M+1)(M-m)}{(m+1)^2(m+2)}\right) + \frac{(M+1)(M-m)E\left(\hat{u}\right)\left[E\left(\hat{u}\right) + m + 1\right]}{(m+1)^2(m+2)}$$

$$Var\left(\hat{U}\right) = Var\left(\hat{u}\right)\left(\frac{(M+1)^2}{(m+1)^2} + \frac{(M+1)(M-m)}{(m+1)^2(m+2)}\right) + Var\left(\hat{U}\middle|E\left(\hat{u}\right)\right)$$

$$Var\left(\hat{U}\right) = \frac{(M+1)}{(m+1)^2} Var\left(\hat{u}\right)\left(\frac{(M+1)(m+2)}{(m+2)} + \frac{(M-m)}{(m+2)}\right) + Var\left(\hat{U}\middle|E\left(\hat{u}\right)\right)$$

$$Var\left(\hat{U}\right) = \frac{(M+1)}{(m+1)^2} Var\left(\hat{u}\right)\left(\frac{Mm + 2M + m + 2 + M - m}{(m+2)}\right) + Var\left(\hat{U}\middle|E\left(\hat{u}\right)\right)$$

$$Var\left(\hat{U}\right) = Var\left(\hat{u}\right)\left(\frac{(M+1)(Mm + 3M + 2)}{(m+1)^2(m+2)}\right) + Var\left(\hat{U}\middle|E\left(\hat{u}\right)\right)$$

Appendix B:
Daily Catches in the Mainstem Skagit River Scoop and Screw Traps, 2005

Appendix B 1. Total daily catches, by species and age, in the Skagit River mainstem scoop trap, 2007.

Date	HOURS		CHINOOK		Chum	COHO		Pink	Sock	TROUT			Unmarked		
	Fished	Out	0+	1+		0+	1+			Parr	Sthd1	Cutt1	Chin0	Coho1	Sthd1
01/19	11.83	0.17	7	0	0	0	0	0	0	0	0	0	2	0	0
01/20	15.00	9.00	10	1	0	0	0	0	0	0	0	0	10	0	0
01/21	14.50	9.50	8	2	0	0	0	0	0	1	0	0	11	0	0
01/22	23.67	0.33	12	2	0	0	0	0	1	0	0	0	7	0	0
01/23	13.50	10.50	18	1	0	0	0	0	0	0	0	0	14	0	0
01/24	23.58	0.42	26	0	0	0	0	0	0	0	0	0	30	0	0
01/25	14.75	9.25	17	0	1	0	0	0	0	0	0	0	16	0	0
01/26	14.00	10.00	17	0	0	0	0	0	0	0	0	0	17	0	0
01/27	23.58	0.42	23	2	0	0	0	0	0	0	0	0	23	0	0
01/28	14.25	9.75	15	1	0	0	0	0	0	0	0	0	17	0	0
01/29	14.25	9.75	12	1	0	0	0	0	0	0	0	0	14	0	0
01/30	23.67	0.33	22	0	5	0	0	0	0	0	0	0	13	0	0
01/31	14.25	9.75	24	0	5	0	0	0	0	0	0	0	29	0	0
02/01	14.50	9.50	24	0	3	0	0	0	0	1	0	1	18	0	0
02/02	23.25	0.75	36	2	2	0	0	0	0	0	0	0	36	0	0
02/03	14.00	10.00	23	1	3	0	0	0	0	0	0	0	30	0	0
02/04	12.50	11.50	11	0	3	0	0	0	0	0	0	0	15	0	0
02/05	23.58	0.42	10	2	4	0	0	0	0	0	0	0	9	0	0
02/06	14.50	9.50	23	2	4	0	0	0	0	0	0	0	10	0	0
02/07	14.25	9.75	30	1	3	0	0	0	0	0	0	0	39	0	0
02/08	23.67	0.33	33	0	2	0	0	0	0	0	0	0	24	0	0
02/09	13.75	10.25	37	0	2	0	0	0	0	0	0	0	38	0	0
02/10	14.25	9.75	28	0	4	0	0	0	0	0	0	0	36	0	0
02/11	23.50	0.50	22	0	8	0	0	0	0	0	0	0	25	0	0
02/12	14.00	10.00	23	0	8	0	0	0	0	1	0	0	12	0	0
02/13	13.50	10.50	57	0	6	0	0	0	0	0	0	0	37	0	0
02/14	23.58	0.42	99	0	5	0	0	0	0	0	0	0	88	0	0
02/15	11.67	12.33	82	1	6	0	0	0	1	0	0	0	113	0	0
02/16	6.08	5.92	25	0	2	0	0	0	0	0	0	0	17	0	0
02/17	23.50	0.50	188	0	12	0	1	0	0	0	0	0	164	1	0
02/18	13.25	10.75	123	0	12	0	0	0	0	0	0	0	112	0	0
02/19	13.50	10.50	148	0	14	0	1	0	0	0	0	0	141	1	0
02/20	17.50	6.50	153	0	14	0	0	0	0	0	0	0	176	0	0
02/21	14.25	9.75	110	0	6	0	0	0	0	0	0	0	104	0	0
02/22	13.50	10.50	107	0	7	0	0	0	0	0	0	0	111	0	0
02/23	23.58	0.42	149	0	19	0	1	0	1	0	0	0	145	1	0
02/24	13.50	10.50	97	0	18	0	0	0	0	0	0	0	113	0	0
02/25	13.25	10.75	66	0	16	0	0	0	0	0	0	0	76	0	0
02/26	23.67	0.33	86	0	40	0	0	0	0	0	0	0	66	0	0
02/27	13.00	11.00	87	0	42	0	0	0	0	0	0	0	96	0	0
02/28	13.00	11.00	89	0	27	0	0	0	0	0	0	0	78	0	0
03/01	23.50	0.50	133	1	41	0	0	0	0	0	0	0	143	0	0
03/02	12.75	11.25	89	0	31	0	0	0	0	0	0	0	78	0	0
03/03	12.75	11.25	99	0	75	0	0	0	0	0	0	0	105	0	0
03/04	23.67	0.33	88	0	125	0	0	0	0	0	0	0	111	0	0
03/05	13.00	11.00	49	0	63	0	0	0	0	0	1	0	39	0	1
03/06	13.00	11.00	82	0	95	0	0	0	0	0	0	0	62	0	0
03/07	23.58	0.42	175	1	175	0	0	0	0	0	0	0	132	0	0
03/08	12.00	12.00	246	0	157	0	0	0	0	0	0	0	199	0	0
03/09	12.75	11.25	306	0	200	0	1	0	0	0	0	0	312	1	0
03/10	23.50	0.50	403	0	335	0	0	0	0	0	0	0	340	0	0

Table continued on next page

Appendix B1: Total daily catches, by species and age, in the Skagit River mainstem scoop trap, 2007 (cont'd).

Date	HOURS		CHINOOK		Chum	COHO		Pink	Sock	TROUT			Unmarked		
	Fished	Out	0+	1+		0+	1+			Parr	Sthd1	Cutt1	Chin0	Coho1	Sthd1
03/11	8.25	15.75	291	0	186	0	0	0	0	0	0	0	485	0	0
03/12		24.00													
03/13		24.00													
03/14	1.00	23.00	21	0	19	0	0	0	0	0	0	0	21	0	0
03/15	6.67	17.33	178	1	217	1	0	0	0	0	0	0	80	0	0
03/16	13.25	10.75	277	2	364	2	0	0	0	0	1	0	266	0	1
03/17	11.25	12.75	318	1	572	0	1	0	1	1	2	0	270	1	2
03/18	8.00	16.00	217	0	331	0	0	0	0	0	0	0	286	0	0
03/19	23.67	0.33	388	1	838	0	1	0	0	0	0	0	388	1	0
03/20	7.75	16.25	125	0	237	0	0	0	1	0	1	0	213	0	1
03/21	7.00	17.00	102	0	201	0	0	0	0	0	0	0	38	0	0
03/22	23.67	0.33	267	2	628	0	0	0	0	0	0	0	272	0	0
03/23	11.75	12.25	192	3	550	0	0	0	0	0	0	0	168	0	0
03/24	7.00	17.00	138	3	337	0	0	0	0	0	0	0	221	0	0
03/25		24.00													
03/26	1.00	22.50	6	0	80	0	0	0	0	0	0	0	6	0	0
03/27	3.98	20.02	37	0	395	1	0	0	0	0	0	0		0	0
03/28	15.85	8.15	200	5	878	2	0	0	0	0	0	0	207	0	0
03/29	11.25	12.75	135	3	412	0	0	0	0	0	1	0	83	0	1
03/30	11.33	12.67	221	5	705	0	0	0	1	0	0	0	231	0	0
03/31	23.58	0.42	497	15	2,217	1	0	0	0	0	1	0	453	0	0
04/01	11.00	13.00	325	7	1,952	0	0	0	0	1	0	0	327	0	0
04/02	11.00	13.00	323	4	1,525	0	0	0	0	1	0	0	314	0	0
04/03	23.50	0.50	500	10	3,170	0	1	0	1	0	0	0	529	0	0
04/04	10.75	13.25	264	8	1,617	0	2	0	0	0	0	0	269	2	0
04/05	11.00	13.00	288	5	2,203	0	2	0	1	0	0	0	255	2	0
04/06	11.00	13.00	390	8	3,141	0	6	0	4	0	0	0	335	6	0
04/07	23.67	0.33	1,039	13	5,914	0	17	0	2	0	1	0	793	17	1
04/08	11.00	13.00	1,104	5	1,914	0	13	0	1	0	0	0	1,217	13	0
04/09	23.00	1.00	1,613	20	5,364	1	6	0	1	0	1	0	1,594	6	1
04/10	5.50	18.50	401	1	1,441	0	4	0	0	0	0	0	493	4	0
04/11	10.75	13.25	614	3	2,596	0	8	0	1	0	0	0	712	6	0
04/12	23.50	0.50	848	16	4,413	0	15	0	0	0	0	0	823	12	0
04/13	10.50	13.50	470	0	1,414	0	10	0	1	0	0	0	471	8	0
04/14	11.00	13.00	553	2	1,542	0	13	0	1	0	1	0	513	13	1
04/15	23.33	0.67	970	6	5,087	0	21	0	1	0	1	0	1,005	20	1
04/16	11.00	13.00	489	7	1,596	0	15	0	1	0	0	0	529	15	0
04/17	11.00	13.00	392	115	1,212	2	16	0	1	0	0	0	401	15	0
04/18	23.50	0.50	506	297	2,190	2	28	0	2	1	1	0	526	26	1
04/19	10.75	13.25	286	92	1,426	1	27	0	3	1	1	0	290	26	1
04/20	10.75	13.25	346	40	1,755	0	29	0	5	0	1	0	293	28	1
04/21	23.25	0.75	829	36	4,198	0	40	0	3	0	0	0	759	39	0
04/22	10.75	13.25	623	13	938	0	51	0	2	0	1	0	705	51	1
04/23	10.75	13.25	394	8	1,023	0	62	0	3	0	1	0	418	62	1
04/24	23.50	0.50	400	7	1,783	0	70	0	1	1	1	0	377	69	1
04/25	10.75	13.25	438	5	607	1	66	0	1	0	1	0	436	66	1

Table continued on next page

Appendix B1: Total daily catches, by species and age, in the Skagit River mainstem scoop trap, 2007 (cont'd).

Date	HOURS		CHINOOK		Chum	COHO		Pink	Sock	TROUT			Unmarked		
	Fished	Out	0+	1+		0+	1+			Parr	Sthd1	Cutt1	Chin0	Coho1	Sthd1
04/26	10.25	13.75	398	3	607	1	69	0	2	0	1	0	400	69	1
04/27	23.58	0.42	542	9	1,885	0	113	0	3	0	6	0	503	95	6
04/28	5.50	18.50	286	9	258	1	98	0	2	0	6	0	460	68	6
04/29	3.50	20.50	43	3	9	0	32	0	2	0	1	0		27	1
04/30	23.58	0.42	377	10	414	1	110	0	5	0	4	0	324	97	4
05/01	10.00	14.00	277	2	35	0	112	0	2	0	3	0	283	110	3
05/02	9.50	14.50	205	2	80	0	129	0	2	0	2	0	250	128	1
05/03	23.67	0.33	236	3	1,430	0	146	0	2	0	5	0	252	136	1
05/04	9.42	14.58	93	2	92	0	168	0	3	0	4	0	88	125	1
05/05	9.50	14.50	86	2	123	0	155	0	4	1	3	0	100	105	0
05/06	23.58	0.42	130	3	557	0	126	0	2	0	0	0	99	115	0
05/07	9.25	14.75	151	1	192	0	236	1	1	1	2	0	164	224	1
05/08	9.50	14.50	142	2	220	3	319	0	2	0	7	1	116	309	6
05/09	18.75	5.25	300	5	1,431	4	411	0	10	0	12	0	294	402	8
05/10	9.25	14.75	214	9	15	0	414	0	14	0	17	0	215	407	8
05/11	9.00	15.00	191	3	26	1	315	0	2	0	7	0	206	308	3
05/12	23.58	0.42	308	9	408	0	405	0	3	0	6	0	296	399	4
05/13	9.25	14.75	206	2	24	1	295	0	4	0	10	0	204	288	4
05/14	9.42	14.58	210	4	20	0	312	0	6	0	18	0	213	300	8
05/15	23.42	0.58	213	7	326	0	277	0	1	0	6	0	242	266	2
05/16	8.50	15.50	133	4	22	0	281	0	6	0	10	0	114	269	5
05/17	8.50	15.50	160	8	16	0	281	0	17	0	34	0	188	270	18
05/18	23.58	0.42	200	20	824	0	317	0	12	0	34	0	189	311	17
05/19	8.50	15.50	111	2	72	0	177	0	1	0	8	0	120	173	5
05/20	8.50	15.50	104	3	11	0	164	0	0	0	9	1	100	159	4
05/21	23.50	0.50	223	5	204	0	192	0	0	0	9	0	231	185	4
05/22	9.25	14.75	90	2	9	0	171	0	0	0	4	0	86	164	3
05/23	8.75	15.25	81	0	5	0	196	0	1	1	2	1	88	193	2
05/24	23.58	0.42	146	1	181	1	237	0	1	0	4	1	142	235	2
05/25	8.25	15.75	97	1	19	0	185	0	1	0	4	0	87	183	2
05/26	8.50	15.50	162	2	31	0	139	0	0	0	1	1	131	136	1
05/27	23.58	0.42	605	3	63	1	196	0	0	0	8	3	276	191	7
05/28	9.25	14.75	569	5	22	0	124	0	0	0	14	0	191	122	12
05/29	8.50	15.50	473	2	27	0	81	0	0	0	3	0	136	80	3
05/30	23.50	0.50	506	4	148	0	94	0	1	0	1	2	134	94	1
05/31	8.25	15.75	576	6	27	0	86	0	2	0	3	2	168	85	3
06/01	6.50	17.50	392	7	21	0	40	0	1	0	2	1	114	38	1
06/02	10.00	14.00	364	4	9	0	68	0	1	0	0	1	167	31	0
06/03	5.50	18.50	197	4	1	0	85	0	1	0	1	0	139	20	1
06/04		24.00													
06/05		24.00													
06/06		24.00													
06/07	2.50	21.50	13	0	1	0	5	0	0	0	0	0		1	0
06/08	23.50	0.50	193	5	5	0	32	0	1	0	1	0	158	11	1
06/09	8.00	16.00	87	0	2	0	21	0	1	0	1	0	77	10	1
06/10	8.00	16.00	82	0	5	0	19	0	0	0	1	1	78	8	1

Table continued on next page

Appendix B1: Total daily catches, by species and age, in the Skagit River mainstem scoop trap, 2007 (cont'd).

Date	HOURS		CHINOOK		Chum	COHO		Pink	Sock	TROUT			Unmarked		
	Fished	Out	0+	1+		0+	1+			Parr	Sthd1	Cutt1	Chin0	Coho1	Sthd1
06/11	23.50	0.50	187	0	3	0	38	0	0	0	0	0	158	11	0
06/12	7.25	16.75	100	0	1	0	7	0	0	0	0	0	47	3	0
06/13	8.00	16.00	152	0	3	0	18	0	0	0	0	0	55	13	0
06/14	23.50	0.50	442	0	24	0	30	0	0	0	0	0	261	23	0
06/15	8.25	15.75	371	0	3	0	14	0	1	0	1	0	68	11	0
06/16	8.25	15.75	1,063	0	3	0	14	0	0	0	0	0	82	9	0
06/17	23.25	0.75	2,347	0	8	0	7	0	0	0	0	0	310	5	0
06/18	8.25	15.75	497	0	2	0	5	0	0	0	0	0	80	4	0
06/19	8.25	15.75	256	0	3	0	9	0	0	0	0	1	61	9	0
06/20	23.50	0.50	424	0	3	0	11	0	0	0	0	0	102	11	0
06/21	8.25	15.75	108	0	0	0	2	0	0	0	0	0	31	2	0
06/22	7.75	16.25	128	0	0	0	3	0	0	0	0	0	37	3	0
06/23	23.58	0.42	281	0	0	0	3	0	0	0	0	0	118	2	0
06/24	8.42	15.58	80	0	0	0	1	0	0	0	0	0	48	1	0
06/25	8.25	15.75	58	0	1	1	1	0	0	0	0	0	31	1	0
06/26	23.50	0.50	156	0	0	1	6	0	0	0	0	1	75	6	0
06/27	8.00	16.00	40	0	0	0	1	0	0	0	0	0	15	1	0
06/28	8.25	15.75	63	0	0	0	1	0	0	1	0	0	44	1	0
06/29	23.67	0.33	127	0	0	0	2	0	0	0	0	0	53	2	0
06/30	8.25	15.75	53	0	0	0	0	0	0	0	0	0	24	0	0
07/01	8.00	16.00	63	0	0	0	1	0	0	0	0	0	51	1	0
07/02	8.25	15.75	21	0	1	0	0	0	0	1	0	0	10	0	0
07/03	23.50	0.50	101	0	0	0	1	0	0	1	0	0	65	0	0
07/04	6.00	18.00	17	0	0	0	2	0	0	0	0	0	21	1	0
07/05	2.25	21.75	13	0	0	0	0	0	0	0	0	0		0	0
07/06	6.25	17.75	43	0	0	0	1	0	0	0	0	0	15	1	0
07/07	7.50	16.50	82	0	0	0	0	0	0	0	0	0	46	0	0
07/08	23.58	0.42	122	0	0	0	0	0	0	0	0	0	66	0	0
07/09	8.50	15.50	66	0	1	0	0	0	0	0	0	0	44	0	0
07/10	8.50	15.50	33	0	1	0	0	0	0	0	0	0	21	0	0
07/11	23.67	0.33	58	0	0	0	8	0	2	0	0	0	38	2	0
07/12	9.25	14.75	15	0	0	0	4	0	2	0	0	0	10	0	0
07/13	8.75	15.25	10	0	0	0	0	0	0	0	0	0	5	0	0
07/14	8.50	15.50	20	0	0	0	0	0	0	0	0	0	8	0	0
07/15	23.67	0.33	80	0	1	0	0	0	0	0	0	0	38	0	0
07/16	6.75	17.25	34	0	0	0	0	0	0	0	0	0	30	0	0
07/17		24.00													
07/18	2.25	21.75	14	0	0	0	0	0	0	0	0	0		0	0
07/19	23.67	0.33	174	0	0	0	0	0	0	0	0	0	115	0	0
07/20	9.08	14.92	57	0	0	0	1	0	0	0	0	0	43	0	0
07/21	5.00	19.00	20	0	0	0	0	0	0	0	0	0	24	0	0
07/22		24.00													
07/23	2.75	21.25	14	0	0	0	0	0	0	0	0	0		0	0
07/24	23.67	0.33	147	0	0	0	1	0	0	0	0	0	83	0	0
07/25	6.50	0.00	89	0	1	0	0	0	0	0	0	0	77	0	0
Season Total			**40,260**	**968**	**80,724**	**30**	**8,153**	**1**	**166**	**15**	**293**	**18**	**32,058**	**7,582**	**179**

Note: The unmarked coho 1+ includes fish marked at Mannser Creek or Baker Dam.

Appendix B 2. Total daily catches, by species and age, in the Skagit River mainstem screw trap, 2007.

Date	HOURS		CHINOOK		Chum	COHO		Pink	Sock	TROUT			Unmarked		
	Fished	Out	0+	1+		0+	1+			Parr	Sthd1	Cutt1	Chin0	Coho1	Sthd1
01/19	11.75	0.00	5	0	0	0	0	0	0	0	0	0	1	0	0
01/20	15.00	9.00	9	1	0	0	0	0	0	1	0	1	9	0	0
01/21	14.50	9.50	12	0	0	0	0	0	0	0	0	0	8	0	0
01/22	23.50	0.50	18	1	0	0	0	0	1	0	1	0	20	0	1
01/23	13.50	10.50	17	0	0	0	0	0	0	0	0	0	11	0	0
01/24	24.00	0.00	20	1	0	0	0	0	0	0	0	0	29	0	0
01/25	14.75	9.25	4	0	0	0	0	0	0	1	0	0	6	0	0
01/26	14.00	10.00	3	0	0	0	0	0	0	0	0	0	2	0	0
01/27	24.00	0.00	12	1	0	0	0	0	0	0	1	0	9	0	1
01/28	14.25	9.75	14	1	0	0	0	0	0	0	0	0	12	0	0
01/29	14.50	9.50	16	2	0	0	0	0	0	0	0	0	17	0	0
01/30	24.00	0.00	20	1	0	0	0	0	0	0	0	0	21	0	0
01/31	14.25	9.75	14	0	1	0	0	0	0	0	0	0	12	0	0
02/01	14.50	9.50	14	0	1	0	0	0	0	0	0	0	16	0	0
02/02	23.25	0.75	16	0	1	0	0	0	0	0	0	0	15	0	0
02/03	24.00	0.00	14	2	3	0	0	0	0	0	0	0	12	0	0
02/04	12.50	11.50	8	0	1	0	0	0	0	0	0	0	12	0	0
02/05	23.75	0.25	14	0	2	0	0	0	0	0	0	0	13	0	0
02/06	14.50	9.50	17	1	4	0	0	0	0	0	0	0	12	0	0
02/07	14.25	9.75	18	0	3	0	0	0	0	0	0	0	23	0	0
02/08	23.75	0.25	22	0	1	0	0	0	0	0	0	0	14	0	0
02/09	13.75	10.25	31	0	0	0	0	0	0	0	0	0	30	0	0
02/10	14.25	9.75	24	1	2	0	0	0	0	0	0	0	31	0	0
02/11	23.75	0.25	17	1	3	1	0	0	0	0	0	0	20	0	0
02/12	14.00	10.00	9	0	2	0	0	0	0	0	0	0	9	0	0
02/13	13.50	10.50	23	0	2	0	0	0	0	0	0	0	9	0	0
02/14	24.00	0.00	61	0	3	0	0	0	0	0	0	0	47	0	0
02/15	8.50	15.50	44	0	2	0	0	0	0	0	0	0	76	0	0
02/16	6.00	18.00	59	0	1	0	0	0	0	0	0	0		0	0
02/17	23.83	0.17	171	0	6	0	1	0	1	0	0	1	193	1	0
02/18	13.25	10.75	85	0	3	0	0	0	0	1	0	0	84	0	0
02/19	13.50	10.50	95	1	4	0	0	0	0	0	0	1	92	0	0
02/20	17.25	6.75	128	0	6	0	0	0	0	0	0	0	127	0	0
02/21	14.25	9.75	70	0	1	0	1	0	0	0	0	0	102	1	0
02/22	13.50	10.50	58	1	3	0	0	0	0	0	1	1	23	0	1
02/23	24.00	0.00	109	0	6	0	0	0	0	1	0	0	133	0	0
02/24	13.50	10.50	34	1	2	0	0	0	0	1	0	0	48	0	0
02/25	13.25	10.75	24	1	1	0	0	0	0	0	0	0	17	0	0
02/26	24.00	0.00	51	0	13	0	0	0	0	0	0	0	42	0	0
02/27	13.00	11.00	56	0	7	0	0	0	0	1	0	0	50	0	0
02/28	13.00	11.00	64	1	12	0	0	0	0	0	0	0	66	0	0
03/01	23.50	0.50	102	0	26	0	0	0	0	0	0	0	99	0	0
03/02	12.75	11.25	65	0	17	0	0	0	0	0	0	0	66	0	0
03/03	12.75	11.25	48	1	18	0	0	0	0	0	0	0	65	0	0
03/04	23.75	0.25	42	0	49	0	0	0	0	0	1	0	40	0	1
03/05	13.00	11.00	47	1	41	0	0	0	0	0	0	0	31	0	0
03/06	12.75	11.25	89	1	67	0	1	0	0	0	0	0	66	1	0
03/07	23.75	0.25	116	0	131	0	1	0	0	0	0	0	137	1	0
03/08	12.00	12.00	77	1	35	0	0	0	0	0	0	0	69	0	0
03/09	12.75	11.25	131	0	51	0	1	0	0	0	1	0	92	1	1
03/10	23.58	0.42	297	0	183	0	0	0	0	0	1	0	228	0	1

Table continued on next page

Appendix B2: Total daily catches, by species and age, in the Skagit River mainstem screw trap, 2007 (cont'd).

Date	HOURS		CHINOOK		Chum	COHO		Pink	Sock	TROUT			Unmarked		
	Fished	Out	0+	1+		0+	1+			Parr	Sthd1	Cutt1	Chin0	Coho1	Sthd1
03/11	8.25	15.75	209	0	99	0	1	0	1	0	0	0	357	1	0
03/12		24.00													
03/13		24.00													
03/14		24.00													
03/15	5.58	18.42	128	0	168	1	0	0	0	0	0	0	27	0	0
03/16	13.42	10.58	266	4	263	2	0	0	0	0	0	0	265	0	0
03/17	11.25	12.75	333	5	400	2	0	0	1	0	0	0	256	0	0
03/18	8.00	16.00	196	1	237	0	0	0	0	0	0	0	326	0	0
03/19	23.67	0.33	337	1	815	0	0	0	0	0	2	0	274	0	2
03/20	5.75	18.25	157	0	258	0	0	0	1	0	0	0	269	0	0
03/21	6.92	17.08	65	1	137	0	0	0	0	0	0	0	24	0	0
03/22	24.00	0.00	198	6	345	0	0	0	0	0	0	0	188	0	0
03/23	11.75	12.25	141	4	257	0	0	0	0	0	0	0	141	0	0
03/24	7.00	17.00	83	2	232	0	0	1	0	0	1	0	134	0	1
03/25		24.00													
03/26	1.00	23.00	13	0	107	0	0	0	0	0	0	0	13	0	0
03/27	3.50	20.50	56	2	346	0	0	0	0	0	0	0		0	0
03/28	15.85	8.15	146	4	917	1	0	0	0	0	1	1	155	0	1
03/29	11.17	12.83	126	4	544	1	0	0	0	0	2	1	125	0	2
03/30	11.17	12.83	153	9	584	0	0	0	0	0	1	2	135	0	1
03/31	24.00	0.00	497	17	2,075	0	0	0	0	0	1	1	464	0	1
04/01	11.00	13.00	226	5	1,155	0	0	0	1	0	2	0	273	0	2
04/02	11.00	13.00	137	5	496	0	0	0	2	0	1	0	144	0	1
04/03	23.67	0.33	271	8	1,769	0	1	0	3	1	0	1	253	1	0
04/04	10.75	13.25	155	9	602	0	2	0	1	0	0	0	177	2	0
04/05	11.00	13.00	157	8	955	0	1	0	2	0	2	0	118	1	2
04/06	11.00	13.00	198	8	1,368	0	3	0	5	0	1	0	219	3	1
04/07	23.50	0.50	431	7	5,369	0	6	0	3	0	0	1	429	6	0
04/08	7.50	16.50	274	5	667	0	3	0	1	0	2	0	130	3	2
04/09	23.33	0.67	1,177	13	5,459	0	5	0	3	0	3	0	1,189	5	2
04/10	5.50	18.50	191	1	348	0	4	0	1	0	1	0	290	4	1
04/11	10.75	13.25	238	3	330	0	14	0	4	0	4	0	283	13	4
04/12	24.00	0.00	389	5	2,857	0	16	1	5	0	2	0	374	12	2
04/13	10.50	13.50	191	2	704	0	13	0	4	0	2	0	175	10	2
04/14	11.00	13.00	267	3	1,071	0	14	0	1	0	1	0	253	11	1
04/15	23.33	0.67	554	1	4,106	0	26	0	3	1	3	0	562	25	3
04/16	10.00	14.00	216	3	584	0	22	0	1	0	3	1	270	21	3
04/17	11.00	13.00	114	82	356	0	15	0	0	0	2	0	127	14	2
04/18	22.83	1.17	164	187	1,679	1	23	0	2	1	3	2	165	22	3
04/19	10.75	13.25	70	45	728	0	30	0	1	0	1	0	52	30	1
04/20	10.75	13.25	120	21	1,400	0	24	0	1	0	1	0	111	24	1
04/21	23.58	0.42	431	17	4,801	0	27	0	2	0	2	0	428	27	2
04/22	10.75	13.25	128	6	288	0	39	0	1	0	2	1	153	38	2
04/23	10.75	13.25	78	5	320	0	43	0	0	0	3	1	71	43	3
04/24	23.67	0.33	117	8	1,362	0	36	0	1	0	5	1	117	36	5
04/25	10.75	13.25	89	4	360	1	40	0	0	0	7	0	96	40	7

Table continued on next page

Appendix B2: Total daily catches, by species and age, in the Skagit River mainstem screw trap, 2007 (cont'd).

Date	HOURS		CHINOOK		Chum	COHO		Pink	Sock	TROUT			Unmarked		
	Fished	Out	0+	1+		0+	1+			Parr	Sthd1	Cutt1	Chin0	Coho1	Sthd1
04/26	10.25	13.75	75	3	176	0	48	0	0	0	6	1	68	48	6
04/27	24.00	0.00	189	8	1,745	0	109	0	1	0	16	0	176	93	16
04/28	5.00	19.00	61	10	65	0	96	0	0	0	16	0	104	74	16
04/29	3.50	20.50	17	2	4	0	47	0	14	0	9	1		40	9
04/30	23.50	0.50	259	8	603	0	141	0	28	0	22	1	231	120	22
05/01	10.00	14.00	106	5	15	0	114	0	3	0	9	0	134	103	9
05/02	9.50	14.50	33	4	14	0	119	0	2	0	22	0	46	114	11
05/03	23.75	0.25	116	5	1,476	0	140	0	2	0	46	3	111	125	12
05/04	9.33	14.67	28	5	45	0	148	0	2	0	42	4	28	107	8
05/05	9.50	14.50	22	3	93	1	118	0	1	0	26	3	26	75	3
05/06	23.75	0.25	40	0	327	0	93	0	1	0	18	2	37	83	4
05/07	9.25	14.75	32	1	110	0	159	0	0	0	31	2	24	150	9
05/08	9.50	14.50	58	4	202	0	210	0	4	0	40	2	50	206	15
05/09	18.33	5.67	176	7	2,030	0	266	0	13	0	67	0	158	263	25
05/10	9.25	14.75	107	2	60	0	222	0	13	0	88	2	131	217	19
05/11	9.00	15.00	41	2	4	0	240	0	5	0	123	2	52	233	25
05/12	23.50	0.50	103	5	516	0	258	0	7	1	130	2	94	251	29
05/13	9.25	14.75	40	1	13	0	177	0	2	0	102	3	45	170	30
05/14	9.25	14.75	27	3	4	0	231	0	4	0	220	4	32	223	54
05/15	23.83	0.17	57	1	330	0	221	0	4	0	147	4	51	213	32
05/16	8.50	15.50	37	3	67	1	223	0	5	0	107	2	33	215	28
05/17	8.50	15.50	41	8	48	0	242	0	13	0	299	2	50	232	59
05/18	22.75	1.25	93	12	1,050	0	262	0	26	0	492	3	94	252	64
05/19	8.50	15.50	18	2	0	0	153	0	1	0	176	2	18	147	20
05/20	8.50	15.50	21	2	0	0	151	0	0	0	92	6	18	146	18
05/21	23.58	0.42	96	9	89	0	155	0	2	0	75	5	97	150	20
05/22	9.25	14.75	22	4	2	0	118	0	1	0	41	3	23	116	16
05/23	8.75	15.25	15	0	3	0	49	0	0	0	10	4	17	48	5
05/24	23.50	0.50	34	0	80	0	104	0	0	0	19	8	29	101	10
05/25	8.25	15.75	40	2	22	0	107	0	0	0	12	3	29	103	7
05/26	8.50	15.50	89	2	55	0	77	0	0	0	7	3	74	76	5
05/27	23.50	0.50	323	7	73	0	136	0	1	0	27	6	165	135	19
05/28	9.25	14.75	311	4	9	0	97	0	1	0	27	6	81	95	19
05/29	8.50	15.50	249	0	4	0	59	0	0	0	13	5	65	59	10
05/30	23.50	0.50	277	1	84	0	69	0	0	0	10	7	67	65	8
05/31	6.00	18.00	259	1	1	0	77	0	0	0	14	4	92	67	10
06/01	0.75	23.25	19	0	4	0	1	0	0	0	0	0	10	1	0
06/02		24.00													
06/03		24.00													
06/04		24.00													
06/05		24.00													
06/06		24.00													
06/07		24.00													
06/08	2.25	21.75	33	1	1	0	27	0	0	0	0	1		9	0
06/09	8.00	16.00	114	1	3	0	93	0	0	0	2	1	97	30	1
06/10	8.00	16.00	101	1	3	0	79	0	0	0	1	0	104	15	0

Table continued on next page

Appendix B2: Total daily catches, by species and age, in the Skagit River mainstem screw trap, 2007 (cont'd).

Date	HOURS		CHINOOK		Chum	COHO		Pink	Sock	TROUT			Unmarked		
	Fished	Out	0+	1+		0+	1+			Parr	Sthd1	Cutt1	Chin0	Coho1	Sthd1
06/11	23.75	0.25	200	0	6	0	62	0	0	0	1	2	184	15	1
06/12	7.25	16.75	109	0	1	0	16	0	0	0	0	0	43	9	0
06/13	8.00	16.00	205	0	0	0	30	0	0	0	1	0	82	21	1
06/14	23.58	0.42	447	0	11	0	35	0	0	0	1	1	263	21	1
06/15	8.25	15.75	359	0	1	0	21	0	0	0	0	0	74	11	0
06/16	8.25	15.75	896	0	2	0	21	0	0	0	1	0	79	12	1
06/17	20.75	3.25	1,498	1	2	1	15	0	0	0	0	1	223	8	0
06/18	2.50	21.50	67	0	0	0	2	0	0	0	0	0		2	0
06/19	8.25	15.75	200	0	1	0	7	0	0	0	1	1	53	6	1
06/20	23.58	0.42	365	0	4	0	17	0	0	1	1	1	112	16	1
06/21	8.25	15.75	143	1	1	0	9	0	0	0	0	0	51	8	0
06/22	7.75	16.25	178	0	0	0	2	0	0	1	0	0	54	1	0
06/23	23.58	0.42	360	0	1	0	9	0	0	0	0	1	141	7	0
06/24	8.42	15.58	99	0	1	0	0	0	0	0	0	0	61	0	0
06/25	8.25	15.75	54	0	1	0	1	0	0	0	0	0	31	1	0
06/26	23.50	0.50	133	0	3	1	4	0	0	0	0	0	71	4	0
06/27	8.00	16.00	41	0	1	0	4	0	0	0	1	1	21	4	1
06/28	8.25	15.75	37	0	1	0	2	0	0	0	0	0	23	2	0
06/29	23.67	0.33	102	1	0	0	2	0	0	1	0	0	54	2	0
06/30	8.25	15.75	53	0	1	0	1	0	0	0	0	2	28	0	0
07/01	8.00	16.00	70	0	1	0	1	0	1	0	0	1	56	0	0
07/02	8.25	15.75	21	0	1	0	0	0	0	0	0	0	15	0	0
07/03	23.67	0.33	48	0	0	0	1	0	0	0	0	1	34	1	0
07/04	6.00	18.00	11	0	0	0	1	0	0	0	0	0	10	0	0
07/05	2.25	21.75	18	0	0	0	0	0	0	0	0	0		0	0
07/06	6.00	18.00	64	0	0	0	0	0	0	0	0	0	21	0	0
07/07	7.75	16.25	165	1	1	0	2	0	1	0	0	0	91	2	0
07/08	23.67	0.33	237	0	1	0	0	0	0	0	0	0	146	0	0
07/09	8.50	15.50	84	0	0	0	1	0	0	0	0	0	60	1	0
07/10	8.50	15.50	33	0	1	0	0	0	0	0	0	0	27	0	0
07/11	23.67	0.33	56	0	0	0	3	0	0	0	0	0	32	1	0
07/12	9.25	14.75	19	0	0	0	8	0	1	0	0	0	10	2	0
07/13	8.75	15.25	19	0	0	0	1	0	1	0	0	0	16	0	0
07/14	8.50	15.50	17	0	0	0	0	0	0	0	0	0	7	0	0
07/15	23.67	0.33	76	0	0	0	2	0	0	0	0	0	35	0	0
07/16	6.75	17.25	18	0	0	0	0	0	0	0	0	0	15	0	0
07/17		24.00													
07/18	2.25	21.75	4	0	0	0	0	0	0	0	0	0		0	0
07/19	23.67	0.33	79	0	0	0	0	0	0	0	0	0	51	0	0
07/20	9.08	14.92	42	0	0	0	0	0	0	0	0	0	40	0	0
07/21	5.00	19.00	14	0	0	0	0	0	0	0	0	0	16	0	0
07/22		24.00													
07/23	2.75	21.25	14	0	0	0	0	0	0	0	0	0		0	0
07/24	23.67	0.33	131	0	0	0	0	0	0	1	0	0	84	0	0
07/25	6.50	0.00	57	0	0	0	0	0	0	0	0	0	60	0	0
Season Total			**22,623**	**686**	**57,105**	**14**	**6,129**	**2**	**213**	**14**	**2,678**	**136**	**17,213**	**5,524**	**746**

Note: The unmarked coho 1+ includes fish marked at Mannser Creek or Baker Dam.

References

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