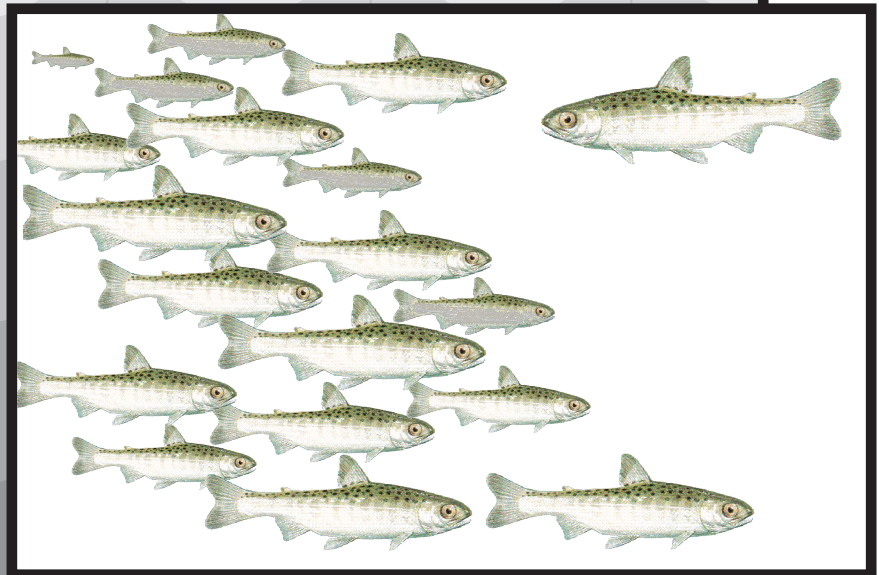


Mid-Hood Canal Juvenile Salmonid Evaluation: Duckabush 2008-2010 Hamma Hamma 2002-2010



by Josh Weinheimer, Mara Zimmerman,
and Patrick Hanratty



*Washington Department of
FISH AND WILDLIFE
Fish Program
Science Division
Wild Salmon Production/Evaluation*

Mid-Hood Canal Juvenile Salmonid Evaluation:

Duckabush 2008-2010

Hamma Hamma 2002-2010



Josh Weinheimer

Mara Zimmerman

Patrick Hanratty

Washington Department of Fish and Wildlife

Fish Program, Science Division

August 2011

Acknowledgements

Measuring juvenile salmonid production from large systems like the Duckabush and Hamma Hamma rivers involves a tremendous amount of work. We would like to thank Long Live the Kings biologist's Joy Lee Waltermire and Rick Endicott for initiating the Hamma Hamma River juvenile trapping project and conducting this operation since 2002. The Duckabush River juvenile trapping project was operated by the Washington Department of Fish and Wildlife (WDFW) beginning 2008 by biologist Patrick Hanratty and his team of dedicated scientific technicians: Phil Aurdal and Claire Landry. Logistical support was provided by Wild Salmon Production Evaluation Unit biologists Pete Topping and Mike Ackley.

A number of other individuals and agencies contributed to these projects. Diane Henry, the adjacent landowner, provided access to the trap site. Thom Johnson and Mark Downen, WDFW Region 6, provided adult spawner survey data.

The Hamma Hamma juvenile trap project has been funded by Long Live the Kings since 2002. The Duckabush juvenile trap project has been funded by Washington State General Funds and Long Live the Kings since 2008.

Table of Contents

ACKNOWLEDGEMENTS	I
TABLE OF CONTENTS	III
LIST OF TABLES	V
LIST OF FIGURES	VII
EXECUTIVE SUMMARY	1
INTRODUCTION	3
OBJECTIVES.....	4
METHODS	5
TRAP OPERATION.....	5
FISH COLLECTION	6
FRESHWATER PRODUCTION ESTIMATE.....	7
EGG-TO-MIGRANT SURVIVAL	10
MIGRATION TIMING	10
DUCKABUSH RESULTS	11
CHUM.....	11
PINK.....	12
OTHER SPECIES	13
HAMMA HAMMA RESULTS	15
CHUM.....	15
CHINOOK.....	16
PINK.....	18
OTHER CATCH.....	19
DISCUSSION	21
PRECISION AND ACCURACY OF MARK-RECAPTURE ESTIMATES	21
ASSUMPTIONS FOR MISSED CATCH	23
DUCKABUSH CHUM SALMON	24
DUCKABUSH PINK SALMON	26
HAMMA HAMMA CHUM SALMON	28
HAMMA HAMMA CHINOOK SALMON	29
HAMMA HAMMA PINK SALMON.....	31

FRESHWATER SURVIVAL AND STOCK PRODUCTIVITY	33
RECOMMENDATIONS	35
APPENDIX A	37
APPENDIX B	43
APPENDIX C	47
APPENDIX D	51
APPENDIX E	59
APPENDIX F	65
APPENDIX G	71
APPENDIX H	77
APPENDIX I	85
APPENDIX J	95
APPENDIX K	103
APPENDIX L	111
APPENDIX M	119
APPENDIX N	127
APPENDIX O	133
APPENDIX P	141
LITERATURE CITED	147

List of Tables

TABLE 1.—PRODUCTION, COEFFICIENT OF VARIATION (CV), AND EGG-TO-MIGRANT SURVIVAL FOR JUVENILE SALMONIDS OF NATURAL ORIGIN LEAVING THE DUCKABUSH RIVER, 2008-2010.	2
TABLE 2.—PRODUCTION, COEFFICIENT OF VARIATION (CV), AND EGG-TO-MIGRANT SURVIVAL FOR JUVENILE SALMONIDS LEAVING THE HAMMA HAMMA RIVER, 2002-2010.	2
TABLE 3.—SUMMARY OF JUVENILE TRAP OPERATIONS FOR THE DUCKABUSH RIVER SCREW TRAP, 2008-2010.	6
TABLE 4.—SUMMARY OF JUVENILE TRAP OPERATIONS FOR THE HAMMA HAMMA RIVER SCREW TRAP, 2002-2010.	6
TABLE 5.—JUVENILE CATCH, JUVENILE ABUNDANCE AND ASSOCIATED COEFFICIENT OF VARIATION, ADULT ESCAPEMENT, AND EGG-TO-MIGRANT SURVIVAL FOR CHUM SALMON IN THE DUCKABUSH RIVER, 2008 TO 2010.	11
TABLE 6.—JUVENILE CATCH, JUVENILE ABUNDANCE AND ASSOCIATED COEFFICIENT OF VARIATION, ADULT ESCAPEMENT, AND EGG-TO-MIGRANT SURVIVAL FOR PINK SALMON IN THE DUCKABUSH RIVER, 2008 TO 2010.	12
TABLE 7.—TOTAL CATCH OF CHINOOK, COHO, STEELHEAD, CUTTHROAT AND TROUT IN THE DUCKABUSH SCREW TRAP 2008 TO 2010.	13
TABLE 8.— JUVENILE CATCH, JUVENILE ABUNDANCE AND ASSOCIATED COEFFICIENT OF VARIATION, ADULT ESCAPEMENT, AND EGG-TO-MIGRANT SURVIVAL FOR CHUM SALMON IN THE HAMMA HAMMA RIVER, MIGRATION YEAR 2002 TO 2010.	15
TABLE 9.—JUVENILE CATCH, JUVENILE ABUNDANCE AND ASSOCIATED COEFFICIENT OF VARIATION, ADULT ESCAPEMENT, AND EGG-TO-MIGRANT SURVIVAL FOR CHINOOK SALMON IN THE HAMMA HAMMA RIVER, 2002 TO 2010.	17
TABLE 10.—JUVENILE CATCH, JUVENILE ABUNDANCE AND ASSOCIATED COEFFICIENT OF VARIATION, ADULT ESCAPEMENT, AND EGG-TO-MIGRANT SURVIVAL FOR PINK SALMON IN THE HAMMA HAMMA RIVER, MIGRATION YEAR 2002 TO 2010.	18
TABLE 11.—TOTAL CATCH OF COHO, STEELHEAD, CUTTHROAT AND TROUT IN THE HAMMA HAMMA SCREW TRAP 2002 TO 2010.	19

List of Figures

FIGURE 1.—LOCATION OF DUCKABUSH AND HAMMA HAMMA SCREW TRAPS.....	5
FIGURE 2.—WEEKLY OUT-MIGRATION OF NATURAL-ORIGIN CHUM SALMON FRY IN THE DUCKABUSH RIVER, 2008-2009.....	12
FIGURE 3.—WEEKLY OUT-MIGRATION OF NATURAL-ORIGIN PINK SALMON FRY IN THE DUCKABUSH RIVER, 2008 AND 2010.....	13
FIGURE 4.—WEEKLY OUT-MIGRATION OF NATURAL ORIGIN CHUM SALMON FRY IN THE HAMMA HAMMA RIVER, 2002-2010.....	16
FIGURE 5.—WEEKLY OUT-MIGRATION OF NATURAL ORIGIN CHINOOK SALMON SUB-YEARLINGS IN THE HAMMA	17
FIGURE 6.—WEEKLY OUT-MIGRATION OF NATURAL ORIGIN PINK SALMON FRY IN THE HAMMA HAMMA RIVER, 2002-2010.....	19
FIGURE 7.—NUMBER OF SPAWNERS AND JUVENILE MIGRANTS BY OUT-MIGRATION YEAR FOR DUCKABUSH RIVER CHUM.....	25
FIGURE 8.—EGG-TO-MIGRANT SURVIVAL FOR CHUM SALMON IN DUCKABUSH RIVER (2008 AND 2009 OUT-MIGRATION) AS A FUNCTION OF PEAK INCUBATION FLOW.	25
FIGURE 9.—NUMBER OF SPAWNERS AND JUVENILE MIGRANTS BY OUT-MIGRATION YEAR FOR DUCKABUSH RIVER PINK SALMON.	27
FIGURE 10.—EGG-TO-MIGRANT SURVIVAL FOR PINK SALMON IN DUCKABUSH RIVER, OUT- MIGRATION YEARS 2008 AND 2010, AS A FUNCTION OF PEAK INCUBATION FLOW.....	27
FIGURE 11.—NUMBER OF SPAWNERS AND JUVENILE MIGRANTS BY OUT-MIGRATION YEAR FOR HAMMA HAMMA RIVER CHUM SALMON.....	28
FIGURE 12.—EGG-TO-MIGRANT SURVIVAL FOR CHUM SALMON IN HAMMA HAMMA RIVER	29
FIGURE 13.—NUMBER OF SPAWNERS AND JUVENILE MIGRANTS BY OUT-MIGRATION YEAR FOR HAMMA HAMMA RIVER CHINOOK SALMON	30
FIGURE 14.—EGG-TO-MIGRANT SURVIVAL FOR CHINOOK SALMON IN HAMMA HAMMA RIVER.....	31
FIGURE 15.—NUMBER OF SPAWNERS AND JUVENILE MIGRANTS BY OUT-MIGRATION YEAR FOR HAMMA HAMMA PINK SALMON.....	32
FIGURE 16.—EGG-TO-MIGRANT SURVIVAL FOR HAMMA HAMMA PINK SALMON	32
FIGURE 17.—FRESHWATER (EGG-TO-MIGRANT) AND MARINE (FRY MIGRANT-TO-SPAWNER) SURVIVAL COMBINATIONS	34

Executive Summary

Juvenile salmonid monitoring in central Hood Canal, Washington began in 2002 on the Hamma Hamma River and in 2008 on the Duckabush River. This work has been a collaborative project between the Washington Department of Fish and Wildlife (WDFW), Long Live the Kings (LLTK), and the Northwest Fisheries Science Center's (NWFSC) Manchester Research Station. This report describes the abundance, egg-to-migrant survival, and migration timing of chum, Chinook, and pink salmon juvenile migrants in each basin. These results are among the first published results of pink and chum egg-to-migrant survival for the Puget Sound region. Steelhead trout data from both systems are compiled and analyzed by the NWFSC Manchester Research Team as part of the Hood Canal Steelhead Project. Coho smolt catches have been too few to expand to an abundance estimate.

Duckabush River

Juvenile monitoring on the Duckabush River has been a cooperative effort between WDFW and LLTK since 2008. Results from LLTK trap operation in 2007 focused on the steelhead outmigration and are not included in this report. A floating five-foot screw trap is located at river mile 0.3 (0.48 rkm). In 2008 and 2009, the trap was operated from early February to the middle of June. In 2010, the trap was installed in the beginning of March and fished until the middle of May.

Juvenile production of Duckabush chum salmon ranged 4.7-fold during the 2008 and 2009 out-migration (Table 1). Egg-to-migrant survival for these years ranged between 3.0% and 17.1%. Chum estimates were a composite of summer and fall run stocks due to overlap in the out-migration timing. Genetic analyses will be needed in future years in order to partition the out-migration between the two parental stocks. Juvenile chum production was not estimated in 2010 due to a late start (early March) to the trapping season. Juvenile production of Duckabush odd-year pink salmon ranged between 17,750 (brood year 2009) and 35,788 (brood year 2007) with very low egg-to-migrant survival estimated for both years (0.93% for brood year 2007 and 0.93% for brood year 2009). Catches of Chinook salmon were too few to provide an abundance estimate.

Hamma Hamma River

Juvenile monitoring on the Hamma Hamma is led by LLTK staff and has been ongoing since 2002. Trap operations have changed over time. Between 2002 and 2007, a floating five-foot screw trap was operated at river mile 0.5 (0.8 rkm) between mid January and late July. In 2008, the five-foot trap was swapped out for an eight-foot screw trap in order to increase catches of yearling migrants. During 2008 and 2009, the trap was operated from early February to the end of June. In 2010, the trap was installed in the beginning of March and fished through the end

of May. Juvenile production was estimated for all years except 2003, 2006, and 2010 (Chinook and chum) and 2006 (pink) due to long trap outages in these years.

Juvenile production of Hamma Hamma Chinook salmon ranged 44-fold between 2002 and 2010 with an egg-to-migrant survival between 0.06% and 6.1% (Table 2). Juvenile production of Hamma Hamma chum salmon ranged 11.8-fold with an egg-to-migrant survival between 0.5% and 14.0%. Similar to the Duckabush results, Hamma Hamma chum estimates were a summer-fall composite and genetic analyses will be needed in future years to partition the out-migration into parental stocks. Juvenile production of Hamma Hamma odd-year pink salmon ranged 160-fold with egg-to-migrant survival between 0.08% and 0.5%.

TABLE 1—Production, coefficient of variation (CV), and egg-to-migrant survival for juvenile salmonids of natural origin leaving the Duckabush River, 2008-2010.

	Out-migration Year		
	2008	2009	2010
<u>Chum</u>			
Production	127,424	608,276	-
CV	6.26%	4.80%	-
Survival	3.00%	17.15%	-
<u>Pink</u>			
Production	35,788	-	17,750
CV	7.93%	-	9.61%
Survival	0.93%	-	0.55%

TABLE 2.—Production, coefficient of variation (CV), and egg-to-migrant survival for juvenile salmonids leaving the Hamma Hamma River, 2002-2010.

	Out-migration year						
	2002	2004	2005	2007	2008	2009	2010
<u>Chinook</u>							
Production	18,047	5,852	7,291	1,279	1,021	408	-
CV	12.19%	19.12%	21.72%	16.25%	15.03%	6.49%	-
Survival	2.91%	2.46%	6.08%	3.20%	0.68%	0.06%	-
<u>Chum</u>							
Production	1,009,539	2,430,222	3,975,397	4,885,211	167,382	413,216	-
CV	9.56%	19.99%	10.92%	10.05%	5.65%	4.58%	-
Survival	6.07%	4.27%	5.82%	13.98%	0.50%	4.57%	-
<u>Pink</u>							
Production	236,329	42,111	-	-	4,387	-	1,473
CV	9.18%	9.06%	-	-	7.05%	-	14.26%
Survival	0.53%	0.53%	-	-	0.14%	-	0.08%

Introduction

The Duckabush and Hamma Hamma rivers are adjacent high-gradient watersheds draining into western edge of Hood Canal, Washington. Peak flow events in these watersheds occur twice each year, during rain-on-snow in the winter months and again during snow melt in the spring months. Both systems originate in the Olympic Mountains within the Olympic National Park. Human development is minimal on both systems with the exception of light logging activity in the upper watershed and residential homes and dikes in the lower part of the river and estuary.

The Duckabush and Hamma Hamma rivers support a diverse salmonid community, including Chinook (*Oncorhynchus tshawytscha*) and summer chum (*Oncorhynchus keta*) salmon and steelhead trout (*Oncorhynchus mykiss*). In these watersheds, summer chum populations are part of the Hood Canal summer chum Evolutionary Significant Unit (ESU), Chinook salmon are part of the Puget Sound Chinook ESU, and steelhead are part of the Puget Sound steelhead ESU, as delineated by the National Marine Fisheries Service.

Chinook salmon in the Duckabush and Hamma Hamma rivers are part of the Puget Sound Chinook Evolutionary Significant Unit (ESU) listed as *threatened* in 1999 by the National Marine Fisheries Service under the Endangered Species Act (NOAA 1999b). Hood Canal has two genetically distinct Chinook populations, one is the Skokomish River stock and the other is the Mid-Hood Canal stock that is composed of the Hamma Hamma, Duckabush and Dosewallips subpopulations (Shared Strategy Development Committee 2007). Under the recovery plan, Hamma Hamma and Duckabush stocks are roughly half of the Mid-Hood Canal population.

Summer chum salmon in the Duckabush and Hamma Hamma rivers are part of the Hood Canal summer chum ESU listed as *threatened* in 1999 by NMFS (NOAA 1999a). The Hood Canal summer chum ESU was historically composed of 16 independent populations (Ames et al. 2000). Summer chum are distinguished from fall and winter chum based on spawn timing and genetics (Ames et al. 2000; Small et al. 2010). Historically, summer chum stocks in Hood Canal returned in the tens of thousands. By 1980, these returns plummeted to fewer than 5,000 adults and 8 of the 16 stocks were considered to be extinct. Based on the framework developed in the “Summer Chum Salmon Conservation Initiative” (Ames et al. 2000), harvest of Hood Canal summer chum was greatly reduced and hatchery supplementation was implemented in order to rebuild stocks to harvestable levels. The initiative also called for increased monitoring and improvement to freshwater habitat conditions. The Duckabush and Hamma Hamma summer chum stocks are part of the eight remaining viable stocks within Hood Canal.

Under NMFS Listing Status Decision Framework, listing status of a species under the Endangered Species Act (ESA) will be evaluated based on biological criteria (abundance, productivity, spatial distribution and diversity) and threats to population viability (e.g., harvest, habitat) (McElhaney et al. 2000). A statewide monitoring framework, termed “Fish-In Fish-Out”,

was developed by the Governor's Forum on Monitoring Salmon Recovery and Watershed Health and recommended the coupling of juvenile and adult monitoring for representative populations within each ESU (Crawford 2007). Guidelines for monitoring data needed to assess recovery status were recently published by the National Marine Fisheries Service (Crawford and Rumsey 2011). At the time of listing, little to no information was available on juvenile abundance or freshwater productivity of Chinook, summer chum, or steelhead in Hood Canal. Freshwater productivity (egg-to-migrant survival or smolts per spawner) is an important factor that contributes to stock resiliency when survival in the marine environment is poor (McElhaney et al. 2000). Without information on juvenile migrants, managers are limited in their ability to assess the contributions of freshwater versus marine environment towards species recovery.

In response to these information needs, juvenile monitoring studies were initiated on the Hamma Hamma River in 2002 and on the Duckabush River in 2007. The Hamma Hamma juvenile trapping project was initiated in 2002 by Long Live the Kings (LLTK), a regional enhancement group, with a focus on freshwater production and survival of Chinook salmon. This project has also provided data needed to assess freshwater production of summer and fall chum and pink salmon. The Duckabush River juvenile trapping project was initiated in 2007 by Long Live the Kings with a focus on wild steelhead production. In 2008, the Duckabush trapping season was expanded to catch summer and fall chum, Chinook, and pink salmon and became a joint effort between Washington Department of Fish and Wildlife and Long Live the Kings. Steelhead smolt data collected in both systems are compiled and analyzed by the NWFSC Manchester research group as part of the Hood Canal Steelhead Project. This report summarizes results from both watersheds through the 2010 out-migration. Throughout this report, the number of juvenile migrants estimated for a given year will be referred to as "freshwater production" because they are the offspring of naturally spawning salmon in the Hamma Hamma and Duckabush Rivers.

The combination of juvenile and spawner abundance for the Duckabush and Hamma Hamma populations allows for brood-specific survival to be partitioned between the freshwater and marine environment. Spawner abundance is currently derived by staff from WDFW Region 6 and LLTK. Long-term combination of juvenile and adult abundance data over a range of spawner abundances and flow regimes should provide a measure of freshwater capacity and current ranges of egg-to-migrant survival.

Objectives

The primary objective of this study was to estimate the abundance, survival, and migration timing of juvenile migrants produced by Chinook, chum, and pink salmon spawning naturally in the Duckabush and Hamma Hamma rivers. Additional objectives were to enumerate catches of other salmonid species in both systems. The long-term goal for this study is to understand the factors that limit freshwater productivity of salmonids in the Duckabush and Hamma Hamma rivers.

Methods

Trap Operation

On the Duckabush River, juvenile migrants were captured in a floating screw trap (5-foot or 1.5-m diameter) located on the right bank at river mile 0.3 (0.48 rkm), approximately 1,600 foot (490-m) upstream of the Highway 101 bridge (Figure 1). The trap consisted of two, four-foot wide tapered flights, wrapped 360 degrees around a nine-foot long shaft. These flights were housed inside a five-foot diameter cone-shaped frame covered with perforated plating. The shaft was aligned parallel with the flow and was lowered to the water's surface via davits and winches mounted on two 20-ft aluminum pontoons. The trap fished half of a five-foot circle with a cross sectional area of 9.8-foot². Water current acting on the flights caused the trap to rotate, and with every 180 degrees of rotation, a flight entered the water while the other emerged. As the leading edge of a flight emerged from the water it prevented the escape of trapped fish. The fish were gently augured into a solid sided, baffled live box.

On the Hamma Hamma River, juvenile migrants were captured in a 5-foot (1.5-m diameter) floating screw trap between 2002 and 2007. In 2008, a larger 8-foot diameter screw trap replaced the 5-foot trap and increased the cross sectional area fished to 25.1-foot². The Hamma Hamma trap was located on the right bank at river mile 0.5 (0.8 rkm), approximately 2,640 foot (805-m) upstream of the river mouth (Figure 1). Similar to the Duckabush trap, fish were gently guided into a solid sided, baffled live box.

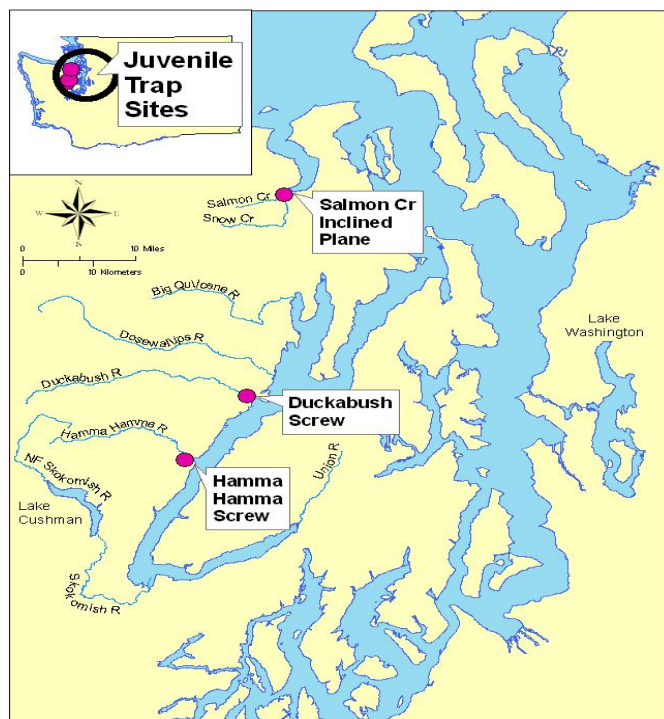


Figure 1.—Location of Duckabush and Hamma Hamma screw traps.

The Duckabush and Hamma Hamma traps were fished 24 hours a day, seven days a week except when flows or debris would not allow the trap to fish effectively (Table 3 and 4). On the Hamma Hamma River, the total hours fished could not be calculated for 2003, 2004, and 2006 because existing data records had date or times when trap status was unknown.

TABLE 3.—Summary of juvenile trap operations for the Duckabush River screw trap, 2008-2010.

Year	Start Date	End Date	Hours Fished	Total Possible Hours	Percent Fished	Number of Outages	Avg Outage (Hours)	St. Dev.
2008	1/30	6/10	2,763.75	3,167.75	87.25%	8	50.50	59.3
2009	1/30	6/16	3,035.50	3,289.00	92.29%	5	50.70	47.2
2010	3/2	5/19	1,627.00	1,872.00	86.91%	8	30.63	18.1

TABLE 4.—Summary of juvenile trap operations for the Hamma Hamma River screw trap, 2002-2010. Hours fished are not reported for 2003, 2004 and 2006 due to unknown trap status.

Year	Start Date	End Date	Hours Fished	Total Possible Hours	Percent Fished	Number of Outages	Avg Outage Hrs	St. Dev.
2002	1/28	8/19	4,801.00	4,875.00	98.48%	1	74.00	-
2003	1/07	9/01	-	-	-	-	-	-
2004	1/19	7/31	-	-	-	-	-	-
2005	1/03	7/26	4,522.50	4,882.50	92.63%	4	90.00	41.0
2006	1/25	7/05	-	-	-	-	-	-
2007	1/16	7/31	4,369.00	4,700.50	92.95%	3	110.50	58.6
2008	2/04	6/09	2,280.50	3,025.25	75.38%	3	248.25	166.8
2009	2/03	7/02	2,763.00	3,581.00	77.16%	8	102.25	67.7
2010	3/03	5/29	1,550.50	2,090.00	74.19%	7	77.07	34.1

Fish Collection

On both rivers, the traps were checked for fish at dawn each day throughout the trapping season. At each trap check, all captured fish were identified to species and enumerated. Juvenile steelhead were checked for hatchery marks or fin clips (adipose fin). Steelhead of natural origin were sampled for scales, DNA (fin clip), and fork length.

Coho were enumerated as either fry or smelts (yearlings). Defining characteristics of coho fry were a bright orange-brown color, elongated white anal fin ray, small eye and small size (under 60-mm fork length). Yearling coho were larger in size (approx 90-160mm), with silver sides, black tips on the caudal fin and large eye compared to the size of the head.

Trout were enumerated by three different age classes: fry, parr and smolt. Fry were small in size (<40-mm fork length), dark brown in color with orange fins, and caught late in the

trapping season (after May 1). Parr were trout, other than fry, that were not “smolted”. Parr were typically between 50 and 150 mm fork length, dark in color (brown with spots on the tale), and caught throughout the trapping season. Smolts were chrome in appearance, larger in size (90 to 350-mm fork length) and with many spots along the dorsal surface and tail. Parr and smolts were assigned as either steelhead or cutthroat based on mouth size and presence or absence of red coloration on the ventral surface of the gill covers. Fry could not be assigned to species and were recorded as “trout”.

On the Duckabush River, trap efficiency trials were conducted in all years. Trials were conducted with maiden-caught chum and pink fry (fish captured for the first time) of natural origin throughout the season. Pink fry were used in conjunction with chum fry to increase the number of fish in the release group. No efficiency trials were conducted using Chinook due to very low catches of this species. Captured fish were anesthetized with tricaine methanesulfonate (MS-222) and marked with Bismark-brown dye. Marked fish were allowed to recover in freshwater. Marked fish were released at dusk into fast flowing water upstream of a bend in the river, approximately 75-m distance from the trap. The release site was selected to maximize mixing of marked and unmarked fish while minimizing in-river predation between release and recapture. Trials were conducted every few days to allow adequate time for all marked fish to reach the trap. Most marked fish were caught the day immediately following a release. Dyed fish captured in the trap were recorded as recaptures.

On the Hamma Hamma River, trap efficiency trials were conducted between 2002 and 2010. Trials were conducted with natural-origin chum, pink and hatchery Chinook and chum throughout the season. Captured fish were anesthetized with tricaine methanesulfonate (MS-222) and marked with Bismark-brown dye. Marked fish were released 100-m upstream of the trap after being allowed to recover in freshwater. The releases site was selected to maximize mixing of marked and unmarked fish while minimizing in-river predation between release and recapture. Dyed fish captured in the trap were recorded as recaptures.

Freshwater Production Estimate

Freshwater production was estimated using a single partial-capture trap design (Volkhardt et al. 2007). Maiden catch (\hat{u}) was expanded by the recapture rate of marked fish (M) released above the trap and subsequently recaptured (m). Data were stratified by time over the out-migration period in order to accommodate for temporal changes in trap efficiency. The general approach was to estimate (1) missed catch, (2) efficiency strata, (3) time-stratified abundance, (4) extrapolated migration outside the trapping season, and (5) total abundance.

(1) Missed catch. Total catch (\hat{u}) was the actual catch (n_i) for period i summed with missed catch (\hat{n}_i) during periods of trap outages.

Equation 1

$$\hat{u}_i = n_i + \hat{n}_i$$

Missed catch for a given period i was estimated as:

Equation 2

$$\hat{n}_i = \bar{R} * T_i$$

where:

\bar{R} = Mean catch rate (fish/hour) from adjacent fished periods, and

T_i = time (hours) during the missed fishing period.

Variance associated with \hat{u}_i was the sum of estimated catch variances for this period. Catch variance was:

Equation 3

$$Var(\hat{u}_i) = Var(\hat{n}_i) = Var(\bar{R}) * T_i^2$$

where:

Equation 4

$$V(\bar{R}) = \frac{\sum_{i=1}^{i=k} (R_i - \bar{R})^2}{k(k-1)}$$

(2) Efficiency strata. A G -test (Sokal and Rohlf 1981) was used to determine whether adjacent efficiency trials were statistically different. *A priori* pooling prior to the G -test occurred for efficiency trials with expected frequencies of less than five (Sokal and Rohlf 1981). Of the marked fish released in each efficiency trial (M_i), a portion are recaptured (m) and a portion are not seen ($M-m$). If the *seen:unseen* [$m:(M-m)$] ratio differed between trials, the trial periods were considered as separate strata. However, if the ratio did not differ between trials, the two trials were pooled into a single stratum. A G -test determined whether adjacent efficiency trials were statistically different ($\alpha = 0.05$). Trials that did not differ were pooled and the pooled group compared to the next adjacent efficiency trial. Trials that did differ were held separately. Pooling of time-adjacent efficiency trials continued iteratively until the *seen:unseen* ratio differed between time-adjacent trials. Once a significant difference is identified, the pooled trials are assigned to one strata and the significantly different trial is the beginning of the next stratum.

(3) Time-stratified abundance. Abundance for a given stratum h (\hat{U}_h) was calculated from maiden catch (\hat{u}_h), marked fish released (M_h), and marked fish recaptured (m_h). Abundance was estimated with a Bailey estimator (Carlson et al. 1998; Volkhardt et al. 2007).

Equation 5

$$\hat{U}_h = \frac{\hat{u}_h(M_h + 1)}{m_h + 1}$$

Variance associated with the Bailey estimator was modified to account for variance of the estimated catch during trap outages (derivation in Appendix A):

Equation 6

$$V(\hat{U}_h) = V(\hat{u}_h) \left(\frac{(M_h + 1)(M_h m_h + 3M_h + 2)}{(m_h + 1)^2 (m_h + 2)} \right) + \left(\frac{(M_h + 1)(M_h - m_h) \hat{u}_h (\hat{u}_h + m_h + 1)}{(m_h + 1)^2 (m_h + 2)} \right)$$

(4) Extrapolated migration. Extrapolation was used for Chinook salmon (January 1 – July 31) due to their extended outmigration period and the low levels of catch occurring at the beginning and end of the trapping season. Migration outside the trapping period (\hat{N}_e) was estimated based on an assumed number of days (t) outside the trapping period that the migration was assumed to occur. Extrapolation was calculated based on the estimated daily migration (\hat{N}_d) for the first k days of trapping (and the last k days of trapping).

Equation 7

$$\hat{N}_e = \frac{\sum_{d=1}^{d=k} \hat{N}_d}{k} * \frac{t}{2}$$

Variance associated with the extrapolated migration was:

Equation 8

$$V(\hat{N}_e) = \frac{\sum_{d=1}^{d=k} (\hat{N}_d - \bar{N})^2}{k(k-1)} * \left(\frac{t}{2} \right)^2$$

(5) Total abundance. Total abundance of juvenile migrants was the sum of in-season stratified estimates and extrapolated estimates.

Equation 9

$$\hat{N}_T = \sum_{h=1}^{h=k} \hat{U}_h + \sum \hat{N}_e$$

Variance was the sum of variances associated with all in-season and extrapolated estimates:

Equation 10

$$V(\hat{N}_T) = \sum_{h=1}^{h=k} V(\hat{U}_h) + \sum V(\hat{N}_e)$$

Coefficient of variation was:

Equation 11

$$CV = \frac{\hat{N}_T}{\sqrt{V(\hat{N}_T)}}$$

Egg-to-Migrant Survival

Egg-to-migrant survival was estimated for chum and pink salmon in both rivers and for Chinook salmon in the Hamma Hamma. Low catches of Chinook on the Duckabush prevented a survival estimate for this watershed. Egg-to-migrant survival was the number of migrants divided by potential egg deposition (P.E.D.). Chum and pink escapement is estimated using an Area-Under-the-Curve approach (Ames 1984). Chinook escapement is derived from a combination of observed redds and live counts. Female spawners assumed a 1-to-1 ratio of male-to-female spawners in the total escapement. Potential egg deposition was based on estimated female spawners above the trap site and estimated fecundity of 2,500 for chum (Joy Lee Waltermire, Lilliwaup hatchery, LLTK, personal communication), 1,800 for pink (Heard 1991), and 5,000 for Chinook salmon (Healey 1991).

Migration Timing

Migration data was plotted according to statistical week for both river systems. A statistical week begins on a Monday and ends on a Sunday (Appendix B). The first and last week of the year are typically less than 7 days.

Duckabush Results

Chum

Freshwater production of Duckabush chum salmon (composite summer and fall run) was estimated to be 127,424 fry ($CV = 6.3\%$) in 2008 and 608,276 fry ($CV = 4.8\%$) in 2009 (Table 5). These estimates were based on a total of 29 efficiency trials conducted each year. Trap efficiency of the stratified data ranged between 9% and 33% in 2008 and between 7 and 25% in 2009 (Appendix C and D). No abundance estimate was derived for 2010 because the majority of the out-migration was assumed to occur prior to trap installation.

Egg-to-migrant survival was estimated to be 3.00% for brood year 2007 and 17.15% for brood year 2008 (Table 5).

TABLE 5.—Juvenile catch, juvenile abundance and associated coefficient of variation, adult escapement, and egg-to-migrant survival for chum salmon in the Duckabush River, 2008 to 2010. Data are a composite of summer and fall chum and correspond to brood year 2007 to 2009.

Migration Year	Juvenile Catch		Juvenile	Juvenile	Female Adult	Egg to Migrant Survival
	Actual	Missed	Abundance	CV	Escapement	
2008	20,371	3,274	127,424	6.3%	1,697	3.00%
2009	92,063	1,477	608,276	4.8%	1,419	17.15%
2010	2,726	-	-	-	-	-

Although there were two peaks in spawn timing of chum salmon in the Duckabush River, out-migration timing did not appear to be bimodal with years and the juveniles could not be assigned to spawning stock based on out-migration timing alone (Figure 2). Out-migration timing differed between 2008 and 2009. The 2008 migration had a longer duration (16 weeks) and a later peak than the 2009 migration. In 2008, juvenile migrants were still being captured when trapping ended on June 10 (statistical week 24) whereas the last migrants captured in 2009 occurred on May 21 (statistical week 21). In addition, the peak of the 2009 out-migration was 5 weeks earlier than the 2008 peak.

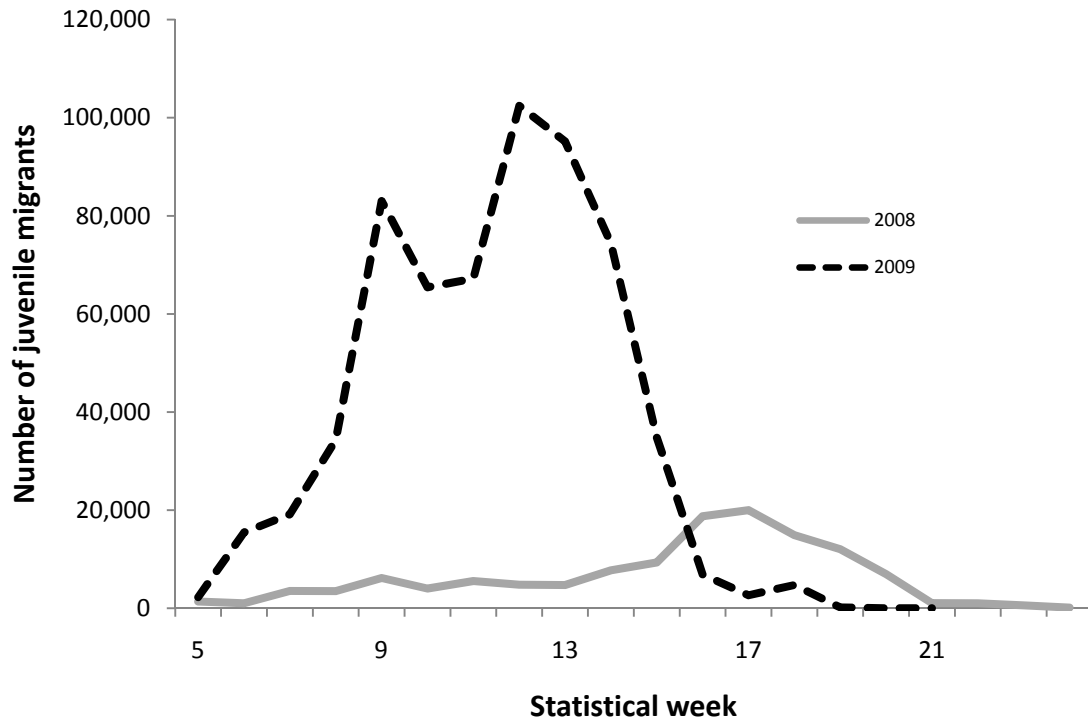


Figure 2.—Weekly out-migration of natural-origin chum salmon fry in the Duckabush River, migration year 2008-2009.

Pink

Freshwater production of Duckabush pink salmon was estimated to be 35,788 fry ($CV = 7.9\%$) in 2008 and 17,750 fry ($CV = 9.6\%$) in 2010 (Table 6). Chum efficiency strata were used as a surrogate for pink salmon in both years (Appendix C and E).

Egg-to-migrant survival of natural-origin pink salmon (brood years 2007-09) was estimated to be 0.93% and 0.55% (Table 6).

TABLE 6.—Juvenile catch, juvenile abundance and associated coefficient of variation, adult escapement, and egg-to-migrant survival for pink salmon in the Duckabush River, 2008 to 2010. Missed catch were calculated for periods that the trap did not fish.

Migration Year	Juvenile Catch		Juvenile Abundance	Juvenile CV	Female Adult Escapement	Egg to Migrant Survival
2008	5,974	888	35,788	7.9%	2,148	0.93%
2010	2,205	373	17,750	9.6%	1,784	0.55%

Out-migration timing of pink salmon fry was similar between the two years (Figure 3) with a peak in migration occurring during statistical week 16 (late April). The migration was over 95% complete by statistical week 20 (late May) in both years.

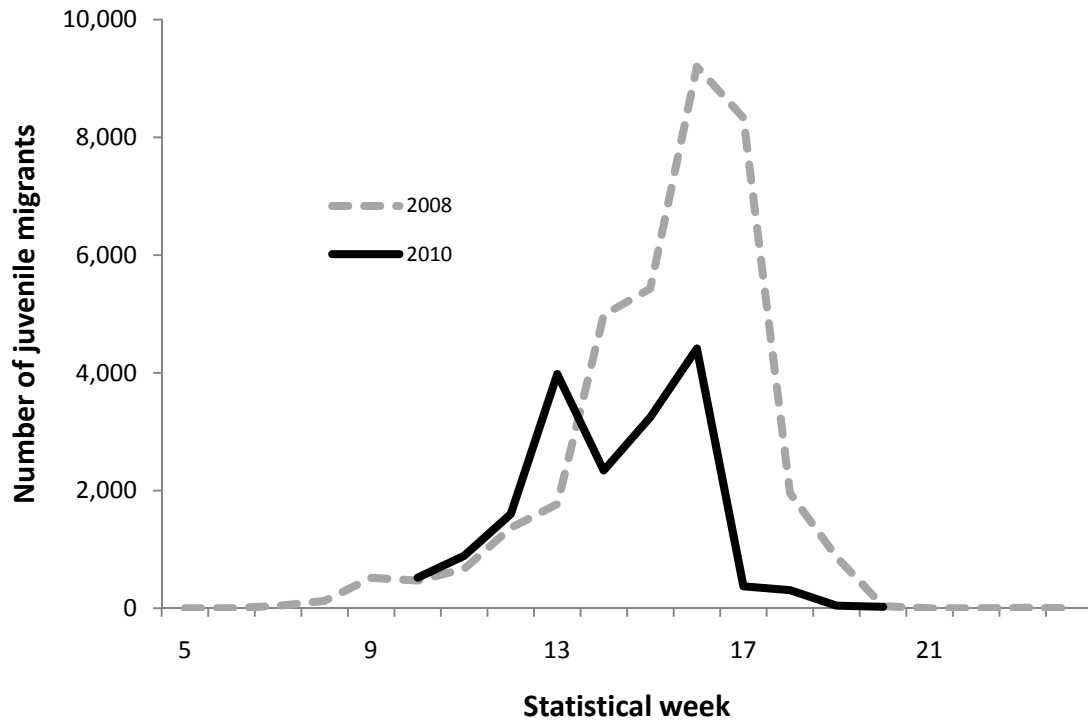


Figure 3.—Weekly out-migration of natural-origin pink salmon fry in the Duckabush River, migration year 2008 and 2010.

Other Species

TABLE 7.—Total catch of Chinook, coho, steelhead, cutthroat and trout in the Duckabush screw trap 2008 to 2010.

Trap Year	Wild Chinook		Wild Coho		Steelhead		Cutthroat	Trout	
	Fry	Fry	Smolts	Smolts	Wild Smolts	Hatch Smolts	Smolts	Parr	Parr
2008	2	94	85	30	0	0	0	1	2
2009	23	159	58	59	1	2	0	0	0
2010	9	282	3	3	0	0	0	0	0

Hamma Hamma Results

Chum

Freshwater production of Hamma Hamma chum salmon (composite summer and fall run) ranged between 167,832 fry ($CV = 5.6\%$) in 2008 and 4,886,211 fry ($CV = 10.1\%$) in 2007 (Table 7). Trap efficiencies of the stratified data ranged between 1.2% and 13.1% with the 5-foot screw (2002-2007) and 5.6% to 70.4% with the 8-foot screw trap (Appendix F through N). No abundance estimates were made for 2003, 2006 and 2010. In 2003 and 2006, long trap outages occurred during the out-migration period and missed catch could not be estimated with any degree of certainty. In 2010, the trapping season began in early March, missing a large portion of the chum migration. Furthermore, missed catch could not be estimated for the 2004 out-migration because data records did not describe the exact time periods when the trap did not fish.

Egg-to-migrant survival of natural-origin chum (brood years 2001 to 2008) was estimated to range between 0.5% and 14.0% (Table 7).

TABLE 8.— Juvenile catch, juvenile abundance and associated coefficient of variation, adult escapement, and egg-to-migrant survival for chum salmon in the Hamma Hamma River, migration year 2002 to 2010. Missed catch were calculated for periods that the trap did not fish.

Migration	Juvenile Catch		Juvenile	Juvenile	Female Adult	Egg to Migrant Survival
Year	Actual	Missed	Abundance	CV	Escapement	
2002	41,188	0	1,009,539	9.6%	6,658	6.07%
2003	29,669	-	-	-	27,941	-
2004	78,252	0	2,430,222	20%	22,771	4.27%
2005	138,932	4,168	3,975,397	10.9%	27,338	5.82%
2006	17,709	-	-	-	3,834	-
2007	115,097	5,268	4,885,211	10.1%	13,982	13.98%
2008	13,486	2,083	167,832	5.7%	13,442	0.50%
2009	128,721	22,967	413,216	4.6%	3,614	4.57%
2010	10,083	-	-	-	1,210	-

Similar to the Duckabush, the out-migration timing of Hamma Hamma chum fry was not clearly bimodal within years (Figure 4). In all years, the first migrants were observed on the first day of trapping, peak migration occurred in late April (statistical week 16 or 17), and the last migrants were captured in mid-June (statistical week 25).

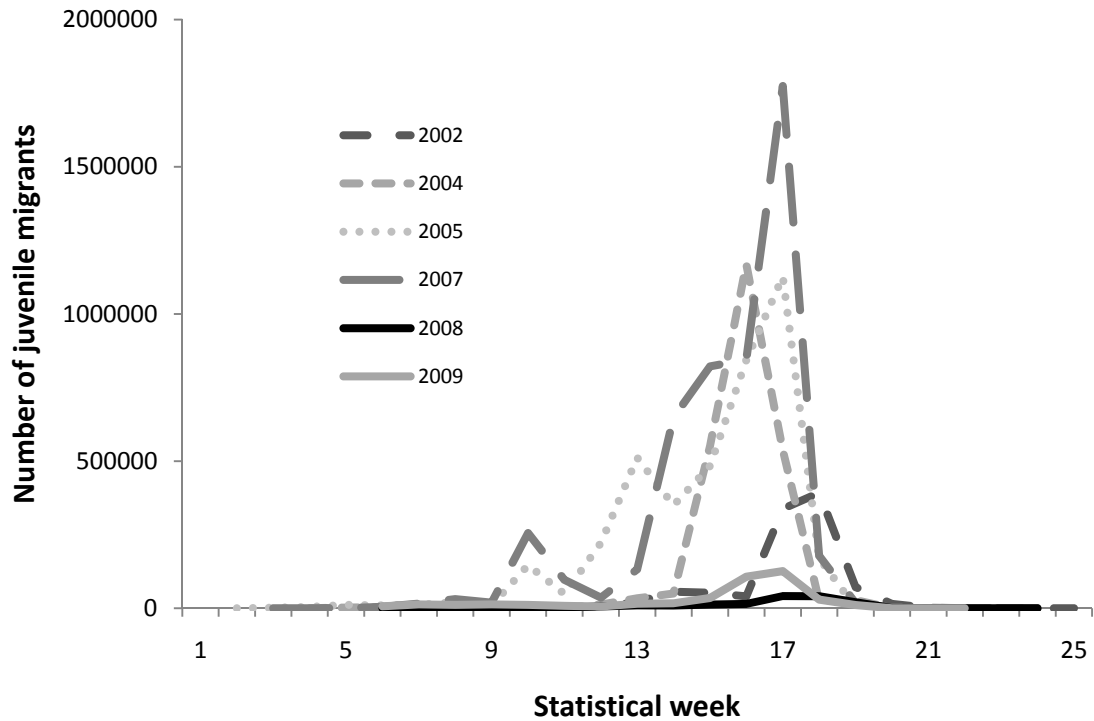


Figure 4.—Weekly out-migration of natural origin chum salmon fry in the Hamma Hamma River, migration year 2002-2010. No estimates were derived for 2003, 2006 or 2010.

Chinook

Freshwater production of Hamma Hamma Chinook salmon was estimated range between 408 ($CV = 7.9\%$) in 2009 and 18,047 ($CV = 9.6\%$) in 2002 (Table 8). The same pooled efficiency strata used to estimate chum production were used to estimate Chinook production (Appendix F through N). No abundance estimates were made for 2003, 2006 and 2010 because missed catch could not be estimated due to long trap outages.

Egg-to-migrant survival of natural-origin Chinook (brood years 2001-08) was estimated to range between 0.06% and 6.1% (Table 8).

TABLE 9.—Juvenile catch, juvenile abundance and associated coefficient of variation, adult escapement, and egg-to-migrant survival for Chinook salmon in the Hamma Hamma River, 2002 to 2010. Missed catch were calculated for periods that the trap did not fish.

Migration Year	Juvenile Catch		Juvenile	Juvenile	Female Adult	Egg to Migrant Survival
	Actual	Missed	Abundance	CV	Escapement	
2002	592	25	18,047	12.2%	124	2.91%
2003	113	-	-	-	16	-
2004	210	0	5,852	19.1%	48	2.46%
2005	215	22	7,291	21.7%	25	6.08%
2006	36	-	-	-	17	-
2007	48	8	1,279	16.3%	8	3.20%
2008	43	29	1,021	15%	30	0.68%
2009	142	59	408	6.5%	128	0.06%
2010	277	-	-	-	49	-

Timing of the Chinook out-migration was variable among years and had at least two peaks during the trapping season (Figure 5).

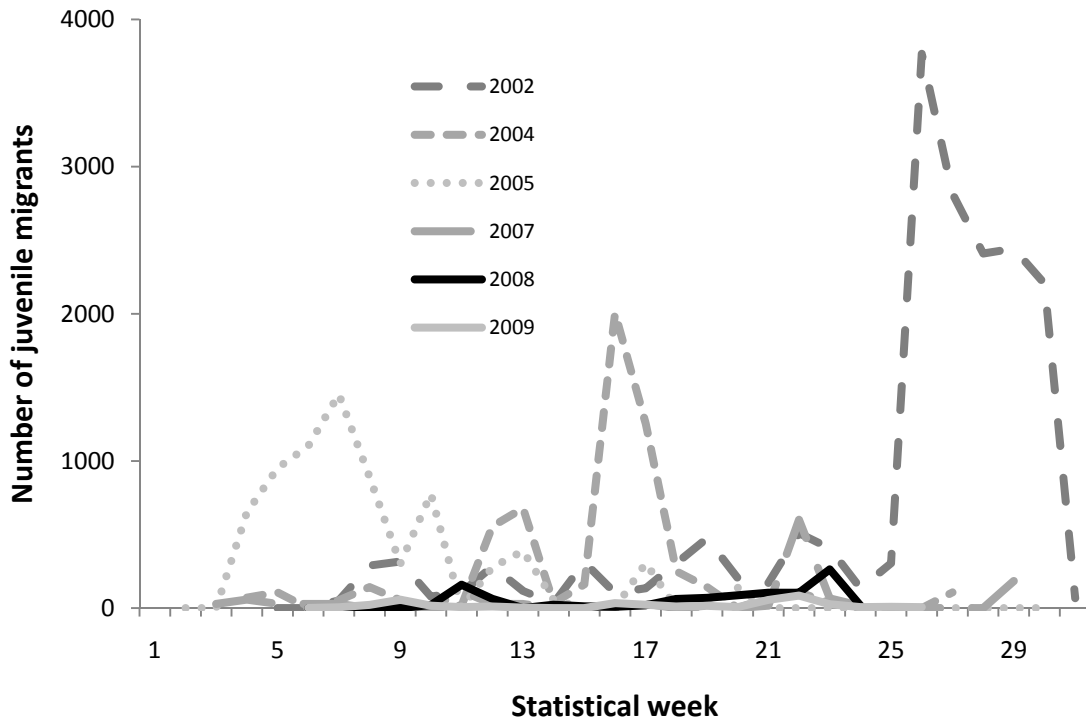


Figure 5.—Weekly out-migration of natural origin Chinook salmon sub-yearlings in the Hamma Hamma River, 2002-2010. No migration estimates were derived for 2003, 2006 or 2010.

Pink

Freshwater production of Hamma Hamma pink salmon was estimated to range between 1,473 fry (*CV* = 14.6%) in 2010 and 236,329 fry (*CV* = 9.2%) in 2002 (Table 9). The same pooled efficiency strata used to estimate chum production were used to estimate pink production (Appendix F through N). No abundance estimates were made for 2003, 2006 and 2010 because long trap outages prevented estimation of missed catch.

Egg-to-migrant survival of natural-origin pink (brood years 2001-08) was estimated to range between 0.08% and 0.53% (Table 9).

TABLE 10.—Juvenile catch, juvenile abundance and associated coefficient of variation, adult escapement, and egg-to-migrant survival for pink salmon in the Hamma Hamma River, migration year 2002 to 2010. Missed catch were calculated for periods that the trap did not fish.

Migration Year	Juvenile Catch		Juvenile Abundance	Juvenile CV	Female Adult Escapement	Egg to Migrant Survival
2002	19,587	0	236,329	9.2%	24,940	0.53%
2003	-	-	-	-	-	-
2004	2,215	0	42,111	9.1%	4,452	0.53%
2005	-	-	-	-	-	-
2006	327	-	-	-	739	-
2007	-	-	-	-	-	-
2008	447	56	4,387	7.1%	1,681	0.14%
2009	-	-	-	-	-	-
2010	118	84	1,473	14.3%	1,083	0.08%

The peak in pink salmon out-migration occurred in late March (statistical week 14 and 15, Figure 6). The first migrants were captured during late January (statistical week 4) and the last migrants were captured during mid-May (statistical week 20).

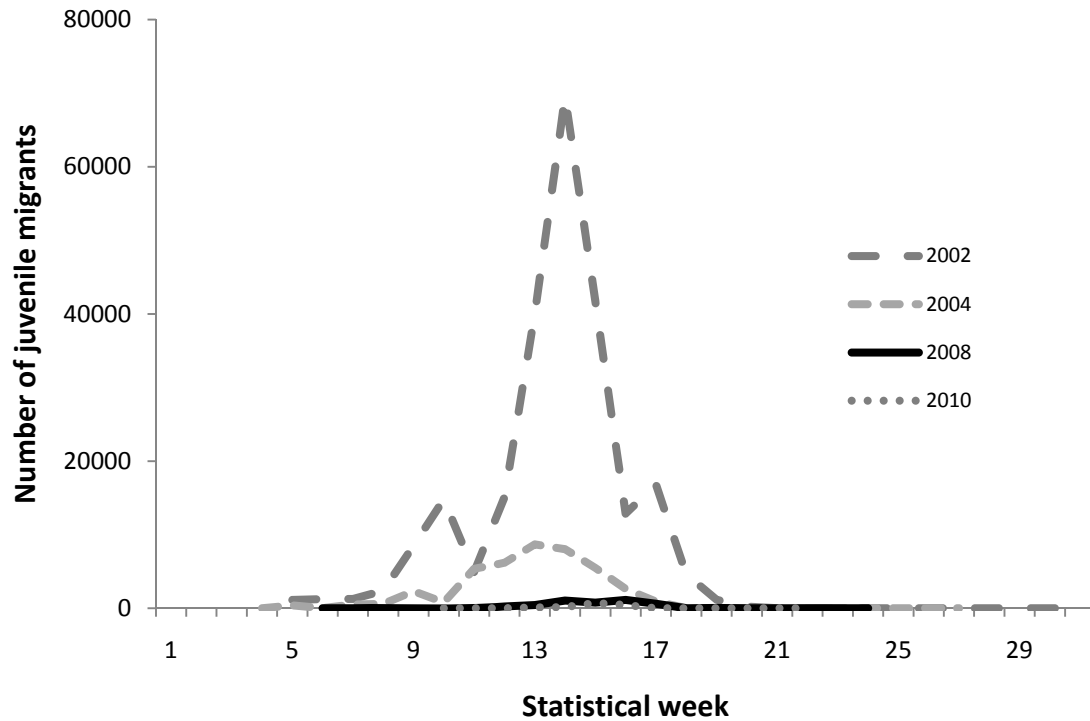


Figure 6.—Weekly out-migration of natural origin pink salmon fry in the Hamma Hamma River, migration year 2002-2010. Estimates were not derived for 2006.

Other Catch

TABLE 11.—Total catch of coho, steelhead, cutthroat and trout in the Hamma Hamma screw trap 2002 to 2010.

Trap Year	Wild Coho		Wild Steelhead	Cutthroat		Trout	
	Fry	Smolts	Smolts	Smolts	Parr	Parr	Fry
2002	1,354	101	73	0	0	0	0
2003	263	138	130	0	0	38	0
2004	2,009	75	60	0	0	0	31
2005	660	211	125	0	0	0	14
2006	128	15	4	0	0	0	2
2007	82	43	3	0	0	0	20
2008	163	115	79	5	0	0	0
2009	2,023	219	206	15	0	0	0
2010	877	113	81	2	0	0	0

Discussion

This report provides some of the first estimates of freshwater production, survival, and out-migration timing for chum, Chinook, and pink salmon populations in Hood Canal. Conclusions drawn from these data will depend on the quality of the juvenile abundance estimates. Therefore, we begin this discussion with an assessment of the quality of abundance estimations provided in this report.

The combinations of juvenile and adult abundance estimates from the Duckabush and Hamma Hamma rivers can be used to understand the extent to which freshwater variables limit salmonid production in these watersheds. In this discussion, we evaluate the potential contributions of two freshwater variables, spawner abundance and incubation flows, known to limit freshwater production in other Puget Sound systems. Variation in spawner abundance is a product of previous freshwater production, marine conditions, and harvest rates. Variation in peak incubation flow results from inter-annual differences in rainfall, although peak flows are also likely to be affected by stream gradient and land use. Our conclusions on the relative contribution of each variable for Duckabush and Hamma Hamma populations are tentative and limited by relatively few years of study.

The abundance, egg-to-migrant survival, and out-migration timing of each salmonid species varied among years in both watersheds, especially in the Hamma Hamma where the length of the data set is more extensive. Low egg-to-migrant survival is a potential concern for sustaining wild populations in both of these watersheds. Therefore, we compare freshwater survival estimates for chum, Chinook, and pink salmon in the Duckabush and Hamma Hamma rivers to the combinations of egg-to-migrant and migrant-to-adult survival necessary to maintain spawner-to-spawner recruitment greater than 1.0.

Precision and Accuracy of Mark-Recapture Estimates

Precision of the juvenile abundance estimates provided in this report were within the NMFS guidelines recommended for monitoring of ESA-listed species (Crawford and Rumsey 2011). Precision was represented by the coefficient of variation (*CV*) and represents the ability of a value to be consistently reproduced. The precision of a mark-recapture estimate is a function of both catch and recapture rates (i.e., trap efficiency; Robson and Regier 1964). Low catches may still result in a precise abundance estimate if the recapture of marked fish is high enough. Conversely, low recapture rates of marked fish may still result in a precise abundance estimate if the catches are high enough.

The accuracy of the juvenile abundance estimates provided in this report were assessed with respect to five assumptions of the mark-recapture estimator (Hayes et al. 2007; Seber 1973). Accuracy represents the ability of the derived estimate to match the true value. An estimate

derived from a mark-recapture study design is considered to be accurate (i.e., unbiased) when the estimator assumptions are met. Therefore, the Hamma Hamma and Duckabush River juvenile monitoring studies were designed to minimize violating these assumptions.

Assumption 1. Population is closed with no immigration or emigration and no births or deaths. The emigration assumption is technically violated because the trap catches downstream migrants that are emigrating from the river. However, we assume that the entire cohort is leaving the system within a defined period and that the abundance of juveniles can be estimated at a fixed station during this migration. This assumption is supported by the modality of downstream movement.

Two potential sources of deaths are mark-related mortality and in-river predation. Evaluating these types of mortality is particularly relevant for marked fish. Unknown deaths of marked fish will reduce the estimated trap efficiency and result in an overestimate of abundance. Death between release and recapture in response to handling or marking appears to be minimal based on fish held for 24-hour periods after the marking process. The stress associated with handling or marking is minimized by gentle handling and dying by trained staff. Death between release and recapture due to in-river predation or live box predation is expected to be an important issue for the small fry migrants (Chinook, chum, pink). The release site above the trap was selected to be close enough to the trap to minimize in-river predation but far enough from the trap to maximize mixing of marked and unmarked fish (assumption #4 below). Predation within the live box is a potential source of mortality, especially later in the season when catch of yearling migrants increase.

Assumption 2. All animals have the same probability of being caught. This assumption would be violated if trap efficiency changes over time, if small fish are caught at a different rate than large fish of the same species, or if some fish are not moving in a downstream direction. Changes in trap efficiency are most likely to bias migration estimates if they occur during peak migration periods. Changes in trap efficiency are accommodated by stratifying the migration estimate into different time periods that incorporate time-specific mark and recapture data. Size-biased capture rates are unlikely for chum, Chinook, and pink salmon that migrate at relatively small sizes (30-45 mm fork length).

Equal probability of capture would also be violated if a portion of the juvenile fish were caught because they were redistributing in the river rather than in process of a downstream migration. The location of the traps near the mouth of each river, the recapture of marked sub-yearlings within one day of release, and the modality of the outmigration do not support the idea that the fry migrants caught in this study were simply redistributing in the river.

Assumption 3. Marking does not affect catchability. This assumption would be violated if marked fish were better able to avoid the trap or were more prone to capture than maiden-caught fish. Trap avoidance would over estimate abundance whereas trap attraction would under

estimate abundance. Trap avoidance of marked fish was more likely for coho or steelhead than the smaller sub-yearling Chinook, chum or pink salmon. However, behavioral differences between maiden captures and recaptured fish are currently unknown. Handling and marking the fish may also make them more prone to capture if the stress of handling compromises fish health. To minimize this effect, fish held for release were monitored for the 10+ hours between initial capture and release. During this period, fish are held in a perforated bucket that allows water to be exchanged between bucket and stream. Fish that do not appear to be healthy or swimming naturally were not included in the release group.

Assumption 4. Marked fish mix at random with unmarked fish. This assumption would be violated if marked and unmarked fish were spatially or temporally distinct in their downstream movements. Spatial or temporal segregation could increase likelihood of recapture (underestimate migrant abundance) or decrease likelihood of capture (overestimate migrant abundance). The locations of the trap and release sites were selected to minimize both possibilities. Marked fish have been released at the same locations that have been used since trapping began in 2002 in the Hamma Hamma and 2008 in the Duckabush. Release locations at both trap sites were selected in order to maximize mixing of marked and unmarked sub yearlings while minimizing in-river predation.

Assumption 5. No marks are lost and all marks are detected. This assumption would be violated if dye or fin clips were not retained or recognized on recaptured fish. This assumption was likely met. Bismark Brown dye is known to stain fish for up to two weeks. The frequency of undetected marks should also have been low given the highly trained staff performing both the marking procedure and collecting the recapture data. If marks were lost or undetected, catch data would be inflated (individuals would be recorded as maiden capture) and the recapture rate decreased. In combination, these errors would result in an underestimate of trap efficiency and an overestimate of migrant abundance.

Assumptions for Missed Catch

The accuracy of each abundance estimate depends, in part, on accurate estimates of missed catch during periods that the trap did not fish. One type of missed catch occurred within the trapping season. The linear interpolation method used to estimate in-season missed catch assumed that no major changes occurred in fish migration during the outage period. Drops or spikes in migration rates during high flows would violate this assumption but are nearly impossible to verify. A second type of missed catch occurred prior to or after the trapping season. Chum salmon have the most extended migration of any species in the Duckabush and Hamma Hamma juvenile monitoring studies and low levels of catch still occur at the beginning and end of the trapping season. Emergence timing of summer and fall chum is expected to vary as a function of adult spawn timing, incubation temperatures, and total days in the gravel (Koski 1975; Tynan 1997). The combination of these factors changes from year to year and leads to

some variability in the timing of emergence for all species in a system. This variability in emergence made migration prior to trap installation difficult to estimate. As the onset and termination of the chum migration is unknown, a more complete abundance estimate would only be possible by increasing the length of the trapping season.

Duckabush Chum Salmon

The abundance and survival of Duckabush chum salmon was treated as a composite value in these analyses because the out-migrants could not be assigned to summer or fall run based on out-migration timing alone. In future years, the study design will require genetic sampling to distinguish offspring and develop independent estimates for the two parental run types (Small et al. 2010).

Freshwater production of Duckabush chum salmon increased from 127,424 fry in 2008 to 608,276 fry in 2009 (Figure 7). The 4.8-fold increase in freshwater production could not be explained by changes in adult chum escapement, which decreased between these two years. The difference in juvenile chum production between years appears to be the result of higher egg-to-migrant survival for the 2009 out-migration (17%) when compared with the 2008 out-migration (3%, Figure 8). Lower survival for the 2008 out-migration as compared to that in 2009 was associated with higher peak incubation flows (Figure 8). Given the two year data set, any definitive relationship between peak incubation flows and egg-to-migrant survival would be premature; however, incubation flows have been identified as a variable limiting freshwater production of salmonid species in other Puget Sound watersheds (Kinsel et al. 2008; Kiyohara and Zimmerman 2011). The mechanisms for disturbance caused by peak flow events during winter freshets include both scour and sedimentation (Devries 1997; Montgomery et al. 1996).

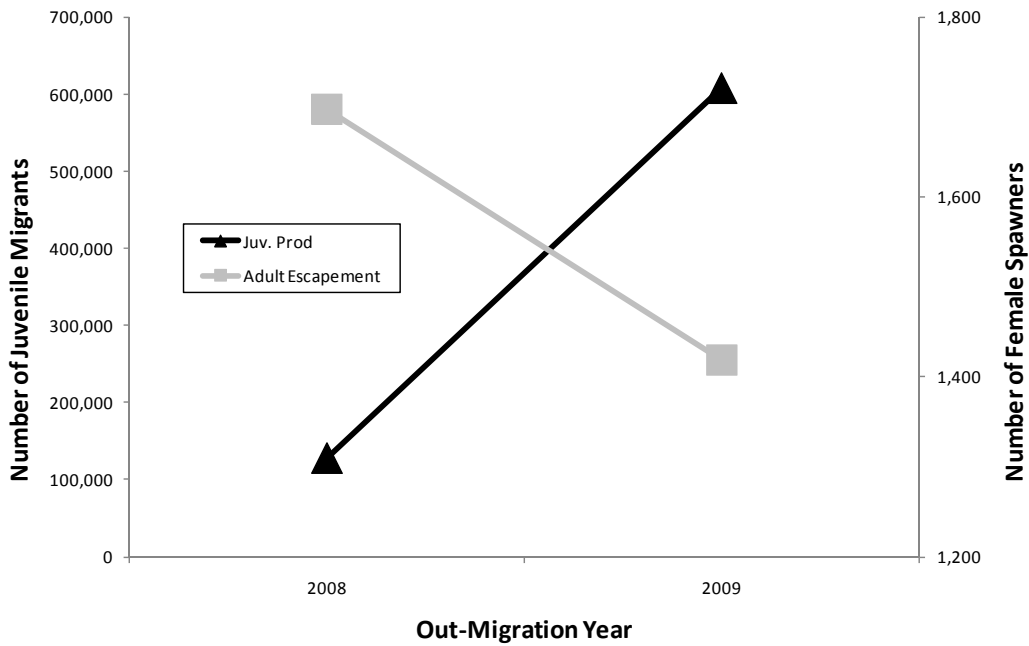


Figure 7.—Number of spawners and juvenile migrants by out-migration year for Duckabush River chum. Data are a composite of summer and fall run stocks.

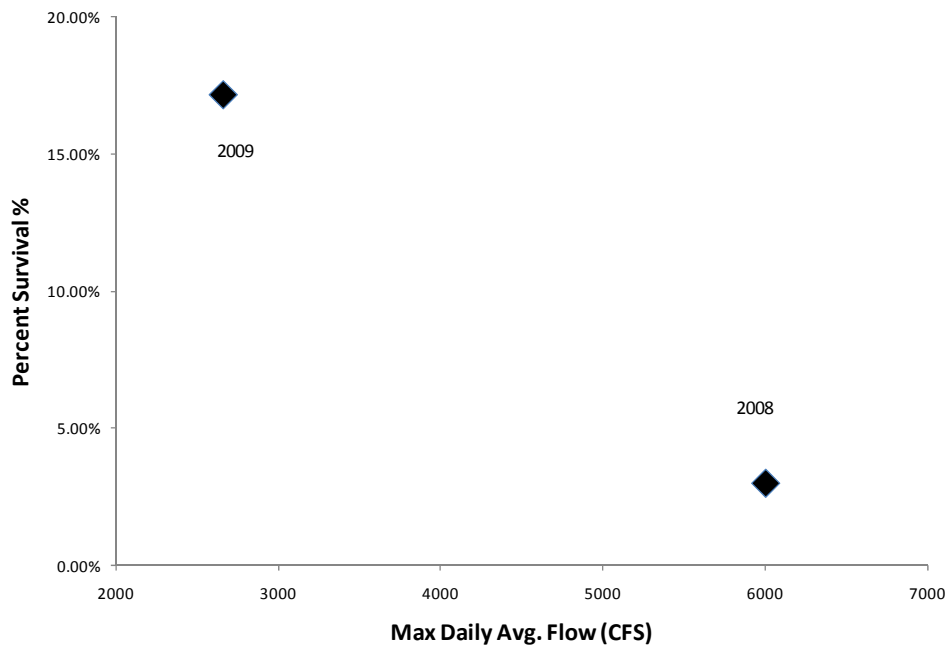


Figure 8.—Egg-to-migrant survival for chum salmon in Duckabush River, out-migration year 2008 and 2009, as a function of peak incubation flow. Incubation flow was the maximum daily average flow at USGS gage #12054000 (Hamma Hamma) between September 1 and December 31.

Duckabush Pink Salmon

Egg-to-migrant survival of Duckabush pink salmon was surprisingly low. Literature values of pink salmon survival in other watersheds indicate that pink salmon typically have comparable egg-to-fry survival rates as chum and sockeye salmon (Bradford 1995). However, the egg-to-migrant values estimated for the Duckabush pink salmon were an order of magnitude lower than those estimated for chum salmon in the Duckabush and for Chinook and sockeye elsewhere in the Puget Sound region (Kinsel et al. 2008; Kiyohara and Zimmerman 2011; Topping et al. 2008).

Freshwater production of Duckabush pink salmon in 2010 was more than 50% of the fry production in 2008. The adult escapement corresponding to the 2010 out-migration was 17% fewer than the escapement associated with the 2008 out-migration (Figure 9). In addition, egg-to-migrant survival associated with the 2010 out-migration was 60% less than survival estimated for the 2008 out-migration. Therefore, the combined effect of lower escapement and egg-to-migrant survival explains the difference in pink fry production between the 2008 and 2010 out-migrations. Understanding the relative importance of these variables will require additional years of information; however, the extremely low egg-to-migrant survival observed make it unlikely that high numbers of spawners will return to these watersheds under even the best of marine conditions (see analysis below).

Egg-to-migrant survival of Duckabush pink salmon could not be explained by differences in peak incubation flows (Figure 10). Some alternate explanations for the inter-annual differences include in-river predation, poor spawning habitat, or missed catch before the trapping season started. In 2010, a percentage of the juvenile pink production may have already left the river by the time trapping began on March 3. Based on results from the 2008 trapping season (which began in late January), the 2010 estimate assumed that a March 3, 2010 installation date was adequate to capture the first pink salmon out-migrants.

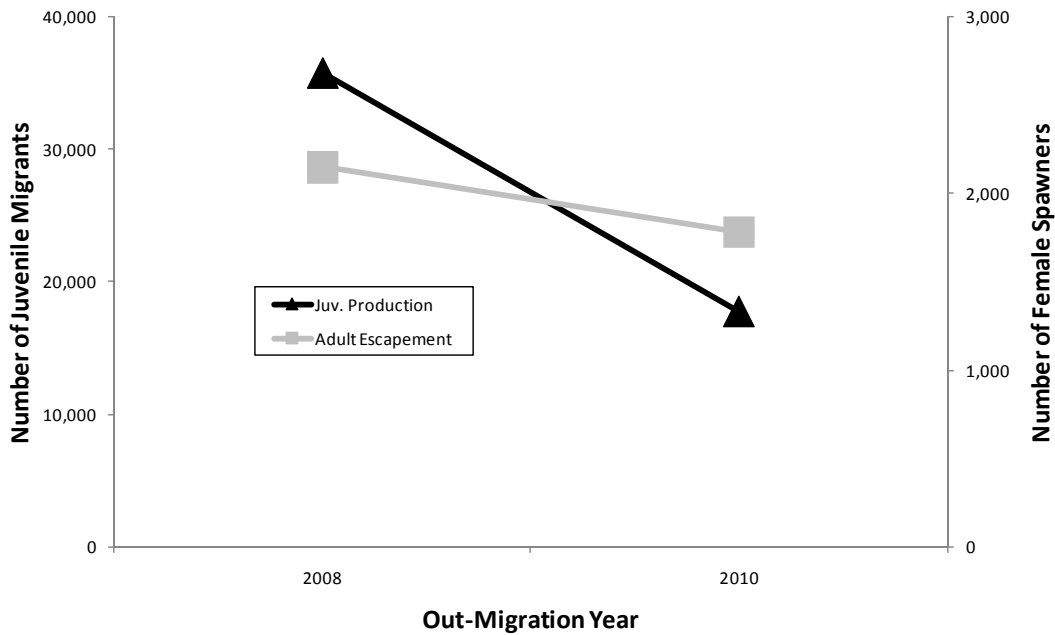


Figure 9.—Number of spawners and juvenile migrants by out-migration year for Duckabush River pink salmon, out-migration year 2008 and 2010.

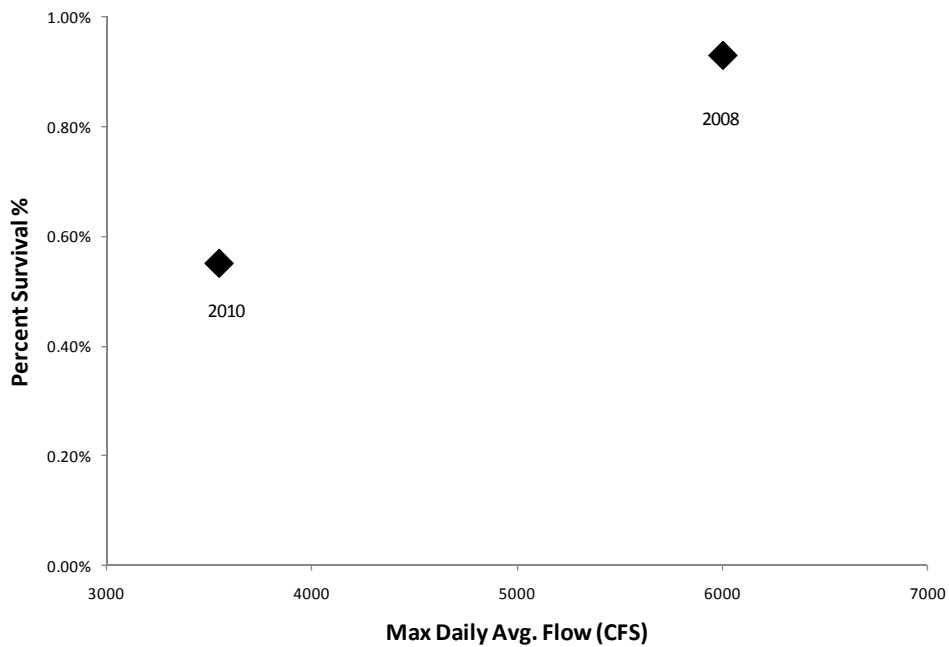


Figure 10.—Egg-to-migrant survival for pink salmon in Duckabush River, out-migration years 2008 and 2010, as a function of peak incubation flow. Incubation flow was the maximum daily average flow at USGS gage #12054000 (Hamma Hamma) between September 1 and December 1.

Hamma Hamma Chum Salmon

Freshwater production of Hamma Hamma chum salmon has ranged between 114,347 and 4,885,211 fry over the study period (Figure 11). Adult escapement during this same time frame has ranged from 2,420 to 54,676 spawners. Although changes in juvenile production generally tracked the spawner abundance of corresponding adult brood years, egg-to-migrant survival was also variable (0.5% to 13.98%) and appeared to be an additional determinant of freshwater production. For example, the 2007 and 2008 out-migrations represent the highest and lowest juvenile production years in this data set and yet both out-migrations resulted from moderate and comparable adult escapements (Figure 12). Differences in freshwater production between these two years were almost entirely explained by differences in egg-to-migrant survival. Egg-to-migrant survival of Hamma Hamma chum salmon was not correlated with peak incubation flows (Figure 12).

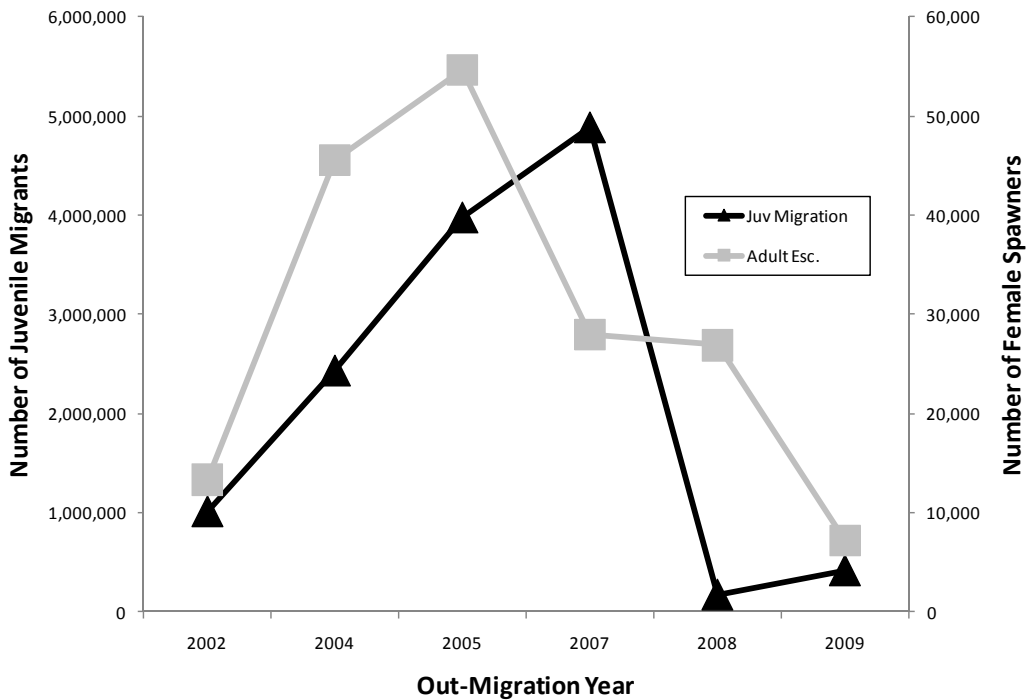


Figure 11.—Number of spawners and juvenile migrants by out-migration year for Hamma Hamma River chum salmon (out-migration years 2002, 2004-2005, 2007-2009).

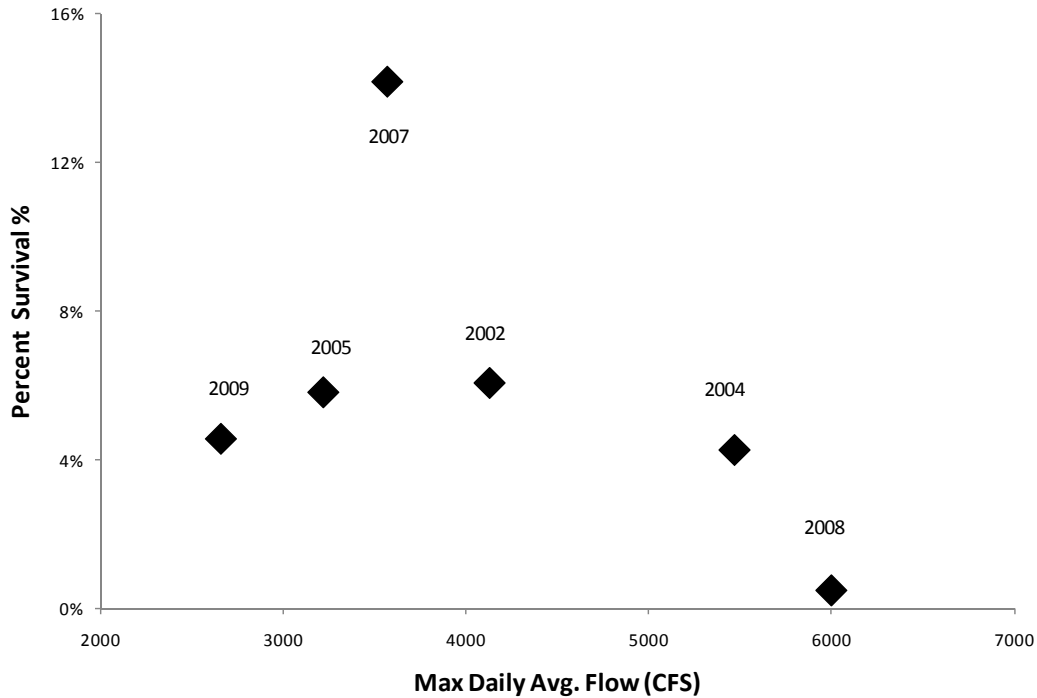


Figure 12.—Egg-to-migrant survival for chum salmon in Hamma Hamma River (out-migration years 2002, 2004-2005, 2007-2009) as a function of peak incubation flow. Incubation flow was the maximum daily average flow at USGS gage #12054000 between September 1 and December 1.

Hamma Hamma Chinook Salmon

Freshwater production of Hamma Hamma Chinook salmon has declined steeply since monitoring began in 2002 (Figure 13). Between the 2002 and 2007 out-migration years, this decline paralleled a decrease in spawner abundance. However, increases in spawner abundance associated with the 2008 and 2009 out-migration years did not result in a corresponding increase in juvenile production. Low egg-to-migrant survival for the 2008 out-migration year may have resulted from high peak incubation flows (highest peak among all years of study, Figure 14).

The low Chinook egg-to-migrant survival for the 2009 out-migration year was surprising and requires further examination. The estimated egg-to-migrant survival of 0.06% was two orders of magnitude lower than Chinook egg-to-migrant survival estimated elsewhere in Puget Sound (Kinsel et al. 2008; Kiyohara and Zimmerman 2011; Topping et al. 2008). In the absence of a biological explanation for this value, an alternate explanation is that the freshwater production was underestimated for this out-migration year. One potential explanation is that Chinook migration was underestimated during long trap outage periods. The 2009 season had several long trap outages (7 days or longer), a low number of efficiency trials (6), and the highest seasonal trapping efficiency (44%) observed for the Hamma Hamma Chinook data set. Low numbers of trapping trials coupled with high efficiency during those trials and long trapping outages may have under-estimated total juvenile abundance and biased the estimate of egg-to-

migrant survival in 2009. In order to estimate migration during the trap outages, the time-adjacent trap efficiency is applied to the estimated missed catch. Estimated missed catch is based on catch rates of adjacent trapping periods. Our estimates assumed that these catch rates were representative of the long outage periods. If trap catch rates (fish per day) increased during outage events then our analysis may have underestimated the migration. If the trap efficiency (recapture per number of marked fish) decreased due to higher flows during the trap outage, our analysis may have underestimated the migration.

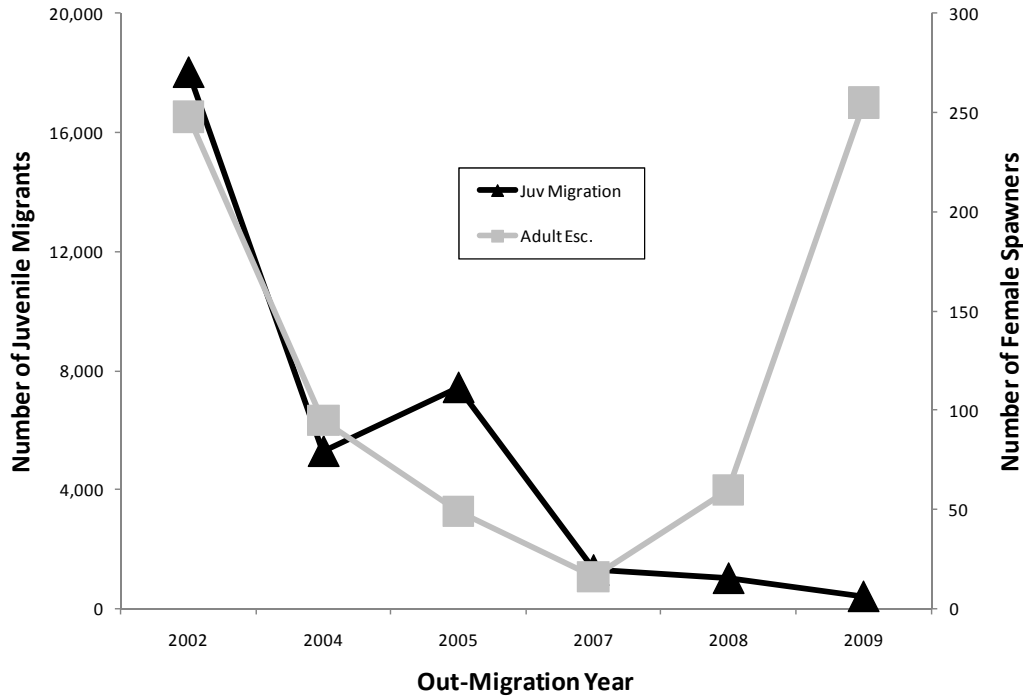


Figure 13.—Number of spawners and juvenile migrants by out-migration year for Hamma Hamma River Chinook salmon (out-migration years 2002, 2004-2005, 2007-2009).

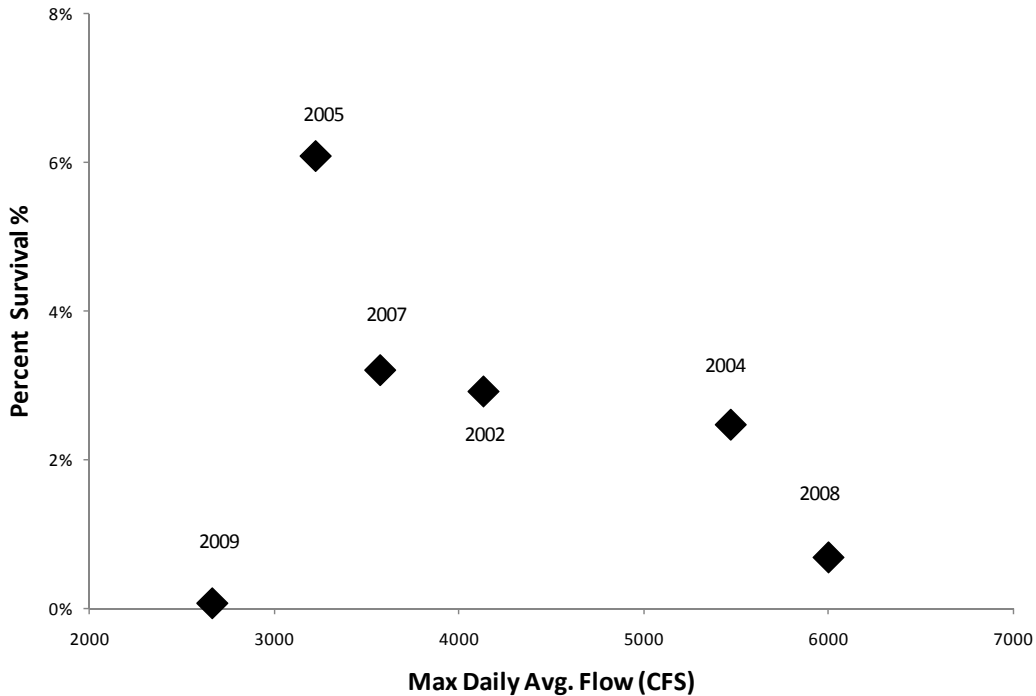


Figure 14.—Egg-to-migrant survival for Chinook salmon in Hamma Hamma River (out-migration years 2002, 2004-05, 2007-09) as a function of peak incubation flow. Incubation flow was the maximum daily average flow at USGS gage #12054000 between September 1 and December 1.

Hamma Hamma Pink Salmon

Freshwater production of Hamma Hamma pink salmon has declined sharply over time (Figure 15). In 2002, nearly 25,000 female pink salmon returned to the Hamma Hamma River and produced nearly 10 fry per female spawner (~236,000 fry migrants, 0.53% egg-to-migrant survival). By 2010, the number of spawners decreased to 1,000 females that produced approximately 1.5 fry per female spawner (~1,500 fry migrants, 0.08% egg-to-migrant survival). The temporal decline in juvenile production of pink salmon tracked the changes in spawner abundance, although this decline was also associated with decreasing egg-to-migrant survival over time. Similar to results observed for Duckabush, Hamma Hamma pink salmon are characterized by decreasing spawner abundance, extremely low egg-to-migrant survival, and no correlation between egg-to-migrant survival and peak incubation flows (Figure 16).

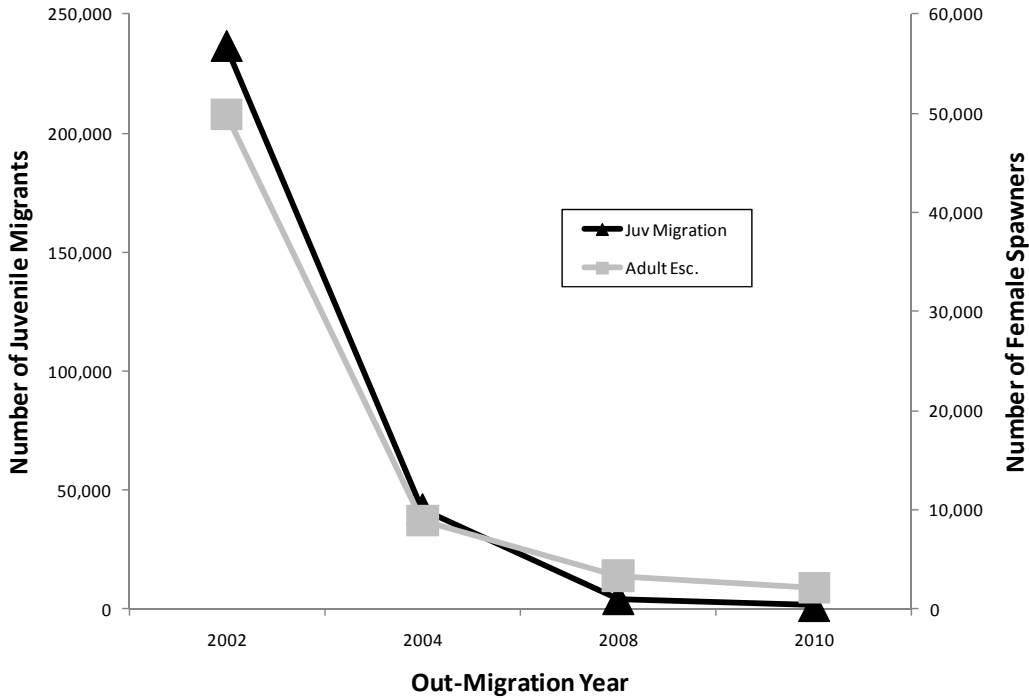


Figure 15.—Number of spawners and juvenile migrants by out-migration year for Hamma Hamma pink salmon (out-migration years 2002, 2004, 2008 and 2010).

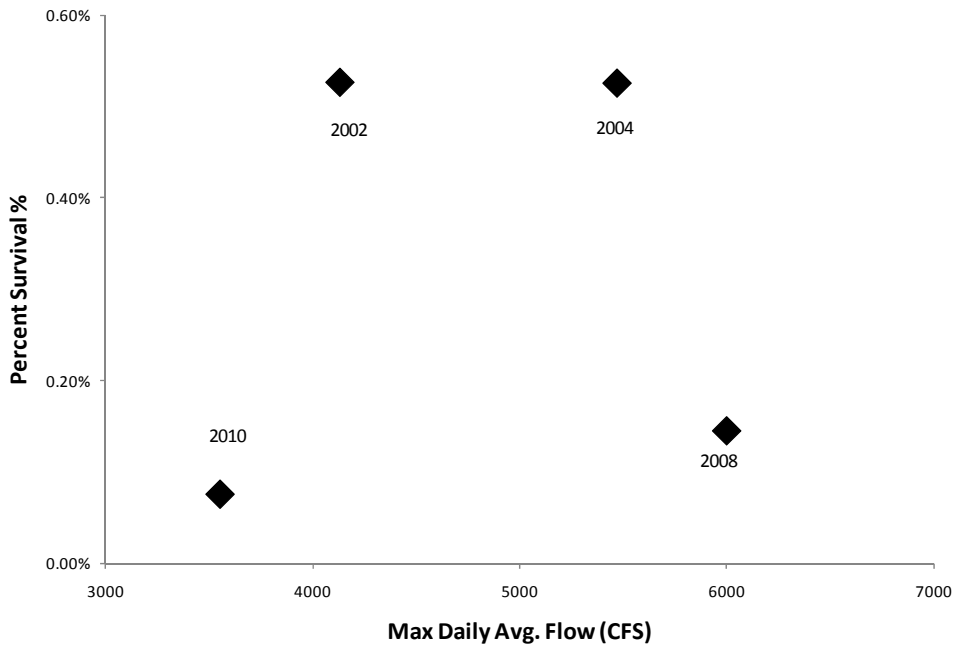


Figure 16.—Egg-to-migrant survival for Hamma Hamma pink salmon (out-migration years 2002, 2004, 2006 and 2010) as a function of peak incubation flow. Incubation flow was the maximum daily average flow at USGS gage #12054000 between September 1 and December 1.

Freshwater Survival and Stock Productivity

Egg-to-migrant survival in the freshwater environment was highly variable among years for all species in the Duckabush and Hamma Hamma watersheds. Early survival in the freshwater environment has the potential to boost or reduce stock productivity (spawner-to-spawner) under given estuary or ocean conditions and harvest rates. For example, Bradford (1995) estimated that the freshwater environment accounted for 35% to 43% of the total natural mortality for each cohort of chum and pink salmon. If egg-to-migrant survival is too low, adult returns may not be sufficient to replace the parent brood even under the best of marine conditions.

In order to determine whether the estimated egg-to-migrant survival rates were adequate to sustain wild salmonid populations at a replacement level (spawner-to-spawner productivity of 1.0) in the Duckabush and Hamma Hamma rivers, we calculated the combinations of freshwater (egg-to-migrant) survival and marine (fry-to-adult) survival needed to maintain a spawner-to-spawner ratio of 1.0. Egg-to-migrant survival rates were restricted to a range of 0.5% to 20% based on results from the Duckabush and Hamma Hamma watersheds. Fry-to-adult survival rates were restricted to a range of 0.5% to 5% based on reported literature values (Bradford 1995) and hatchery return rates for Chinook salmon (WDFW unpublished data). The number of spawner recruits (R) was a function of the number of parent females (F), fecundity (f), freshwater survival (S_f) and marine survival (S_o):

Equation 12

$$R = F * f * S_f * S_o$$

Productivity (P) was the ratio of spawner recruits (R) produced by all males (M) and females (F) in the parent stock:

Equation 13

$$P = \frac{R}{(M + F)}$$

The results varied based on estimated fecundity, which we assumed to differ among species. For Chinook salmon, freshwater survival (egg-to-migrant) rates of 5% will require a marine survival (fry migrant-to-spawner) rate of 0.8% to replace the parent spawner population (Figure 17). For chum, a 5% freshwater survival rate will require even higher marine survival (1.6%) to replace the parent spawner population. These numbers are optimistic at best and yet do not account for the productivity levels required to rebuild the currently depleted stocks and achieve recovery goals for these watersheds. For pink salmon, the current levels of freshwater survival (~0.5%) in both the Duckabush and Hamma Hamma watersheds are unlikely to result in a sustainable population because the marine survival needed for a “replacement” level of spawners is unreasonably high (22%). A future comparison of freshwater survival of pink

salmon is needed from other Puget Sound watersheds in order to determine if poor freshwater survival is partially responsible for the current low returns of pink salmon to Hood Canal when compared to the exponential increase of pink salmon currently returning to the in other areas of Puget Sound (e.g., Puyallup, Green and Nisqually rivers).

Based on this analysis and the relatively low egg-to-migrant survival rates for Chinook salmon in the Hamma Hamma River and pink salmon in the Duckabush and Hamma Hamma rivers, we conclude that survival in the freshwater environment is likely to be an important variable limiting the overall return of spawners to these watersheds. Freshwater survival rates for chum salmon were higher, on average, than Chinook or pink salmon. However, interpretations of the chum results are limited by our current inability to distinguish summer and fall run chum in the juvenile out-migrant samples.

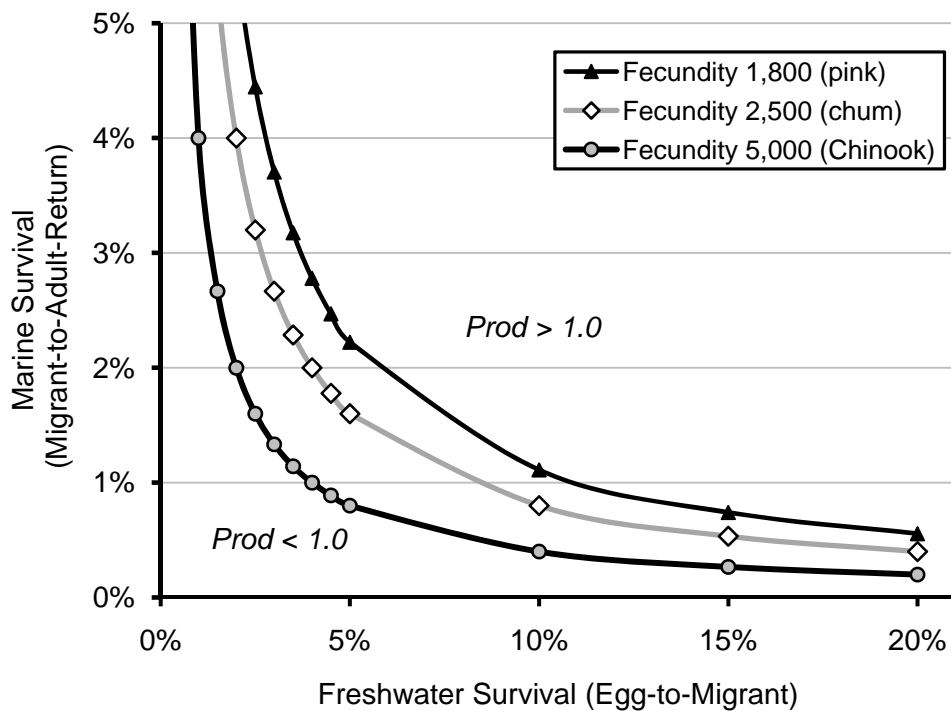


Figure 17.—Freshwater (egg-to-migrant) and marine (fry migrant-to-adult-return) survival combinations yielding an adult productivity (spawner-to-spawner) of 1.0. The freshwater-marine survival combinations to the right of each curve have a stock productivity greater than 1.0 (increase abundance over time). The freshwater-marine survival combinations to the left of each curve have a stock productivity less than 1.0 (decrease abundance over time). Contours differ based on female fecundity.

Recommendations

The following recommendations should improve future assessments of juvenile production and survival in the Duckabush and Hamma Hamma watersheds:

- (1) Implement genetic sampling of juvenile chum migrants and derive independent estimates of freshwater production for summer and fall chum.
- (2) Incorporate length measurements into the sampling protocol. Partition Chinook migrants into their fry (early and small) and parr (late and large) out-migration strategies.
- (3) Improve accuracy of data entry on field forms in order to improve missed catch estimates during trap outages.

Appendix A

Variance of total unmarked smolt numbers, when the number of unmarked juvenile out-migrants, is estimated.

Author: Kristen Ryding, WDFW Biometrician

APPENDIX A.—Variance of total unmarked smolt numbers, when the number of unmarked juvenile out-migrants, is estimated.

The estimator for \hat{U}_i is,

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

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

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

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

$E(\hat{u}_i)$ = 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, $Var(\hat{u}_i)$ 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,

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

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

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

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

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

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

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

Note that,

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

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

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

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

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

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

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

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

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

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

Appendix B

Statistical Weeks for 2002-2010

APPENDIX B1.—Statistical Weeks for 2002-2010.

Stat Week	First Day of Stat Week								
	2002	2003	2004	2005	2006	2007	2008	2009	2010
1	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan
2	7-Jan	6-Jan	5-Jan	3-Jan	2-Jan	8-Jan	7-Jan	5-Jan	4-Jan
3	14-Jan	13-Jan	12-Jan	10-Jan	9-Jan	15-Jan	14-Jan	12-Jan	11-Jan
4	21-Jan	20-Jan	19-Jan	17-Jan	16-Jan	22-Jan	21-Jan	19-Jan	18-Jan
5	28-Jan	27-Jan	26-Jan	24-Jan	23-Jan	29-Jan	28-Jan	26-Jan	25-Jan
6	4-Feb	3-Feb	2-Feb	31-Jan	30-Jan	5-Feb	4-Feb	2-Feb	1-Feb
7	11-Feb	10-Feb	9-Feb	7-Feb	6-Feb	12-Feb	11-Feb	9-Feb	8-Feb
8	18-Feb	17-Feb	16-Feb	14-Feb	13-Feb	19-Feb	18-Feb	16-Feb	15-Feb
9	25-Feb	24-Feb	23-Feb	21-Feb	20-Feb	26-Feb	25-Feb	23-Feb	22-Feb
10	4-Mar	3-Mar	1-Mar	28-Feb	27-Feb	5-Mar	3-Mar	2-Mar	1-Mar
11	11-Mar	10-Mar	8-Mar	7-Mar	6-Mar	12-Mar	10-Mar	9-Mar	8-Mar
12	18-Mar	17-Mar	15-Mar	14-Mar	13-Mar	19-Mar	17-Mar	16-Mar	15-Mar
13	25-Mar	24-Mar	22-Mar	21-Mar	20-Mar	26-Mar	24-Mar	23-Mar	22-Mar
14	1-Apr	31-Mar	29-Mar	28-Mar	27-Mar	2-Apr	31-Mar	30-Mar	29-Mar
15	8-Apr	7-Apr	5-Apr	4-Apr	3-Apr	9-Apr	7-Apr	6-Apr	5-Apr
16	15-Apr	14-Apr	12-Apr	11-Apr	10-Apr	16-Apr	14-Apr	13-Apr	12-Apr
17	22-Apr	21-Apr	19-Apr	18-Apr	17-Apr	23-Apr	21-Apr	20-Apr	19-Apr
18	29-Apr	28-Apr	26-Apr	25-Apr	24-Apr	30-Apr	28-Apr	27-Apr	26-Apr
19	6-May	5-May	3-May	2-May	1-May	7-May	5-May	4-May	3-May
20	13-May	12-May	10-May	9-May	8-May	14-May	12-May	11-May	10-May
21	20-May	19-May	17-May	16-May	15-May	21-May	19-May	18-May	17-May
22	27-May	26-May	24-May	23-May	22-May	28-May	26-May	25-May	24-May
23	3-Jun	2-Jun	31-May	30-May	29-May	4-Jun	2-Jun	1-Jun	31-May
24	10-Jun	9-Jun	7-Jun	6-Jun	5-Jun	11-Jun	9-Jun	8-Jun	7-Jun
25	17-Jun	16-Jun	14-Jun	13-Jun	12-Jun	18-Jun	16-Jun	15-Jun	14-Jun
26	24-Jun	23-Jun	21-Jun	20-Jun	19-Jun	25-Jun	23-Jun	22-Jun	21-Jun
27	1-Jul	30-Jun	28-Jun	27-Jun	26-Jun	2-Jul	30-Jun	29-Jun	28-Jun
28	8-Jul	7-Jul	5-Jul	4-Jul	3-Jul	9-Jul	7-Jul	6-Jul	5-Jul
29	15-Jul	14-Jul	12-Jul	11-Jul	10-Jul	16-Jul	14-Jul	13-Jul	12-Jul
30	22-Jul	21-Jul	19-Jul	18-Jul	17-Jul	23-Jul	21-Jul	20-Jul	19-Jul
31	29-Jul	28-Jul	26-Jul	25-Jul	24-Jul	30-Jul	28-Jul	27-Jul	26-Jul
32	5-Aug	4-Aug	2-Aug	1-Aug	31-Jul	6-Aug	4-Aug	3-Aug	2-Aug
33	12-Aug	11-Aug	9-Aug	8-Aug	7-Aug	13-Aug	11-Aug	10-Aug	9-Aug
34	19-Aug	18-Aug	16-Aug	15-Aug	14-Aug	20-Aug	18-Aug	17-Aug	16-Aug
35	26-Aug	25-Aug	23-Aug	22-Aug	21-Aug	27-Aug	25-Aug	24-Aug	23-Aug

Appendix C

Duckabush River catches, trap efficiencies, and abundance estimates for 2008 through 2010

APPENDIX C1.—Catch, marked and recaptured fish, and estimated abundance of fry chum migrants at the Duckabush River screw trap in 2008. Release groups were pooled to form 7 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Abundance			
		Actual	Missed	Variance	Marked	Recaptured	Estimated	Variance
1	1/31-2/05	209	13	7.94E+00	83	9	1,865	2.28E+05
2	2/06-2/10	163	0	0.00E+00	67	19	554	8.70E+03
3	2/11-2/20	489	6	2.52E+00	277	25	5,293	7.25E+05
4	2/21-3/05	1,491	0	0.00E+00	653	100	9,655	5.96E+05
5	3/06-3/16	1,369	175	5.77E+01	494	96	7,879	3.13E+05
6	3/17-3/18	251	0	0.00E+00	101	33	753	8.02E+03
7	3/19-6/10	16,399	3080	1.44E+05	603	115	101,425	6.18E+07
Season Total		20,371	3,274	1.44E+05	2,278	397	127,424	6.37E+07

APPENDIX C2.—Catch, marked and recaptured fish, and estimated abundance of fry chum migrants at the Duckabush River screw trap in 2009. Release groups were pooled to form 7 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Abundance			
		Actual	Missed	Variance	Marked	Recaptured	Estimated	Variance
1	1/31-2/24	22,585	0	0.00E+00	1,507	381	89,158	1.14E+07
2	2/05-3/06	11,706	1,025	1.70E+05	408	47	108,479	1.48E+08
3	3/07-3/16	14,292	19	1.22E+01	401	58	97,509	6.95E+07
4	3/17-3/18	3,394	0	0.00E+00	100	7	42,849	1.14E+08
5	3/19-3/20	5,061	0	0.00E+00	104	21	24,155	1.22E+07
6	3/21-3/22	2,154	0	0.00E+00	100	7	27,194	4.61E+07
7	3/23-6/16	32,871	433	6.73E+04	400	60	218,933	4.58E+08
Season Total		92,063	1,477	2.37E+05	3,020	581	608,276	8.60E+08

APPENDIX C3.—Catch, marked and recaptured fish, and estimated abundance of fry pink migrants at the Duckabush River screw trap in 2008. Release groups were pooled to form 7 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Abundance			
		Actual	Missed	Variance	Marked	Recaptured	Estimated	Variance
1	1/31-2/05	0	0	0.00E+00	83	9	0	7.62E+01
2	2/06-2/10	0	0	0.00E+00	67	19	0	1.19E+01
3	2/11-2/20	11	0	2.64E-02	277	25	118	1.68E+03
4	2/21-3/05	115	0	0.00E+00	653	100	745	8.68E+03
5	3/06-3/16	174	15	2.33E+00	494	96	964	1.16E+04
6	3/17-3/18	58	0	0.00E+00	101	33	174	9.24E+02
7	3/19-6/10	5,616	873	6.80E+04	603	115	33,788	8.02E+06
Season Total		5,974	888	6.80E+04	2,278	397	35,788	8.05E+06

APPENDIX C4.—Catch, marked and recaptured fish, and estimated abundance of fry pink migrants at the Duckabush River screw trap in 2010. Release groups were pooled to form 6 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Abundance			
		Actual	Missed	Variance	Marked	Recaptured	Estimated	Variance
1	3/01-3/07	61	0	0.00E+00	408	47	520	8.77E+03
2	3/08-3/17	165	40	4.53E+01	401	58	1,397	3.58E+04
3	3/18-3/19	22	37	2.10E+02	100	7	745	6.46E+04
4	3/20-3/21	74	0	0.00E+00	104	21	353	5.59E+03
5	3/22-3/23	68	0	0.00E+00	100	7	859	8.45E+04
6	3/24-5/19	1,815	296	6.36E+03	400	60	13,877	2.71E+06
	Season Total	2,205	373	6.62E+03	1,513	200	17,750	2.91E+06

Appendix D

Hamma Hamma River catches, trap efficiencies, and abundance estimates for 2002 through 2010

APPENDIX D1.—Catch, marked and recaptured fish, and estimated abundance of fry chum migrants at the Hamma Hamma River screw trap in 2002. Release groups were pooled to form 6 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Abundance			
		Actual	Missed	Variance	Marked	Recaptured	Estimated	Variance
1	1/28-3/7	396	0	0.00E+00	500	18	10,442	4.00E+06
2	3/08-3/21	661	0	0.00E+00	1,068	140	5,011	1.10E+05
3	3/22-4/11	4,363	0	0.00E+00	500	46	46,508	2.91E+07
4	4/12-4/23	4,696	0	0.00E+00	500	28	81,127	1.78E+08
5	4/24-4/30	7,996	0	0.00E+00	500	47	83,458	1.10E+08
6	5/01-8/19	23,076	0	0.00E+00	1,967	57	782,993	8.99E+09
Season Total		41,188	0	0.00E+00	5,035	336	1,009,539	9.31E+09

APPENDIX D2.—Catch, marked and recaptured fish, and estimated abundance of fry chum migrants at the Hamma Hamma River screw trap in 2004. Release groups were pooled to form 2 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Abundance			
		Actual	Missed	Variance	Marked	Recaptured	Estimated	Variance
1	1/20-4/09	20,698	0	0.00E+00	1,897	105	370,611	8.94E+08
2	4/10-7/31	57,554	0	0.00E+00	500	13	2,059,611	2.35E+11
Season Total		78,252	0	0.00E+00	2,397	118	2,430,222	2.36E+11

APPENDIX D3.—Catch, marked and recaptured fish, and estimated abundance of fry chum migrants at the Hamma Hamma River screw trap in 2005. Release groups were pooled to form 5 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Abundance			
		Actual	Missed	Variance	Marked	Recaptured	Estimated	Variance
1	1/04-2/17	1,047	124	2.49E+03	500	9	58,667	2.47E+08
2	2/18-3/06	12,555	0	0.00E+00	500	39	157,251	3.81E+08
3	3/07-4/28	130,662	4,044	2.50E+03	1,500	53	3,744,328	1.88E+11
4	4/29-5/30	877	0	0.00E+00	500	28	15,151	6.56E+06
5	5/31-7/26	0	0	0.00E+00	1,000	88	0	2.56E+02
Season Total		145,141	4,168	4.99E+03	4,000	217	3,975,397	1.88E+11

APPENDIX D4.—Catch, marked and recaptured fish, and estimated abundance of fry chum migrants at the Hamma Hamma River screw trap in 2007. Release groups were pooled to form 5 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Abundance			
		Actual	Missed	Variance	Marked	Recaptured	Estimated	Variance
1	1/17-5/02	161,105	5,268	9.71E+06	2,000	68	4,824,817	2.41E+11
2	5/03-6/13	3,620	0	0.00E+00	1,000	59	60,394	5.71E+07
3	6/14-6/16	0	0	0.00E+00	23,850	296	0	1.29E+04
4	6/17-6/18	0	0	0.00E+00	5,958	234	0	1.29E+03
5	6/19-7/31	0	0	0.00E+00	54,567	2,954	0	6.82E+02
Season Total		164,725	5,268	9.71E+06	87,375	3,611	4,885,211	2.41E+11

APPENDIX D5.—Catch, marked and recaptured fish, and estimated abundance of fry chum migrants at the Hamma Hamma River screw trap in 2008. Release groups were pooled to form 4 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Abundance			
		Actual	Missed	Variance	Marked	Recaptured	Estimated	Variance
1	2/05-4/02	1,473	1,401	3.83E+03	1,000	93	30,605	4.93E+06
2	4/03-4/12	1,887	0	0.00E+00	500	79	11,817	1.30E+06
3	4/13-5/01	7,834	0	0.00E+00	1,000	106	73,288	3.86E+07
4	5/02-6/09	2,292	682	9.17E+03	1,000	56	52,228	4.52E+07
Season Total		13,486	2,083	1.30E+04	3,500	334	167,938	9.00E+07

APPENDIX D6.—Catch, marked and recaptured fish, and estimated abundance of fry chum migrants at the Hamma Hamma River screw trap in 2009. Release groups were pooled to form 4 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Abundance			
		Actual	Missed	Variance	Marked	Recaptured	Estimated	Variance
1	2/04-3/31	52,099	11,744	4.99E+05	500	352	90,610	3.75E+06
2	4/01-4/14	19,544	6,183	2.76E+06	500	225	57,032	6.78E+06
3	4/15-4/24	36,635	0	0.00E+00	500	87	208,570	3.45E+08
4	4/25-7/02	20,443	5,040	2.62E+04	1,500	670	57,004	2.48E+06
Season Total		128,721	22,967	3.29E+06	3,000	1,334	413,216	3.58E+08

APPENDIX D7.—Catch, marked and recaptured fish, and estimated abundance of fry Chinook migrants at the Hamma Hamma River screw trap in 2002. Release groups were pooled to form 6 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Abundance			
		Actual	Missed	Variance	Marked	Recaptured	Estimated	Variance
1	1/28-3/07	28	0	0.00E+00	500	18	738	4.47E+04
2	3/08-3/21	50	0	0.00E+00	1,068	140	379	3.41E+03
3	3/22-4/11	15	0	0.00E+00	500	46	160	2.11E+03
4	4/12-4/23	24	0	0.00E+00	500	28	415	1.22E+04
5	4/24-4/30	26	0	0.00E+00	500	47	271	3.98E+03
6	5/01-8/19	449	25	5.08E+01	1,967	57	16,083	4.78E+06
Season Total		592	25	5.08E+01	5,035	336	18,047	4.84E+06

APPENDIX D8.—Catch, marked and recaptured fish, and estimated abundance of fry Chinook migrants at the Hamma Hamma River screw trap in 2004. Release groups were pooled to form 2 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Abundance			
		Actual	Missed	Variance	Marked	Recaptured	Estimated	Variance
1	1/20-4/09	101	0	0.00E+00	1,897	105	1,808	5.95E+04
2	4/10-7/31	113	0	0.00E+00	500	13	4,044	1.19E+06
Season Total		214	0	0.00E+00	2,397	118	5,852	1.25E+06

APPENDIX D9.—Catch, marked and recaptured fish, and estimated abundance of fry Chinook migrants at the Hamma Hamma River screw trap in 2005. Release groups were pooled to form 5 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Abundance			
		Actual	Missed	Variance	Marked	Recaptured	Estimated	Variance
1	1/04-2/17	92	10	5.00E-01	500	9	5,110	2.56E+06
2	2/18-3/06	93	0	0.00E+00	500	39	1,165	4.37E+04
3	3/07-4/28	25	12	3.60E+01	1,500	53	1,028	4.64E+04
4	4/29-5/30	8	0	0.00E+00	500	28	138	3.08E+03
5	5/31-7/26	0	0	0.00E+00	1,000	88	0	1.28E+02
Season Total		218	22	3.65E+01	4,000	217	7,442	2.65E+06

APPENDIX D10.—Catch, marked and recaptured fish, and estimated abundance of fry Chinook migrants at the Hamma Hamma River screw trap in 2007. Release groups were pooled to form 5 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Abundance			
		Actual	Missed	Variance	Marked	Recaptured	Estimated	Variance
1	1/17-5/02	11	2	2.24E+00	2,000	68	377	1.32E+04
2	5/03-6/13	43	0	0.00E+00	1,000	59	717	1.93E+04
3	6/14-6/16	0	0	0.00E+00	23,850	296	0	6.47E+03
4	6/17-6/18	0	0	0.00E+00	5,958	234	0	6.46E+02
5	6/19-7/31	4	6	1.20E+01	54,567	2,954	185	3.58E+03
Season Total		58	8	1.42E+01	87,375	3,611	1,279	4.32E+04

APPENDIX D11.—Catch, marked and recaptured fish, and estimated abundance of fry Chinook migrants at the Hamma Hamma River screw trap in 2008. Release groups were pooled to form 4 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Abundance			
		Actual	Missed	Variance	Marked	Recaptured	Estimated	Variance
1	2/05-4/02	6	18	3.95E+00	1,000	93	256	3.18E+03
2	4/03-4/12	4	0	0.00E+00	500	79	25	1.76E+02
3	4/13-5/01	4	0	0.00E+00	1,000	106	37	4.10E+02
4	5/02-6/09	29	11	2.39E+00	1,000	56	702	1.98E+04
Season Total		43	29	6.34E+00	3,500	334	1,021	2.35E+04

APPENDIX D12.—Catch, marked and recaptured fish, and estimated abundance of fry Chinook migrants at the Hamma Hamma River screw trap in 2009. Release groups were pooled to form 4 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Abundance			
		Actual	Missed	Variance	Marked	Recaptured	Estimated	Variance
1	2/04-3/31	57	32	1.15E+02	500	352	126	6.81E+01
2	4/01-4/14	0	0	0.00E+00	500	225	0	4.93E+00
3	4/15-4/24	9	0	0.00E+00	500	87	51	2.95E+02
4	4/25-7/02	76	27	3.97E+01	1,500	670	230	3.33E+02
Season Total		142	59	1.55E+02	3,000	1,334	408	7.01E+02

APPENDIX D13.—Catch, marked and recaptured fish, and estimated abundance of fry pink migrants at the Hamma Hamma River screw trap in 2002. Release groups were pooled to form 6 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Marked	Recaptured	Abundance	
		Actual	Missed	Variance			Estimated	Variance
1	1/28-3/07	1,044	0	0.00E+00	500	18	27,529	3.71E+07
2	3/08-3/21	1,698	0	0.00E+00	1,068	140	12,873	1.10E+06
3	3/22-4/11	13,383	0	0.00E+00	500	46	142,657	3.86E+08
4	4/12-4/23	2,145	0	0.00E+00	500	28	37,057	4.37E+07
5	4/24-4/30	1,212	0	0.00E+00	500	47	12,650	3.07E+06
6	5/01-8/19	105	0	0.00E+00	1,967	57	3,563	3.25E+05
Season Total		19,587	0	0	5,035	336	236,329	4.71E+08

APPENDIX D14.—Catch, marked and recaptured fish, and estimated abundance of fry pink migrants at the Hamma Hamma River screw trap in 2004. Release groups were pooled to form 2 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Marked	Recaptured	Abundance	
		Actual	Missed	Variance			Estimated	Variance
1	1/20-4/09	2078	0	0.00E+00	1,897	105	37,208	1.28E+07
2	4/10-7/31	137	0	0.00E+00	500	13	4,903	1.72E+06
Season Total		2215	0	0.00E+00	2,397	118	42,111	1.46E+07

APPENDIX D15.—Catch, marked and recaptured fish, and estimated abundance of fry pink migrants at the Hamma Hamma River screw trap in 2008. Release groups were pooled to form 4 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Marked	Recaptured	Abundance	
		Actual	Missed	Variance			Estimated	Variance
1	2/05-4/02	75	54	6.34E+01	1,000	93	1,374	3.12E+04
2	4/03-4/12	165	0	0.00E+00	500	79	1,033	1.65E+04
3	4/13-5/01	206	0	0.00E+00	1,000	106	1,927	4.68E+04
4	5/02-6/09	1	2	5.92E-01	1,000	56	53	1.22E+03
Season Total		447	56	6.40E+01	3,500	334	4,387	9.57E+04

APPENDIX D16.—Catch, marked and recaptured fish, and estimated abundance of fry pink migrants at the Hamma Hamma River screw trap in 2010. Release groups were pooled to form 3 strata. Missed catch and associated variance were calculated for periods that the trap did not fish.

Strata	Date	Catch			Marked	Recaptured	Abundance	
		Actual	Missed	Variance			Estimated	Variance
1	3/04-4/06	40	50	3.17E+02	460	98	419	2.92E+03
2	4/07-4/14	62	34	3.20E+01	250	24	964	4.07E+04
3	4/15-5/29	16	0	0.00E+00	500	88	90	5.18E+02
Season Total		118	84	3.49E+02	1,210	210	1,473	4.41E+04

Appendix E

2008 Duckabush River daily catch and migration estimates for juvenile chum and pink salmon.

APPENDIX E.—Daily catches of juvenile chum and pink salmon caught in the Duckabush River screw trap in 2008. Total catch represents actual and estimated catch for a given day. Time in and out reflect time fished (in) and not fished (out) on a given day.

Date	Time Fished		<u>Chum</u>			<u>Pink</u>			Migration	
	Hours		Catch		Migration	Catch		Migration		
	In	Out	Actual	Estimated		Actual	Estimated			Total
1/31/08	15.50	6.00	40	13	53	445	0	0	0	0
2/1/08	30.00	0.00	42	0	42	353	0	0	0	0
2/2/08	14.00	0.00	14	0	14	118	0	0	0	0
2/3/08	35.33	0.00	56	0	56	470	0	0	0	0
2/4/08	12.67	0.00	15	0	15	126	0	0	0	0
2/5/08	23.50	0.00	42	0	42	353	0	0	0	0
2/6/08	23.00	0.00	31	0	31	105	0	0	0	0
2/7/08	24.00	0.00	15	0	15	51	0	0	0	0
2/8/08	32.00	0.00	38	0	38	129	0	0	0	0
2/9/08	17.25	0.00	45	0	45	153	0	0	0	0
2/10/08	24.50	0.00	34	0	34	116	0	0	0	0
2/11/08	23.25	0.00	49	0	49	524	0	0	0	0
2/12/08	23.50	0.00	49	0	49	524	0	0	0	0
2/13/08	24.50	0.00	30	0	30	321	0	0	0	0
2/14/08	23.00	3.50	47	6	53	567	1	0	1	11
2/15/08	22.00	0.00	25	0	25	267	3	0	3	32
2/16/08	23.50	0.00	40	0	40	428	0	0	0	0
2/17/08	24.00	0.00	84	0	84	898	0	0	0	0
2/18/08	24.00	0.00	47	0	47	503	1	0	1	11
2/19/08	24.00	0.00	47	0	47	503	3	0	3	32
2/20/08	24.00	0.00	71	0	71	759	3	0	3	32
2/21/08	24.00	0.00	66	0	66	427	1	0	1	6
2/22/08	24.00	0.00	60	0	60	389	1	0	1	6
2/23/08	23.50	0.00	50	0	50	324	2	0	2	13
2/24/08	25.25	0.00	95	0	95	615	4	0	4	26
2/25/08	23.25	0.00	78	0	78	505	8	0	8	52
2/26/08	24.00	0.00	100	0	100	648	17	0	17	110
2/27/08	24.00	0.00	73	0	73	473	13	0	13	84
2/28/08	24.00	0.00	189	0	189	1,224	14	0	14	91
2/29/08	24.00	0.00	252	0	252	1,632	7	0	7	45
3/1/08	24.00	0.00	186	0	186	1,204	16	0	16	104
3/2/08	24.00	0.00	77	0	77	499	5	0	5	32
3/3/08	24.00	0.00	70	0	70	453	7	0	7	45

Continued on next page

Appendix E continued

Date	Time Fished		<u>Chum</u>				<u>Pink</u>			
	Hours		Catch		Migration	Catch		Migration		
	In	Out	Actual	Estimated		Actual	Estimated		Total	
3/4/08	24.00	0.00	124	0	124	803	8	0	8	52
3/5/08	24.00	0.00	71	0	71	460	12	0	12	78
3/6/08	24.00	0.00	97	0	97	495	13	0	13	66
3/7/08	24.00	0.00	114	0	114	582	15	0	15	77
3/8/08	24.00	0.00	109	0	109	556	20	0	20	102
3/9/08	24.50	0.00	133	0	133	679	10	0	10	51
3/10/08	23.50	0.00	262	0	262	1,337	30	0	30	153
3/11/08	18.50	5.00	115	30	145	740	9	3	12	61
3/12/08	0.00	24.50	0	145	145	740	0	12	12	61
3/13/08	23.00	0.00	129	0	129	658	12	0	12	61
3/14/08	25.00	0.00	185	0	185	944	14	0	14	71
3/15/08	23.50	0.00	64	0	64	327	28	0	28	143
3/16/08	25.00	0.00	161	0	161	822	23	0	23	117
3/17/08	23.50	0.00	118	0	118	354	25	0	25	75
3/18/08	24.00	0.00	133	0	133	399	33	0	33	99
3/19/08	24.00	0.00	131	0	131	682	36	0	36	187
3/20/08	24.00	0.00	124	0	124	646	49	0	49	255
3/21/08	24.00	0.00	238	0	238	1,239	81	0	81	422
3/22/08	23.00	0.00	141	0	141	734	40	0	40	208
3/23/08	19.00	8.25	72	72	144	750	10	13	23	120
3/24/08	21.75	0.00	246	0	246	1,281	58	0	58	302
3/25/08	24.50	0.00	133	0	133	693	37	0	37	193
3/26/08	23.00	0.00	158	0	158	823	31	0	31	161
3/27/08	24.50	0.00	123	0	123	640	54	0	54	281
3/28/08	23.00	0.00	68	0	68	354	58	0	58	302
3/29/08	25.00	0.00	113	0	113	588	71	0	71	370
3/30/08	24.00	0.00	72	0	72	375	31	0	31	161
3/31/08	24.00	0.00	103	0	103	536	65	0	65	338
4/1/08	24.50	0.00	174	0	174	906	62	0	62	323
4/2/08	25.00	0.00	177	0	177	922	121	0	121	630
4/3/08	23.00	0.00	199	0	199	1,036	156	0	156	812
4/4/08	24.00	0.00	319	0	319	1,661	201	0	201	1,047
4/5/08	0.00	24.00	0	258	258	1,343	0	176	176	916
4/6/08	0.00	24.00	0	258	258	1,343	0	176	176	916
4/7/08	0.00	24.00	0	258	258	1,343	0	176	176	916

Continued on next page

Appendix E continued

Date	Time Fished		<u>Chum</u>			Migration	<u>Pink</u>			Migration
	Hours		Catch		Total		Catch		Total	
	In	Out	Actual	Estimated			Actual	Estimated		
4/8/08	0.00	24.00	0	258	258	1,343	0	176	176	916
4/9/08	25.00	0.00	205	0	205	1,067	157	0	157	817
4/10/08	27.00	0.00	158	0	158	823	130	0	130	677
4/11/08	24.00	0.00	162	0	162	844	127	0	127	661
4/12/08	27.50	0.00	3	0	3	16	6	0	6	31
4/13/08	23.50	0.00	752	0	752	3,916	271	0	271	1,411
4/14/08	21.00	0.00	17	0	17	89	15	0	15	78
4/15/08	24.50	0.00	785	0	785	4,087	315	0	315	1,640
4/16/08	24.50	0.00	569	0	569	2,963	235	0	235	1,224
4/17/08	25.00	0.00	780	0	780	4,061	284	0	284	1,479
4/18/08	24.75	0.00	424	0	424	2,208	262	0	262	1,364
4/19/08	25.25	0.00	462	0	462	2,406	378	0	378	1,968
4/20/08	22.50	0.00	565	0	565	2,942	278	0	278	1,448
4/21/08	24.75	0.00	490	0	490	2,551	189	0	189	984
4/22/08	23.75	0.00	809	0	809	4,212	314	0	314	1,635
4/23/08	24.00	0.00	602	0	602	3,135	240	0	240	1,250
4/24/08	24.00	0.00	582	0	582	3,030	177	0	177	922
4/25/08	24.00	0.00	711	0	711	3,702	340	0	340	1,770
4/26/08	24.33	0.00	330	0	330	1,718	189	0	189	984
4/27/08	23.17	0.00	316	0	316	1,645	151	0	151	786
4/28/08	22.75	0.00	497	0	497	2,588	166	0	166	864
4/29/08	25.75	0.00	268	0	268	1,395	38	0	38	198
4/30/08	0.00	24.00	0	360	360	1,874	0	36	36	187
5/1/08	0.00	24.00	0	360	360	1,874	0	36	36	187
5/2/08	8.42	15.00	159	225	384	1,999	15	22	37	193
5/3/08	23.83	0.00	467	0	467	2,432	36	0	36	187
5/4/08	24.00	0.00	530	0	530	2,760	27	0	27	141
5/5/08	0.00	23.75	0	835	835	4,348	0	62	62	323
5/6/08	23.50	0.00	1,134	0	1,134	5,905	97	0	97	505
5/7/08	22.00	0.00	42	0	42	219	1	0	1	5
5/8/08	21.57	0.00	60	0	60	312	2	0	2	10
5/9/08	27.93	0.00	75	0	75	391	3	0	3	16
5/10/08	21.50	0.00	103	0	103	536	2	0	2	10
5/11/08	22.50	0.00	67	0	67	349	0	0	0	0
5/12/08	30.00	0.00	774	0	774	4,030	6	0	6	31

Continued on next page

Appendix E continued

Date	Time Fished		<u>Chum</u>			<u>Pink</u>			Migration	
	Hours		Catch		Migration	Catch		Migration		
	In	Out	Actual	Estimated		Actual	Estimated			Total
5/13/08	23.08	0.00	153	0	153	797	1	0	1	5
5/14/08	23.67	0.00	317	0	317	1,651	0	0	0	0
5/15/08	18.25	0.00	6	0	6	31	0	0	0	0
5/16/08	0.00	30.00	0	34	34	177	0	0	0	0
5/17/08	0.00	25.00	0	28	28	146	0	0	0	0
5/18/08	0.00	24.00	0	27	27	141	0	0	0	0
5/19/08	0.00	24.00	0	27	27	141	0	0	0	0
5/20/08	0.00	24.00	0	27	27	141	0	0	0	0
5/21/08	0.00	24.00	0	27	27	141	0	0	0	0
5/22/08	0.00	23.00	0	26	26	135	0	0	0	0
5/23/08	23.00	0.00	44	0	44	229	0	0	0	0
5/24/08	25.42	0.00	29	0	29	151	0	0	0	0
5/25/08	23.58	0.00	21	0	21	109	0	0	0	0
5/26/08	22.67	0.00	28	0	28	146	0	0	0	0
5/27/08	25.00	0.00	41	0	41	213	0	0	0	0
5/28/08	24.75	0.00	41	0	41	213	0	0	0	0
5/29/08	23.33	0.00	26	0	26	135	0	0	0	0
5/30/08	19.67	0.00	23	0	23	120	0	0	0	0
5/31/08	29.83	0.00	26	0	26	135	0	0	0	0
6/1/08	23.00	0.00	10	0	10	52	0	0	0	0
6/2/08	21.50	0.00	16	0	16	83	0	0	0	0
6/3/08	27.25	0.00	6	0	6	31	0	0	0	0
6/4/08	22.00	0.00	19	0	19	99	0	0	0	0
6/5/08	22.00	0.00	20	0	20	104	0	0	0	0
6/6/08	26.25	0.00	16	0	16	83	0	0	0	0
6/7/08	22.75	0.00	13	0	13	68	2	0	2	10
6/8/08	26.00	0.00	26	0	26	135	0	0	0	0
6/9/08	23.00	0.00	16	0	16	83	0	0	0	0
6/10/08	25.25	0.00	13	0	13	68	1	0	1	5
Total	2763.75	404.00	20,371	3,274	23,645	127,424	5,974	888	6,862	35,788

Appendix F

2009 Duckabush River daily catch and migration estimates for juvenile chum and pink salmon.

APPENDIX F.—Daily catches of juvenile chum salmon caught in the Duckabush River screw trap in 2009. Total catch represents actual and estimated catch for a given day. Time in and out reflect time fished (in) and not fished (out) on a given day.

Date	Time Fished		<u>Chum</u>			Migration
	In	Out	Actual	Estimated	Total	
1/31/09	19.00	0.00	251	0	251	991
2/1/09	25.00	0.00	324	0	324	1,279
2/2/09	23.00	0.00	339	0	339	1,338
2/3/09	24.00	0.00	493	0	493	1,946
2/4/09	24.00	0.00	531	0	531	2,096
2/5/09	24.00	0.00	572	0	572	2,258
2/6/09	32.50	0.00	868	0	868	3,427
2/7/09	15.50	0.00	749	0	749	2,957
2/8/09	25.00	0.00	369	0	369	1,457
2/9/09	23.00	0.00	354	0	354	1,397
2/10/09	32.50	0.00	618	0	618	2,440
2/11/09	15.50	0.00	846	0	846	3,340
2/12/09	24.00	0.00	522	0	522	2,061
2/13/09	24.00	0.00	628	0	628	2,479
2/14/09	24.00	0.00	848	0	848	3,348
2/15/09	24.00	0.00	1,038	0	1,038	4,098
2/16/09	24.00	0.00	1,001	0	1,001	3,952
2/17/09	23.50	0.00	1,228	0	1,228	4,848
2/18/09	33.00	0.00	1,127	0	1,127	4,449
2/19/09	15.50	0.00	848	0	848	3,348
2/20/09	24.00	0.00	1,330	0	1,330	5,250
2/21/09	24.00	0.00	1,144	0	1,144	4,516
2/22/09	25.00	0.00	2,021	0	2,021	7,978
2/23/09	23.00	0.00	2,722	0	2,722	10,745
2/24/09	23.00	0.00	1,814	0	1,814	7,161
2/25/09	24.00	0.00	427	0	427	3,638
2/26/09	25.00	0.00	1,003	0	1,003	8,546
2/27/09	24.00	0.00	1,554	0	1,554	13,241
2/28/09	24.00	0.00	1,823	0	1,823	15,533
3/1/09	25.00	0.00	2,833	0	2,833	24,140
3/2/09	18.00	5.00	848	153	1,001	8,529
3/3/09	0.00	28.50	0	872	872	7,430
3/4/09	27.50	0.00	549	0	549	4,678
3/5/09	16.00	0.00	538	0	538	4,584

Continued on next page

Appendix F continued

Date	Time Fished		Actual	<u>Chum</u>		Migration
	Hours			Catch		
	In	Out		Estimated	Total	
3/6/09	23.00	0.00	2,131	0	2,131	18,158
3/7/09	25.00	0.00	1,755	0	1,755	11,958
3/8/09	24.00	0.00	1,484	0	1,484	10,111
3/9/09	24.00	0.00	930	0	930	6,337
3/10/09	24.00	0.00	780	0	780	5,315
3/11/09	24.00	0.50	763	19	782	5,328
3/12/09	23.50	0.00	1,076	0	1,076	7,331
3/13/09	24.00	0.00	1,285	0	1,285	8,755
3/14/09	24.00	0.00	2,338	0	2,338	15,930
3/15/09	24.00	0.00	2,674	0	2,674	18,219
3/16/09	34.50	0.00	1,207	0	1,207	8,224
3/17/09	13.50	0.00	1,563	0	1,563	19,733
3/18/09	24.00	0.00	1,831	0	1,831	23,116
3/19/09	34.50	0.00	2,511	0	2,511	11,984
3/20/09	13.50	0.00	2,550	0	2,550	12,170
3/21/09	24.00	0.00	1,130	0	1,130	14,266
3/22/09	25.00	0.00	1,024	0	1,024	12,928
3/23/09	23.00	0.00	1,135	0	1,135	7,461
3/24/09	24.00	0.00	1,963	0	1,963	12,904
3/25/09	34.50	0.00	2,412	0	2,412	15,856
3/26/09	13.50	0.00	2,217	0	2,217	14,574
3/27/09	24.00	0.00	2,174	0	2,174	14,291
3/28/09	24.00	0.00	2,298	0	2,298	15,107
3/29/09	25.00	0.00	2,281	0	2,281	14,995
3/30/09	23.00	0.00	2,017	0	2,017	13,259
3/31/09	24.00	0.00	2,120	0	2,120	13,936
4/1/09	26.00	0.00	2,222	0	2,222	14,607
4/2/09	24.00	0.00	1,620	0	1,620	10,650
4/3/09	24.00	0.00	940	0	940	6,179
4/4/09	24.00	0.00	1,270	0	1,270	8,349
4/5/09	24.00	0.00	1,126	0	1,126	7,402
4/6/09	24.00	0.00	1,561	0	1,561	10,262
4/7/09	24.00	0.00	546	0	546	3,589
4/8/09	24.00	0.00	700	0	700	4,602
4/9/09	24.00	0.00	414	0	414	2,722
4/10/09	24.00	0.00	720	0	720	4,733

Continued on next page

Appendix F continued

Date	Time Fished		Actual	<u>Chum</u>		Migration
	Hours			Catch		
	In	Out		Estimated	Total	
4/11/09	24.00	0.00	546	0	546	3,589
4/12/09	30.00	0.00	817	0	817	5,371
4/13/09	0.00	24.50	0	408	408	2,682
4/14/09	17.50	0.00	13	0	13	85
4/15/09	24.00	0.00	146	0	146	960
4/16/09	24.00	0.00	16	0	16	105
4/17/09	24.00	0.00	111	0	111	730
4/18/09	24.00	0.00	3	0	3	20
4/19/09	24.00	0.00	350	0	350	2,301
4/20/09	24.00	0.00	117	0	117	769
4/21/09	24.00	0.00	6	0	6	39
4/22/09	24.00	0.00	10	0	10	66
4/23/09	24.00	0.00	12	0	12	79
4/24/09	24.00	0.00	3	0	3	20
4/25/09	24.00	0.00	146	0	146	960
4/26/09	24.00	0.00	112	0	112	736
4/27/09	24.00	0.00	273	0	273	1,795
4/28/09	24.00	0.00	51	0	51	335
4/29/09	24.00	0.00	135	0	135	887
4/30/09	24.00	0.00	118	0	118	776
5/1/09	24.00	0.00	64	0	64	421
5/2/09	24.00	0.00	71	0	71	467
5/3/09	24.00	0.00	10	0	10	66
5/4/09	24.00	0.00	3	0	3	20
5/5/09	31.00	0.00	0	0	0	0
5/6/09	0.00	17.00	0	4	4	26
5/7/09	0.00	24.00	0	5	5	33
5/8/09	0.00	24.00	0	5	5	33
5/9/09	0.00	24.00	0	5	5	33
5/10/09	0.00	31.00	0	6	6	39
5/11/09	17.00	0.00	1	0	1	7
5/12/09	24.00	0.00	0	0	0	0
5/13/09	24.00	0.00	0	0	0	0
5/14/09	24.00	0.00	0	0	0	0
5/15/09	24.00	0.00	0	0	0	0
5/16/09	24.00	0.00	0	0	0	0

Continued on next page

Appendix F continued

Date	Time Fished		Actual	<u>Chum</u>		Migration
	Hours			Catch		
	In	Out		Estimated	Total	
5/17/09	24.00	0.00	0	0	0	0
5/18/09	24.00	0.00	0	0	0	0
5/19/09	24.00	0.00	0	0	0	0
5/20/09	24.00	0.00	0	0	0	0
5/21/09	24.00	0.00	1	0	1	7
5/22/09	24.00	0.00	0	0	0	0
5/23/09	24.00	0.00	0	0	0	0
5/24/09	24.00	0.00	0	0	0	0
5/25/09	24.00	0.00	0	0	0	0
5/26/09	24.00	0.00	0	0	0	0
5/27/09	24.00	0.00	0	0	0	0
5/28/09	24.00	0.00	0	0	0	0
5/29/09	0.00	24.00	0	0	0	0
5/30/09	0.00	24.00	0	0	0	0
5/31/09	0.00	27.00	0	0	0	0
6/1/09	21.00	0.00	0	0	0	0
6/2/09	24.00	0.00	0	0	0	0
6/3/09	24.00	0.00	0	0	0	0
6/4/09	24.00	0.00	0	0	0	0
6/5/09	24.00	0.00	0	0	0	0
6/6/09	24.00	0.00	0	0	0	0
6/7/09	24.00	0.00	0	0	0	0
6/8/09	24.00	0.00	0	0	0	0
6/9/09	24.00	0.00	0	0	0	0
6/10/09	24.00	0.00	0	0	0	0
6/11/09	24.00	0.00	0	0	0	0
6/12/09	24.00	0.00	0	0	0	0
6/13/09	24.00	0.00	0	0	0	0
6/14/09	24.00	0.00	0	0	0	0
6/15/09	24.00	0.00	0	0	0	0
6/16/09	28.00	0.00	0	0	0	0
Total	3035.50	253.50	92,063	1,477	93,540	608,276

Appendix G

2010 Duckabush River daily catch and migration estimates for juvenile chum and pink salmon

APPENDIX G.— Daily catches of juvenile chum and pink salmon caught in the Duckabush River screw trap in 2010. Total catch represents actual and estimated catch for a given day. Chum migration was not estimated due to a late start in the trapping season. Time in and out reflect time fished (in) and not fished (out) on a given day.

Date	Time Fished		<u>Chum</u>			Migration	<u>Pink</u>			Migration
	Hours		Catch		Total		Catch		Total	
	In	Out	Actual	Estimated			Actual	Estimated		
3/3/10	24.00	0.00	149	0	149		8	0	8	68
3/4/10	24.00	0.00	187	0	187		0	0	0	0
3/5/10	24.00	0.00	162	0	162		0	0	0	0
3/6/10	24.00	0.00	90	0	90		32	0	32	273
3/7/10	24.00	0.00	112	0	112		21	0	21	179
3/8/10	0.00	24.00	0	0	0		0	26	26	177
3/9/10	24.00	0.00	84	0	84		30	0	30	204
3/10/10	24.00	0.00	88	0	88		19	0	19	129
3/11/10	24.00	0.00	68	0	68		19	0	19	129
3/12/10	0.00	24.00	0	0	0		0	14	14	95
3/13/10	24.00	0.00	78	0	78		9	0	9	61
3/14/10	24.00	0.00	48	0	48		14	0	14	95
3/15/10	24.00	0.00	39	0	39		21	0	21	143
3/16/10	24.00	0.00	72	0	72		46	0	46	313
3/17/10	24.00	0.00	20	0	20		7	0	7	48
3/18/10	24.00	0.00	76	0	76		22	0	22	278
3/19/10	0.00	24.00	0	0	0		0	37	37	467
3/20/10	24.00	0.00	67	0	67		51	0	51	243
3/21/10	24.00	0.00	70	0	70		23	0	23	110
3/22/10	24.00	0.00	43	0	43		3	0	3	38
3/23/10	24.00	0.00	39	0	39		65	0	65	821
3/24/10	24.00	0.00	79	0	79		42	0	42	276
3/25/10	24.00	0.00	91	0	91		133	0	133	874
3/26/10	24.00	0.00	43	0	43		96	0	96	631
3/27/10	24.00	0.00	20	0	20		91	0	91	598
3/28/10	24.00	0.00	41	0	41		113	0	113	743
3/29/10	0.00	24.00	0	0	0		0	60	60	394
3/30/10	23.00	0.00	26	0	26		6	0	6	39
3/31/10	25.00	0.00	32	0	32		17	0	17	112
4/1/10	24.00	0.00	118	0	118		67	0	67	440
4/2/10	24.00	0.00	62	0	62		55	0	55	362
4/3/10	0.00	25.50	0	0	0		0	73	73	480

Continued on next page

Appendix G continued.

Date	Time Fished		<u>Chum</u>			<u>Pink</u>			Migration
	Hours		Catch		Migration	Catch		Migration	
	In	Out	Actual	Estimated		Actual	Estimated		
4/4/10	22.50	0.00	73	0	73	78	0	78	513
4/5/10	24.00	0.00	53	0	53	49	0	49	322
4/6/10	24.00	0.00	48	0	48	29	0	29	191
4/7/10	24.00	0.00	35	0	35	131	0	131	861
4/8/10	24.00	0.00	47	0	47	69	0	69	454
4/9/10	24.00	0.00	24	0	24	87	0	87	572
4/10/10	24.00	0.00	46	0	46	53	0	53	348
4/11/10	24.00	0.00	38	0	38	76	0	76	500
4/12/10	0.00	24.00	0	0	0	0	132	132	868
4/13/10	24.00	0.00	70	0	70	188	0	188	1,236
4/14/10	24.00	0.00	43	0	43	83	0	83	546
4/15/10	24.00	0.00	44	0	44	111	0	111	730
4/16/10	24.00	0.00	38	0	38	62	0	62	408
4/17/10	24.00	0.00	45	0	45	94	0	94	618
4/18/10	24.00	0.00	10	0	10	1	0	1	7
4/19/10	24.00	0.00	13	0	13	1	0	1	7
4/20/10	24.00	0.00	10	0	10	28	0	28	184
4/21/10	24.00	0.00	11	0	11	12	0	12	79
4/22/10	24.00	0.00	7	0	7	8	0	8	53
4/23/10	24.00	0.00	2	0	2	3	0	3	20
4/24/10	0.00	24.00	0	0	0	0	3	3	20
4/25/10	24.00	0.00	7	0	7	2	0	2	13
4/26/10	24.00	0.00	27	0	27	16	0	16	105
4/27/10	0.00	24.00	0	0	0	0	9	9	59
4/28/10	0.00	24.00	0	0	0	0	9	9	59
4/29/10	0.00	27.50	0	0	0	0	10	10	66
4/30/10	20.50	0.00	0	0	0	1	0	1	7
5/1/10	24.00	0.00	6	0	6	0	0	0	0
5/2/10	24.00	0.00	1	0	1	2	0	2	13
5/3/10	24.00	0.00	4	0	4	1	0	1	7
5/4/10	24.00	0.00	3	0	3	4	0	4	26
5/5/10	24.00	0.00	1	0	1	0	0	0	0
5/6/10	24.00	0.00	0	0	0	0	0	0	0
5/7/10	24.00	0.00	0	0	0	0	0	0	0
5/8/10	24.00	0.00	3	0	3	1	0	1	7

Continued on next page

Appendix G continued.

Date	Time Fished		<u>Chum</u>			<u>Pink</u>			Migration	
	Hours		Catch		Migration	Catch		Migration		
	In	Out	Actual	Estimated		Actual	Estimated			Total
5/9/10	24.00	0.00	3	0	3	1	0	1	7	
5/10/10	24.00	0.00	0	0	0	1	0	1	7	
5/11/10	24.00	0.00	3	0	3	1	0	1	7	
5/12/10	24.00	0.00	3	0	3	0	0	0	0	
5/13/10	24.00	0.00	0	0	0	1	0	1	7	
5/14/10	24.00	0.00	0	0	0	0	0	0	0	
5/15/10	24.00	0.00	0	0	0	0	0	0	0	
5/16/10	24.00	0.00	3	0	3	1	0	1	7	
5/17/10	24.00	0.00	1	0	1	0	0	0	0	
5/18/10	24.00	0.00	0	0	0	0	0	0	0	
5/19/10	24.00	0.00	0	0	0	0	0	0	0	
Total	1627.00	245.00	2,726	0	0	0	2,205	373	2,578	17,750

Appendix H

2002 Hamma Hamma River daily catch and migration estimates for juvenile chum, Chinook, and pink salmon

APPENDIX H.—Daily catches of juvenile chum, Chinook, and pink salmon caught in the Hamma Hamma River screw trap in 2002. Catch represents actual and estimated catch for a given day. Time in and out reflect time fished (in) and not fished (out) on a given day.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>			<u>Pink</u>			Migration	
	Hours		Catch			Migration			Catch				
	In	Out	Actual	Estimated	Total	Actual	Estimated	Total	Actual	Estimated	Total		
1/28/02	3.00	0.00	0	0	0	0	0	0	0	0	0	0	0
1/29/02	28.00	0.00	2	0	2	53	0	0	0	0	0	0	0
1/30/02	17.00	0.00	5	0	5	132	0	0	0	0	3	0	3
1/31/02	32.00	0.00	2	0	2	53	0	0	0	0	6	0	6
2/1/02	24.00	0.00	19	0	19	501	0	0	0	0	21	0	21
2/2/02	24.00	0.00	22	0	22	580	0	0	0	0	13	0	13
2/3/02	14.00	0.00	0	0	0	0	0	0	0	0	0	0	0
2/4/02	34.00	0.00	11	0	11	290	0	0	0	0	8	0	8
2/5/02	24.00	0.00	0	0	0	0	0	0	0	0	5	0	5
2/6/02	14.00	0.00	7	0	7	185	0	0	0	0	21	0	21
2/7/02	37.50	0.00	1	0	1	26	0	0	0	0	8	0	8
2/8/02	20.50	0.00	4	0	4	105	0	0	0	0	0	0	0
2/9/02	24.00	0.00	7	0	7	185	0	0	0	0	5	0	5
2/10/02	24.00	0.00	2	0	2	53	0	0	0	0	0	0	0
2/11/02	24.00	0.00	17	0	17	448	0	0	0	0	10	0	10
2/12/02	17.00	0.00	19	0	19	501	0	0	0	0	5	0	5
2/13/02	31.00	0.00	5	0	5	132	0	0	0	0	2	0	2
2/14/02	25.00	0.00	8	0	8	211	0	0	0	0	6	0	6
2/15/02	16.00	0.00	24	0	24	633	2	0	2	53	2	0	2
2/16/02	23.00	0.00	24	0	24	633	0	0	0	0	12	0	12
2/17/02	24.00	0.00	23	0	23	606	0	0	0	0	11	0	11
2/18/02	32.00	0.00	20	0	20	527	1	0	1	26	15	0	15
2/19/02	24.00	0.00	12	0	12	316	3	0	3	79	16	0	16
2/20/02	24.00	0.00	4	0	4	105	3	0	3	79	27	0	27
2/21/02	24.00	0.00	6	0	6	158	2	0	2	53	15	0	15
2/22/02	15.50	0.00	4	0	4	105	0	0	0	0	0	0	0
2/23/02	34.00	0.00	48	0	48	1,266	1	0	1	26	15	0	15
2/24/02	22.00	0.00	4	0	4	105	1	0	1	26	2	0	2
2/25/02	17.00	0.00	1	0	1	26	7	0	7	185	1	0	1
2/26/02	31.50	0.00	2	0	2	53	1	0	1	26	31	0	31
2/27/02	24.00	0.00	14	0	14	369	2	0	2	53	69	0	69
2/28/02	23.00	0.00	3	0	3	79	2	0	2	53	84	0	84
3/1/02	17.00	0.00	6	0	6	158	0	0	0	0	44	0	44

Continued on next page

Appendix H continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>				<u>Pink</u>			
	Hours		Catch			Migration	Catch			Migration	Catch			Migration
	In	Out	Actual	Estimated	Total		Actual	Estimated	Total		Actual	Estimated	Total	
3/2/02	32.00	0.00	3	0	3	79	0	0	0	0	62	0	62	1,635
3/3/02	24.00	0.00	8	0	8	211	0	0	0	0	32	0	32	844
3/4/02	25.50	0.00	1	0	1	26	3	0	3	79	62	0	62	1,635
3/5/02	22.50	0.00	28	0	28	738	0	0	0	0	143	0	143	3,771
3/6/02	26.00	0.00	21	0	21	554	0	0	0	0	109	0	109	2,874
3/7/02	21.00	0.00	9	0	9	237	0	0	0	0	179	0	179	4,720
3/8/02	25.00	0.00	7	0	7	53	0	0	0	0	99	0	99	751
3/9/02	24.00	0.00	5	0	5	38	0	0	0	0	97	0	97	735
3/10/02	24.00	0.00	7	0	7	53	0	0	0	0	45	0	45	341
3/11/02	24.00	0.00	141	0	141	1,069	3	0	3	23	90	0	90	682
3/12/02	24.00	0.00	148	0	148	1,122	0	0	0	0	42	0	42	318
3/13/02	24.00	0.00	28	0	28	212	2	0	2	15	44	0	44	334
3/14/02	24.00	0.00	27	0	27	205	2	0	2	15	19	0	19	144
3/15/02	24.00	0.00	42	0	42	318	2	0	2	15	180	0	180	1,365
3/16/02	24.00	0.00	14	0	14	106	2	0	2	15	106	0	106	804
3/17/02	24.00	0.00	11	0	11	83	3	0	3	23	169	0	169	1,281
3/18/02	24.00	0.00	63	0	63	478	11	0	11	83	329	0	329	2,494
3/19/02	24.00	0.00	40	0	40	303	1	0	1	8	108	0	108	819
3/20/02	24.00	0.00	55	0	55	417	10	0	10	76	180	0	180	1,365
3/21/02	24.00	0.00	73	0	73	553	14	0	14	106	190	0	190	1,440
3/22/02	24.00	0.00	130	0	130	1,386	0	0	0	0	329	0	329	3,507
3/23/02	24.00	0.00	147	0	147	1,567	0	0	0	0	342	0	342	3,646
3/24/02	24.00	0.00	100	0	100	1,066	1	0	1	11	172	0	172	1,833
3/25/02	24.00	0.00	102	0	102	1,087	1	0	1	11	337	0	337	3,592
3/26/02	24.00	0.00	102	0	102	1,087	0	0	0	0	510	0	510	5,436
3/27/02	24.00	0.00	87	0	87	927	4	0	4	43	181	0	181	1,929
3/28/02	24.00	0.00	36	0	36	384	0	0	0	0	424	0	424	4,520
3/29/02	24.00	0.00	211	0	211	2,249	0	0	0	0	772	0	772	8,229
3/30/02	24.00	0.00	768	0	768	8,187	0	0	0	0	936	0	936	9,977
3/31/02	24.00	0.00	666	0	666	7,099	6	0	6	64	589	0	589	6,278
4/1/02	24.00	0.00	399	0	399	4,253	0	0	0	0	485	0	485	5,170
4/2/02	24.00	0.00	699	0	699	7,451	1	0	1	11	736	0	736	7,845
4/3/02	24.00	0.00	260	0	260	2,771	1	0	1	11	300	0	300	3,198
4/4/02	24.00	0.00	656	0	656	6,993	1	0	1	11	1258	0	1258	13,410
4/5/02	24.00	0.00	699	0	699	12,076	0	0	0	0	1266	0	1266	13,495
4/6/02	24.00	0.00	537	0	537	9,277	0	0	0	0	1265	0	1265	13,484

Continued on next page

Appendix H continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>				<u>Pink</u>			
	Hours		Catch			Migration	Catch			Migration	Catch			Migration
	In	Out	Actual	Estimated	Total		Actual	Estimated	Total		Actual	Estimated	Total	
4/7/02	24.00	0.00	777	0	777	13,423	0	0	0	0	1217	0	1217	12,973
4/8/02	24.00	0.00	745	0	745	12,871	0	0	0	0	811	0	811	8,645
4/9/02	24.00	0.00	755	0	755	13,043	0	0	0	0	888	0	888	9,466
4/10/02	24.00	0.00	179	0	179	3,092	0	0	0	0	72	0	72	767
4/11/02	24.00	0.00	671	0	671	11,592	0	0	0	0	493	0	493	5,255
4/12/02	24.00	0.00	333	0	333	5,753	10	0	10	173	730	0	730	12,611
4/13/02	24.00	0.00	607	0	607	6,336	2	0	2	35	244	0	244	4,215
4/14/02	24.00	0.00	52	0	52	543	6	0	6	104	44	0	44	760
4/15/02	24.00	0.00	236	0	236	2,463	4	0	4	69	49	0	49	847
4/16/02	24.00	0.00	132	0	132	1,378	0	0	0	0	31	0	31	536
4/17/02	24.00	0.00	200	0	200	2,088	1	0	1	17	46	0	46	795
4/18/02	24.00	0.00	734	0	734	7,661	1	0	1	17	219	0	219	3,783
4/19/02	24.00	0.00	446	0	446	4,655	0	0	0	0	35	0	35	605
4/20/02	24.00	0.00	855	0	855	8,924	0	0	0	0	128	0	128	2,211
4/21/02	24.00	0.00	1,272	0	1,272	13,277	0	0	0	0	236	0	236	4,077
4/22/02	24.00	0.00	970	0	970	10,124	0	0	0	0	113	0	113	1,952
4/23/02	24.00	0.00	1,762	0	1,762	18,391	0	0	0	0	270	0	270	4,664
4/24/02	24.00	0.00	730	0	730	7,619	3	0	3	31	262	0	262	2,735
4/25/02	16.00	0.00	735	0	735	24,939	0	0	0	0	240	0	240	2,505
4/26/02	32.00	0.00	931	0	931	31,590	0	0	0	0	280	0	280	2,923
4/27/02	24.00	0.00	2,779	0	2,779	94,294	3	0	3	31	91	0	91	950
4/28/02	24.00	0.00	4,447	0	4,447	150,891	7	0	7	73	105	0	105	1,096
4/29/02	24.00	0.00	5,389	0	5,389	182,854	6	0	6	63	186	0	186	1,941
4/30/02	24.00	0.00	2,769	0	2,769	93,955	7	0	7	73	48	0	48	501
5/1/02	25.00	0.00	1,306	0	1,306	44,314	0	0	0	0	9	0	9	305
5/2/02	24.00	0.00	417	0	417	14,149	0	0	0	0	7	0	7	238
5/3/02	24.00	0.00	797	0	797	27,043	0	0	0	0	19	0	19	645
5/4/02	24.00	0.00	373	0	373	12,656	0	0	0	0	9	0	9	305
5/5/02	24.00	0.00	504	0	504	17,101	5	0	5	170	20	0	20	679
5/6/02	24.00	0.00	621	0	621	21,071	2	0	2	68	13	0	13	441
5/7/02	24.00	0.00	450	0	450	15,269	1	0	1	34	5	0	5	170
5/8/02	14.00	0.00	189	0	189	6,413	0	0	0	0	0	0	0	0
5/9/02	34.00	0.00	143	0	143	4,852	2	0	2	68	6	0	6	204
5/10/02	24.00	0.00	489	0	489	16,592	4	0	4	136	7	0	7	238
5/11/02	24.00	0.00	168	0	168	5,700	0	0	0	0	1	0	1	34
5/12/02	14.00	0.00	59	0	59	2,002	5	0	5	170	2	0	2	68

Continued on next page

Appendix H continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>				<u>Pink</u>			
	Hours	In	Out	Catch		Migration	Catch		Migration	Catch		Migration		
				Actual	Estimated		Actual	Estimated		Actual	Estimated			
5/13/02	24.00	0.00	64	0	64	2,172	0	0	0	0	0	0	0	0
5/14/02	34.00	0.00	135	0	135	4,581	3	0	3	102	6	0	6	204
5/15/02	24.00	0.00	64	0	64	2,172	2	0	2	68	0	0	0	0
5/16/02	24.00	0.00	21	0	21	713	0	0	0	0	0	0	0	0
5/17/02	24.00	0.00	139	0	139	4,716	1	0	1	34	1	0	1	34
5/18/02	24.00	0.00	9	0	9	305	0	0	0	0	0	0	0	0
5/19/02	24.00	0.00	8	0	8	271	0	0	0	0	0	0	0	0
5/20/02	24.00	0.00	14	0	14	475	2	0	2	68	0	0	0	0
5/21/02	24.00	0.00	11	0	11	373	0	0	0	0	0	0	0	0
5/22/02	14.00	0.00	4	0	4	136	1	0	1	34	0	0	0	0
5/23/02	34.00	0.00	2	0	2	68	0	0	0	0	0	0	0	0
5/24/02	14.00	0.00	1	0	1	34	1	0	1	34	0	0	0	0
5/25/02	24.00	0.00	2	0	2	68	0	0	0	0	0	0	0	0
5/26/02	24.00	0.00	5	0	5	170	1	0	1	34	0	0	0	0
5/27/02	24.00	0.00	2	0	2	68	0	0	0	0	0	0	0	0
5/28/02	24.00	0.00	14	0	14	475	1	0	1	34	0	0	0	0
5/29/02	24.00	0.00	7	0	7	238	9	0	9	305	0	0	0	0
5/30/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
5/31/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
6/1/02	0.00	0.00	0	0	0	34	0	0	0	0	0	0	0	0
6/2/02	48.00	0.00	2	0	2	34	5	0	5	170	0	0	0	0
6/3/02	24.00	0.00	0	0	0	0	2	0	2	68	0	0	0	0
6/4/02	24.00	0.00	0	0	0	0	1	0	1	34	0	0	0	0
6/5/02	24.00	0.00	2	0	2	68	1	0	1	34	0	0	0	0
6/6/02	24.00	0.00	0	0	0	0	1	0	1	34	0	0	0	0
6/7/02	24.00	0.00	0	0	0	0	2	0	2	68	0	0	0	0
6/8/02	24.00	0.00	3	0	3	102	5	0	5	170	0	0	0	0
6/9/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
6/10/02	24.00	0.00	0	0	0	0	2	0	2	68	0	0	0	0
6/11/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
6/12/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
6/13/02	24.00	0.00	0	0	0	0	1	0	1	34	0	0	0	0
6/14/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
6/15/02	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
6/16/02	48.00	0.00	0	0	0	0	1	0	1	34	0	0	0	0
6/17/02	24.00	0.00	0	0	0	0	4	0	4	136	0	0	0	0

Continued on next page

Appendix H continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>				<u>Pink</u>			
	Hours	In	Out	Catch		Migration	Catch		Migration	Catch		Migration		
				Actual	Estimated		Actual	Estimated		Actual	Estimated			
6/18/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
6/19/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
6/20/02	24.00	0.00	1	0	1	34	2	0	2	68	0	0	0	0
6/21/02	24.00	0.00	0	0	0	0	1	0	1	34	0	0	0	0
6/22/02	24.00	0.00	0	0	0	0	1	0	1	34	0	0	0	0
6/23/02	24.00	0.00	0	0	0	0	1	0	1	34	0	0	0	0
6/24/02	24.00	0.00	0	0	0	0	3	0	3	102	0	0	0	0
6/25/02	24.00	0.00	0	0	0	0	3	0	3	102	0	0	0	0
6/26/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
6/27/02	24.00	0.00	0	0	0	0	18	0	18	611	0	0	0	0
6/28/02	28.00	0.00	0	0	0	0	18	0	18	611	0	0	0	0
6/29/02	20.00	0.00	0	0	0	0	26	0	26	882	0	0	0	0
6/30/02	24.00	0.00	0	0	0	0	43	0	43	1,459	0	0	0	0
7/1/02	24.00	0.00	0	0	0	0	13	0	13	441	0	0	0	0
7/2/02	24.00	0.00	0	0	0	0	24	0	24	814	0	0	0	0
7/3/02	24.00	0.00	0	0	0	0	2	0	2	68	0	0	0	0
7/4/02	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
7/5/02	52.00	0.00	0	0	0	0	17	0	17	577	0	0	0	0
7/6/02	20.00	0.00	0	0	0	0	23	0	23	780	0	0	0	0
7/7/02	24.00	0.00	0	0	0	0	4	0	4	136	0	0	0	0
7/8/02	24.00	0.00	0	0	0	0	10	0	10	339	0	0	0	0
7/9/02	24.00	0.00	0	0	0	0	9	0	9	305	0	0	0	0
7/10/02	34.00	0.00	0	0	0	0	12	0	12	407	0	0	0	0
7/11/02	14.00	0.00	0	0	0	0	16	0	16	543	0	0	0	0
7/12/02	28.00	0.00	0	0	0	0	12	0	12	407	0	0	0	0
7/13/02	24.00	0.00	0	0	0	0	4	0	4	136	0	0	0	0
7/14/02	0.00	24.00	0	0	0	0	0	8	8	271	0	0	0	0
7/15/02	0.00	24.00	0	0	0	0	0	8	8	271	0	0	0	0
7/16/02	0.00	26.00	0	0	0	0	0	9	9	305	0	0	0	0
7/17/02	22.00	0.00	0	0	0	0	11	0	11	373	0	0	0	0
7/18/02	30.00	0.00	0	0	0	0	11	0	11	373	0	0	0	0
7/19/02	14.00	0.00	0	0	0	0	26	0	26	882	0	0	0	0
7/20/02	34.00	0.00	0	0	0	0	2	0	2	68	0	0	0	0
7/21/02	24.00	0.00	0	0	0	0	5	0	5	170	0	0	0	0
7/22/02	14.00	0.00	0	0	0	0	7	0	7	238	0	0	0	0
7/23/02	34.00	0.00	0	0	0	0	4	0	4	136	0	0	0	0

Continued on next page

Appendix H continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>				<u>Pink</u>			
	Hours		Catch			Migration	Catch			Migration	Catch			Migration
	In	Out	Actual	Estimated	Total		Actual	Estimated	Total		Actual	Estimated	Total	
7/24/02	14.00	0.00	0	0	0	0	38	0	38	1,289	0	0	0	0
7/25/02	28.00	0.00	0	0	0	0	6	0	6	204	0	0	0	0
7/26/02	20.00	0.00	0	0	0	0	5	0	5	170	0	0	0	0
7/27/02	34.00	0.00	0	0	0	0	3	0	3	102	0	0	0	0
7/28/02	14.00	0.00	0	0	0	0	2	0	2	68	0	0	0	0
7/29/02	34.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
7/30/02	24.00	0.00	0	0	0	0	1	0	1	34	0	0	0	0
8/1/02	38.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
8/2/02	28.00	0.00	0	0	0	0	1	0	1	34	0	0	0	0
8/3/02	20.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
8/4/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
8/5/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
8/6/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
8/7/02	28.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
8/8/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
8/9/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
8/10/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
8/11/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
8/12/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
8/13/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
8/14/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
8/15/02	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
8/16/02	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
8/17/02	48.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
8/18/02	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
8/19/02	48.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
Total	4801.00	74.00	41,188	0	41,188	1,009,539	592	25	617	18,047	19,587	0	19,587	236,329

Appendix I

2003 Hamma Hamma River daily catch and migration estimates for juvenile chum, Chinook, and pink salmon

APPENDIX I.—Daily catches of juvenile chum, Chinook, and pink salmon caught in the Hamma Hamma River screw trap in 2003. No time data are available for this year. Actual catch data are blank when no information was available. The estimated catch and migration could not be calculated based on the absence of time data and extended trap outages.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>		
	Hours		Catch			Migration		
	In	Out	Actual	Estimated	Total	Actual	Estimated	Total
1/7/03	-	-	0	0	0	0	0	0
1/8/03	-	-	1	0	1	0	0	0
1/9/03	-	-	1	0	1	0	0	0
1/10/03	-	-		0	0		0	0
1/11/03	-	-	1	0	1	0	0	0
1/12/03	-	-	0	0	0	0	0	0
1/13/03	-	-		0	0		0	0
1/14/03	-	-	2	0	2	0	0	0
1/15/03	-	-	0	0	0	0	0	0
1/16/03	-	-	1	0	1	0	0	0
1/17/03	-	-	3	0	3	0	0	0
1/18/03	-	-		0	0		0	0
1/19/03	-	-		0	0		0	0
1/20/03	-	-		0	0		0	0
1/21/03	-	-	1	0	1	0	0	0
1/22/03	-	-		0	0		0	0
1/23/03	-	-		0	0		0	0
1/24/03	-	-		0	0		0	0
1/25/03	-	-		0	0		0	0
1/26/03	-	-		0	0		0	0
1/27/03	-	-		0	0		0	0
1/28/03	-	-		0	0		0	0
1/29/03	-	-		0	0		0	0
1/30/03	-	-		0	0		0	0
1/31/03	-	-	13	0	13	2	0	2
2/1/03	-	-	12	0	12	6	0	6
2/2/03	-	-		0	0		0	0
2/3/03	-	-	16	0	16	2	0	2
2/4/03	-	-		0	0		0	0
2/5/03	-	-	7	0	7	5	0	5
2/6/03	-	-		0	0		0	0
2/7/03	-	-		0	0		0	0
2/8/03	-	-		0	0		0	0

Continued on next page

Appendix I continued.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>		
	Hours		Catch		Migration	Catch		Migration
	In	Out	Actual	Estimated	Total	Actual	Estimated	Total
2/9/03	-	-		0	0		0	0
2/10/03	-	-	0	0	0	2	0	2
2/11/03	-	-		0	0		0	0
2/12/03	-	-	1	0	1	1	0	1
2/13/03	-	-		0	0		0	0
2/14/03	-	-	24	0	24	1	0	1
2/15/03	-	-		0	0		0	0
2/16/03	-	-	106	0	106	13	0	13
2/17/03	-	-		0	0		0	0
2/18/03	-	-		0	0		0	0
2/19/03	-	-	69	0	69	12	0	12
2/20/03	-	-		0	0		0	0
2/21/03	-	-		0	0		0	0
2/22/03	-	-		0	0		0	0
2/23/03	-	-		0	0		0	0
2/24/03	-	-		0	0		0	0
2/25/03	-	-		0	0		0	0
2/26/03	-	-	20	0	20	6	0	6
2/27/03	-	-		0	0		0	0
2/28/03	-	-	119	0	119	1	0	1
3/1/03	-	-		0	0		0	0
3/2/03	-	-		0	0		0	0
3/3/03	-	-	452	0	452	0	0	0
3/4/03	-	-	247	0	247	5	0	5
3/5/03	-	-		0	0		0	0
3/6/03	-	-	868	0	868	3	0	3
3/7/03	-	-		0	0		0	0
3/8/03	-	-		0	0		0	0
3/9/03	-	-	743	0	743	6	0	6
3/10/03	-	-		0	0		0	0
3/11/03	-	-	322	0	322	0	0	0
3/12/03	-	-	361	0	361	0	0	0
3/13/03	-	-	64	0	64	0	0	0
3/14/03	-	-		0	0		0	0
3/15/03	-	-	103	0	103	0	0	0
3/16/03	-	-	40	0	40	0	0	0

Continued on next page

Appendix I continued.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>		
	Hours		Catch		Migration	Catch		Migration
	In	Out	Actual	Estimated	Total	Actual	Estimated	Total
3/17/03	-	-	13	0	13	0	0	0
3/18/03	-	-	96	0	96	0	0	0
3/19/03	-	-	161	0	161	0	0	0
3/20/03	-	-	23	0	23	0	0	0
3/21/03	-	-	175	0	175	0	0	0
3/22/03	-	-	0	0	0	0	0	0
3/23/03	-	-	137	0	137	0	0	0
3/24/03	-	-	1	0	1	0	0	0
3/25/03	-	-	102	0	102	0	0	0
3/26/03	-	-		0	0		0	0
3/27/03	-	-	397	0	397	0	0	0
3/28/03	-	-	407	0	407	0	0	0
3/29/03	-	-	616	0	616	0	0	0
3/30/03	-	-	916	0	916	0	0	0
3/31/03	-	-		0	0		0	0
4/1/03	-	-	910	0	910	0	0	0
4/2/03	-	-	523	0	523	0	0	0
4/3/03	-	-	892	0	892	0	0	0
4/4/03	-	-	0	0	0	0	0	0
4/5/03	-	-	634	0	634	0	0	0
4/6/03	-	-	916	0	916	0	0	0
4/7/03	-	-	559	0	559	0	0	0
4/8/03	-	-	474	0	474	0	0	0
4/9/03	-	-		0	0		0	0
4/10/03	-	-		0	0		0	0
4/11/03	-	-	0	0	0	0	0	0
4/12/03	-	-		0	0		0	0
4/13/03	-	-	1,631	0	1,631	0	0	0
4/14/03	-	-		0	0		0	0
4/15/03	-	-	2,306	0	2,306	0	0	0
4/16/03	-	-	3,288	0	3,288	0	0	0
4/17/03	-	-		0	0		0	0
4/18/03	-	-		0	0		0	0
4/19/03	-	-	3,812	0	3,812	0	0	0
4/20/03	-	-		0	0		0	0
4/21/03	-	-		0	0		0	0

Continued on next page

Appendix I continued.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>		
	Hours		Catch		Migration	Catch		Migration
	In	Out	Actual	Estimated	Total	Actual	Estimated	Total
4/22/03	-	-	0	0	0	0	0	0
4/23/03	-	-	946	0	946	0	0	0
4/24/03	-	-	312	0	312	0	0	0
4/25/03	-	-	157	0	157	0	0	0
4/26/03	-	-		0	0		0	0
4/27/03	-	-		0	0		0	0
4/28/03	-	-	1,435	0	1,435	0	0	0
4/29/03	-	-		0	0		0	0
4/30/03	-	-		0	0		0	0
5/1/03	-	-	1,973	0	1,973	0	0	0
5/2/03	-	-		0	0		0	0
5/3/03	-	-		0	0		0	0
5/4/03	-	-	962	0	962	0	0	0
5/5/03	-	-		0	0		0	0
5/6/03	-	-	363	0	363	0	0	0
5/7/03	-	-	384	0	384	0	0	0
5/8/03	-	-	188	0	188	0	0	0
5/9/03	-	-	68	0	68	0	0	0
5/10/03	-	-		0	0		0	0
5/11/03	-	-	164	0	164	0	0	0
5/12/03	-	-		0	0		0	0
5/13/03	-	-		0	0		0	0
5/14/03	-	-	10	0	10	0	0	0
5/15/03	-	-	74	0	74	0	0	0
5/16/03	-	-	26	0	26	1	0	1
5/17/03	-	-		0	0		0	0
5/18/03	-	-		0	0		0	0
5/19/03	-	-		0	0		0	0
5/20/03	-	-		0	0		0	0
5/21/03	-	-	0	0	0	0	0	0
5/22/03	-	-	1	0	1	1	0	1
5/23/03	-	-		0	0		0	0
5/24/03	-	-		0	0		0	0
5/25/03	-	-		0	0		0	0
5/26/03	-	-		0	0		0	0
5/27/03	-	-	0	0	0	3	0	3

Continued on next page

Appendix I continued.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>		
	Hours		Catch			Migration		
	In	Out	Actual	Estimated	Total	Actual	Estimated	Total
5/28/03	-	-		0	0		0	0
5/29/03	-	-		0	0		0	0
5/30/03	-	-	0	0	0	0	0	0
5/31/03	-	-		0	0		0	0
6/1/03	-	-		0	0		0	0
6/2/03	-	-		0	0		0	0
6/3/03	-	-		0	0		0	0
6/4/03	-	-	0	0	0	6	0	6
6/5/03	-	-		0	0		0	0
6/6/03	-	-		0	0		0	0
6/7/03	-	-	0	0	0	1	0	1
6/8/03	-	-		0	0		0	0
6/9/03	-	-		0	0		0	0
6/10/03	-	-		0	0		0	0
6/11/03	-	-	2	0	2	3	0	3
6/12/03	-	-		0	0		0	0
6/13/03	-	-		0	0		0	0
6/14/03	-	-		0	0		0	0
6/15/03	-	-		0	0		0	0
6/16/03	-	-	2	0	2	0	0	0
6/17/03	-	-		0	0		0	0
6/18/03	-	-	7	0	7	3	0	3
6/19/03	-	-	4	0	4	1	0	1
6/20/03	-	-		0	0		0	0
6/21/03	-	-		0	0		0	0
6/22/03	-	-		0	0		0	0
6/23/03	-	-		0	0		0	0
6/24/03	-	-		0	0		0	0
6/25/03	-	-		0	0		0	0
6/26/03	-	-		0	0		0	0
6/27/03	-	-		0	0		0	0
6/28/03	-	-		0	0		0	0
6/29/03	-	-		0	0		0	0
6/30/03	-	-		0	0		0	0
7/1/03	-	-		0	0		0	0
7/2/03	-	-	1	0	1	0	0	0

Continued on next page

Appendix I continued.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>		
	Hours		Catch		Migration	Catch		Migration
	In	Out	Actual	Estimated	Total	Actual	Estimated	Total
7/3/03	-	-	0	0	0	2	0	2
7/4/03	-	-	0	0	0	1	0	1
7/5/03	-	-	0	0	0	6	0	6
7/6/03	-	-	0	0	0	4	0	4
7/7/03	-	-	0	0	0	4	0	4
7/8/03	-	-		0	0		0	0
7/9/03	-	-	0	0	0	1	0	1
7/10/03	-	-	0	0	0	2	0	2
7/11/03	-	-	0	0	0	1	0	1
7/12/03	-	-	0	0	0	0	0	0
7/13/03	-	-	0	0	0	0	0	0
7/14/03	-	-	0	0	0	1	0	1
7/15/03	-	-	0	0	0	0	0	0
7/16/03	-	-	0	0	0	0	0	0
7/17/03	-	-	1	0	1	0	0	0
7/18/03	-	-	1	0	1	0	0	0
7/19/03	-	-	0	0	0	0	0	0
7/20/03	-	-	0	0	0	0	0	0
7/21/03	-	-		0	0		0	0
7/22/03	-	-		0	0		0	0
7/23/03	-	-	0	0	0	0	0	0
7/24/03	-	-	0	0	0	0	0	0
7/25/03	-	-	0	0	0	4	0	4
7/26/03	-	-	1	0	1	0	0	0
7/27/03	-	-	0	0	0	1	0	1
7/28/03	-	-		0	0		0	0
7/29/03	-	-	0	0	0	0	0	0
7/30/03	-	-	0	0	0	1	0	1
7/31/03	-	-	0	0	0	0	0	0
8/1/03	-	-	0	0	0	0	0	0
8/2/03	-	-	0	0	0	0	0	0
8/3/03	-	-	0	0	0	0	0	0
8/4/03	-	-	0	0	0	0	0	0
8/5/03	-	-	0	0	0	0	0	0
8/6/03	-	-	0	0	0	0	0	0
8/7/03	-	-	1	0	1	0	0	0

Continued on next page

Appendix I continued.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>			Migration
	Hours		Actual	Catch		Actual	Catch		
	In	Out		Estimated	Total		Estimated	Total	
8/8/03	-	-	0	0	0	0	0	0	
8/9/03	-	-	0	0	0	0	0	0	
8/10/03	-	-	0	0	0	0	0	0	
8/11/03	-	-		0	0		0	0	
8/12/03	-	-		0	0		0	0	
8/13/03	-	-	0	0	0	0	0	0	
8/14/03	-	-	0	0	0	1	0	1	
8/15/03	-	-		0	0		0	0	
8/16/03	-	-		0	0		0	0	
8/17/03	-	-		0	0		0	0	
8/18/03	-	-	0	0	0	0	0	0	
8/19/03	-	-	0	0	0	0	0	0	
8/20/03	-	-	0	0	0	0	0	0	
8/21/03	-	-	0	0	0	0	0	0	
8/22/03	-	-	0	0	0	0	0	0	
8/23/03	-	-		0	0		0	0	
8/24/03	-	-	0	0	0	0	0	0	
8/25/03	-	-	0	0	0	0	0	0	
8/26/03	-	-	0	0	0	0	0	0	
8/27/03	-	-	0	0	0	0	0	0	
8/28/03	-	-	0	0	0	0	0	0	
8/29/03	-	-	0	0	0	0	0	0	
8/30/03	-	-	0	0	0	0	0	0	
8/31/03	-	-	0	0	0	0	0	0	
9/1/03	-	-	0	0	0	0	0	0	
Total	0	0	29,669	0	0	0	113	0	0

Appendix J

2004 Hamma Hamma River daily catch and migration estimates for juvenile chum, Chinook, and pink salmon

APPENDIX J.—Daily catches of juvenile chum, Chinook, and pink salmon caught in the Hamma Hamma River screw trap in 2004. Actual catch data are blank when no information was available. Catch represents actual and estimated catch for a given day. Time in and out reflect time fished (in) and not fished (out) on a given day.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>			<u>Pink</u>					
	Hours		Catch			Migration			Catch			Migration		
	In	Out	Actual	Estimated	Total	Actual	Estimated	Total	Actual	Estimated	Total			
1/20/04	-	-	5	0	5	90	1	0	1	18	0	0	0	0
1/21/04	-	-		0	0	0		0	0	0		0	0	0
1/22/04	-	-	6	0	6	107	3	0	3	54	1	0	1	18
1/23/04	-	-		0	0	0		0	0	0		0	0	0
1/24/04	-	-		0	0	0		0	0	0		0	0	0
1/25/04	-	-		0	0	0		0	0	0		0	0	0
1/26/04	-	-	2	0	2	36	1	0	1	18	1	0	1	18
1/27/04	-	-	8	0	8	143	0	0	0	0	1	0	1	18
1/28/04	-	-	8	0	8	143	0	0	0	0	3	0	3	54
1/29/04	-	-	12	0	12	215	1	0	1	18	3	0	3	54
1/30/04	-	-	60	0	60	1,074	4	0	4	72	13	0	13	233
1/31/04	-	-	25	0	25	448	0	0	0	0	1	0	1	18
2/1/04	-	-	10	0	10	179	0	0	0	0	1	0	1	18
2/2/04	-	-	4	0	4	72	0	0	0	0	1	0	1	18
2/3/04	-	-	8	0	8	143	0	0	0	0	0	0	0	0
2/4/04	-	-	28	0	28	501	0	0	0	0	1	0	1	18
2/5/04	-	-	45	0	45	806	0	0	0	0	0	0	0	0
2/6/04	-	-	124	0	124	2,220	0	0	0	0	0	0	0	0
2/7/04	-	-	8	0	8	143	0	0	0	0	0	0	0	0
2/8/04	-	-	11	0	11	197	0	0	0	0	0	0	0	0
2/9/04	-	-	20	0	20	358	0	0	0	0	12	0	12	215
2/10/04	-	-	5	0	5	90	2	0	2	36	0	0	0	0
2/11/04	-	-	8	0	8	143	1	0	1	18	5	0	5	90
2/12/04	-	-	17	0	17	304	0	0	0	0	6	0	6	107
2/13/04	-	-	35	0	35	627	0	0	0	0	1	0	1	18
2/14/04	-	-	31	0	31	555	0	0	0	0	1	0	1	18
2/15/04	-	-	36	0	36	645	0	0	0	0	4	0	4	72
2/16/04	-	-	21	0	21	376	0	0	0	0	0	0	0	0
2/17/04	-	-	20	0	20	358	1	0	1	18	0	0	0	0
2/18/04	-	-	39	0	39	698	5	0	5	90	11	0	11	197
2/19/04	-	-	71	0	71	1,271	0	0	0	0	12	0	12	215
2/20/04	-	-	68	0	68	1,218	2	0	2	36	12	0	12	215

Continued on next page

Appendix J continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>				<u>Pink</u>			
	Hours		Catch		Migration	Catch		Migration	Catch		Migration			
	In	Out	Actual	Estimated		Actual	Estimated		Actual	Estimated		Total		
2/21/04	-	-		0	0	0	0	0	0	0	0	0	0	
2/22/04	-	-		0	0	0	0	0	0	0	0	0	0	
2/23/04	-	-	40	0	40	716	1	0	1	18	4	0	4	72
2/24/04	-	-	34	0	34	609	2	0	2	36	11	0	11	197
2/25/04	-	-	27	0	27	483	0	0	0	0	13	0	13	233
2/26/04	-	-	38	0	38	680	0	0	0	0	48	0	48	859
2/27/04	-	-		0	0	0		0	0	0		0	0	0
2/28/04	-	-	13	0	13	233	0	0	0	0	6	0	6	107
2/29/04	-	-	49	0	49	877	0	0	0	0	47	0	47	842
3/1/04	-	-		0	0	0		0	0	0		0	0	0
3/2/04	-	-	12	0	12	215	0	0	0	0	4	0	4	72
3/3/04	-	-		0	0	0		0	0	0		0	0	0
3/4/04	-	-	34	0	34	609	0	0	0	0	7	0	7	125
3/5/04	-	-	60	0	60	1,074	0	0	0	0	14	0	14	251
3/6/04	-	-	43	0	43	770	0	0	0	0	12	0	12	215
3/7/04	-	-	71	0	71	1,271	0	0	0	0	8	0	8	143
3/8/04	-	-		0	0	0		0	0	0		0	0	0
3/9/04	-	-	11	0	11	197	0	0	0	0	2	0	2	36
3/10/04	-	-		0	0	0		0	0	0		0	0	0
3/11/04	-	-	28	0	28	501	1	0	1	18	68	0	68	1,218
3/12/04	-	-	18	0	18	322	0	0	0	0	49	0	49	877
3/13/04	-	-	31	0	31	555	0	0	0	0	69	0	69	1,235
3/14/04	-	-	17	0	17	304	0	0	0	0	111	0	111	1,988
3/15/04	-	-	22	0	22	394	3	0	3	54	107	0	107	1,916
3/16/04	-	-		0	0	0		0	0	0		0	0	0
3/17/04	-	-	90	0	90	1,612	2	0	2	36	43	0	43	770
3/18/04	-	-	173	0	173	3,098	9	0	9	161	53	0	53	949
3/19/04	-	-	329	0	329	5,891	13	0	13	233	87	0	87	1,558
3/20/04	-	-		0	0	0		0	0	0		0	0	0
3/21/04	-	-	93	0	93	1,665	4	0	4	72	56	0	56	1,003
3/22/04	-	-	192	0	192	3,438	4	0	4	72	67	0	67	1,200
3/23/04	-	-	322	0	322	5,766	6	0	6	107	119	0	119	2,131
3/24/04	-	-	311	0	311	5,569	16	0	16	286	93	0	93	1,665
3/25/04	-	-	401	0	401	7,180	1	0	1	18	147	0	147	2,632
3/26/04	-	-	63	0	63	1,128	2	0	2	36	30	0	30	537
3/27/04	-	-	316	0	316	5,658	2	0	2	36	17	0	17	304

Continued on next page

Appendix J continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>				<u>Pink</u>			
	Hours		Catch		Migration	Catch		Migration	Catch		Migration			
	In	Out	Actual	Estimated		Actual	Estimated		Actual	Estimated		Total		
3/28/04	-	-	297	0	297	5,318	7	0	7	125	12	0	12	215
3/29/04	-	-	261	0	261	4,673	2	0	2	36	197	0	197	3,527
3/30/04	-	-		0	0	0		0	0	0		0	0	0
3/31/04	-	-	751	0	751	13,447	0	0	0	0	104	0	104	1,862
4/1/04	-	-	658	0	658	11,782	0	0	0	0	58	0	58	1,039
4/2/04	-	-	606	0	606	10,851	0	0	0	0	19	0	19	340
4/3/04	-	-	542	0	542	9,705	0	0	0	0	71	0	71	1,271
4/4/04	-	-		0	0	0		0	0	0		0	0	0
4/5/04	-	-	1,843	0	1,843	33,000	2	0	2	36	105	0	105	1,880
4/6/04	-	-	1,888	0	1,888	33,806	2	0	2	36	38	0	38	680
4/7/04	-	-	3,341	0	3,341	59,823	1	0	1	18	33	0	33	591
4/8/04	-	-	2,901	0	2,901	51,944	0	0	0	0	33	0	33	591
4/9/04	-	-	4,037	0	4,037	72,285	0	0	0	0	26	0	26	466
4/10/04	-	-	4,552	0	4,552	162,897	2	0	2	72	17	0	17	608
4/11/04	-	-	3,839	0	3,839	137,381	0	0	0	0	19	0	19	680
4/12/04	-	-	5,388	0	5,388	192,813	49	0	49	1,754	29	0	29	1,038
4/13/04	-	-	6,826	0	6,826	244,273	1	0	1	36	14	0	14	501
4/14/04	-	-	4,619	0	4,619	165,294	0	0	0	0	10	0	10	358
4/15/04	-	-	3,977	0	3,977	142,320	4	0	4	143	7	0	7	251
4/16/04	-	-	3,850	0	3,850	137,775	0	0	0	0	4	0	4	143
4/17/04	-	-	4,894	0	4,894	175,135	2	0	2	72	7	0	7	251
4/18/04	-	-	3,091	0	3,091	110,614	0	0	0	0	3	0	3	107
4/19/04	-	-	5,056	0	5,056	180,933	10	0	10	358	7	0	7	251
4/20/04	-	-	5,031	0	5,031	180,038	2	0	2	72	3	0	3	107
4/21/04	-	-	2,002	0	2,002	71,643	5	0	5	179	0	0	0	0
4/22/04	-	-	1,389	0	1,389	49,706	0	0	0	0	8	0	8	286
4/23/04	-	-	1,180	0	1,180	42,227	12	0	12	429	6	0	6	215
4/24/04	-	-	355	0	355	12,704	6	0	6	215	1	0	1	36
4/25/04	-	-		0	0	0		0	0	0		0	0	0
4/26/04	-	-	355	0	355	12,704	6	0	6	215	1	0	1	36
4/27/04	-	-		0	0	0		0	0	0		0	0	0
4/28/04	-	-	350	0	350	12,525	1	0	1	36	0	0	0	0
4/29/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0
4/30/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0
5/1/04	-	-		0	0	0		0	0	0		0	0	0
5/2/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0

Continued on next page

Appendix J continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>				<u>Pink</u>			
	Hours		Catch		Migration	Catch		Migration	Catch		Migration			
	In	Out	Actual	Estimated		Actual	Estimated		Actual	Estimated		Total		
5/3/04	-	-	346	0	346	12,382	1	0	1	36	1	0	1	36
5/4/04	-	-	213	0	213	7,622	2	0	2	72	0	0	0	0
5/5/04	-	-	203	0	203	7,265	0	0	0	0	0	0	0	0
5/6/04	-	-		0	0	0		0	0	0		0	0	0
5/7/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0
5/8/04	-	-		0	0	0		0	0	0		0	0	0
5/9/04	-	-	1	0	1	36	1	0	1	36	0	0	0	0
5/10/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0
5/11/04	-	-	11	0	11	394	0	0	0	0	0	0	0	0
5/12/04	-	-	6	0	6	215	0	0	0	0	0	0	0	0
5/13/04	-	-	2	0	2	72	0	0	0	0	0	0	0	0
5/14/04	-	-	8	0	8	286	0	0	0	0	0	0	0	0
5/15/04	-	-		0	0	0		0	0	0		0	0	0
5/16/04	-	-		0	0	0		0	0	0		0	0	0
5/17/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0
5/18/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0
5/19/04	-	-	6	0	6	215	2	0	2	72	0	0	0	0
5/20/04	-	-	1	0	1	36	0	0	0	0	0	0	0	0
5/21/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0
5/22/04	-	-		0	0	0		0	0	0		0	0	0
5/23/04	-	-	1	0	1	36	0	0	0	0	0	0	0	0
5/24/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0
5/25/04	-	-	2	0	2	72	0	0	0	0	0	0	0	0
5/26/04	-	-	0	0	0	0	1	0	1	36	0	0	0	0
5/27/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0
5/28/04	-	-	0	0	0	0	2	0	2	72	0	0	0	0
5/29/04	-	-		0	0	0		0	0	0		0	0	0
5/30/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0
5/31/04	-	-		0	0	0		0	0	0		0	0	0
6/1/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0
6/2/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0
6/3/04	-	-	0	0	0	0	1	0	1	36	0	0	0	0
6/4/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0
6/5/04	-	-		0	0	0		0	0	0		0	0	0
6/6/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0
6/7/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0

Continued on next page

Appendix J continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>				<u>Pink</u>				
	Hours		Catch			Migration	Catch			Migration	Catch			Migration	
	In	Out	Actual	Estimated	Total		Actual	Estimated	Total		Actual	Estimated	Total		
6/8/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
6/9/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
6/10/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
6/11/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
6/12/04	-	-		0	0	0		0	0	0		0	0	0	0
6/13/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
6/14/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
6/15/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
6/16/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
6/17/04	-	-		0	0	0		0	0	0		0	0	0	0
6/18/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
6/19/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
6/20/04	-	-		0	0	0		0	0	0		0	0	0	0
6/21/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
6/22/04	-	-		0	0	0		0	0	0		0	0	0	0
6/23/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
6/24/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
6/25/04	-	-		0	0	0		0	0	0		0	0	0	0
6/26/04	-	-		0	0	0		0	0	0		0	0	0	0
6/27/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
6/28/04	-	-	0	0	0	0	3	0	3	107	0	0	0	0	0
6/29/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
6/30/04	-	-		0	0	0		0	0	0		0	0	0	0
7/1/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
7/2/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
7/3/04	-	-		0	0	0		0	0	0		0	0	0	0
7/4/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
7/5/04	-	-		0	0	0		0	0	0		0	0	0	0
7/6/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
7/7/04	-	-		0	0	0		0	0	0		0	0	0	0
7/8/04	-	-		0	0	0		0	0	0		0	0	0	0
7/9/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
7/10/04	-	-		0	0	0		0	0	0		0	0	0	0
7/11/04	-	-		0	0	0		0	0	0		0	0	0	0
7/12/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
7/13/04	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0

Continued on next page

Appendix J continued.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>			<u>Pink</u>			Migration		
	Hours		Catch		Migration	Catch		Migration	Catch					
	In	Out	Actual	Estimated		Actual	Estimated		Actual	Estimated	Total			
7/14/04	-	-		0	0	0	0	0	0	0	0	0	0	
7/15/04	-	-		0	0	0	0	0	0	0	0	0	0	
7/16/04	-	-	0	0	0	0	0	0	0	0	0	0	0	
7/17/04	-	-		0	0	0	0	0	0	0	0	0	0	
7/18/04	-	-	0	0	0	0	0	0	0	0	0	0	0	
7/19/04	-	-		0	0	0	0	0	0	0	0	0	0	
7/20/04	-	-		0	0	0	0	0	0	0	0	0	0	
7/21/04	-	-	0	0	0	0	0	0	0	0	0	0	0	
7/22/04	-	-		0	0	0	0	0	0	0	0	0	0	
7/23/04	-	-	0	0	0	0	0	0	0	0	0	0	0	
7/24/04	-	-		0	0	0	0	0	0	0	0	0	0	
7/25/04	-	-		0	0	0	0	0	0	0	0	0	0	
7/26/04	-	-		0	0	0	0	0	0	0	0	0	0	
7/27/04	-	-	0	0	0	0	0	0	0	0	0	0	0	
7/28/04	-	-		0	0	0	0	0	0	0	0	0	0	
7/29/04	-	-	0	0	0	0	0	0	0	0	0	0	0	
7/30/04	-	-		0	0	0	0	0	0	0	0	0	0	
7/31/04	-	-	0	0	0	0	0	0	0	0	0	0	0	
Total	-	-	78,252	0	78,252	2,430,222	214	0	214	5,852	2,215	0	2,215	42,111

Appendix K

2005 Hamma Hamma River daily catch and migration estimates for juvenile chum, Chinook, and pink salmon

APPENDIX K.—Daily catches of juvenile chum, Chinook, and pink salmon caught in the Hamma Hamma River screw trap in 2005. Actual catch data are blank when no information was available. Catch represents actual and estimated catch for a given day. Time in and out reflect time fished (in) and not fished (out) on a given day.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>			
	Hours		Catch			Migration	Catch			Migration
	In	Out	Actual	Estimated	Total		Actual	Estimated	Total	
1/4/05	24.00	0.00	0	0	0	0	0	0	0	0
1/5/05	24.00	0.00	0	0	0	0	0	0	0	0
1/6/05	24.00	0.00	0	0	0	0	0	0	0	0
1/7/05	24.00	0.00	0	0	0	0	0	0	0	0
1/8/05	24.00	0.00	0	0	0	0	0	0	0	0
1/9/05	24.00	0.00	0	0	0	0	0	0	0	0
1/10/05	24.00	0.00	0	0	0	0	0	0	0	0
1/11/05	24.00	0.00	13	0	13	651	0	0	0	0
1/12/05	24.00	0.00	2	0	2	100	0	0	0	0
1/13/05	24.00	0.00	8	0	8	401	0	0	0	0
1/14/05	24.00	0.00	12	0	12	601	0	0	0	0
1/15/05	24.00	0.00	0	0	0	0	0	0	0	0
1/16/05	24.00	0.00	0	0	0	0	0	0	0	0
1/17/05	24.00	0.00	7	0	7	351	0	0	0	0
1/18/05	24.00	0.00	7	0	7	351	0	0	0	0
1/19/05	24.00	0.00	16	0	16	802	0	0	0	0
1/20/05	24.00	0.00	21	0	21	1,052	1	0	1	50
1/21/05	24.00	0.00	15	0	15	752	6	0	6	301
1/22/05	24.00	0.00	6	0	6	301	1	0	1	50
1/23/05	0.00	24.00		17	17	852	0	5	5	251
1/24/05	0.00	24.00		17	17	852	0	5	5	251
1/25/05	24.00	0.00	27	0	27	1,353	5	0	5	251
1/26/05	24.00	0.00	38	0	38	1,904	6	0	6	301
1/27/05	24.00	0.00	30	0	30	1,503	3	0	3	150
1/28/05	24.00	0.00	57	0	57	2,856	0	0	0	0
1/29/05	0.00	24.00		30	30	1,503	0	0	0	0
1/30/05	0.00	24.00		30	30	1,503	0	0	0	0
1/31/05	0.00	24.00		30	30	1,503	0	0	0	0
2/1/05	24.00	0.00	2	0	2	100	0	0	0	0
2/2/05	24.00	0.00	37	0	37	1,854	12	0	12	601
2/3/05	24.00	0.00	20	0	20	1,002	5	0	5	251
2/4/05	24.00	0.00	36	0	36	1,804	0	0	0	0
2/5/05	24.00	0.00	39	0	39	1,954	0	0	0	0

Continued on next page

Appendix K continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>			
	Hours		Catch			Migration	Catch			Migration
	In	Out	Actual	Estimated	Total		Actual	Estimated	Total	
2/6/05	24.00	0.00	34	0	34	1,703	5	0	5	251
2/7/05	24.00	0.00	21	0	21	1,052	0	0	0	0
2/8/05	24.00	0.00	42	0	42	2,104	7	0	7	351
2/9/05	24.00	0.00	22	0	22	1,102	2	0	2	100
2/10/05	24.00	0.00	13	0	13	651	0	0	0	0
2/11/05	24.00	0.00	122	0	122	6,112	18	0	18	902
2/12/05	24.00	0.00	7	0	7	351	2	0	2	100
2/13/05	24.00	0.00	5	0	5	251	0	0	0	0
2/14/05	24.00	0.00	18	0	18	902	1	0	1	50
2/15/05	24.00	0.00	136	0	136	6,814	6	0	6	301
2/16/05	24.00	0.00	171	0	171	8,567	3	0	3	150
2/17/05	24.00	0.00	63	0	63	3,156	6	0	6	301
2/18/05	24.00	0.00	48	0	48	601	6	0	6	75
2/19/05	24.00	0.00	36	0	36	451	1	0	1	13
2/20/05	24.00	0.00	26	0	26	326	0	0	0	0
2/21/05	24.00	0.00	21	0	21	263	6	0	6	75
2/22/05	24.00	0.00	17	0	17	213	3	0	3	38
2/23/05	24.00	0.00	98	0	98	1,227	8	0	8	100
2/24/05	24.00	0.00	386	0	386	4,835	1	0	1	13
2/25/05	24.00	0.00	25	0	25	313	6	0	6	75
2/26/05	24.00	0.00	102	0	102	1,278	0	0	0	0
2/27/05	24.00	0.00	104	0	104	1,303	0	0	0	0
2/28/05	24.00	0.00	142	0	142	1,779	0	0	0	0
3/1/05	24.00	0.00	642	0	642	8,041	4	0	4	50
3/2/05	24.00	0.00	3,081	0	3,081	38,590	15	0	15	188
3/3/05	24.00	0.00	3,335	0	3,335	41,771	11	0	11	138
3/4/05	24.00	0.00	1,756	0	1,756	21,994	23	0	23	288
3/5/05	24.00	0.00	1,535	0	1,535	19,226	9	0	9	113
3/6/05	24.00	0.00	1,201	0	1,201	15,043	0	0	0	0
3/7/05	24.00	0.00	909	0	909	25,267	0	0	0	0
3/8/05	24.00	0.00	152	0	152	4,225	0	0	0	0
3/9/05	24.00	0.00	281	0	281	7,811	0	0	0	0
3/10/05	24.00	0.00	232	0	232	6,449	0	0	0	0
3/11/05	24.00	0.00	68	0	68	1,890	0	0	0	0
3/12/05	24.00	0.00	34	0	34	945	0	0	0	0
3/13/05	24.00	0.00	72	0	72	2,001	0	0	0	0

Continued on next page

Appendix K continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>			
	Hours		Catch		Total	Migration	Catch		Total	Migration
	In	Out	Actual	Estimated			Actual	Estimated		
3/14/05	24.00	0.00	512	0	512	14,232	0	0	0	0
3/15/05	24.00	0.00	2,547	0	2,547	70,797	1	0	1	28
3/16/05	24.00	0.00	866	0	866	24,072	0	0	0	0
3/17/05	24.00	0.00	1,036	0	1,036	28,797	0	0	0	0
3/18/05	0.00	24.00		1,011	1,011	28,102	0	3	3	83
3/19/05	0.00	24.00		1,011	1,011	28,102	0	3	3	83
3/20/05	0.00	24.00		1,011	1,011	28,102	0	3	3	83
3/21/05	0.00	24.00		1,011	1,011	28,102	0	3	3	83
3/22/05	24.00	0.00	986	0	986	27,407	6	0	6	167
3/23/05	24.00	0.00	2,157	0	2,157	59,957	3	0	3	83
3/24/05	24.00	0.00	3,263	0	3,263	90,699	0	0	0	0
3/25/05	24.00	0.00	3,497	0	3,497	97,204	2	0	2	56
3/26/05	24.00	0.00		0	0	0	0	0	0	0
3/27/05	24.00	0.00	7,500	0	7,500	208,472	0	0	0	0
3/28/05	24.00	0.00	1,732	0	1,732	48,143	0	0	0	0
3/29/05	24.00	0.00	1,352	0	1,352	37,581	0	0	0	0
3/30/05	24.00	0.00	1,170	0	1,170	32,522	2	0	2	56
3/31/05	24.00	0.00	2,992	0	2,992	83,167	0	0	0	0
4/1/05	24.00	0.00		0	0	0	0	0	0	0
4/2/05	24.00	0.00	1,860	0	1,860	51,701	0	0	0	0
4/3/05	24.00	0.00	3,471	0	3,471	96,481	0	0	0	0
4/4/05	24.00	0.00	2,784	0	2,784	77,385	0	0	0	0
4/5/05	24.00	0.00	2,027	0	2,027	56,343	0	0	0	0
4/6/05	24.00	0.00	3,499	0	3,499	97,259	0	0	0	0
4/7/05	24.00	0.00	3,739	0	3,739	103,930	0	0	0	0
4/8/05	24.00	0.00	2,137	0	2,137	59,401	0	0	0	0
4/9/05	24.00	0.00	3,213	0	3,213	89,310	0	0	0	0
4/10/05	24.00	0.00		0	0	0	0	0	0	0
4/11/05	24.00	0.00	3,134	0	3,134	87,114	0	0	0	0
4/12/05	24.00	0.00	2,955	0	2,955	82,138	0	0	0	0
4/13/05	24.00	0.00	3,317	0	3,317	92,200	0	0	0	0
4/14/05	24.00	0.00	2,841	0	2,841	78,969	0	0	0	0
4/15/05	24.00	0.00	7,560	0	7,560	210,140	0	0	0	0
4/16/05	24.00	0.00	8,440	0	8,440	234,601	0	0	0	0
4/17/05	24.00	0.00	2,100	0	2,100	58,372	0	0	0	0
4/18/05	24.00	0.00	4,228	0	4,228	117,523	1	0	1	28

Continued on next page

Appendix K continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>			
	Hours		Catch		Total	Migration	Catch		Total	Migration
	In	Out	Actual	Estimated			Actual	Estimated		
4/19/05	24.00	0.00	1,442	0	1,442	40,082	0	0	0	0
4/20/05	24.00	0.00	1,818	0	1,818	50,534	6	0	6	167
4/21/05	24.00	0.00	7,726	0	7,726	214,754	2	0	2	56
4/22/05	24.00	0.00	12,907	0	12,907	358,767	0	0	0	0
4/23/05	24.00	0.00	8,189	0	8,189	227,624	1	0	1	28
4/24/05	24.00	0.00	4,230	0	4,230	117,578	1	0	1	28
4/25/05	24.00	0.00	4,885	0	4,885	135,785	0	0	0	0
4/26/05	24.00	0.00		0	0	0	0	0	0	0
4/27/05	24.00	0.00		0	0	0	0	0	0	0
4/28/05	24.00	0.00	802	0	802	22,293	0	0	0	0
4/29/05	24.00	0.00	312	0	312	5,390	0	0	0	0
4/30/05	24.00	0.00	414	0	414	7,152	0	0	0	0
5/1/05	24.00	0.00		0	0	0	0	0	0	0
5/2/05	24.00	0.00	128	0	128	2,211	0	0	0	0
5/3/05	24.00	0.00	11	0	11	190	0	0	0	0
5/4/05	24.00	0.00	7	0	7	121	0	0	0	0
5/5/05	24.00	0.00	2	0	2	35	0	0	0	0
5/6/05	24.00	0.00	3	0	3	52	0	0	0	0
5/7/05	24.00	0.00		0	0	0	0	0	0	0
5/8/05	24.00	0.00		0	0	0	0	0	0	0
5/9/05	24.00	0.00		0	0	0	0	0	0	0
5/10/05	24.00	0.00	0	0	0	0	1	0	1	17
5/11/05	24.00	0.00	0	0	0	0	2	0	2	35
5/12/05	24.00	0.00	0	0	0	0	3	0	3	52
5/13/05	24.00	0.00	0	0	0	0	2	0	2	35
5/14/05	24.00	0.00		0	0	0	0	0	0	0
5/15/05	24.00	0.00		0	0	0	0	0	0	0
5/16/05	24.00	0.00	0	0	0	0	0	0	0	0
5/17/05	24.00	0.00	0	0	0	0	0	0	0	0
5/18/05	0.00	24.00		0	0	0	0	0	0	0
5/19/05	0.00	24.00		0	0	0	0	0	0	0
5/20/05	0.00	24.00		0	0	0	0	0	0	0
5/21/05	0.00	24.00		0	0	0	0	0	0	0
5/22/05	0.00	24.00		0	0	0	0	0	0	0
5/23/05	0.00	24.00		0	0	0	0	0	0	0
5/24/05	24.00	0.00	0	0	0	0	0	0	0	0

Continued on next page

Appendix K continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>			
	Hours		Catch		Migration	Catch		Migration		
	In	Out	Actual	Estimated		Actual	Estimated		Total	
5/25/05	24.00	0.00	0	0	0	0	0	0	0	0
5/26/05	24.00	0.00	0	0	0	0	0	0	0	0
5/27/05	24.00	0.00	0	0	0	0	0	0	0	0
5/28/05	24.00	0.00		0	0	0	0	0	0	0
5/29/05	24.00	0.00	0	0	0	0	0	0	0	0
5/30/05	24.00	0.00		0	0	0	0	0	0	0
5/31/05	24.00	0.00	0	0	0	0	0	0	0	0
6/1/05	24.00	0.00	0	0	0	0	0	0	0	0
6/2/05	24.00	0.00	0	0	0	0	0	0	0	0
6/3/05	24.00	0.00	0	0	0	0	0	0	0	0
6/4/05	24.00	0.00		0	0	0	0	0	0	0
6/5/05	24.00	0.00		0	0	0	0	0	0	0
6/6/05	24.00	0.00	0	0	0	0	0	0	0	0
6/7/05	24.00	0.00	0	0	0	0	0	0	0	0
6/8/05	24.00	0.00	0	0	0	0	0	0	0	0
6/9/05	24.00	0.00	0	0	0	0	0	0	0	0
6/10/05	24.00	0.00	0	0	0	0	0	0	0	0
6/11/05	24.00	0.00	0	0	0	0	0	0	0	0
6/12/05	24.00	0.00	0	0	0	0	0	0	0	0
6/13/05	24.00	0.00	0	0	0	0	0	0	0	0
6/14/05	24.00	0.00	0	0	0	0	0	0	0	0
6/15/05	24.00	0.00	0	0	0	0	0	0	0	0
6/16/05	24.00	0.00	0	0	0	0	0	0	0	0
6/17/05	24.00	0.00	0	0	0	0	0	0	0	0
6/18/05	24.00	0.00	0	0	0	0	0	0	0	0
6/19/05	24.00	0.00		0	0	0	0	0	0	0
6/20/05	24.00	0.00	0	0	0	0	0	0	0	0
6/21/05	24.00	0.00	0	0	0	0	0	0	0	0
6/22/05	24.00	0.00	0	0	0	0	0	0	0	0
6/23/05	24.00	0.00	0	0	0	0	0	0	0	0
6/24/05	24.00	0.00	0	0	0	0	0	0	0	0
6/25/05	24.00	0.00		0	0	0	0	0	0	0
6/26/05	24.00	0.00	0	0	0	0	0	0	0	0
6/27/05	24.00	0.00	0	0	0	0	0	0	0	0
6/28/05	24.00	0.00	0	0	0	0	0	0	0	0
6/29/05	24.00	0.00	0	0	0	0	0	0	0	0

Continued on next page

Appendix K continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>			
	Hours		Catch		Migration	Catch		Migration		
	In	Out	Actual	Estimated		Actual	Estimated		Total	
6/30/05	24.00	0.00		0	0	0	0	0	0	0
7/1/05	24.00	0.00	0	0	0	0	0	0	0	0
7/2/05	24.00	0.00		0	0	0	0	0	0	0
7/3/05	24.00	0.00		0	0	0	0	0	0	0
7/4/05	24.00	0.00		0	0	0	0	0	0	0
7/5/05	24.00	0.00	0	0	0	0	0	0	0	0
7/6/05	24.00	0.00		0	0	0	0	0	0	0
7/7/05	24.00	0.00		0	0	0	0	0	0	0
7/8/05	24.00	0.00	0	0	0	0	0	0	0	0
7/9/05	24.00	0.00		0	0	0	0	0	0	0
7/10/05	24.00	0.00		0	0	0	0	0	0	0
7/11/05	24.00	0.00	0	0	0	0	0	0	0	0
7/12/05	24.00	0.00	0	0	0	0	0	0	0	0
7/13/05	24.00	0.00		0	0	0	0	0	0	0
7/14/05	24.00	0.00		0	0	0	0	0	0	0
7/15/05	24.00	0.00		0	0	0	0	0	0	0
7/16/05	24.00	0.00		0	0	0	0	0	0	0
7/17/05	24.00	0.00		0	0	0	0	0	0	0
7/18/05	34.67	0.00	0	0	0	0	0	0	0	0
7/19/05	25.33	0.00		0	0	0	0	0	0	0
7/20/05	24.00	0.00		0	0	0	0	0	0	0
7/21/05	24.00	0.00		0	0	0	0	0	0	0
7/22/05	22.67	0.00	0	0	0	0	0	0	0	0
7/23/05	25.33	0.00		0	0	0	0	0	0	0
7/24/05	24.00	0.00		0	0	0	0	0	0	0
7/26/05	22.50	0.00	0	0	0	0	0	0	0	0
Total	4522.50	360.00	145,141	4,168	149,309	3,975,397	215	22	237	7,291

Appendix L

2006 Hamma Hamma River daily catch and migration estimates for juvenile chum, Chinook, and pink salmon

APPENDIX L.—Daily catches of juvenile chum, Chinook, and pink salmon caught in the Hamma Hamma River screw trap in 2006. The estimated catch could not be calculated based on the extended trap outages. Migration could not be calculated because total catch was unknown during trap outages.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>			<u>Pink</u>			
	Hours		Catch			Migration			Catch			Migration
	In	Out	Actual	Estimated	Total	Actual	Estimated	Total	Actual	Estimated	Total	
1/25/06	23.00	0.00	2	0	2	0	0	0	0	0	0	
1/26/06	24.00	0.00	0	0	0	0	0	0	0	0	0	
1/27/06	24.00	0.00	0	0	0	1	0	1	0	0	0	
1/28/06	25.00	0.00	0	0	0	0	0	0	0	0	0	
1/29/06	0.00	24.00		0	0		0	0		0	0	
1/30/06	0.00	24.00		0	0		0	0		0	0	
1/31/06	0.00	24.00		0	0		0	0		0	0	
2/1/06	0.00	24.00		0	0		0	0		0	0	
2/2/06	0.00	24.00		0	0		0	0		0	0	
2/3/06	0.00	24.00		0	0		0	0		0	0	
2/4/06	0.00	24.00		0	0		0	0		0	0	
2/5/06	0.00	24.00		0	0		0	0		0	0	
2/6/06	0.00	24.00		0	0		0	0		0	0	
2/7/06	0.00	24.00		0	0		0	0		0	0	
2/8/06	0.00	24.00		0	0		0	0		0	0	
2/9/06	0.00	24.00		0	0		0	0		0	0	
2/10/06	0.00	24.00		0	0		0	0		0	0	
2/11/06	0.00	24.00		0	0		0	0		0	0	
2/12/06	0.00	24.00		0	0		0	0		0	0	
2/13/06	0.00	24.00		0	0		0	0		0	0	
2/14/06	0.00	24.00		0	0		0	0		0	0	
2/15/06	0.00	24.00		0	0		0	0		0	0	
2/16/06	0.00	24.00		0	0		0	0		0	0	
2/17/06	0.00	24.00		0	0		0	0		0	0	
2/18/06	0.00	24.00		0	0		0	0		0	0	
2/19/06	0.00	24.00		0	0		0	0		0	0	
2/20/06	0.00	24.00		0	0		0	0		0	0	
2/21/06	0.00	24.00		0	0		0	0		0	0	
2/22/06	0.00	24.00		0	0		0	0		0	0	
2/23/06	0.00	24.00		0	0		0	0		0	0	
2/24/06	0.00	24.00		0	0		0	0		0	0	

Continued on next page

Appendix L continued.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>			<u>Pink</u>		
	Hours		Catch		Migration	Catch		Migration	Catch		Migration
	In	Out	Actual	Estimated	Total	Actual	Estimated	Total	Actual	Estimated	Total
2/25/06	0.00	24.00		0	0		0	0		0	0
2/26/06	0.00	24.00		0	0		0	0		0	0
2/27/06	0.00	24.00		0	0		0	0		0	0
2/28/06	0.00	24.00		0	0		0	0		0	0
3/1/06	0.00	24.00		0	0		0	0		0	0
3/2/06	0.00	24.00		0	0		0	0		0	0
3/3/06	0.00	24.00		0	0		0	0		0	0
3/4/06	0.00	24.00		0	0		0	0		0	0
3/5/06	0.00	24.00		0	0		0	0		0	0
3/6/06	0.00	24.00		0	0		0	0		0	0
3/7/06	0.00	24.00		0	0		0	0		0	0
3/8/06	0.00	24.00		0	0		0	0		0	0
3/9/06	0.00	24.00		0	0		0	0		0	0
3/10/06	0.00	24.00		0	0		0	0		0	0
3/11/06	0.00	24.00		0	0		0	0		0	0
3/12/06	0.00	24.00		0	0		0	0		0	0
3/13/06	0.00	24.00		0	0		0	0		0	0
3/14/06	22.00	0.00	73	0	73	3	0	3	16	0	16
3/15/06	24.00	0.00	59	0	59	0	0	0	9	0	9
3/16/06	24.00	0.00	37	0	37	0	0	0	3	0	3
3/17/06	25.00	0.00	66	0	66	0	0	0	2	0	2
3/18/06	0.00	24.00		0	0		0	0		0	0
3/19/06	0.00	24.00		0	0		0	0		0	0
3/20/06	24.00	0.00	252	0	252	0	0	0	14	0	14
3/21/06	23.00	0.00	440	0	440	0	0	0	6	0	6
3/22/06	0.00	24.00		0	0		0	0		0	0
3/23/06	0.00	24.00		0	0		0	0		0	0
3/24/06	0.00	24.00		0	0		0	0		0	0
3/25/06	0.00	24.00		0	0		0	0		0	0
3/26/06	0.00	24.00		0	0		0	0		0	0
3/27/06	0.00	24.00		0	0		0	0		0	0
3/28/06	0.00	24.00		0	0		0	0		0	0
3/29/06	0.00	24.00		0	0		0	0		0	0
3/30/06	0.00	24.00		0	0		0	0		0	0
3/31/06	0.00	24.00		0	0		0	0		0	0
4/1/06	0.00	24.00		0	0		0	0		0	0

Continued on next page

Appendix L continued.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>			<u>Pink</u>					
	Hours		Catch			Migration			Catch			Migration		
	In	Out	Actual	Estimated	Total	Actual	Estimated	Total	Actual	Estimated	Total			
4/2/06	0.00	24.00		0	0		0	0		0	0			
4/3/06	0.00	24.00		0	0		0	0		0	0			
4/4/06	0.00	25.00		0	0		0	0		0	0			
4/5/06	27.50	0.00	899	0	899	0	0	0	26	0	26			
4/6/06	20.50	0.00	584	0	584	0	0	0	31	0	31			
4/7/06	24.00	0.00	580	0	580	0	0	0	31	0	31			
4/8/06	24.00	0.00	586	0	586	0	0	0	30	0	30			
4/9/06	31.00	0.00	642	0	642	0	0	0	16	0	16			
4/10/06	17.00	0.00	470	0	470	0	0	0	13	0	13			
4/11/06	24.00	0.00	470	0	470	0	0	0	13	0	13			
4/12/06	24.00	0.00	659	0	659	0	0	0	22	0	22			
4/13/06	28.00	0.00	660	0	660	0	0	0	35	0	35			
4/14/06	19.50	0.00	1239	0	1239	0	0	0	13	0	13			
4/15/06	26.00	0.00	2856	0	2856	2	0	2	16	0	16			
4/16/06	28.50	0.00	3215	0	3215	0	0	0	10	0	10			
4/17/06	20.00	0.00	691	0	691	0	0	0	6	0	6			
4/18/06	22.00	0.00	362	0	362	0	0	0	0	0	0			
4/19/06	25.00	0.00	362	0	362	0	0	0	0	0	0			
4/20/06	24.00	0.00	317	0	317	0	0	0	1	0	1			
4/21/06	23.00	0.00	317	0	317	0	0	0	1	0	1			
4/22/06	25.00	0.00	193	0	193	0	0	0	1	0	1			
4/23/06	31.00	0.00	262	0	262	0	0	0	1	0	1			
4/24/06	15.00	0.00	208	0	208	1	0	1	0	0	0			
4/25/06	24.00	0.00	100	0	100	0	0	0	0	0	0			
4/26/06	24.00	0.00	69	0	69	1	0	1	0	0	0			
4/27/06	24.50	0.00	144	0	144	9	0	9	11	0	11			
4/28/06	27.25	0.00	94	0	94	1	0	1	0	0	0			
4/29/06	21.25	0.00	40	0	40	0	0	0	0	0	0			
4/30/06	24.00	0.00	32	0	32	1	0	1	0	0	0			
5/1/06	24.00	0.00	39	0	39	0	0	0	0	0	0			
5/2/06	24.00	0.00	5	0	5	0	0	0	0	0	0			
5/3/06	23.50	0.00	4	0	4	0	0	0	0	0	0			
5/4/06	24.50	0.00	8	0	8	2	0	2	0	0	0			
5/5/06	23.92	0.00	10	0	10	2	0	2	0	0	0			
5/6/06	24.08	0.00	9	0	9	0	0	0	0	0	0			
5/7/06	26.50	0.00	7	0	7	0	0	0	0	0	0			

Continued on next page

Appendix L continued.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>			<u>Pink</u>		
	Hours		Catch		Migration	Catch		Migration	Catch		Migration
	In	Out	Actual	Estimated	Total	Actual	Estimated	Total	Actual	Estimated	Total
5/8/06	23.00	0.00	24	0	24	0	0	0	0	0	0
5/9/06	22.00	0.00	6	0	6	0	0	0	0	0	0
5/10/06	30.00	0.00	2	0	2	2	0	2	0	0	0
5/11/06	21.50	0.00	3	0	3	0	0	0	0	0	0
5/12/06	24.00	0.00	1	0	1	0	0	0	0	0	0
5/13/06	26.00	0.00	2	0	2	0	0	0	0	0	0
5/14/06	24.00	0.00	0	0	0	0	0	0	0	0	0
5/15/06	18.00	0.00	1	0	1	5	0	5	0	0	0
5/16/06	23.00	0.00	1	0	1	0	0	0	0	0	0
5/17/06	27.00	0.00	3	0	3	0	0	0	0	0	0
5/18/06	24.00	0.00	0	0	0	1	0	1	0	0	0
5/19/06	22.50	0.00	1	0	1	1	0	1	0	0	0
5/20/06	33.00	0.00	0	0	0	0	0	0	0	0	0
5/21/06	16.50	0.00	1	0	1	1	0	1	0	0	0
5/22/06	22.50	0.00	1	0	1	1	0	1	0	0	0
5/23/06	26.50	0.00	0	0	0	2	0	2	0	0	0
5/24/06	24.00	0.00	1	0	1	0	0	0	0	0	0
5/25/06	24.00	0.00	0	0	0	0	0	0	0	0	0
5/26/06	21.00	0.00	0	0	0	0	0	0	0	0	0
5/27/06	24.00	0.00	0	0	0	0	0	0	0	0	0
5/28/06	24.00	0.00	0	0	0	0	0	0	0	0	0
5/29/06	24.00	0.00	0	0	0	0	0	0	0	0	0
5/30/06	29.00	0.00	0	0	0	0	0	0	0	0	0
5/31/06	24.00	0.00	0	0	0	0	0	0	0	0	0
6/1/06	19.00	0.00	0	0	0	0	0	0	0	0	0
6/2/06	24.00	0.00	0	0	0	0	0	0	0	0	0
6/3/06	22.00	0.00	0	0	0	0	0	0	0	0	0
6/4/06	24.00	0.00	0	0	0	0	0	0	0	0	0
6/5/06	26.50	0.00	0	0	0	0	0	0	0	0	0
6/6/06	26.50	0.00	0	0	0	0	0	0	0	0	0
6/7/06	24.00	0.00	0	0	0	0	0	0	0	0	0
6/8/06	23.00	0.00	0	0	0	0	0	0	0	0	0
6/9/06	23.00	0.00	0	0	0	0	0	0	0	0	0
6/10/06	24.00	0.00	0	0	0	0	0	0	0	0	0
6/11/06	24.00	0.00	0	0	0	0	0	0	0	0	0
6/12/06	23.50	0.00	0	0	0	0	0	0	0	0	0

Continued on next page

Appendix L continued.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>			<u>Pink</u>					
	Hours		Catch			Migration			Catch			Migration		
	In	Out	Actual	Estimated	Total	Actual	Estimated	Total	Actual	Estimated	Total			
6/13/06	24.00	0.00	0	0	0	0	0	0	0	0	0	0		
6/14/06	25.50	0.00	0	0	0	0	0	0	0	0	0	0		
6/15/06	24.00	0.00	0	0	0	0	0	0	0	0	0	0		
6/16/06	22.50	0.00	0	0	0	0	0	0	0	0	0	0		
6/17/06	22.50	0.00	0	0	0	0	0	0	0	0	0	0		
6/18/06	29.00	0.00	0	0	0	0	0	0	0	0	0	0		
6/19/06	20.42	0.00	0	0	0	0	0	0	0	0	0	0		
6/20/06	24.00	0.00	0	0	0	0	0	0	0	0	0	0		
6/21/06	24.00	0.00	0	0	0	0	0	0	0	0	0	0		
6/22/06	24.00	0.00	0	0	0	0	0	0	0	0	0	0		
6/23/06	24.08	0.00	0	0	0	0	0	0	0	0	0	0		
6/24/06	24.00	0.00	0	0	0	0	0	0	0	0	0	0		
6/25/06	24.00	0.00	0	0	0	0	0	0	0	0	0	0		
6/26/06	24.25	0.00	0	0	0	0	0	0	0	0	0	0		
6/27/06	24.00	0.00	0	0	0	0	0	0	0	0	0	0		
6/28/06	24.00	0.00	0	0	0	0	0	0	0	0	0	0		
6/29/06	24.00	0.00	0	0	0	0	0	0	0	0	0	0		
6/30/06	24.17	0.00	0	0	0	0	0	0	0	0	0	0		
7/1/06	24.08	0.00	0	0	0	0	0	0	0	0	0	0		
7/2/06	24.00	0.00	0	0	0	0	0	0	0	0	0	0		
7/3/06	24.00	0.00	0	0	0	0	0	0	0	0	0	0		
7/4/06	24.00	0.00	0	0	0	0	0	0	0	0	0	0		
7/5/06	24.83	0.00	0	0	0	0	0	0	0	0	0	0		
Total	2446.83	1441.00	17,109	0	17,109	0	36	0	36	0	327	0	327	0

Appendix M

2007 Hamma Hamma River daily catch and migration estimates for juvenile chum, Chinook, and pink salmon

APPENDIX M.—Daily catches of juvenile chum, Chinook, and pink salmon caught in the Hamma Hamma River screw trap in 2007. Total catch represents actual and estimated catch for a given day. Time in and out reflect time fished (in) and not fished (out) on a given day.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>			
	Hours		Catch			Migration	Catch			Migration
	In	Out	Actual	Estimated	Total		Actual	Estimated	Total	
1/17/07	22.50	0.00	1	0	1	29	0	0	0	0
1/18/07	22.25	0.00	0	0	0	0	0	0	0	0
1/19/07	24.75	0.00	1	0	1	29	0	0	0	0
1/20/07	22.00	0.00	0	0	0	0	1	0	1	29
1/21/07	23.00	0.00	1	0	1	29	0	0	0	0
1/22/07	26.50	0.00	0	0	0	0	0	0	0	0
1/23/07	21.50	0.00	0	0	0	0	1	0	1	29
1/24/07	27.00	0.00	0	0	0	0	0	0	0	0
1/25/07	23.00	0.00	2	0	2	58	0	0	0	0
1/26/07	24.00	0.00	0	0	0	0	0	0	0	0
1/27/07	23.00	0.00	4	0	4	116	0	0	0	0
1/28/07	23.00	0.00	1	0	1	29	1	0	1	29
1/29/07	24.00	0.00	0	0	0	0	0	0	0	0
1/30/07	24.00	0.00	0	0	0	0	0	0	0	0
1/31/07	26.50	0.00	3	0	3	87	0	0	0	0
2/1/07	23.50	0.00	0	0	0	0	1	0	1	29
2/2/07	24.00	0.00	1	0	1	29	0	0	0	0
2/3/07	23.00	0.00	7	0	7	203	0	0	0	0
2/4/07	23.00	0.00	9	0	9	261	0	0	0	0
2/5/07	24.00	0.00	32	0	32	928	0	0	0	0
2/6/07	25.00	0.00	11	0	11	319	0	0	0	0
2/7/07	25.00	0.00	17	0	17	493	1	0	1	29
2/8/07	0.00	24.00	0	25	25	725	0	0	0	0
2/9/07	0.00	24.50	0	26	26	754	0	0	0	0
2/10/07	24.50	0.00	35	0	35	1,015	0	0	0	0
2/11/07	21.00	0.00	26	0	26	754	0	0	0	0
2/12/07	24.00	0.00	72	0	72	2,088	0	0	0	0
2/13/07	26.75	0.00	86	0	86	2,494	0	0	0	0
2/14/07	23.25	0.00	59	0	59	1,711	0	0	0	0
2/15/07	24.25	0.00	79	0	79	2,291	0	0	0	0
2/16/07	22.75	0.00	53	0	53	1,537	1	0	1	29
2/17/07	23.50	0.00	67	0	67	1,943	0	0	0	0
2/18/07	22.50	0.00	143	0	143	4,147	0	0	0	0
2/19/07	25.00	0.00	235	0	235	6,815	0	0	0	0

Continued on next page

Appendix M continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>			
	Hours		Catch		Total	Migration	Catch		Total	Migration
	In	Out	Actual	Estimated			Actual	Estimated		
2/20/07	24.00	0.00	135	0	135	3,915	0	0	0	0
2/21/07	25.00	0.00	112	0	112	3,248	0	0	0	0
2/22/07	23.00	0.00	195	0	195	5,655	0	0	0	0
2/23/07	23.50	0.00	136	0	136	3,944	0	0	0	0
2/24/07	24.50	0.00	200	0	200	5,800	0	0	0	0
2/25/07	24.00	0.00	64	0	64	1,856	0	0	0	0
2/26/07	23.00	0.00	103	0	103	2,987	0	0	0	0
2/27/07	24.00	0.00	66	0	66	1,914	0	0	0	0
2/28/07	25.00	0.00	94	0	94	2,726	0	0	0	0
3/1/07	24.00	0.00	132	0	132	3,828	0	0	0	0
3/2/07	26.00	0.00	81	0	81	2,349	0	0	0	0
3/3/07	28.00	0.00	82	0	82	2,378	0	0	0	0
3/4/07	18.00	0.00	111	0	111	3,219	0	0	0	0
3/5/07	27.00	0.00	234	0	234	6,786	0	0	0	0
3/6/07	20.00	0.00	297	0	297	8,613	0	0	0	0
3/7/07	25.00	0.00	318	0	318	9,222	0	0	0	0
3/8/07	24.00	0.00	363	0	363	10,527	0	0	0	0
3/9/07	27.00	0.00	218	0	218	6,322	0	0	0	0
3/10/07	26.00	0.00	4,983	0	4,983	144,507	0	0	0	0
3/11/07	0.00	24.00	0	2,397	2,397	69,513	0	0	0	0
3/12/07	0.00	24.00	0	2,397	2,397	69,513	0	0	0	0
3/13/07	0.00	24.00	0	145	145	4,205	0	0	0	0
3/14/07	0.00	24.00	0	145	145	4,205	0	1	1	29
3/15/07	0.00	22.00	0	133	133	3,857	0	1	1	29
3/16/07	24.50	0.00	162	0	162	4,698	2	0	2	58
3/17/07	20.50	0.00	113	0	113	3,277	0	0	0	0
3/18/07	24.00	0.00	241	0	241	6,989	0	0	0	0
3/19/07	23.50	0.00	133	0	133	3,857	0	0	0	0
3/20/07	24.50	0.00	182	0	182	5,278	0	0	0	0
3/21/07	24.00	0.00	61	0	61	1,769	0	0	0	0
3/22/07	24.00	0.00	103	0	103	2,987	1	0	1	29
3/23/07	23.50	0.00	133	0	133	3,857	0	0	0	0
3/24/07	25.50	0.00	288	0	288	8,352	0	0	0	0
3/25/07	24.00	0.00	344	0	344	9,976	0	0	0	0
3/26/07	27.00	0.00	197	0	197	5,713	0	0	0	0
3/27/07	24.00	0.00	586	0	586	16,994	0	0	0	0

Continued on next page

Appendix M continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>			
	Hours		Catch		Migration	Catch		Migration		
	In	Out	Actual	Estimated		Actual	Estimated		Total	
3/28/07	24.50	0.00	608	0	608	17,632	1	0	1	29
3/29/07	23.50	0.00	566	0	566	16,414	0	0	0	0
3/30/07	25.25	0.00	544	0	544	15,776	0	0	0	0
3/31/07	23.75	0.00	1,784	0	1,784	51,736	0	0	0	0
4/1/07	22.50	0.00	277	0	277	8,033	0	0	0	0
4/2/07	22.50	0.00	221	0	221	6,409	0	0	0	0
4/3/07	22.00	0.00	389	0	389	11,281	0	0	0	0
4/4/07	29.50	0.00	2,152	0	2,152	62,408	0	0	0	0
4/5/07	18.50	0.00	1,566	0	1,566	45,414	0	0	0	0
4/6/07	26.00	0.00	5,162	0	5,162	149,698	0	0	0	0
4/7/07	21.75	0.00	6,385	0	6,385	185,165	0	0	0	0
4/8/07	24.25	0.00	6,453	0	6,453	187,137	0	0	0	0
4/9/07	27.00	0.00	1,815	0	1,815	52,635	0	0	0	0
4/10/07	23.00	0.00	1,607	0	1,607	46,603	0	0	0	0
4/11/07	22.00	0.00	1,165	0	1,165	33,785	0	0	0	0
4/12/07	25.00	0.00	3,854	0	3,854	111,766	0	0	0	0
4/13/07	25.00	0.00	3,621	0	3,621	105,009	0	0	0	0
4/14/07	24.00	0.00	14,560	0	14,560	422,240	0	0	0	0
4/15/07	22.00	0.00	1,702	0	1,702	49,358	0	0	0	0
4/16/07	24.00	0.00	1,619	0	1,619	46,951	0	0	0	0
4/17/07	29.00	0.00	5,922	0	5,922	171,738	0	0	0	0
4/18/07	22.50	0.00	5,300	0	5,300	153,700	0	0	0	0
4/19/07	21.17	0.00	3,337	0	3,337	96,773	0	0	0	0
4/20/07	28.58	0.00	3,282	0	3,282	95,178	0	0	0	0
4/21/07	28.25	0.00	1,463	0	1,463	42,427	0	0	0	0
4/22/07	14.50	0.00	8,250	0	8,250	239,250	0	0	0	0
4/23/07	22.00	0.00	9,021	0	9,021	261,609	1	0	1	29
4/24/07	27.50	0.00	9,251	0	9,251	268,279	0	0	0	0
4/25/07	24.50	0.00	8,851	0	8,851	256,679	0	0	0	0
4/26/07	25.50	0.00	11,251	0	11,251	326,279	0	0	0	0
4/27/07	23.50	0.00	8,965	0	8,965	259,985	0	0	0	0
4/28/07	21.00	0.00	9,450	0	9,450	274,050	0	0	0	0
4/29/07	25.00	0.00	4,408	0	4,408	127,832	0	0	0	0
4/30/07	25.00	0.00	2,104	0	2,104	61,016	0	0	0	0
5/1/07	26.00	0.00	1,141	0	1,141	33,089	0	0	0	0
5/2/07	21.50	0.00	1,647	0	1,647	47,763	0	0	0	0

Continued on next page

Appendix M continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>			
	Hours		Catch		Total	Migration	Catch		Total	Migration
	In	Out	Actual	Estimated			Actual	Estimated		
5/3/07	21.50	0.00	693	0	693	11,562	0	0	0	0
5/4/07	32.00	0.00	730	0	730	12,179	0	0	0	0
5/5/07	19.00	0.00	390	0	390	6,507	0	0	0	0
5/6/07	26.00	0.00	377	0	377	6,290	0	0	0	0
5/7/07	22.00	0.00	417	0	417	6,957	0	0	0	0
5/8/07	25.50	0.00	548	0	548	9,142	0	0	0	0
5/9/07	22.50	0.00	0	0	0	0	0	0	0	0
5/10/07	24.50	0.00	0	0	0	0	0	0	0	0
5/11/07	21.50	0.00	74	0	74	1,235	1	0	1	17
5/12/07	32.00	0.00	3	0	3	50	0	0	0	0
5/13/07	25.50	0.00	17	0	17	284	0	0	0	0
5/14/07	16.50	0.00	88	0	88	1,468	0	0	0	0
5/15/07	26.00	0.00	39	0	39	651	0	0	0	0
5/16/07	25.00	0.00	11	0	11	184	0	0	0	0
5/17/07	22.00	0.00	6	0	6	100	0	0	0	0
5/18/07	19.00	0.00	0	0	0	0	0	0	0	0
5/19/07	26.00	0.00	6	0	6	100	0	0	0	0
5/20/07	26.00	0.00	0	0	0	0	0	0	0	0
5/21/07	28.00	0.00	71	0	71	1,185	0	0	0	0
5/22/07	20.00	0.00	2	0	2	33	0	0	0	0
5/23/07	27.50	0.00	39	0	39	651	0	0	0	0
5/24/07	20.50	0.00	0	0	0	0	0	0	0	0
5/25/07	24.00	0.00	23	0	23	384	0	0	0	0
5/26/07	22.00	0.00	0	0	0	0	0	0	0	0
5/27/07	28.00	0.00	0	0	0	0	1	0	1	17
5/28/07	20.00	0.00	0	0	0	0	0	0	0	0
5/29/07	25.00	0.00	8	0	8	133	0	0	0	0
5/30/07	25.00	0.00	0	0	0	0	0	0	0	0
5/31/07	25.00	0.00	1	0	1	17	27	0	27	450
6/1/07	20.25	0.00	3	0	3	50	9	0	9	150
6/2/07	26.75	0.00	0	0	0	0	0	0	0	0
6/3/07	28.50	0.00	17	0	17	284	0	0	0	0
6/4/07	22.50	0.00	0	0	0	0	0	0	0	0
6/5/07	24.00	0.00	14	0	14	234	3	0	3	50
6/6/07	19.00	0.00	9	0	9	150	1	0	1	17
6/7/07	27.50	0.00	7	0	7	117	0	0	0	0

Continued on next page

Appendix M continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>			
	Hours		Catch		Total	Migration	Catch		Total	Migration
	In	Out	Actual	Estimated			Actual	Estimated		
6/8/07	19.50	0.00	11	0	11	184	0	0	0	0
6/9/07	31.00	0.00	6	0	6	100	0	0	0	0
6/10/07	18.00	0.00	4	0	4	67	0	0	0	0
6/11/07	27.00	0.00	5	0	5	83	0	0	0	0
6/12/07	26.50	0.00	1	0	1	17	1	0	1	17
6/13/07	26.00	0.00	0	0	0	0	0	0	0	0
6/14/07	22.00	0.00	0	0	0	0	0	0	0	0
6/15/07	20.50	0.00	0	0	0	0	0	0	0	0
6/16/07	22.00	0.00	0	0	0	0	0	0	0	0
6/17/07	26.00	0.00	0	0	0	0	0	0	0	0
6/18/07	20.50	0.00	0	0	0	0	0	0	0	0
6/19/07	27.50	0.00	0	0	0	0	0	0	0	0
6/20/07	24.00	0.00	0	0	0	0	0	0	0	0
6/21/07	24.00	0.00	0	0	0	0	0	0	0	0
6/22/07	21.00	0.00	0	0	0	0	0	0	0	0
6/23/07	26.00	0.00	0	0	0	0	0	0	0	0
6/24/07	26.00	0.00	0	0	0	0	0	0	0	0
6/25/07	24.00	0.00	0	0	0	0	0	0	0	0
6/26/07	24.25	0.00	0	0	0	0	0	0	0	0
6/27/07	23.25	0.00	0	0	0	0	0	0	0	0
6/28/07	23.50	0.00	0	0	0	0	0	0	0	0
6/29/07	24.00	0.00	0	0	0	0	0	0	0	0
6/30/07	30.00	0.00	0	0	0	0	0	0	0	0
7/1/07	18.50	0.00	0	0	0	0	0	0	0	0
7/2/07	20.50	0.00	0	0	0	0	0	0	0	0
7/3/07	24.00	0.00	0	0	0	0	0	0	0	0
7/5/07	49.00	0.00	0	0	0	0	0	0	0	0
7/6/07	26.00	0.00	0	0	0	0	0	0	0	0
7/7/07	24.00	0.00	0	0	0	0	0	0	0	0
7/8/07	24.00	0.00	0	0	0	0	0	0	0	0
7/9/07	24.00	0.00	0	0	0	0	0	0	0	0
7/10/07	22.00	0.00	0	0	0	0	0	0	0	0
7/11/07	30.00	0.00	0	0	0	0	0	0	0	0
7/12/07	20.00	0.00	0	0	0	0	0	0	0	0
7/13/07	25.25	0.00	0	0	0	0	0	0	0	0
7/14/07	25.25	0.00	0	0	0	0	0	0	0	0

Continued on next page

Appendix M continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>			
	Hours		Catch		Migration	Catch		Migration		
	In	Out	Actual	Estimated		Actual	Estimated		Total	
7/15/07	21.50	0.00	0	0	0	0	0	0	0	0
7/16/07	24.00	0.00	0	0	0	0	0	0	0	0
7/17/07	27.00	0.00	0	0	0	0	0	0	0	0
7/18/07	24.00	0.00	0	0	0	0	4	0	4	74
7/19/07	0.00	24.00	0	0	0	0	0	2	2	37
7/20/07	0.00	24.00	0	0	0	0	0	2	2	37
7/21/07	0.00	24.00	0	0	0	0	0	2	2	37
7/22/07	0.00	24.00	0	0	0	0	0	0	0	0
7/23/07	0.00	24.00	0	0	0	0	0	0	0	0
7/24/07	0.00	24.00	0	0	0	0	0	0	0	0
7/25/07	0.00	21.00	0	0	0	0	0	0	0	0
7/26/07	22.00	0.00	0	0	0	0	0	0	0	0
7/27/07	24.00	0.00	0	0	0	0	0	0	0	0
7/28/07	24.00	0.00	0	0	0	0	0	0	0	0
7/29/07	27.00	0.00	0	0	0	0	0	0	0	0
7/30/07	24.50	0.00	0	0	0	0	0	0	0	0
7/31/07	22.50	0.00	0	0	0	0	0	0	0	0
Total	4369.00	331.50	164,725	5,268	169,993	4,885,211	58	8	66	1,279

Appendix N

2008 Hamma Hamma River daily catch and migration estimates for juvenile chum, Chinook, and pink salmon

APPENDIX N.—Daily catches of juvenile chum, Chinook, and pink salmon caught in the Hamma Hamma River screw trap in 2008. Total catch represents actual and estimated catch for a given day. Time in and out reflect time fished (in) and not fished (out) on a given day.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>			<u>Pink</u>			Migration		
	Hours		Catch		Migration	Catch		Migration	Catch					
	In	Out	Actual	Estimated	Total	Actual	Estimated	Total	Actual	Estimated	Total			
2/5/08	23.50	0.00	4	0	4	43	0	0	0	0	0	0	0	0
2/6/08	23.50	0.00	1	0	1	11	0	0	0	0	0	0	0	0
2/7/08	23.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
2/8/08	25.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
2/9/08	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
2/10/08	23.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
2/11/08	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
2/12/08	23.75	0.00	0	0	0	0	0	0	0	0	0	0	0	0
2/13/08	26.25	0.00	0	0	0	0	0	0	0	0	0	0	0	0
2/14/08	23.00	0.00	1	0	1	11	0	0	0	0	0	0	0	0
2/15/08	21.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
2/16/08	28.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
2/17/08	27.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
2/18/08	19.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
2/19/08	24.00	0.00	1	0	1	11	0	0	0	0	0	0	0	0
2/20/08	23.00	0.00	1	0	1	11	0	0	0	0	0	0	0	0
2/21/08	25.00	0.00	4	0	4	43	0	0	0	0	0	0	0	0
2/22/08	26.00	0.00	41	0	41	437	0	0	0	0	0	0	0	0
2/23/08	24.00	0.00	23	0	23	245	0	0	0	0	0	0	0	0
2/24/08	25.00	0.00	85	0	85	905	0	0	0	0	0	0	0	0
2/25/08	24.50	0.00	54	0	54	575	0	0	0	0	1	0	1	11
2/26/08	21.50	0.00	84	0	84	895	0	0	0	0	1	0	1	11
2/27/08	22.00	0.00	28	0	28	298	0	0	0	0	0	0	0	0
2/28/08	27.00	0.00	32	0	32	341	0	0	0	0	0	0	0	0
2/29/08	25.00	0.00	15	0	15	160	0	0	0	0	0	0	0	0
3/1/08	28.00	0.00	63	0	63	671	0	0	0	0	0	0	0	0
3/2/08	24.00	0.00	37	0	37	394	0	0	0	0	0	0	0	0
3/3/08	17.25	0.00	19	0	19	202	0	0	0	0	0	0	0	0
3/4/08	25.75	0.00	16	0	16	170	0	0	0	0	0	0	0	0
3/5/08	25.00	0.00	26	0	26	277	0	0	0	0	0	0	0	0
3/6/08	23.00	0.00	28	0	28	298	0	0	0	0	0	0	0	0
3/7/08	23.00	0.00	77	0	77	820	1	0	1	11	0	0	0	0
3/8/08	27.00	0.00	41	0	41	437	0	0	0	0	0	0	0	0
3/9/08	20.00	0.00	29	0	29	309	1	0	1	11	0	0	0	0

Continued on next page

Appendix N continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>				<u>Pink</u>			
	Hours		Catch			Migration	Catch			Migration	Catch			Migration
	In	Out	Actual	Estimated	Total		Actual	Estimated	Total		Actual	Estimated	Total	
3/10/08	28.25	0.00	12	0	12	128	3	0	3	32	0	0	0	0
3/11/08	0.00	21.75	0	20	20	213	0	2	2	21	0	0	0	0
3/12/08	0.00	24.00	0	22	22	234	0	2	2	21	0	0	0	0
3/13/08	0.00	24.00	0	22	22	234	0	2	2	21	0	0	0	0
3/14/08	0.00	24.00	0	22	22	234	0	2	2	21	0	0	0	0
3/15/08	0.00	24.00	0	22	22	234	0	2	2	21	0	0	0	0
3/16/08	0.00	24.00	0	22	22	234	0	2	2	21	0	0	0	0
3/17/08	0.00	24.00	0	22	22	234	0	2	2	21	0	0	0	0
3/18/08	0.00	24.00	0	22	22	234	0	2	2	21	0	0	0	0
3/19/08	0.00	24.00	0	22	22	234	0	2	2	21	0	0	0	0
3/20/08	0.00	24.00	0	134	134	1,427	0	0	0	0	0	6	6	64
3/21/08	0.00	24.00	0	134	134	1,427	0	0	0	0	0	6	6	64
3/22/08	0.00	24.00	0	134	134	1,427	0	0	0	0	0	6	6	64
3/23/08	0.00	24.00	0	134	134	1,427	0	0	0	0	0	6	6	64
3/24/08	0.00	24.00	0	134	134	1,427	0	0	0	0	0	6	6	64
3/25/08	0.00	24.00	0	134	134	1,427	0	0	0	0	0	6	6	64
3/26/08	0.00	24.00	0	134	134	1,427	0	0	0	0	0	6	6	64
3/27/08	0.00	24.00	0	134	134	1,427	0	0	0	0	0	6	6	64
3/28/08	0.00	22.00	0	123	123	1,310	0	0	0	0	0	5	5	53
3/29/08	24.00	0.00	117	0	117	1,246	0	0	0	0	3	0	3	32
3/30/08	26.00	0.00	163	0	163	1,736	0	0	0	0	9	0	9	96
3/31/08	24.00	0.00	242	0	242	2,577	0	0	0	0	26	0	26	277
4/1/08	22.00	0.00	138	0	138	1,470	1	0	1	11	19	0	19	202
4/2/08	24.00	0.00	91	0	91	969	0	0	0	0	16	0	16	170
4/3/08	29.50	0.00	163	0	163	1,021	0	0	0	0	14	0	14	88
4/4/08	24.00	0.00	232	0	232	1,453	1	0	1	6	37	0	37	232
4/5/08	20.50	0.00	180	0	180	1,127	0	0	0	0	6	0	6	38
4/6/08	23.00	0.00	176	0	176	1,102	1	0	1	6	9	0	9	56
4/7/08	22.00	0.00	99	0	99	620	0	0	0	0	47	0	47	294
4/8/08	24.75	0.00	133	0	133	833	1	0	1	6	0	0	0	0
4/9/08	27.08	0.00	133	0	133	833	0	0	0	0	9	0	9	56
4/10/08	21.17	0.00	189	0	189	1,184	1	0	1	6	23	0	23	144
4/11/08	24.00	0.00	386	0	386	2,417	0	0	0	0	4	0	4	25
4/12/08	32.00	0.00	196	0	196	1,227	0	0	0	0	16	0	16	100
4/13/08	16.00	0.00	611	0	611	5,716	0	0	0	0	16	0	16	150
4/14/08	28.25	0.00	228	0	228	2,133	0	0	0	0	12	0	12	112

Continued on next page

Appendix N continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>				<u>Pink</u>			
	Hours		Catch			Migration	Catch			Migration	Catch			Migration
	In	Out	Actual	Estimated	Total		Actual	Estimated	Total		Actual	Estimated	Total	
4/15/08	23.75	0.00	65	0	65	608	0	0	0	0	8	0	8	75
4/16/08	25.00	0.00	315	0	315	2,947	1	0	1	9	62	0	62	580
4/17/08	24.00	0.00	123	0	123	1,151	0	0	0	0	6	0	6	56
4/18/08	21.00	0.00	262	0	262	2,451	0	0	0	0	7	0	7	65
4/19/08	24.00	0.00	244	0	244	2,283	0	0	0	0	16	0	16	150
4/20/08	30.00	0.00	367	0	367	3,433	0	0	0	0	12	0	12	112
4/21/08	15.00	0.00	541	0	541	5,061	0	0	0	0	26	0	26	243
4/22/08	29.93	0.00	752	0	752	7,035	0	0	0	0	18	0	18	168
4/23/08	22.47	0.00	1229	0	1229	11,497	1	0	1	9	8	0	8	75
4/24/08	21.60	0.00	313	0	313	2,928	0	0	0	0	1	0	1	9
4/25/08	28.50	0.00	855	0	855	7,999	1	0	1	9	5	0	5	47
4/26/08	20.50	0.00	352	0	352	3,293	0	0	0	0	6	0	6	56
4/27/08	22.00	0.00	418	0	418	3,910	0	0	0	0	3	0	3	28
4/28/08	30.50	0.00	427	0	427	3,995	0	0	0	0	0	0	0	0
4/29/08	17.50	0.00	412	0	412	3,854	1	0	1	9	0	0	0	0
4/30/08	25.00	0.00	193	0	193	1,806	0	0	0	0	0	0	0	0
5/1/08	29.00	0.00	127	0	127	1,188	0	0	0	0	0	0	0	0
5/2/08	23.00	0.00	1162	0	1162	20,406	1	0	1	18	0	0	0	0
5/3/08	24.00	0.00	179	0	179	3,143	0	0	0	0	0	0	0	0
5/4/08	27.00	0.00	382	0	382	6,708	2	0	2	35	0	0	0	0
5/5/08	17.00	0.00	244	0	244	4,285	1	0	1	18	0	0	0	0
5/6/08	23.00	0.00	210	0	210	3,688	1	0	1	18	1	0	1	18
5/7/08	0.00	26.00	0	305	305	5,356	0	1	1	18	0	1	1	18
5/8/08	0.00	24.00	0	282	282	4,952	0	1	1	18	0	1	1	18
5/9/08	0.00	24.00	0	34	34	597	0	0	0	0	0	0	0	0
5/10/08	0.00	24.00	0	34	34	597	0	0	0	0	0	0	0	0
5/11/08	30.00	0.00	65	0	65	1,141	0	0	0	0	0	0	0	0
5/12/08	20.50	0.00	14	0	14	246	0	0	0	0	0	0	0	0
5/13/08	18.50	0.00	19	0	19	334	0	0	0	0	0	0	0	0
5/14/08	24.00	0.00	3	0	3	53	1	0	1	18	0	0	0	0
5/15/08	0.00	27.00	0	3	3	53	0	1	1	18	0	0	0	0
5/16/08	0.00	24.00	0	3	3	53	0	1	1	18	0	0	0	0
5/17/08	0.00	24.00	0	3	3	53	0	1	1	18	0	0	0	0
5/18/08	0.00	24.00	0	3	3	53	0	1	1	18	0	0	0	0
5/19/08	0.00	24.00	0	3	3	53	0	1	1	18	0	0	0	0
5/20/08	0.00	24.00	0	3	3	53	0	1	1	18	0	0	0	0

Continued on next page

Appendix N continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>				<u>Pink</u>			
	Hours		Catch			Migration	Catch			Migration	Catch			Migration
	In	Out	Actual	Estimated	Total		Actual	Estimated	Total		Actual	Estimated	Total	
5/21/08	0.00	24.00	0	3	3	53	0	1	1	18	0	0	0	0
5/22/08	0.00	24.00	0	3	3	53	0	1	1	18	0	0	0	0
5/23/08	0.00	24.00	0	3	3	53	0	1	1	18	0	0	0	0
5/24/08	27.00	0.00	3	0	3	53	1	0	1	18	0	0	0	0
5/25/08	20.00	0.00	2	0	2	35	0	0	0	0	0	0	0	0
5/26/08	25.00	0.00	3	0	3	53	0	0	0	0	0	0	0	0
5/27/08	23.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
5/28/08	22.00	0.00	1	0	1	18	0	0	0	0	0	0	0	0
5/29/08	27.00	0.00	3	0	3	53	1	0	1	18	0	0	0	0
5/30/08	26.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
5/31/08	26.00	0.00	0	0	0	0	3	0	3	53	0	0	0	0
6/1/08	21.25	0.00	0	0	0	0	2	0	2	35	0	0	0	0
6/2/08	25.25	0.00	0	0	0	0	13	0	13	228	0	0	0	0
6/3/08	19.83	0.00	1	0	1	18	1	0	1	18	0	0	0	0
6/4/08	25.67	0.00	1	0	1	18	0	0	0	0	0	0	0	0
6/5/08	26.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
6/6/08	21.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
6/7/08	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0
6/8/08	24.00	0.00	0	0	0	0	1	0	1	18	0	0	0	0
6/9/08	26.25	0.00	0	0	0	0	1	0	1	18	0	0	0	0
Total	2280.50	744.75	13,486	2,073	15,559	167,832	43	29	72	1,021	447	55	502	4,376

Appendix O

2009 Hamma Hamma River daily catch and migration estimates for juvenile chum, Chinook, and pink salmon

APPENDIX O.—Daily catches of juvenile chum, Chinook, and pink salmon caught in the Hamma Hamma River screw trap in 2009. Actual catch data are blank when no information was available. Total catch represents actual and estimated catch for a given day. Time in and out reflect time fished (in) and not fished (out) on a given day.

Date	Time Fished		<u>Chum</u>			Migration	<u>Chinook</u>			Migration
	Hours		Catch				Catch			
	In	Out	Actual	Estimated	Total		Actual	Estimated	Total	
2/4/09	24.00	0.00	564	0	564	800	1	0	1	1
2/5/09	24.00	0.00	668	0	668	948	0	0	0	0
2/6/09	24.00	0.00	915	0	915	1,299	0	0	0	0
2/7/09	24.00	0.00	1,471	0	1,471	2,088	0	0	0	0
2/8/09	24.00	0.00	1,135	0	1,135	1,611	0	0	0	0
2/9/09	24.00	0.00	1,760	0	1,760	2,498	0	0	0	0
2/10/09	24.00	0.00	1,446	0	1,446	2,052	1	0	1	1
2/11/09	24.00	0.00	975	0	975	1,384	0	0	0	0
2/12/09	24.00	0.00	1,350	0	1,350	1,916	0	0	0	0
2/13/09	24.00	0.00	1,157	0	1,157	1,642	3	0	3	4
2/14/09	24.00	0.00	1,365	0	1,365	1,937	0	0	0	0
2/15/09	24.00	0.00	1,170	0	1,170	1,661	0	0	0	0
2/16/09	24.00	0.00	1,635	0	1,635	2,320	0	0	0	0
2/17/09	24.00	0.00	1,750	0	1,750	2,484	0	0	0	0
2/18/09	24.00	0.00	1,366	0	1,366	1,939	2	0	2	3
2/19/09	24.00	0.00	1,108	0	1,108	1,573	11	0	11	16
2/20/09	24.00	0.00	979	0	979	1,389	1	0	1	1
2/21/09	24.00	0.00	762	0	762	1,081	2	0	2	3
2/22/09	24.00	0.00	746	0	746	1,059	0	0	0	0
2/23/09	24.00	0.00	892	0	892	1,266	0	0	0	0
2/24/09	0.00	24.00	0	969	969	1,375	0	6	6	9
2/25/09	0.00	24.00	0	969	969	1,375	0	6	6	9
2/26/09	0.00	24.00	0	969	969	1,375	0	6	6	9
2/27/09	24.00	0.00	1,045	0	1,045	1,483	11	0	11	16
2/28/09	24.00	0.00	1,855	0	1,855	2,633	2	0	2	3
3/1/09	24.00	0.00	2,640	0	2,640	3,747	9	0	9	13
3/2/09	0.00	24.00	0	2248	2,248	3,191	0	6	6	9
3/3/09	0.00	24.00	0	2248	2,248	3,191	0	6	6	9
3/4/09	0.00	24.00	0	778	778	1,104	0	0	0	0
3/5/09	0.00	24.00	0	778	778	1,104	0	0	0	0
3/6/09	24.00	0.00	881	0	881	1,250	0	0	0	0
3/7/09	24.00	0.00	675	0	675	958	0	0	0	0
3/8/09	24.00	0.00	540	0	540	766	0	0	0	0

Continued on next page

Appendix O continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>			
	Hours		Catch		Migration	Catch		Migration		
	In	Out	Actual	Estimated		Actual	Estimated		Total	
3/9/09	24.00	0.00	672	0	672	954	1	0	1	1
3/10/09	24.00	0.00	664	0	664	942	1	0	1	1
3/11/09	24.00	0.00	427	0	427	606	0	0	0	0
3/12/09	24.00	0.00	637	0	637	904	1	0	1	1
3/13/09	24.00	0.00	1,332	0	1,332	1,890	0	0	0	0
3/14/09	24.00	0.00	1,144	0	1,144	1,624	0	0	0	0
3/15/09	24.00	0.00	1,246	0	1,246	1,768	2	0	2	3
3/16/09	24.00	0.00	532	0	532	755	0	0	0	0
3/17/09	24.00	0.00	388	0	388	551	0	0	0	0
3/18/09	24.00	0.00	539	0	539	765	2	0	2	3
3/19/09	24.00	0.00	843	0	843	1,196	0	0	0	0
3/20/09	29.00	0.00	1,035	0	1,035	1,469	2	0	2	3
3/21/09	0.00	24.00	0	676	676	959	0	2	2	3
3/22/09	24.00	0.00	496	0	496	704	2	0	2	3
3/23/09	24.00	0.00	876	0	876	1,243	1	0	1	1
3/24/09	24.00	0.00	1,154	0	1,154	1,638	0	0	0	0
3/25/09	24.00	0.00	1,206	0	1,206	1,712	0	0	0	0
3/26/09	24.00	0.00	1,436	0	1,436	2,038	0	0	0	0
3/27/09	24.00	0.00	1,810	0	1,810	2,569	2	0	2	3
3/28/09	22.50	0.00	2,166	0	2,166	3,074	0	0	0	0
3/29/09	0.00	25.50	0	2109	2,109	2,993	0	0	0	0
3/30/09	24.00	0.00	1,659	0	1,659	2,355	0	0	0	0
3/31/09	24.00	0.00	987	0	987	1,401	0	0	0	0
4/1/09	24.00	0.00	968	0	968	2,146	0	0	0	0
4/2/09	24.00	0.00	1,474	0	1,474	3,268	0	0	0	0
4/3/09	24.00	0.00	1,802	0	1,802	3,995	0	0	0	0
4/4/09	24.00	0.00	830	0	830	1,840	0	0	0	0
4/5/09	24.00	0.00	865	0	865	1,918	0	0	0	0
4/6/09	24.00	0.00	2,253	0	2,253	4,994	0	0	0	0
4/7/09	24.00	0.00	2,170	0	2,170	4,810	0	0	0	0
4/8/09	24.00	0.00	1,102	0	1,102	2,443	0	0	0	0
4/9/09	24.00	0.00	1,844	0	1,844	4,088	0	0	0	0
4/10/09	24.00	0.00	3,174	0	3,174	7,036	0	0	0	0
4/11/09	24.00	0.00	3,062	0	3,062	6,788	0	0	0	0
4/12/09	0.00	24.00	0	2,090	2,090	4,633	0	0	0	0
4/13/09	0.00	24.00	0	2,090	2,090	4,633	0	0	0	0

Continued on next page

Appendix O continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>			
	Hours		Catch		Migration	Catch		Migration		
	In	Out	Actual	Estimated		Actual	Estimated		Total	
4/14/09	0.00	23.00	0	2,003	2,003	4,440	0	0	0	0
4/15/09	25.00	0.00	1,164	0	1,164	6,627	0	0	0	0
4/16/09	24.00	0.00	2,206	0	2,206	12,559	0	0	0	0
4/17/09	24.00	0.00	2,672	0	2,672	15,212	6	0	6	34
4/18/09	24.00	0.00	2,542	0	2,542	14,472	0	0	0	0
4/19/09	24.00	0.00	8,655	0	8,655	49,274	0	0	0	0
4/20/09	24.00	0.00	3,048	0	3,048	17,353	1	0	1	6
4/21/09	24.00	0.00	4,534	0	4,534	25,813	0	0	0	0
4/22/09	24.00	0.00	3,620	0	3,620	20,609	1	0	1	6
4/23/09	24.00	0.00	4,750	0	4,750	27,043	1	0	1	6
4/24/09	24.00	0.00	3,444	0	3,444	19,607	0	0	0	0
4/25/09	24.00	0.00	3,900	0	3,900	8,724	0	0	0	0
4/26/09	24.00	0.00	3,243	0	3,243	7,254	3	0	3	7
4/27/09	24.00	0.00	3,402	0	3,402	7,610	0	0	0	0
4/28/09	24.00	0.00	2,876	0	2,876	6,433	0	0	0	0
4/29/09	24.00	0.00	2,285	0	2,285	5,111	4	0	4	9
4/30/09	24.00	0.00	843	0	843	1,886	0	0	0	0
5/1/09	24.00	0.00	1,361	0	1,361	3,045	0	0	0	0
5/2/09	24.00	0.00	1,341	0	1,341	3,000	1	0	1	2
5/3/09	24.00	0.00	1,179	0	1,179	2,637	0	0	0	0
5/4/09	0.00	24.00	0	1,260	1,260	2,819	0	1	1	2
5/5/09	0.00	24.00	0	1,260	1,260	2,819	0	1	1	2
5/6/09	0.00	24.00	0	1,260	1,260	2,819	0	1	1	2
5/7/09	0.00	24.00	0	1,260	1,260	2,819	0	1	1	2
5/8/09	0.00	24.00	0	0	0	0	0	1	1	2
5/9/09	0.00	24.00	0	0	0	0	0	1	1	2
5/10/09	0.00	24.00	0	0	0	0	0	1	1	2
5/11/09	0.00	24.00	0	0	0	0	0	1	1	2
5/12/09	24.00	0.00	0	0	0	0	1	0	1	2
5/13/09	24.00	0.00	0	0	0	0	0	0	0	0
5/14/09	24.00	0.00	8	0	8	18	1	0	1	2
5/15/09	24.00	0.00	0	0	0	0	0	0	0	0
5/16/09	24.00	0.00	1	0	1	2	0	0	0	0
5/17/09	24.00	0.00	0	0	0	0	0	0	0	0
5/18/09	24.00	0.00	0	0	0	0	0	0	0	0
5/19/09	24.00	0.00	0	0	0	0	0	0	0	0

Continued on next page

Appendix O continued.

Date	Time Fished		<u>Chum</u>				<u>Chinook</u>			
	Hours		Catch		Total	Migration	Catch		Total	Migration
	In	Out	Actual	Estimated			Actual	Estimated		
5/20/09	24.00	0.00	0	0	0	0	1	0	1	2
5/21/09	24.00	0.00	0	0	0	0	2	0	2	4
5/22/09	24.00	0.00	0	0	0	0	8	0	8	18
5/23/09	24.00	0.00	2	0	2	4	6	0	6	13
5/24/09	24.00	0.00	0	0	0	0	8	0	8	18
5/25/09	24.00	0.00	1	0	1	2	7	0	7	16
5/26/09	24.00	0.00	0	0	0	0	12	0	12	27
5/27/09	24.00	0.00	1	0	1	2	5	0	5	11
5/28/09	24.00	0.00	0	0	0	0	6	0	6	13
5/29/09	22.50	0.00	0	0	0	0	4	0	4	9
5/30/09	0.00	25.50	0	0	0	0	0	2	2	4
5/31/09	0.00	24.00	0	0	0	0	0	2	2	4
6/1/09	0.00	24.00	0	0	0	0	0	2	2	4
6/2/09	0.00	24.00	0	0	0	0	0	2	2	4
6/3/09	0.00	24.00	0	0	0	0	0	2	2	4
6/4/09	0.00	24.00	0	0	0	0	0	2	2	4
6/5/09	0.00	24.00	0	0	0	0	0	2	2	4
6/6/09	0.00	24.00	0	0	0	0	0	2	2	4
6/7/09	24.00	0.00	0	0	0	0	0	0	0	0
6/8/09	24.00	0.00	0	0	0	0	1	0	1	2
6/9/09	24.00	0.00	0	0	0	0	0	0	0	0
6/10/09	24.00	0.00	0	0	0	0	0	0	0	0
6/11/09	24.00	0.00	0	0	0	0	1	0	1	2
6/12/09	24.00	0.00	0	0	0	0	1	0	1	2
6/13/09	24.00	0.00	0	0	0	0	0	0	0	0
6/14/09	24.00	0.00	0	0	0	0	0	0	0	0
6/15/09	0.00	24.00	0	0	0	0	0	0	0	0
6/16/09	0.00	24.00	0	0	0	0	0	0	0	0
6/17/09	0.00	24.00	0	0	0	0	0	0	0	0
6/18/09	0.00	24.00	0	0	0	0	0	1	1	2
6/19/09	0.00	24.00	0	0	0	0	0	1	1	2
6/20/09	0.00	24.00	0	0	0	0	0	1	1	2
6/21/09	24.00	0.00	0	0	0	0	1	0	1	2
6/22/09	24.00	0.00	0	0	0	0	0	0	0	0
6/23/09	24.00	0.00	0	0	0	0	0	0	0	0
6/24/09	24.00	0.00	0	0	0	0	1	0	1	2

Continued on next page

Appendix O continued.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>			Migration	
	Hours		Catch		Migration	Catch		Migration		
	In	Out	Actual	Estimated		Actual	Estimated			Total
6/25/09	24.00	0.00	0	0	0	0	0	0	0	0
6/26/09	24.00	0.00	0	0	0	0	0	0	0	0
6/27/09	24.00	0.00	0	0	0	0	1	0	1	2
6/28/09	24.00	0.00	0	0	0	0	1	0	1	2
6/29/09	24.00	0.00	0	0	0	0	0	0	0	0
6/30/09	24.00	0.00	0	0	0	0	0	0	0	0
7/1/09	24.00	0.00	0	0	0	0	0	0	0	0
7/2/09	24.00	0.00	0	0	0	0	0	0	0	0
Total	2763.00	818.00	128,721	22,967	151,688	413,216	142	59	201	408

Appendix P

2010 Hamma Hamma River daily catch and migration estimates for juvenile chum, Chinook, and pink salmon

APPENDIX P.— Daily catches of juvenile chum, Chinook, and pink salmon caught in the Hamma Hamma River screw trap in 2010. Total catch represents actual and estimated catch for a given day. Time in and out reflect time fished (in) and not fished (out) on a given day. Migration was not estimated for chum or Chinook salmon because the trapping season did not include the majority of the outmigration for these species.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>			<u>Pink</u>			Migration
	Hours		Catch			Migration			Catch			
	In	Out	Actual	Estimated	Total	Actual	Estimated	Total	Actual	Estimated	Total	
3/4/10	30.00	0.00	35	0	35	2	0	2	2	0	2	9
3/5/10	24.00	0.00	157	0	157	2	0	2	0	0	0	0
3/6/10	24.00	0.00	23	0	23	0	0	0	0	0	0	0
3/7/10	24.00	0.00	42	0	42	0	0	0	0	0	0	0
3/8/10	24.00	0.00	93	0	93	6	0	6	0	0	0	0
3/9/10	24.00	0.00	77	0	77	23	0	23	0	0	0	0
3/10/10	24.00	0.00	26	0	26	2	0	2	0	0	0	0
3/11/10	24.00	0.00	12	0	12	1	0	1	0	0	0	0
3/12/10	24.00	0.00	19	0	19	0	0	0	0	0	0	0
3/13/10	24.00	0.00	54	0	54	7	0	7	0	0	0	0
3/14/10	0.00	24.00	0	92	92	0	10	10	0	0	0	0
3/15/10	0.00	24.00	0	92	92	0	10	10	0	0	0	0
3/16/10	0.00	24.00	0	92	92	0	10	10	0	0	0	0
3/17/10	24.00	0.00	130	0	130	13	0	13	0	0	0	0
3/18/10	24.00	0.00	167	0	167	27	0	27	0	0	0	0
3/19/10	24.00	0.00	219	0	219	46	0	46	0	0	0	0
3/20/10	24.00	0.00	62	0	62	5	0	5	0	0	0	0
3/21/10	24.00	0.00	63	0	63	7	0	7	0	0	0	0
3/22/10	24.00	0.00	111	0	111	9	0	9	6	0	6	28
3/23/10	24.00	0.00	525	0	525	56	0	56	0	0	0	0
3/24/10	24.00	0.00	262	0	262	2	0	2	0	0	0	0
3/25/10	24.00	0.00	876	0	876	3	0	3	3	0	3	14
3/26/10	24.00	0.00	203	0	203	6	0	6	8	0	8	37
3/27/10	0.00	24.00	0	306	306	0	4	4	0	4	4	19
3/28/10	0.00	24.00	0	306	306	0	4	4	0	4	4	19
3/29/10	0.00	24.00	0	306	306	0	4	4	0	4	4	19
3/30/10	0.00	24.00	0	306	306	0	4	4	0	4	4	19
3/31/10	0.00	24.00	0	306	306	0	4	4	0	4	4	19
4/1/10	0.00	26.00	0	332	332	0	4	4	0	4	4	19
4/2/10	22.00	0.00	375	0	375	2	0	2	0	0	0	0
4/3/10	0.00	24.00	0	296	296	0	3	3	0	9	9	42
4/4/10	0.00	24.00	0	296	296	0	3	3	0	9	9	42

Continued on next page

Appendix P continued.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>			<u>Pink</u>			Migration
	Hours		Catch			Catch			Catch			
	In	Out	Actual	Estimated	Total	Actual	Estimated	Total	Actual	Estimated	Total	
4/5/10	0.00	20.00	0	247	247	0	2	2	0	8	8	37
4/6/10	28.00	0.00	214	0	214	4	0	4	21	0	21	98
4/7/10	24.00	0.00	352	0	352	10	0	10	4	0	4	40
4/8/10	24.00	0.00	262	0	262	5	0	5	0	0	0	0
4/9/10	24.00	0.00	667	0	667	2	0	2	18	0	18	181
4/10/10	24.00	0.00	682	0	682	3	0	3	21	0	21	211
4/11/10	0.00	24.00	0	1,209	1,209	0	2	2	0	17	17	171
4/12/10	0.00	24.00	0	1,209	1,209	0	2	2	0	17	17	171
4/13/10	24.00	0.00	1,735	0	1,735	0	0	0	13	0	13	131
4/14/10	24.00	0.00	451	0	451	2	0	2	6	0	6	60
4/15/10	24.00	0.00	385	0	385	1	0	1	2	0	2	11
4/16/10	24.00	0.00	567	0	567	5	0	5	11	0	11	62
4/17/10	24.00	0.00	296	0	296	1	0	1	0	0	0	0
4/18/10	24.00	0.00	270	0	270	1	0	1	0	0	0	0
4/19/10	24.00	0.00	140	0	140	1	0	1	2	0	2	11
4/20/10	24.00	0.00	3	0	3	0	0	0	0	0	0	0
4/21/10	24.00	0.00	3	0	3	0	0	0	0	0	0	0
4/22/10	24.00	0.00	1	0	1	0	0	0	0	0	0	0
4/23/10	24.00	0.00	3	0	3	0	0	0	0	0	0	0
4/24/10	24.00	0.00	60	0	60	0	0	0	0	0	0	0
4/25/10	24.00	0.00	2	0	2	0	0	0	0	0	0	0
4/26/10	24.00	0.00	444	0	444	1	0	1	0	0	0	0
4/27/10	0.00	24.00	0	222	222	0	1	1	0	0	0	0
4/28/10	0.00	24.00	0	222	222	0	1	1	0	0	0	0
4/29/10	0.00	24.00	0	222	222	0	1	1	0	0	0	0
4/30/10	0.00	20.00	0	185	185	0	1	1	0	0	0	0
5/1/10	28.00	0.00	0	0	0	1	0	1	0	0	0	0
5/2/10	24.00	0.00	0	0	0	2	0	2	0	0	0	0
5/3/10	24.00	0.00	4	0	4	1	0	1	0	0	0	0
5/4/10	24.00	0.00	2	0	2	0	0	0	0	0	0	0
5/5/10	24.00	0.00	2	0	2	0	0	0	0	0	0	0
5/6/10	24.00	0.00	2	0	2	0	0	0	0	0	0	0
5/7/10	24.00	0.00	2	0	2	0	0	0	0	0	0	0
5/8/10	24.00	0.00	1	0	1	0	0	0	0	0	0	0
5/9/10	24.00	0.00	1	0	1	0	0	0	0	0	0	0
5/10/10	24.00	0.00	0	0	0	2	0	2	0	0	0	0

Continued on next page

Appendix P continued.

Date	Time Fished		<u>Chum</u>			<u>Chinook</u>			<u>Pink</u>			Migration		
	Hours		Catch			Catch			Catch					
	In	Out	Actual	Estimated	Total	Actual	Estimated	Total	Actual	Estimated	Total			
5/11/10	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	
5/12/10	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	
5/13/10	24.00	0.00	0	0	0	3	0	3	0	0	0	0	0	
5/14/10	24.00	0.00	0	0	0	6	0	6	1	0	1	1	6	
5/15/10	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	
5/16/10	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	
5/17/10	24.00	0.00	1	0	1	0	0	0	0	0	0	0	0	
5/18/10	26.00	0.00	0	0	0	7	0	7	0	0	0	0	0	
5/19/10	0.00	22.00	0	0	0	0	3	3	0	0	0	0	0	
5/20/10	0.00	24.00	0	0	0	0	3	3	0	0	0	0	0	
5/21/10	0.00	21.00	0	0	0	0	3	3	0	0	0	0	0	
5/22/10	27.00	0.00	0	0	0	0	0	0	0	0	0	0	0	
5/23/10	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	
5/24/10	24.00	0.00	0	0	0	0	0	0	0	0	0	0	0	
5/25/10	23.50	0.00	0	0	0	0	0	0	0	0	0	0	0	
5/26/10	0.00	24.50	0	0	0	0	0	0	0	0	0	0	0	
5/27/10	0.00	22.00	0	0	0	0	0	0	0	0	0	0	0	
5/28/10	26.00	0.00	0	0	0	0	0	0	0	0	0	0	0	
5/29/10	20.00	0.00	0	0	0	0	0	0	0	0	0	0	0	
Total	1550.50	539.50	10,083	6,246	16,329	0	277	79	356	0	118	84	202	1,473

Literature Cited

- Ames, J. 1984. Puget Sound chum salmon escapement estimates using spawner curve methodology. Pages 135-148 in P. E. K. Symons, and M. Waldichuk, editors. Proceedings of the Workshop on Stream Indexing for Salmon Escapement Estimation. Canadian Fisheries and Aquatic Sciences Technical Report, Number 1326.
- Ames, J., G. Graves, and C. Weller, editors. 2000. Summer chum salmon conservation initiative: an implementation plan to recovery summer chum in the Hood Canal and Strait of Juan de Fuca region. Washington Department of Fish and Wildlife and Point-No-Point Treaty Tribes.
- Bradford, M. J. 1995. Comparative review of Pacific salmon survival rates. Canadian Journal of Fisheries and Aquatic Sciences 52(6):1327-1338.
- Carlson, S. R., L. G. Coggins, and C. O. Swanton. 1998. A simple stratified design for mark-recapture estimation of salmon smolt abundance. Alaska Fishery Research Bulletin 5:88-102.
- Crawford, B. A., editor. 2007. Washington State framework for monitoring salmon populations listed under the federal Endangered Species Act and associated freshwater habitats. Governor's Forum of Monitoring Salmon Recovery and Watershed Health, Olympia, Washington.
- Crawford, B. A., and S. M. Rumsey. 2011. Guidance for the monitoring recovery of Pacific Northwest salmon and steelhead listed under the Federal Endangered Species Act. NOAA's National Marine Fisheries Service, Northwest Region.
- Devries, P. 1997. Riverine salmonid egg burial depths: Review of published data and implications for scour studies. Canadian Journal of Fisheries and Aquatic Sciences 54(8):1685-1698.
- Hayes, D. B., J. R. Bence, T. J. Kwak, and B. E. Thompson. 2007. Abundance, biomass, and production. Pages 327-374 in C. S. Guy, and M. L. Brown, editors. Analysis and interpretation of freshwater fisheries data. American Fisheries Society, Bethesda, Maryland.
- Healey, M. 1991. Life history of Chinook salmon (*Oncorhynchus kisutch*). Pages 311-394 in C. Groot, and L. Margolis, editors. Pacific salmon life histories. UBC Press, Vancouver, British Columbia.
- Heard, W. R. 1991. Life history of pink salmon (*Oncorhynchus gorbuscha*). Pages 119-230 in C. Groot, and L. Margolis, editors. Pacific salmon life histories. UBC Press, Vancouver, BC.
- Kinsel, C., M. S. Zimmerman, L. Kishimoto, and P. Topping. 2008. 2007 Skagit River salmon production evaluation, FPA 08-08. Washington Department of Fish and Wildlife, Olympia, Washington.
- Kiyohara, K., and M. S. Zimmerman. 2011. Evaluation of juvenile salmon production in 2009 from the Cedar River and Bear Creek, FPA 11-03. Washington Department of Fish and Wildlife, Olympia, WA.

- Koski, K. V. 1975. The survival and fitness of two stocks of chum salmon (*Oncorhynchus keta*) from egg deposition to emergence in a controlled-stream environment at Big Beef Creek. Ph.D. Dissertation, University of Washington, Seattle, Washington.
- McElhane, P., M. H. Ruckelhaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionary significant units. U.S. Department of Commerce, NOAA Technical Memo, NMFS-NWFSC-42.
- Montgomery, D. R., J. M. Buffington, N. P. Peterson, D. Schuett-Hames, and T. P. Quinn. 1996. Stream-bed scour, egg burial depths, and the influence of salmonid spawning on bed surface mobility and embryo survival. *Canadian Journal of Fisheries and Aquatic Sciences* 53(5):1061-1070.
- NOAA. 1999a. Endangered and threatened species: threatened status for two ESUs of chum salmon in Washington and Oregon. *Federal Register* 64(57):14508-14517.
- NOAA. 1999b. Endangered and threatened species; threatened status for three Chinook salmon evolutionary significant units (ESUs) in Washington and Oregon, and endangered status for one Chinook salmon ESU in Washington. *Federal Register* 64(56):14308-14328.
- Robson, D. S., and H. A. Regier. 1964. Sample size in Petersen mark-recapture experiments. *Transactions of the American Fisheries Society* 93(3):214-217.
- Seber, G. A. F. 1973. The estimation of animal abundance. Charles Griffin and Company Limited, London.
- Shared Strategy Development Committee. 2007. Puget Sound Salmon Recovery Plan. <http://www.sharedsalmonstrategy.org/plan/toc.htm>.
- Small, M. P., K. Currens, T. H. Johnson, A. E. Frye, and J. F. Von Bargen. 2010. Impacts of supplementation: genetic diversity in supplemented and unsupplemented populations of summer chum salmon (*Oncorhynchus keta*) in Puget Sound (Washington, USA). *Canadian Journal of Fisheries and Aquatic Sciences* 66:1216-1229.
- Sokal, R. R., and F. J. Rohlf. 1981. *Biometry*, 2nd edition. W.H. Freeman and Company, New York.
- Topping, P., M. S. Zimmerman, and L. Kishimoto. 2008. Green River and Dungeness River Chinook monitoring evaluations in 2007, FPA 08-09. Washington Department of Fish and Wildlife, Olympia, Washington.
- Tynan, T. 1997. Life history characterization of summer chum salmon populations in the Hood Canal and Eastern Strait of Juan de Fuca regions, H97-06. Washington Department of Fish and Wildlife, Olympia, Washington.
- Volkhardt, G. C., S. L. Johnson, B. A. Miller, T. E. Nickelson, and D. E. Seiler. 2007. Rotary screw traps and inclined plane screen traps. Pages 235-266 in D. H. Johnson, and coeditors, editors. *Salmonid field protocols handbook: techniques for assessing status and trends in salmon and trout populations*. American Fisheries Society, Bethesda, Maryland.



This program receives Federal financial assistance from the U.S. Fish and Wildlife Service Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title II of the Americans with Disabilities Act of 1990, the Age Discrimination Act of 1975, and Title IX of the Education Amendments of 1972. The U.S. Department of the Interior and its bureaus prohibit discrimination on the bases of race, color, national origin, age, disability and sex (in educational programs). If you believe that you have been discriminated against in any program, activity or facility, please write to:

U.S. Fish and Wildlife Service
Civil Rights Coordinator for Public Access
4401 N. Fairfax Drive, Mail Stop: WSFR-4020
Arlington, VA 22203