Mark-Recapture Studies of Taku River Adult Sockeye Salmon Stocks in 2009

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James E. Andel

December 2012

Pacific Salmon Commission Technical Report No. 29

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Pacific Salmon Commission
Transboundary Technical Committee Report No. 29

Mark-Recapture Studies of Taku River Adult Sockeye Salmon Stocks in 2009

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Prepared for:
Pacific Salmon Commission
Transboundary Technical Committee

December 2012

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TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

LIST OF APPENDICES

Page

ABSTRACT

Mark-recapture studies of adult Taku River salmon *Oncorhynchus* stocks were conducted by the Department of Fisheries and Oceans Canada, the Alaska Department of Fish and Game, and the Taku River Tlingit First Nation in 2009. The objectives of the studies were to provide inseason estimates of the inriver abundance of sockeye *O. nerka* and to document biological characteristics (migratory timing, migratory rates and age, sex, and size composition) of Taku River sockeye stocks. Tagged-to-untagged ratios of salmon harvested in the Canadian inriver gillnet fisheries were used to develop the estimates of the inriver abundance of sockeye. A total of 3,388 and 101 sockeye salmon were captured in fish wheels and gillnets, respectively, located at Canyon Island, Alaska. Of these fish, 3,144 were tagged and 808 (26%) were subsequently recovered or observed in fisheries or on the spawning grounds. The inriver run of sockeye salmon past Canyon Island from June 7 to October 10 was estimated to be 85,528 fish (95% confidence interval 77,395 to 93,661). An expansion factor based on fish wheel CPUE estimated 71 additional sockeye salmon migrated past Canyon Island prior to June 7, for a total above border escapement of 85,599. Canadian commercial, test and Aboriginal fisheries harvested 10,980, 174 and 106 sockeye, respectively, resulting in a spawning escapement estimate of 74,339 sockeye salmon. Based on mean date and standard deviation of migration timing the sockeye salmon run was similar to but more compressed than the 1999-2008 average. The Canyon Island catches of 9,225 pink salmon, 214 chum salmon and 19 steelhead salmon were 25%, 34% and 83% below average, respectively. The pink salmon run was three days later and slightly less compressed than average.

KEY WORDS: mark-recapture, stratified population estimations, escapement estimation, migratory timing, Taku River, transboundary river, salmon, fish wheel, age, length and sex composition, Pacific Salmon Treaty

INTRODUCTION

Inseason estimates of the spawning escapement of Taku River sockeye *Oncorhynchus nerka* are needed to fulfill the escapement goal and international harvest sharing requirements for stocks specified by the Canada/U.S. Pacific Salmon Treaty. The Taku River mark-recapture project has been conducted annually since 1984 (Clark et al. 1986; McGregor and Clark 1987, 1988, 1989; McGregor et al. 1991; Kelley and Milligan 1999; Andel and Boyce 2012, TTC 2012) as a joint Canada/U.S. program involving the Department of Fisheries and Oceans Canada (DFO) and the Alaska Department of Fish and Game (ADF&G) to provide weekly estimates of the Taku River salmon escapement past Canyon Island, Alaska (Figure 1). The Taku River Tlingit First Nation (TRTFN) began providing a technician to assist with operations in 1994. Canadian and U.S. fishery managers use CPUE and stock composition data from the Canadian Taku River and U.S. District 111 commercial gillnet fisheries along with escapement estimates from this project to adjust fishing times, catches, and escapements.

The Taku River is a transboundary river which originates in northern British Columbia and flows southwest through the Coastal Mountain Range and Southeast Alaska to the Pacific Ocean (Figure 1). The Taku River supports numerous stocks of salmon that are harvested by Canadian and U.S. gillnet fisheries. The Canadian fishery, which occurs inriver, targets Taku River chinook[1], sockeye and coho salmon and incidentally harvests chinook and pink salmon. The U.S. drift gillnet fishery which occurs in Taku Inlet and approach waters, primarily targets Taku River chinook and sockeye salmon stocks as well as summer chum salmon from local Alaskan enhancement programs during the summer months and mixed stocks of coho in fall. The U.S. fishery also incidentally harvests chinook and pink salmon. The Canada/U.S. Pacific Salmon Treaty (PST) of 1985, and subsequent additions to the original treaty, established conservation (71,000 to 80,000 escapement goal) and harvest sharing (percentage sharing of the allowable catch) objectives for the Taku River sockeye salmon run. The PST mandates cooperative international management of transboundary river stocks. The most intensive cooperative management is directed at sockeye, coho, and chinook salmon.

Mark-recapture methods were used in 2009 to estimate sockeye, chinook and coho salmon escapements. Chinook and coho studies are described in separate reports published by the ADF&G Division of Sport Fish and the Pacific Salmon Commission (in prep.). Fish wheels located at Canyon Island were used to capture sockeye, chinook, and coho for tagging. Tagging data coupled with ratios of tagged to untagged fish in the Canadian fisheries upstream were used to develop escapement estimates inseason.

The fish wheels also catch pink, chum and steelhead salmon. Although abundance is not estimated, the catches do provide an index of interannual variation. This is especially valuable if the entire migration period is bracketed by the period of fish wheel operation (for example, as with pink salmon).

Age, length, and sex data were collected from sockeye, pink, and chum salmon caught in the fish wheels.

[1] New directed chinook fisheries have been implemented as a result of an agreement reached between Canada and the U.S.in February 2005.

OBJECTIVES

The primary goals of the Taku River sockeye salmon tagging program in 2009 were to obtain information on the above-border run size, distribution, migratory timing, and age-sex-size composition of sockeye salmon stocks in the Taku River drainage.

Specific objectives of this study were:

1. Estimate the total spawning abundance of sockeye salmon returning to Canadian portions of the Taku River with an estimated coefficient of variation no greater than 10% of the estimate. Estimate weekly inriver abundance with a coefficient of variation no greater than 20% of the estimate;
2. Estimate the age, length, and sex composition of sockeye salmon migrating past the fish wheel site on a weekly basis;
3. Forecast total abundance of sockeye salmon on a weekly basis based on tag-recovery data and historical migration-timing data;
4. Quantitatively describe the migratory timing (mean and variance) of the sockeye, pink, and chum salmon migrations past Canyon Island; and
5. Estimate the annual age and sex composition of pink and chum salmon migrating past the fish wheel site.

Objectives for the Taku River coho and chinook salmon mark-recapture studies are outlined in reports published by the Pacific Salmon Commission and/or the ADF&G Division of Sport Fish.

METHODS

Study Area Description

The Taku River originates in the Stikine plateau of northwestern British Columbia, and drains an area of approximately 17,000 square kilometres (Figure 1). The merging of two principal tributaries, the Inklin and Nakina Rivers, approximately 50 km upstream from the international border forms the Taku River. The river flows southwest from this point though the Coast Mountain Range and empties into Taku Inlet about 30 km east of Juneau, Alaska. Approximately 95% of the Taku River watershed lies within Canada.

The Taku River is turbid, with much of its discharge originating in glacial fields on the eastern slopes of the Coast Range Mountains. This turbidity precludes complete enumeration of salmon escapements in many areas by aerial or foot surveys. Water discharge in the summer generally increases in proportion to the amount of sunshine received in the interior on coastal mountain ranges (ADF&G 1955). Winter (February) flows range from approximately 40-104 m^3/s at the U.S. Geological Survey water gauging station located on the lower Taku River near Canyon Island (Schellekens et al. 1996). Discharge increases in April and May and reaches a maximum average flow of 700-1,400 m^3/s during June. Flow usually remains high in July and drops in late August. The efficiency of fish wheels used to capture fish for tagging and the effectiveness of the Canadian commercial fishery are affected by the magnitude of river discharge. Sudden increases in discharge in the lower river result from the release of the glacially impounded waters of Tulsequah Lake (Kerr 1948; Marcus 1960). These floods usually occur once or twice a year between May and August. During water years 1988 to 1995 the instantaneous peak flow due to a Tulsequah event was 2,889 m^3/s (August 17, 1989; Shellekens et al. 1996). During the floods, water levels fluctuate dramatically and the river carries a tremendous load of debris.

Fish Wheel Operation

Migrating adult salmon were captured with two fish wheels at Canyon Island, located approximately 4 km downstream from the international border (Figure 1). Each fish wheel consisted of two aluminum pontoons in a framework, measuring approximately 12 m in length and 6 m in width and filled with closed-cell styrofoam for flotation, supporting an axle, paddle, and basket assembly. Two fish-catching baskets were rotated about the axle by the force of the water current against the baskets and/or paddles. As the fish wheel baskets rotated, they scooped up salmon. V-shaped slides attached to the rib structure of each basket directed fish to aluminum liveboxes bolted to the outer sides of the pontoons.

The fish wheels were positioned in the vicinity of Canyon Island on opposite riverbanks, approximately 200 m apart, and have been operated in identical locations since 1984. They were secured in position by anchoring to large trees with 0.95 cm steel cable and were held out from, and parallel to, the shoreline by log booms. The Taku River channel at this location is ideal for fish wheel operation. The river is fully channelized through a relatively narrow canyon that has very steep walls.

The fish wheels rotated at 0-4 r.p.m., depending on the water velocity and the number of attached paddles. When water levels subsided, more paddles were attached and the fish wheels were moved farther out from shore into faster water currents to maintain a speed of basket rotation adequate to catch fish.

Over time it has become clear that Tulsequah River floods are preceded by a sudden decline in river temperature and a corresponding rapid increase in river level. It is standard operating procedure to stop the fish wheels when river levels near 290 cm (114 inches, standardized gauge measure). By doing so, damage to the fish wheels is minimized and significant labour and material costs avoided.

Baskets and liveboxes are removed from the pontoons and stored on high ground during the off season. The pontoons are towed upstream to a backwater slough and securely moored during the off season.

Tagging and Sampling Procedures

All sockeye captured in the fish wheels were sampled for sex and mid-eye to fork of tail length (MEF). In addition, a sub-sample of 260 sockeye salmon per week were sampled for scales.

All chum salmon were sampled for sex, scales, and MEF length. The daily sampling goal for pink salmon was 25 fish; these fish were sampled for sex and MEF length.

All uninjured sockeye greater than 350 mm (MEF length) were tagged with numbered spaghetti tags. Sockeye less than 350 mm (MEF) were not tagged because fish in this size range are virtually unsusceptible to capture in the upriver gillnet fishery from which tagged to untagged ratios are used to develop population estimates for these species. Sockeye salmon with serious wounds (most often thought to be seal inflicted) were not tagged. Pink, chum and steelhead salmon were not tagged.

Salmon were dipnetted from the fish wheel liveboxes into a tagging trough partially filled with river water. Spaghetti tags (Floy Tag and Manufacturing Inc., Seattle, WA)[2] were applied to sockeye salmon as follows: one individual held the fish in the tagging trough while a second inserted a 15 cm applicator needle and attached spaghetti tag through the dorsal musculature immediately below the dorsal fin. The ends of the spaghetti tag were then knotted together with a single overhand hitch. Biological sampling was also conducted during application of the spaghetti tags. Sex and length measurements were recorded, and scale samples taken from all chum salmon, and sub-samples of the sockeye salmon caught. Sex and length data were also collected daily from a sub-sample of 25 pink salmon, but scales were not taken from this species. The tagging and sampling procedures took from 40 to 60 seconds per fish to complete. The fish were then immediately and gently released back into the river.

The spaghetti tags used for sockeye salmon were made of hollow fluorescent orange PVC tubing (approximately 2.0 mm in diameter and 30 cm in length) and were consecutively numbered and labeled with project description information.

In general, fish wheel catches were sampled in the morning, afternoon, and evening. Less frequent checks, morning and evening, were made during lulls in the migration to minimize crew overtime. During peak migration times catches were sampled more frequently, early in the morning and late at night.

Tag Recovery

Sockeye were inspected for tags in Canadian fisheries occurring in the Taku River within 20 km of the international border. Catches that were not available by statistical week were censored, for example the Aboriginal ("food fish") catch. All sockeye salmon caught in the commercial and test fisheries were considered to have been examined for tags and all of the captured tags were considered to have been recovered.

The commercial fishery was open from one to seven days per week from April 2 to October 9. Chinook salmon were targeted until mid-June; sockeye salmon from then until mid-August; and finally coho salmon for the remainder of the season. A test fishery was conducted from August 23 through October 8 targeting coho salmon. Drift and set gillnets were the gear types used; mesh sizes ranged from 15 cm (5 1/2 inches) to 20.4 cm (8 inches) with the mesh size of 15 cm predominating during the sockeye season.

Daily tag return was a condition of the Canadian commercial salmon fishing licence. As an additional incentive, a cash reward of $5.00 (Canadian) was offered by DFO for each sockeye tag returned from any fishery (i.e. commercial, Aboriginal, or test). Canadian catch statistics and tags were collected daily during fishery openings by DFO personnel stationed at Ericksen Slough, just upstream of the Tulsequah River. Catch statistics were communicated to the DFO office in Whitehorse via single side band radio or satellite telephone and then relayed via email to the ADF&G office in Juneau. ADF&G offered a $2.00 (U.S.) reward for each tag returned from the District 111 and the inriver personal use fisheries. Additional tag observations and recoveries were made in Canada at enumeration weirs (Kuthai, King

[2] Mention of trade names does not constitute endorsement by DFO or ADF&G.

Salmon, Little Trapper, and Tatsamenie lakes) and during sampling excursions to spawning areas on the Nahlin, Tulsequah, and mainstem Taku rivers.

Sex, length, and scale data were obtained from these locations as well as from the commercial and test fisheries.

Tagging and tag recovery data were organized by statistical week for analysis. Statistical weeks begin at 00:01 AM Sunday and end the following Saturday at midnight, with weeks being numbered sequentially beginning with the week encompassing the first Saturday in January. Inclusive dates for 2009 statistical weeks are shown in Appendix A.

Statistical Methods

Sockeye salmon tagging data, tag recovery data and catch data were entered into an abundance estimation program which is referred to as the Stratified Population Analysis System (SPAS) (Arnason et al. 1996). This model provides stratified population estimates using maximum likelihood techniques (Plante 1990) and associated variances when s (the number of tagging stratum) and t (number of recovery stratum) are not equal. For cases in which s=t, the model provides stratified population estimates based on Chapman and Junge (1956) and Darroch (1961). This stratified method was used because it allows the probabilities of capture in tagging and recovery strata to vary across the strata.

Assumptions necessary to form consistent (i.e., approaching unbiased as sample size increases) stratified mark-recapture estimates in this study include (Arnason, et al. 1996):

1. All fish that pass Canyon Island during the period of interest have a non-zero probability of recovery in the commercial fishery and all fish caught by the fishery have a non-zero probability of being tagged (i.e., the population is closed);

2. There is no tag loss, tag induced mortality, tag mis-identification or non-reporting. Should any of these occur, they are to be estimated and adjusted for;

3. All fish, tagged or not, are independently caught with the same probability in any given recovery stratum;

4. All fish, tagged or not, move from a given release stratum to the recovery strata independently with the same probability distribution; and

5. There are no release strata or recovery strata where no tags are released or found respectively, and there are no rows or columns of the release-recovery matrix which are linear combinations of other rows or columns respectively.

The first assumption is addressed by the fact that two fish wheels are used in a consistent manner throughout the season and that the inriver fishery is conducted weekly. For the second assumption, tag-induced mortality was shown to be insignificant in a holding study conducted by McGregor and Milligan (1991, unpublished data). The extent of tag loss by shedding, misidentification, or non-reporting, was also found to be negligible in that study and several subsequent ones (e.g. Kelley et al., 1997). The third and fourth assumptions have not been assessed, while the fifth assumption is met by pooling of various recovery or release strata.

Inriver sockeye salmon run estimates were generated on an inseason basis in 2009. Mark-recapture data were forwarded to the Whitehorse DFO and Juneau ADF&G offices after each day of the commercial fishery. Data was analyzed and abundance estimates generated. Historical migratory timing data was then used each week to project the total inriver run size for the season. Due to the estimated three to four days travel time for fish between the Taku Inlet gillnet fishery and Canyon Island (Clark et al. 1986), as well as between Canyon Island and the Canadian fishery (based on current year tag recovery data), our estimates of inriver abundance corresponds with the movement of Taku River sockeye salmon through District 111 approximately one to two weeks earlier.

Fishery management decisions that affect the magnitude and distribution of harvests and escapements are based in principle on the measured or perceived abundance of fish through time. Mundy (1982) described a set of statistics, termed migratory timing statistics, useful for characterizing the annual timing of fish migrations and for comparing the timing of migrations between years. Abundance per unit of time is divided by the total abundance throughout the migration to generate a time series of proportions, or time density. The shape of the time density characterizes the timing and temporal distribution of the migration. Two simple features of the time density are the mean date and variance or dispersion of the migration through time. We used fish wheel CPUE as an index of the abundance of fish migrating past Canyon Island, and calculated migratory timing statistics following the procedures of Mundy (1982). The mean date of passage in a migration of *m* days was estimated by:

$$\bar{t} = \sum_{t=1}^{m} t * P_t \quad , \tag{1}$$

where $\bar{t}$ was the mean day of the migration (t=1 was the first day of the migration and m was the last day), and P_t is the proportion of the total cumulative fish wheel CPUE that occurred on day t. The calculated mean date is reported as the corresponding calendar date.

The variance of the migrations was estimated by:

$$s_t^2 = \sum_{t=1}^{m} (t - \bar{t})^2 * P_t \quad , \tag{2}$$

The timing of individual sockeye salmon stocks past Canyon Island was derived from recoveries of tagged fish on the spawning grounds and was weighted by fish wheel CPUE to permit the escapement of a particular stock to be apportioned to week of passage past Canyon Island. The formula we used for determining the proportion of the run occurring each week for each stock was:

$$\frac{\dfrac{C_k * T_{ks}}{T_k - T_{kc}}}{\displaystyle\sum_{j=22}^{38} \frac{C_k * T_k}{T_K - T_{kc}}} \quad , \tag{3}$$

where: k is the statistical week of interest; C_k is the weekly proportion of the total season's fish wheel CPUE, T_{ks} is the number of spawning ground recoveries of stock s that were tagged in week k, T_k is the number of fish tagged at Canyon Island in statistical week k, and T_{kc} is the number of fish tagged at Canyon Island in statistical week k and caught in the Canadian fishery.

An assumption implicit in this calculation is that the removal of fish by the Canadian inriver fishery does not alter the migratory timing distribution of individual stocks. This assumption may have been violated because the Canadian fishery harvest rate varied between fishing periods.

RESULTS

Fish Wheel Operation

Fish wheels were operated on the Taku River from May 12 through September 27. Fish wheel I, located furthest upriver, was installed on May 13; fish wheel II was installed on May 12. Additional details regarding operations are presented in Appendix B.1.

The aluminum two-basket configuration first used in 1996 has proven to be effective at low river levels (as measured on a permanent staff gauge).[3] However, small mesh gillnets were used intermittently between August 13 and September 20 when river levels were very low.

Fish Wheel Catches

Daily catches of sockeye, pink, and chum salmon in the Canyon Island fish wheels are listed in Appendices B.1. Dates of operation and the total fish wheel catch by species for the 1984 to 2009 period are presented in Table 1. Graphs of the fish wheel CPUE for sockeye, pink, and chum salmon are included in Figure 3.

The catch of sockeye salmon in the Canyon Island fish wheels in 2009 was 3,388. An additional 101 sockeye were caught in gillnets after August 12. The total fishwheel catch was 38.9% below the 1999 to 2008 average (Table 1; Appendix B.1). Fish wheel catches occurred from June 1 through September 27, and peaked during statistical week 29 (July 12 through July 18), when 836 sockeye salmon were captured. Prior to the first Canadian directed sockeye commercial fishery opening on June 21 (statistical week 26), 39 sockeye salmon had been captured in the fish wheels (Appendix B.1). As in past years, the daily catches fluctuated dramatically. The effects of the U.S. commercial fishery in Taku Inlet were observable as fish wheel catches declined to their lowest levels between Thursday and Saturday weekly; this suggested that the average travel time between Taku Inlet and Canyon Island was three to four days.

The total 2009 pink salmon catch in the fish wheels at Canyon Island was 9,225 (Table 1; Appendix B.1), 25.3% below the 1999 to 2008 average. The peak daily catch of pink salmon in 2009 (967 fish) occurred on July 26. The 2009 fish wheel catch of chum salmon was 233. The total catch was 28.4% above the 1999 to 2008 average of 325. The peak daily catch of chum salmon (19 fish) occurred on September 13 (Appendix B.1). The total fish wheel catches of steelhead and Dolly Varden in 2009

[3] The aluminum baskets were experimentally used in 1996. Previous programs were constrained by low water conditions, particularly in the fall, which would not effectively turn the fish wheels.

were 19 and 249 fish respectively. The steelhead catch was 83.1% below the 1999 to 2008 average of 113. The Dolly Varden catch was 17.5% below the 1999 to 2008 average of 302.

Tagging and Recovery Data

Of the 3,388 sockeye salmon caught in the Taku fish wheels, 3,053 were tagged (90.1**%**). Coincidently 90.1% of the sockeye salmon caught in gillnets were tagged (91 out of 101 fish). Only jack sockeye salmon (fish smaller than approximately 350 mm MEF that have spent only one year at sea) or sockeye with noticeable injuries were not tagged. Daily numbers of sockeye caught and tagged in the fishwheels are listed in Appendix B.1. Recoveries downstream of Canyon Island in U.S. personal use and D-111 fisheries totaled 9 (0.29**%** of tags applied), leaving 3,135 available for recapture in Canadian fisheries. The Canadian commercial fishery recaptured 394 tagged sockeye and accounted for 97.3% of the total sockeye tags recovered or observed in upstream fisheries (Table 2). The Canadian test fishery recovered 11 sockeye tags; no tags were recovered from the Aboriginal fishery. Tags were also recovered and observed at terminal weirs, located at Little Trapper, Tatsamenie, Kuthai and King Salmon lakes. These numbered 261, 95, 13, and five, respectively. The weir counts at these locations were 5,552, 2,032, 1,442 and 54 sockeye respectively; the King Salmon Lake count was incomplete.

Escapement Estimates

Ratios of tagged to untagged sockeye salmon in the Canadian commercial and test fisheries were used to estimate the magnitude of the inriver run of sockeye salmon that passed Canyon Island during the period of June 7 to October 10, 2009. Catches that were not available by statistical week, for example the Aboriginal ("food fish") catch, were censored. All sockeye in the commercial and test fisheries were considered to have been examined for tags and all of the captured tags were considered to have been recovered.

A total of 405 tags with corresponding recovery date information were returned from 11,217 sockeye salmon examined in the Canadian fisheries (Table 3). Recovery data from statistical weeks 24-29 (June 7 through July 18), and 30-41 (July 19 through October 10) were pooled due to statistically similar tagging ratios and/or low fishery effort. Tagging and recovery data were each grouped into two strata (Table 4).

Using a maximum likelihood Darroch estimator, it was estimated that 85,528 sockeye salmon passed Canyon Island between June 7 and October 10. The approximate 95% confidence interval associated with this estimate is 77,395 to 93,661 fish. To determine the number of sockeye salmon that passed Canyon Island prior to the mark-recapture period, the estimate was expanded by using fish wheel CPUE. Using this method, it was estimated that 71 additional sockeye passed Canyon Island during statistical week 23. Therefore, the estimate of the total sockeye salmon run migrating past Canyon Island was 85,599. This is 37.9% below the 1999 to 2008 average of 138,024 sockeye salmon (Table 5; Figure 4). Downriver of the Canyon Island fishwheels, the U.S. inriver personal use fishery catch was estimated at 871 sockeye, 190 pink, and 4 chum, based on personal survey returns logged into the ADF&G ALEX database.

The Taku River sockeye salmon run above Canyon Island was exploited by the Canadian fisheries at an estimated rate of 13.0%, compared to a 1999-2008 average of 19.1% (range 12.8% to 25.0%; Table 5). After removal of 10,980, 106, and 174 sockeye salmon by the Canadian commercial, Aboriginal and test fisheries, respectively, from the estimated escapement to the Canada/U.S. border, the spawning escapement totaled an estimated 74,339 fish (Table 4). This is 33.4% below the 1999-2008 average of 111,579 sockeye salmon.

The escapement estimate does not include two groups of sockeye salmon that spawn in the drainage: (1) fish that spawn in streams located downriver from Canyon Island, and (2) jack sockeye salmon. The number of sockeye salmon spawning downstream from Canyon Island is unknown but presumed to be small; spawning has been observed annually in lower tributaries of the lower Taku River (i.e. Fish Creek, Sockeye Creek, and Yehring Creek) during annual aerial and foot surveys (McGregor, personal communication; Figure 1). The contribution of jacks can represent a sizable portion of the Taku River run; contribution rates to the Canyon Island fish wheel catches averaged 3.2% from 1999 to 2008. (range 0.3% to 9.1%; Table 6). In 2009, the contribution of jacks was a record 10.3%.

A necessary assumption of the population estimation technique used is that all fish in a particular recovery stratum, whether tagged or untagged, have the same capture probability. A factor that could violate this assumption is that tagging and recapture gear are selective for different sized fish. Based on length frequency distributions of sockeye salmon tagged at the fish wheels and of tagged sockeye recovered in the commercial fishery it is clear that the fish wheels tend to capture a higher proportion of smaller fish or the fishery captures a higher percentage of large fish. In past years (Kelley et al. 1996, McGregor et al. 1991) the possible effects of size selectivity on the sockeye salmon population estimate were assessed by stratifying tagging and recovery data by size class. Results for those years demonstrate that the mark-recapture estimates are robust in respect to fish length differences between the tagging and recapture events. The summed abundance estimates obtained for large and small sockeye salmon separately were not significantly different than the pooled estimates. Based on those results the 2009 mark-recapture data was not examined by fish size.

Migratory Timing

The mean date (July 20) of the sockeye salmon migration in 2009 matched the 1999-2008 average (Table 7). The standard deviation was slightly less (15.9 days in 2009 versus an average of 18.9 days); meaning the run was more compressed than average. Migratory timing statistics (mean date July 24; standard deviation 9.9 days) showed the pink salmon run timing was three days later than average and slightly less compressed. The migratory timing relative to average for chum salmon is more difficult to assess because the duration of fish wheel operations has varied between years and has failed to cover the complete migration of this species. Assuming fish wheel CPUE in 2009 was reflective of the run, the mean date of migration was September 6 (standard deviation 17.5 days). However, it is likely that this assumption was not completely valid as there were still a small number of chum being caught at the time of fish wheel demobilization.

Sockeye Salmon Stock Timing

The timing of four individual stock groups of sockeye salmon past Canyon Island in 2009 was determined using recoveries and observations of tagged fish from enumeration weirs (Table 8; Figure 5). These were weirs on the outlet streams Little Trapper Lake (261 tags)**,** Tatsamenie Lake (95 tags) lakes, Kuthai Lake (13 tags) and King Salmon Lake (five tags).

The Kuthai Lake stock migrated past Canyon Island the earliest of these four stocks examined. These fish were passing Canyon Island from statistical weeks 25 to 29 (June 14 to July 18). The peak of the Kuthai Lake migration took place during statistical week 27 (June 28 to July 4).

Little Trapper Lake sockeye salmon peaked during statistical week 28, July 5 through 11. They were present at Canyon Island during statistical weeks 26 to 32 (June 21 to August 8).

It is unlikely that tag recovery at King Salmon Lake was representative, since the weir operation did not enumerate the entire run. However, based on the five tags observed, this stock was present at Canyon Island during statistical weeks 29 (July 12 to 18) and 31 (July 26 to August 1).

The Tatsamenie Lake stock had both the latest and most protracted return timing; tagged fish bound for this system were present at Canyon Island between statistical weeks 27 and 36 (June 28 to September 5). The peak week of migration for Tatsamenie Lake sockeye was statistical week 32 (August 2 through 8).

Inriver Sockeye Salmon Migration Rates

Inriver travel times of four lake stocks could be determined from the recovery of tagged fish at enumeration weirs as described in the previous section (Table 9). Inriver travel times from Canyon Island for the Kuthai Lake, King Salmon Lake, Little Trapper Lake and Tatsamenie Lake stocks are shown in Figure 6. Travel times averaged 48.0, 40.3, 33.5, 37.7 and 31.1 days for each of these respective stocks. Again, it is unlikely that the King salmon tag recovery sample was representative.

Migration rates generally increased over the course of the run. Little Trapper Lake fish tagged in statistical week 26 averaged 48.0 days in transit while those tagged in statistical week 32 averaged 23.3 days. For the Tatsamenie stock, fish tagged in statistical week 27 averaged 49.5 days in transit while those tagged in statistical week 34 averaged 29.2 days. King Salmon Lake fish tagged in statistical week 29 averaged 42.7 in transit while the fish tagged in statistical week 28 took 33.0 days. Kuthai Lake fish tagged in statistical week 25 averaged 54.0 days in transit, while those tagged in statistical week 29 averaged 38.5 days.

Age, Length, and Sex Composition

The age and sex compositions, by sex and time period, of the Canyon Island fish wheel catches of sockeye and chum salmon in 2009 are summarized in Appendices C.1 and C.2. Lengths at age are presented in Tables 10 and 12.

For sockeye salmon, age-1.3 fish were most prevalent (44.0%) with age-1.2 fish comprising 20.6%, age-0.3 10.8%, age-1.1 9.5%, age-0.2 8.4%, age-2.3 4.4%, and very small numbers of age-0.1, 2.1, 0.4, and 2.2 fish (Table 6). The lengths of age 1.2 and 1.3 sockeye salmon were less than and equal to than the 1999 to 2008 averages, respectively (Table 10). Females comprised 44.1% of the fish wheel catch of sockeye salmon (Appendix C.1).

Fish wheel catches of chum salmon were comprised of equal proportions (49.5%) of age-0.3 and age 0.4 fish. The 1999-2008 averages for these age classes were 59.3% and 38.7%, respectively (Table 11). Female chum salmon were more prevalent (63.8%) than males (Appendix C.2). The average lengths at age for chum salmon passing Canyon Island were 545, 621, and 662 mm MEF for age 0.2, 0.3, and 0.4 fish respectively; these were slightly lower than the 1999 to 2008 averages (Table 12).

DISCUSSION

The accuracy of mark-recapture studies in providing estimates of abundance is dependent on the degree to which the underlying assumptions of the analytical methods used are satisfied. We have chosen to use a stratified Darroch-type estimator for our Taku River sockeye abundance estimates because we have different capture probabilities in the tagging and recovery strata due, primarily, to fluctuations in river level. In estimating the abundance of adult sockeye salmon in the Taku River we assumed: (a) tagging of adult sockeye salmon was in proportion to their numbers immigrating over time; (b) no sockeye salmon entered or left the system between the tagging and recovery events or sockeye salmon that made up the population of the capture strata have a non-zero probability of recapture during the recovery event; (c) no tag-induced mortality occurred; (d) the probability of recovering sockeye salmon is independent of its tagged/untagged status. Assumptions underlying this model, outlined above, have been examined at various times during the course of this project (Kelley et al. 1997, McGregor et al. 1991).

With respect to assumption (a), tagging efforts at the Taku River fish wheels and recovery efforts in the Canadian commercial and test fisheries were conducted on a frequent basis throughout the season. Both of the fish wheels were strictly maintained and adjusted throughout the entire sockeye salmon run. Although the wheels operated 24-hours per day, efficiencies were affected by flow rates. Recovery efforts were conducted a minimum of two days per week throughout the season, but water conditions can also affect the efficiency of commercial and test fishery set and drift nets. We are able to address these variations in gear efficiency by using the Darroch stratified estimator for generating abundance estimates; this allows the probabilities of capture in tagging and recovery strata to vary across time but not within these strata.

It was likely that assumption (b) was violated in recent years of the Taku sockeye mark–recapture program because significant differences in the cumulative distribution function of length between fish sampled at the fish wheels and at the recovery location have been noted. Smaller fish were more prevalent in fish wheel samples than among the recovery samples. Stratification of mark–recapture data by size would remove possible bias in population estimates caused by differences in capture probabilities due to fish size (Bernard and Hansen 1992). In past Taku River sockeye salmon studies, summed abundance estimates obtained for large and small fish were not significantly different than the pooled estimates. Consequently, the mark-recapture data for 2009 were not examined by fish size. We were able to make some correction for this possible bias by completely removing smaller "jack" salmon (less than or equal to 360 mm MEF length) from tag and recovery data.

We were able to assess the short-term loss of tags caused by physical breakage or shedding. Fish that lose their spaghetti tags are readily identifiable by the presence of entrance and exit holes just below the dorsal fin created during tag application. Those holes serve as a secondary mark. In the fish wheels, no sockeye or coho salmon were found throughout the season that had the needle hole "secondary mark" and no spaghetti tag. These results are consistent with those observed in previous years. In addition, in statistical weeks 26 through 37, 1,863 fish were examined for tagging needle marks in the Canadian commercial fishery after tags had been removed by fishers. Tagging needle mark rates were compared with tag recovery rates, and proportions found to be the same overall (3.5%) (Appendix D). We therefore believe that breakage or shedding of tags among sockeye subjected to the inriver fishery is minimal or nonexistent. The close proximity of the fishery to the tagging site (4 km) results in a very short travel time between the two locations.

Fish wheels were not modified in 2009 and functioned effectively. As in recent years, a 2-basket configuration was used for the entire season.

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Table 1. Canyon Island fish wheel dates of operation and catches of sockeye, pink, chum, steelhead, and Dolly Varden, 2009.

Year	Dates of Operation	Sockeye	Pink	Chum	Steelhead	Dolly Varden
1984	6/15-9/18	2,334	20,751	316	NA	NA
1985	6/16-9/21	3,601	27,670	1,376	NA	NA
1986	6/14-8/25	5,808	7,256	80	14	2,716
1987	6/15-9/20	4,307	42,786	1,533	38	868
1988	5/12-9/19	3,292	3,982	1,089	37	701
1989	5/5-10/1	5,650	31,189	645	34	1,308
1990	5/3-9/23	6,091	13,358	748	33	1,433
1991	6/8-10/15	5,102	23,553	1,063	135	326
1992	6/20-9/24	6,279	9,252	189	22	241
1993	6/12-9/29	8,975	1,625	345	30	375
1994	6/10-9/21	6,485	27,100	367	107	584
1995	5/4-9/27	6,228	1,712	218	65	509
1996	5/3-9/20	5,919	21,583	388	65	681
1997	5/3-10/1	5,708	4,962	485	102	454
1998	5/2-9/15	4,230	23,347	179	120	323
1999	5/14-9/28	4,639	23,503	164	76	330
2000	5/14-10/3	5,865	6,529	423	159	244
2001	5/27-9/27	6,201	9,134	250	125	196
2002	5/19-9/14	5,812	5,672	205	90	419
2003	5/20-10/4	5,970	15,491	262	49	285
2004	5/12-10/4	6,255	8,464	414	313	63
2005	5/5-10/4	3,953	15,839	258	79	293
2006	5/20-9/30	5,296	21,726	466	47	341
2007	5/18-9/30	7,664	12,405	462	63	425
2008	5/16-9/23	3,804	4,704	350	124	423
2009	5/12-9/27	3,388	9,225	214	19	249
Average(99-08)		5,546	12,347	325	113	302

Table 2. Summary of Taku River sockeye tag recoveries by location and species, 2009.

	Tags Recovered	Tags Observed Only	Total	Fish Inspected	Tag Ratio	Percent Tags Observed
Commercial Fishery	394		394	10,980	0.036	0.487
Test Fishery	11		11	237	0.046	0.014
Hackett	3		3	132	0.023	0.004
King Salmon Lake	4	1	5	54	0.093	0.006
Kuthai Lake	12	1	13	1,442	0.009	0.016
Little Trapper Lake	175	86	261	5,552	0.047	0.323
Tatsamenie Lake	91	4	95	2,032	0.047	0.117
Taku River mainstem	16		16	591	0.027	0.020
Nahlin River	1		1	200	0.005	0.001
Tulsequah River	1		1	67	0.015	0.001
Fish Creek (U.S.)	0		0	65	0.000	0.000
Yehring Creek (U.S.)	0		0	55	0.000	0.000
U.S. downstream	9		9	871	0.010	0.011
Total	717	92	809	22,278		

Table 3. Tagging and recovery data from the 2009 Taku River sockeye salmon mark-recapture program. Data includes number of sockeye salmon tagged and recovered in the Canadian inriver fishery by statistical week (downstream recoveries excluded).

Statistical Week of Tagging	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	Total Tags Recovered	Total Tags Applied	Tag Ratio Recovered/ Applied
24																			0	4	
25			2	1															3	32	0.094
26			3	17															20	185	0.108
27				20	15	4													39	251	0.155
28					19	49	8	1	1			1							79	590	0.134
29						49	87	7	1		1								145	781	0.186
30							13	13	1		1								28	183	0.153
31								4	32	2	1		1						40	425	0.094
32									6	8	4	1	1						20	370	0.054
33										4	7	1	1						13	116	0.112
34											6	2							8	74	0.108
35													4						4	55	0.073
36														2					2	32	0.063
37														2					2	25	0.080
38															1				1	8	0.125
39																			0	1	0.000
40																	1		1	3	0.333
Total	0	0	5	38	34	102	108	25	41	14	20	5	7	4	1	0	1	0	405	3,135	0.129
Sockeye Examined[a]:																			Total		
Test [b]												83	77	28	30	8	4	7	237		
Commercial	7	12	1,512	1,776	1,031	2,094	1,161	697	1,548	489	435	100	80	38					10,980		
Total	7	12	1,512	1,776	1,031	2,094	1,161	697	1,548	489	435	183	157	66	30	8	4	7	11,217		

[a] Equals the number examined for Canyon Island tags.

[b] A portion of the test fishery catch was live-released, with a mark to prevent double-counting.

Table 4. Pooled-strata tagging and recovery data used to calculate mark-recapture estimates of the inriver sockeye salmon run past Canyon Island, 2009.

Statistical Week of Tagging	Statistical Week of Recovery 24-29	30-41	Total Tags Recovered	Total Tags Applied	Tag Ratio
24-28	130	11	141	1062	0.133
29-40	49	215	264	2073	0.127
Total	179	226	405	3,135	0.129
Catch Examined For Tags[a]	6,432	4,785	11,217		
Marked Fraction	0.029	0.050	0.037		
Above Border Run Estimate	44,651	40,877	85,528		
Fish Wheel CPUE Expansion[b]			71		
Total Above Border Run			85,599		
U.S. Personal Use Catch[c]			871		
95% Lower C.I.	43,969	34,926	77,395		
95% Upper C.I.	45,333	46,828	93,661		
Above Border Catch	6,432	4,828	11,260		
Spawning Escapment	38,219	36,049	74,339		

[a] Includes Canadian commercial and test fishery catches

[b] Expansion based on fish wheel CPUE

[c] Not subtracted from above border run estimate.

Table 5. Historical sockeye salmon above border abundance, above border harvests, and escapement for the Taku River, 1984 to 2009[a].

Year	Border Escapement	Canadian Commercial and Test Harvest	Canadian Commercial and Test Harvest Rate	Spawning Escapement[a]	Total Run	U.S. Harvest
1984	141,254	27,292	0.193	113,962	199,796	58,543
1985	123,974	14,411	0.116	109,563	197,783	73,809
1986	115,045	14,939	0.130	100,106	175,980	60,934
1987	96,023	13,887	0.145	82,136	150,147	54,124
1988	92,641	12,967	0.140	79,674	118,452	25,811
1989	114,068	18,805	0.165	95,263	176,873	62,805
1990	117,573	21,474	0.183	96,099	226,072	108,499
1991	154,873	25,380	0.164	129,493	258,285	103,412
1992	167,376	29,862	0.178	137,514	289,814	122,438
1993	142,148	33,523	0.236	108,625	283,456	141,308
1994	131,580	29,001	0.220	102,579	228,626	97,046
1995	146,450	32,711	0.223	113,739	237,458	91,008
1996	134,651	42,025	0.312	92,626	321,858	187,207
1997	95,438	24,352	0.255	71,086	173,726	78,288
1998	91,548	19,038	0.208	70,715	141,041	49,493
1999	113,705	20,681	0.182	92,562	177,032	63,327
2000	115,693	27,942	0.242	87,298	247,405	131,712
2001	192,269	47,988	0.250	144,071	399,277	207,008
2002	135,233	31,053	0.230	103,343	251,943	116,710
2003	200,918	32,933	0.171	167,691	337,768	156,727
2004	127,949	20,346	0.159	106,691	205,866	77,917
2005	134,841	21,697	0.161	112,739	179,781	44,940
2006	167,053	21,361	0.128	145,572	231,166	64,113
2007	105,012	17,090	0.163	87,763	217,253	112,241
2008	87,568	19,509	0.223	68,059	168,809	81,241
2009	85,599	11,154	0.130	74,339	121,138	35,539
Average(99-08)	138,024	26,060	0.191	111,579	241,630	105,594
Maximum(99-08)	200,918	47,988	0.250	167,691	399,277	207,008
Minimum(99-08)	87,568	17,090	0.128	68,059	168,809	44,940
S.D.(99-08)	37,396	9,325	0.042	31,385	74,176	49,771
C.V.(99-08)	27.1%	35.8%	21.9%	28.1%	30.7%	47.1%

[a] Spawning escapement includes removals for Canadian Aboriginal.

Table 6. Historical age composition of sockeye salmon passing Canyon Island, Taku River, 1983 to 2009.

	Sample	Percent By Age Class													
Year	Size	0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	3.2	2.4	3.3
1983	1,574	0.0	0.4	0.0	5.7	16.6	0.0	0.0	62.5	7.6	0.2	7.4	0.0	0.0	0.1
1984	1,583	0.3	2.1	1.8	11.5	15.4	0.2	0.2	57.0	9.2	0.3	2.8	0.0	0.0	0.0
1985	2,437	0.3	6.0	4.1	4.0	17.2	0.4	0.4	53.8	8.7	0.7	4.8	0.0	0.1	0.0
1986	3,468	0.0	2.9	0.4	6.3	29.7	0.1	0.0	50.2	2.4	0.3	8.0	0.0	0.0	0.0
1987	2,987	0.8	1.0	5.0	12.7	17.3	2.0	0.2	54.2	2.3	0.2	4.6	0.0	0.1	0.0
1988	2,450	0.3	6.5	6.2	8.0	29.8	0.3	0.0	38.7	5.6	0.2	4.6	0.1	0.0	0.0
1989	4,272	0.3	3.0	4.2	7.0	19.5	0.4	0.0	58.3	3.3	0.2	4.0	0.0	0.0	0.0
1990	4,489	0.4	4.9	3.6	4.7	26.3	0.2	0.1	48.5	6.4	0.3	4.8	0.0	0.0	0.0
1991	3,594	0.1	7.9	3.3	9.5	31.4	0.8	0.1	37.7	4.9	0.3	4.4	0.0	0.0	0.0
1992	1,678	0.3	7.1	3.0	12.3	26.7	0.7	0.1	41.2	3.8	0.0	5.4	0.0	0.0	0.0
1993	2,593	0.2	4.3	3.2	11.0	15.6	0.7	0.0	55.5	4.9	0.2	4.9	0.0	0.0	0.0
1994	2,789	1.0	5.1	5.2	9.4	17.3	0.1	0.0	55.2	4.0	0.1	3.0	0.0	0.0	0.0
1995	3,461	0.3	14.6	3.0	4.0	32.9	0.1	0.1	36.3	5.8	0.1	3.0	0.0	0.0	0.0
1996	2,659	0.1	3.8	1.3	18.3	17.1	0.1	0.0	51.1	5.9	0.2	2.1	0.0	0.0	0.0
1997	2,787	0.1	1.4	1.8	9.4	27.4	0.2	0.2	44.5	7.3	0.1	7.6	0.1	0.0	0.0
1998	2,429	0.1	2.4	5.2	0.8	19.7	0.3	0.0	60.4	6.9	0.2	4.0	0.0	0.0	0.1
1999	2,261	0.9	4.8	6.5	2.5	39.9	1.1	0.0	30.3	12.1	0.1	1.7	0.0	0.0	0.0
2000	2,305	0.0	6.3	1.2	8.6	34.5	0.2	0.0	42.3	4.6	0.1	2.0	0.0	0.0	0.0
2001	2,145	0.5	2.2	8.3	9.7	21.4	0.3	0.0	53.8	2.1	0.1	1.4	0.0	0.0	0.0
2002	2,460	0.3	8.9	2.8	2.6	37.1	0.0	0.2	43.9	2.0	0.4	1.7	0.0	0.0	0.0
2003	1,982	0.4	6.8	3.5	7.6	24.9	0.1	0.1	54.4	1.1	0.2	1.2	0.0	0.0	0.0
2004	2,232	0.3	7.5	0.7	16.2	30.8	0.0	0.0	39.1	3.4	0.2	1.8	0.0	0.0	0.0
2005	1,724	0.1	4.9	0.2	15.0	24.7	0.0	0.1	50.2	2.7	0.1	2.1	0.0	0.0	0.0
2006	1,862	0.2	8.2	1.4	5.5	27.2	0.1	0.0	47.3	7.5	0.4	2.3	0.0	0.0	0.0
2007	1,767	0.1	7.7	0.7	8.3	39.2	0.1	0.0	36.6	3.2	0.3	3.9	0.0	0.0	0.0
2008	1,578	0.5	7.4	1.8	11.0	20.1	0.1	0.1	54.1	2.6	0.3	2.1	0.0	0.0	0.0
2009	1,333	0.4	8.4	9.5	10.8	20.6	0.4	0.2	44.0	1.4	0.0	4.4	0.0	0.0	0.0
Average(98-07)	2,032	0.3	6.5	2.7	8.7	30.0	0.2	0.1	45.2	4.1	0.2	2.0	0.0	0.0	0.0
SD(98-07)		0.3	2.0	2.7	4.6	7.4	0.3	0.1	8.2	3.3	0.1	0.7	0.0	0.0	0.0
CV(98-07)		79.0%	30.9%	99.5%	52.8%	24.6%	164.3%	141.4%	18.2%	80.2%	54.8%	36.7%	-	-	-

Table 7. Migratory timing statistics of sockeye, pink, and chum salmon past the Canyon Island fish wheels, 1984 to 2009. Timing statistics in 1984 were based on catch, all other years were based on fish wheel CPUE.

	Species					
	Sockeye		Pink		Chum	
Year	Mean Date	S.D.	Mean Date	S.D.	Mean Date	S.D.
1984	7/23	17.6	7/19	9.3	8/14	12.8
1985	7/24	18.1	7/19	8.5	9/8	11.8
1986	7/16	14.2	7/27	5.5	8/7	11.3
1987	7/24	15.8	7/19	9.3	9/8	10.5
1988	7/19	19.5	7/21	9.6	8/31	12.5
1989	7/14	20.1	7/18	7.8	9/13	15.9
1990	7/20	18.8	7/23	8.9	8/30	15.1
1991	7/24	20.6	7/23	6.6	9/11	13.0
1992	7/25	14.4	7/24	7.2	8/28	13.5
1993	7/21	16.9	7/15	8.9	9/7	14.4
1994	7/23	20.2	7/24	10.1	9/2	15.6
1995	7/22	22.0	7/14	7.8	9/3	9.8
1996	7/21	18.9	7/23	6.5	8/27	14.0
1997	7/26	23.9	7/14	10.0	9/5	11.6
1998	7/18	21.1	7/24	7.9	9/4	8.7
1999	7/18	19.5	7/24	7.9	9/3	14.5
2000	7/17	20.8	7/25	8.7	8/30	16.9
2001	7/20	18.1	7/18	8.4	9/2	13.4
2002	7/9	18.6	7/20	7.6	8/31	12.3
2003	7/19	16.5	7/15	7.8	9/3	12.2
2004	7/18	19.5	7/24	8.3	9/4	19.2
2005	7/20	20.5	7/15	7.7	9/5	16.4
2006	8/4	18.6	7/26	7.8	9/4	13.2
2007	7/29	16.6	7/26	8.4	9/7	10.7
2008	7/22	20.6	7/25	10.0	8/28	14.7
2009	7/20	15.9	7/24	9.9	9/6	17.5
Average(99-08)	7/20	18.9	7/21	8.3	9/2	14.4

Table 8. Weekly and cumulative proportions of three individual sockeye salmon stocks passing Canyon Island in 2009, based on spawning ground tag recoveries expanded by fish wheel indices (fish wheel CPUE).

			Little Trapper Lake		Tatsamenie Lake		Kuthai Lake		King Salmon Lake	
Statistical Week	Week Starting	Week Ending	Weekly Proportion	Cumul. Proportion	Weekly Proportion	Cumul. Proportion	Weekly Proportion	Cumul. Proportion	Weekly Proportion	Cumul. Proportion
22	24-May	30-May								
23	31-May	06-Jun								
24	07-Jun	13-Jun								
25	14-Jun	20-Jun					0.118	0.118		
26	21-Jun	27-Jun	0.012	0.012			0.263	0.381		
27	28-Jun	04-Jul	0.101	0.113	0.020	0.020	0.341	0.722		
28	05-Jul	11-Jul	0.424	0.537	0.052	0.072	0.090	0.812		
29	12-Jul	18-Jul	0.281	0.818	0.224	0.296	0.188	1.000	0.822	0.822
30	19-Jul	25-Jul	0.067	0.885	0.057	0.353			0.000	0.822
31	26-Jul	01-Aug	0.073	0.959	0.171	0.523			0.178	1.000
32	02-Aug	08-Aug	0.041	1.000	0.360	0.883				
33	09-Aug	15-Aug			0.019	0.902				
34	16-Aug	22-Aug			0.079	0.981				
35	23-Aug	29-Aug			0.010	0.991				
36	30-Aug	05-Sep			0.009	1.000				
37	06-Sep	12-Sep								

Table 9. Inriver migration timing for four Taku River sockeye salmon stocks, 2009.

Stock	Week	Travel Time	SD	SE	N	95% C.I.
L. Trapper	26	48.00	8.83	3.61	6	7.07
	27	38.35	4.55	1.02	20	1.99
	28	35.32	4.23	0.50	73	0.97
	29	32.18	4.47	0.67	44	1.32
	30	27.00	4.75	1.68	8	3.29
	31	21.73	4.92	1.48	11	2.91
	32	23.25	5.60	1.98	8	3.88
	Average	33.47	7.0		170	
Tatsamenie	27	49.50	0.71	0.50	2	-
	28	45.20	5.26	2.35	5	4.61
	29	44.80	8.76	1.96	20	3.84
	30	37.25	3.20	1.60	4	3.14
	31	35.00	5.93	1.36	19	2.67
	32	35.27	7.43	1.36	30	2.66
	33	36.00	1.41	1.00	2	1.96
	34	29.17	3.06	1.25	6	2.45
	35	34.50	0.71	0.50	2	0.98
	36	22.00	0.00	-	1	-
	Average	37.70	8.5		91	
King Salmon	29	42.67	2.31	1.33	3	2.61
	31	33.00	-	-	1	-
	Average	40.25	5.2		4	
Kuthai	25	54.00	19.80	14.00	2	27.44
	26	29.50	3.54	2.50	2	4.90
	27	58.75	3.20	1.60	4	3.14
	28	49.00	-	-	1	-
	29	38.50	2.12	1.50	2	2.94
	Average	48.00	13.6		11	

[a] The average travel time for each weekly period was derived from the number of days the tagged fish took to travel between the tagging site (Canyon Island) and the recovery site (enumeration weir).

Table 10. Historical length (MEF) at age composition of sockeye salmon passing Canyon Island, Taku River, 1983 to 2009.

	Sample	Length At Age Class													
Year	Size	0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	2.4	3.2	3.3
1983	1,573		447		577	469			578	522	618	582			
1984	1,572	297	445	315	575	476	320	610	576	511	580	589			
1985	2,422	309	457	337	572	486	372	609	579	510	597	590	625		
1986	3,362		449	305	584	493	310		582	491	598	581			
1987	2,923	316	460	319	587	463	329	610	592	494	565	592	650		
1988	2,422	313	443	319	576	482	324		578	480	600	578			
1989	4,254	315	442	340	578	468	334		591	488	619	589			
1990	4,432	316	427	326	570	470	322	612	574	485	578	576	555		
1991	3,581	313	442	322	561	463	321	610	569	482	602	572			
1992	1,667	351	431	328	564	467	345	585	568	482		569			
1993	2,582	316	440	327	555	470	333		558	507	573	556			
1994	2,784	329	431	327	559	455	325		557	497	585	561			
1995	3,435	324	455	329	563	481	357	625	562	509	630	569			
1996	2,649	300	472	323	581	489	338		583	524	607	587			
1997	2,770	310	461	332	579	503	339	581	580	514	585	574		490	
1998	2,427	313	445	327	578	483	346		569	510	579	575			555
1999	2,251	328	446	317	565	485	326	555	568	515	612	575		540	
2000	2,300	310	460	324	583	503	329		582	508	610	581			
2001	2,140	308	449	324	581	498	340	600	586	519	572	567			
2002	2,453	299	437	334	583	473	320	614	589	522	609	595			
2003	1,966	336	458	340	570	475	340	570	578	492	582	593			
2004	2,231	338	463	332	580	500		585	570	505	588	591			
2005	1,842	345	457	331	564	472		600	563	490	585	563			
2006	1,858	325	450	334	564	484			570	515	574	565			
2007	1,834	326	465	337	585	499	353		585	523	602	589			
2008	1,574	309	445	326	586	487	345		583	506	600	592			
2009	3,610	326	448	336	592	467	345	662	577	517	595	582		525	
Average(99-08)	2,045	322	453	330	576	488	336	587	577	510	593	581		540	555
SD(98-08)		15.2	9.0	7.0	9.2	11.9	11.6	21.8	9.0	11.6	15.1	12.6			
CV(99-08)		4.7%	2.0%	2.1%	1.6%	2.4%	3.4%	3.7%	1.6%	2.3%	2.5%	2.2%			-

Table 11. Historical age composition of chum salmon passing Canyon Island fish wheels, Taku River, 1983 to 2009.

Year	Sample Size	Percent by Age Class 0.2	0.3	0.4	0.5	0.6
1983	24	8.3	45.8	54.2	8.3	0.0
1984	280	2.5	85.0	13.6	0.0	0.0
1985	728	0.4	68.1	31.9	0.0	0.0
1986	64	0.0	51.6	51.6	0.0	0.0
1987	1075	1.0	48.6	48.8	2.0	0.0
1988	853	0.0	30.4	68.5	1.5	0.0
1989	574	0.5	77.4	19.5	3.1	0.3
1990	636	0.3	23.0	76.7	0.5	0.3
1991	missing data					
1992	163	0.0	56.4	37.4	8.0	0.0
1993	278	0.7	22.3	75.9	2.5	0.0
1994	310	0.6	32.6	63.2	4.8	0.0
1995	192	2.1	19.8	75.5	4.7	0.0
1996	351	1.1	68.4	23.4	7.1	0.0
1997	425	0.9	56.2	42.4	0.5	0.0
1998	152	0.7	27.6	67.8	3.9	0.0
1999	151	2.0	84.1	13.9	0.0	0.0
2000	273	0.0	75.5	24.5	0.0	0.0
2001	207	1.0	44.9	54.1	0.0	0.0
2002	144	0.7	45.8	53.5	0.0	0.0
2003	230	2.7	72.9	23.1	1.3	0.0
2004	305	0.2	67.8	31.9	0.1	0.0
2005	198	1.0	54.0	44.9	0.0	0.0
2006	375	1.1	66.7	31.2	1.1	0.0
2007	377	1.6	54.1	42.4	1.9	0.0
2008	283	0.4	77.4	20.5	1.8	0.0
2009	188	0.5	49.5	49.5	0.5	0.0
Average(99-08)	254.3	1.1	59.3	38.7	0.8	0.0
SD(99-08)		0.8	13.8	14.1	0.8	0.0
CV(99-08)		1.3	4.3	2.8	1.0	

Table 12. Historical length (MEF) at age composition of chum salmon passing Canyon Island, Taku River, 1983 to 2009.

Year	Sample Size	Length at Age Class 0.2	0.3	0.4	0.5	0.6
1983	24	599	651	658	714	
1984	279	615	630	683		
1985	727	592	658	680		
1986	63		640	666		
1987	1,061	579	642	668	668	
1988	845		642	675	690	
1989	571	587	628	669	678	680
1990	634	655	629	666	690	600
1991	missing data					
1992	163		614	656	667	
1993	277	510	598	638	616	
1994	310	660	610	645	660	
1995	192	556	632	652	663	
1996	350	595	642	662	684	
1997	424	651	640	673	693	
1998	151	600	634	662	703	
1999	149	615	644	664		
2000	273		650	680		
2001	207	528	623	665		
2002	144	610	649	669		
2003	227	564	612	644	650	
2004	634	633	623	657	660	
2005	250	605	646	665		
2006	374	615	647	681	692	
2007	377	581	633	669	663	
2008	283	545	649	689	665	
2009	188	545	621	662	695	
Average(99-08)	292	588	638	668	666	
SD(99-08)		35.9	13.8	12.8	15.6	
CV(99-08)		6.1%	2.2%	1.9%	2.3%	

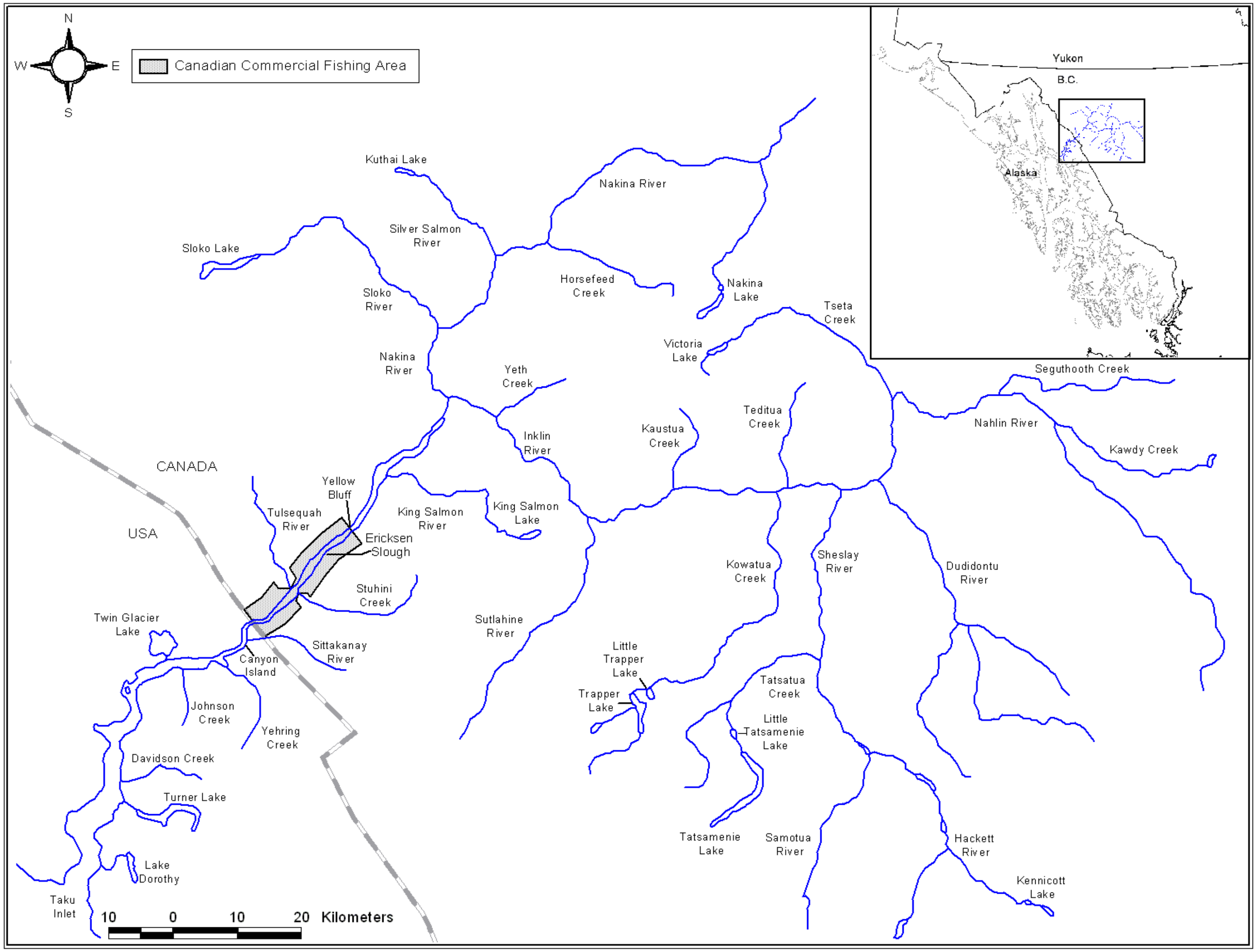


Figure 1. Taku River drainage, with location of tagging site and Canadian commercial fishing area.

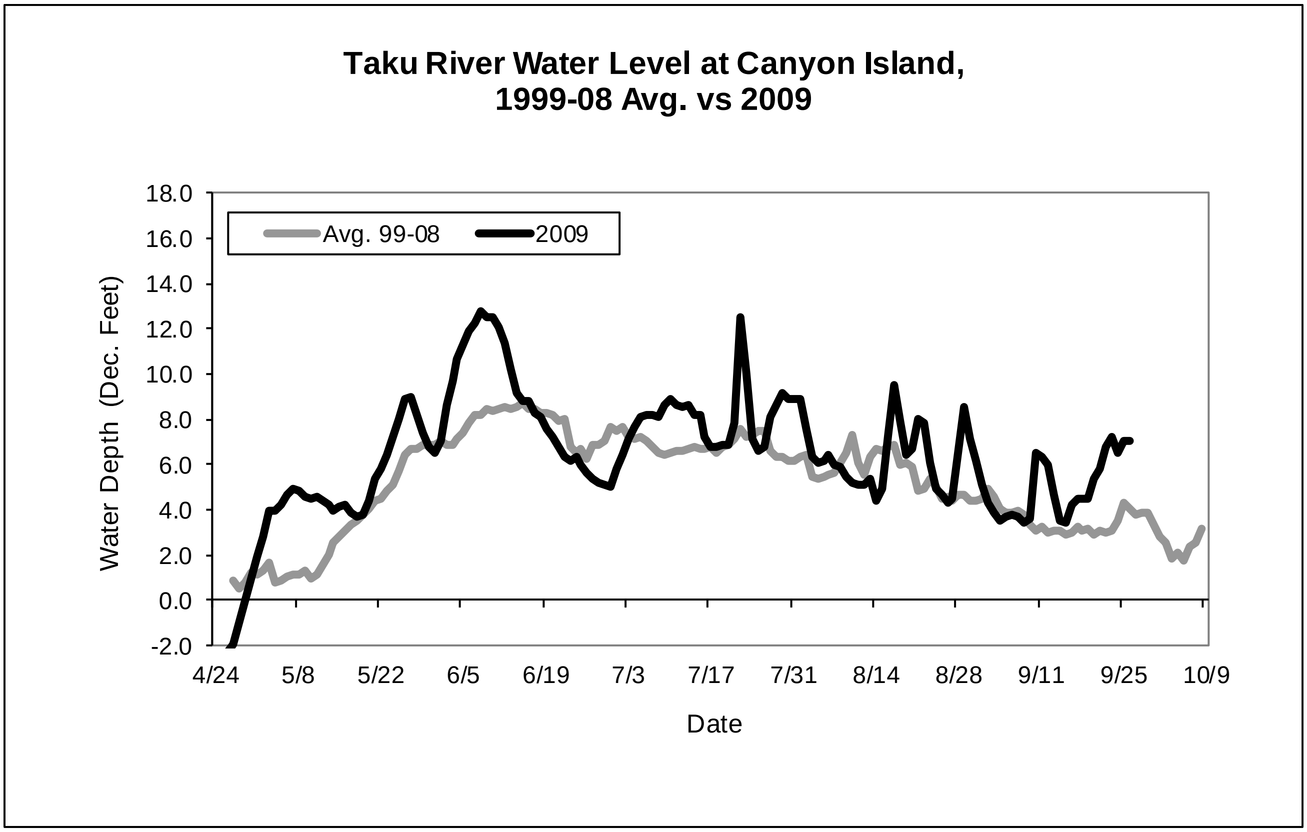
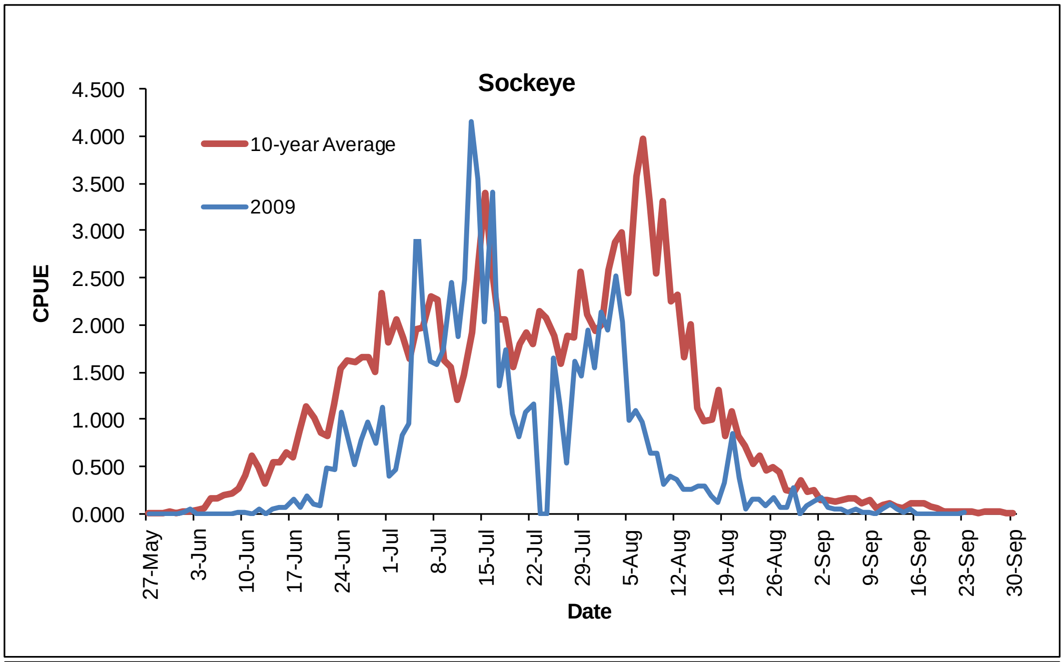


Figure 2. Water levels at Canyon Island, Taku River, 2009 vs. 1999-2008 average.



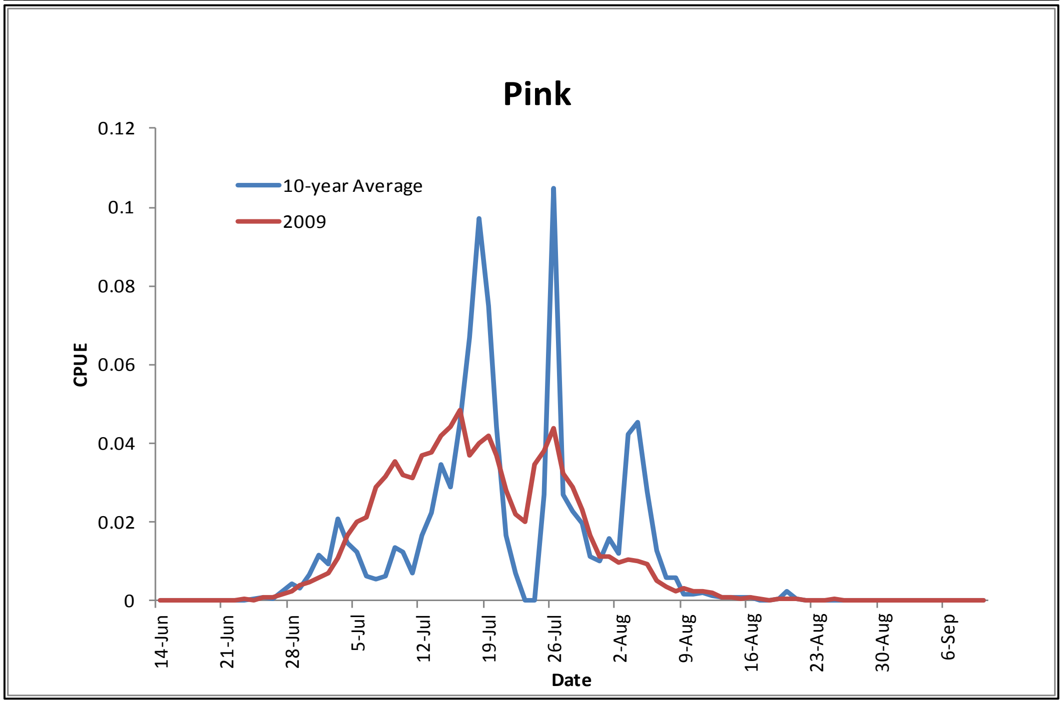


Figure 3. Fish wheel CPUE for sockeye, pink, and chum salmon at Canyon Island, 2009.

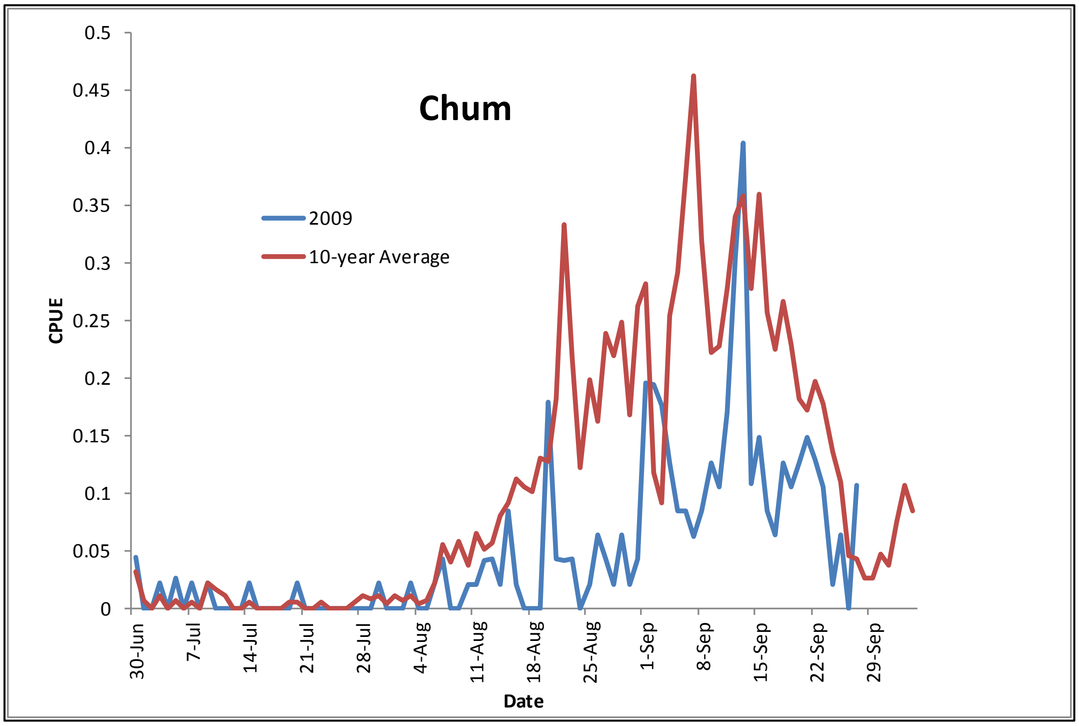


Figure 3. (Cont'd) Fish wheel CPUE for sockeye, pink, and chum salmon at Canyon Island, 2009.

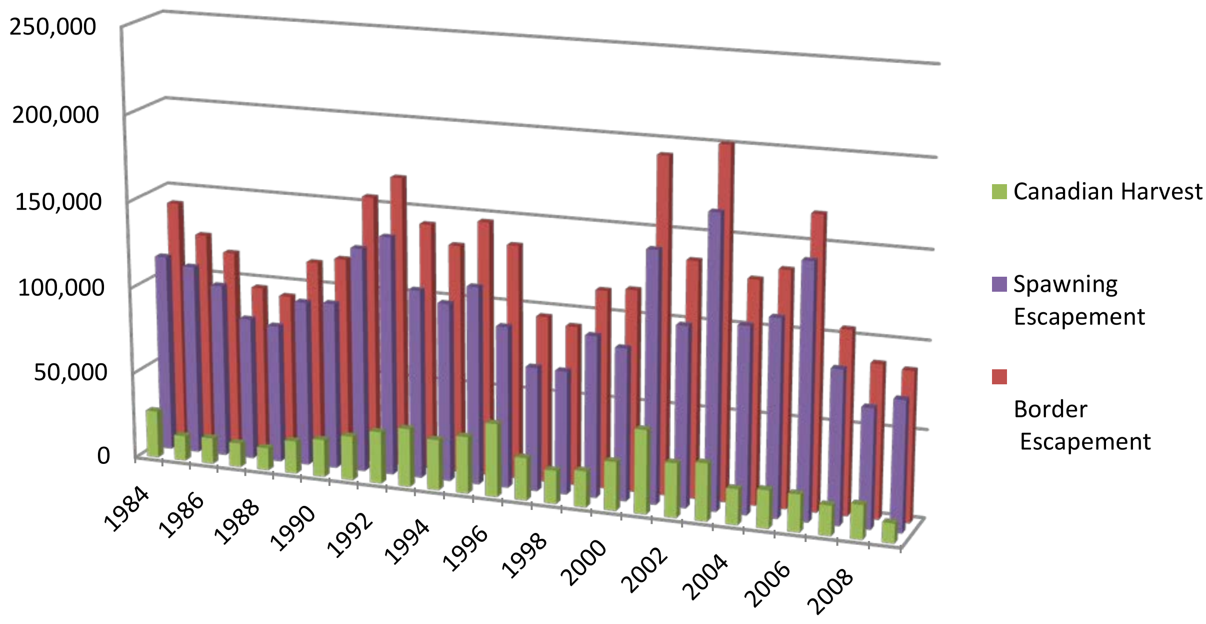


Figure 4. Historical sockeye mark-recapture abundance estimates above the Canada/U.S. border including Canadian inriver harvests and escapements for Taku River sockeye, 1984-2009.

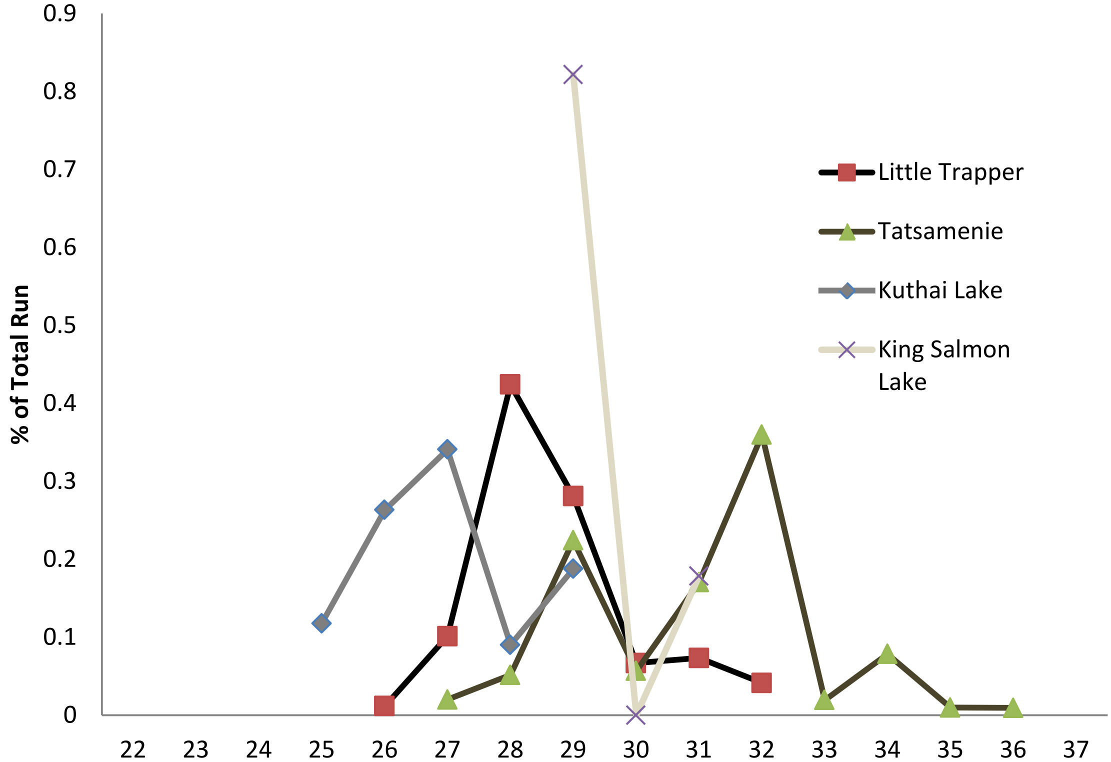


Figure 5. Run timing of four sockeye salmon stock groups passing Canyon Island, 2009.

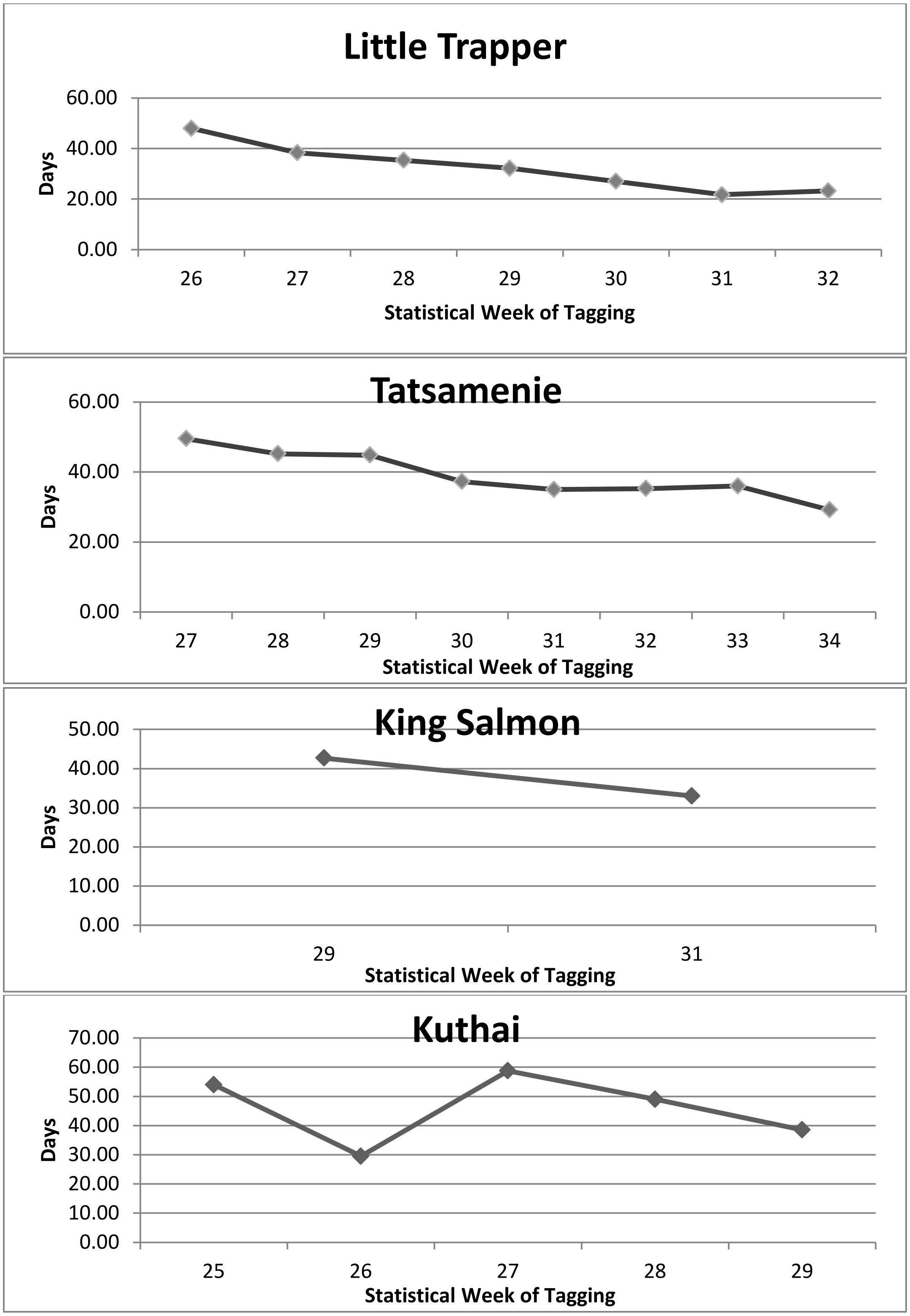


Figure 6. Mean travel times for tagged sockeye salmon between Canyon Island and four upriver locations, 2009.

Appendix A. Inclusive dates for statistical weeks, 2009.

2009 Statistical Week Calendar						
Stat Week	From	Through		Stat Week	From	Through
1	01-Jan	03-Jan		28	05-Jul	11-Jul
2	04-Jan	10-Jan		29	12-Jul	18-Jul
3	11-Jan	17-Jan		30	19-Jul	25-Jul
4	18-Jan	24-Jan		31	26-Jul	01-Aug
5	25-Jan	31-Jan		32	02-Aug	08-Aug
6	01-Feb	07-Feb		33	09-Aug	15-Aug
7	08-Feb	14-Feb		34	16-Aug	22-Aug
8	15-Feb	21-Feb		35	23-Aug	29-Aug
9	22-Feb	28-Feb		36	30-Aug	05-Sep
10	01-Mar	07-Mar		37	06-Sep	12-Sep
11	08-Mar	14-Mar		38	13-Sep	19-Sep
12	15-Mar	21-Mar		39	20-Sep	26-Sep
13	22-Mar	28-Mar		40	27-Sep	03-Oct
14	29-Mar	04-Apr		41	04-Oct	10-Oct
15	05-Apr	11-Apr		42	11-Oct	17-Oct
16	12-Apr	18-Apr		43	18-Oct	24-Oct
17	19-Apr	25-Apr		44	25-Oct	31-Oct
18	26-Apr	02-May		45	01-Nov	07-Nov
19	03-May	09-May		46	08-Nov	14-Nov
20	10-May	16-May		47	15-Nov	21-Nov
21	17-May	23-May		48	22-Nov	28-Nov
22	24-May	30-May		49	29-Nov	05-Dec
23	31-May	06-Jun		50	06-Dec	12-Dec
24	07-Jun	13-Jun		51	13-Dec	19-Dec
25	14-Jun	20-Jun		52	20-Dec	26-Dec
26	21-Jun	27-Jun		53	27-Dec	31-Dec
27	28-Jun	04-Jul				

Appendix B.1. Catches and number tagged of salmon in the fish wheels at Canyon Island, 2009.

			FISHING EFFORT				SOCKEYE							PINK					CHUM			DV		Steelhead	
Stat			FWI	FWI	FWII	FWII	FW Catches		FW Tagged		CPUE			Total Catches		CPUE			Total Catches		CPUE	Total Catches		Total Catches	
Week	Date	Day	Effort	RPM	Effort	RPM	Daily	Cum.	Daily	Cum.	Daily	Cum.	Cum. Prop	Daily	Cum.	Daily	Cum.	Cum. Prop	Daily	Cum.	Daily	Daily	Cum.	Daily	Cum.
17	23-Apr																						0		0
17	24-Apr																						0		0
17	25-Apr																						0		0
18	26-Apr																						0		0
18	27-Apr																						0		0
18	28-Apr																						0		0
18	29-Apr																						0		0
18	30-Apr																						0		0
18	01-May																						0		0
18	02-May																						0		0
19	03-May																						0		0
19	04-May																						0		0
19	05-May																						0		0
19	06-May																						0		0
19	07-May																						0		0
19	08-May																						0		0
19	09-May																						0		0
20	10-May																						0		0
20	11-May																						0		0
20	12-May				6.00	2.3																	0		0
20	13-May		9.00	2.0	23.92	2.1																	0		0
20	14-May		23.92	2.1	21.17	2.1																	0		0
20	15-May		23.75	1.8	23.50	2.0																	0		0
20	16-May		23.92	1.8	23.83	2.1																	0		0
21	17-May		23.92	1.5	23.75	1.9																	0		0
21	18-May		23.83	1.5	23.83	2.0																	0		0
21	19-May		23.92	1.0	23.75	2.1																	0		0
21	20-May		23.75	1.7	23.58	2.0																	0		0
21	21-May		23.83	2.0	23.75	2.3																	0		0
21	22-May		23.75	2.2	23.75	2.3																1	1		0
21	23-May		23.67	2.7	23.83	2.3																	1		0
22	24-May		23.50	2.4	23.58	2.5																	1		0
22	25-May		23.92	2.5	23.92	2.7																	1		0
22	26-May		23.83	2.6	21.50	2.5																1	2		0
22	27-May		23.75	2.9	23.83	2.9																	2		0
22	28-May		23.92	2.7	23.83	2.4																	2		0
22	29-May		23.83	2.5	23.58	2.2																	2		0
22	30-May	1	23.42	2.5	23.58	2.2																2	4		0
23	31-May	2	23.42	2.5	23.00	2.5																	4		0
23	01-Jun	3	23.08	2.3	23.58	2.6	1	1	0	0	0.021	0.021	0.0003										4		0
23	02-Jun	4	23.67	2.3	23.42	2.4	2	3	0	0	0.042	0.064	0.0008										4		0
23	03-Jun	5	23.83	2.6	23.92	2.2	0	3	0	0	0.000	0.064	0.0008										4		0
23	04-Jun	6	23.92	2.8	23.92	2.4	0	3	0	0	0.000	0.064	0.0008										4		0
23	05-Jun	7	23.92	2.8	23.92	2.4	0	3	0	0	0.000	0.064	0.0008										4		0
23	06-Jun	8	23.92	2.9	23.92	2.5	0	3	0	0	0.000	0.064	0.0008								0.000		4		0
24	07-Jun	9	23.33	3.0	23.92	2.5	0	3	0	0	0.000	0.064	0.0008								0.000		4		0
24	08-Jun	10	23.92	3.1	23.92	2.4	0	3	0	0	0.000	0.064	0.0008								0.000		4		0
24	09-Jun	11	23.75	2.6	23.75	2.3	1	4	1	1	0.021	0.085	0.0011								0.000		4		0
24	10-Jun	12	23.83	3.0	23.92	2.3	1	5	1	2	0.021	0.106	0.0014								0.000	1	5		0
24	11-Jun	13	23.92	3.0	22.92	2.1	0	5	0	2	0.000	0.106	0.0014								0.000		5		0
24	12-Jun	14	23.83	3.0	23.75	2.0	2	7	2	4	0.042	0.148	0.0019								0.000	1	6		0
24	13-Jun	15	23.83	3.0	23.42	2.5	0	7	0	4	0.000	0.148	0.0019								0.000		6	1	1
25	14-Jun	16	23.75	2.8	23.75	2.3	2	9	2	6	0.042	0.190	0.0025								0.000		6		1
25	15-Jun	17	23.83	2.5	23.42	2.4	3	12	3	9	0.063	0.254	0.0033								0.000		6		1
25	16-Jun	18	23.67	2.5	23.75	2.6	3	15	3	12	0.063	0.317	0.0041								0.000		6	1	2
25	17-Jun	19	23.75	2.5	23.75	2.2	7	22	7	19	0.147	0.464	0.0060								0.000		6		2
25	18-Jun	20	23.50	2.2	23.67	2.3	3	25	3	22	0.064	0.528	0.0069								0.000		6		2
25	19-Jun	21	23.25	2.2	23.08	2.4	9	34	9	31	0.194	0.722	0.0094								0.000		6	2	4
25	20-Jun	22	23.58	2.3	23.67	2.4	5	39	5	36	0.106	0.828	0.0108								0.000		6		4
26	21-Jun	23	23.92	2.2	23.83	2.1	4	43	4	40	0.084	0.912	0.0119								0.000	2	8		4
26	22-Jun	24	21.75	2.4	23.33	2.1	22	65	20	60	0.488	1.400	0.0182								0.000	1	9	1	5
26	23-Jun	25	23.50	2.3	22.33	2.1	21	86	19	79	0.458	1.858	0.0242	1	1	0.022	0.0218	0.0001			0.000	4	13	1	6
26	24-Jun	26	23.42	2.0	21.92	2.0	49	135	49	128	1.081	2.939	0.0383	4	5	0.088	0.1100	0.0005			0.000	4	17		6
26	25-Jun	27	23.50	2.3	21.83	2.0	36	171	35	163	0.794	3.733	0.0486	8	13	0.176	0.2865	0.0014			0.000	2	19		6
26	26-Jun	28	23.75	2.3	21.17	2.1	23	194	22	185	0.512	4.245	0.0553	4	17	0.089	0.3756	0.0018			0.000	2	21		6
26	27-Jun	29	23.50	2.2	23.17	2.0	36	230	36	221	0.771	5.016	0.0653	23	40	0.493	0.8684	0.0042			0.000	14	35		6
27	28-Jun	30	23.25	2.0	23.14	1.8	45	275	43	264	0.970	5.986	0.0779	40	80	0.862	1.7306	0.0083			0.000	3	38	0	6
27	29-Jun	31	23.08	2.0	23.00	1.8	34	309	33	297	0.738	6.724	0.0875	29	109	0.629	2.3600	0.0113			0.000	2	40	1	7
27	30-Jun	32	23.17	1.9	22.75	2.2	52	361	52	349	1.132	7.856	0.1023	63	172	1.372	3.7319	0.0179	2	2	0.044	2	42	0	7
27	01-Jul	33	23.33	2.1	23.67	2.2	19	380	19	368	0.404	8.261	0.1075	109	281	2.319	6.0511	0.0290	0	2	0.000	4	46	0	7
27	02-Jul	34	23.33	2.3	23.33	2.2	22	402	22	390	0.471	8.732	0.1137	88	369	1.886	7.9371	0.0380	0	2	0.000	4	50	1	8
27	03-Jul	35	23.42	2.7	22.75	2.3	38	440	38	428	0.823	9.555	0.1244	192	561	4.159	12.0956	0.0579	1	3	0.022	12	62	0	8
27	04-Jul	36	23.33	2.7	23.15	2.1	44	484	44	472	0.947	10.502	0.1367	135	696	2.904	15.0001	0.0718	0	3	0.000	4	66	1	9
28	05-Jul	37	15.67	2.4	23.50	2.5	125	609	120	592	3.191	13.693	0.1783	115	811	2.936	17.9360	0.0858	1	4	0.026	2	68	0	9
28	06-Jul	38	15.67	2.4	22.50	2.5	79	688	76	668	2.070	15.763	0.2052	59	870	1.546	19.4817	0.0932	0	4	0.000	1	69	0	9
28	07-Jul	39	23.58	2.2	22.75	2.5	75	763	70	738	1.619	17.382	0.2263	51	921	1.101	20.5825	0.0985	1	5	0.022	2	71	0	9
28	08-Jul	40	23.58	2.6	22.83	2.5	73	836	70	808	1.573	18.955	0.2468	59	980	1.271	21.8538	0.1046	0	5	0.000	5	76	0	9
28	09-Jul	41	23.58	2.4	22.42	2.3	80	916	76	884	1.739	20.694	0.2694	126	1106	2.739	24.5929	0.1177	1	6	0.022	2	78	0	9
28	10-Jul	42	16.92	2.4	23.00	2.3	98	1014	96	980	2.455	23.149	0.3014	116	1222	2.906	27.4987	0.1316	0	6	0.000	1	79	0	9
28	11-Jul	43	23.42	2.6	23.08	2.5	87	1101	84	1064	1.871	25.020	0.3257	65	1287	1.398	28.8966	0.1383	0	6	0.000	3	82	1	10
29	12-Jul	44	23.42	2.6	21.92	2.3	113	1214	106	1170	2.492	27.512	0.3582	154	1441	3.397	32.2932	0.1545	0	6	0.000	3	85	0	10
29	13-Jul	45	23.33	2.4	20.92	2.3	184	1398	165	1335	4.158	31.670	0.4123	206	1647	4.655	36.9485	0.1768	0	6	0.000	2	87	0	10
29	14-Jul	46	22.75	2.5	21.17	2.3	156	1554	147	1482	3.552	35.222	0.4586	320	1967	7.286	44.2345	0.2117	1	7	0.023	3	90	0	10
29	15-Jul	47	23.33	2.4	22.25	2.2	93	1647	91	1573	2.040	37.262	0.4851	266	2233	5.836	50.0704	0.2396	0	7	0.000	2	92	0	10

Appendix B.1. (Cont'd) Catches and number tagged of salmon in the fish wheels at Canyon Island, 2009.

			FISHING EFFORT				SOCKEYE							PINK					CHUM			DV		Steelhead	
Stat			FWI	FWI	FWII	FWII	FW Catches		FW Tagged		CPUE			Total Catches		CPUE			Total Catches		CPUE	Total Catches		Total Catches	
Week	Date	Day	Effort	RPM	Effort	RPM	Daily	Cum.	Daily	Cum.	Daily	Cum.	Cum. Prop	Daily	Cum.	Daily	Cum.	Cum. Prop	Daily	Cum.	Daily	Daily	Cum.	Daily	Cum.
29	16-Jul	48	23.17	2.5	21.25	2.3	151	1798	142	1715	3.399	40.662	0.5294	418	2651	9.410	59.4806	0.2846	0	7	0.000	2	94	0	10
29	17-Jul	49	23.00	2.3	22.33	2.2	61	1859	58	1773	1.346	42.007	0.5469	619	3270	13.655	73.1360	0.3500	0	7	0.000	2	96	0	10
29	18-Jul	50	23.17	2.6	21.83	2.6	78	1937	76	1849	1.733	43.741	0.5695	897	4167	19.933	93.0693	0.4453	0	7	0.000	5	101	0	10
30	19-Jul	51	23.17	2.5	22.92	2.3	49	1986	43	1892	1.063	44.804	0.5833	692	4859	15.014	108.0834	0.5172	0	7	0.000	5	106	0	10
30	20-Jul	52	23.33	2.6	23.00	2.6	38	2024	35	1927	0.820	45.624	0.5940	409	5268	8.828	116.9114	0.5594	1	8	0.022	3	109	0	10
30	21-Jul	53	7.50	2.5	23.08	2.4	33	2057	31	1958	1.079	46.703	0.6080	153	5421	5.003	121.9147	0.5834	0	8	0.000	6	115	0	10
30	22-Jul	54	0.00	0.0	23.17	2.6	27	2084	25	1983	1.165	47.868	0.6232	64	5485	2.762	124.6769	0.5966	0	8	0.000	2	117	0	10
30	23-Jul	55	0.00	0.0	10.50	2.7		2084		1983	0.000	47.868	0.6232	0	5485	0.000	124.6769	0.5966	0	8	0.000		117		10
30	24-Jul	56	0.00	0.0	14.00	2.5		2084		1983	0.000	47.868	0.6232	0	5485	0.000	124.6769	0.5966	0	8	0.000		117		10
30	25-Jul	57	9.00	2.6	22.67	2.5	52	2136	50	2033	1.642	49.510	0.6446	250	5735	7.894	132.5708	0.6344	0	8	0.000	5	122	0	10
31	26-Jul	58	22.67	2.5	22.92	2.3	52	2188	43	2076	1.141	50.651	0.6594	967	6702	21.211	153.7816	0.7358	0	8	0.000	21	143	0	10
31	27-Jul	59	22.83	2.5	23.66	2.5	25	2213	23	2099	0.538	51.189	0.6664	249	6951	5.356	159.1375	0.7615	0	8	0.000	4	147	0	10
31	28-Jul	60	22.75	2.6	23.33	2.3	74	2287	71	2170	1.606	52.795	0.6873	212	7163	4.601	163.7382	0.7835	0	8	0.000	10	157	0	10
31	29-Jul	61	23.33	2.4	22.58	2.4	67	2354	63	2233	1.459	54.254	0.7063	181	7344	3.942	167.6807	0.8024	0	8	0.000	2	159	0	10
31	30-Jul	62	23.42	2.6	21.67	2.6	88	2442	79	2312	1.952	56.206	0.7317	104	7448	2.306	169.9872	0.8134	1	9	0.022	9	168	0	10
31	31-Jul	63	23.50	2.5	22.42	2.5	71	2513	61	2373	1.546	57.752	0.7519	92	7540	2.003	171.9907	0.8230	0	9	0.000	2	170	0	10
31	01-Aug	64	23.67	2.5	21.67	2.6	97	2610	86	2459	2.139	59.891	0.7797	145	7685	3.198	175.1888	0.8383	0	9	0.000	11	181	0	10
32	02-Aug	65	23.75	2.5	21.92	2.6	89	2699	76	2535	1.949	61.840	0.8051	110	7795	2.409	177.5974	0.8498	0	9	0.000	2	183	0	10
32	03-Aug	66	23.41	2.0	21.41	2.0	113	2812	99	2634	2.521	64.361	0.8379	390	8185	8.701	186.2988	0.8914	1	10	0.022	1	184	0	10
32	04-Aug	67	23.16	2.3	22.17	1.8	92	2904	74	2708	2.030	66.391	0.8643	420	8605	9.265	195.5642	0.9358	0	10	0.000	3	187	0	10
32	05-Aug	68	23.16	2.2	22.75	2.2	45	2949	38	2746	0.980	67.371	0.8771	258	8863	5.620	201.1839	0.9627	0	10	0.000	4	191	0	10
32	06-Aug	69	23.33	2.3	22.75	2.4	50	2999	34	2780	1.085	68.456	0.8912	117	8980	2.539	203.7230	0.9748	1	11	0.022	3	194	0	10
32	07-Aug	70	23.58	2.3	23.17	2.3	45	3044	27	2807	0.963	69.419	0.9038	54	9034	1.155	204.8781	0.9803	2	13	0.043	0	194	0	10
32	08-Aug	71	23.33	2.1	23.17	2.3	30	3074	22	2829	0.645	70.064	0.9122	53	9087	1.140	206.0178	0.9858	0	13	0.000	1	195	0	10
33	09-Aug	72	23.25	2.3	23.14	2.4	30	3104	20	2849	0.647	70.710	0.9206	15	9102	0.323	206.3412	0.9873	0	13	0.000	1	196	0	10
33	10-Aug	73	23.66	2.1	23.50	2.2	15	3119	10	2859	0.318	71.028	0.9247	15	9117	0.318	206.6592	0.9889	1	14	0.021	1	197	0	10
33	11-Aug	74	23.66	2.6	23.50	2.0	19	3138	15	2874	0.403	71.431	0.9300	21	9138	0.445	207.1045	0.9910	1	15	0.021	2	199	0	10
33	12-Aug	75	23.50	2.4	23.58	1.9	17	3155	13	2887	0.361	71.792	0.9347	11	9149	0.234	207.3382	0.9921	2	17	0.042	1	200	0	10
33	13-Aug	76	23.34	2.6	23.33	1.9	12	3167	11	2898	0.257	72.050	0.9380	9	9158	0.193	207.5310	0.9930	2	19	0.043	2	202	0	10
33	14-Aug	77	23.58	2.6	23.58	2.1	12	3179	9	2907	0.254	72.304	0.9413	7	9165	0.148	207.6795	0.9937	1	20	0.021	1	203	0	10
33	15-Aug	78	23.25	2.4	23.58	1.9	14	3193	12	2919	0.299	72.603	0.9452	6	9171	0.128	207.8076	0.9944	4	24	0.085	1	204	0	10
34	16-Aug	79	23.42	2.4	23.50	2.5	14	3207	12	2931	0.298	72.901	0.9491	5	9176	0.107	207.9141	0.9949	1	25	0.021	0	204	0	10
34	17-Aug	80	23.58	2.9	23.67	2.7	9	3216	9	2940	0.190	73.092	0.9516	1	9177	0.021	207.9353	0.9950	0	25	0.000	0	204	0	10
34	18-Aug	81	23.83	2.2	23.83	2.4	6	3222	5	2945	0.126	73.218	0.9532	0	9177	0.000	207.9353	0.9950	0	25	0.000	1	205	0	10
34	19-Aug	82	23.50	2.8	23.08	2.3	15	3237	11	2956	0.322	73.540	0.9574	6	9183	0.129	208.0641	0.9956	0	25	0.000	1	206	0	10
34	20-Aug	83	22.42	2.4	22.16	2.1	38	3275	26	2982	0.852	74.392	0.9685	22	9205	0.493	208.5576	0.9980	8	33	0.179	0	206	0	10
34	21-Aug	84	23.58	2.6	23.33	2.1	18	3293	6	2988	0.384	74.776	0.9735	6	9211	0.128	208.6855	0.9986	2	35	0.043	2	208	0	10
34	22-Aug	85	23.50	2.7	23.58	2.5	2	3295	2	2990	0.042	74.818	0.9741	0	9211	0.000	208.6855	0.9986	2	37	0.042	0	208	0	10
35	23-Aug	86	23.33	2.3	23.50	2.5	7	3302	5	2995	0.149	74.968	0.9760	3	9214	0.064	208.7496	0.9989	2	39	0.043	0	208	0	10
35	24-Aug	87	23.33	2.0	22.92	2.1	7	3309	4	2999	0.151	75.119	0.9780	3	9217	0.065	208.8144	0.9992	0	39	0.000	3	211	0	10
35	25-Aug	88	23.16	2.0	23.58	1.9	4	3313	3	3002	0.086	75.205	0.9791	1	9218	0.021	208.8358	0.9993	1	40	0.021	2	213	0	10
35	26-Aug	89	23.50	2.3	23.67	2.2	8	3321	7	3009	0.170	75.374	0.9813	1	9219	0.021	208.8570	0.9994	3	43	0.064	2	215	0	10
35	27-Aug	90	23.50	1.7	22.67	2.1	3	3324	1	3010	0.065	75.439	0.9821	1	9220	0.022	208.8787	0.9995	2	45	0.043	0	215	0	10
35	28-Aug	91	23.50	2.1	23.84	2.0	3	3327	1	3011	0.063	75.503	0.9830	0	9220	0.000	208.8787	0.9995	1	46	0.021	2	217	0	10
35	29-Aug	92	23.25	2.4	23.75	2.5	13	3340	12	3023	0.277	75.779	0.9866	0	9220	0.000	208.8787	0.9995	3	49	0.064	2	219	0	10
36	30-Aug	93	23.75	2.6	23.75	2.9	0	3340	0	3023	0.000	75.779	0.9866	1	9221	0.021	208.8998	0.9996	1	50	0.021	0	219	0	10
36	31-Aug	94	23.08	2.2	23.42	2.3	4	3344	3	3026	0.086	75.865	0.9877	0	9221	0.000	208.8998	0.9996	2	52	0.043	1	220	0	10
36	01-Sep	95	23.08	2.3	22.92	2.2	6	3350	5	3031	0.130	75.996	0.9894	0	9221	0.000	208.8998	0.9996	9	61	0.196	1	221	0	10
36	02-Sep	96	23.50	2.0	22.58	1.9	8	3358	3	3034	0.174	76.169	0.9916	1	9222	0.022	208.9215	0.9997	9	70	0.195	2	223	0	10
36	03-Sep	97	22.50	2.4	23.08	1.6	3	3361	0	3034	0.066	76.235	0.9925	1	9223	0.022	208.9434	0.9998	8	78	0.176	4	227	0	10
36	04-Sep	98	23.50	1.7	23.67	1.7	2	3363	1	3035	0.042	76.278	0.9931	1	9224	0.021	208.9646	0.9999	6	84	0.127	0	227	0	10
36	05-Sep	99	23.59	1.0	23.67	0.9	2	3365	0	3035	0.042	76.320	0.9936	0	9224	0.000	208.9646	0.9999	4	88	0.085	0	227	0	10
37	06-Sep	100	23.58	1.8	23.67	1.6	1	3366	1	3036	0.021	76.341	0.9939	0	9224	0.000	208.9646	0.9999	4	92	0.085	3	230	1	11
37	07-Sep	101	23.58	1.5	23.83	2.1	2	3368	2	3038	0.042	76.383	0.9944	0	9224	0.000	208.9646	0.9999	3	95	0.063	3	233	1	12
37	08-Sep	102	23.50	1.6	23.75	1.8	1	3369	1	3039	0.021	76.404	0.9947	0	9224	0.000	208.9646	0.9999	4	99	0.085	0	233	0	12
37	09-Sep	103	23.75	1.8	23.75	2.1	1	3370	1	3040	0.021	76.425	0.9950	0	9224	0.000	208.9646	0.9999	6	105	0.126	1	234	0	12
37	10-Sep	104	23.67	1.8	23.50	2.1	0	3370	0	3040	0.000	76.425	0.9950	1	9225	0.021	208.9858	1.0000	5	110	0.106	0	234	0	12
37	11-Sep	105	23.25	2.9	23.67	2.7	2	3372	2	3042	0.043	76.468	0.9955	0	9225	0.000	208.9858	1.0000	8	118	0.171	3	237	0	12
37	12-Sep	106	22.92	2.1	23.50	2.2	5	3377	2	3044	0.108	76.576	0.9969	0	9225	0.000	208.9858	1.0000	14	132	0.302	0	237	0	12
38	13-Sep	107	23.25	2.0	23.83	2.0	2	3379	2	3046	0.042	76.618	0.9975	0	9225	0.000	208.9858	1.0000	19	151	0.404	1	238	0	12
38	14-Sep	108	23.00	2.0	23.08	1.8	1	3380	1	3047	0.022	76.640	0.9978	0	9225	0.000	208.9858	1.0000	5	156	0.109	0	238	0	12
38	15-Sep	109	23.08	1.7	23.75	1.8	2	3382	2	3049	0.043	76.683	0.9983	0	9225	0.000	208.9858	1.0000	7	163	0.149	1	239	0	12
38	16-Sep	110	23.50	1.8	23.50	1.8	0	3382	0	3049	0.000	76.683	0.9983	0	9225	0.000	208.9858	1.0000	4	167	0.085	0	239	2	14
38	17-Sep	111	23.42	2.1	23.42	2.5	0	3382	0	3049	0.000	76.683	0.9983	0	9225	0.000	208.9858	1.0000	3	170	0.064	1	240	0	14
38	18-Sep	112	23.67	2.2	23.50	2.0	0	3382	0	3049	0.000	76.683	0.9983	0	9225	0.000	208.9858	1.0000	6	176	0.127	1	241	0	14
38	19-Sep	113	23.67	2.3	23.67	2.0	0	3382	0	3049	0.000	76.683	0.9983	0	9225	0.000	208.9858	1.0000	5	181	0.106	1	242	0	14
39	20-Sep	114	23.67	2.2	23.58	2.2	0	3382	0	3049	0.000	76.683	0.9983	0	9225	0.000	208.9858	1.0000	6	187	0.127	1	243	0	14
39	21-Sep	115	23.67	2.4	23.67	2.8	0	3382	0	3049	0.000	76.683	0.9983	0	9225	0.000	208.9858	1.0000	7	194	0.148	2	245	1	15
39	22-Sep	116	23.25	2.4	23.17	2.2	0	3382	0	3049	0.000	76.683	0.9983	0	9225	0.000	208.9858	1.0000	6	200	0.129	2	247	2	17
39	23-Sep	117	23.50	2.8	23.67	2.6	1	3383	1	3050	0.021	76.704	0.9986	0	9225	0.000	208.9858	1.0000	5	205	0.106	0	247	0	17
39	24-Sep	118	23.50	2.2	23.92	2.7	0	3383	0	3050	0.000	76.704	0.9986	0	9225	0.000	208.9858	1.0000	1	206	0.021	0	247	0	17
39	25-Sep	119	23.50	2.0	23.58	2.2	1	3384	0	3050	0.021	76.725	0.9989	0	9225	0.000	208.9858	1.0000	3	209	0.064	1	248	0	17
39	26-Sep	120	23.58	2.2	23.83	2.5	0	3384	0	3050	0.000	76.725	0.9989	0	9225	0.000	208.9858	1.0000	0	209	0.000	0	248	0	17
40	27-Sep	121	23.08	2.1	23.58	2.2	4	3388	3	3053	0.086	76.811	1.0000	0	9225	0.000	208.9858	1.0000	5	214	0.107	1	249	2	19

Appendix C.1. Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2009.

	Brood Year and Age Class											
	2007	2006	2006	2005	2005	2005	2004	2004	2004	2003	2003	
	0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	Total
Statistical Week 24 (June 7 - 13)												
Male												
Sample Size					1							1
Percent					100.0							100.0
Std. Error					-							-
Female												
Sample Size												
Percent												
Std. Error												
All Fish												
Sample Size					1							1
Percent					100.0							100.0
Std. Error					-							
Statistical Week 25 (June 14 - June 20)												
Male												
Sample Size					1			10			1	12
Percent					4.2			41.7			4.2	50.0
Std. Error					4.2			10.3			4.2	10.4
Female												
Sample Size					2			9			1	12
Percent					8.3			37.5			4.2	50.0
Std. Error					5.8			10.1			4.2	10.4
All Fish												
Sample Size					3			19			2	24
Percent					12.5			79.2			8.3	100.0
Std. Error					6.9			8.5			5.8	

Appendix C.1 (Cont'd). Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2009.

	Brood Year and Age Class											
	2007	2006	2006	2005	2005	2005	2004	2004	2004	2003	2003	
	0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	Total
Statistical Week 26 (June 21 - 27)												
Male												
Sample Size		2		5	12			37	1			57
Percent		1.7		4.2	10.0			30.8	0.8			47.5
Std. Error		1.2		1.8	2.8			4.2	0.8			4.6
Female												
Sample Size				4	15			40	1		3	63
Percent				3.3	12.5			33.3	0.8		2.5	52.5
Std. Error				1.6	3.0			4.3	0.8		1.4	4.6
All Fish												
Sample Size		2		9	27			77	2		3	120
Percent		1.7		7.5	22.5			64.2	1.7		2.5	100.0
Std. Error		1.2		2.4	3.8			4.4	1.2		1.4	
Statistical Week 27 (June 28 - July 4)												
Male												
Sample Size		2		17	24			39			1	83
Percent		1.3		11.3	16.0			26.0			0.7	55.3
Std. Error		0.9		2.6	3.0			3.6			0.7	4.1
Female												
Sample Size				8	12			42			5	67
Percent				5.3	8.0			28.0			3.3	44.7
Std. Error				1.8	2.2			3.7			1.5	4.1
All Fish												
Sample Size		2		25	36			81			6	150
Percent		1.3		16.7	24.0			54.0			4.0	100.0
Std. Error		0.9		3.1	3.5			4.1			1.6	

Appendix C.1 (Cont'd). Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2009.

	Brood Year and Age Class											
	2007	2006	2006	2005	2005	2005	2004	2004	2004	2003	2003	
	0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	Total
Statistical Week 28 (July 5 - 11)												
Male												
Sample Size		15	2	10	25			27	1		3	83
Percent		8.6	1.1	5.7	14.3			15.4	0.6		1.7	47.4
Std. Error		2.1	0.8	1.8	2.7			2.7	0.6		1.0	3.8
Female												
Sample Size		5		18	11			52	1		5	92
Percent		2.9		10.3	6.3			29.7	0.6		2.9	52.6
Std. Error		1.3		2.3	1.8			3.5	0.6		1.3	3.8
All Fish												
Sample Size		20	2	28	36			79	2		8	175
Percent		11.4	1.1	16.0	20.6			45.1	1.1		4.6	100.0
Std. Error		2.4	0.8	2.8	3.1			3.8	0.8		1.6	
Statistical Week 29 (July 12 - 18)												
Male												
Sample Size		22	3	10	41			26	1		2	105
Percent		12.0	1.6	5.5	22.4			14.2	0.5		1.1	57.4
Std. Error		2.4	0.9	1.7	3.1			2.6	0.5		0.8	3.7
Female												
Sample Size		1		11	8			55			3	78
Percent		0.5		6.0	4.4			30.1			1.6	42.6
Std. Error		0.5		1.8	1.5			3.4			0.9	3.7
All Fish												
Sample Size		23	3	21	49			81	1		5	183
Percent		12.6	1.6	11.5	26.8			44.3	0.5		2.7	100.0
Std. Error		2.5	0.9	2.4	3.3			3.7	0.5		1.2	

Appendix C.1 (Cont'd). Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2009.

	Brood Year and Age Class											
	2007	2006	2006	2005	2005	2005	2004	2004	2004	2003	2003	
	0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	Total
Statistical Week 30 (July 19 - July 25)												
Male												
Sample Size		12	1	2	25	1		10			3	54
Percent		12.1	1.0	2.0	25.3	1.0		10.1			3.0	54.5
Std. Error		3.3	1.0	1.4	4.4	1.0		3.0			1.7	5.0
Female												
Sample Size		2	1	8	6			27			1	45
Percent		2.0	1.0	8.1	6.1			27.3			1.0	45.5
Std. Error		1.4	1.0	2.8	2.4			4.5			1.0	5.0
All Fish												
Sample Size		14	2	10	31			37			4	99
Percent		14.1	2.0	10.1	31.3			37.4			4.0	99.0
Std. Error		3.5	1.4	3.0	4.7			4.9			2.0	
Statistical Week 31 (July 26 - August 1)												
Male												
Sample Size		15	10	4	37	2		21	3		1	93
Percent		8.9	6.0	2.4	22.0			12.5	1.8		0.6	54.2
Std. Error		2.2	1.8	1.2	3.2			2.6	1.0		0.6	3.9
Female												
Sample Size	1	1		12	4		2	48	1		6	75
Percent	0.6	0.6		7.1	2.4		1.2	28.6	0.6		3.6	44.6
Std. Error	0.6	0.6		2.0	1.2		0.8	3.5	0.6		1.4	3.8
All Fish												
Sample Size	1	16	10	16	41		2	69	4		7	168
Percent	0.6	9.5	6.0	9.5	24.4		1.2	41.1	2.4		4.2	98.8
Std. Error	0.6	2.3	1.8	2.3	3.3		0.8	3.8	1.2		1.5	

Appendix C.1 (Cont'd). Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2009.

	Brood Year and Age Class											
	2007	2006	2006	2005	2005	2005	2004	2004	2004	2003	2003	
	0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	Total
Statistical Week 32 (August 2 - 8)												
Male												
Sample Size	1	14	45	10	17	1		13	1		3	105
Percent	0.6	8.3	26.6	5.9	10.1	0.6		7.7	0.6		1.8	62.1
Std. Error	0.6	2.1	3.4	1.8	2.3	0.6		2.1	0.6		1.0	3.7
Female												
Sample Size		1	1	9	6			45	1		1	64
Percent		0.6	0.6	5.3	3.6			26.6	0.6		0.6	37.9
Std. Error		0.6	0.6	1.7	1.4			3.4	0.6		0.6	3.7
All Fish												
Sample Size	1	15	46	19	23			58	2		4	169
Percent	0.6	8.9	27.2	11.2	13.6			34.3	1.2		2.4	99.4
Std. Error	0.6	2.2	3.4	2.4	2.6			3.7	0.8		1.2	
Statistical Week 33 (August 9 - 15)												
Male												
Sample Size	2	7	19	5	6			11	3		2	55
Percent	2.4	8.2	22.4	5.9	7.1			12.9	3.5		2.4	64.7
Std. Error	1.7	3.0	4.5	2.6	2.8			3.7	2.0		1.7	5.2
Female												
Sample Size				5	4			19	1		1	30
Percent				5.9	4.7			22.4	1.2		1.2	35.3
Std. Error				2.6	2.3			4.5	1.2		1.2	5.2
All Fish												
Sample Size	2	7	19	10	10			30	4		3	85
Percent	2.4	8.2	22.4	11.8	11.8			35.3	4.7		3.5	100.0
Std. Error	1.7	3.0	4.5	3.5	3.5			5.2	2.3		2.0	

Appendix C.1 (Cont'd). Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2009.

	Brood Year and Age Class											
	2007	2006	2006	2005	2005	2005	2004	2004	2004	2003	2003	
	0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	Total
Statistical Week 34 (August 16 - 22)												
Male												
Sample Size		11	23	1	5	1		5	1		1	48
Percent		16.7	34.8	1.5	7.6	1.5		7.6	1.5		1.5	72.7
Std. Error		4.6	5.9	1.5	3.3	1.5		3.3	1.5		1.5	5.5
Female												
Sample Size		1		2	4			6			5	18
Percent		1.5		3.0	6.1			9.1			7.6	27.3
Std. Error		1.5		2.1	3.0			3.6			3.3	5.5
All Fish												
Sample Size		12	23	3	9			11	1		6	66
Percent		18.2	34.8	4.5	13.6			16.7	1.5		9.1	98.5
Std. Error		4.8	5.9	2.6	4.3			4.6	1.5		3.6	
Statistical Week 35 (August 23 - 29)												
Male												
Sample Size	1	1	11	1	5			2	1		1	23
Percent	2.6	2.6	28.9	2.6	13.2			5.3	2.6		2.6	60.5
Std. Error	2.6	2.6	7.5	2.6	5.6			3.7	2.6		2.6	8.0
Female												
Sample Size				1				13			1	15
Percent				2.6				34.2			2.6	39.5
Std. Error				2.6				7.8			2.6	8.0
All Fish												
Sample Size	1	1	11	2	5			15	1		2	38
Percent	2.6	2.6	28.9	5.3	13.2			39.5	2.6		5.3	100.0
Std. Error	2.6	2.6	7.5	3.7	5.6			8.0	2.6		3.7	

Appendix C.1 (Cont'd). Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2009.

	Brood Year and Age Class											
	2007	2006	2006	2005	2005	2005	2004	2004	2004	2003	2003	
	0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	Total
Statistical Week 36 (August 30 - September 5)												
Male												
Sample Size			10		1			1			1	13
Percent			37.0		3.7			3.7			3.7	48.1
Std. Error			9.5		3.7			3.7			3.7	9.8
Female												
Sample Size				1				10			3	14
Percent				3.7				37.0			11.1	51.9
Std. Error				3.7				9.5			6.2	9.8
All Fish												
Sample Size			10	1	1			11			4	27
Percent			37.0	3.7	3.7			40.7			14.8	100.0
Std. Error			9.5	3.7	3.7			9.6			7.0	
Statistical Week 37 (September 6 - 12)												
Male												
Sample Size			1		3			5			1	10
Percent			5.0		15.0			25.0			5.0	50.0
Std. Error			5.0		8.2			9.9			5.0	11.5
Female												
Sample Size								9			1	10
Percent								45.0			5.0	50.0
Std. Error								11.4			5.0	11.5
All Fish												
Sample Size			1		3			14			2	20
Percent			5.0		15.0			70.0			10.0	100.0
Std. Error			5.0		8.2			10.5			6.9	

Appendix C.1 (Cont'd). Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2009.

	Brood Year and Age Class											
	2007	2006	2006	2005	2005	2005	2004	2004	2004	2003	2003	
	0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	Total
Statistical Week 38 (September 13 - 19)												
Male												
Sample Size									1		2	3
Percent									16.7		33.3	50.0
Std. Error									16.7		21.1	22.4
Female												
Sample Size								3				3
Percent								50.0				50.0
Std. Error								22.4				22.4
All Fish												
Sample Size								3	1		2	6
Percent								50.0	16.7		33.3	100.0
Std. Error								22.4	16.7		21.1	
Statistical Week 39 (September 20 - 26)												
Male												
Sample Size												0
Percent												0.0
Std. Error												
Female												
Sample Size											1	1
Percent											100.0	100.0
Std. Error											-	-
All Fish												
Sample Size											1	1
Percent											100.0	100.0
Std. Error											-	-

Appendix C.1 (Cont'd). Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2009.

	Brood Year and Age Class											
	2007	2006	2006	2005	2005	2005	2004	2004	2004	2003	2003	
	0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	Total
Statistical Week 40 (September 27 - October 3)												
Male												
Sample Size												0
Percent												0.0
Std. Error												
Female												
Sample Size								1				1
Percent								100.0				100.0
Std. Error								-				-
All Fish												
Sample Size								1				1
Percent								100.0				100.0
Std. Error								-				
Combined Periods (June 7 - October 3)												
Male												
Sample Size	4.0	101.0	125.0	65.0	203.0	5.0	0.0	207.0	13.0	0.0	22.0	745
Percent	0.3	7.6	9.4	4.9	15.2	0.4	0.0	15.5	1.0	0.0	1.7	55.9
Std. Error	0.1	0.7	0.8	0.6	1.0	0.2	0.0	1.0	0.3	0.0	0.3	1.4
Female												
Sample Size	1.0	11.0	2.0	79.0	72.0	0.0	2.0	379.0	5.0	0.0	37.0	588
Percent	0.1	0.8	0.2	5.9	5.4	0.0	0.2	28.4	0.4	0.0	2.8	44.1
Std. Error	0.1	0.2	0.1	0.6	0.6	0.0	0.1	1.2	0.2	0.0	0.5	1.4
All Fish												
Sample Size	5	112	127	144	275	5	2	586	18		59	1333
Percent	0.4	8.4	9.5	10.8	20.6	0.4	0.2	44.0	1.4		4.4	100
Std. Error	0.2	0.8	0.8	0.9	1.1	0.2	0.1	1.4	0.3		0.6	

Appendix C.2. Age composition of chum salmon in the Canyon Island fish wheels by sex and fishing period, 2009.

	Brood Year and Age Class				
	2004	2003	2002	2006	
	0.2	0.3	0.4	0.5	Total
Statistical Weeks 27					
Male					
Sample Size					
Percent					
Std. Error					
Female					
Sample Size			1		1
Percent			100.0		100.0
Std. Error			-		0.0
All Fish					
Sample Size			1		1
Percent			100.0		100.0
Std. Error					
Statistical Week 28					
Male					
Sample Size					
Percent					
Std. Error					
Female					
Sample Size			1		1
Percent			100.0		100.0
Std. Error			-		-
All Fish					
Sample Size			1		1
Percent			100.0		100.0
Std. Error					

Appendix C.2 (Cont'd). Age composition of chum salmon in the Canyon Island fish wheels by sex and fishing period, 2009.

	Brood Year and Age Class				
	2003	2002	2001	2005	
	0.2	0.3	0.4	0.5	Total
Statistical Week 29					
Male					
Sample Size					
Percent					
Std. Error					
Female					
Sample Size			1		1
Percent			100.0		0.0
Std. Error			-		
All Fish					
Sample Size			1		1
Percent			100.0		100.0
Std. Error					
Statistical Week 30					
Male					
Sample Size		1			1.0
Percent		100.0			100.0
Std. Error		-			-
Female					
Sample Size					
Percent					
Std. Error					
All Fish					
Sample Size		1			1
Percent		100.0			100.0
Std. Error		-			-

Appendix C.2 (Cont'd). Age composition of chum salmon in the Canyon Island fish wheels by sex and fishing period, 2009.

	Brood Year and Age Class				
	2003	2002	2001	2005	
	0.2	0.3	0.4	0.5	Total
Statistical Week 31					
Male					
Sample Size		1			1
Percent		100.0			100.0
Std. Error		-			-
Female					
Sample Size					
Percent					
Std. Error					
All Fish					
Sample Size		1			1
Percent		100.0			100.0
Std. Error		-			-
Statistical Week 32					
Male					
Sample Size					0
Percent					0.0
Std. Error					
Female					
Sample Size			3		3
Percent			100.0		100.0
Std. Error			0.0		0.0
All Fish					
Sample Size			3		3
Percent			100.0		100.0
Std. Error			0.0		

Appendix C.2 (Cont'd). Age composition of chum salmon in the Canyon Island fish wheels by sex and fishing period, 2009.

	Brood Year and Age Class				
	2003	2002	2001	2005	
	0.2	0.3	0.4	0.5	Total
Statistical Week 33					
Male					
Sample Size			4		4
Percent			40.0		40.0
Std. Error			16.3		16.3
Female					
Sample Size		2	4		6
Percent		20.0	40.0		60.0
Std. Error		13.3	16.3		16.3
All Fish					
Sample Size		2	8		10
Percent		20.0	80.0		100.0
Std. Error		13.3	13.3		
Statistical Week 34					
Male					
Sample Size		1	2		3
Percent		14.3	28.6		42.9
Std. Error		14.3	18.4		20.2
Female					
Sample Size			3	1	4
Percent			42.9	14.3	57.1
Std. Error			20.2	14.3	20.2
All Fish					
Sample Size		1	5	1	7
Percent		14.3	71.4	14.3	100.0
Std. Error		14.3	18.4	14.3	

Appendix C.2 (Cont'd). Age composition of chum salmon in the Canyon Island fish wheels by sex and fishing period, 2009.

	Brood Year and Age Class				
	2003	2002	2001	2005	
	0.2	0.3	0.4	0.5	Total
Statistical Week 35					
Male					
Sample Size		2	1		3
Percent		22.2	11.1		33.3
Std. Error		14.7	11.1		16.7
Female					
Sample Size		2	4		6
Percent		22.2	44.4		66.7
Std. Error		14.7	17.6		16.7
All Fish					
Sample Size		4	5		9
Percent		44.4	55.6		100.0
Std. Error		17.6	17.6		0.0
Statistical Week 36					
Male					
Sample Size		6	12		18
Percent		17.6	35.3		52.9
Std. Error		6.6	8.3		8.7
Female					
Sample Size		7	9		16
Percent		20.6	26.5		47.1
Std. Error		7.0	7.7		8.7
All Fish					
Sample Size		13	21		34
Percent		38.2	61.8		100.0
Std. Error		8.5	8.5		

Appendix C.2 (Cont'd). Age composition of chum salmon in the Canyon Island fish wheels by sex and fishing period, 2009.

	Brood Year and Age Class				
	2003	2002	2001	2005	
	0.2	0.3	0.4	0.5	Total
Statistical Week 37					
Male					
Sample Size		13	7		20
Percent		31.0	16.7		47.6
Std. Error		7.2	5.8		7.8
Female					
Sample Size		14	8		22
Percent		33.3	19.0		52.4
Std. Error		7.4	6.1		7.8
All Fish					
Sample Size		27	15		42
Percent		64.3	35.7		100.0
Std. Error		7.5	7.5		
Statistical Week 38-40					
Male					
Sample Size	1	5	12		18
Percent	1.3	6.4	15.4		23.1
Std. Error	1.3	2.8	4.1		4.8
Female					
Sample Size		39	21		60
Percent		50.0	26.9		76.9
Std. Error		5.7	5.1		4.8
All Fish					
Sample Size	1	44	29		78
Percent	1.3	56.4	37.2		94.9
Std. Error	1.3	5.7	5.5		

Appendix C.2 (Cont'd). Age composition of chum salmon in the Canyon Island fish wheels by sex and fishing period, 2009.

	Brood Year and Age Class				
	2003	2002	2001	2005	
	0.2	0.3	0.4	0.5	Total
Combined Periods (June 29 - October 4)					
Male					
Sample Size	1	29	38		68
Percent	0.5	15.4	20.2		36.2
Std. Error	0.5	2.6	2.9		3.5
Female					
Sample Size	0	64	55	1	120
Percent		34.0	29.3	0.5	63.8
Std. Error		3.5	3.3	0.5	3.5
All Fish					
Sample Size	1	93	93	1	188
Percent	0.5	49.5	49.5	0.5	100.0
Std. Error	0.5	3.7	3.7	0.5	

Appendix D. Results of secondary marking study to test for short term tag loss for sockeye captured at the Canyon Island fish wheels, 2009.

Stat. Week	Fishery Catch	Tags Recovered	Fishery Ratio	Fish Examined for 2nd Marks	Number of 2nd Marks	Sample Ratio	Fishery Ratio - Sampled Ratio
26	1,512	5	0.003	200	2	0.010	-0.007
27	1,776	38	0.021	200	9	0.045	-0.024
28	1,031	34	0.033	200	10	0.050	-0.017
29	2,094	102	0.049	200	12	0.060	-0.011
30	1,161	108	0.093	200	10	0.050	0.043
31	697	25	0.036	200	5	0.025	0.011
32	1,548	41	0.026	200	9	0.045	-0.019
33	489	14	0.029	200	6	0.030	-0.001
34	435	20	0.046	144	0	0.000	0.046
35	183	3	0.016	38	1	0.026	-0.010
36	157	4	0.025	63	1	0.016	0.010
37	66	0	0.000	18	0	0.000	0.000
Total	11,149	394	0.035	1,863	65	0.035	0.000