Mark-Recapture Studies of Taku River Adult Sockeye Salmon Stocks in 2011

James E. Andel
Ian M. Boyce

June 2014

Pacific Salmon Commission
Technical Report No. 31

The Pacific Salmon Commission is charged with the implementation of the Pacific Salmon Treaty, which was signed by Canada and the United States in 1985. The focus of the agreement are salmon stocks that originate in one country and are subject to interception by the other country. The objectives of the Treaty are to 1) conserve the five species of Pacific salmon in order to achieve optimum production, and 2) to divide the harvests so each country reaps the benefits of its investment in salmon management.

Technical Reports of the Pacific Salmon Commission present results of completed or ongoing investigations carried out by the Pacific Salmon Commission that are deemed of sufficient interest to be made available to the scientific community and the public.

Pacific Salmon Commission
600 - 1155 Robson Street
Vancouver, B.C.
V6E 1B5
(604) 684-8081

Pacific Salmon Commission
Transboundary Technical Committee Report No. 31

Mark-Recapture Studies of Taku River Adult Sockeye Salmon Stocks in 2011

Prepared by:
James E. Andel[1] and Ian M. Boyce[2]

Prepared for:
Pacific Salmon Commission
Transboundary Technical Committee

June 2014

[1] Alaska Department of Fish and Game, Division of Commercial Fisheries, P.O. Box 240020, Douglas, Alaska 99824.
[2] Fisheries and Oceans Canada, Yukon/Transboundary Rivers Area, 100-419 Range Road, Whitehorse, Yukon Territory, Y1A 3V1.

Correct citation for this publication:

Andel, J.E. and I.M. Boyce. 2014. Mark-recapture studies of Taku River adult sockeye salmon stocks in 2011. Pacific Salmon Comm. Tech. Rep. No. 31: 50 p.

AUTHORS

James E. Andel is the Taku River Stock Assesment Research Biologist for the Alaska Department of Fish and Game, Division of Commercial Fisheries, P.O. Box 240020, Douglas, Alaska 99824. Voice: 907-465-4396, FAX: 907-465-4944, e-mail: jim.andel@alaska.gov.

Ian M. Boyce is the Taku River Stock Assessment Biologist for Fisheries and Oceans Canada, Yukon/ Transboundary Rivers Area, 100-419 Range Road, Whitehorse, Yukon Territory, Y1A 3V1. Voice: 867-393-6739, FAX: 867-393-6738, e-mail: Ian.Boyce@dfo-mpo.gc.ca

ACKNOWLEDGMENTS

This project was conducted co-operatively by the Alaska Department of Fish and Game (ADF&G), the Department of Fisheries and Oceans Canada (DFO), and the Taku River Tlingit First Nation (TRTFN). The authors would like to express their appreciation to the staff at the Canyon Island fish wheels: Mike LaFollette, Aaron Vachowski, Dave Dreyer as well as Mike Smarch and Joey Jack (TRTFN); and to the crew stationed at the lower Taku River: Kirstie Falkevitch, Michael Lake, Jassin Godard, Julie Bernier, Clodie-Pascale Brasset-Villeneuve, Manon Fontaine and Josee Deslandes (DFO) for collecting fishery statistics and applying spaghetti tags. We would also like to thank Canadian commercial fishers, United States personal use and commercial gillnet fishers, as well as Brian Mercer, Harry Carlick, and other individuals working on spawning escapement projects, for recovering spaghetti tags. Thanks also to Nicole Gordon for supervising TRTFN field operations. We would also like to thank Iris Frank (ADF&G) for her efforts in running the Canyon Island AWL forms through the OPSCAN machine, Angela Jobin (DFO) and Norm Miller (ADF&G) for expediting.

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

LIST OF APPENDICES

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 2011. 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 3,584 sockeye salmon were captured in fish wheels located at Canyon Island, Alaska, of which 3,338 were tagged and 1,070 (32.1%) were subsequently recovered or observed in fisheries or on the spawning grounds. The inriver run of sockeye salmon past Canyon Island from June 12 to September 24 was estimated to be 139,926 fish (95% confidence interval 121,499 to 155,470). Canadian commercial and test fisheries harvested 24,032, and 521 sockeye, respectively, resulting in a spawning escapement estimate of 115,249 sockeye salmon. Based on mean date and standard deviation of migration timing the sockeye salmon run was slightly late and less compressed than the 2001-2010 average. The Canyon Island catches of 17,774 pink salmon, 160 chum salmon and 503 steelhead salmon were 59.3% above average, 46.2% below average, and 72.5% above average, respectively. The pink salmon run was three days later and slightly more 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 U.S./Canada 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 2014) as a joint U.S./Canada program involving the Alaska Department of Fish and Game (ADF&G) and the Department of Fisheries and Oceans Canada (DFO) 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. U.S. and Canadian fishery managers use CPUE and stock composition data from the U.S. District 111 and Canadian Taku River commercial gillnet fisheries and 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 2011 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 the U.S. and Canada in February 2005.

OBJECTIVES

The primary goals of the Taku River sockeye salmon tagging program in 2011 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. Cliethral arch to fork of tail (CAF) length measurements were taken from 200 sockeye salmon throughout the season, and paired with MEF measurements. Canadian fish buyers prefer a headless, gutted product; because of this, the only length measurement available from the commercial fishery was CAF. The paired MEF and CAF measurements from the fish wheels allow conversion of CAF measurements to MEF.

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 person held the fish in the tagging trough while a second person 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 commercial and test fisheries, which occurred in Canadian portions of 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 27 to to October 6. 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 coho salmon test fishery took place from August 14 through October 5. Drift and set gillnets were the gear types used; maximum allowable mesh sizes ranged from 14 cm (5 1/2 inches) to 20.4 cm (8 inches); most fishers used mesh sizes of 13-14 cm (5 1/4 - 5 ½ inches) during the sockeye season.

Daily tag return was a condition of the Canadian commercial 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 fishery). 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 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. Tag observations and recoveries were also made at enumeration weirs located at Kuthai, King Salmon, Little Trapper, and Tatsamenie lakes. Additional recoveries were made on directed sampling excursions to the Nahlin River and mainstem Taku River spawning grounds.

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

Sex, length, and scale data were obtained from these locations as well as 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 2006 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 2011. Mark-recapture data was forwarded to the Juneau ADF&G and Whitehorse DFO offices after each day of the commercial fishery. Data was analyzed and inriver abundance estimates were developed. 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:

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

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 be violated because the Canadian fishery harvest rate of the inriver run varied between fishing periods.

RESULTS

Fish Wheel Operation

Fish wheels were operated on the Taku River from May 22 through September 25. Fish wheel I, located furthest upriver, was installed on May 22; fish wheel II was installed on May 23. 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 very low river levels (as measured on a permanent staff gauge).[3]

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 2011 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 2011 was 3,584. The total catch was 30.4% below the 2001 to 2010 average (Table 1; Appendix B.1). Fish wheel catches occurred from June 4 through September 22, and peaked during statistical week 32 (July 31 through August 6), when 628 sockeye salmon were captured. Prior to the first Canadian directed sockeye commercial fishery opening on June 20 (statistical week 26), 299 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 2011 pink salmon catch in the fish wheels at Canyon Island was 17,774 (Table 1; Appendix B.1), 59.4% above the 2001 to 2010 average. The peak daily catch of pink salmon in 2011 (1,765 fish) occurred on July 15. The 2011 fish wheel catch of chum salmon was 160. The total catch was 46.2% below the 2001 to 2010 average of 298. The peak daily catch of chum salmon (23 fish) occurred on subsequent days: September 12 and September 13 (Appendix B.1). The total fish wheel catch of steelhead and Dolly Varden in 2011 were 34 and 503 fish respectively. The total catch of 34 steelhead was 74.1% below the 2001 to 2010 average of 132. The total catch of 503 Dolly Varden was 72.5% above the 2001 to 2010 average.

Tagging and Recovery Data

Of the 3,584 sockeye salmon caught in the Taku fish wheels, 3,338 were tagged (93.1**%**). 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 are listed in Appendix B.1. Recoveries downstream (U.S. personal use and D-111 fishery) of Canyon Island totaled 10 (0.09**%** of tags applied), leaving 3,574 available for recapture in Canadian fisheries. The Canadian commercial fishery recaptured 675 tagged sockeye and accounted for 63.1% of the total sockeye tags recovered or observed in upstream fisheries (Table 2). The Canadian test fishery

[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.

recaptured 24 tags and the aboriginal fishery recovered two sockeye tags. Tags were also observed in terminal areas, principally Little Trapper, Tatsamenie, Kuthai, and King Salmon Lakes lakes. These numbered 67, 233, 13, and 19 respectively. The escapements to these locations numbered 3,809, 7,880, 811 and 2,899 sockeye respectively.

Escapement Estimates

Ratios of tagged to untagged sockeye salmon in the Canadian commercial, test and catch-and-release gillnet fisheries were used to estimate the magnitude of the inriver run of sockeye salmon that passed Canyon Island during the period of June 12 to September 24.

A total of 701 tags with corresponding recovery date information were returned from 24,677 sockeye salmon examined in the Canadian fisheries (Table 3). Recovery data from statistical weeks 25 and 26 (June 12 through June 18), and 36 through 39 (August 28 through September 24), were pooled due to low fishery/tagging effort. Tagging and recovery data were grouped into 13 and 11 strata, respectively (Table 4).

Using a maximum likelihood Darroch estimator, we estimated that 139,926 sockeye salmon passed Canyon Island between June 12 to September 24. The approximate 95% confidence interval associated with this estimate is 121,499 to 155,470 fish. This estimate is 2.9% above the 2001 to 2010 average of 138,422 sockeye salmon (Table 5; Figure 4).

The Taku River sockeye salmon run above Canyon Island was exploited by the Canadian fisheries at an estimated rate of 17.7%, compared to a 2001-2010 average of 18.0% (range 12.8% to 25.0%; Table 5). After removal of 24,032, 521 and 124 sockeye salmon by the Canadian commercial, test and aboriginal fisheries from the estimated escapement to the Canada/U.S. border, the spawning escapement totaled an estimated 115,249 fish (Table 4). This is 4.9% above the 2001-2010 average of 109,870 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; the contribution of jack (one ocean) sockeye salmon to the Canyon Island fish wheel catches from 2001 to 2010 averaged 3.8% (range 0.3% to 9.1%; Table 6). However, in 2011 the contribution of jacks was 4.4%.

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 (Figure 5).

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 2011 mark-recapture data was not examined by fish size.

Migratory Timing

The mean date (July 23) of the sockeye salmon migration in 2011 was later (2 days) than the 2001-2010 average (Table 7). The standard deviation was slightly more (20.3 days in 2011 versus an average of 19.0 days); meaning the run was less compressed than average. Migratory timing statistics showed the pink salmon run timing was five days later than average and slightly less compressed (mean date July 24; standard deviation 7.8 days). 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 2011 was reflective of the run, the mean date of migration was September 9 (standard deviation 12.1 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 2011 was determined using recoveries of tagged fish from enumeration weirs (Table 8; Figure 6). These were weirs on the outlet streams of Little Trapper Lake (55 tags)**,** Tatsamenie Lake (208 tags), Kuthai Lake (13 tags) and King Samon Lake (19 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 24 to 30 (June 5 to July 23). The peak of the Kuthai Lake migration took place during statistical week 27 (June 26 to July 2).

Little Trapper Lake sockeye salmon peaked during stat week 29, July 10 through July 16. They were present at Canyon Island during statistical weeks 26 to 33 (June 19 to August 13).

King Salmon Lake sockeye salmon were present at Canyon Island during statistical weeks 26 to 29 (June 19 to July 16) and peaked during stat week 27 (June 26 through July 2).

The Tatsamenie Lake stock exhibited both the latest and most protracted return timing; tagged fish bound for this system were present at Canyon Island between statistical weeks 28 to 34 (July 3 to August 20). The peak week of migration for Tatsamenie Lake sockeye was statistical week 30 (July 17 through July 23).

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 7. Travel times averaged 38.8, 18.9, 25.2, and 34.6 days for each of these respective stocks.

Migration rates generally increased over the course of the run. Little Trapper Lake fish tagged in statistical week 28 averaged 28.6 days in transit while those tagged in statistical week 31 averaged 19.3

days. For the Tatsamenie stock, fish tagged in statistical week 28 averaged 39.8 days in transit while fish tagged in statistical week 33 averaged 32.7 days. King Salmon Lake fish tagged in statistical week 26 averaged 25.2 in transit while those tagged in statistical week 28 averaged 15.1 days. Kuthai Lake fish tagged in statistical week 24 (4 tags recovered) averaged 48.4 days in transit, while those tagged in statistical week 26 averaged 36.5 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 2011 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 (56.7%) with age-1.2 fish comprising 15.4%, age-2.2 4.2%, age-0.2 7.3%, age-2.3 5.6%, age-0.3 6.1%,age-1.1 3.5% and very small numbers of age-0.1, 0.4, and 1.4 fish (Table 6). The lengths of age 1.2 sockeye salmon were smaller than the 2001 to 2010 averages (Table 10) but the length of age 1.3 sockeye salmon were identical. Age 1.3 Females comprised 34.5% of the fish wheel catch of sockeye salmon (Appendix C.1).

Fish wheel catches of chum salmon were primarily comprised of age-0.3 (72.1%) fish, which is higher than the 2001-2010 average of 57.0% (Table 11). Age-0.4 fish constituted 18.6% of the fish wheel catch, lower than the 39.9% average. Female chum salmon were more prevalent (59.1%) than males (Appendix C.2). The average lengths at age for chum salmon passing Canyon Island were 573, 633, and 666 mm (MEF) for age 0.2, 0.3, and 0.4 fish respectively; these were all smaller than the 2001 to 2010 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 at the Canadian commercial and test fisheries were conducted on a frequent basis through the season. Both of the fish wheels were strictly maintained and adjusted throughout the entire sockeye salmon run. The wheels operated 24-hours per day except during equipment breakdowns; however it is known that river conditions affect the fishing efficiencies of both wheels. Recovery efforts were conducted a minimum of twice 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 work around 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 there were significant differences in the cumulative distribution function of length between fish sampled at the fish wheels and at the recovery location (Figure 5). 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 studies, summed abundance estimates obtained for large and small sockeye salmon were not significantly different than the pooled estimates (Andel and Boyce, 2014). Based on those results the mark-recapture data for 2010 was 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, over 6,484 fish were examined for tagging needle marks in the Canadian commercial and test fisheries after tags had been removed by fishers. The proportion with tagging needle marks was compared with tag recovery rates, and found to be slightly lower overall (2.3% versus 2.8%) (Appendix D). We therefore believe that significant breakage or shedding of tags among sockeye subjected to the inriver fishery is minimal. 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 2011 and functioned effectively. As in recent years, a 2-basket configuration was used for the entire season.

LITERATURE CITED

(ADF&G) Alaska Department of Fish and Game. 1955. Annual Report for 1955. Report No. 7, Juneau.

Arnason, A. N., C. W. Kirby, C. J. Schwarz, and J. R. Irvine. 1996. Computer analysis of data from stratified mark-recovery experiments for estimation of salmon escapements and other populations. Canadian Technical Report of Fisheries and Aquatic Sciences. 2106: 37p.

Boyce, I.M., and J.E..Andel. 2012. Mark-Recapture Studies of Taku River Adult Sockeye Salmon Stocks in 2009. PSC Tech. Rep. No. 27.

Chapman, D. G., and C. O. Junge. 1956. The estimation of the size of a stratified animal population. Annals of Mathematical Statistics. 27:375-389.

Clark, J. E., A. J. McGregor, and F. E. Bergander. 1986. Migratory timing and escapement of Taku River salmon stocks, 1984-1985. In ADF&G (Alaska Department of Fish and Game) Section Report in 1985 Salmon Research conducted in Southeast Alaska by the Alaska Department of Fish and Game in conjunction with the National Marine Fisheries Service Auke Bay Laboratory for Joint U.S.-Canada Interception Studies. Division of Commercial Fisheries, Final Report, Contract Report WASC-85-ABC-00142 Juneau, Alaska.

Darroch, J. N. 1961. The two-sample capture-recapture census when tagging and sampling are stratified. Biometrika. 48:241-260.

Kelley, M. S., P. A. Milligan, and A. J. McGregor. 1997. Adult mark-recapture studies of Taku River adult salmon stocks in 1995. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 1J97-01. Juneau.

Kelley, M. S. and P. A. Milligan. 1997. Adult mark-recapture studies of Taku River adult salmon stocks in 1996. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 1J97-22. Juneau.

Kerr, F. A. 1948. Taku River map area, British Columbia. Canadian Department of Mines and Resources, Geological Survey Memoir 248, Ottawa.

Marcus, M. G. 1960. Periodic drainage of glacier-dammed Tulsequah Lake, British Columbia. The Geographical Review V. L., 1: 89-106.

McGregor, A. J., and J. E. Clark. 1987. Migratory timing and escapement of Taku River salmon stocks in 1986. Final Report - 1986 Salmon Research Conducted in Southeast Alaska by the Alaska Department of Fish and Game in Conjunction with the National Marine Fisheries Service Auke Bay Laboratory for Joint U.S.-Canada Interception Studies. Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau.

McGregor, A. J., and J. E. Clark. 1988. Migratory timing and escapement of Taku River salmon stocks in 1987. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 1J88-26, Juneau.

McGregor, A. J., and J. E. Clark. 1989. Migratory timing and escapement of Taku River salmon stocks in 1988. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 1J89-40, Juneau.

McGregor, A. J., P. A. Milligan, and J. E. Clark. 1991. Adult mark-recapture studies of Taku River salmon stocks in 1989. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report 91-05, Juneau.

Mundy, P. R. 1982. Computation of migratory timing statistics for adult chinook salmon in the Yukon River, Alaska, and their relevance to fisheries management. North American Journal of Fisheries Management 2:359-370.

Plante, N. 1990. Estimation de la taille d'une population animale à l'aide d'une modèle de capture-recapture avec stratification. M. Sc. thesis, Université Laval, Quebec.

Schellekens, M. F., K. R. Linn, B. B. Bigelow, S. K. Shaw, and M. M. Hiner. 1996. Water resources data Alaska water year 1995. U.S. Geological Survey water Data report. AK-95-1.

TTC (Transboundary Technical Committee). *In Prep*. Pacific Salmon Commission Joint Transboundary Technical Committee. Estimates of transboundary river salmon production, harvest, and escapement and a review of joint enhancement activities in 2005. Pacific Salmon Commission, TCTR (0X)-X, Vancouver, British Columbia.

Table 1. Canyon Island fish wheel dates of operation and catches of sockeye, pink, chum, steelhead, and Dolly Varden, 2011.

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	249	19
2010	5/9-8/31	3,160	8,868	94	176	452
2011	5/22-9/25	3,584	17,774	160	34	503
Average(01-10)		5,150	11,153	298	132	292

Table 2. Summary of Taku River sockeye tag recoveries by location and species, 2011.

	Tags Recovered	Tags Observed Only	Total	Fish Inspected	Tag Ratio	Percent Tags Observed
Commercial Fishery	675		675	24,032	0.028	0.631
Test Fishery	24		24	521	0.046	0.022
King Salmon Lake	19		19	523	0.036	0.018
Kuthai Lake	13		13	811	0.016	0.012
Little Trapper Lake	55	12	67	3,809	0.018	0.063
Tatsamenie Lake	208	25	233	7,880	0.030	0.218
Taku River mainstem	16		16	570	0.028	0.015
Nahlin River	6		6	212	0.028	0.006
Tulsequah River	5		5	94	0.053	0.005
Fish Creek (U.S.)						0.000
Yehring Creek (U.S.)						0.000
Food Fishery	2		2	124	0.016	0.002
U.S. downstream	10		10			0.009
Total	1,033	37	1,070	38,576		

Table 3. Tagging and recovery data from the 2011 Taku River sockeye salmon mark-recapture program. Data includes number of sockeye salmon tagged and recovered in the Canadian commercial fishery by statistical week (downstream recoveries excluded).

Statistical Week of Tagging	Statistical Week of Recovery																	Total Tags Recovered	Total Tags Applied	Tag Ratio Recovered/ Applied
	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40			
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.000
24	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	94	0.011
25	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	164	0.073
26	0	0	3	9	1	1	1	0	0	0	0	0	0	0	0	0	0	15	209	0.072
27	0	0	0	6	9	1	0	0	0	0	0	0	1	0	0	0	0	17	151	0.113
28	0	0	0	0	40	6	1	1	0	0	0	0	0	0	0	0	0	48	212	0.226
29	0	0	0	0	0	15	18	1	0	0	0	0	0	0	0	0	0	34	306	0.111
30	0	0	0	0	0	0	94	37	5	1	0	0	2	0	0	0	0	139	565	0.246
31	0	0	0	0	0	0	0	65	42	3	0	1	0	1	0	0	0	112	461	0.243
32	0	0	0	0	0	0	0	0	145	27	2	0	6	0	1	0	0	181	579	0.313
33	0	0	0	0	0	0	0	0	0	45	16	2	3	0	0	0	0	66	292	0.226
34	0	0	0	0	0	0	0	0	0	0	7	13	5	1	3	0	0	29	173	0.168
35	0	0	0	0	0	0	0	0	0	0	0	3	12	0	1	0	0	16	71	0.225
36	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	22	92	0.239
37	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	1	0	5	11	0.455
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	4	31	0.129
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.000
Total	0	1	15	15	50	23	114	104	192	76	25	19	51	5	9	2	0	701	3,415	0.205

Sockeye Examined[a]:																		Total
Test Fishery											232	143	127	19				521
Can. Comm. Catch	0	17	869	837	2117	1391	4668	4355	4900	2415	1001	502	828	56	72	4		24,032
Aboriginal Fishery	5	4		5	2	1			8	16	67	2	3				11	124
Total	5	21	869	842	2,119	1,392	4,668	4,355	4,908	2,431	1,300	647	958	75	72	4		24,677

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

Table 4. Pooled-strata tagging and recovery data used to calculate mark-recapture estimates of the inriver sockeye salmon run past Canyon Island, 2011.

Statistical Week of Tagging	Statistical Week of Recovery											Total Tags Recovered	Total Tags Applied	Tag Ratio
	25-26	27	28	29	30	31	32	33	34	35	36-39			
24	1											1	94	0.011
25	12											12	164	0.073
26	3	9	1	1	1							15	209	0.072
27		6	9	1							1	17	151	0.113
28			40	6	1	1						48	212	0.226
29				15	18	1						34	306	0.111
30					94	37	5	1			2	139	565	0.246
31						65	42	3		1	1	112	461	0.243
32							145	27	2		7	181	579	0.313
33								45	16	2	3	66	292	0.226
34									7	13	9	29	173	0.168
35										3	13	16	71	0.225
36-39											31	31	135	0.230
Total	16	15	50	23	114	104	192	76	25	19	67	701	3,412	0.205
Harvest Examined For Tags[a]	886	837	2,117	1,391	4,668	4,355	4,900	2,415	1,233	645	1,106	24,553		
Marked Fraction	0.018	0.018	0.024	0.017	0.025	0.024	0.041	0.032	0.021	0.030	0.064	0.029		
Above Border Run Estimate	17,280	13,282	5,975	21,408	17,944	20,788	15,656	5,850	12,343	3,175	4,783	139,926		
Aboriginal Fishery[c]	4	5	2	1	0	0	8	16	67	2	3	124		
Total Above Border Run												139,926		
U.S. Personal Use Harvest[d]												1,111		
95% Lower C.I.	8,364	5,360	1,261	10,522	13,271	15,382	9,547	-13,186	-15,812	-4,402	3,305	121,499		
95% Upper C.I.	26,196	21,204	10,689	32,294	22,617	26,194	21,765	24,886	40,498	10,752	6,261	155,470		
Spawning Escapment	16,390	12,440	3,856	20,016	13,276	16,433	10,748	3,419	11,043	2,528	3,674	115,249		

[a] Includes Canadian commercial and test fishery catches

[b] Expansion based on fish wheel CPUE

[c] 5 sockeye were harvested in SW24. 11 sockeye were reported havested near headwaters (SW harvested unavailable.)

[d] 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 2011[a].

Year	Border Escapement	Canadian Commercial and Test Harvest	Canadian Commercial and Test Harvest Rate	Spawning Escapement[b]	Terminal	U.S. Harvest
1984	141,254	27,292	0.193	113,962	198,873	57,619
1985	123,974	14,411	0.116	109,563	198,261	74,287
1986	115,045	14,939	0.130	100,106	175,689	60,644
1987	96,023	13,887	0.145	82,136	150,986	54,963
1988	92,641	12,967	0.140	79,674	118,427	25,785
1989	114,068	18,805	0.165	95,263	177,434	63,366
1990	117,573	21,474	0.183	96,099	226,858	109,285
1991	154,873	25,380	0.164	129,493	260,143	105,271
1992	167,376	29,862	0.178	137,514	288,551	121,176
1993	142,148	33,523	0.236	108,625	284,236	142,089
1994	131,580	29,001	0.220	102,579	229,642	98,063
1995	146,450	32,711	0.223	113,739	238,434	91,984
1996	134,651	42,025	0.312	92,626	322,379	187,727
1997	95,438	24,352	0.255	71,086	174,565	79,127
1998	91,548	19,038	0.208	70,715	139,824	49,832
1999	113,705	20,681	0.182	92,562	176,764	63,058
2000	115,693	27,942	0.242	87,298	246,954	131,262
2001	192,269	47,988	0.250	144,071	396,678	204,433
2002	135,233	31,053	0.230	103,343	251,634	116,401
2003	200,918	32,933	0.171	167,691	328,884	135,494
2004	127,949	20,346	0.159	106,691	204,059	77,012
2005	134,841	21,697	0.161	112,739	188,245	46,090
2006	167,053	21,361	0.128	145,572	233,425	65,828
2007	105,012	17,090	0.163	87,763	170,141	65,129
2008	87,568	19,509	0.223	68,059	163,260	75,692
2009	85,599	11,154	0.130	74,339	119,477	36,380
2010	109,028	20,508	0.188	88,428	154,769	46,818
2011	139,926	24,553	0.175	115,249	208,665	71,804
Average(01-10)	134,547	24,364	0.180	109,870	221,057	86,928
Maximum(01-10)	200,918	47,988	0.250	167,691	396,678	204,433
Minimum(01-10)	85,599	11,154	0.128	68,059	119,477	36,380
S.D.(01-10)	40,776	10,405	0.046	33,011	85,354	51,652
C.V.(01-10)	30.3%	42.7%	25.5%	30.0%	38.6%	59.4%

[a] U.S. catch and run size are preliminary.

[b] Spawning escapement includes removals for Canadian Aboriginal.

Table 6. Historical age composition of sockeye salmon passing Canyon Island, Taku River, 1983 to 2011.

	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
2010	1,356	0.8	8.9	3.8	16.7	22.2	0.1	0.1	40.9	6.3	0.1	0.5	0.0	0.0	0.0
2011	1,779	0.5	7.3	3.5	6.1	15.4	0.4	0.1	56.7	4.2	0.1	5.6	0.0	0.0	0.0
Average(01-10)	1,844	0.4	7.1	3.3	10.3	26.8	0.1	0.1	46.4	3.2	0.2	2.1	0.0	0.0	0.0
SD(01-10)		0.2	2.1	3.2	4.6	6.8	0.1	0.1	6.5	2.1	0.1	1.2	0.0	0.0	0.0
CV(01-10)		58.3%	29.3%	98.3%	44.8%	25.4%	109.0%	98.6%	14.1%	64.6%	64.3%	55.4%	-	-	-

Table 7. Migratory timing statistics of sockeye, pink , and chum salmon past the Canyon Island fish wheels, 1984 to 2011. 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
2010	7/24	21.8	7/25	9.4	9/5	11.0
2011	7/23	20.3	7/24	7.8	9/9	12.1
Average(01-10)	7/21	19.0	7/21	8.1	9/3	14.1

Table 8. Weekly and cumulative proportions of four individual sockeye salmon stocks passing Canyon Island in 2011, 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	22-May	28-May								
23	29-May	4-Jun								
24	5-Jun	11-Jun					0.149	0.149		
25	12-Jun	18-Jun					0.127	0.276		
26	19-Jun	25-Jun	0.015	0.015			0.163	0.439	0.207	0.207
27	26-Jun	2-Jul	0.209	0.224			0.459	0.898	0.389	0.596
28	3-Jul	9-Jul	0.152	0.376	0.025	0.025		0.898	0.348	0.944
29	10-Jul	16-Jul	0.455	0.831	0.110	0.135		0.898	0.055	1.000
30	17-Jul	23-Jul	0.117	0.948	0.382	0.517	0.102	1.000		
31	24-Jul	30-Jul	0.034	0.982	0.325	0.842				
32	31-Jul	6-Aug	0.000	0.982	0.102	0.943				
33	7-Aug	13-Aug	0.018	1.000	0.035	0.978				
34	14-Aug	20-Aug			0.019	1.000				
35	21-Aug	27-Aug								
36	28-Aug	3-Sep								
37	28-Aug	3-Sep								
38	4-Sep	10-Sep								

Table 9. Inriver migration timing for four Taku River sockeye salmon stocks, 2011.

Stock	Week	Travel Time	SD	SE	N	95% C.I.
L. Trapper	26	38.00			1	
	27	33.25	1.91	0.67	8	1.32
	28	28.60	2.63	0.83	10	1.63
	29	23.08	2.34	0.48	24	0.94
	30	18.14	2.61	0.99	7	1.93
	31	19.33	3.51	2.03	3	3.97
	32					
	33	16.00			1	
	Average	25.20	2.6		8	
Tatsamenie	26	44.00			1	
	27					
	28	39.83	6.21	2.54	6	4.97
	29	36.81	7.76	1.49	27	2.93
	30	31.67	5.67	0.64	79	1.25
	31	29.28	4.97	0.60	68	1.18
	32	27.67	6.35	1.50	18	2.93
	33	32.67	3.83	1.56	6	3.06
	34	34.50	2.12	1.50	2	2.94
	Average	34.55	5.3		26	
King Salmon	26	25.20	2.77	1.24	5	2.43
	27	19.20	2.17	0.97	5	1.90
	28	15.13	0.99	0.35	8	0.69
	29					
	30	16.00			1	
	Average	18.88	2.0		5	
Kuthai	24	48.25	18.84	9.42	4	18.46
	25	35.33	2.08	1.20	3	2.36
	26	36.50	7.78	5.50	2	10.78
	27	42.67	15.37	8.88	3	17.40
	28					
	29					
	30	31.00			1	
	Average	38.75	11.0		3	

[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 location (weir site).

Table 10. Historical length (MEF) at age composition of sockeye salmon passing Canyon Island, Taku River, 2011.

	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	
2010	1,766	319	437	335	565	477	340	560	563	494	580	556			
2011	1,779	320	447	338	568	466	336	610	576	508	603	573			
Average(01-10)	2,127	323	451	333	577	483	340	599	576	508	589	579		525	
SD(01-10)		15.1	8.8	5.6	9.6	13.5	11.0	31.6	8.4	11.7	13.6	12.5			
CV(01-10)		4.7%	2.0%	1.7%	1.7%	2.8%	3.2%	5.3%	1.4%	2.3%	2.3%	2.1%			

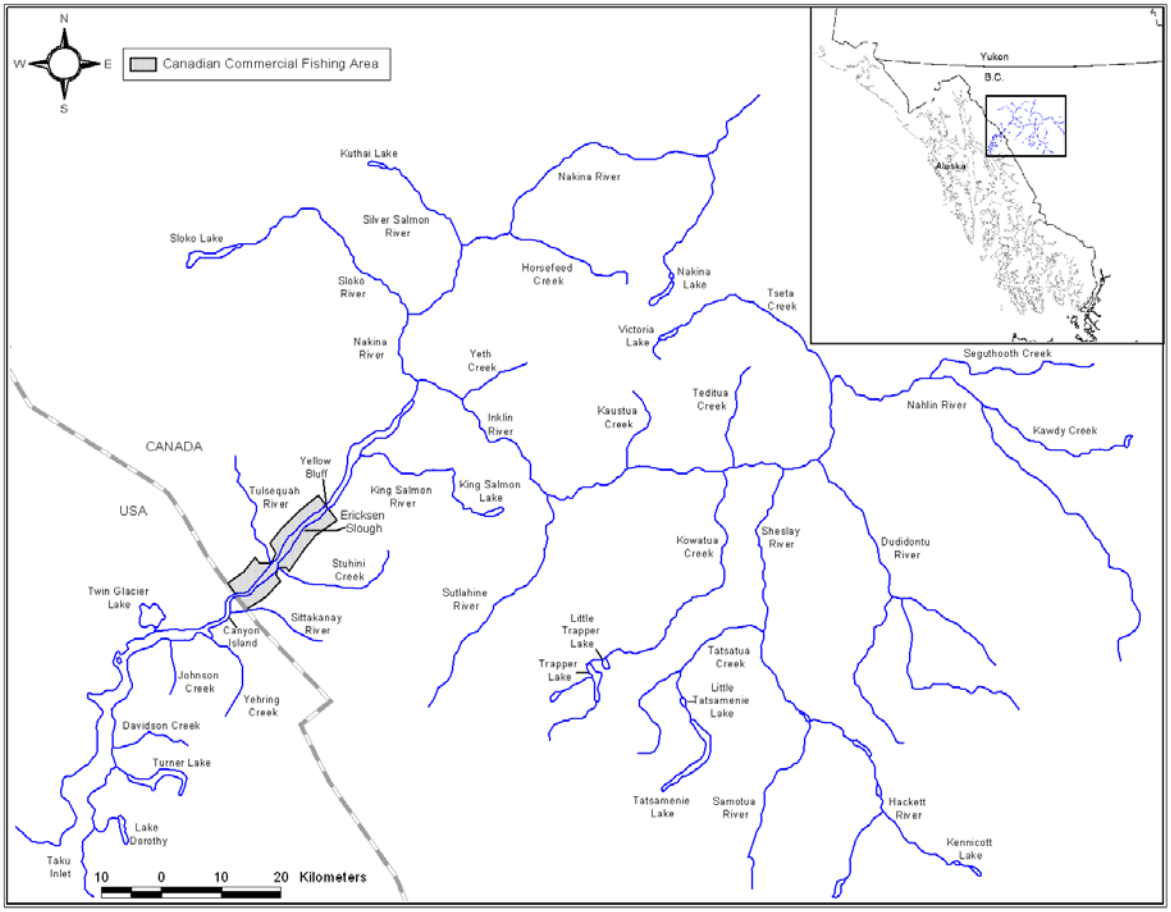
Table 11. Historical age composition of chum salmon passing Canyon Island fish wheels, Taku River, 2011.

	Sample	Percent by Age Class				
Year	Size	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
2010	95	3.2	36.8	47.4	0.0	0.0
2011	172	1.2	72.1	18.6	0.6	0.0
Average(01-10)	240.2	1.2	57.0	39.9	0.7	0.0
SD(01-10)		1.0	13.5	12.3	0.8	0.0
CV(01-10)		1.2	4.2	3.2	0.9	

Table 12. Historical length (MEF) at age composition of chum salmon passing Canyon Island, Taku River, 1983 to 2011.

	Sample	Length at Age Class				
Year	Size	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	
2010	95	505	626	655		
2011	172	582	615	649	640	
Average(01-10)	278	573	633	666	671	
SD(01-10)		42.3	13.8	12.8	18.3	
CV(01-10)		7.4%	2.2%	1.9%	2.7%	

Figure 1. Taku River drainage, with location of tagging sites.



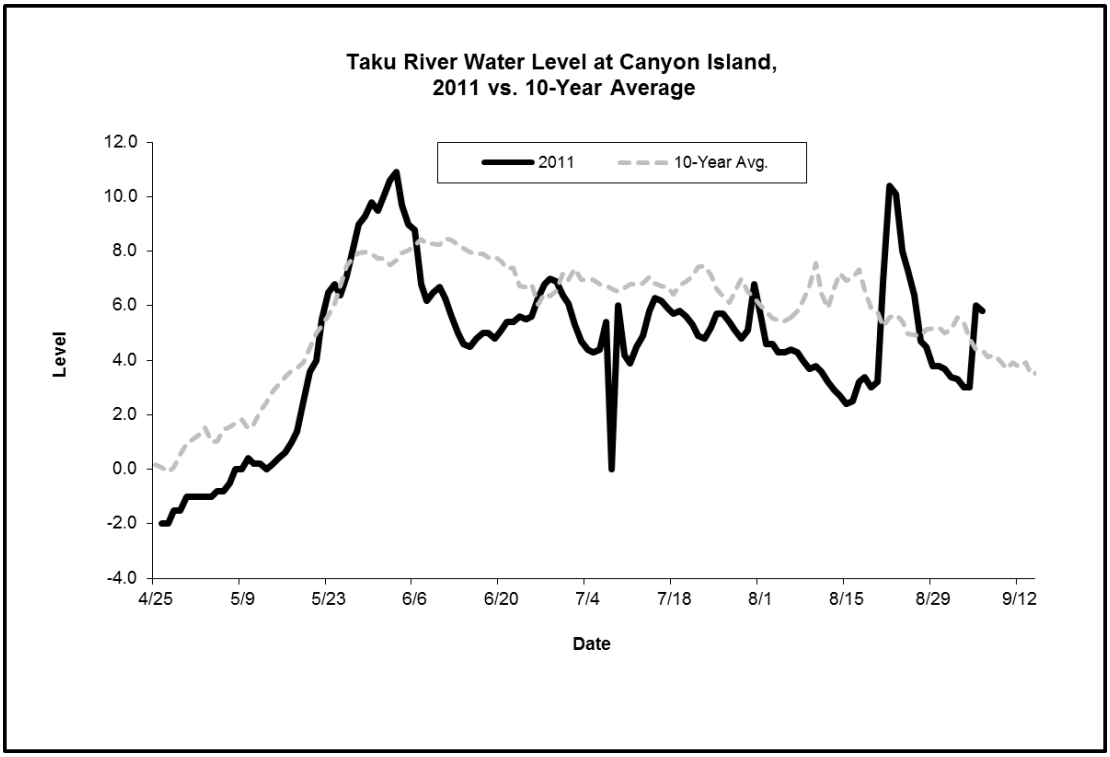


Figure 2. Water levels at Canyon Island, Taku River, 2011 vs. 2001-2010 average.

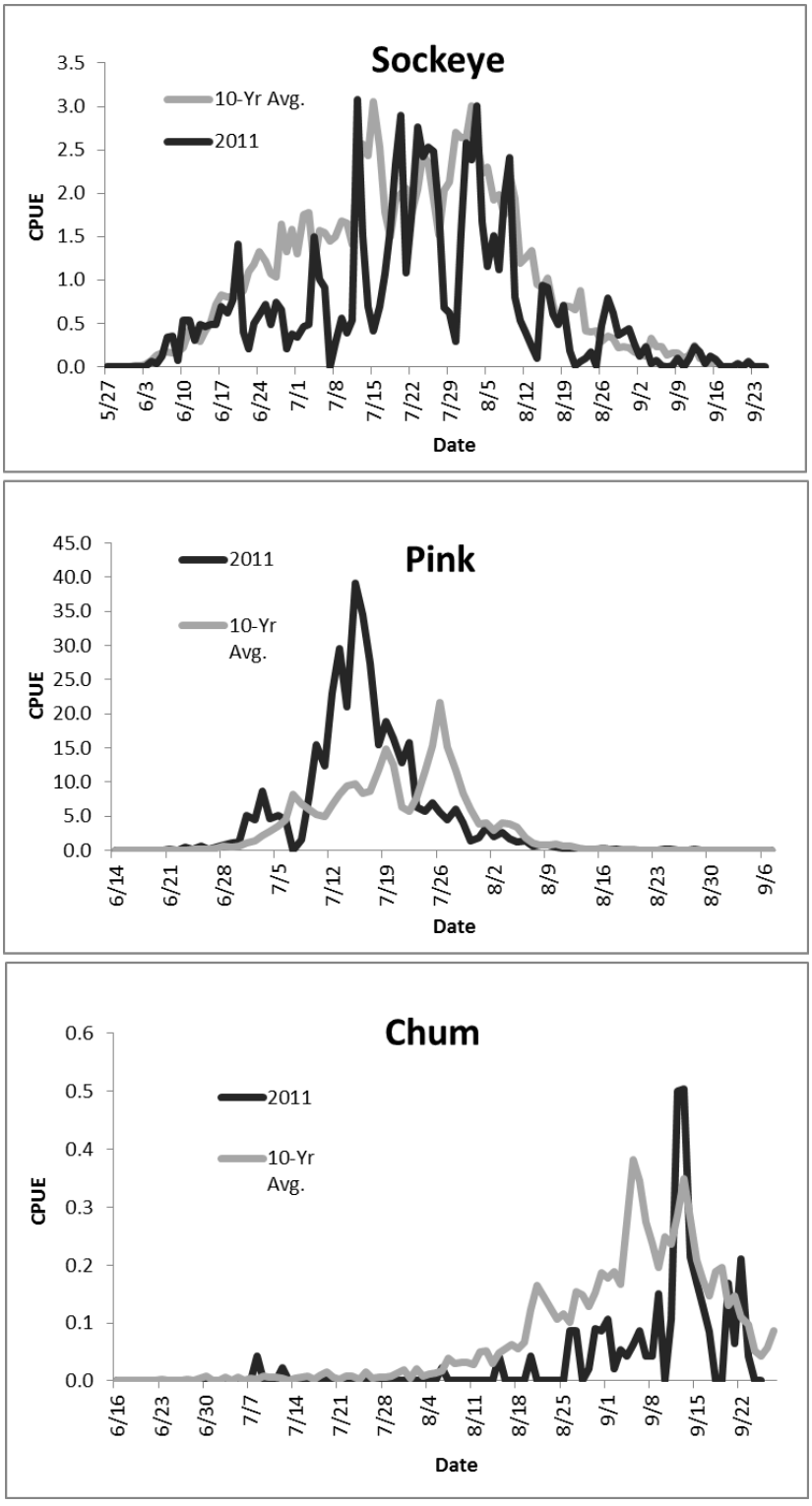


Figure 3. Fish wheel CPUE for sockeye, pink, and chum salmon at Canyon Island, 2011.

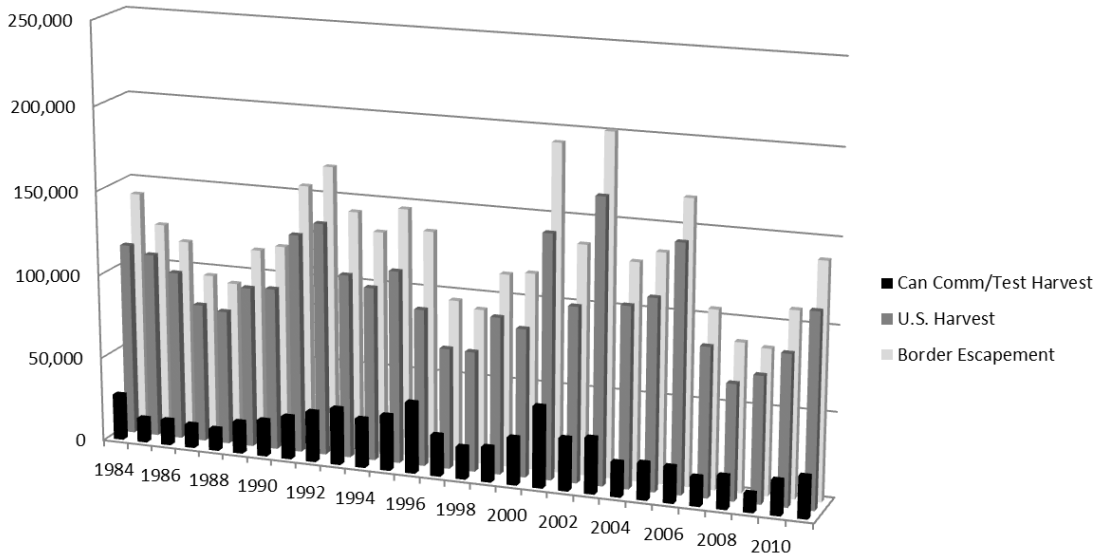


Figure 4. Historical sockeye mark-recapture abundance estimates above the U.S./Canada border including Canadian inriver harvests and escapements for Taku River sockeye, 1984-2011.

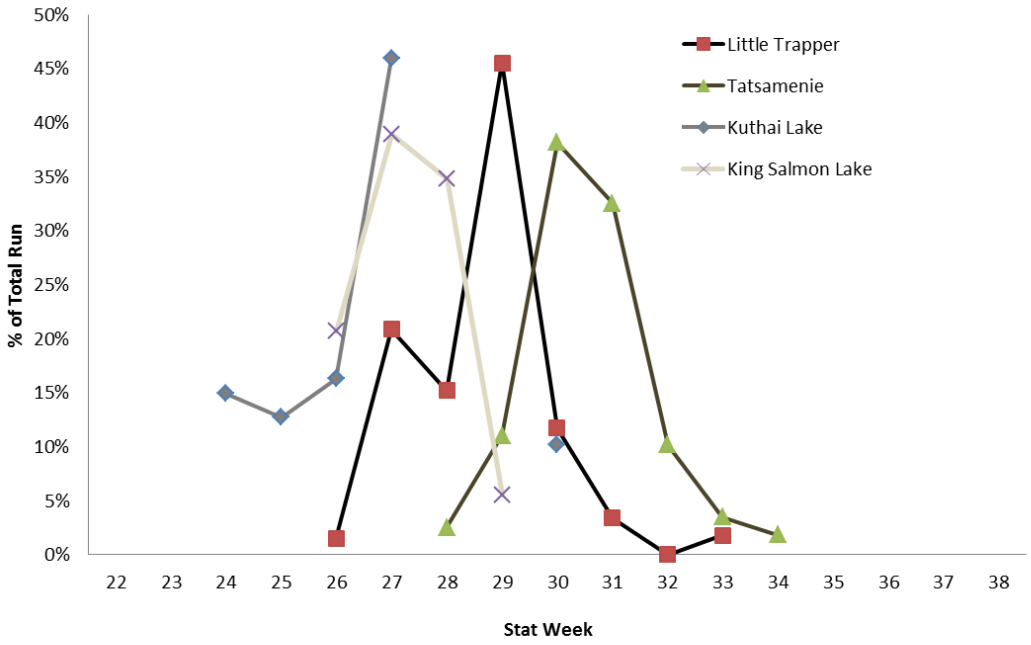


Figure 5. Run timing of four sockeye salmon stock groups passing Canyon Island, 2011.

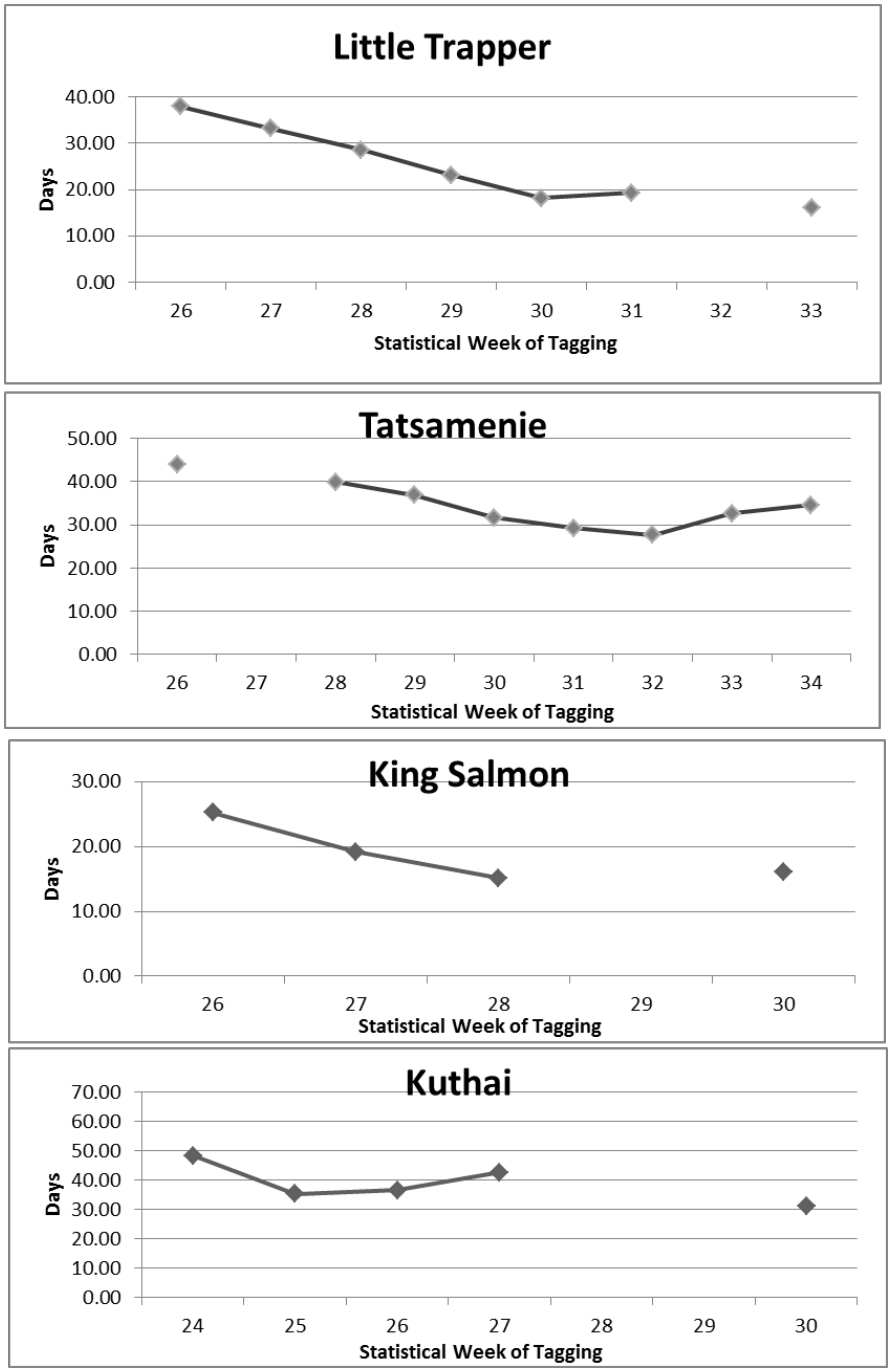


Figure 6. Mean travel times for tagged sockeye salmon between Canyon Island and four upriver locations, 2011.

Appendix A. Inclusive dates for statistical weeks, 2011.

2010 Statistical Week Calendar						
Stat Week	**From**	**Through**		**Stat Week**	**From**	**Through**
1	1-Jan	3-Jan		28	4-Jul	10-Jul
2	4-Jan	10-Jan		29	11-Jul	17-Jul
3	11-Jan	17-Jan		30	18-Jul	24-Jul
4	18-Jan	24-Jan		31	25-Jul	31-Jul
5	25-Jan	31-Jan		32	1-Aug	7-Aug
6	1-Feb	7-Feb		33	8-Aug	14-Aug
7	8-Feb	14-Feb		34	15-Aug	21-Aug
8	15-Feb	21-Feb		35	22-Aug	28-Aug
9	22-Feb	28-Feb		36	29-Aug	4-Sep
10	29-Feb	6-Mar		37	5-Sep	11-Sep
11	7-Mar	13-Mar		38	12-Sep	18-Sep
12	14-Mar	20-Mar		39	19-Sep	25-Sep
13	21-Mar	27-Mar		40	26-Sep	2-Oct
14	28-Mar	3-Apr		41	3-Oct	9-Oct
15	4-Apr	10-Apr		42	10-Oct	16-Oct
16	11-Apr	17-Apr		43	17-Oct	23-Oct
17	18-Apr	24-Apr		44	24-Oct	30-Oct
18	25-Apr	1-May		45	31-Oct	6-Nov
19	2-May	8-May		46	7-Nov	13-Nov
20	9-May	15-May		47	14-Nov	20-Nov
21	16-May	22-May		48	21-Nov	27-Nov
22	23-May	29-May		49	28-Nov	4-Dec
23	30-May	5-Jun		50	5-Dec	11-Dec
24	6-Jun	12-Jun		51	12-Dec	18-Dec
25	13-Jun	19-Jun		52	19-Dec	25-Dec
26	20-Jun	26-Jun		53	26-Dec	1-Jan
27	27-Jun	3-Jul				

Appendix B.1. Catches and number tagged of salmon in the fish wheels at Canyon Island, 2011.

		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	Effort	RPM	Effort	RPM	Daily	Cum.	Daily	Cum.	Daily	Daily	Cum.	Daily	Daily	Cum.	Daily	Daily	Cum.	Daily	Cum.
18	25-Apr																			
18	26-Apr																			
18	27-Apr																			
18	28-Apr																			
18	29-Apr																			
18	30-Apr																			
19	1-May																			
19	2-May																			
19	3-May																			
19	4-May																			
19	5-May																			
19	6-May																			
19	7-May																			
20	8-May																			
20	9-May																			
20	10-May																			
20	11-May																			
20	12-May																			
20	13-May																			
20	14-May																			
21	15-May																			
21	16-May																			
21	17-May																			
21	18-May																			
21	19-May																			
21	20-May																			
21	21-May																			
22	22-May	17.25	2.3																	
22	23-May	19.83	2.5	23.25	2.3												1	1		
22	24-May	23.42	2.4	23.93	2.6													1		
22	25-May	23.50	2.5	23.58	2.6													1		
22	26-May	23.66	2.6	23.58	2.7													1		
22	27-May	23.75	2.8	23.75	2.5													1		
22	28-May	23.83	2.7	23.75	2.3													1		
23	29-May	23.83	3.0	23.92	2.5													1		
23	30-May	23.83	2.8	23.83	2.2													1		
23	31-May	23.83	2.8	23.75	2.3													1		
23	1-Jun	23.83	2.8	23.75	2.3													1		
23	2-Jun	23.92	2.8	23.92	2.5													1		
23	3-Jun	23.83	2.7	23.75	2.4													1		
23	4-Jun	23.50	2.8	23.75	2.6	3	3	3	3	0.063							1	2		
24	5-Jun	23.75	2.3	23.75	2.6	2	5	2	5	0.042								2		
24	6-Jun	23.12	2.4	23.83	2.3	6	11	6	11	0.128								2		
24	7-Jun	22.92	2.1	23.00	2.0	16	27	15	26	0.348							2	4		
24	8-Jun	23.33	2.6	23.50	2.3	17	44	17	43	0.363							2	6		
24	9-Jun	23.83	2.6	23.75	2.5	4	48	4	47	0.084								6		
24	10-Jun	23.08	2.3	23.42	2.1	25	73	25	72	0.538								6		
24	11-Jun	23.17	2.0	23.08	1.9	25	98	25	97	0.541								6	1	1
25	12-Jun	23.17	2.0	22.83	1.8	14	112	14	111	0.304								6		1
25	13-Jun	23.08	2.1	23.67	1.9	23	135	23	134	0.492							1	7	1	2
25	14-Jun	23.17	2.1	23.58	2.0	22	157	22	156	0.471							5	12	2	4
25	15-Jun	22.17	2.4	22.83	2.0	22	179	22	178	0.489								12	1	5
25	16-Jun	23.83	2.2	23.42	2.0	23	202	23	201	0.487							3	15	1	6
25	17-Jun	23.00	2.2	23.00	2.1	32	234	31	232	0.696							2	17	1	7
25	18-Jun	22.58	2.0	23.42	1.9	29	263	29	261	0.630							2	19	2	9
26	19-Jun	22.83	2.2	23.67	2.0	36	299	36	297	0.774	1	1	0.022				1	20	1	10
26	20-Jun	22.42	2.6	23.58	2.2	65	364	64	361	1.413		1	0.000				5	25	2	12
26	21-Jun	23.67	2.5	23.50	2.0	19	383	19	380	0.403	5	6	0.106				3	28	1	13
26	22-Jun	23.67	2.5	23.75	2.1	10	393	9	389	0.211	2	8	0.042				6	34	1	14
26	23-Jun	23.75	2.6	23.42	2.0	24	417	23	412	0.509	19	27	0.403				7	41	1	15
26	24-Jun	23.00	2.6	23.50	2.4	28	445	27	439	0.602	10	37	0.215				2	43		15
26	25-Jun	22.42	2.3	23.42	2.5	33	478	31	470	0.720	26	63	0.567				5	48	1	16
27	26-Jun	23.17	2.6	23.67	2.7	23	501	20	490	0.491	10	73	0.213				1	49	1	17
27	27-Jun	23.33	2.6	23.67	2.6	35	536	35	525	0.745	24	97	0.511				6	55		17
27	28-Jun	23.17	2.5	23.33	2.1	31	567	31	556	0.667	38	135	0.817				4	59		17
27	29-Jun	23.58	2.4	23.58	2.2	10	577	10	566	0.212	52	187	1.103				1	60		17
27	30-Jun	23.58	2.0	23.25	2.3	18	595	18	584	0.384	61	248	1.303				5	65		17

Appendix B.1. Catches and number tagged of salmon in the fish wheels at Canyon Island, 2011.

		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	Effort	RPM	Effort	RPM	Daily	Cum.	Daily	Cum.	Daily	Daily	Cum.	Daily	Daily	Cum.	Daily	Daily	Cum.	Daily	Cum.
27	1-Jul	23.50	1.6	23.42	2.1	16	611	15	599	0.341	236	484	5.030				12	77		17
27	2-Jul	23.42	1.6	23.33	1.5	22	633	22	621	0.471	209	693	4.471				12	89		17
28	3-Jul	23.50	2.0	23.42	2.0	23	656	21	642	0.490	405	1098	8.632				10	99	1	18
28	4-Jul	22.67	2.3	22.75	2.3	68	724	65	707	1.497	223	1321	4.910				16	115	0	18
28	5-Jul	23.17	2.4	23.25	2.4	47	771	47	754	1.012	244	1565	5.256				9	124		18
28	6-Jul	23.25	2.7	23.50	2.7	43	814	41	795	0.920	201	1766	4.299				10	134		18
28	7-Jul						814		795			1766						134		18
28	8-Jul	23.42	2.3	23.83	2.2	13	827	13	808	0.275	74	1840	1.566	2	2	0.042	9	143		18
28	9-Jul	23.25	2.7	23.08	2.0	26	853	25	833	0.561	363	2203	7.835	0	2	0.000	23	166		18
29	10-Jul	22.92	2.0	23.33	1.9	18	871	18	851	0.389	719	2922	15.546	0	2	0.000	38	204		18
29	11-Jul	22.67	2.1	23.25	2.4	25	896	22	873	0.544	559	3481	12.173	0	2	0.000	33	237		18
29	12-Jul	21.08	2.4	22.08	2.4	133	1029	126	999	3.082	1057	4538	24.490	1	3	0.023	23	260		18
29	13-Jul	22.50	2.6	23.00	2.4	69	1098	62	1061	1.516	1361	5899	29.912	0	3	0.000	16	276		18
29	14-Jul	22.00	2.7	23.50	2.4	32	1130	30	1091	0.703	976	6875	21.451	0	3	0.000	4	280		18
29	15-Jul	22.75	2.6	23.12	2.3	19	1149	18	1109	0.414	1765	8640	38.478	0	3	0.000	4	284		18
29	16-Jul	22.33	2.5	23.33	2.3	32	1181	30	1139	0.701	1502	10142	32.895	0	3	0.000	2	286		18
30	17-Jul	22.08	2.4	20.83	2.2	46	1227	42	1181	1.072	1228	11370	28.618	0	3	0.000	2	288		18
30	18-Jul	21.75	2.5	23.00	2.3	71	1298	67	1248	1.587	689	12059	15.397	0	3	0.000	4	292		18
30	19-Jul	22.00	2.3	23.42	2.3	106	1404	99	1347	2.334	863	12922	19.000	0	3	0.000	4	296		18
30	20-Jul	21.83	2.1	22.67	2.0	129	1533	122	1469	2.899	756	13678	16.989	0	3	0.000	2	298		18
30	21-Jul	22.67	2.0	22.17	2.2	49	1582	44	1513	1.093	598	14276	13.336	0	3	0.000	4	302		18
30	22-Jul	22.42	2.0	23.67	2.5	79	1661	74	1587	1.714	730	15006	15.839	0	3	0.000	6	308		18
30	23-Jul	22.33	2.3	23.17	2.7	126	1787	117	1704	2.769	293	15299	6.440	0	3	0.000	5	313		18
31	24-Jul	22.08	2.4	22.83	2.7	109	1896	102	1806	2.427	264	15563	5.878	0	3	0.000	8	321		18
31	25-Jul	22.00	2.4	23.75	2.4	116	2012	109	1915	2.536	323	15886	7.060	0	3	0.000	4	325		18
31	26-Jul	21.83	2.2	23.25	2.2	112	2124	110	2025	2.484	263	16149	5.834	0	3	0.000	2	327		18
31	27-Jul	21.17	2.1	23.33	2.1	81	2205	75	2100	1.820	210	16359	4.719	0	3	0.000	3	330		18
31	28-Jul	22.83	2.1	23.58	1.9	32	2237	29	2129	0.690	273	16632	5.882	0	3	0.000	4	334		18
31	29-Jul	23.08	2.2	23.67	2.1	29	2266	24	2153	0.620	185	16817	3.957	0	3	0.000	4	338		18
31	30-Jul	23.50	2.8	23.75	2.8	14	2280	12	2165	0.296	64	16881	1.354	0	3	0.000	0	338		18
32	31-Jul	22.50	2.0	22.75	2.0	70	2350	69	2234	1.547	87	16968	1.923	0	3	0.000	3	341		18
32	1-Aug	22.42	1.9	22.92	2.1	117	2467	107	2341	2.581	161	17129	3.551	0	3	0.000	4	345		18
32	2-Aug	22.17	2.2	22.67	2.3	107	2574	95	2436	2.386	93	17222	2.074	0	3	0.000	4	349		18
32	3-Aug	21.92	2.2	22.58	2.1	134	2708	118	2554	3.011	119	17341	2.674	0	3	0.000	8	357		18
32	4-Aug	22.67	2.3	23.33	2.2	77	2785	72	2626	1.674	83	17424	1.804	0	3	0.000	7	364		18
32	5-Aug	23.08	2.2	23.50	2.1	54	2839	52	2678	1.159	55	17479	1.181	0	3	0.000	3	367		18
32	6-Aug	22.33	2.3	23.33	2.0	69	2908	66	2744	1.511	65	17544	1.424	1	4	0.022	8	375		18
33	7-Aug	15.42	2.3	23.00	2.0	43	2951	39	2783	1.119	26	17570	0.677	0	4	0.000	1	376		18
33	8-Aug	22.67	2.0	22.67	2.0	89	3040	82	2865	1.963	37	17607	0.816	0	4	0.000	8	384		18
33	9-Aug	22.25	2.1	22.92	2.1	109	3149	99	2964	2.413	37	17644	0.819	0	4	0.000	4	388		18
33	10-Aug	21.42	2.1	23.17	2.0	36	3185	29	2993	0.807	22	17666	0.493	0	4	0.000	3	391		18
33	11-Aug	23.00	1.8	23.25	1.8	25	3210	20	3013	0.541	14	17680	0.303	0	4	0.000	4	395		18
33	12-Aug	23.33	1.5	23.25	1.6	19	3229	14	3027	0.408	7	17687	0.150	0	4	0.000	6	401		18
33	13-Aug	23.58	1.5	23.66	1.4	11	3240	9	3036	0.233	7	17694	0.148	0	4	0.000	1	402		18
34	14-Aug	23.66	1.5	23.83	1.3	5	3245	5	3041	0.105	4	17698	0.084	0	4	0.000	4	406		18
34	15-Aug	23.75	1.4	23.75	1.6	8	3253	8	3049	0.168	1	17699	0.021	2	6	0.042	2	408		18
34	16-Aug	23.50	1.9	23.66	2.0	24	3277	22	3071	0.509	16	17715	0.339	0	6	0.000	6	414		18
34	17-Aug	23.42	2.3	20.33	2.2	27	3304	23	3094	0.617	6	17721	0.137	0	6	0.000	2	416		18
34	18-Aug	23.25	1.8	23.33	1.9	23	3327	22	3116	0.494	8	17729	0.172	0	6	0.000	0	416		18
34	19-Aug	23.83	1.9	23.67	1.7	11	3338	9	3125	0.232	2	17731	0.042	0	6	0.000	1	417		18
34	20-Aug	23.50	3.3	23.58	3.0	9	3347	8	3133	0.191	2	17733	0.042	0	6	0.000	4	421		18
35	21-Aug	23.83	2.7	23.92	2.5	1	3348	1	3134	0.021	0	17733	0.000	0	6	0.000	0	421		18
35	22-Aug	23.83	2.5	23.92	2.5	3	3351	3	3137	0.063	3	17736	0.063	0	6	0.000	0	421		18
35	23-Aug	23.75	2.4	23.75	2.1	5	3356	5	3142	0.105	3	17739	0.063	0	6	0.000	1	422		18
35	24-Aug	23.50	2.5	23.58	2.6	8	3364	8	3150	0.170	6	17745	0.127	0	6	0.000	0	422	1	19
35	25-Aug	23.33	2.5	23.92	2.4	1	3365	1	3151	0.021	6	17751	0.127	0	6	0.000	0	422		19
35	26-Aug	23.00	2.0	23.42	2.1	22	3387	19	3170	0.474	3	17754	0.065	4	10	0.086	2	424		19
35	27-Aug	23.12	2.0	23.50	2.2	37	3424	34	3204	0.794	2	17756	0.043	4	14	0.086	2	426		19
36	28-Aug	23.33	2.2	23.08	2.2	29	3453	27	3231	0.625	6	17762	0.129	0	14	0.000	5	431		19
36	29-Aug	22.50	2.3	23.66	2.1	17	3470	13	3244	0.368	3	17765	0.065	1	15	0.022	4	435	1	20
36	30-Aug	22.20	2.2	22.33	2.0	18	3488	13	3257	0.404	2	17767	0.045	4	19	0.090	4	439		20
36	31-Aug	23.25	2.2	23.50	1.9	21	3509	18	3275	0.449	2	17769	0.043	4	23	0.086	8	447		20

Appendix B.1. Catches and number tagged of salmon in the fish wheels at Canyon Island, 2011.

		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	Effort	RPM	Effort	RPM	Daily	Cum.	Daily	Cum.	Daily	Daily	Cum.	Daily	Daily	Cum.	Daily	Daily	Cum.	Daily	Cum.
36	1-Sep	23.42	1.7	23.58	1.9	13	3522	12	3287	0.277	0	17769	0.000	5	28	0.106	2	449		20
36	2-Sep	23.50	1.5	23.67	1.5	6	3528	6	3293	0.127	1	17770	0.021	1	29	0.021	3	452		20
36	3-Sep	23.42	1.5	13.83	1.5	3	3531	3	3296	0.081	0	17770	0.000	2	31	0.054	1	453	2	22
37	4-Sep	23.7	2.5	23.75	2.3	2	3533	2	3298	0.042	0	17770	0.000	2	33	0.042	0	453	1	23
37	5-Sep	23.50	2.3	23.83	2.1	4	3537	4	3302	0.085	1	17771	0.021	3	36	0.063	4	457		23
37	6-Sep	23.08	2.8	23.50	2.7	1	3538	1	3303	0.021	0	17771	0.000	4	40	0.086	2	459		23
37	7-Sep	23.42	2.7	23.83	2.5	0	3538	0	3303	0.000	0	17771	0.000	2	42	0.042	1	460		23
37	8-Sep	23.25	2.6	23.25	2.6	1	3539	1	3304	0.022	0	17771	0.000	2	44	0.043	0	460		23
37	9-Sep	22.92	3.0	23.58	2.8	5	3544	3	3307	0.108	2	17773	0.043	7	51	0.151	2	462		23
37	10-Sep	23.67	2.7	23.67	2.8	0	3544	0	3307	0.000	0	17773	0.000	0	51	0.000	0	462		23
38	11-Sep	23.33	2.5	23.67	2.4	5	3549	5	3312	0.106	1	17774	0.021	5	56	0.106	1	463		23
38	12-Sep	22.58	2.1	23.50	2.0	11	3560	9	3321	0.239	0	17774	0.000	23	79	0.499	3	466		23
38	13-Sep	22.42	2.3	23.33	2.1	8	3568	8	3329	0.175	0	17774	0.000	23	102	0.503	3	469		23
38	14-Sep	23.42	2.2	23.42	2.1	2	3570	1	3330	0.043	0	17774	0.000	10	112	0.213	4	473	1	24
38	15-Sep	23.42	2.5	23.50	2.4	6	3576	5	3335	0.128	0	17774	0.000	8	120	0.171	2	475		24
38	16-Sep	23.33	1.7	23.67	1.8	4	3580	3	3338	0.085	0	17774	0.000	6	126	0.128	3	478	1	25
38	17-Sep	23.50	1.3	23.33	1.2	0	3580	0	3338	0.000	0	17774	0.000	4	130	0.085	5	483		25
39	18-Sep						3580		3338			17774			130			483		25
39	19-Sep						3580		3338			17774			130			483		25
39	20-Sep	23.75	1.5			1	3581	0	3338	0.042	0	17774	0.000	3	133	0.126	6	489	2	27
39	21-Sep	23.42	2.5	23.58	2.4	0	3581	0	3338	0.000	0	17774	0.000	2	135	0.043	5	494	2	29
39	22-Sep	23.67	2.7	23.75	2.5	3	3584	1	3339	0.063	0	17774	0.000	10	145	0.211	0	494	0	29
39	23-Sep	23.67	2.4	23.75	2.3	0	3584	0	3339	0.000	0	17774	0.000	5	150	0.105	3	497	3	32
39	24-Sep	23.42	2.2	23.50	2.1	0	3584	0	3339	0.000	0	17774	0.000	2	152	0.043	4	501	2	34
40	25-Sep	23.33	1.8	23.75	1.5	0	3584	0	3339	0.000	0	17774	0.000	8	160	0.170	2	503	0	34

Appendix C.1. Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2011.

	2009	2008	2008	2007	2007	2007	2006	2006	2006	2005	2005	
	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 23 (May 29 - June 4)												
Male												
Sample Size								1				1
Percent								50.0				50.0
Std. Error								50.0				50.0
Female												
Sample Size								1				1
Percent								50.0				50.0
Std. Error								50.0				50.0
All Fish												
Sample Size								2				2
Percent								100.0				100.0
Std. Error								0.0				
Statistical Week 24 (June 5 - 11)												
Male												
Sample Size				2	1			21			2	26
Percent				3.0	1.5			31.3			3.0	38.8
Std. Error				2.1	1.5			5.7			2.1	6.0
Female												
Sample Size								28			13	41
Percent								41.8			19.4	61.2
Std. Error								6.1			4.9	6.0
All Fish												
Sample Size				2	1			49			15	67
Percent				3.0	1.5			73.1			22.4	100.0
Std. Error				2.1	1.5			5.5			5.1	

Appendix C.1 (Cont'd). Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2011.

	Brood Year and Age Class											
	2009	2008	2008	2007	2007	2007	2006	2006	2006	2005	2005	
	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 25 (June 12 - June 18)												
Male												
Sample Size				8	1			31	1		2	43
Percent				7.0	0.9			27.2	0.9		1.8	37.7
Std. Error				2.4	0.9			4.2	0.9		1.2	4.6
Female												
Sample Size				1	4			51	4		11	71
Percent				0.9	3.5			44.7	3.5		9.6	62.3
Std. Error				0.9	1.7			4.7	1.7		2.8	4.6
All Fish												
Sample Size				9	5			82	5		13	114
Percent				7.9	4.4			71.9	4.4		11.4	100.0
Std. Error				2.5	1.9			4.2	1.9		3.0	
Statistical Week 26 (June 19 - June 25)												
Male												
Sample Size		2		5	13			44	5		9	78
Percent		1.2		3.0	7.8			26.3	3.0		5.4	46.7
Std. Error		0.8		1.3	2.1			3.4	1.3		1.8	3.9
Female												
Sample Size				4	5			49	9		22	89
Percent				2.4	3.0			29.3	5.4		13.2	53.3
Std. Error				1.2	1.3			3.5	1.8		2.6	3.9
All Fish												
Sample Size		2		9	18			93	14		31	167
Percent		1.2		5.4	10.8			55.7	8.4		18.6	100.0
Std. Error		0.8		1.8	2.4			3.9	2.2		3.0	

Appendix C.1 (Cont'd). Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2011.

	Brood Year and Age Class											
	2009	2008	2008	2007	2007	2007	2006	2006	2006	2005	2005	
	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 27 (June 26 - July 2)												
Male												
Sample Size		3	1	3	19			34			2	62
Percent		2.5	0.8	2.5	16.0			28.6			1.7	52.1
Std. Error		1.4	0.8	1.4	3.4			4.2			1.2	4.6
Female												
Sample Size				5	6			35	7		4	57
Percent				4.2	5.0			29.4	5.9		3.4	47.9
Std. Error				1.8	2.0			4.2	2.2		1.7	4.6
All Fish												
Sample Size		3	1	8	25			69	7		6	119
Percent		2.5	0.8	6.7	21.0			58.0	5.9		5.0	100.0
Std. Error		1.4	0.8	2.3	3.8			4.5	2.2		2.0	
Statistical Week 28 (July 3 - July 9)												
Male												
Sample Size	1	6	1	6	23	1		37	4	1	2	82
Percent	0.7	4.2	0.7	4.2	16.1	0.7		25.9	2.8	0.7	1.4	57.3
Std. Error	0.7	1.7	0.7	1.7	3.1	0.7		3.7	1.4	0.7	1.0	4.2
Female												
Sample Size				3	6			41	7		4	61
Percent				2.1	4.2			28.7	4.9		2.8	42.7
Std. Error				1.2	1.7			3.8	1.8		1.4	4.2
All Fish												
Sample Size	1	6	1	9	29	1		78	11	1	6	143
Percent	0.7	4.2	0.7	6.3	20.3	0.7		54.5	7.7	0.7	4.2	100.0
Std. Error	0.7	1.7	0.7	2.0	3.4	0.7		4.2	2.2	0.7	1.7	

Appendix C.1 (Cont'd). Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2011.

	Brood Year and Age Class											
	2009	2008	2008	2007	2007	2007	2006	2006	2006	2005	2005	
	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 29 (July 10 - July 16)												
Male												
Sample Size		16			21			38	4		4	83
Percent		8.8			11.5			20.9	2.2		2.2	45.6
Std. Error		2.1			2.4			3.0	1.1		1.1	3.7
Female												
Sample Size				10	8			68	7	1	5	99
Percent				5.5	4.4			37.4	3.8	0.5	2.7	54.4
Std. Error				1.7	1.5			3.6	1.4	0.5	1.2	3.7
All Fish												
Sample Size		16		10	29			106	11	1	9	182
Percent		8.8		5.5	15.9			58.2	6.0	0.5	4.9	100.0
Std. Error		2.1		1.7	2.7			3.7	1.8	0.5	1.6	
Statistical Week 30 (July 17 - July 23)												
Male												
Sample Size	1	15	4	1	26	1		61	1		4	114
Percent	0.5	6.9	1.8	0.5	11.9	0.5		28.0	0.5		1.8	52.3
Std. Error	0.5	1.7	0.9	0.5	2.2	0.5		3.0	0.5		0.9	3.4
Female												
Sample Size				9	3			82	4		6	104
Percent				4.1	1.4			37.6	1.8		2.8	47.7
Std. Error				1.4	0.8			3.3	0.9		1.1	3.4
All Fish												
Sample Size	1	15	4	10	29			143	5		10	218
Percent	0.5	6.9	1.8	4.6	13.3			65.6	2.3		4.6	99.5
Std. Error	0.5	1.7	0.9	1.4	2.3			3.2	1.0		1.4	

Appendix C.1 (Cont'd). Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2011.

	Brood Year and Age Class											
	2009	2008	2008	2007	2007	2007	2006	2006	2006	2005	2005	
	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 31 (July 24 - July 30)												
Male												
Sample Size	3	17	5	1	15			30			1	72
Percent	1.9	11.0	3.2	0.6	9.7			19.5			0.6	46.8
Std. Error	1.1	2.5	1.4	0.6	2.4			3.2			0.6	4.0
Female												
Sample Size		2		3	4			69	3		1	82
Percent		1.3		1.9	2.6			44.8	1.9		0.6	53.2
Std. Error		0.9		1.1	1.3			4.0	1.1		0.6	4.0
All Fish												
Sample Size	3	19	5	4	19			99	3		2	154
Percent	1.9	12.3	3.2	2.6	12.3			64.3	1.9		1.3	100.0
Std. Error	1.1	2.7	1.4	1.3	2.7			3.9	1.1		0.9	
Statistical Week 32 (July 31 - August 6)												
Male												
Sample Size	1	23	13	9	40	3		34	2		1	126
Percent	0.5	11.2	6.3	4.4	19.5	1.5		16.6	1.0		0.5	61.5
Std. Error	0.5	2.2	1.7	1.4	2.8	0.8		2.6	0.7		0.5	3.4
Female												
Sample Size		2		7	2			63	3		2	79
Percent		1.0		3.4	1.0			30.7	1.5		1.0	38.5
Std. Error		0.7		1.3	0.7			3.2	0.8		0.7	3.4
All Fish												
Sample Size	1	25	13	16	42	3		97	5		3	205
Percent	0.5	12.2	6.3	7.8	20.5	1.5		47.3	2.4		1.5	100.0
Std. Error	0.5	2.3	1.7	1.9	2.8	0.8		3.5	1.1		0.8	

Appendix C.1 (Cont'd). Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2011.

	Brood Year and Age Class											
	2009	2008	2008	2007	2007	2007	2006	2006	2006	2005	2005	
	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 33 (August 7 - August 13)												
Male												
Sample Size	2	14	13	1	26	1		33			1	91
Percent	1.3	9.4	8.7	0.7	17.4	0.7		22.1			0.7	61.1
Std. Error	0.9	2.4	2.3	0.7	3.1	0.7		3.4			0.7	4.0
Female												
Sample Size		2		7	6			39	2		2	58
Percent		1.3		4.7	4.0			26.2	1.3		1.3	38.9
Std. Error		0.9		1.7	1.6			3.6	0.9		0.9	4.0
All Fish												
Sample Size	2	16	13	8	32	1		72	2		3	149
Percent	1.3	10.7	8.7	5.4	21.5	0.7		48.3	1.3		2.0	100.0
Std. Error	0.9	2.5	2.3	1.9	3.4	0.7		4.1	0.9		1.2	
Statistical Week 34 (August 14 - August 20)												
Male												
Sample Size	1	9	6	4	12		1	10	5			48
Percent	1.0	8.8	5.9	3.9	11.8		1.0	9.8	4.9			47.1
Std. Error	1.0	2.8	2.3	1.9	3.2		1.0	3.0	2.1			5.0
Female												
Sample Size		2		6	8			35	1		2	54
Percent		2.0		5.9	7.8			34.3	1.0		2.0	52.9
Std. Error		1.4		2.3	2.7			4.7	1.0		1.4	5.0
All Fish												
Sample Size	1	11	6	10	20		1	45	6		2	102
Percent	1.0	10.8	5.9	9.8	19.6		1.0	44.1	5.9		2.0	100.0
Std. Error	1.0	3.1	2.3	3.0	4.0		1.0	4.9	2.3		1.4	

Appendix C.1 (Cont'd). Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2011.

	Brood Year and Age Class											
	2009	2008	2008	2007	2007	2007	2006	2006	2006	2005	2005	
	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 35 (August 21 - August 27)												
Male												
Sample Size		3	3	2	5	1		10	1			25
Percent		6.1	6.1	4.1	10.2	2.0		20.4	2.0			51.0
Std. Error		3.5	3.5	2.9	4.4	2.0		5.8	2.0			7.2
Female												
Sample Size				5				18	1			24
Percent				10.2				36.7	2.0			49.0
Std. Error				4.4				7.0	2.0			7.2
All Fish												
Sample Size		3	3	7	5	1		28	2			49
Percent		6.1	6.1	14.3	10.2	2.0		57.1	4.1			100.0
Std. Error		3.5	3.5	5.1	4.4	2.0		7.1	2.9			
Statistical Week 36 (August 28 - September 3)												
Male												
Sample Size		11	8		9	1		6				35
Percent		15.9	11.6		13.0	1.4		8.7				50.7
Std. Error		4.4	3.9		4.1	1.4		3.4				6.1
Female												
Sample Size			1	3	4			24	1		1	34
Percent			1.4	4.3	5.8			34.8	1.4		1.4	49.3
Std. Error			1.4	2.5	2.8			5.8	1.4		1.4	6.1
All Fish												
Sample Size		11	9	3	13	1		30	1		1	69
Percent		15.9	13.0	4.3	18.8	1.4		43.5	1.4		1.4	100.0
Std. Error		4.4	4.1	2.5	4.7	1.4		6.0	1.4		1.4	

Appendix C.1 (Cont'd). Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2011.

	Brood Year and Age Class											
	2009	2008	2008	2007	2007	2007	2006	2006	2006	2005	2005	
	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 37 (September 4 - September 10)												
Male												
Sample Size		1						3				4
Percent		12.5						37.5				50.0
Std. Error		12.5						18.3				18.9
Female												
Sample Size				1	2			1				4
Percent				12.5	25.0			12.5				50.0
Std. Error				12.5	16.4			12.5				18.9
All Fish												
Sample Size		1		1	2			4				8
Percent		12.5		12.5	25.0			50.0				100.0
Std. Error		12.5		12.5	16.4			18.9				
Statistical Week 38 (September 11 - September 17)												
Male												
Sample Size		1	6	1	1			1	1			11
Percent		3.8	23.1	3.8	3.8			3.8	3.8			42.3
Std. Error		3.8	8.4	3.8	3.8			3.8	3.8			9.9
Female												
Sample Size				2	3			8	2			15
Percent				7.7	11.5			30.8	7.7			57.7
Std. Error				5.3	6.4			9.2	5.3			9.9
All Fish												
Sample Size		1	6	3	4			9	3			26
Percent		3.8	23.1	11.5	15.4			34.6	11.5			100.0
Std. Error		3.8	8.4	6.4	7.2			9.5	6.4			

Appendix C.1 (Cont'd). Age composition of sockeye salmon in the Canyon Island fish wheels by sex and fishing period, 2011.

	Brood Year and Age Class											
	2009	2008	2008	2007	2007	2007	2006	2006	2006	2005	2005	
	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 39 (September 18 - September 24)												
Male												
Sample Size			2									2
Percent			40.0									40.0
Std. Error			24.5									24.5
Female												
Sample Size					1			2				3
Percent					20.0			40.0				60.0
Std. Error					20.0			24.5				24.5
All Fish												
Sample Size			2		1			2				5
Percent			40.0		20.0			40.0				100.0
Std. Error			24.5		20.0			24.5				
Combined Periods (May 29 - September 24)												
Male												
Sample Size	9	121	62	43	212	8	1	394	24	1	28	903
Percent	0.5	6.8	3.5	2.4	11.9	0.4	0.1	22.1	1.3	0.1	1.6	50.8
Std. Error	0.2	0.6	0.4	0.4	0.8	0.2	0.1	1.0	0.3	0.1	0.3	1.2
Female												
Sample Size	0	8	1	66	62	0	0	614	51	1	73	876
Percent	0.0	0.4	0.1	3.7	3.5	0.0	0.0	34.5	2.9	0.1	4.1	49.2
Std. Error	0.0	0.2	0.1	0.4	0.4	0.0	0.0	1.1	0.4	0.1	0.5	1.2
All Fish												
Sample Size	9	129	63	109	274	8	1	1008	75	2	101	1779
Percent	0.5	7.3	3.5	6.1	15.4	0.4	0.1	56.7	4.2	0.1	5.7	100.0
Std. Error	0.2	0.6	0.4	0.6	0.9	0.2	0.1	1.2	0.5	0.1	0.5	

Appendix C.2. Age composition of chum salmon in the Canyon Island fish wheels by sex and fishing period, 2011.

	Brood Year and Age Class					
	2008	2007	2006	2005		
	0.2	0.3	0.4	0.5		Total
Statistical Weeks 28 (July 3 - July 9)						
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 29 (July 10 - July 16)						
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			-			-

Appendix C.2 (Cont'd). Age composition of chum salmon in the Canyon Island fish wheels by sex and fishing period, 2011.

	Brood Year and Age Class				
	2008	2007	2006	2005	
	0.2	0.3	0.4	0.5	Total
Statistical Week 32 (July 31 - August 6)					
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	-				-
Statistical Week 34 (August 14 - August 20)					
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, 2011.

	Brood Year and Age Class				
	2008	2007	2006	2005	
	0.2	0.3	0.4	0.5	Total
Statistical Week 35 (August 21 - August 27)					
Male					
Sample Size		2			2
Percent		33.3			33.3
Std. Error		21.1			21.1
Female					
Sample Size		3	1		4
Percent		50.0	16.7		66.7
Std. Error		22.4	16.7		21.1
All Fish					
Sample Size		5	1		6
Percent		83.3	16.7		100.0
Std. Error		16.7	16.7		
Statistical Week 36 (August 28 - September 3)					
Male					
Sample Size		6			6
Percent		46.2			46.2
Std. Error		14.4			14.4
Female					
Sample Size		3	4		7
Percent		23.1	30.8		53.8
Std. Error		12.2	13.3		14.4
All Fish					
Sample Size		9	4		13
Percent		69.2	30.8		100.0
Std. Error		13.3	13.3		

Appendix C.2 (Cont'd). Age composition of chum salmon in the Canyon Island fish wheels by sex and fishing period, 2011.

	Brood Year and Age Class				
	2008	2007	2006	2005	
	0.2	0.3	0.4	0.5	Total
Statistical Week 37 (September 4 - September 10)					
Male					
Sample Size		6			6
Percent		31.6			31.6
Std. Error		11.0			11.0
Female					
Sample Size		8	4	1	13
Percent		42.1	21.1	5.3	68.4
Std. Error		11.6	9.6	5.3	11.0
All Fish					
Sample Size		14	4		19
Percent		73.7	21.1		94.7
Std. Error		10.4	9.6		
Statistical Week 38 (September 11 - September 17)					
Male					
Sample Size		26	6		32
Percent		35.1	8.1		43.2
Std. Error		5.6	3.2		5.8
Female					
Sample Size	1	34	7		42
Percent	1.4	45.9	9.5		56.8
Std. Error	1.4	5.8	3.4		5.8
All Fish					
Sample Size	1	60	13		74
Percent	1.4	81.1	17.6		100.0
Std. Error	1.4	4.6	4.5		

Appendix C.2 (Cont'd). Age composition of chum salmon in the Canyon Island fish wheels by sex and fishing period, 2011.

	Brood Year and Age Class				
	2008	2007	2006	2005	
	0.2	0.3	0.4	0.5	Total
Statistical Week 39 (September 18 - September 24)					
Male					
Sample Size		10	2		12
Percent		31.3	6.3		37.5
Std. Error		8.3	4.3		8.7
Female					
Sample Size		18	2		20
Percent		56.3	6.3		62.5
Std. Error		8.9	4.3		8.7
All Fish					
Sample Size		28	4		32
Percent		87.5	12.5		100.0
Std. Error		5.9	5.9		
Statistical Week 40 (September 25 - October 1)					
Male					
Sample Size		4	1		5
Percent		36.4	9.1		45.5
Std. Error		15.2	9.1		15.7
Female					
Sample Size		6			6
Percent		54.5			54.5
Std. Error		15.7			15.7
All Fish					
Sample Size		10	1		11
Percent		90.9	9.1		100.0
Std. Error		9.1	9.1		
Combined Periods (June 29 - October 4)					
Male					
Sample Size		54	11		65
Percent		34.0	6.9		40.9
Std. Error		3.8	2.0		3.9
Female					
Sample Size	2	72	19	1	94
Percent	1.3	45.3	11.9	0.6	59.1
Std. Error	0.9	4.0	2.6	0.6	3.9
All Fish					
Sample Size	2	126	30	1	159
Percent	1.3	79.2	18.9	0.6	100.0
Std. Error	0.9	3.2	3.1	0.6	

Appendix D. Results of secondary marking study to test for short term tag loss for sockeye captured at the Canyon Island fish wheels, 2011.

Stat. Week	Canadian Catch	Tags Recovered	Fishery Ratio	Fish Examined for 2nd Marks	Number of 2nd Marks	Sample Ratio	Fishery Ratio - Sampled Ratio
26	869	15	0.017	506	11	0.022	-0.004
27	837	18	0.022	635	10	0.016	0.006
28	2117	50	0.024	700	17	0.024	-0.001
29	1391	23	0.017	700	12	0.017	-0.001
30	4668	114	0.024	700	8	0.011	0.013
31	4355	104	0.024	700	24	0.034	-0.010
32	4900	192	0.039	700	15	0.021	0.018
33	2415	76	0.031	702	20	0.028	0.003
34	1001	17	0.017	700	10	0.014	0.003
35	502	18	0.036	200	9	0.045	-0.009
36	828	38	0.046	200	10	0.050	-0.004
37	56	4	0.071	41	1	0.024	0.047
Total	23,939	669	0.028	6,484	147	0.023	0.005