Enumeration of Juvenile and Adult Coho Salmon at Black Creek, Vancouver Island, 2006

P. Van Will, H.W. Stiff, E. Miyagi, and K. Duncan

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ENUMERATION OF JUVENILE AND ADULT

COHO SALMON AT BLACK CREEK, VANCOUVER ISLAND, 2006

by

P. Van Will[1], H.W. Stiff[2], E. Miyagi[3], and K. Duncan[2]

[1] Fisheries and Oceans Canada
Stock Assessment
Science Branch, Pacific Region
8585 Wollason Street
Port Hardy, British Columbia V0N 2P0

[2] A'Tlegay Fisheries Society,
Campbell River, British Columbia V9W 2E4

[3] Fisheries and Oceans Canada
Stock Assessment
Science Branch, Pacific Region
150-1260 Shopper's Row
Campbell River, British Columbia V9W 2C8

ii

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

Van Will, P., Stiff, H.W., Miyagi, E., and Duncan, K. 2010. Enumeration of
juvenile and adult coho salmon at Black Creek, Vancouver Island, 2006.
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The permanent counting fence on Black Creek was operated between April 6 and
June 11, 2006, to enumerate and coded-wire tag coho smolt out-migration.
During the spring program, a total 126,171 smolts were captured, and sampled,
of which 36,717 (29.1%) were successfully coded-wire tagged and released. As
in most previous years of the program, the out-migration was predominantly
comprised of age 1 smolts (98.9%). Due to drought conditions the adult counting
fence was operated from November 5 to November 15, 2006. A total of 189 large
adults and 389 jacks were enumerated (male to female ratio of 1:1.4) and tagged
for mark-recovery escapement estimation. Stream surveys extended from
November 21 to December 12 to determine the proportion of marks in the
population. The single-census Petersen mark-recapture population estimate (α =
.05) for adult coho was 550 ± 250 and 486 ± 200 for jacks. The mode of the
Bayesian population estimate for adult coho escapement is 565 (95% highest
probability density (HPD) of 353 to 1,113). The mode of the Bayesian population
estimate for adults + jacks is 1,530 with 95% HPD of 1,085 to 2,395,. Catch of
Black Creek coho was back-calculated from the formula for exploitation rate
(4.4%), which resulted in an estimate of 1.5% for Black Creek coho marine
survival.

RÉSUMÉ

Van Will, P., Stiff, H.W., Miyagi, E., and Duncan, K. 2010. Enumeration of juvenile and adult coho salmon at Black Creek, Vancouver Island, 2006. Can. Manuscr. Rep. Fish. Aquat. Sci. 2928: viii + 54 p.

La barrière de dénombrement permanente installée dans le ruisseau Black a été utilisée du 6 avril au 11 juin 2006 pour dénombrer les smolts du saumon coho en dévalaison. Au total, 126 171 smolts ont été capturés durant le programme d'échantillonnage de printemps, dont 36 717 (29,1 %) ont été munis d'une micromarque magnétisée codée puis relâchés. Comme cela était le cas la plupart des années précédentes du programme, les individus en dévalaison étaient surtout des smolts d'âge 1 (98,9 %). En raison du faible niveau d'eau dû à la sécheresse, la barrière de dénombrement des adultes a été utilisée du 5 au 15 novembre 2006. Au total, 189 grands saumons et 389 madeleineaux ont été dénombrés (rapport des sexes de 1 mâle:1,4 femelle) et étiquetés aux fins d'estimation de l'échappée par marquage-recapture. Des relevés de ce ruisseau ont eu lieu du 21 novembre au 12 décembre pour déterminer la proportion de marques dans la population. L'estimation du nombre de cohos adultes et de madeleineaux (α = 0,05) par recensement unique (méthode de Petersen) par marquage-recapture se situait respectivement à 550 ± 250 et 486 ± 200. Le mode de l'estimation bayésienne de l'échappée pour les cohos adultes était de 565 (densité de la probabilité la plus élevée de 95 % allant de 353 à 1 113), alors que le mode de l'estimation bayésienne pour l'ensemble des adultes et des madeleineaux était de 1 530 (densité de la probabilité la plus élevée de 95 % allant de 1 085 à 2 395). Les prises de cohos provenant du ruisseau Black ont été rétrocalculées à l'aide de la formule pour le taux d'exploitation (4,4 %), ce qui a donné un taux estimatif de survie de ce saumon en mer de 1,5 %.

INTRODUCTION

This report documents the 2006 smolt and adult enumeration programs for coho salmon (*Oncorhynchus kisutch*) at the Black Creek fence. Both enumeration programs are based on sampling conducted at the permanent fence site located 100 m upstream of tidal influence, about 40 m downstream from Seaview Road in Miracle Beach Provincial Park. A series of projects have been conducted sporadically at this location since 1968 (Baillie, Simpson & Taylor 2004) and an uninterrupted data set has been compiled, under the present program, from 1984. In addition to coho, Black Creek supports populations of coastal cutthroat trout (*O. clarki*), and rainbow trout (*O. mykiss*).

The spring program is designed to assess the out-migration of coho smolts with respect to numbers, size and age composition, and migration timing. Coded-wire tags (CWTs) are implanted in smolts during specific periods throughout the migration.

Adult coho returning in the fall are counted at the same location utilizing a modified fence configuration. The general structure has been described by Baillie et al. (2004). Modifications were made in 2001, replacing the steel panels with aluminium grates and extending the cat-walk for a further 1.5 m beyond the downstream edge of the concrete sill. The traps were also modified to incorporate an adjustable height exit at the upstream end, through which fish could be counted into the system during flooding, eliminating the necessity to net each one. Each exit features a right-angle aluminum plate, leading upstream, to increase the visibility of fish and counting accuracy under turbid flows. In 2003, the fence centre panels were cut in half lengthways and Teflon runners were attached along the contact edge with the A-frame, to facilitate removal during high water events.

Spawners counted through the fence are enumerated by sex, and sampled for length, age and maturity. Carcasses are sampled and heads are recovered from coded-wire tagged fish. Since 1984, mark-recapture has been the primary method of escapement estimation, with marking conducted at the fence and recovery surveys conducted at up to 15 upstream sites.

Recoveries of coded wire tagged coho in the escapement are used with catch recoveries and release data to estimate ocean survival and exploitation rates. The utility of the data depends on long-term monitoring of escapements, smolt abundances, survivals, catches, exploitations and escapements. Data from the project, along with other sources, is used to predict coho returns, ocean survival and migration patterns for the south coast of British Columbia.

STUDY AREA

Black Creek is a moderately sized coastal stream located 30 km north of Courtenay, on the east coast of Vancouver Island. It is approximately 31 km long and flows into the Strait of Georgia at Elma Bay (Figure 1). The watershed area is approximately 81 km^2 (Brown, Barton & Langford 1996) and predominantly

comprised of agricultural lands with forested areas in the upper catchment. Lower in the watershed, small lakes, of which Northy Lake is the largest, beaver ponds and swampy areas are abundant (Figure 2). These areas contribute to the characteristic humic stained flows in the lower sections via a number of tributaries, the largest being Millar Creek. Discharge is largely dependant on rainfall; irrigation and drainage projects have reduced already low summer flows in Black Creek, such that, in summer, some sections of the creek are dry. In contrast, fall freshets can result in a discharge of up to 60 m^3/s (Labelle 1990). Once the storage capacity of the watershed is reached, the creek responds rapidly to rainfall, and prolonged flood events tend to be the norm.

METHODS

PHYSICAL OBSERVATIONS

General weather observations were made daily and recorded as subjective comments on rainfall, cloud cover and wind strength. Measurements of river height were normally made each day at about 8:00 a.m. Water temperature was taken with a Tidbit temperature logger upstream of the fence site. Water level was recorded from a staff gauge ($\pm$ 5 mm) located approximately 250 m upstream of the fence.

SMOLT OPERATIONS

The basic sampling and tagging procedures resembled other years of the program. Catches from the previous day were removed from the holding boxes at about 8:00 a.m. and sorted into buckets, by species. All sampling and tagging was performed on anaesthetized smolts using tricaine methane sulphonate (MS-222) as the anesthetic. Random length samples were collected by measuring, approximately, every tenth coho smolt on days when coded wire tags (CWTs) were applied. Additionally, at the start of the run and following the peak, up to 10 lengths and weights ($\pm$ 0.1 g) were recorded per 5 mm length group. Weight and scale samples were not randomly selected since an effort was made to sample the entire size range of smolts. Data collection to determine the age structure of the population was divided into two periods: April 6th to May 9th and May 10th to June 8th. During each sample period a scale smear was taken from up to 10 coho smolts per 5 mm length group.

Age determinations were performed by the Fish Ageing Unit at the Pacific Biological Station in Nanaimo, BC. The age composition of smolts was calculated for each of the three sampling periods after Ketchen's stratified sub-sampling method (Ricker 1975). The age composition of each 5 mm length group was determined in the non-random age sample and this was used to derive the frequency of age classes in most of the total catch by size group, due to the very large number of measurements made. The proportional age composition by period was determined from the summed frequencies by age over all sizes.

Smolts were injected with a CWT, which was applied with a MK IV Tagging Unit (Northwest Marine Technologies, Shaw Island, WA 98286). Tagged coho were

placed into a floating holding box to recover from the operation, and released periodically through the day. Untagged coho (no tag detection by hand held wand) were re-tagged. Moribund fish were released untagged. Tag retention tests were conducted weekly to estimate the number of coho smolts that had lost their tag in the first 24 hours.

Weekly duties were divided into two days of coded-wire tagging and five days of enumerating only. The tag code series used throughout the migration period is listed in Table 1.

While coho fry (which are not consistently captured by the screen size used in traps and panels) and other salmonids were enumerated at the counting fence, meristics data were not collected in 2006. Non-salmonids were enumerated by species.

ADULT OPERATIONS

Adult Enumeration and Sampling

The counting fence was installed on September 19th. Due to drought conditions the fence was not staffed until November 5th when fish started to enter the adult holding box.

The fence traps were inspected at 8:00 a.m., and periodically throughout the day as warranted by fish movement. Individual fish were netted from the trap and sampled for fork length ($\pm$ 5 mm), sex (female, adult male or jack), random scale sample for age determination and the presence of fin clips or external marks, including hook scars and severe injuries. Weights were not recorded. The presence of a CWT in fin-clipped coho was verified with a Northwest Marine Technology wand tag detector. Fish condition was assessed using the subjective categories of:

1. Silver (no spawning colour or characteristic morphological changes commonly associated with spawning coho);

2. Green (some darkening of body colour but little morphological change);

3. Mature (colour and morphological characteristics of a spawning coho but eggs or sperm not easily expelled); and

4. Ripe (similar to a mature fish, except eggs and sperm readily expelled with little or no force).

Jack coho were defined as those male fish with a fork length of less than 44 cm, although this category may include some small adults. Weights were not measured in 2006. Other salmonid species encountered at the fence were identified, sexed and measured for fork length ($\pm$ 5 mm).

Mark-Recapture

Adult and jack coho were tagged with a numbered, clear T-bar anchor tag (TBA-2, 2 in., Hallmark Pty Ltd., South Australia, 5211). Tags were inserted into the dorsal musculature on the left side of the dorsal fin, between the anterior

pterygiophores. A small (7 mm) hole was punched in the left operculum of each tagged fish.

Recoveries of marked and unmarked coho were conducted at 14 sites during spawning ground surveys between November 17th and December 12th (Figure 2). All fish encountered were checked for marks. Recoveries were classified as untagged, tagged (T-bar tag), or lost tag (opercular punch but no tag). Tag numbers were noted, as were other marks such as adipose clips present or unknown due to the condition of the fish. The heads from carcasses that gave a positive response when tested for the presence of a CWT were removed and preserved for analysis.

DATA ANALYSIS

Escapement Estimation

Coho escapement population estimates N and variance were derived from single-census Petersen mark-recapture methods (Ricker 1975), using both the bias-corrected hypergeometric estimator and the direct binomial estimator for small samples without replacement. The former was calculated as:

$$N = ((M+1) * (C+1) / (R+1)) - 1$$

where M is the number of marks applied, C is the number of fish recovered, and R is the number of marks in the total fish recovered. The variance of this estimate was calculated from:

$$Var\ (N) = (M+1) * (C+1) * (M-R) * (C-R) / ((R+1)^2 * (R+2))$$

The binomial estimator can be calculated as:

$$N = ((M * (C+1) / (R+1))$$

with variance:

$$Var\ (N) = M^2 * (C+1) * (C-R) / ((R+1)^2 * (R+2))$$

Additional estimates for coho adults and adult + jack populations were derived from temporal sub-sets of the mark-recapture data using the sequential Bayesian approach (Gazey & Staley 1986). This method has been used in a majority of previous studies to account for under-reporting of tags in visual surveys and to eliminate tag loss corrections (Taylor, Baillie & Simpson 2006). It determines the posterior distribution of probabilities associated with population size from the joint probabilities of mark recovery rates. Calculated population parameters include the mode, a maximum likelihood estimate of the sampling distribution, and the 95% highest probability density (HPD). It should be noted that while the HPD has equivalence to a confidence interval, it forms a direct probability statement about population size (Gazey & Staley 1986). The mode is reported as a single value which denotes that each integer between the population bounds has been evaluated.

Exploitation Rate

The percent exploitation rate (*ER*) of adult Black Creek coho is calculated as:

$$ER = 100 \ C \ / \ (C + M + E)$$

where C is the estimated fishing mortality, M is the known pre-spawn natural mortality, and E is the adult escapement.

Marine Survival

Percent marine survival rate (S), is calculated as:

$$S = 100 \ (C + M + E) \ / \ R$$

where C is the estimated fishing mortality, M is the pre-spawn natural mortalities, E is the tagged adult escapement, and R is the number of tagged smolts in 2005, corrected for short term tag loss.

RESULTS

JUVENILE ENUMERATION

The 2006 coho smolt sampling program unfolded as planned without any major high water events affecting the tagging or enumeration. The 2006 smolt migration timing was essentially bimodal, commencing in late April, with spikes in daily migration occurring May 6th and 18th (Figure 3). Peak migration was recorded on May 6th (9,103). A summary of catch and tag releases is provided in Table 1. Daily catches of coho and other species are listed in Appendix A and Appendix B.

The sampling and tagging procedures resulted in a total of 36,717 coded-wire tagged smolts (29.1% of the out-migration). Combined with 88,147 untagged smolts, a total of 126,171 coho smolts were enumerated which was a 300% increase over 2005. 815 coho fry were also counted.

Pre-sample mortalities (1,307) affected 1.0% of the total catch. However, this mortality represented 4 - 5% of the daily catch on May 5th and May 6th, and appears to be largely due to trap box overcrowding during peak migration (May 1st — May 18th).

No tagging mortalities were detected. The tag loss rate was estimated at 1.3%, based on 496 tagged smolts that did not retain their CWTs. Therefore the number of successfully tagged smolts is estimated as 36,221.

Biological Sampling

A total of 5,991 smolts were sampled for age, including 2,707 in period 1 and 3,284 in period 2 (Table 2). The overall age-length distribution of the out-migration for each sampling period is illustrated in Figure 5 and Figure 7. Age 1 smolts predominated, representing 94.0% of the successfully aged smolts in period 1 samples, and 99.3% of aged smolts in period 2 samples. For calculated ages in each of these periods, age 1.0 fish exceeded 99% of the total smolt output.

The mean fork length of the out-migration was 110.4 mm (SD = 12.3, range 78 – 187 mm, n = 6,267). The mean weight (g) for smolts measured was 17.1 g (SD =

7.8, range 6 – 43 g, n = 212). The weight/length relationship (Figure 4) for all measured smolts was:

$$\text{Weight (g)} = 0.0000139 * \text{Length (mm)}^{2.932} ; \quad (r^2=0.96, SE=0.09, n=212)$$

Other Species

Adult coastal cutthroat trout (*O. clarki*) were the most numerous of the other species enumerated at the fence with 1,157 recorded (Appendix B). A total of 22 rainbow trout (*O. mykiss*) were also collected at the fence. Other species enumerated included: sculpins (*Cottus asper (*2), and *C. aleuticus,* (42)) and lamprey (61).

Physical Observations

Daily water temperature and water height data during spring out-migration are provided in Appendix C. Water levels were erratic in April but smooth during smolt migration, averaging about 60 cm in depth (Figure 3). Mean water temperature during the smolt study was 11.4°C (range 7.4°C to 15.8°C).

ADULT ENUMERATION

In 2006, drought conditions persisted through the fall until the end of October. On October 27th there was a small rise in water levels insufficient for fish migration upstream but enough to encourage fish to move into the bottom reach of the creek on a high tide. As the tide receded, these fish remained trapped in a pool which was full of decaying seaweed. The resulting anoxic conditions were responsible for killing approximately 100 jack and 20 adult coho.

Black Creek water flow remained low, preventing upstream movement of fish until November 5th, at which time larger rainfall events stimulated migration (Figure 6). Coho migration peaked on November 6th. Daily migration dropped to zero on November 9th. Rising river levels resulted in fish movement again on November 10th which tapered off over subsequent days. The daily numbers of coho at the fence did not exceed the tagging crew capacity of the one holding box.

Heavy rainfall and flood conditions however, necessitated the removal of fence panels at Black Creek on November 15th. The fence remained open due to flooding for the remainder of the program, with no further tagging of returning coho. It is uncertain how many coho may have migrated upstream during this time.

Adult Escapement

A total of 578 coho consisting of 189 adults and 389 jacks were counted, sampled, and marked at the fence between November 5th and 15th (Table 4, Appendix D). The tally of 78 males and 111 females yielded a sex ratio of 1:1.42. Daily escapement totals for adult and jack coho are presented in (Table 5, Appendix D).

Biological Sampling

The length-frequency distribution of the escapement is illustrated in Figure 7. The mean length for adult males was 664 mm, females 697mm, and jack coho was 375 mm (Table 6). Weights were not recorded in 2006.

A majority of large adult coho assessed at the fence were classified as condition 4 ("ripe", 88.5%). A larger proportion of males (98.6%) contributed to this category than females (82.0%) (Table 8). The second largest category for adults was condition 3 (9.3%), with 1.4% of males compared to 14.4% of females. No silver bright adults were found, and no males that weren't showing significant sexual dimorphism were encountered at the fence, likely due to the late migration timing. Jacks were predominately classified as condition 4 (97.2%), with the remainder split relatively evenly between conditions 2 and 3 (2.8%).

Age Distribution

Due to the advanced condition factor of the coho entering the river, not all fish were scale-sampled, in order to minimize delays in upstream migration. A total of 306 (53% of 578) coho were sampled for scales at the counting fence (Appendix D). Of that number, 134 coho were successfully aged and sexed (Table 4).

Collectively, 66% were age 2.2 jacks, originating from the 2004 brood year, 32% were age 3.2 (brood year 2003) and 3 fish (2.2%) were 4.3s from brood 2002. 30% of scales collected (172) were only partially aged and classified as no marine annulus (115), or 1 marine annulus (57). Two jills (females < 44 cm) were encountered, but these fish were not distinguished from adult females in this report's tabulations.

Mark-Recapture

A total of 189 adults and 389 jacks were each marked with a uniquely numbered, clear T-bar anchor tag, combined with a left opercular punch approximately 7 mm in diameter (Table 7). There were no immediate mortalities due to capture, handling, or tagging. Delayed tag-induced mortality was not assessed and is assumed negligible.

Recoveries of marked and unmarked coho were conducted at 14 sites between November 17th and December 12th, with carcasses located and examined at 7 sites (Table 9). All fish encountered were checked for marks. Total carcasses recovered (35) represented 6% of the fence count, and 2.3% of the estimated total escapement. As usual, the recovery of jack carcasses was problematic, with only 4 jacks recovered during stream surveys, of which 3 were marked fish (Table 12).

Of the 31 adult carcasses examined, 21 unmarked coho were recovered, 9 adults were evidently T-bar tagged, including 2 adults that were ascertained to have missing tags and one tag-less female with a probable operculum punch (Table 13). Another tagged fish could not be identified by age or sex, but most likely was an adult. Thus the T-bar tag loss percentage was 33%. However, the T-bar tag

loss does not affect the population estimate since the presence of an operculum punch mark confirmed the tag status for all fish recovered.

<u>Population Estimates</u>

The single-census Petersen mark-recapture estimates for adults and jacks were 552 (SD = 131) and 486 (SD = 108) respectively. Since the ratio of marked recaptures to catch exceeds 0.1, it may be more appropriate to use the binomial confidence interval calculation (Seber, 1982) which yields 550 (SD = 129) adults and 486 (SD = 97) jacks.

Sequential plots of the posterior distribution with time are illustrated in Figure 8, and the input data are organized in Table 14.

The posterior probability distribution for adult coho was constructed from 2001 discrete population levels between bounds of 200 – 2,200 adult individuals. These data produced a modal population estimate for adults of 565 fish (95% highest probability density of 760 and 95% confidence interval of 353 – 1,113) (Figure 8). The minimum estimate of adults is 424 coho adults ($\alpha = 0.05$) (Figure 9).

Of the 4 jack carcasses encountered only 1 was unmarked. The posterior probability distribution for jack coho was constructed from 1001 discrete population levels between bounds of 80 – 1,080 adult individuals. These data produced a modal population estimate for jacks of 515 fish (95% highest probability density of 1,427 and 95% confidence interval of 388 – 1,815) (Figure 8).

The Bayesian estimate for adults + jacks combined is 1,530 with 95% confidence HPD of 1,310 and interval of 1,085 to 2,395, constructed from 1001 discrete population levels between 1,000 – 2,000 fish (Figure 8). The minimum estimated population size is 1,184 coho adults + jacks ($\alpha = 0.05$) (Figure 9).

<u>Coded-Wire Tag Recoveries</u>

A total of 182 adults and 396 jacks were assessed at the counting fence for coded-wire tag (CWT) presence (Table 10). Tags were positively identified by wand in 33 adults (18 females and 15 males) and 83 jacks. In total, CWTs were detected in 18% of adult fish and 21% of the jacks examined, which is in line with the 21% CWT application rate in 2005.

EXPLOITATION RATE AND MARINE SURVIVAL

Virtually all coho from the major South Coast hatcheries have been marked since 1997 (a pelvic fin clip in the first year and an adipose clip thereafter). This was in anticipation of selective mark fisheries, which are intended to harvest hatchery but not wild production. 1997 was the last year when major non-selective fisheries occurred in southern BC. Since Black Creek coho are a wild stock, smolts were not adipose clipped between 1997 and 2002. However, in 2003 and again in 2004, a portion of the smolt output was adipose clipped as well as coded-wire tagged. This was not repeated for the 2005 or 2006 smolt output.

It is also assumed that Black Creek coho are encountered in BC and Alaska sport fisheries at the same rate as marked coho from Quinsam Hatchery, 27 km from Black Creek. Since studies suggest that 10% of sport-caught coho do not survive after release, the exploitation rate in BC sport fisheries is assumed to be 10% of the Quinsam exploitation in BC catch-and-release recreational fisheries. However, for Alaskan fisheries all coho are retained so the Alaskan exploitation rate of Black Creek coho is assumed equal to Quinsam hatchery coho exploitation.

The percent exploitation rate (*ER*) of adult Black Creek coho is normally calculated as:

$$ER = 100 * C / (C + M + E)$$

where *C* is the estimated fishing mortality, *M* is the known pre-spawn natural adult mortality, *E* is the adult escapement. The *M* term represents 18% (which is the adult CWT presence rate) of the 20 pre-spawn adult mortalities in the false migration start, i.e. *M* = 4 fish.   Escapement *E* was calculated for CWT-tagged adult coho using an estimate of escaped CWT adults derived from the observed 33 CWT adults divided by the number of adult coho examined for CWTs at the fence (182) and then multiplied by the Bayesian estimate of total adult escapement (565).

Though catch data (*C*) are unavailable for Black Creek coho in 2006, an estimate of 4.4% exploitation was independently provided for Black Creek coho for 2006 (S. Baillie, DFO Nanaimo pers. comm.; Table 11), which can be used to back-calculate the catch mortality. Substituting and re-arranging the *ER* equation yields:

$$ER = 100 * C / (C + 4 + 102) = 4.4\%$$

$$C = 466.4 / 95.6$$

$$C = 4.9$$

Percent marine survival rate (*S*), is:

$$S = 100 (C + M + E) / R$$

where *C*, *M* and *E* are calculated as for exploitation rate, and *R* is the number of tagged smolts in 2005 corrected for long-term tag loss. Though long-term CWT tag loss was not available for 2005, it was estimated at 10% based on the average of tag loss estimates in two previous years (range 6.4 – 14.6%)[1]. The number of tagged smolts *R* = 7,586 was then derived by applying the 10% CWT tag loss rate to tagged releases of 8,429 smolts in 2005.

Thus:

$$S = 100 * (5 + 4 + 102) / 7,586$$

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[1] Since CWT'd smolts were not adipose fin-clipped in 2005, long-term CWT tag loss cannot be directly determined. In previous years, long-term CWT tag loss in adult Black Creek coho was 6.4% (2004) (Taylor, Baillie & Simpson, in prep) and 14.6% (2005) (Taylor & Baillie, in prep).

$$S = 1.46\% \text{ (range: } 1.40 - 1.54\%)$$

Estimated marine survival and exploitation rates are presented in Table 11, where available, since 1976.

DISCUSSION

SMOLTS

Smolt migration past the Black Creek fence in 2006 peaked in early May, similar to recent years. Smolt enumeration totaled 126,171, the highest in the past 3 years. Short term tag loss of 1.3% was based on derivations in past years (Taylor and Baillie, in prep), while tag mortalities were reduced to zero, resulting in 36,717 successfully coded wire tagged smolts released (29%), compared to 8,429 CWTs in 2005 (20%).

As usual for Black Creek, age 1 fish predominated in the 2006 smolt migration (96.7% of sampled fish, 99.5% of calculated age fish). The remainder of the migration was composed of age 2 smolts, which were most common during the first time period. Age 3 smolts rarely contribute to the Black Creek out-migration and none were encountered in 2006: two were captured in each of the years 2001 and 2002, 5 were found in 2003, and 1 in 2005.

ADULTS

Black Creek coho upstream migration is highly dependent on precipitation events to raise creek levels. Peak coho migration has occurred shortly after the first significant rainfalls over the past four years (Taylor and Baillie in prep., Taylor, Baillie and Simpson, in prep.). Extended drought conditions in 2006 not only delayed upstream migration till November 5th, but resulted in the loss of 20 adult and 100 jack coho. These fish were trapped in a tidal pool off the mouth of the creek after a precipitation event on October 27th stimulated a false migration start. By the time creek levels were adequate for upstream movement in early November, 82% of female coho and 99% of males were reproductively "ripe". Adult and jack migration peaked shortly thereafter,on November 6th, with another pulse of adults on November 10th. The fence was operated only until November 15th due to high water flows.

A total of 189 large adults were counted through the fence, accompanied by 389 jacks, representing the lowest enumerated escapement of the past four years. Adult escapement was comprised of 111 females and 78 males, resulting in a male to female ratio of 1:1.42.

In 2005, the number of upstream migrants arriving at the fence in an advanced reproductive condition necessitated the use of a second trap box for biosampling and tagging operations at times. However, the footing for the second trap box was damaged as a result of flooding and erosion in 2005, so establishing a second sampling and tagging station in 2006 wouldn't have been an option if the need had arisen. Rebuilding the footing for a second trap box is recommended for future years, to accommodate larger potential returns.

POPULATION ESTIMATES

The single-census Petersen hypergeometric and binomial mark-recapture estimators for adults and jacks were not significantly different from each other at the α = .05 level, being approximately 550 ± 250 for adult coho and 486 ± 200 for jacks.

Taylor and Baillie (in prep.) describe the potentials for bias in generating Bayesian population estimates due to differential rates of recapture of tagged versus untagged fish, tag loss, and/or unobserved migration. They found in 2005 that the initial trend of increasing population size stabilized in the final sampling sequences after mid-November, following the dispersal of unmarked coho into the spawning sites. In 2006, all upstream migrants were enumerated at the fence until November 5th; unobserved migrants would have been restricted to periods after that date.

The modal Bayesian population estimate was 1,530 for adults + jacks (combined) (95% HPD = 1,085 - 2,395). Adults (only) ranged from 353 – 1,113 (95% HPD) with a modal estimate of 565. Jacks were estimated at 515 (95% HPD = 388 – 1,815). Stability in the posterior probability sequences for Bayesian analyses occurred only after surveys in early December, which suggests that the low numbers of recaptured fish may be a limiting factor in the utility of Bayesian mark-recapture population estimates.

These estimates indicate that 2006 was the lowest return year of the past four years (Figure 10).

The T-bar tag loss percentage (33%) was higher than previous years. The loss rate did not appear to result from faulty tag application, since a number of fish carcasses were found to have retained the T portion of the tag in the tagging site, often with a short portion of the tag stem. Again, this year, it could not be determined whether the tagging process weakened the tag or if subsequent fish movement resulted in tag breakage. Low water temperatures may make the tags brittle and prone to breakage. The same type of tags were applied this year as in previous years, for which Taylor and Baillie (in prep) recommended substitution with a shorter, thicker anchor tag with a stronger tag shaft.

The high tag loss rate had little repercussion on the population estimate since the accompanying opercular punch identified each case of tag loss, though in one carcass the operculum and associated punch was only probable.

Taylor and Baillie (in prep) showed that inter-annual variation in the distribution of spawners amongst spawning ground sites is high, particularly at site I5 and I7 (Table 15, Figure 11). In 2006, sites I7 (40%), I11 (23%) and I15 (14%) figured prominently in spawner distribution. It appears that greater utilization of the upper watershed may be inversely related to spawning at I5 (Figure 12). Taylor and Baillie (in prep) indicate that spawner distribution does not appear to be a function of run size or available spawner habitat at the latter site, or related in any obvious way to variations in hydrologic conditions, which have tended to be similar in most years of the program, as has the general pattern of coho migration into Black Creek (Figure 13). It may be useful to obtain more physical data from

these locations during future spawn surveys, including water temperature data and/or cross-sectional creek profiles, to ascertain whether temperature or bedload movement might be a factor in spawning distribution.

EXPLOITATION RATE

Commercial fisheries in southern BC have been designed to avoid coho catches, and incidentally-caught coho cannot be retained. However, non-selective sport and commercial fisheries still exist from the central coast to Alaska and in Washington State. Retention of unmarked coho by sport fishermen is now permitted in some terminal areas on the west coast of Vancouver Island. Though few Black Creek coho have occurred in these areas historically, those that were caught go largely undetected since unmarked coho are typically not scanned for the presence of a CWT. The catch is assumed to be small; fishing mortality is assumed to consist entirely of release mortality in sport fisheries.

Significant conservation measures initiated in 1997 have reduced fishing mortality on Black Creek coho. The exploitation rate estimate has averaged 1.5% between 1998 and 2005, down from an average of 73% for the years 1986-1997. However, the exploitation estimate for 2006 of 4.4% suggests a continued low catch rate for Black Creek coho and probably other Vancouver Island-based Georgia Strait coho stocks.

MARINE SURVIVAL

Taylor and Baillie (in prep) show that over the last decade, wild coho escapement to Black Creek has been highly variable and displays no significant trend but is still primarily influenced by poor ocean survival. The decline in ocean survival as seen through the 1990s, mirrors declines seen elsewhere in the Strait of Georgia basin. The 2006 estimate of 1.5% for Black Creek coho highlights the continued challenge faced by Strait of Georgia coho stocks.

RECOMMENDATIONS

This following recommendations arising out of this study may simplify data management and enhance the operational and analytical utility of similar tagging studies in the future.

JUVENILE ENUMERATION OPERATIONS

1. Continue to perform short-term CWT tag loss sampling for representative portions of the smolt migration periods. Tag loss sampling was not conducted in 2005, and must therefore be extrapolated from other years for calculation of recruitment in 2006, and possibly 2007.

2. Include adipose fin-clipping or equivalent marking to facilitate assessment of long-term CWT tag loss.

3. Trap box over-crowding during peak out-migration can result in pre-sample mortality rates of up to 5% on a given date, and potentially delay or impact tagging operations if surviving fish are significantly stressed.

Extra attention to trap management during peak migration periods may alleviate this unnecessary mortality.

ADULT ENUMERATION OPERATIONS

1. Substitute currently used 2" T-bar anchor tags (TBA-2 from Hallmark Pty Ltd.) with an unbreakable shorter, thicker anchor tag with a stronger tag shaft.

2. Rebuild the footings for the second fence trap box to accommodate more rapid processing of migrating adults.

3. Monitor a subset of marked adults for short-term (24 hr) tag-induced mortality rates to adjust number of marked fish released.

SPAWN SURVEY OPERATIONS

1. Obtain physical data from key spawn locations, including water temperature data and/or cross-sectional creek profiles, to ascertain whether temperature or bedload movement might be a factor in spawner distribution.

ACKNOWLEDGEMENTS

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TABLES

Table 1. Summary of catches and coded-wire tag releases of coho smolts by tag series and sampling date.

Tag Series	Sampling Date	Total Catch	Pre-Sample Mortalities	Number Tagged	Tagging Mortalities	Untagged Releases
080421	25APR - 09MAY	40,323	1,112	11,732	0	27,479
080420	10MAY - 16MAY	28,086	73	11,670	0	16,343
081512	17MAY - 24MAY	16,744	90	11,661	0	4,993
081315	24MAY - 31MAY	1,701	31	1,654	0	16
NO TAG	06APR - 11JUN	39,317	1	0	0	39,316
TOTAL		**126,171**	**1,307**	**36,717**	**0**	**88,147**

Table 2. Age distribution of coho smolts by sampling period. Proportional representation of age was calculated from non-random sampling within length classes and extrapolated to the measured portion of the population. RG = regenerated.

Period 1: April 6 - May 9, 2006								
Length Range (mm)	No. Sampled for Ageing	Measured Ages			Random Sample	Calculated Ages		
		1.0	2.0	RG		1.0	2.0	RG
80-84	0	0	0	0	0	NA	NA	NA
85-89	3	2	1	0	2	1	1	0
90-94	5	3	2	0	20	12	8	0
95-99	19	6	5	8	69	22	18	29
100-104	10	9	0	1	161	145	0	16
105-109	12	12	0	0	247	247	0	0
110-114	15	15	0	0	346	346	0	0
115-119	12	12	0	0	437	437	0	0
120-124	18	18	0	0	393	393	0	0
125-129	12	12	0	0	362	362	0	0
130-134	13	13	0	0	223	223	0	0
135-139	13	13	0	0	157	157	0	0
140-144	8	8	0	0	66	66	0	0
145-149	1	1	0	0	40	40	0	0
150-154	1	1	0	0	22	22	0	0
155-159	0	0	0	0	11	11 *	0	0
160-164	0	0	0	0	3	3 *	0	0
165-169	0	0	0	0	3	3 *	0	0
170-174	0	0	0	0	1	1 *	0	0
175-179	0	0	0	0	1	1 *	0	0
180-184	0	0	0	0	0	0	0	0
185-189	0	0	0	0	1	1 *	0	0
190-194	0	0	0	0	0	0	0	0
195-199	0	0	0	0	0	0	0	0
Total	142	125	8	9	2,565	2,493	27	45
Percent of Aged		94.0%	6.0%			98.9%	1.1%	

* Calculated age not supplied; assumed 1.0.

Table 2. cont'd.

Length Range (mm)	No. Sampled for Ageing	Measured Ages			Random Sample	Calculated Ages		
		1.0	2.0	RG		1.0	2.0	RG
	Period 2: May 10 - June 8, 2006							
80-84	0	0	0	0	0	NA	NA	NA
85-89	0	0	0	0	11	NA	NA	11 ▪
90-94	0	0	0	0	112	NA	NA	112 ▪
95-99	1	0	0	1	363	0	0	363
100-104	18	18	0	0	625	625	0	0
105-109	20	20	0	0	691	691	0	0
110-114	30	29	0	1	539	521	0	18
115-119	24	24	0	0	405	405	0	0
120-124	23	23	0	0	220	220	0	0
125-129	5	5	0	0	91	91	0	0
130-134	8	6	0	2	47	35	0	12
135-139	4	4	0	0	22	22	0	0
140-144	7	7	0	0	8	8	0	0
145-149	1	1	0	0	3	3	0	0
150-154	2	1	1	0	2	2 *	NA	NA
155-159	0	0	0	0	0	NA	NA	NA
160-164	0	0	0	0	1	1 *	NA	NA
165-169	0	0	0	0	0	NA	NA	NA
170-174	0	0	0	0	0	NA	NA	NA
175-179	0	0	0	0	1	1 *	NA	NA
180-184	0	0	0	0	0	NA	NA	NA
185-189	0	0	0	0	0	NA	NA	NA
190-194	0	0	0	0	0	NA	NA	NA
195-199	0	0	0	0	0	NA	NA	NA
Total	**143**	**138**	**1**	**4**	**3,141**	**2,625**	**0**	**516**
Percent of Aged		**99.3%**	**0.7%**			**100%**	**0%**	

▪ Calculated age not supplied; assumed RG.

* Calculated age not supplied; assumed 1.0.

Table 3. Summary of fork lengths (mm) by sampling period and age of coho smolts. Data are from non-random sampling for age determinations. RG = regenerated.

Age	Period	Mean FL	SD	Min	Max	N
1.0	1	115.9	14.3	84.0	148.0	125
	2	112.8	11.3	96.0	148.0	138
2.0	1	89.9	2.8	85.0	92.0	8
	2	150.0		NA	NA	1
RG	1	94.0	1.1	93.0	96.0	9
	2	114.3	15.6	94.0	127.0	4
ALL	**ALL**	**113.1**		**84.0**	**148.0**	**285**

Table 4. Age/sex composition of coho adults captured at the fence.

AGE	Data	F	J	M	Grand Total
0M	Count		112	3	115
	Average		376.7	463.3	379.0
	Minimum		298	440	298
	Maximum		460	480	480
1M	Count	35	4	18	57
	Average	710.1	405.0	665.1	674.5
	Minimum	500	390	460	390
	Maximum	820	420	770	820
2.2	Count		88		88
	Average		374.7		374.7
	Minimum		280		280
	Maximum		440		440
3.2	Count	23		20	43
	Average	697.9		727.2	711.5
	Minimum	525		570	525
	Maximum	800		870	870
4.3	Count	2		1	3
	Average	685.0		580.0	650.0
	Minimum	650		580	580
	Maximum	720		580	720
(blank)	Count	51	192	29	272
	Average	688.1	375.7	697.8	468.6
	Minimum	380	292	440	292
	Maximum	780	440	820	820
Count		111	396	71	578
Average		697.0	376.1	686.2	475.8
Minimum		380	280	440	280
Maximum		820	460	870	870

Table 5.   Summary of daily escapement of adult and jack coho through the counting fence 2006.

DATE	Females	Males	Jacks	Total
05/11/2006	5	14	62	81
06/11/2006	47	28	217	292
07/11/2006	6	5	49	60
08/11/2006			2	2
10/11/2006	44	26	32	102
11/11/2006	7	4	19	30
12/11/2006		1	1	2
13/11/2006			6	6
14/11/2006			1	1
15/11/2006	2			2
Total	**111**	**78**	**389**	**578**

Table 6. Summary of fork length (mm) data for adult and jack coho.

Fork Length Data (mm)	Females	Males	Jacks	Total
Count	111	78	389	578
Average	697.0	664.4	374.9	475.8
Minimum	380	440	280	280
Maximum	820	870	431	870
Std Deviation	72.7	120.4	29.8	156.9

Table 7. Summary of adult and jack movement through the counting fence and mark application.

Sex	Total captured	T-bar tagged	Punched
Male	78	78	78
Female	111	111	111
Jack	389	389	389
Total	**578**	**578**	**578**

Table 8. Relative condition of maturity of the Black Creek escapement as assessed subjectively at the counting fence.

	Number of coho		
Condition	**Male**	**Female**	**Jack**
Silver	0	0	0
Green	0	4	5
Mature	1	16	6
Ripe	77	91	378
ALL	78	111	389

Table 9. Summary of recoveries of adult and jack coho from sampling sites.

Location	Female	Male	Adult Sex Unknown	Jacks	Age and Sex Unknown	Total
I2	1	1		2		**4**
I4	2					**2**
I5		1				**1**
I6	1					**1**
I7	1		12	1		**14**
I11	2	3		1	2	**8**
I15	2		3			**5**
Total	**9**	**5**	**15**	**4**	**2**	**35**

Table 10. Summary of movement of coded-wire tagged coho through the Black Creek fence by sex. No adipose fin clipping was done on the brood for 2006 adult returns.

Sex	**CWT present**	**CWT absent**	**Not checked**[1]	**Total**
F	18	91	2	111
M	15	62	1	78
J	83	305	1	389
Total	**116**	**458**	**4**	**578**

[1] Some fish were not wanded at the fence

Table 11. Estimated marine survival and associated exploitation rate in marine
fisheries.

Return Year	% Smolt to Adult Survival	% Exploitation
1976	19.0[1]	91.5[2]
1977	19.8[1]	83.6[2]
1978	-	-
1979	-	-
1980	-	-
1981	-	-
1982	-	-
1983	-	-
1984	-	-
1985	-	-
1986	12.5	72.7
1987	11.4	84.7
1988	12.7	67.6
1989	11.4	69.7
1990	12.4	71.3
1991	7.6	67.7
1992	12.2	76.7
1993	6.3	73.9
1994	5.7	79.0
1995	4.6	56.7
1996	3.4	70.3
1997	4.4	54.1
1998	4.5	3.0
1999	1.7	3.0
2000	2.2	3.0
2001	7.4	4.6
2002	4.8	5.9
2003	2.8	4.3
2004	4.3	4.3
2005	1.4	4.4
2006	1.5	4.4

[1] Probable under-estimate due to probable under-estimate of escapement.
[2] Probable over-estimate due to probable under-estimate of escapement.

Table 12. Mark application and recovery by sex for the 2006 Black Creek escapement, comparing recovery rates for tagged and left opercular punched coho.

Sex	Applied		Recovered		% Recovery	
	T-Bar[1]	L-Punch	T-Bar[1]	L-Punch	T-Bar[1]	L-Punch
M	78	78	2	0	2.56%	0.00%
F	111	111	3	1	2.70%	0.90%
J	389	389	3	0	0.77%	0.00%
Adult[2]	NA	NA	1	2	0.55%	1.10%
Undefined[3]			1[4]	0		
Total Adult	189		6[5]	3		
Male : Female	1 : 1.4		1 : 1.5			

[1] All fish caught at the fence had a T-Bar tag applied and left opercular punch.
[2] Sex was not determined.
[3] Sex and adult or jack stage was not reported.
[4] Tag number was not recovered.
[5] Undefined count was not included in adult count, and not factored into t-bar tag loss percentage, thus tag loss = 3/ (6+3) = 33%.

Table 13. Summary of adult and jack coho recoveries on the spawning grounds, 2006.

Date	Tag	adult	female	jack	male	NA	Total
09/11/2006	211			1			1
14/11/2006	158		1				1
18/11/2006	437			1			1
23/11/2006	390		1				1
28/11/2006	205			1			1
	441				1		1
	76/77				1		1
	no		1			1	2
29/11/2006	535		1				1
	no	1					1
	punched	2					2
02/12/2006	165	1					1
	no	11	1	1	2		15
	tagged					1	1
03/12/2006	no		1				1
05/12/2006	no		1		1		2
07/12/2006	no		1				1
	punched		1				1
Total		**15**	**9**	**4**	**5**	**2**	**35**

Table 14. Coho marks and recoveries, for use in Bayesian population estimation (T = time interval, C = captured fish in sample, M = total marks available at start of time interval; R = recovered tags in sample; Date = date of recapture).

Adults and Jacks

T	C	M	R	Date
1	1	435	1	09-Nov
2	1	574	1	14-Nov
3	1	576	1	18-Nov
4	1	575	1	23-Nov
5	5	574	3	28-Nov
6	4	571	3	29-Nov
7	17	568	2	02-Dec
8	1	566	0	03-Dec
9	2	566	0	05-Dec
10	2	566	1	07-Dec

Adults Only

T	C	M	R	Date
1	0	105	0	09-Nov
2	1	187	1	14-Nov
3	0	188	0	18-Nov
4	1	188	1	23-Nov
5	4	187	2	28-Nov
6	4	185	3	29-Nov
7	16	182	2	02-Dec
8	1	180	0	03-Dec
9	2	180	0	05-Dec
10	2	180	1	07-Dec

Jacks Only

T	C	M	R	Date
1	1	330	1	09-Nov
2	0	387	0	14-Nov
3	1	388	1	18-Nov
4	0	387	0	23-Nov
5	1	387	1	28-Nov
6	0	386	0	29-Nov
7	1	386	0	02-Dec
8	0	386	0	03-Dec
9	0	386	0	05-Dec
10	0	386	0	07-Dec

Table 15. Comparison of the proportion of recoveries of adult coho from sites in the Black Creek watershed, between 2000 and 2006.

Sub-basin	Site	Year						
		2000	2001	2002	2003	2004	2005	2006
1	E1	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%
1	I2	3.0%	3.3%	9.4%	7.8%	3.3%	7.0%	11.0%
3	I3	0.5%	0.0%	5.4%	9.0%	2.6%	7.0%	0.0%
8	I4	20.2%	8.7%	6.3%	9.6%	12.6%	4.5%	6.0%
5	I5	41.4%	7.2%	4.3%	51.8%	12.1%	25.5%	2.0%
5	I6	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
8	I7	1.5%	21.9%	13.7%	13.9%	3.7%	3.2%	40.0%
10	I9	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10	I10	15.8%	2.8%	10.3%	1.8%	7.3%	4.5%	0.0%
13	I11	6.4%	11.1%	13.4%	1.8%	9.3%	11.5%	23.0%
13	I12	0.0%	20.0%	16.6%	1.2%	22.0%	17.2%	0.0%
12	I14	8.4%	20.1%	18.4%	1.2%	21.4%	15.3%	0.0%
5	I15	2.5%	4.9%	2.0%	1.8%	5.7%	4.5%	14.0%

FIGURES
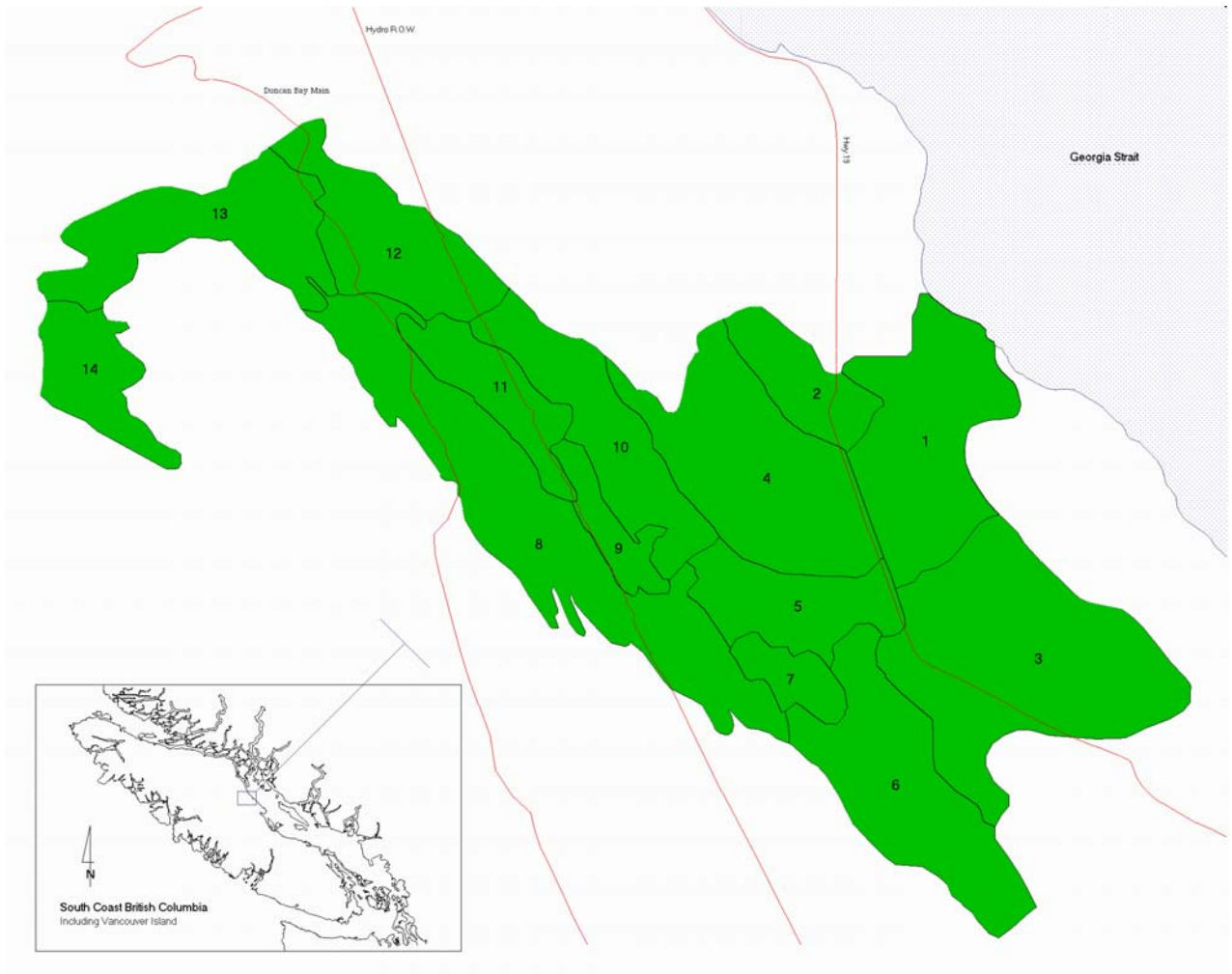
Figure 1. The Black Creek watershed and sub-basin boundaries (after Brown et al. 1999).
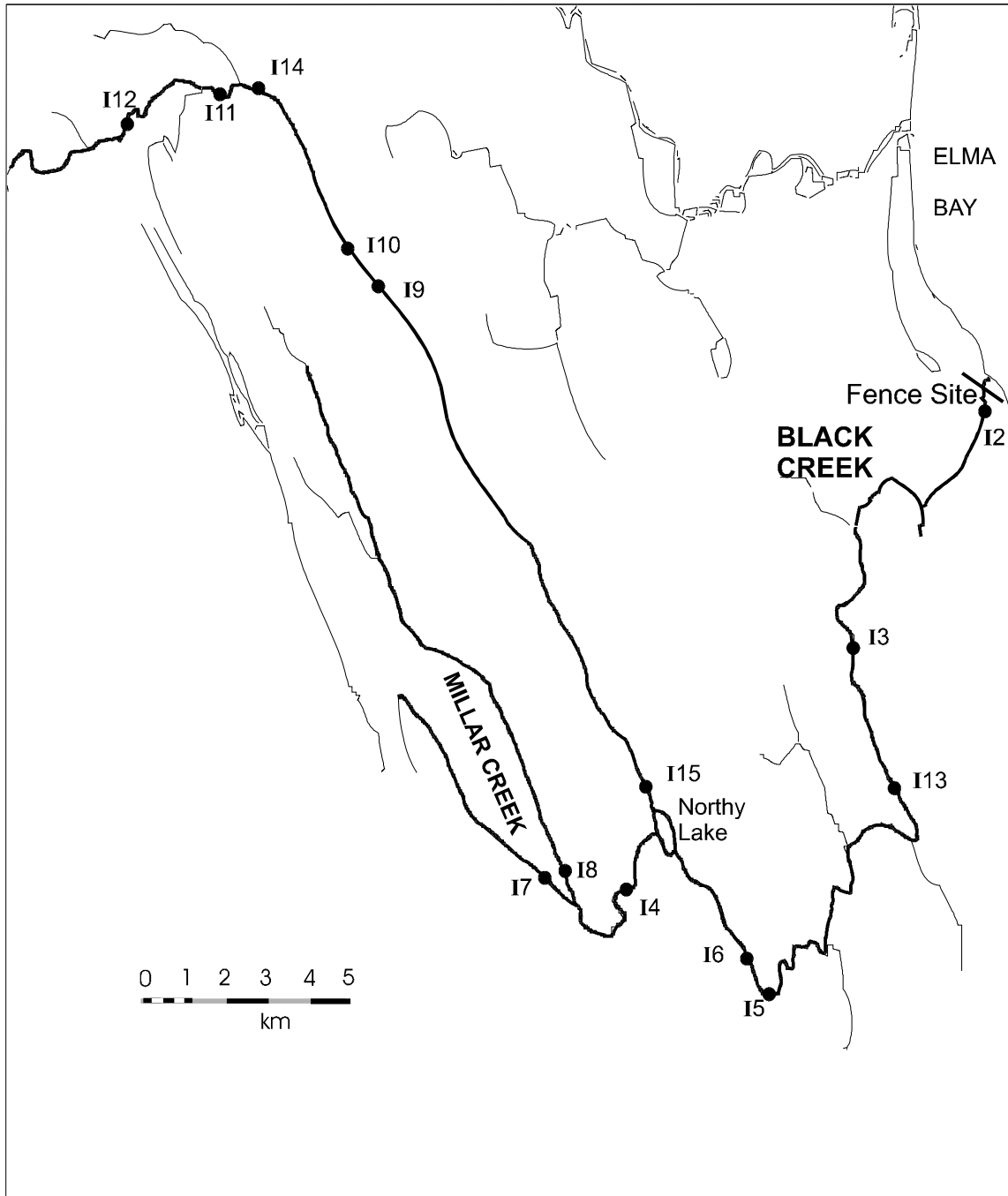
Figure 2. The Black Creek system, showing the locations of the fence and recovery
sampling sites.
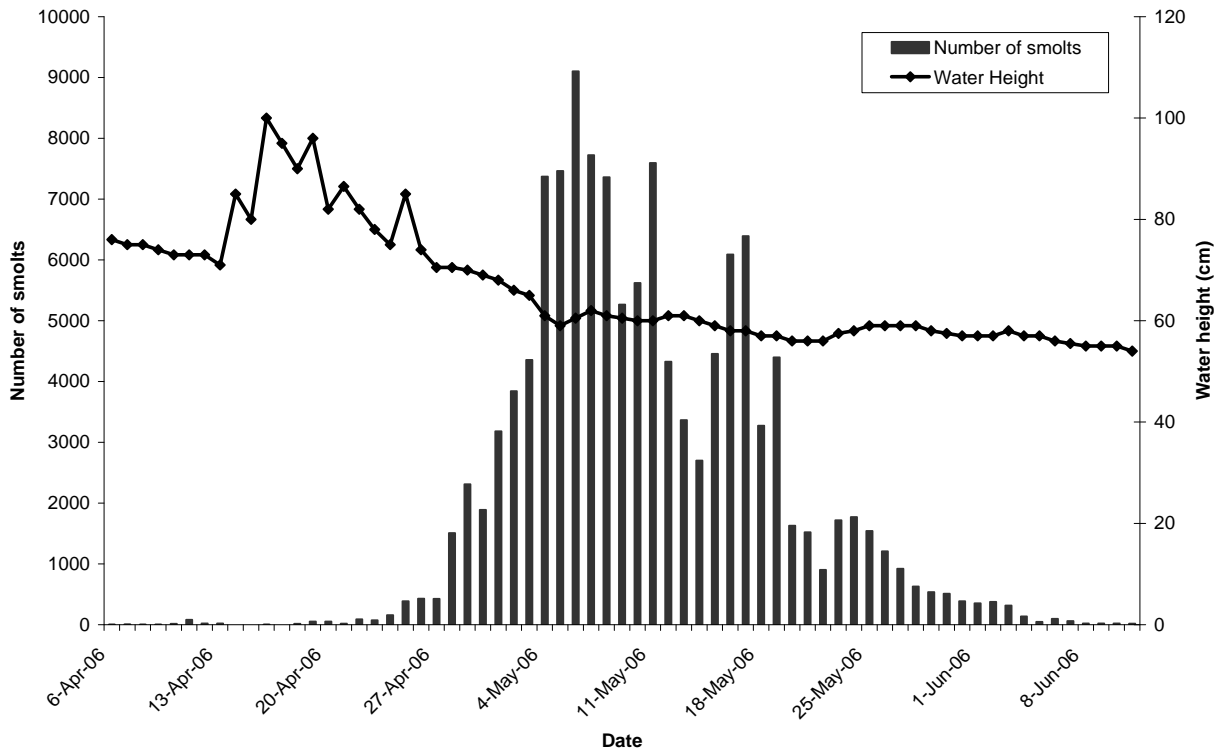
Figure 3. Daily smolt out-migration from Black Creek and water levels during the 2006 program.
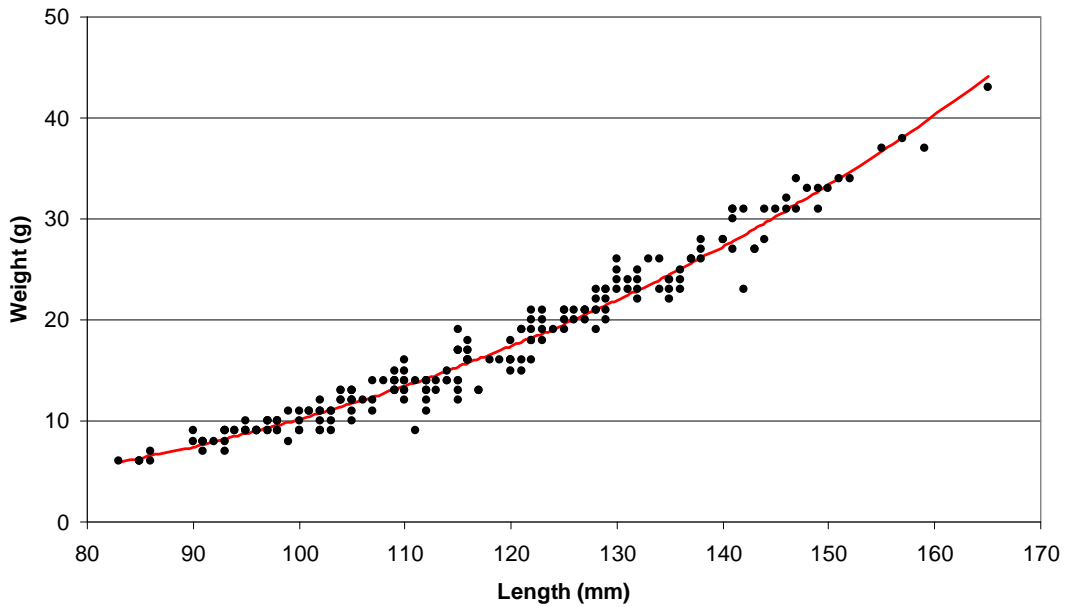
Figure 4. Black Creek coho smolts fork length-weight relationship, 2006 (W = 0.0000139 * $L^{2.932}$; r^2 = .96; n = 212).
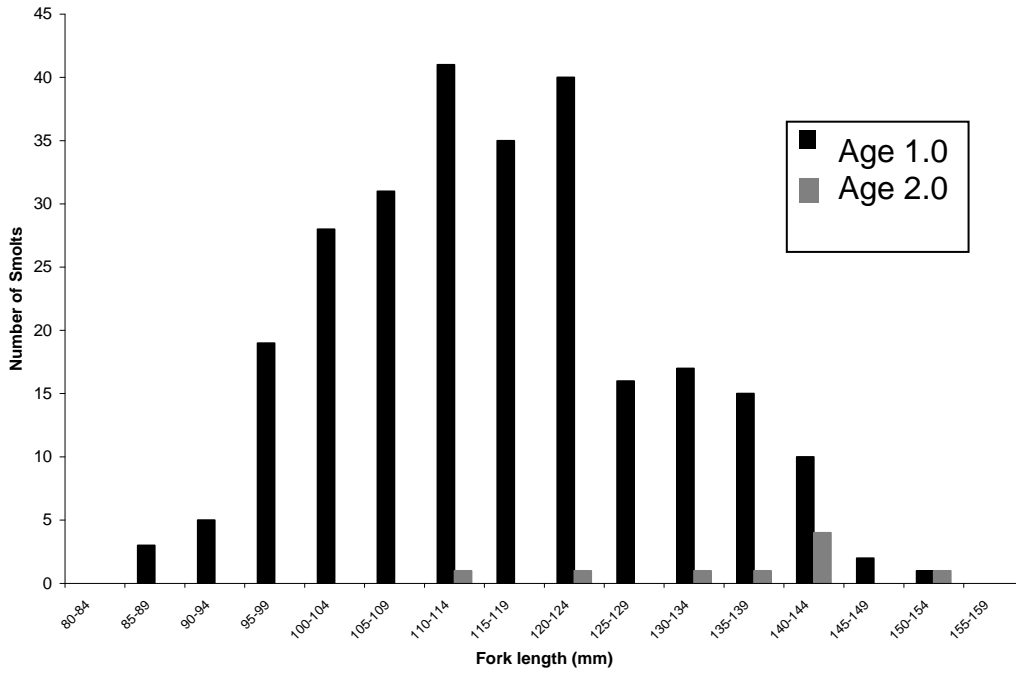
Figure 5. Length at age for coho smolts across all sampling periods, 2006.
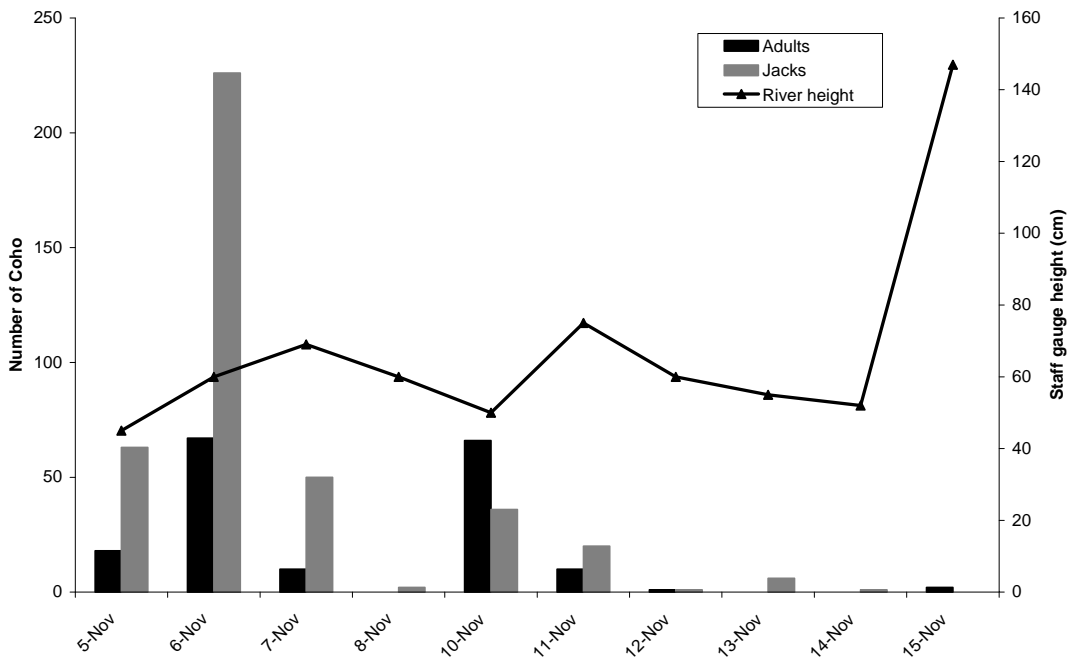
Figure 6. Adult and jack coho escapement and corresponding water levels, 2006.
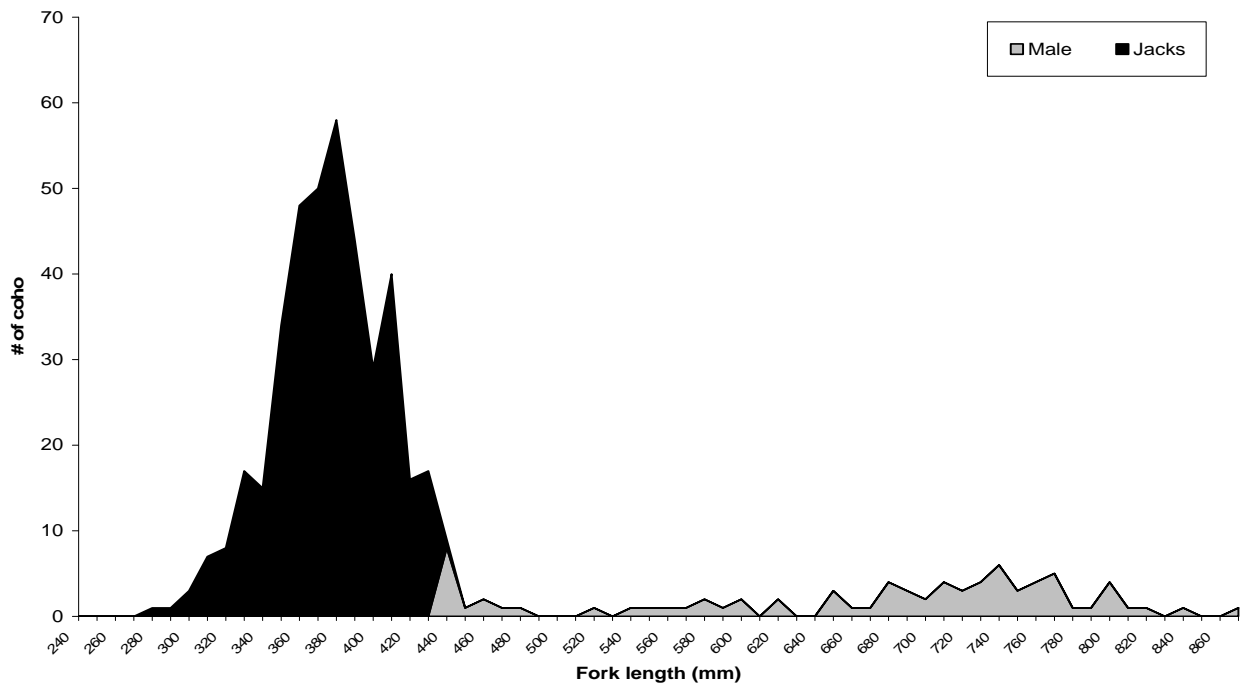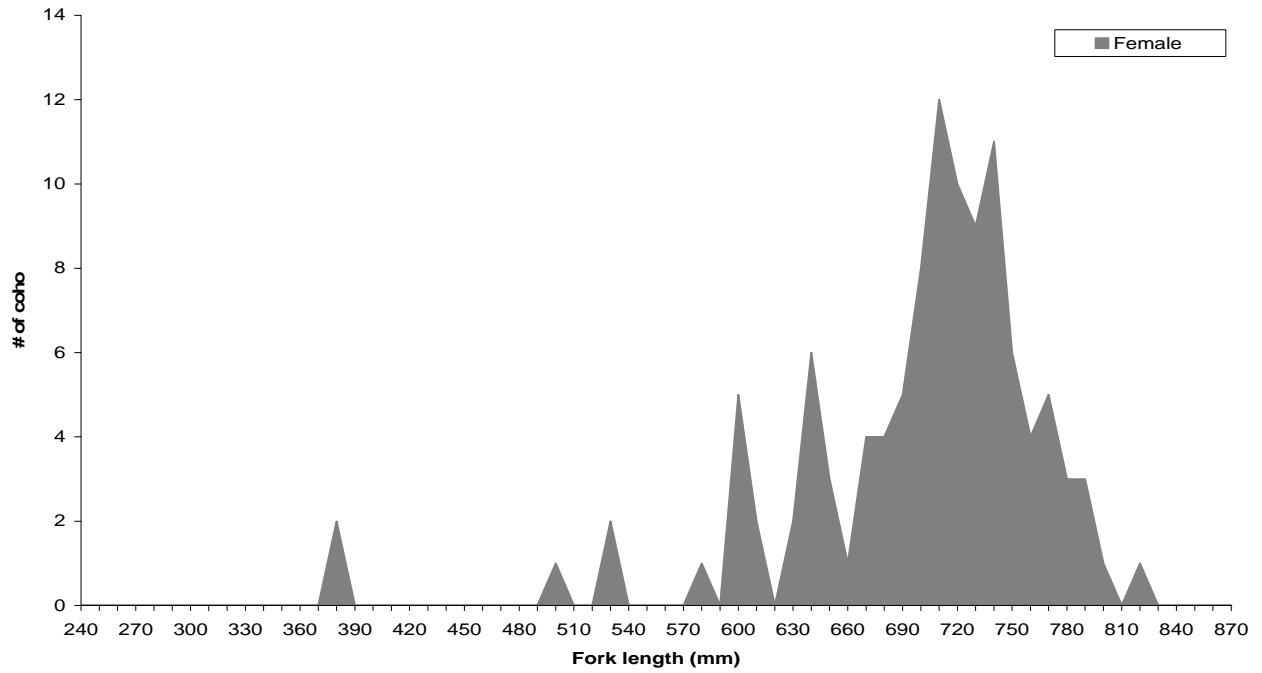
Figure 7. Length-frequency distribution of adult females (top) and adult males and jack coho (bottom), 2006.

Figure 8. Sequential plots of the posterior distribution of the Bayesian population estimate for the total coho adults and jacks (1,530, top), and adults only (565, bottom left), and jacks only (515, bottom right) from T-bar tagged and punched releases. Final sequence is depicted by solid line.

Black Creek Adults + Jacks 2006

Black Creek Adults 2006
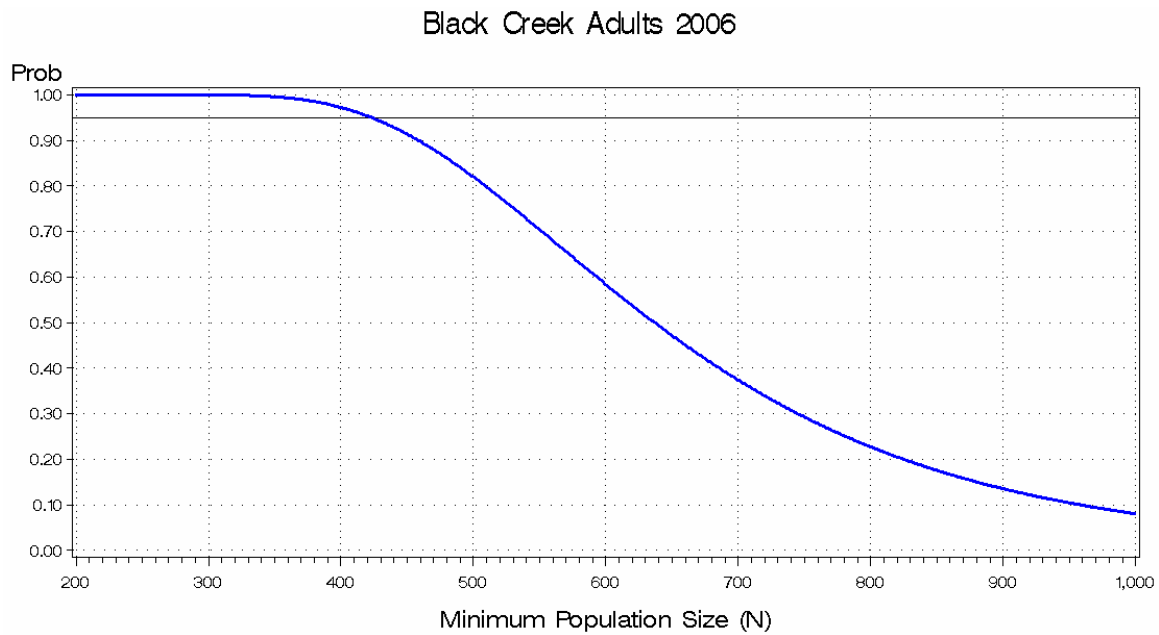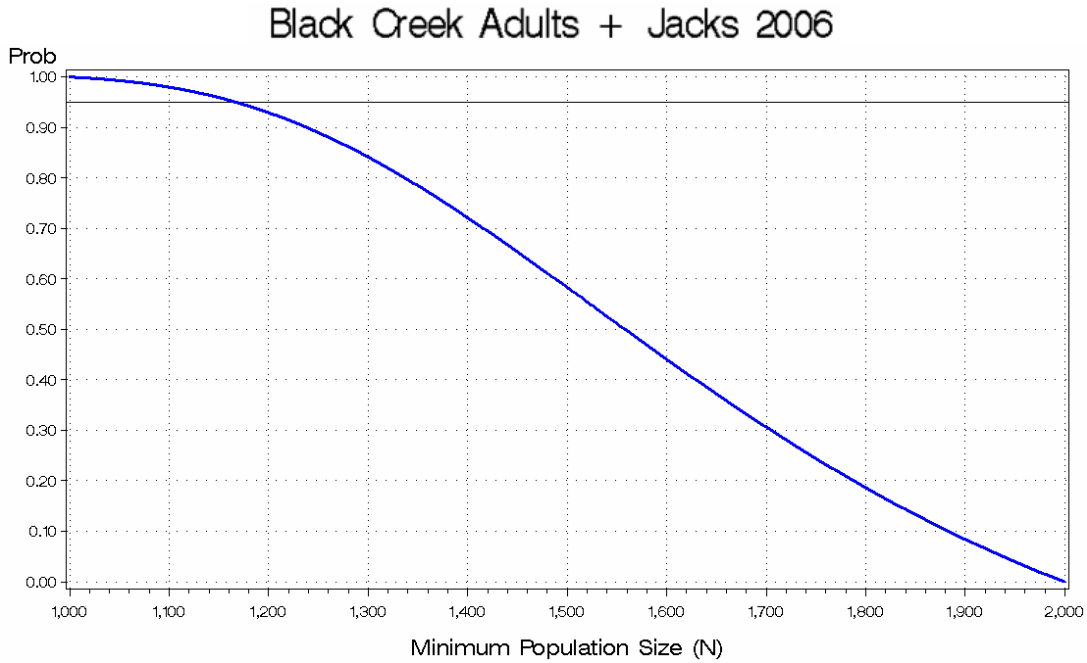
Figure 9. Minimum population size estimates and precision based on posterior distribution of the Bayesian population estimate for total coho adults and jacks (Pop > 1,184, P = 0.95, top), and adults only (Pop > 424, P = 0.95, bottom).
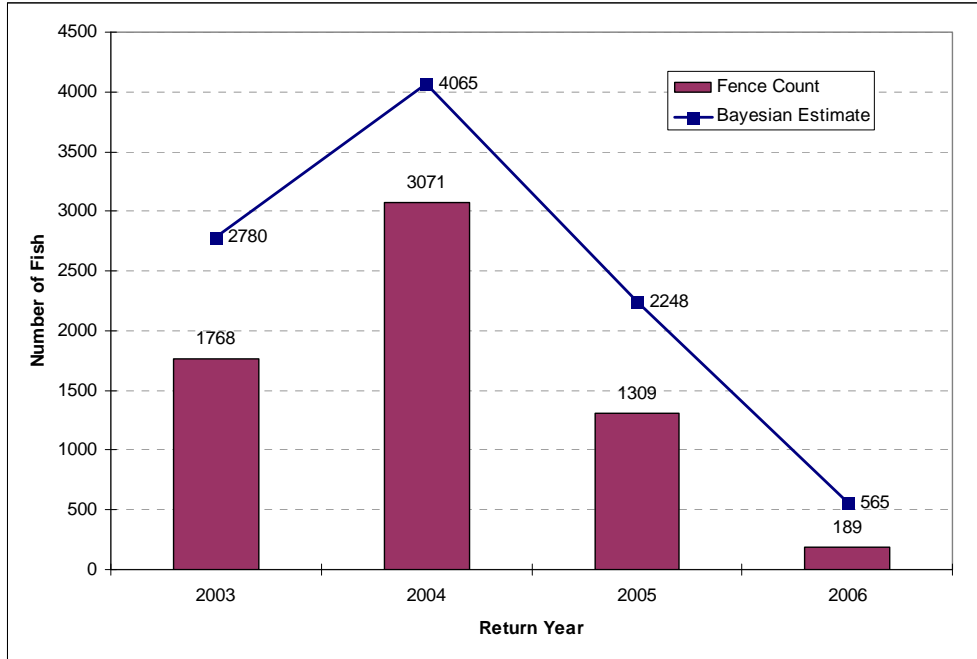
Figure 10. Black Creek adult coho fence counts and Bayesian population estimates, 2003-2006.
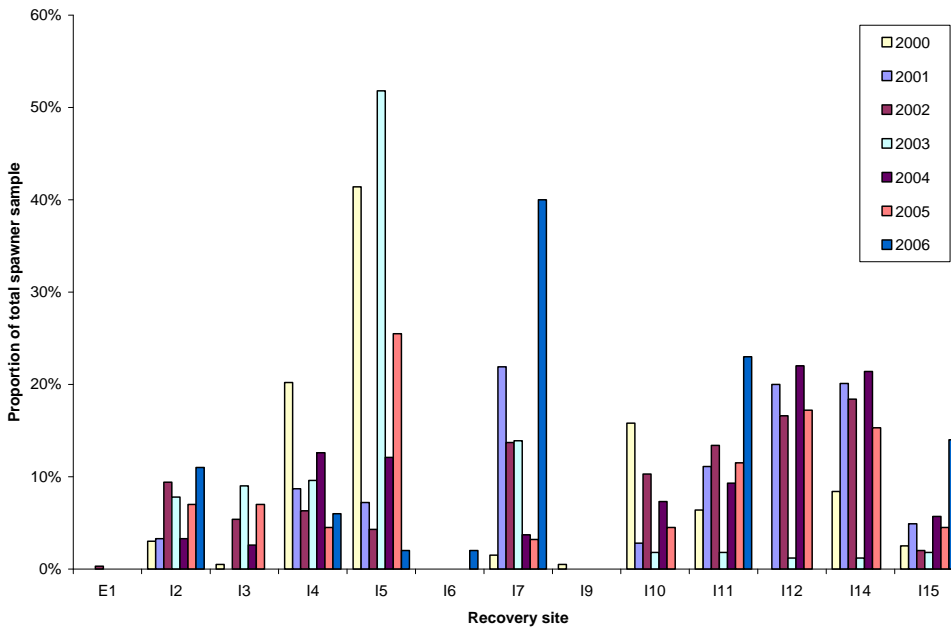
Figure 11. Annual utilization of spawning sites within the Black Creek watershed based on carcass sampling.
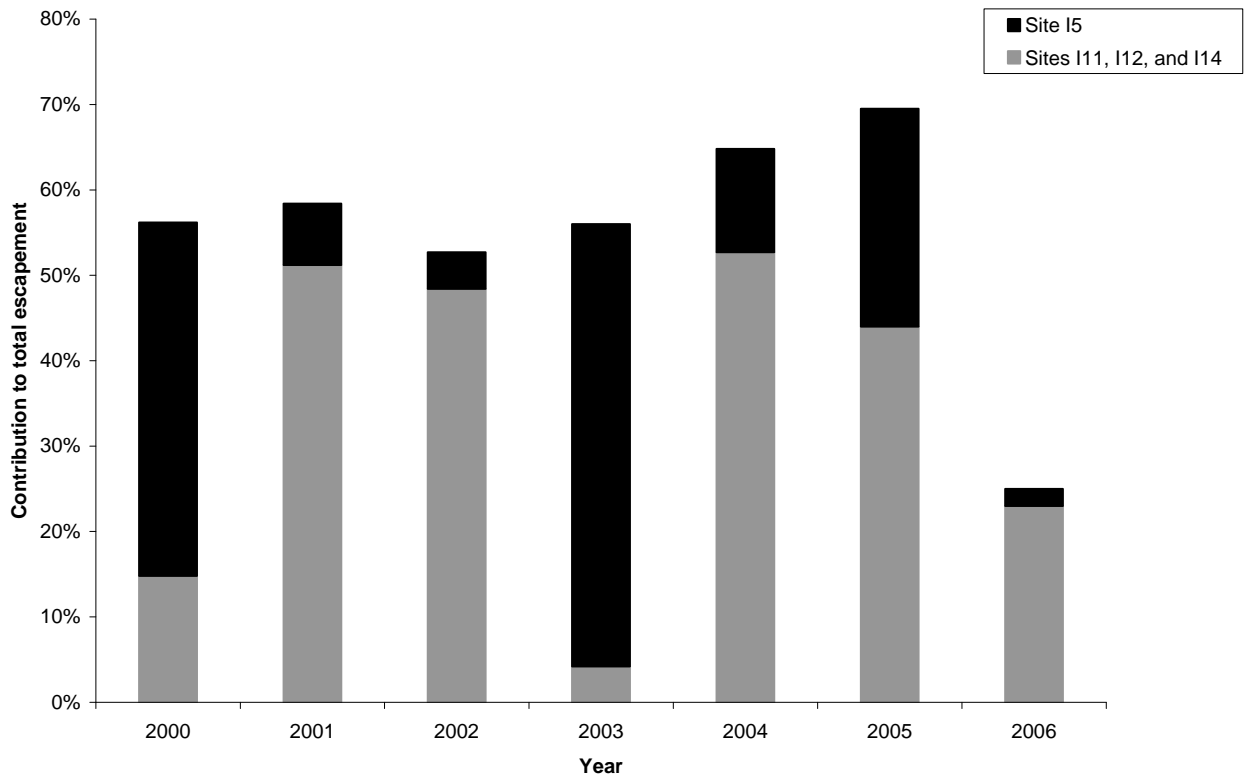
Figure 12. The relative contributions made by site I5 and sites I11, I12 and I14 to escapements between 2000 and 2006.
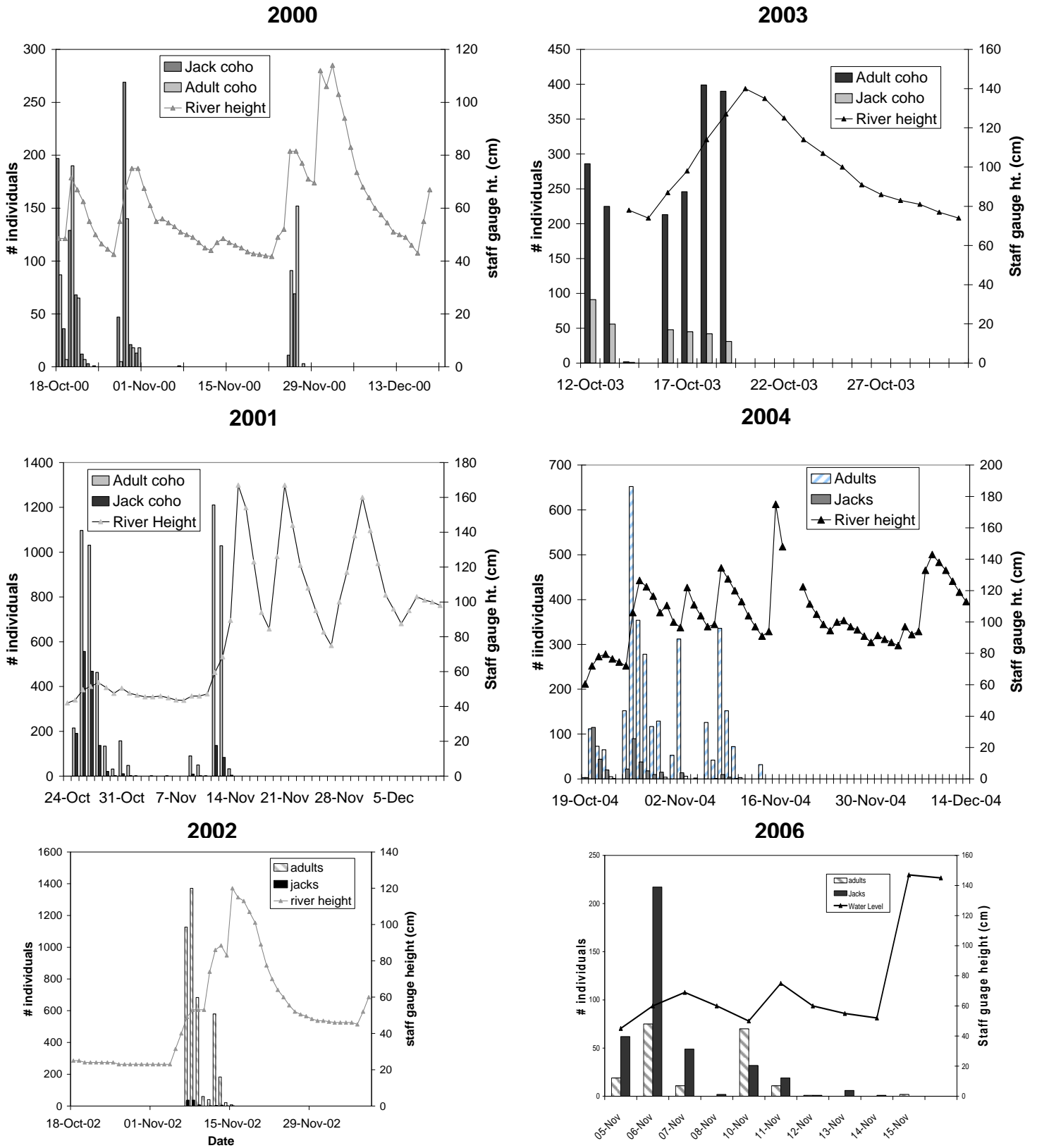
Figure 13. Escapement timing and river height from 2000 to 2006.

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APPENDICES

Appendix A. Daily catch of coho smolts and fry at the Black Creek fence, 2006.

Date	Total	Presample Morts	CWTs Released	CWT Morts	UnCWT'd	Fry	Parr	CWT Code
6-Apr	2	0	0	0	2	1	0	
7-Apr	5	0	0	0	5	0	0	
8-Apr	2	0	0	0	2	0	0	
9-Apr	4	0	0	0	4	1	0	
10-Apr	14	0	0	0	14	0	0	
11-Apr	82	1	0	0	81	0	0	
12-Apr	21	0	0	0	21	0	0	
13-Apr	22	0	0	0	22	0	0	
14-Apr	0	0	0	0	0	0	0	
15-Apr	0	0	0	0	0	0	0	
16-Apr	1	0	0	0	1	1	0	
17-Apr	0	0	0	0	0	0	0	
18-Apr	15	0	0	0	15	5	0	
19-Apr	53	0	0	0	53	1	0	
20-Apr	53	0	0	0	53	0	0	
21-Apr	18	0	0	0	18	0	0	
22-Apr	90	0	0	0	90	0	0	
23-Apr	72	0	0	0	72	0	0	
24-Apr	157	0	0	0	157	0	0	
25-Apr	388	0	388	0	0	2	0	080421
26-Apr	429	0	429	0	0	2	0	080421
27-Apr	425	0	0	0	425	0	0	
28-Apr	1508	0	0	0	1508	0	0	
29-Apr	2311	0	0	0	2311	2	0	
30-Apr	1890	0	0	0	1890	3	0	
1-May	3181	38	1399	0	1744	2	0	080421
2-May	3841	6	1512	0	2323	0	0	080421
3-May	4355	5	1532	0	2818	1	0	080421
4-May	7369	60	1403	0	5906	6	0	080421
5-May	7463	299	2214	0	4950	0	0	080421

Date								
6-May	9103	423	0	0	8680	10	0	
7-May	7722	247	0	0	7475	2	0	
8-May	7360	30	1020	0	6310	4	0	080421
9-May	5267	4	1835	0	3428	2	0	080421
10-May	5621	7	1044	0	4570	0	0	080420
11-May	7595	13	3092	0	4490	2	0	080420
12-May	4326	10	3489	0	827	5	0	080420
13-May	3365	0	0	0	3365	0	0	
14-May	2700	0	0	0	2700	4	0	
15-May	4455	19	2106	0	2330	12	0	080420
16-May	6089	24	1939	0	4126	13	0	080420
17-May	6391	14	3037	0	3340	26	0	081512
18-May	3272	12	3100	0	160	26	0	081512
19-May	4397	46	3013	0	1338	38	0	081512
20-May	1628	0	0	0	1628	12	0	
21-May	1520	0	0	0	1520	21	0	
22-May	902	0	0	0	902	17	0	
23-May	1717	18	1554	0	145	14	0	081512
24-May	1771	26	1725	0	20	42	0	081512 - 957 / 081315 - 768
25-May	1541	0	0	0	1541	40	0	
26-May	1208	0	0	0	1208	70	0	
27-May	920	0	0	0	920	45	0	
28-May	629	0	0	0	629	50	0	
29-May	536	0	0	0	536	48	0	
30-May	511	0	505	0	6	36	0	081315
31-May	386	5	381	0	0	30	0	081315
1-Jun	353	0	0	0	353	35	0	
2-Jun	375	0	0	0	375	45	0	
3-Jun	316	0	0	0	316	33	0	
4-Jun	138	0	0	0	138	30	0	
5-Jun	47	0	0	0	47	5	0	
6-Jun	98	0	0	0	98	9	0	
7-Jun	59	0	0	0	59	8	0	
8-Jun	20	0	0	0	20	24	0	
9-Jun	23	0	0	0	23	15	0	
10-Jun	20	0	0	0	20	8	0	
11-Jun	19	0	0	0	19	7	0	
Totals	**126171**	**1307**	**36717**	**0**	**88147**	**815**	**0**	

Appendix A, continued. Daily catch of coho smolts and fry at the Black Creek fence.

Appendix B. Daily catch of other species at the Black Creek fence.

Date	CT Smolt Total (unclipped)	CT Parr Total (no clip)	CT Adult (clipped)	CT Adult (no clip)	CT Adult Total	Chum Fry	Rain bow	Cottus asper	Cottus aleuticus	Stickle-back	Lamprey
6-Apr	0	0	0	0	0	0	0	0	0	0	0
7-Apr	0	0	0	0	0	0	0	0	0	0	0
8-Apr	0	0	0	0	0	0	0	0	0	0	0
9-Apr	0	0	0	0	0	0	0	0	0	0	0
10-Apr	0	0	0	0	0	0	0	0	0	0	0
11-Apr	0	0	0	0	0	0	0	0	0	0	0
12-Apr	0	0	0	1	0	0	0	0	0	0	0
13-Apr	0	0	0	0	0	0	0	0	0	0	0
14-Apr	0	0	0	3	0	0	0	0	0	0	0
15-Apr	0	0	0	0	0	0	0	0	0	0	0
16-Apr	0	0	0	6	0	0	0	0	0	0	0
17-Apr	0	0	0	0	0	0	0	0	0	0	0
18-Apr	0	0	0	0	0	0	0	0	0	0	0
19-Apr	0	0	0	0	0	0	0	0	0	0	0
20-Apr	0	0	0	0	0	0	0	0	0	0	0
21-Apr	0	0	0	0	0	0	0	0	0	0	0
22-Apr	0	0	0	0	0	0	0	0	0	0	0
23-Apr	0	0	0	0	0	0	0	0	0	0	0
24-Apr	0	0	0	3	0	0	0	0	0	0	0
25-Apr	0	0	0	2	0	0	0	0	0	0	0
26-Apr	0	0	0	0	0	0	0	0	1	0	0
27-Apr	0	0	0	1	0	0	0	0	0	0	0
28-Apr	0	0	0	3	0	0	1	0	0	0	1
29-Apr	0	0	0	29	0	0	2	0	1	0	0
30-Apr	0	0	0	3	0	0	1	0	2	0	0
1-May	0	0	0	4	0	0	0	0	2	0	0
2-May	0	0	0	24	0	1	0	0	1	0	0
3-May	0	0	0	36	0	0	1	0	0	0	1
4-May	0	0	0	66	0	0	2	0	4	0	5
5-May	0	0	0	134	0	0	1	0	3	0	2
6-May	0	0	0	25	0	0	5	0	2	0	2

7-May	0	0	0	15	0	0	3	0	0	0	0
8-May	0	0	0	116	0	0	0	0	3	0	1
9-May	0	0	0	46	0	0	0	0	1	0	0
10-May	0	0	0	85	0	0	0	0	0	0	0
11-May	0	0	0	52	0	0	1	0	0	0	0
12-May	0	0	0	80	0	0	1	0	3	0	3
13-May	0	0	0	33	0	0	0	0	1	0	1
14-May	0	0	0	17	0	0	1	0	0	0	1
15-May	0	0	0	25	0	0	0	0	0	0	0
16-May	0	0	0	43	0	0	1	0	0	0	0
17-May	0	0	0	68	0	0	0	0	0	0	4
18-May	0	0	0	16	0	0	0	1	0	0	0
19-May	0	0	0	43	0	0	0	0	1	0	5
20-May	0	0	0	24	0	0	0	0	3	0	1
21-May	0	0	0	33	0	0	0	0	2	0	0
22-May	0	0	0	6	0	0	0	0	1	0	2
23-May	0	0	0	35	0	0	0	0	3	0	8
24-May	0	0	0	5	0	0	0	1	0	0	0
25-May	0	0	0	6	0	0	0	0	0	0	2
26-May	0	0	0	7	0	0	0	0	0	0	2
27-May	0	0	0	6	0	0	0	0	0	0	3
28-May	0	0	0	3	0	0	0	0	0	0	1
29-May	0	0	0	4	0	0	0	0	0	0	0
30-May	0	0	0	1	0	0	1	0	2	0	0
31-May	0	0	0	9	0	0	1	0	1	0	0
1-Jun	0	0	0	1	0	0	0	0	0	0	1
2-Jun	0	0	0	7	0	0	0	0	0	0	1
3-Jun	0	0	0	3	0	0	0	0	0	0	1
4-Jun	0	0	0	3	0	0	0	0	0	0	1
5-Jun	0	0	0	6	0	0	0	0	1	0	0
6-Jun	0	0	0	7	0	0	0	0	0	0	0
7-Jun	0	0	0	2	0	0	0	0	1	0	4
8-Jun	0	0	0	2	0	0	0	0	0	0	4
9-Jun	0	0	0	4	0	0	0	0	1	0	1
10-Jun	0	0	0	2	0	0	0	0	2	0	3
11-Jun	0	0	0	2	0	0	0	0	0	0	0
Totals	**0**	**0**	**0**	**1157**	**0**	**1**	**22**	**2**	**42**	**0**	**61**

Appendix B, continued. Daily catch of other species at the Black Creek fence.

Appendix C. Daily water level and temperature during the spring outmigration.

Date	Crew	Water Level (cm)	Water Temp (°C)	Comments
6/Apr/2006	LD+MD	76	8.3	sunny
7/Apr/2006	LD+MD	75	8.3	sunny
8/Apr/2006	LD+AP	75	9.1	overcast
9/Apr/2006	LD+AP	74	10.2	rain
10/Apr/2006	LD+MD	73	9.8	rain
11/Apr/2006	PZ+DN	73	11.5	sunny/warm
12/Apr/2006	PZ+DN	73	11.0	overcast
13/Apr/2006	LD+MD	71	9.4	rain
14/Apr/2006	LD+JD	85	7.8	rain
15/Apr/2006	LD+JD	80	8.0	rain
16/Apr/2006	LD+MD	100	7.4	rain
17/Apr/2006	LD+MD	95	7.9	overcast
18/Apr/2006	PZ+DN	90	9.0	overcast
19/Apr/2006	PZ+DN	96	9.0	overcast
20/Apr/2006	LD+MD	82	8.3	rain
21/Apr/2006	LD+MD	87	7.6	sunny
22/Apr/2006	LD+MD	82	7.8	sunny
23/Apr/2006	LD+MD	78	8.2	sunny
24/Apr/2006	LD+MD	75	9.1	sunny
25/Apr/2006	PZ+DN	85	11.0	sunny
26/Apr/2006	PZ+DN	74	11.5	overcast
27/Apr/2006	LD+MD	71	10.7	rain
28/Apr/2006	LD+AG	71	10.4	sunny
29/Apr/2006	LD+AG	70	10.1	overcast
30/Apr/2006	LD+AG	69	9.4	sunny
1/May/2006	LD+AG	68	9.6	sunny/windy
2/May/2006	PZ+TC	66	9.0	sunny
3/May/2006	PZ+IM	65	9.5	sunny
4/May/2006	PZ+DN	61	10.5	sunny
5/May/2006	PZ+DN	59	11.0	sunny
6/May/2006	LD+AG	61	12.2	sunny
7/May/2006	LD+AG	62	10.4	sunny
8/May/2006	LD+AG	61	8.6	overcast
9/May/2006	DN+LD	61	8.8	sunny
10/May/2006	PZ+DN	60	11.0	sunny
11/May/2006	PZ+DN	60	11.5	sunny
12/May/2006	PZ+DN	61	10.5	sunny
13/May/2006	LD+AG	61	8.3	overcast
14/May/2006	LD+AG	60	9.1	overcast
15/May/2006	PZ+DN	59	10.1	sunny
16/May/2006	DN+AG	58	14.2	sunny
17/May/2006	PZ+DN	58	14.5	sunny
18/May/2006	PZ+DN	57	15.8	sunny
19/May/2006	DN+AG	57	14.0	sunny
20/May/2006	LD+AG	56	14.3	sunny/windy

Appendix C, continued. Daily water level and water temperature during the spring outmigration.

Date	Crew	Water Level (cm)	Water Temp (°C)	Comments
21/May/2006	LD+AG	56	14.1	sunny/windy
22/May/2006	LD+AG	56	14.3	sunny
23/May/2006	PZ+DN	58	14.8	sunny
24/May/2006	PZ+DN	58	13.5	sunny
25/May/2006	LD+AG	59	12.6	sunny
26/May/2006	LD+AG	59	12.1	sunny
27/May/2006	LD+AG	59	12.8	sunny
28/May/2006	LD+AG	59	13.8	rain
29/May/2006	LD+AG	58	13.9	rain
30/May/2006	PZ+DN	58	15.5	sunny
31/May/2006	PZ+DN	57	15.0	sunny
1/Jun/2006	LD+AG	57	14.8	sunny
2/Jun/2006	LD+AG	57	14.6	sunny
3/Jun/2006	LD+AG	58	14.4	sunny
4/Jun/2006	LD+AG	57	13.8	sunny
5/Jun/2006	LD+AG	57	13.8	sunny
6/Jun/2006	PZ+DN	56	14.0	sunny
7/Jun/2006	PZ+DN	56	14.8	sunny
8/Jun/2006	LD+AG	55	14.3	sunny
9/Jun/2006	LD+AG	55	14.3	sunny
10/Jun/2006	LD+AG	55	14.2	sunny
11/Jun/2006	LD+AG	54	14.5	sunny

Appendix D. Black Creek 2006 adult fence data.

Date	Fork Length (mm)	Sex	CWT	Condition Factor	Mark	Scale Book	Scale Number	Tag Number	Comment
5-Nov	305	J	Y	4	O	65730	1	52	
5-Nov	330	J	N	4	O	65730	2	53	
5-Nov	440	M	N	4	O	65730	3	54	
5-Nov	390	J	N	4	O	65730	4	55	
5-Nov	340	J	N	4	O	65730	5	56	
5-Nov	410	J	N	4	O	65730	6	57	
5-Nov	370	J	N	4	O	65730	7	58	
5-Nov	350	J	N	4	O	65730	8	59	
5-Nov	360	J	N	4	N	65730	9	60	
5-Nov	380	J	N	4	O	65730	10	61	
5-Nov	390	J	N	4	O	65731	1	42	Net Mark
5-Nov	310	J	Y	4	O	65731	2	44	#43 Wasted
5-Nov	355	J	N	4	O	65731	3	45	
5-Nov	385	J	Y	4	O	65731	4	46	
5-Nov	365	J	Y	4	O	65731	5	47	
5-Nov	305	J	N	4	O	65731	6	48	
5-Nov	750	M	Y	4	O	65731	7	49	
5-Nov	350	J	N	4	O	65731	8	50	
5-Nov	390	J	N	4	O	65731	9	51	
5-Nov	360	J	N	4	O	65731	10	52	
5-Nov	335	J	N	4	O	65732	1	32	
5-Nov	390	J	N	4	O	65732	2	33	
5-Nov	410	J	N	4	O	65732	3	34	
5-Nov	380	J	N	4	O	65732	4	35	
5-Nov	405	J	N	4	O	65732	5	36	
5-Nov	370	J	N	4	O	65732	6	37	
5-Nov	395	J	Y	4	O	65732	7	38	
5-Nov	800	M	NA	4	O	65732	8	39	No Punch
5-Nov	400	J	N	4	O	65732	9	40	
5-Nov	680	F	NA	4	O	65732	10	41	
5-Nov	700	M	N	3	O	65733	1	22	
5-Nov	298	J	N	4	O	65733	2	23	
5-Nov	340	J	N	4	O	65733	3	24	
5-Nov	390	J	N	4	O	65733	4	25	
5-Nov	730	F	N	4	O	65733	5	27	
5-Nov	340	J	N	4	O	65733	6	26	
5-Nov	360	J	Y	4	O	65733	7	28	
5-Nov	330	J	Y	4	O	65733	8	29	
5-Nov	360	J	Y	4	O	65733	9	30	
5-Nov	570	M	N	4	O	65733	10	31	
5-Nov	610.5	M	N	4	O	65734	1	1	
5-Nov	420	J	Y	2	O	65734	2	2	
5-Nov	470	M	N	4	O	65734	3	3	
5-Nov	340	J	N	2	O	65734	4	5	
5-Nov	680	M	N	4	O	65734	5	6	
5-Nov	770	M	N	4	O	65734	6	7	
5-Nov	330	J	Y	4	O	65734	7	8	
5-Nov	320	J	N	3	O	65734	8	9	

Date	Fork Length (mm)	Sex	CWT	Condition Factor	Mark	Scale Book	Scale Number	Tag Number	Comment
5-Nov	325	J	N	3	O	65734	9	10	
5-Nov	421	J	Y	4	O	65734	10	11	
5-Nov	365	J	Y	3	O	65735	1	12	
5-Nov	720	F	N	4	O	65735	2	13	
5-Nov	725	M	Y	4	O	65735	3	14	
5-Nov	650	M	N	4	O	65735	4	15	
5-Nov	350	J	N	2	O	65735	5	16	
5-Nov	688	M	N	4	O	65735	6	17	
5-Nov	690	M	N	4	O	65735	7	18	
5-Nov	670	F	N	4	O	65735	8	19	
5-Nov	325	J	Y	3	O	65735	9	20	
5-Nov	700	F	N	4	O	65735	10	21	
5-Nov	340	J	N	4	O	65737	1	72	
5-Nov	360	J	N	4	O	65737	2	73	
5-Nov	360	J	N	4	O	65737	3	74	
5-Nov	310	J	Y	4	O	65737	4	575	
5-Nov	370	J	Y	4	O	65737	5	574	
5-Nov	380	J	N	4	O	65737	6	573	
5-Nov	380	J	N	4	O	65737	7	572	
5-Nov	350	J	N	4	O	65737	8	571	
5-Nov	370	J	N	4	O	65737	9	570	
5-Nov	350	J	N	4	O	65737	10	569	
5-Nov	340	J	N	4	O	65738	1	62	
5-Nov	325	J	N	4	O	65738	2	63	
5-Nov	340	J	N	4	O	65738	3	64	
5-Nov	360	J	Y	4	O	65738	4	65	
5-Nov	360	J	N	4	O	65738	5	66	
5-Nov	430	J	N	4	O	65738	6	67	
5-Nov	330	J	N	4	O	65738	7	68	
5-Nov	370	J	N	4	O	65738	8	69	
5-Nov	410	J	N	3	O	65738	9	70	
5-Nov	540	M	N	4	O	65738	10	71	
5-Nov	350	J	N	2	O	-	-	4	
6-Nov	705	F	Y	4	O	43160	1	556	
6-Nov	390	J	Y	4	O	43160	2	555	
6-Nov	695	F	Y	4	O	43160	3	554	
6-Nov	410	J	N	4	O	43160	4	553	
6-Nov	340	J	N	4	O	43160	5	552	
6-Nov	380	J	N	4	O	43160	6	551	
6-Nov	430	J	Y	4	O	43160	7	75	
6-Nov	752	M	N	4	O	43160	8	76/77	DOUBLE TAG
6-Nov	400	J	N	4	O	43160	9	78	
6-Nov	770	F	N	3	O	43160	10	79	
6-Nov	370	J	Y	4	O	43161	1	80	
6-Nov	410	J	N	4	O	43161	2	81	
6-Nov	362	J	N	4	O	43161	3	82	
6-Nov	460	M	Y	4	O	43161	4	83	
6-Nov	375	J	Y	4	O	43161	5	84	
6-Nov	650	F	N	3	O	43161	6	85	
6-Nov	410	J	Y	4	O	43161	7	86	

Date	Fork Length (mm)	Sex	CWT	Condition Factor	Mark	Scale Book	Scale Number	Tag Number	Comment
6-Nov	380	J	Y	4	O	43161	8	87	
6-Nov	770	F	N	3	O	43161	9	88	
6-Nov	370	J	N	4	O	43161	10	89	
6-Nov	770	F	N	2	O	43162	1	90	
6-Nov	360	J	N	4	O	43162	2	91	
6-Nov	600	F	Y	3	O	43162	3	92	
6-Nov	590	M	N	4	O	43162	4	93	
6-Nov	360	J	N	4	O	43162	5	94	
6-Nov	740	M	N	4	O	43162	6	95	
6-Nov	360	J	N	4	O	43162	7	96	
6-Nov	760	M	N	4	O	43162	8	97	
6-Nov	375	J	Y	4	O	43162	9	98	
6-Nov	630	F	N	4	O	43162	10	99	
6-Nov	760	M	N	4	O	43163	1	101	100 Wasted
6-Nov	405	J	Y	4	O	43163	2	102	
6-Nov	340	J	N	4	O	43163	3	103	
6-Nov	360	J	Y	4	O	43163	4	104	
6-Nov	410	J	Y	4	O	43163	5	105	
6-Nov	405	J	Y	4	O	43163	6	106	
6-Nov	381	J	Y	4	O	43163	7	108	107 Wasted
6-Nov	395	J	Y	4	O	43163	8	110	109 Wasted
6-Nov	370	J	N	4	O	43163	9	111	
6-Nov	380	J	Y	4	O	43163	10	112	
6-Nov	431	J	Y	4	O	43173	1	113	
6-Nov	422	J	Y	4	O	43173	2	114	
6-Nov	415	J	Y	4	O	43173	3	115	
6-Nov	380	J	Y	4	O	43173	4	116	
6-Nov	312	J	Y	4	O	43173	5	117	
6-Nov	360	J	Y	4	O	43173	6	118	
6-Nov	400	J	N	4	O	43173	7	119	
6-Nov	580	F	N	4	O	43173	8	120	
6-Nov	402	J	N	4	O	43173	9	121	
6-Nov	372	J	N	4	O	43173	10	122	
6-Nov	430	J	N	4	O	43174	1	123	
6-Nov	410	J	Y	4	O	43174	2	124	
6-Nov	410	J	Y	4	O	43174	3	125	
6-Nov	600	F	N	3	O	43174	4	126	
6-Nov	330	J	N	4	O	43174	5	127	
6-Nov	395	J	Y	4	O	43174	6	128	
6-Nov	335	J	Y	4	O	43174	7	129	
6-Nov	410	J	Y	4	O	43174	8	130	
6-Nov	402	J	N	4	O	43174	9	131	
6-Nov	380	J	N	4	O	43174	10	132	
6-Nov	390	J	Y	4	O	43175	1	133	
6-Nov	330	J	Y	4	O	43175	2	134	
6-Nov	370	J	N	4	O	43175	3	135	
6-Nov	440	M	N	4	O	43175	4	136	
6-Nov	360	J	Y	4	O	43175	5	137	
6-Nov	350	J	Y	4	O	43175	6	138	
6-Nov	385	J	Y	4	O	43175	7	139	

Date	Fork Length (mm)	Sex	CWT	Condition Factor	Mark	Scale Book	Scale Number	Tag Number	Comment
6-Nov	370	J	N	4	O	43175	8	140	
6-Nov	390	J	Y	4	O	43175	9	141	
6-Nov	372	J	N	4	O	43175	10	142	
6-Nov	740	M	Y	4	O	43176	1	143	
6-Nov	390	J	Y	4	O	43176	2	144	
6-Nov	600	F	Y	4	O	43176	3	145	
6-Nov	430	J	Y	4	O	43176	4	146	
6-Nov	580	M	N	4	O	43176	5	147	
6-Nov	370	J	Y	4	O	43176	6	148	
6-Nov	640	F	N	4	O	43176	7	149	
6-Nov	355	J	N	4	O	43176	8	150	
6-Nov	680	F	N	3	O	43176	9	151	
6-Nov	730	F	Y	4	O	43176	10	152	
6-Nov	710	M	Y	4	O	43177	1	153	
6-Nov	740	F	N	4	O	43177	2	154	
6-Nov	370	J	Y	4	O	43177	3	155	
6-Nov	700	F	Y	4	P	43177	4	156	
6-Nov	730	F	Y	4	O	43177	5	157	
6-Nov	690	F	Y	4	O	43177	6	158	
6-Nov	390	J	N	4	O	43177	7	159	
6-Nov	760	F	N	4	O	43177	8	160	
6-Nov	670	F	Y	4	O	43177	9	161	
6-Nov	710	F	Y	3	O	43177	10	162	
6-Nov	740	F	Y	4	O	43184	1	568	
6-Nov	362	J	N	3	O	43184	2	567	
6-Nov	372	J	Y	4	O	43184	3	565	566 Wasted
6-Nov	312	J	Y	4	O	43184	4	564	
6-Nov	391	J	Y	4	O	43184	5	563	
6-Nov	525	F	Y	4	O	43184	6	562	
6-Nov	315	J	Y	4	O	43184	7	561	
6-Nov	702	F	N	4	O	43184	8	559	560 Wasted
6-Nov	310	J	Y	4	O	43184	9	558	
6-Nov	342	J	Y	4	O	43184	10	557	
6-Nov	380	F	N	4	O	-	-	231	
6-Nov	380	F	N	4	O	-	-	237	
6-Nov	600	F	N	3	O	-	-	318	
6-Nov	640	F	N	4	O	-	-	190	
6-Nov	640	F	N	4	O	-	-	304	
6-Nov	640	F	N	3	O	-	-	316	
6-Nov	665	F	N	3	O	-	-	305	
6-Nov	680	F	N	4	O	-	-	177	
6-Nov	680	F	Y	4	O	-	-	178	
6-Nov	700	F	N	4	O	-	-	165	
6-Nov	700	F	N	4	O	-	-	173	
6-Nov	710	F	N	3	P	-	-	242	
6-Nov	720	F	N	4	O	-	-	164	
6-Nov	720	F	N	4	O	-	-	248	
6-Nov	720	F	N	4	O	-	-	302	
6-Nov	730	F	N	3	O	-	-	236	
6-Nov	740	F	N	4	O	-	-	163	

Date	Fork Length (mm)	Sex	CWT	Condition Factor	Mark	Scale Book	Scale Number	Tag Number	Comment
6-Nov	740	F	N	4	O	-	-	167	
6-Nov	740	F	N	4	O	-	-	176	
6-Nov	740	F	N	3	O	-	-	210	
6-Nov	740	F	N	4	O	-	-	228	
6-Nov	755	F	N	4	O	-	-	229	
6-Nov	755	F	N	3	O	-	-	243	
6-Nov	292	J	Y	4	O	-	-	298	
6-Nov	300	J	N	4	O	-	-	306	
6-Nov	310	J	N	4	O	-	-	277	
6-Nov	310	J	N	4	O	-	-	347	
6-Nov	315	J	N	4	O	-	-	334	
6-Nov	320	J	N	4	O	-	-	201	
6-Nov	320	J	Y	4	O	-	-	335	
6-Nov	330	J	N	4	O	-	-	195	
6-Nov	330	J	N	4	P	-	-	199	
6-Nov	330	J	N	4	O	-	-	331	
6-Nov	330	J	N	4	O	-	-	337	
6-Nov	335	J	Y	4	O	-	-	280	
6-Nov	340	J	N	4	O	-	-	171	
6-Nov	342	J	N	4	O	-	-	366	
6-Nov	345	J	N	4	O	-	-	287	
6-Nov	345	J	N	4	O	-	-	320	
6-Nov	345	J	N	4	O	-	-	330	
6-Nov	350	J	Y	4	O	-	-	197	
6-Nov	350	J	Y	4	O	-	-	198	
6-Nov	350	J	N	4	O	-	-	206	
6-Nov	350	J	Y	4	O	-	-	217	
6-Nov	350	J	N	4	O	-	-	219	
6-Nov	350	J	N	4	O	-	-	233	
6-Nov	350	J	N	4	O	-	-	255	
6-Nov	350	J	N	4	O	-	-	257	
6-Nov	350	J	Y	4	O	-	-	259	
6-Nov	350	J	N	4	O	-	-	284	
6-Nov	350	J	N	4	O	-	-	289	
6-Nov	350	J	N	4	O	-	-	311	
6-Nov	350	J	N	4	O	-	-	321	
6-Nov	350	J	N	4	O	-	-	353	
6-Nov	350	J	N	4	O	-	-	354	
6-Nov	350	J	N	4	O	-	-	357	
6-Nov	355	J	Y	4	O	-	-	223	
6-Nov	355	J	N	4	O	-	-	271	
6-Nov	355	J	N	4	O	-	-	319	
6-Nov	355	J	N	4	O	-	-	336	
6-Nov	360	J	N	4	O	-	-	196	
6-Nov	360	J	N	4	O	-	-	202	
6-Nov	360	J	N	4	O	-	-	208	
6-Nov	360	J	N	4	O	-	-	216	
6-Nov	360	J	N	4	O	-	-	224	
6-Nov	360	J	N	4	O	-	-	225	
6-Nov	360	J	N	4	O	-	-	250	

Date	Fork Length (mm)	Sex	CWT	Condition Factor	Mark	Scale Book	Scale Number	Tag Number	Comment
6-Nov	360	J	N	4	O	-	-	258	
6-Nov	360	J	N	4	O	-	-	267	
6-Nov	360	J	Y	4	O	-	-	275	
6-Nov	360	J	Y	4	O	-	-	282	
6-Nov	360	J	N	4	O	-	-	309	
6-Nov	360	J	N	4	O	-	-	312	
6-Nov	360	J	N	4	O	-	-	315	
6-Nov	360	J	N	4	O	-	-	345	
6-Nov	360	J	N	4	O	-	-	351	
6-Nov	360	J	N	4	O	-	-	356	
6-Nov	360	J	N	4	O	-	-	227	
6-Nov	362	J	NA	4	O	-	-	283	
6-Nov	365	J	N	4	O	-	-	264	
6-Nov	365	J	N	4	O	-	-	294	
6-Nov	365	J	N	4	O	-	-	300	
6-Nov	365	J	N	4	O	-	-	346	
6-Nov	365	J	N	4	O	-	-	355	
6-Nov	370	J	Y	4	O	-	-	187	
6-Nov	370	J	N	4	O	-	-	200	
6-Nov	370	J	N	4	O	-	-	207	
6-Nov	370	J	N	4	O	-	-	221	
6-Nov	370	J	N	4	O	-	-	240	
6-Nov	370	J	N	4	O	-	-	254	
6-Nov	370	J	N	4	O	-	-	260	
6-Nov	370	J	N	4	O	-	-	263	
6-Nov	370	J	Y	4	O	-	-	270	
6-Nov	370	J	N	4	O	-	-	276	
6-Nov	370	J	N	4	O	-	-	317	
6-Nov	370	J	N	4	O	-	-	322	
6-Nov	370	J	N	4	O	-	-	324	
6-Nov	370	J	N	4	O	-	-	235	
6-Nov	375	J	N	4	O	-	-	185	
6-Nov	375	J	N	4	O	-	-	278	
6-Nov	375	J	N	4	O	-	-	297	
6-Nov	375	J	N	4	O	-	-	299	
6-Nov	375	J	N	4	O	-	-	333	
6-Nov	375	J	N	4	O	-	-	338	
6-Nov	375	J	N	4	O	-	-	343	
6-Nov	380	J	N	4	O	-	-	189	
6-Nov	380	J	Y	4	O	-	-	211	
6-Nov	380	J	N	4	O	-	-	214	
6-Nov	380	J	N	4	O	-	-	239	
6-Nov	380	J	N	4	O	-	-	247	
6-Nov	380	J	N	4	O	-	-	251	
6-Nov	380	J	N	4	O	-	-	279	
6-Nov	380	J	N	4	O	-	-	281	
6-Nov	380	J	N	4	O	-	-	290	
6-Nov	380	J	N	4	O	-	-	307	
6-Nov	380	J	N	4	O	-	-	308	
6-Nov	380	J	N	4	O	-	-	314	

Date	Fork Length (mm)	Sex	CWT	Condition Factor	Mark	Scale Book	Scale Number	Tag Number	Comment
6-Nov	380	J	N	4	O	-	-	340	
6-Nov	380	J	N	4	O	-	-	344	
6-Nov	382	J	N	4	O	-	-	273	
6-Nov	385	J	N	4	O	-	-	272	
6-Nov	385	J	N	4	O	-	-	339	
6-Nov	390	J	N	4	O	-	-	170	
6-Nov	390	J	N	4	O	-	-	186	
6-Nov	390	J	N	4	O	-	-	188	
6-Nov	390	J	N	4	O	-	-	193	
6-Nov	390	J	N	4	O	-	-	203	
6-Nov	390	J	N	4	O	-	-	205	
6-Nov	390	J	Y	4	O	-	-	212	
6-Nov	390	J	N	4	O	-	-	213	
6-Nov	390	J	N	4	O	-	-	215	
6-Nov	390	J	N	4	O	-	-	232	
6-Nov	390	J	N	4	O	-	-	252	
6-Nov	390	J	N	4	O	-	-	262	261 Wasted
6-Nov	390	J	N	4	O	-	-	291	
6-Nov	390	J	N	4	O	-	-	301	
6-Nov	390	J	N	4	O	-	-	326	
6-Nov	390	J	N	4	O	-	-	350	
6-Nov	390	J	N	4	O	-	-	352	
6-Nov	392	J	N	4	O	-	-	269	
6-Nov	395	J	N	4	O	-	-	220	
6-Nov	395	J	N	4	O	-	-	293	
6-Nov	400	J	N	4	O	-	-	204	
6-Nov	400	J	N	4	O	-	-	209	
6-Nov	400	J	Y	4	O	-	-	218	
6-Nov	400	J	N	4	O	-	-	222	
6-Nov	400	J	N	4	O	-	-	249	
6-Nov	400	J	N	4	O	-	-	292	
6-Nov	400	J	N	4	O	-	-	328	
6-Nov	400	J	N	4	O	-	-	342	
6-Nov	400	J	N	4	O	-	-	348	
6-Nov	400	J	N	4	O	-	-	349	
6-Nov	410	J	N	4	O	-	-	194	
6-Nov	410	J	N	4	O	-	-	238	
6-Nov	410	J	N	4	O	-	-	241	
6-Nov	410	J	N	4	O	-	-	244	DOUBLE TAG
6-Nov	410	J	N	4	O	-	-	245	DOUBLE TAG
6-Nov	410	J	N	4	O	-	-	246	
6-Nov	410	J	N	4	O	-	-	265	
6-Nov	410	J	N	4	O	-	-	274	
6-Nov	410	J	N	4	O	-	-	285	
6-Nov	410	J	Y	4	O	-	-	310	
6-Nov	410	J	N	4	O	-	-	327	
6-Nov	410	J	N	4	O	-	-	332	
6-Nov	420	J	N	4	O	-	-	172	
6-Nov	420	J	N	4	O	-	-	220	
6-Nov	420	J	N	4	O	-	-	286	

Date	Fork Length (mm)	Sex	CWT	Condition Factor	Mark	Scale Book	Scale Number	Tag Number	Comment
6-Nov	420	J	N	4	O	-	-	288	
6-Nov	420	J	Y	4	O	-	-	325	
6-Nov	420	J	N	4	O	-	-	341	
6-Nov	430	J	N	4	O	-	-	268	266,267 Wasted
6-Nov	430	J	N	4	O	-	-	295	
6-Nov	430	J	N	4	O	-	-	313	
6-Nov	430	J	Y	4	O	-	-	329	
6-Nov	440	M	N	4	O	-	-	303	
6-Nov	440	M	N	4	O	-	-	323	
6-Nov	445	M	N	4	O	-	-	256	
6-Nov	560	M	N	4	O	-	-	226	
6-Nov	650	M	Y	4	O	-	-	180	
6-Nov	660	M	N	4	O	-	-	234	
6-Nov	680	M	N	4	O	-	-	184	182,183 Wasted
6-Nov	680	M	N	4	O	-	-	192	191 Wasted
6-Nov	690	M	N	4	O	-	-	296	
6-Nov	700	M	N	4	O	-	-	166	
6-Nov	710	M	N	4	O	-	-	168	
6-Nov	720	M	Y	4	O	-	-	169	
6-Nov	720	M	Y	4	O	-	-	179	
6-Nov	730	M	N	4	O	-	-	172	170,171 Wasted
6-Nov	730	M	Y	4	O	-	-	230	
6-Nov	740	M	N	4	O	-	-	181	
6-Nov	800	M	N	4	O	-	-	175	174 Wasted
6-Nov	820	M	N	4	O	-	-	253	
7-Nov	520	M	Y	4	O	43178	1	358	
7-Nov	750	F	N	4	O	43178	2	359	
7-Nov	700	F	N	4	O	43178	3	360	
7-Nov	770	M	N	4	O	43178	4	361	
7-Nov	370	J	N	4	O	43178	5	362	
7-Nov	380	J	N	4	O	43178	6	363	
7-Nov	740	M	Y	4	O	43178	7	364	
7-Nov	650	F	N	4	O	43178	8	365	
7-Nov	430	J	N	4	O	43178	9	366	
7-Nov	370	J	N	4	O	43178	10	367	
7-Nov	340	J	N	4	O	43179	1	368	
7-Nov	410	J	N	4	O	43179	2	369	
7-Nov	430	J	N	4	O	43179	3	370	
7-Nov	390	J	N	4	O	43179	4	371	
7-Nov	380	J	N	4	O	43179	5	372	
7-Nov	350	J	Y	4	O	43179	6	373	
7-Nov	380	J	N	4	O	43179	7	374	
7-Nov	430	J	N	4	O	43179	8	375	
7-Nov	380	J	N	4	O	43179	9	376	
7-Nov	710	F	N	4	O	43179	10	377	
7-Nov	680	M	N	4	O	43185	1	378	
7-Nov	360	J	N	4	O	43185	2	379	
7-Nov	420	J	Y	4	O	43185	3	380	
7-Nov	375	J	Y	4	O	43185	4	381	
7-Nov	345	J	N	4	O	43185	5	382	

Date	Fork Length (mm)	Sex	CWT	Condition Factor	Mark	Scale Book	Scale Number	Tag Number	Comment
7-Nov	360	J	N	4	P	43185	6	383	
7-Nov	325	J	N	4	O	43185	7	384	
7-Nov	360	J	N	4	O	43185	8	385	
7-Nov	380	J	N	4	O	43185	9	387	386 Wasted
7-Nov	280	J	N	4	O	43185	10	388	
7-Nov	375	J	N	4	O	43186	1	389	
7-Nov	720	F	N	4	O	43186	2	390	
7-Nov	380	J	N	4	O	43186	3	391	
7-Nov	370	J	N	4	P	43186	4	392	
7-Nov	340	J	Y	4	O	43186	5	393	
7-Nov	290	J	Y	4	O	43186	6	394	
7-Nov	350	J	N	4	O	43186	7	395	
7-Nov	390	J	N	4	O	43186	8	396	
7-Nov	420	J	N	4	O	43186	9	397	
7-Nov	370	J	N	4	O	43186	10	398	
7-Nov	420	J	N	4	O	43187	1	399	
7-Nov	360	J	N	4	O	43187	2	401	400 Wasted
7-Nov	370	J	N	4	O	43187	3	402	
7-Nov	360	J	N	4	O	43187	4	403	
7-Nov	380	J	N	4	O	43187	5	404	
7-Nov	390	J	N	4	O	43187	6	405	
7-Nov	380	J	N	4	O	43187	7	406	
7-Nov	370	J	N	4	O	43187	8	407	
7-Nov	330	J	N	4	O	43187	9	408	
7-Nov	390	J	N	4	O	43187	10	409	
7-Nov	380	J	N	4	O	43188	1	410	
7-Nov	720	F	N	4	O	43188	2	411	
7-Nov	710	M	N	4	O	43188	3	412	
7-Nov	400	J	N	4	O	43188	4	413	
7-Nov	390	J	N	4	O	43188	5	414	
7-Nov	400	J	N	4	O	43188	6	415	
7-Nov	390	J	N	4	O	43188	7	416	
7-Nov	430	J	N	4	O	43188	8	417	
7-Nov	400	J	Y	4	O	43188	9	418	
7-Nov	355	J	N	4	O	43188	10	419	
8-Nov	370	J	Y	4	O	43189	1	421	
8-Nov	380	J	N	4	O	43189	2	422	
10-Nov	650	M	N	4	O	43192	1	484	
10-Nov	690	F	N	4	O	43192	2	485	
10-Nov	710	F	Y	4	O	43192	3	486	
10-Nov	800	M	N	4	O	43192	4	487	
10-Nov	690	F	N	4	O	43192	5	488	
10-Nov	580	M	N	4	O	43192	6	489	
10-Nov	740	F	N	4	O	43192	7	490	
10-Nov	620	M	Y	4	O	43192	8	491	
10-Nov	790	F	N	4	O	43192	9	492	
10-Nov	730	F	N	4	O	43192	10	493	
10-Nov	600	M	N	4	O	43193	1	474	
10-Nov	370	J	N	4	O	43193	2	475	
10-Nov	440	M	N	4	O	43193	3	476	

Date	Fork Length (mm)	Sex	CWT	Condition Factor	Mark	Scale Book	Scale Number	Tag Number	Comment
10-Nov	750	F	N	4	O	43193	4	477	
10-Nov	360	J	N	4	O	43193	5	478	
10-Nov	840	M	N	4	O	43193	6	479	
10-Nov	410	J	N	4	O	43193	7	480	
10-Nov	360	J	N	4	O	43193	8	481	
10-Nov	610	F	N	4	O	43193	9	482	
10-Nov	600	M	N	4	O	43193	10	483	
10-Nov	360	J	N	4	O	43194	1	464	
10-Nov	410	J	N	4	O	43194	2	465	
10-Nov	410	J	N	4	O	43194	3	466	
10-Nov	720	F	N	4	O	43194	4	467	
10-Nov	810	M	N	4	O	43194	5	468	
10-Nov	430	J	N	4	O	43194	6	469	
10-Nov	480	M	N	4	O	43194	7	470	
10-Nov	320	J	N	4	O	43194	8	471	
10-Nov	380	J	N	4	O	43194	9	472	
10-Nov	380	J	N	4	O	43194	10	473	
10-Nov	770	F	N	4	O	43197	1	434	
10-Nov	410	J	N	4	O	43197	2	435	
10-Nov	770	M	N	4	O	43197	3	436	
10-Nov	410	J	N	4	O	43197	4	437	
10-Nov	740	F	N	4	O	43197	5	438	
10-Nov	790	F	N	4	O	43197	6	439	
10-Nov	800	F	N	4	O	43197	7	440	
10-Nov	790	M	N	4	O	43197	8	441	
10-Nov	700	F	N	4	O	43197	9	442	
10-Nov	740	F	N	4	O	43197	10	443	
10-Nov	870	M	N	4	O	43198	1	423	
10-Nov	820	F	N	4	O	43198	2	424	
10-Nov	410	J	N	4	O	43198	3	425	
10-Nov	630	F	Y	4	O	43198	4	426	
10-Nov	690	F	N	4	O	43198	5	428	427 Wasted
10-Nov	420	J	N	4	O	43198	6	429	
10-Nov	750	F	N	4	O	43198	7	430	
10-Nov	730	F	N	4	O	43198	8	431	
10-Nov	750	F	N	4	O	43198	9	432	
10-Nov	750	F	N	4	O	43198	10	433	
10-Nov	740	M	N	4	O	43199	1	444	TAG FELL OUT
10-Nov	380	J	N	4	O	43199	2	445	
10-Nov	440	M	N	4	O	43199	3	446	
10-Nov	410	J	N	4	O	43199	4	447	
10-Nov	790	F	N	4	O	43199	5	448	
10-Nov	440	M	N	4	O	43199	6	449	
10-Nov	400	J	N	4	P	43199	7	450	
10-Nov	400	J	N	4	O	43199	8	451	
10-Nov	730	M	N	4	O	43199	9	452	
10-Nov	710	F	N	4	O	43199	10	453	
10-Nov	460	M	N	4	O	65736	1	454	
10-Nov	430	J	N	4	O	65736	2	455	
10-Nov	370	J	N	4	O	65736	3	456	

Date	Fork Length (mm)	Sex	CWT	Condition Factor	Mark	Scale Book	Scale Number	Tag Number	Comment
10-Nov	400	J	N	4	O	65736	4	457	
10-Nov	670	F	N	4	O	65736	5	458	
10-Nov	430	J	N	4	O	65736	6	459	
10-Nov	740	F	N	4	O	65736	7	460	
10-Nov	770	M	N	4	O	65736	8	461	
10-Nov	330	J	N	4	O	65736	9	462	
10-Nov	500	F	N	4	O	65736	10	463	
10-Nov	640	F	N	4	O	-	-	498	
10-Nov	650	F	N	2	O	-	-	507	
10-Nov	690	F	N	4	O	-	-	499	
10-Nov	710	F	N	4	O	-	-	494	
10-Nov	710	F	N	4	O	-	-	495	
10-Nov	710	F	Y	4	O	-	-	514	513 Wasted
10-Nov	710	F	N	4	O	-	-	526	
10-Nov	720	F	N	4	O	-	-	500	
10-Nov	720	F	N	2	O	-	-	518	
10-Nov	720	F	N	2	O	-	-	529	527,528 Wasted
10-Nov	730	F	Y	3	O	-	-	530	
10-Nov	745	F	N	4	O	-	-	525	
10-Nov	760	F	N	4	O	-	-	511	
10-Nov	770	F	Y	4	O	-	-	520, 521, 522	TRIPLE TAGGED
10-Nov	775	F	N	4	O	-	-	515	
10-Nov	775	F	N	4	O	-	-	516	
10-Nov	780	F	N	4	O	-	-	501	
10-Nov	330	J	N	4	O	-	-	509	
10-Nov	370	J	N	4	O	-	-	497	
10-Nov	370	J	N	4	O	-	-	503	
10-Nov	380	J	N	4	p	-	-	510	
10-Nov	380	J	N	4	O	-	-	519	
10-Nov	390	J	N	4	O	-	-	506	
10-Nov	400	J	N	4	O	-	-	502	
10-Nov	410	J	N	4	O	-	-	523	
10-Nov	550	M	Y	4	O	-	-	496	
10-Nov	670	M	N	4	O	-	-	504	
10-Nov	740	M	N	4	O	-	-	517	
10-Nov	750	M	N	4	O	-	-	508	
10-Nov	770	M	N	4	O	-	-	505	
10-Nov	780	M	N	4	O	-	-	512	
10-Nov	800	M	N	4	O	-	-	524	
11-Nov	710	F	N	4	O	43164	1	540	539 Wasted
11-Nov	420	J	N	4	O	43164	2	541	
11-Nov	370	J	N	4	P	43164	3	542	
11-Nov	390	J	Y	4	O	43164	4	543	
11-Nov	410	J	N	4	O	43164	5	544	
11-Nov	410	J	N	4	O	43164	6	545	
11-Nov	390	J	N	4	O	43164	7	547	546 Wasted
11-Nov	370	J	N	4	O	43164	8	548	
11-Nov	390	J	N	4	O	43164	9	549	
11-Nov	350	J	N	4	O	43164	10	550	
11-Nov	350	J	N	4	O	43196	1	576	

Date	Fork Length (mm)	Sex	CWT	Condition Factor	Mark	Scale Book	Scale Number	Tag Number	Comment
11-Nov	410	J	N	4	O	43196	2	577	
11-Nov	530	F	N	4	Y	-	-	581	
11-Nov	600	F	N	4	O	-	-	534	
11-Nov	640	F	N	3	O	-	-	532	
11-Nov	700	F	N	4	O	-	-	578	
11-Nov	730	F	N	4	O	-	-	531	
11-Nov	730	F	N	4	O	-	-	535	
11-Nov	370	J	N	4	O	-	-	588	
11-Nov	380	J	N	4	O	-	-	536	
11-Nov	380	J	N	4	O	-	-	582	
11-Nov	380	J	N	4	O	-	-	583	
11-Nov	390	J	N	4	O	-	-	586	
11-Nov	400	J	N	4	O	-	-	587	
11-Nov	420	J	N	4	O	-	-	584	
11-Nov	420	J	N	4	O	-	-	585	
11-Nov	440	M	Y	4	O	-	-	580	579 Wasted
11-Nov	720	M	Y	4	O	-	-	537	
11-Nov	750	M	N	4	O	-	-	533	
11-Nov	760	M	N	4	O	-	-	538	
12-Nov	380	J	N	4	O	-	-	589	
12-Nov	710	M	N	4	O	-	-	590	
13-Nov	350	J	N	4	O	-	-	593	
13-Nov	360	J	N	4	O	-	-	597	
13-Nov	380	J	N	4	O	-	-	594	
13-Nov	380	J	N	4	O	-	-	598	
13-Nov	410	J	N	2	O	-	-	596	
13-Nov	420	J	N	4	O	-	-	595	
14-Nov	400	J	N	4	P	-	-	599	
15-Nov	601	F	NA	4	0	-	-	601	
15-Nov	660	F	N	4	0	-	-	600	