

Mohun Creek Fall Escapement Survey 2004

Prepared for

**Campbell River and District
Fish and Wildlife Association**
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Summary

Snorkel surveys and bank walk surveys of Mohun Creek were completed between August 17 and November 26, 2004. The survey area extended for 6.1km upstream of the mouth, to the confluence with the large unnamed anadromous tributary. The survey area was divided into three reaches, based on habitat characteristics.

The majority of the survey area was swum during the snorkel surveys (a 195m long section immediately upstream of the mouth was not always included). Bank walks were completed in three smaller segments of the survey area, one in each reach.

Coho salmon were first observed in Mohun Creek on September 21, 2004, with a peak in abundance ($n = 32$) recorded on November 3, 2004. The first observation of chum salmon in Mohun Creek occurred on October 13, 2004. A peak count of 142 chum was also made on November 3, 2004. Using the snorkel count data, and taking into account the proportion of habitat observed, the maximum escapement count in Mohun Creek for 2004 was estimated at 48 coho and 203 chum. The only other adult salmon species observed during the snorkel surveys was chinook, with only one individual counted. Pink salmon, once abundant in the watershed, were conspicuously absent.

The distribution of adult fish observed appeared to alter following the onset of the fall freshet. Initially, the distribution was spread among all three reaches, but the low count of fish makes it difficult to determine a specific trend. However, once water levels rose in response to extreme rainfall, the vast majority of adult fish were counted in the upper 1.5km of Reach 3.

Bank walk observers were only able to count adult salmon on two of the six dates when walks were completed. The highest count occurred on November 5, 2004 with two coho and 28 chum observed. Estimates of maximum escapement calculated using the bank walk data, taking into account the proportion of habitat observed, were significantly different than the estimates based on snorkel counts (24 coho and 653 chum). The amount of bank walk data collected was not sufficient to calibrate this method using the snorkel counts for the same sections.

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Thanks are extended again to Weyerhaeuser Ltd. (North Island Timberlands Unit) for their contribution of manpower and equipment for the GPS mapping of the Mohun Creek mainstem and the production of the annotated orthophoto of the lower watershed.

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1.0 Introduction

Several recent projects relating to fish and fish habitat have been completed in the Mohun Creek watershed through the continued support of the Campbell River and District Fish and Wildlife Association (CRFW). Following the completion of the Mohun Creek Watershed Overview (Stewardson, M. 2004a) a series of recommendations for future assessments in the watershed were developed. This report also revealed a lack of specific knowledge regarding the status of the anadromous fish population in the watershed.

Recent fall escapement surveys have focused on the lower 2 - 3km of the Mohun Creek mainstem (out of a possible 7km of anadromous habitat). The previous surveys have also only covered a portion of the spawning period for all returning species (chinook, chum, coho, pink salmon, steelhead and cutthroat trout). As a result, a comprehensive fall escapement project was recommended to more accurately describe the current status of anadromous salmon runs and to further identify key spawning areas in Mohun Creek mainstem. CRFW continued their involvement in the stewardship of the Mohun Creek watershed by supporting this project to conduct fall escapement surveys.

There were two components of the fall escapement project, snorkel surveys and bank walks. Mainstream Biological Consulting (MBC) staff completed snorkel surveys while CRFW volunteers completed the bank walks. This document contains a summary of both components, which were completed between mid-August and the end of November 2004. The objectives of the fall escapement project were:

- To estimate the abundance of each species present in the Mohun Creek mainstem during the fall spawning period for 2004.
- To assess the distribution of fish in relation to identified spawning areas.

1.1 Survey Area

The Mohun Creek watershed is located on the east coast of Vancouver Island, just north of the community of Campbell River. The 14.6km long mainstem drains into Menzies Bay, on the west side of Discovery Passage. A 7m high bedrock waterfall, located 7.2km upstream of the mouth of Mohun Creek, has been reported as the barrier to the upstream migration of anadromous fish.

A detailed description of the known physical characteristics and existing fisheries information (prior to any of the field assessment work completed in 2004) for the entire Mohun Creek watershed is presented in the watershed overview report (Stewardson, M. 2004a). In addition, a habitat assessment was completed for the anadromous habitat of the mainstem of Mohun Creek (Stewardson, M. 2004b). The data collected during the assessment resulted in the division of the anadromous habitat into four reaches, based on significant changes in channel morphology and habitat composition (Figure 1).

The reaches vary from the stream segments that the Department of Fisheries and Oceans (DFO) had previously used when conducting fall escapement surveys. These new reaches, which were based on the detailed field assessment, are believed to be a more accurate representation of the actual division of habitat within the Mohun Creek mainstem than the historic segments used by DFO. DFO Segment 1 and Reach 1 represent the same portion of the mainstem. DFO Segment 2 has been divided into Reach 2, 3 and 4. Details of these reach breaks were provided to DFO and have been incorporated into DFO's Stream Inspection Log (SIL) database.

Snorkel surveys were conducted over the lower 6.1km of Mohun Creek mainstem (Reaches 1 – 3), beginning at the unnamed anadromous tributary and working downstream. Bank walks were conducted over three segments of the survey area, one situated in each reach (Figure 1).

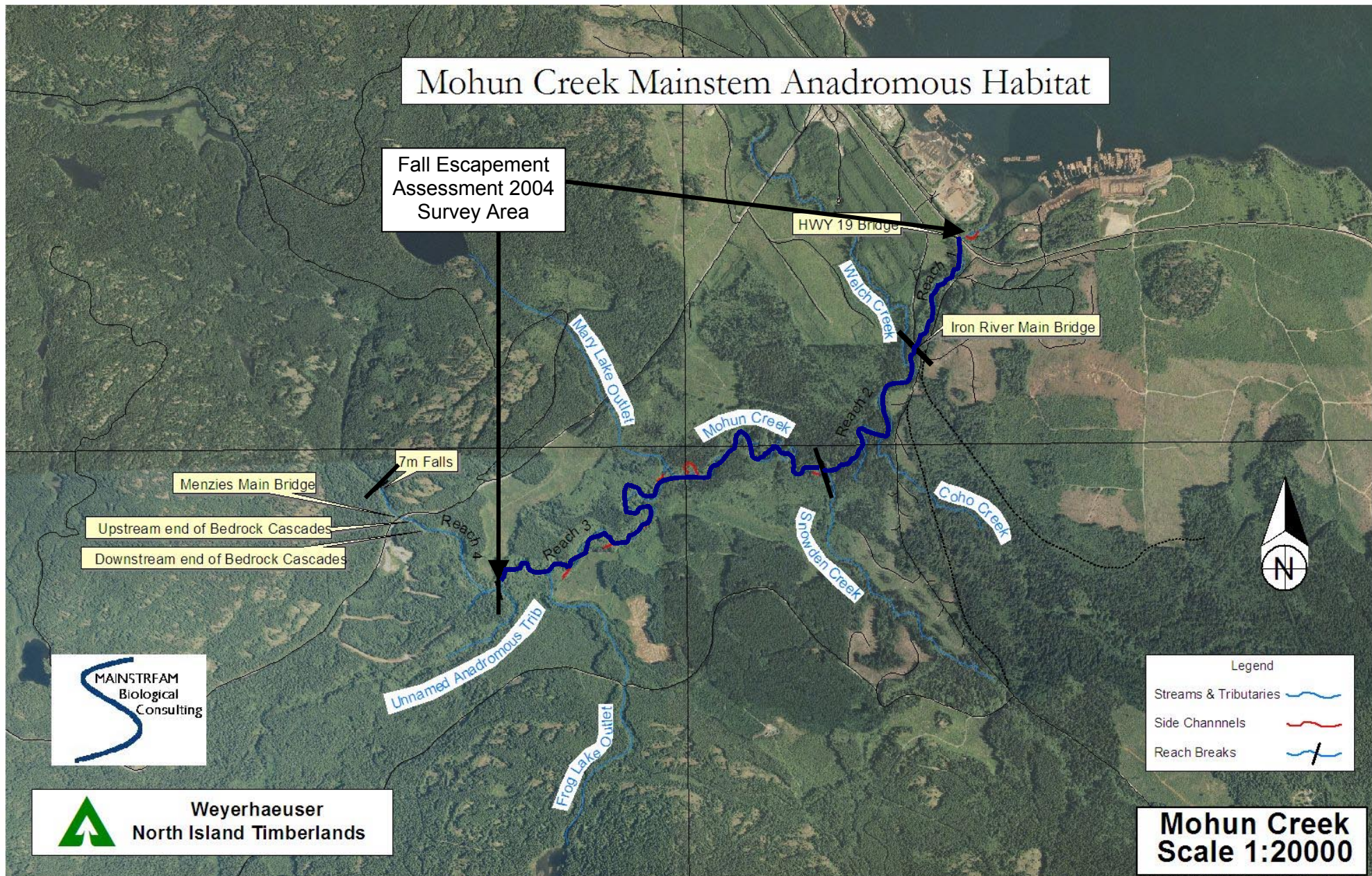


Figure 1. An overview map of the lower portion of the Mohun Creek watershed, showing the approximate location of the anadromous habitat assessment survey area and reach breaks.

2.0 Methods

2.1 Recent Adult Escapement Data

Information on historical escapement counts conducted by the Department of Fisheries and Oceans (DFO) was collected for the Mohun Creek Watershed Overview (Stewardson, M. 2003a). DFO has records for adult salmon escapement for Mohun Creek watershed dating back to 1944 but information on the location and intensity of these surveys was not available. More recent records from the period between 1999 and 2003 include information on the area surveyed, type of survey conducted, dates of surveys and actual counts of adult fish. Only recently collected data will be compared to snorkel and bank walk data obtained through this project as these more thorough records allow for a more meaningful comparison.

2.2 Snorkel Surveys

Mainstream Biological Consulting staff conducted snorkel surveys. Snorkel surveys were completed once a week starting on August 17, 2004 and ending on November 26, 2004. Surveys were completed as long as visibility was greater than 0.5m. Surveys were not completed during one week (Oct. 24-30, 2004) due to poor visibility (0.2 m) and high water flows resulting from heavy rain throughout that week. Surveys generally began at 9:00 am and were completed by 2:30 pm at the latest.

Surveys began at the unnamed anadromous tributary of Mohun Creek located 6.1km upstream of the mouth. Two crewmembers swam downstream, inspecting any areas within the mainstem with enough water for adult salmon to hold in. Initially, low water levels required that the swim crew walk some portions of the survey area between areas of deeper water.

The entire length of the survey area (6.1km) was snorkeled on two occasions, once at the beginning of the survey period and once mid-way through, after the fall freshet. Due to the cascade nature of the habitat downstream of the Highway 19 bridge and the lack of holding areas within this short section (195m) of the stream, the end point of the snorkel survey was moved upstream from the mouth to the Highway 19 bridge for the remaining swims.

The snorkel survey area was divided into three reaches based on the results of the Mohun Creek Anadromous Habitat Assessment (Stewardson, M. 2004b). Reach breaks were determined based on significant changes in channel morphology and habitat composition. Observed adult salmon were identified to species using physical characteristics as described in Pacific Salmon Life Histories (Groot and Margolis, 1991).

In Reach 3, both surveyors inspected the same stream habitat due to the concentration of suitable habitat. The crew would snorkel a section of the stream, compare numbers of each species observed and come to an agreement on the count for that section. In Reaches 1 and 2, the crew swam in the center of the channel, each viewing opposite sides of the channel. The number of fish observed by both swimmers was added together to derive a count for those reaches. Observations were recorded on a waterproof slate and then tallied by species for each reach. Any observed dead adult salmon were also identified to species and tallied for each reach.

Snorkel surveyors recorded the number of fish observed specifically within the bank walk sections on November 3, 2004 in order to compare between the two observation methods.

Surveyors recorded data on visibility, flow and the percentage of the total stream habitat that was observed for each reach. A permanent depth gauge is located at the point where the Highway 19 bridge crosses Mohun creek. The depth level was recorded during all snorkel surveys completed on or after Sept. 21, 2004.

2.3 Bank Walks

Volunteers from the CRFW completed bank walks. Volunteers were given a training session to go over techniques for safe walking, fish observation and species identification. Pat Zetterberg of DFO conducted volunteer training.

Bank walks were completed in three locations, one within each reach, along the south side or right bank of Mohun Creek mainstem. The first segment began at the point where the Highway 19 bridge crosses Mohun Creek and continued upstream for 200m. The second segment began at the point where the Iron River Main crosses Mohun Creek and continued upstream for 160m. The third segment began at the unnamed

anadromous tributary of Mohun Creek, 6.1km above the mouth, and continued downstream for 250m.

Bank walks were conducted weekly from October 4 to November 26, 2004. No surveys were completed for the week of Oct. 24 and Nov. 14, 2004 due to bad weather and high water levels. Volunteers recorded any adult salmon observed, water clarity, the amount of water in the channel (recorded as percent bankfull) and an estimate of the amount of the habitat within the segment that they could observe.

Snorkel survey data and bank walk data was entered into DFO's SIL database.

2.4 Environmental Data

Water temperature in the Mohun Creek mainstem and air temperature were summarized for the survey periods. Water temperature data was recorded using StowAway TidBiT temperature data loggers that were placed at two locations in the mainstem. One was installed at the Menzies Main crossing (upstream of the confluence of all major tributaries in the anadromous portion of the mainstem) and the other was installed at the downstream end of the mainstem, where Highway 19 crosses Mohun Creek. Water temperatures were recorded every hour over a year long period beginning in November 2003, including the duration of the fall escapement project. Water temperatures were averaged for the specific periods of the snorkel surveys or bank walks.

Campbell River air temperature data was downloaded from the Environment Canada National Climate Data and Information archive website at www.climate.weatheroffice.ec.gc.ca/climatedata/canada_e.html. Reported air temperatures are an average of the hourly readings taken at the Campbell River "A" climate station during the period of the snorkel survey or bank walk.

3.0 Results and Discussion

3.1 Recent Adult Escapement Data

The Department of Fisheries and Oceans records for adult escapement data for the Mohun Creek watershed include information on the area surveyed, type of survey conducted, dates of surveys and actual counts of adult fish from 1999 to 2003. This information is summarized in Table 1. As the information for each year was collected over a period of time, there is the possibility that individual fish would be observed on more than one occasion. Therefore, only the maximum number of individuals of each species observed (and the date of the observation) is reported in Table 1.

Table 1. A summary of adult escapement survey information from 1999 – 2003, in the Mohun Creek watershed.

Year	Period	No. of surveys		Max no. fish observed (date)				
		snorkels	stream walks	CO	PK	CM	CH	ST
1999	Oct 18 - Nov 30	4	4	26 (Nov 23)	2 (Oct 18)	25 (Nov 17)	2 (Nov 23)	2 (Nov 30)
2000	Sept 14 - Dec 7	8	1	165 (Nov 2)	30 (Oct 19)	150 (Nov 2)	1 (Oct19)	0
2001	Sept 26 - Nov 7	3	1	57 (Nov 7)	3 (Sept 26)	530 (Nov 7)	0	0
2002	Oct 21 - Dec 4	3	2	3 (Nov 22)	0	4 (Nov 4)	0	0
2003	Nov 6 – Nov 27	1	3	0	0	0	0	0

CO – coho salmon, PK – pink salmon, CM – chum salmon, CH – chinook salmon, ST – steelhead trout

No fish were counted during surveys (n = 4) completed in 2003, and counts were very low in 2002. The peak count of coho between 1999 and 2003 occurred on November 2, 2000 with an observation of 165 individuals. A high of 530 chum were observed on November 7, 2001. A total of 30 pink salmon reported on October 19, 2000 is the highest count for this species in the past five years, with only 2 and 3 individuals observed 1999 and 2001 respectively.

3.2 Snorkel Surveys

Snorkel surveys were completed a total of 14 times between August 17 and November 26, 2004. Data was collected on air and water temperatures, water depth, visibility, flow levels, the percent of habitat observed and adult salmon observed for each reach (Appendix A).

Adult coho (*Oncorhynchus kisutch*), chum (*O. keta*) and chinook salmon (*O. tshawytscha*) were observed within the Mohun Creek mainstem. Coho salmon were the

first adult salmon species to be observed on September 21, 2004, while chum were first observed on October 13, 2004 (Table 2). Only one chinook salmon was counted during the survey period, on November 1, 2004. Peak counts of 32 coho and 142 chum for the surveyed portion of the Mohun Creek mainstem were observed on November 3, 2004.

The abundance of coho and chum was within the range of observed fish reported in the data collected for the previous five years. Counts in 2004 were higher than those reported in the previous two years. Meaningful comparisons related to the abundance of coho and chum is not possible due to the yearly variation in survey area, effort and methods used. The peak count of coho and chum occurred on a date (November 3, 2004) that is consistent with peak counts from previous years, although peaks have been recorded as late as the third week in November.

Table 2. Snorkel count data by species and by reach for the 6.1km survey area of Mohun Creek mainstem, August to November 2004.

Survey date	Coho				Chum			
	Reach 1	Reach 2	Reach 3	Total	Reach 1	Reach 2	Reach 3	Total
17-Aug-04	0	0	0	0	0	0	0	0
24-Aug-04	0	0	0	0	0	0	0	0
31-Aug-04	0	0	0	0	0	0	0	0
7-Sep-04	0	0	0	0	0	0	0	0
14-Sep-04	0	0	0	0	0	0	0	0
21-Sep-04	2	1	1	4	0	0	0	0
28-Sep-04	5	1	0	6	0	0	0	0
5-Oct-04	7	0	0	7	0	0	0	0
13-Oct-04	11	3	4	18	1	2	14	17
19-Oct-04	2	1	5	8	0	0	19	19
3-Nov-04	0	4	28	32	0	0	142	142
9-Nov-04	0	0	5	5	0	0	28	28
19-Nov-04	6	0	12	18	0	0	22	22
26-Nov-04	0	0	5	5	0	0	5	5

The number of chinook reported historically in Mohun Creek, and particularly during the most recent surveys (1999 on), has been almost negligible. It seems probable that the rare individuals observed are strays from the nearby Campbell River system, and are not part of a self-sustaining population in the Mohun Creek watershed. However, juvenile chinook were reported in the lower mainstem in 1998 (Rutherford, SE. et al., 2000), suggesting that the occasional pair of chinook are able to spawn successfully in the watershed.

Pink salmon were notably absent from the Mohun Creek watershed for the third year. Observations from the three years prior also had pink salmon at extremely low levels. The lack of adult pink salmon returning to Mohun Creek confirms that the once abundant species has all but disappeared from the watershed.

Sport fisherman once actively pursued steelhead trout in Mohun Creek, but recent observations of this species are limited to two adults in 1999. Again, juvenile rainbow trout were captured in the lower mainstem in 1998, but it was not confirmed if these individuals were part of an anadromous or resident population. Mature steelhead trout were not observed during this project, but the timing of the survey did not include the peak migration period for this species.

The distribution of adult salmon observed within the Mohun Creek mainstem in 2004 was clumped within areas of preferred habitat. The numbers of adult salmon species recorded by reach are presented within Table 2. The highest numbers of adult salmon of both species were observed in Reach 3. The distribution of fish within Reach 3 was clumped, with the majority of fish observed in the upper 1.5km of the reach. The Mohun Creek Anadromous Habitat Assessment (Stewardson, M. 2004b) described spawning habitat as limited in quality and quantity in Reaches 1 and 2, with Reach 3 containing the most extensive potential spawning areas.

Of note is the fact that escapement surveys conducted during previous years (specifically prior to 2002) were primarily completed in the lower portion of the mainstem, usually corresponding to all or portions of Reaches 1 and 2. This suggests that the counts from previous surveys are an under-representation of the actual number of fish that were present in the mainstem, particularly during the peak periods.

The first dead adult chum salmon were observed on November 9, 2004. Only dead chum salmon were observed with numbers ranging from a count of one on November 9, 2004 to a peak of six dead adults observed on November 19, 2004.

The snorkel crew recorded the percentage of the stream habitat that they observed during surveys. Observed habitat was less than 100% due to water clarity, cut banks or deep pools which decreased the observer's ability to view the entire channel and therefore created the potential to miss fish. Using the percent habitat observed and the actual count data it is possible to extrapolate the numbers of fish that would have been

counted if the entire channel was observed. The resulting estimates of total fish altered the peak counts from 32 to 48 for coho and from 142 to 203 for chum (Table 3).

Table 3. Estimates of total escapement of coho and chum from snorkel surveys completed between August 17 and November 26, 2004 in the Mohun Creek mainstem.

Date	Coho		Chum	
	No. observed	No.estimated	No. observed	No.estimated
17-Aug-04	0	0	0	0
24-Aug-04	0	0	0	0
31-Aug-04	0	0	0	0
7-Sep-04	0	0	0	0
14-Sep-04	0	0	0	0
21-Sep-04	4	5	0	0
28-Sep-04	6	8	0	0
5-Oct-04	7	9	0	0
13-Oct-04	18	22	17	20
19-Oct-04	8	16	19	27
3-Nov-04	32	48	142	203
9-Nov-04	5	25	28	140
19-Nov-04	18	35	22	37
26-Nov-04	5	6	5	6

Observations made during another foot survey within the survey area (completed during the GPS mapping of the mainstem, November 10, 2004) suggested that fish abundance was higher than recorded for the snorkel survey on November 9, 2004. The visibility was very poor (due to high water and increased sediment load) during the snorkel, and the crew felt they had not been able to see a notable number of fish. The mapping crew was able to easily observe a large number of fish from the bank on the following day, as water clarity improved significantly. The fish numbers extrapolated from the snorkel results (taking the total fish counts and water conditions into account) also indicate that the actual number of fish present on that date was notably higher than reported by the snorkel crew.

The mapping crew noted adult coho and chum at the downstream ends of the unnamed anadromous tributary, a small, unnamed tributary immediately upstream of the unnamed anadromous tributary and the Frog Lake outlet stream.

Stream depth was recorded using a depth gauge located where Highway 19 crosses Mohun Creek. Depths ranged from 0.45m to 1.62m. The depth was 0.49m on Sept. 21, 2004 when the first adult salmon was observed. The peak count of coho and chum abundance occurred at a flow depth of 1.07m (Nov. 3, 2004).

Stream depth data is graphed in relation to snorkel adult salmon counts in Figure 2. This figure illustrates the direct response of fish abundance to water levels, with a significant increase in fish counts occurring in conjunction with a significant increase in water flow level.

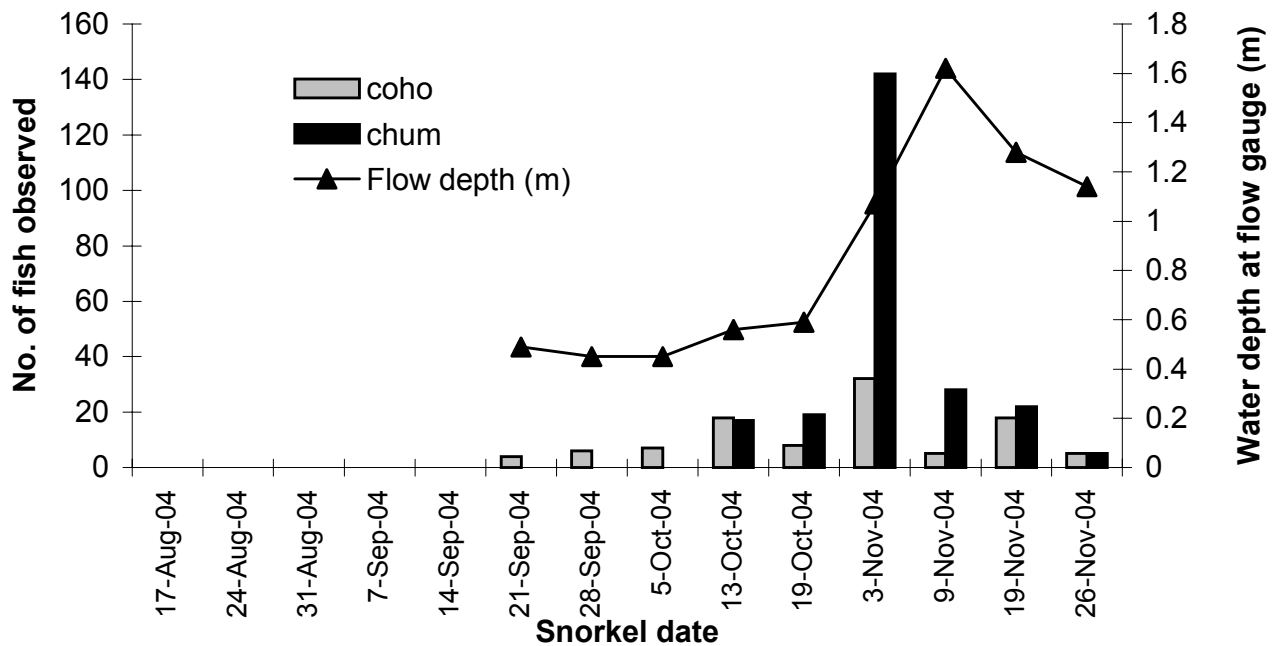


Figure 2. The depth of water measured at the flow gauge at the Highway 19 bridge crossing of Mohun Creek, compared to fish counts during snorkel surveys between August 17 and November 26, 2004.

Flow levels, measured as a range of percent of bankfull flow, were recorded for each reach during snorkel surveys. At the commencement of the surveys flows were at less than 25% bankfull for all three reaches. Flows gradually increased, reaching a maximum of over bankfull on October 26, 2004. Flows remained high, at bankfull or higher, until November 26, 2004 when they subsided to within the range of 75-100% bankfull. Generally flow levels were slightly lower in Reach 3 than in Reaches 1 and 2, until max flows were reached. The timing of the increase in abundance of coho and chum counts can be seen to correlate to the increase in flow level to bankfull or higher.

Water temperatures ranged from 6 to 19 °C over the course of the project. The water temperature was 12°C when the first adult salmon was observed within Mohun Creek and 7°C on the peak count week (November 3, 2004). Water temperature is presented in relation to the adult salmon counts during the snorkel surveys in Figure 3.

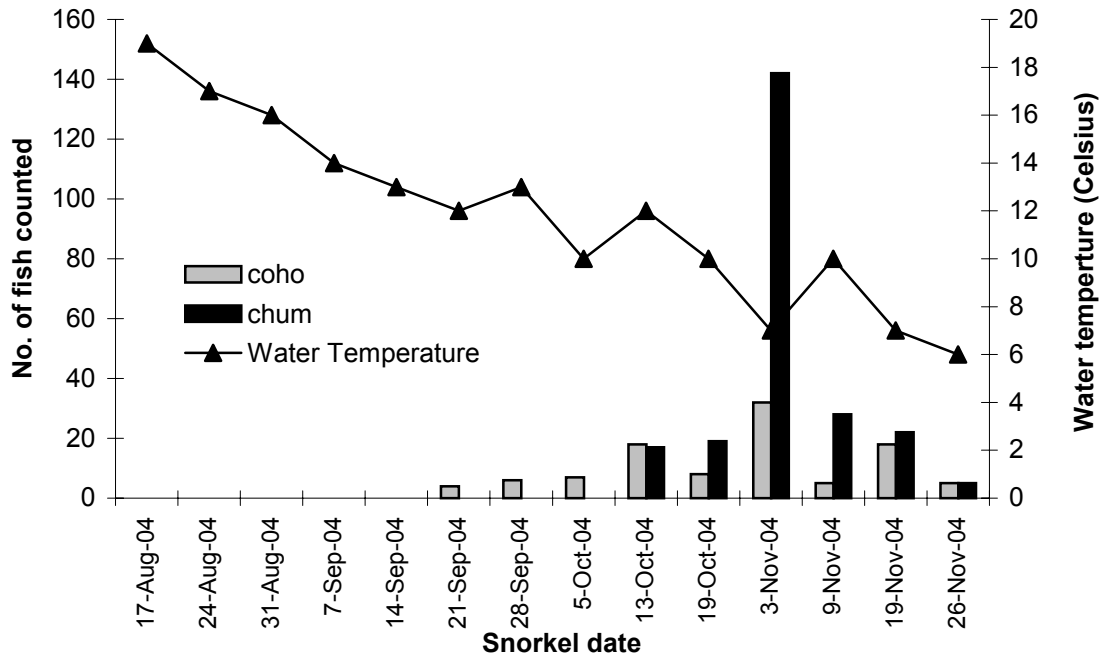


Figure 3. The water temperature in Mohun Creek compared to fish counts during snorkel surveys between August 17 and November 26, 2004.

When comparing the relative abundance of fish to changes in flow levels, stream depth and water temperature, it is evident that the sharp increase in flow level and stream depth precipitates a corresponding increase in fish abundance. The relationship between the increase in stream runoff and the entry of adult coho and chum salmon into freshwater has previously been documented (Groot and Margolis, 1991). This direct relationship is less obvious when comparing water temperature to fish abundance in Mohun Creek, however it has also been shown that the initiation of fish migration into the stream system from the marine environment can be correlated to a specific temperature range. Unfortunately, the absence of pink salmon during the snorkel surveys does not allow for the examination of the relationship between stream flows, water level and water temperature and the appearance of this species in Mohun Creek. A review of the known life history information for pink salmon in British Columbia indicates that this species should be present at peak levels of abundance between August and October (Groot and Margolis, 1991).

Visibility within the stream ranged from 0.2m to greater than 3m. Surveys were only completed if visibility was greater than 0.5m. Of the 14 snorkel surveys, there was one completed when visibility was less than 1m, three completed when visibility ranged from 1m to 2m, six completed with the visibility of 2m - 3m and four completed when visibility was greater than 3m. Visibility generally decreased slightly as the crew proceeded downstream. Most often the visibility was greater than 3m in Reach 3, and 1m to 2m in Reaches 1 and 2.

3.3 Bank Walks

Bank walks were completed on six days between October 4 and November 26, 2004. Volunteers recorded data on flow levels, water clarity and fish observed for each segment of the bank that was walked. This data is presented in Appendix 2. Coho and chum salmon were first observed during the bank walk completed on November 5, 2004. This was the peak week of adult observations with two coho and 28 chum being recorded within the bank walk sections. The only other date where salmon were observed was November 12, 2004. Bank walk data is summarized in Table 4.

Table 4. Counts of adult salmon observed by CRFW volunteers in each bank walk segment along Mohun Creek. Each segment is located within the reach of the same number. (N/S = not surveyed)

Date	Segment 1		Segment 2		Segment 3	
	coho	chum	coho	chum	coho	chum
Oct. 4, 2004	0	0	0	0	0	0
Oct. 14, 2004	0	0	0	0	0	0
Oct. 19, 2004	0	0	0	0	0	0
Nov. 5, 2004	0	0	2	0	0	28
Nov. 12, 2004	N/S	N/S	N/S	N/S	0	8
Nov. 26, 2004	N/S	N/S	N/S	N/S	0	0

On November 3, 2004 the snorkel crew recorded the number of adult salmon that were observed within each bank walk section of Mohun Creek. A comparison of the snorkel data recorded for the bank walk section with the corresponding bank walk data (collected on November 5, 2004) is presented in Table 5.

Table 5. Adult salmon count data collected from snorkel surveys within the bank walk section and bank walk data for the week of October 31-November 6, 2004.

Segment 1		Segment 2		Segment 3	
coho	chum	coho	chum	coho	chum

Nov. 3, 2004 (Snorkel Survey)	0	0	3	0	10	31
Nov. 5, 2004 (Bank Walk)	0	0	2	0	0	28

Bank walks were conducted over a portion of the stream reach, and the observers estimated the percentage of the stream habitat within the segment that they could see. Using these two numbers, it was possible to extrapolate the total number of fish that could have been counted by the observers if they were able to survey the entire stream reach. The total count estimates for bank walks are presented in Table 6. The extrapolated numbers underestimate coho numbers (24 versus 48) and overestimate chum numbers (653 versus 203) when compared to estimates based on snorkel counts

Table 6. Estimates of total escapement of coho and chum from bank walk surveys completed between October 4 and November 26, 2004 on the Mohun Creek mainstem. (N/S = not surveyed)

Date	Segment 1		Segment 2		Segment 3	
	CO	CM	CO	CM	CO	CM
Oct. 4, 2004	0	0	0	0	0	0
Oct. 14, 2004	0	0	0	0	0	0
Oct. 19, 2004	0	0	0	0	0	0
Nov. 5, 2004	0	0	24	0	0	653
Nov. 12, 2004	N/S	N/S	N/S	N/S	0	8*
Nov. 26, 2004	N/S	N/S	N/S	N/S	0	0

* Percent habitat observed was not recorded so an estimated total count cannot be calculated.

4.0 Conclusions

The fall escapement project, completed in 2004 by the Campbell River and District Fish and Wildlife Association, provides extensive information on the number of returning adult salmon for the year. In addition, the temporal and spatial distribution of adult fish in the mainstem during the fall spawning season was investigated. The extended survey period and survey area expands on information previously collected by DFO.

While it is difficult to make definitive conclusions regarding salmon escapement using data collected during one year, the following general conclusions are made based on observations made during this most recent fall escapement survey, taking into consideration other previously collected data.

1. Self-perpetuating populations of coho and chum salmon are present in the Mohun Creek watershed. Chinook salmon may occasionally be present in the watershed, but are likely stray adults from nearby systems, or the progeny of stray adults. The population of pink salmon in the watershed appears to have been decimated.
2. Obtaining accurate peaks counts of coho and chum abundance requires that snorkel surveys be conducted in the third reach of the mainstem (specifically, the upper 1.5km), beginning no later than the end of October. While low numbers of coho and chum were observed in the first two reaches early in the survey period, the count of adults present after the peak in abundance was always highest in Reach 3. Estimates made based on counts from the lower two reaches should take into account the clumped distribution of fish during and following the peak migration period (generally beginning in early November). The good quality spawning habitat present in Reach 3, and the change in habitat that occurs in Reach 4, results in the “stacking up” of the adult salmon in Reach 3, particularly at the upper end.
3. Obtaining accurate estimates of abundance of returning adults during bank walks may be difficult for Mohun Creek, particularly in Reaches 1 and 2. Estimates based on counts by bank walk observers during the week of peak counts were significantly different than estimates extrapolated from the snorkel counts in the same areas. The variation in population estimates is due in part to the variation in survey area (between 11 and 20% of the reaches were surveyed during banks

- walks, as opposed to essentially 100% of the reach lengths surveyed during snorkel swims). Also, differences in observer ability will play in role in the accuracy of bank walk counts. Bank walk observers frequently noted decreased visibility due to “cloudy” water and dark substrate. Unfortunately, the bank walk data collected during this project was insufficient to allow for a calibration of this method, using the snorkels counts for the same areas, for future bank walks.
4. Adult coho and chum were observed at the downstream end of three anadromous tributaries, and the use of the Coho Creek tributary by spawning coho has previously been confirmed. Future escapement surveys could be conducted to assess the proportion of the returning salmon population that disperses into the anadromous tributaries, and to gain a better estimate of the total escapement for the watershed.

5.0 References

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Appendix 1 – Snorkel data

Reach 1:

Date	Water Temp. (°C)	Air Temp. (°C)	% Bankfull	Visibility (m)	% Habitat Obs.	chinook		chum		coho	
						Obs.	Est.	Obs.	Est.	Obs.	Est.
17-Aug-04	19	25	<25	2-3	80	0	0	0	0	0	0
24-Aug-04	17	17	<25	2-3	80	0	0	0	0	0	0
31-Aug-04	16	17	<25	3	80	0	0	0	0	0	0
7-Sep-04	14	17	25-50	1.5-2	80	0	0	0	0	0	0
14-Sep-04	13	13	50-75	1-1.5	80	0	0	0	0	0	0
21-Sep-04	12	13	75-100	2	80	0	0	0	0	2	3
28-Sep-04	13	17	75-100	3+	80	0	0	0	0	5	6
5-Oct-04	10	12	25-50	3+	80	0	0	0	0	7	9
13-Oct-04	12	17	75-100	2	80	0	0	1	1	11	14
19-Oct-04	10	7	75-100	1-1.5	35	0	0	0	0	2	6
26-Oct-04	8	7	>100	0.2	Did not survey						
3-Nov-04	7	6	100	2-3	50	0	0	0	0	0	0
9-Nov-04	10	10	>100	0.5-1.0	5	0	0	0	0	0	0
19-Nov-04	7	6	100	2	40	0	0	0	0	6	15
26-Nov-04	6	3	75-100	3+	75	0	0	0	0	0	0

Reach 2:

Date	Water Temp. (°C)	Air Temp. (°C)	% Bankfull	Visibility (m)	% Habitat Obs.	chinook		chum		coho	
						Obs.	Est.	Obs.	Est.	Obs.	Est.
17-Aug-04	19	25	<25	2-3	80	0	0	0	0	0	0
24-Aug-04	17	17	<25	<2	80	0	0	0	0	0	0
31-Aug-04	16	17	<25	3	80	0	0	0	0	0	0
7-Sep-04	14	17	25-50	1.5-2.0	80	0	0	0	0	0	0
14-Sep-04	13	13	50-75	1-1.5	80	0	0	0	0	0	0
21-Sep-04	12	13	75-100	2	80	0	0	0	0	1	1
28-Sep-04	13	17	75-100	3+	80	0	0	0	0	1	1
5-Oct-04	10	12	25-50	3+	80	0	0	0	0	0	0
13-Oct-04	12	17	75-100	2	80	0	0	2	3	3	4
19-Oct-04	10	7	75-100	1	35	0	0	0	0	1	3
26-Oct-04	8	7	>100	0.2	Did not survey.						
3-Nov-04	7	6	100	3	50	0	0	0	0	4	8
9-Nov-04	10	10	>100	0.5-1.0	5	0	0	0	0	0	0
19-Nov-04	7	6	100	40	40	0	0	0	0	0	0
26-Nov-04	6	3	75-100	3+	75	0	0	0	0	0	0

Reach 3:

Date	Water Temp. (°C)	Air Temp. (°C)	% Bankfull	Visibility (m)	% Habitat Obs.	chinook		chum		coho	
						Obs.	Est.	Obs.	Est.	Obs.	Est.
17-Aug-04	19	25	<25	3+	95	0	0	0	0	0	0
24-Aug-04	17	17	<25	2-3	95	0	0	0	0	0	0
31-Aug-04	16	17	<25	3+	95	0	0	0	0	0	0
7-Sep-04	14	17	25-50	1.5-2.0	95	0	0	0	0	0	0
14-Sep-04	13	13	25-50	3+	95	0	0	0	0	0	0
21-Sep-04	12	13	50-75	3+	95	0	0	0	0	1	1
28-Sep-04	13	17	50-75	3+	95	0	0	0	0	0	0
5-Oct-04	10	12	25-50	3+	95	0	0	0	0	0	0
13-Oct-04	12	17	75-100	2	85	0	0	14	16	4	5
19-Oct-04	10	7	75-100	1.5	70	0	0	19	27	5	7
26-Oct-04	8	7	>100	0.2	Did not survey.						
3-Nov-04	7	6	100	3+	70	1	1	142	203	28	40
9-Nov-04	10	10	>100	1.5-2.0	20	0	0	28	140	5	25
19-Nov-04	7	6	100	3+	60	0	0	22	37	12	20
26-Nov-04	6	3	75-100	3+	85	0	0	5	6	5	6

Appendix 2 – Bank walk data

Date	Water Temp. (°C)	Air Temp. (°C)	% Bankfull	Visibility (m)	% Habitat Observed	% Reach Observed	Chinook		Chum		Coho	
							Observed	Estimated	Observed	Estimated	Observed	Estimated
Reach 1												
4-Oct-04	10	12	25-50	3+	90	20	0	0	0	0	0	0
14-Oct-04	13	17			40	20	0	0	0	0	0	0
19-Oct-04	10	6	75-100	0.5-1.0		20	0	0	0	0	0	0
5-Nov-04	8	8		0.5-1.0	50	20	0	0	0	0	0	0
Reach 2												
4-Oct-04	10	12	25-50	3+	50	11	0	0	0	0	0	0
14-Oct-04	13	17				11	0	0	0	0	0	0
19-Oct-04	10	6	75-100	0.5-1.0		11	0	0	0	0	0	0
5-Nov-04	8	8		0.5-1.0	75	11	0	0	0	0	2	24
Reach 3												
4-Oct-04	10	12	25-50	3+	100	11	0	0	0	0	0	0
14-Oct-04	13	17			40	11	0	0	0	0	0	0
19-Oct-04	10	6	75-100	0.5-1.0		11	0	0	0	0	0	0
5-Nov-04	8	8		0.5-1.0	60	11	0	0	28	653	0	0
12-Nov-04	9	5	100	0.5-1.0		11	0	0	8	0	0	0
26-Nov-04	6	2				11	0	0	0	0	0	0