

# Salmon Escapement to Englishman River, 2001

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## **Abstract**

The Pacific Salmon Endowment Fund was created to conserve and rebuild salmon stocks in British Columbia and the Yukon. In one of three regions of concern, the Georgia Basin coho and steelhead stocks, the Englishman River was identified as the first watershed to have a recovery plan developed. This watershed has all five species of salmon, as well as steelhead and cutthroat trout. As part of the recovery plan assessments of spawning salmon (“escapement”) will be conducted annually.

Escapements of salmon to the Englishman River were estimated at: pink salmon – 13,500, chum – 10,400, sockeye – 11, coho – 8,000, and chinook 2,900. The Centre Creek coho escapement was estimated at 412.

There were some problems in data collection due to weather conditions and other factors. Several recommendations have been made to minimize these concerns. Application of external tags should be more strategic in terms of pulses of incoming salmon, rather than strictly weekly. The collection location of coho and chinook for the tag application should be moved upstream to avoid fish from other systems that have sought refuge in the Englishman River from predators. Mainstem and tributary visual surveys should be conducted weekly, weather permitting, from mid August through mid December, with coho and chinook carcass recovery as part of each survey.

These escapements are at or above the long term average but must be considered with several factors. The methodology of escapement enumeration was changed in 1999 which would have effected the reported numbers. The marine conditions have decreased the ocean survival of smolt to returning adults, which limited the ability of the stocks to withstand high levels of exploitation by the various fisheries. As a result DFO fishery managers drastically reduced the opportunities for the commercial and sport fishing sectors for coho and chinook. This reduction in exploitation rate increased the escapement of salmon to southern BC creeks in general, not just the Englishman River.

## Introduction

The Pacific Salmon Endowment Fund was created on 16 February 2001 by Herb Dhaliwal, then Minister of Fisheries and Oceans (DFO), to conserve and rebuild salmon stocks in British Columbia and the Yukon. The Pacific Salmon Endowment Fund Society was created to oversee the fund and control the direction and expenditures. The goal of the Fund is to achieve healthy, sustainable and naturally diverse salmon stocks by conserving and rebuilding salmon populations through strategic and focused efforts. The Georgia Basin coho (*Oncorhynchus kisutch*) and steelhead (*O. gairdneri*) stocks are one of three concerns that the Society has identified as a priority for developing a recovery plan.

One of the primary components of a recovery strategy is a comprehensive monitoring program. This program is used to track the salmon populations to measure whether objectives are being met and to detect stock declines and increases in each area of concern. Part of this monitoring program is to enumerate the salmon escapement using scientifically accepted practices approved by DFO.

The Englishman River was selected by the Society as the first watershed to receive attention in the Georgia Basin. The Englishman River is an important salmon-producing stream on the mid-east coast of Vancouver Island. The watershed has all species of salmon, including steelhead and is designated a sensitive stream by the BC government under the Fish Protection Act (Bocking and Gaboury 2001). Annual escapement estimates of salmon from 1953 to 2000 are presented in Table 1.

The Englishman River flows into the Strait of Georgia at Parksville on Vancouver Island and drains roughly 324 km<sup>2</sup>. The river originates on the eastern slopes of Mt. Arrowsmith (1820 m) and Mt. Moriarty Ridge and flows in an easterly direction for 40 km. The mainstem has an accessible reach of 15.85 km. There are four main tributaries: South Englishman (4.5 km accessible reach), Morison (2.1 km), Centre (5.2 km), and Shelly (1.0 km). Centre creek is a tributary of the South Englishman, located approximately 200 m upstream from the confluence of the South Englishman with the mainstem (Bocking and Gaboury 2001).

There are four species of Pacific salmon that occur in the Englishman River besides coho: pink, *O. gorbuscha*; chum, *O. keta*; chinook, *O. tshawytscha*; and sockeye, *O. nerka*. . As well as steelhead trout, there are rainbow trout in the system (the non-anadromous form of steelhead trout) and coastal cutthroat trout (*O. clarki*). Coastrange sculpin (*Cottus aleuticus*) and prickly sculpin (*C. asper*) are also resident fish species. Other species that may be present are threespine stickleback (*Gasterosteus aculeatus*) and lamprey (*Lampetra* sp.).

This report presents the results of salmon escapement enumeration work that was done in the Englishman system in the fall of 2001. Data collection was contracted to Community Fisheries Development Centre – Englishman River Enhancement.

## Methods

There are many methods of obtaining escapement estimates of salmon (Cousens et al. 1982). Escapements of pink, chum and sockeye spawners will be estimated by expanding the peak live count by an observer efficiency. This method is used for species that enter a system in one large group and are easily observed. Estimated numbers are calculated by dividing observed counts by observer efficiencies (estimates by the crew of the percent their count represents of the actual population in the reach) for each section, then totalled for the entire reach.

Coho and chinook escapements will be estimated by using an Area-Under-the-Curve technique (AUC, e.g. English et al. 1992). In this method each count is expanded by the observer efficiency and % coverage to calculate a total system estimate. These estimates are plotted against time and the integral of this curve is divided by the survey life (SL). The SL, or average length of time that a fish is in the defined survey reach, can be estimated by tagging fish that have recently migrated into the survey reach and counting the number of those tags present in subsequent surveys. The tag counts are plotted against time. The integral of the curve of this plot is divided by the number of tags applied, resulting in an estimate of the SL.

The tagged salmon allow a Petersen mark-recapture estimate as well (Ricker 1973). The marks are recovered by examining all coho and chinook carcasses, as well as the coho trapped at the counting fence on the Centre creek tributary (described below). The number and type of marked and unmarked salmon were recorded.

## ***Spawner Surveys***

### Tagging

Tags were applied to fresh salmon that had recently entered the Englishman River. A 50 m beach seine was used to capture coho and chinook spawners for marking. We fished 300 m downstream of the Highway 19A bridge and 50 m above the bridge. The fishing occurred one day per week through October and ended on Nov 6. The species and fork length ( $\pm 1$  cm) of each coho and chinook was noted and an anchor tag (Hallprint type TBA-1) was inserted lateral to the posterior insertion of the dorsal fin. This location was used so that the tag would be visible from either side of the animal. Tags were individually numbered and, except for the last session, a unique colour was used each time. Table 2 shows for each date the tag colour and number of each species tagged. Other species were not tagged but catches were recorded.

### Surveys

The mainstem was divided in 26 sections starting at the estuary and finishing at the barrier falls. Each section was approximately 600 meters in length. Mainstem spawner counts started during the week of 17-21 September and continued weekly until 5-9

November. A final survey was done during the week of 3-7 December. Two swimmers conducted the counts, noting the number of live fish for each species and number and colour of each tag encountered.

The Timberwest side channel was counted by instream wading from the outlet confluence to the intake at the upstream end. The channel was counted on 21 and 28 September, 3 October, 14 November and 3 and 11 December. Similarly the Weyerhaeuser side channel was counted by instream wading on 3 October, 8 and 14 November and 3 December, and swam on 27 November.

The South Englishman was divided into 8 sections from the confluence with the mainstem to approximately 500 m downstream from the Northwest Bay Road crossing. These sections were counted via swimmer on 21 and 28 September, 2 and 27 November and 10 December.

Morison Creek was divided into 9 sections from the confluence, with the mainstem with each section approximately 200 m long. The sections were counted by instream wading on 19 November, and 4 and 14 December.

Centre Creek was divided into 21 sections from the confluence with the South Englishman, each about 250 m long. Counts were made by instream wading on 19 and 24 November, and 5 and 13 December.

Recovery and enumeration of spawned-out carcasses started on 30 November and continued until 14 December.

### **Centre Creek**

Estimates of exploitation rate and ocean survival are important measures for managing fisheries and for evaluating the Englishman R. Restoration Plan. We attempted to obtain these estimates for coho in Centre Creek by enumerating coho spawners in Centre creek with a counting weir. The purpose was to provide a reliable estimate of escapement, which could be combined with estimates of fishing mortality to estimate return (fishing mortality + escapement) and exploitation (fishing mortality/return). Coho smolts were enumerated at a weir on Centre Creek in 2000 but they were not coded wire tagged (CWT'd). CWTs were first applied at the fence in 2001 and tag recoveries in fisheries in 2002 will help estimate the fishing mortality of the next return. Tagging also allows us to link the number of smolts that were counted to the subsequent return of this tagged group, to give us an estimate of marine survival (return/smolts). Simple ratios of total escapement to total spring smolt production are usually serious over-estimates of marine survival because some of the adult return derives from juvenile production that occurred outside of the April to June migration period.

The counting fence that was constructed for coho smolt enumeration in the spring was altered to trap adult spawners entering the Centre creek system. The trap was located about 50 m from the confluence with the South Englishman. Steel grates with a 19 mm gap were laid on an angle to the substrate on the upstream side of the fence structure so that they would intercept debris moving down with the water flow. An adult trap was placed upstream of the fence so that adult salmon would enter when they encountered the fence.

Coho entering the trap had a new tag applied. The goal was to obtain a mark recapture estimate for Centre Creek using the new tags and recovering the tagged coho as carcasses either during the creek walks or on the fence. The tagging also provided survey life information for calculating an AUC population estimate from the counts obtained in the creek walks.

## **Results**

### ***Problems in Tag Observations***

The method of calculating SL using the observed number of tags present in the system requires counts through time until all of the tagged fish have died. For coho, the data from the first group of tags (orange) was confusing. The number of tags observed in the mainstem for the ensuing 5 weeks is between 53% and 87% of the number applied, and then the mainstem counts are discontinued due to flood conditions. With no apparent decrease in the number of tags present, and no zero count the data cannot be used to calculate a survey life for coho. We chose to assume a survey life of 30 days, based on the long period with not measured decrease in live tagged coho.

There is evidence that tagged coho left the Englishman River. The Parksville-Qualicum Fish and Game Association collected 82 coho during October and November in French Creek of which 9 had anchor tags that had been applied in Englishman River (6 red, 1 green, 1 orange and 1 yellow). This suggests that some French Creek coho stayed in the Englishman River and later entered their smaller home stream when water levels increased. The mouth of French Creek is 5 km northwest of the mouth of Englishman River. This behaviour has been suggested by DFO escapement enumeration technicians (pers. comm., L. Box, 865 Third Avenue, Courtenay, BC, V9N 1E9) and is consistent with results found by Labelle (1992) in streams like Trent R., 56 km north of Englishman. This emigration of tagged coho before being counted did not bias the SL estimate downward in this case because counts included the reaches where the tagging occurred (emigrants need not be distinguished from mortalities) and a decline in the count of tagged coho did not occur through the season in any event.

The data from tagged chinook salmon did exhibit a decrease over time and a survey life of 19.4 days was calculated using AUC methodology. The tagging locations were part of the survey so the SL estimate accommodates fish that may have emigrated. We also think its likely that fewer chinook left Englishman than coho since there are no other chinook streams as close to the Englishman as French Creek.

### ***Centre Creek***

The Centre Creek fence structure did not perform well under the fall flow conditions. It was designed for spring water flows and low debris loads. Fall flow conditions are much more severe with higher water volumes and substantially higher debris loads due to deciduous leaf fall. Under these conditions constant maintenance is required, particularly under storm events. This level of maintenance was not planned for and as a result the fence was topped and was unable to be fished.

Despite problems with the fence coho salmon were captured and marked on three days. One hundred and twenty-five coho were marked with a small yellow tag. During the recovery 35 coho carcasses were examined, of which 10 had this tag. A mark-recapture estimate of 412 coho is calculated from this data (95% CI: 218 – 606).

An AUC estimate can be obtained from the observation data. A survey life of 10.4 days is calculated using the AUC method, a value typical of many other coho populations in small streams (Perrin and Irvine 1990, Simpson et al. 2000). The population estimate of 376 coho is calculated using the observed data, expanded for observer efficiency and coverage.

### ***Pink***

The estimated total escapement of pink salmon is 13,500. This estimate was made from the sum of the expanded peak counts of live spawners from the sections.

Table 4 presents the observed and estimated number of live pink salmon spawners for each of the reaches that were enumerated. The estimated peak count for the mainstem was 10,500 and for the Timberwest channel was 3,000 with minor numbers of spawners in other tributaries.

Pink salmon were seen in all mainstem sections, with high numbers in sections 3, 7 and 11. They were present in the system during the first counts in September and peaked at that time. Numbers dropped rapidly until mid October when only remnants remained.

### ***Chum***

The estimated total escapement of chum salmon is 10,400. This estimate was a sum of the expanded peak live counts for all sections.

Table 5 presents the observed and estimated number of live chum salmon spawners for each of the reaches that were enumerated. The peak count in the mainstem occurred during the week of 29 October – 2 November but surveys in the tributaries did not start until the following week when mainstem numbers started declining. Peak numbers of spawners in the tributaries were estimated by applying the change in the estimated number in the mainstem to the mid-November counts in the tributaries. The estimated peak counts for the late October time period were 9850 in the mainstem, 280 in the Timberwest channel, 160 in the Weyerhaeuser channel and 150 in the South Englishman tributary. The late peak counts in Morison creek and Weyerhaeuser channel were not used because these fish would have been taken into account during the period that was used.

Chum salmon were seen in all mainstem sections, with high numbers in the first 13 sections. Chum started entering the system during the first week of October and a few individuals were still present at the end of the surveys in mid-December.

Field staff noted that there were 500-1,000 chum kills in the estuary, possibly from seal predation.

## **Sockeye**

The estimated total escapement of sockeye salmon is 11. This estimate was from the expanded peak count of live spawners.

Table 6 presents the observed and estimated number of live sockeye salmon spawners for each of the reaches that were enumerated. We saw sockeye in the mainstem, in sections 2 – 13, 23 and 24.

Sockeye were present during the first surveys in mid September and were observed in low numbers until the end of October. The peak observed count of 9, expanded to 11, occurred during mid October.

## **Coho**

The estimated total escapement of coho salmon is 8,000. This estimate is from an AUC calculation using an assumed survey life of 30 days.

Table 7 presents the observed and estimated number of live coho salmon spawners for each of the reaches that were enumerated. Coho were present in the system during the first mainstem surveys in middle September. The observed numbers peaked in the mainstem in late October when many started moving into the tributaries. The numbers of coho peaked in the tributaries in late November. Coho were still present in small numbers when the surveys ended in mid December.

Appendix A shows the calculation for survey life and the AUC calculation for both coho and chinook.

## **Chinook**

The estimated total escapement of chinook salmon is 2,900. This estimate is from an AUC calculation using the chinook survey life estimate of 19.4 days.

Table 8 presents the observed and estimated number of live chinook salmon spawners for each of the reaches that were enumerated. Chinook started entering the Englishman system before the first surveys in mid-September and peak numbers were counted in early to middle October. Chinook were no longer present in the early December mainstem survey. They were only seen in the mainstem.

## **Conclusions**

Escapement enumeration of the five species of Pacific salmon (pink, chum, sockeye, coho and chinook) was successful. The escapement levels for pink, chum, coho and chinook are above long-term averages but there are several points that must be considered in the current situation.

First, the methodology of estimating escapement on the Englishman changed in 1999. Prior to this year the escapements were estimated by DFO charter patrol and Fisheries Officers and, considering the other demands on the time of these workers, we may assume estimates were based on fewer and less extensive counts. Assessment effort

significantly increased in 1999. When the historic data is examined this change must be kept in mind. Any inferences about population trends may be the result of changes in methodology and not necessarily real.

Second, there have been major shifts and increases in commercial and sport fishing restrictions that have a direct influence in the number of salmon returning to fresh water to spawn. In 1998 the troll fishery along the west coast of Vancouver Island was halted, resulting in a dramatic increase in coho escapement along both sides of Vancouver Island in 1998. This is the brood year for the 2001 coho escapement. Additionally, the sportfishing sector has had severe restrictions in both coho and chinook retention, resulting in additional escapement (Baillie et al. 1999, Simpson et al. 1999).

Finally, ocean survival of smolts, particularly coho and steelhead, have been low in recent years. Any change in this factor will affect the number of salmon that return to freshwater. This may mask any changes in the population levels of the Englishman stocks that are due to changes in the fresh water habitat. Escapement enumerations are a necessary but not sufficient evaluation of the status of Englishman River stocks and the effectiveness of the recovery plan.

In order to put the 2001 Englishman coho escapement in context, we present a comparison of the 2001 escapement of other systems with previous years. Similar AUC estimates have been conducted on selected streams around Vancouver Island since 1998. Appendix B presents the AUC estimate of the coho escapement to these creeks, and the 2001 escapement expressed as a percent of the average over 1998-2000 and as a percent of the brood year (1998). The table shows that the 2001 escapement was almost double that of the 1998-2000 average as well as the brood year, indicating that in this period when commercial and sport fishing was limited the stocks have shown an increase in size.

Two separate estimates have been obtained for the Centre Creek coho escapement. The AUC estimate is limited by the uncertainty in the observer efficiency. This number, which represents the proportion of the total population that has been enumerated, is an estimate by the observer based upon the counting conditions at the time of the survey. Factors such as water clarity, light levels, precipitation and water depth are all considered. In addition the same uncertainty extends to the survey life estimate. The mark recapture estimate is considered more accurate under these conditions therefore it is this estimate that is accepted.

## **Recommendations**

1. Mainstem surveys should be conducted from the middle of August through to the middle of January. Surveys on tributaries should be started when appropriate and carried through to mid January. This regime will allow a complete enumeration of pink salmon, as well as more complete AUC calculation and carcass recovery on coho.
2. Carcass recovery for tagged coho and chinook should be conducted throughout the survey period. The location, species, tag number, date of recovery and condition of carcass should be noted.

3. Anchor tags should be applied to coho and chinook when there are large groups of escapement entering the Englishman system, rather than every week. These peaks of migration would occur with flood events. The date, species, and tag number should be noted for each fish. An AUC estimate may not be achievable because of the high water conditions that prevent accurate data collection. A mark recapture estimate may be the only option so it will be important to tag representative groups of coho as they enter the system, and recover as many carcasses as possible.
4. The location at which fish are tagged be moved further upstream to prevent or minimize tagging of non-target stocks.
5. The 2002 escapement will have coded-wire tagged coho from the 2001 smolt project on Centre Creek. Although the majority of these fish will return to Centre Creek, there will be some that remain in the mainstem or other tributaries to spawn. In order to check carcasses for tags, a portable tag detector will have to be used by the field crews.

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## Tables

Table 1. Escapement of each salmon species to the Englishman River, 1953-2000, from DFO NuSEDS database. UNK = unknown, NO = none observed.

	<b>Sockeye</b>	<b>Coho</b>	<b>Pink</b>	<b>Chum</b>	<b>Chinook</b>
<b>2000</b>	25	5280	1600	3500	1200
<b>1999</b>	20	2978	2500	25000	750
<b>1998</b>	UNK	1500	350	8000	UNK
<b>1997</b>	UNK	200	100	8000	20
<b>1996</b>	UNK	250	800	900	50
<b>1995</b>	UNK	UNK	UNK	2000	UNK
<b>1994</b>	NO	1150	NO	5500	NO
<b>1993</b>	30	246	UNK	1100	24
<b>1992</b>	UNK	440	2000	3500	40
<b>1991</b>	15	800	50	250	50
<b>1990</b>	10	1050	UNK	800	100
<b>1989</b>	30	200	UNK	1500	UNK
<b>1988</b>	30	250	UNK	3000	NO
<b>1987</b>	50	200	UNK	600	NO
<b>1986</b>	10	65	NO	2000	NO
<b>1985</b>	UNK	UNK	UNK	2500	UNK
<b>1984</b>	UNK	2000	UNK	2500	UNK
<b>1983</b>	UNK	UNK	UNK	200	UNK
<b>1982</b>	18	1000	3	2500	14
<b>1981</b>	UNK	300	UNK	400	NO
<b>1980</b>	UNK	300	100	1000	UNK
<b>1979</b>	UNK	1200	UNK	4000	UNK
<b>1978</b>	300	1500	10	6000	75
<b>1977</b>	25	1500	25	1500	25
<b>1976</b>	25	750	25	1500	25
<b>1975</b>	25	400	75	750	75
<b>1974</b>	25	1500	25	5000	25
<b>1973</b>	75	750	25	7500	75
<b>1972</b>	25	400	25	15000	75
<b>1971</b>	25	1500	25	3500	75
<b>1970</b>	25	1500	75	3500	75
<b>1969</b>	25	400	25	7500	75
<b>1968</b>	75	1000	100	6000	115
<b>1967</b>	20	285	NO	500	75
<b>1966</b>	25	1500	200	7500	25
<b>1965</b>	UNK	1500	NO	1500	75
<b>1964</b>	25	1500	NO	1500	25
<b>1963</b>	UNK	750	2	750	25
<b>1962</b>	NO	750	NO	3500	UNK
<b>1961</b>	25	750	25	3500	25
<b>1960</b>	25	400	200	3500	25
<b>1959</b>	1	750	1	3500	UNK
<b>1958</b>	25	750	400	15000	UNK
<b>1957</b>	25	3500	3500	7500	UNK
<b>1956</b>	25	1500	400	750	UNK
<b>1955</b>	25	750	750	1500	UNK
<b>1954</b>	UNK	1500	750	15000	UNK
<b>1953</b>	UNK	750	200	15000	UNK

Table 2. Number of anchor tags applied, by date, to coho and chinook salmon in the Englishman River, Fall 2001.

<b>Date</b>	<b>Tag Colour</b>	<b>Coho</b>	<b>Chinook</b>
04 Oct 2001	Orange	30	24
11 Oct 2001	Green	143	43
16 Oct 2001	Red	444	51
23 Oct 2001	Yellow	251	5
30 Oct 2001	Blue	249	0
06 Nov 2001	Orange right	239	0

Table 3. Observed and estimated number of live pink salmon spawners in the Englishman River and tributaries, 2001.

Location	Date	Observed number	Estimated number
Mainstem	17-21 Sept 2001	9256	10478
	24-28 Sept 2001	3785	5916
	1-5 Oct 2001	2279	3030
	8-12 Oct 2001	335	462
	15-19 Oct 2001	75	111
	22-26 Oct 2001	8	9
	29 Oct-2 Nov 2001	2	2
	5-9 Nov 2001	2	2
	3-7 Dec 2001	0	0
Timberwest channel	21 Sep 2001	2000 <sup>1</sup>	3000
	28 Sep 2001	3000	3000
	03 Oct 2001	1200	1200
	14 Nov 2001	0	0
	3 Dec 2001	0	0
	11 Dec 2001	0	0
Weyerhaeuser channel	3 Oct 2001	1	4
	8 Nov 2001	0	0
	14 Nov 2001	0	0
	3 Dec 2001	0	0
South Englishman	unknown	5	10
	unknown	5	10
	2 Nov 2001	0	0
	27 Nov 2001	0	0
	10 Dec 2001	0	0
Morison Creek	19 Nov 2001	0	0
	4 Dec 2001	0	0
	14 Dec 2001	0	0
Centre Creek	19 Nov 2001	0	0
	24 Nov 2001	0	0
	5 Dec 2001	0	0
	13 Dec 2001	0	0

1 – Incomplete count.

Table 4. Observed and estimated number of live chum salmon spawners in the Englishman River and tributaries, 2001.

Location	Date	Observed number	Estimated number
Mainstem	17-21 Sept 2001	0	0
	24-28 Sept 2001	0	0
	1-5 Oct 2001	56	68
	8-12 Oct 2001	253	338
	15-19 Oct 2001	1260	1663
	22-26 Oct 2001	3648	4790
	29 Oct-2 Nov 2001	7572	9847
	5-9 Nov 2001	7326	9381
	3-7 Dec 2001	162	234
Timberwest channel	21 Sep 2001	0	0
	28 Sep 2001	0	0
	03 Oct 2001	0	0
	14 Nov 2001	195	267
	3 Dec 2001	22	26
	11 Dec 2001	1	1
Weyerhaeuser channel	3 Oct 2001	0	0
	8 Nov 2001	112	149
	14 Nov 2001	175	350
	3 Dec 2001	44	88
South Englishman	21 Sep 2001	0	0
	28 Sep 2001	0	0
	2 Nov 2001	146	146
	27 Nov 2001	26	26
	10 Dec 2001	0	0
Morison Creek	19 Nov 2001	0	0
	4 Dec 2001	103	137
	14 Dec 2001	3	6
Centre Creek	19 Nov 2001	0	0
	24 Nov 2001	0	0
	5 Dec 2001	0	0
	13 Dec 2001	0	0

Table 5. Observed and estimated number of live sockeye salmon spawners in the Englishman River and tributaries, 2001.

Location	Date	Observed number	Estimated number
Mainstem	17-21 Sept 2001	5	8
	24-28 Sept 2001	0	0
	1-5 Oct 2001	7	9
	8-12 Oct 2001	9	11
	15-19 Oct 2001	5	8
	22-26 Oct 2001	1	3
	29 Oct-2 Nov 2001	0	0
	5-9 Nov 2001	0	0
	3-7 Dec 2001	0	0
Timberwest channel	21 Sep 2001	0	0
	28 Sep 2001	0	0
	03 Oct 2001	0	0
	14 Nov 2001	0	0
	3 Dec 2001	0	0
	11 Dec 2001	0	0
Weyerhaeuser channel	3 Oct 2001	0	0
	8 Nov 2001	0	0
	14 Nov 2001	0	0
	3 Dec 2001	0	0
South Englishman	Unknown	0	0
	Unknown	0	0
	2 Nov 2001	0	0
	27 Nov 2001	0	0
	10 Dec 2001	0	0
Morison Creek	19 Nov 2001	0	0
	4 Dec 2001	0	0
	14 Dec 2001	0	0
Centre Creek	19 Nov 2001	0	0
	24 Nov 2001	0	0
	5 Dec 2001	0	0
	13 Dec 2001	0	0

Table 6. Observed and estimated number of live coho salmon spawners in the Englishman River and tributaries, 2001.

Location	Date	Observed number	Estimated number
Mainstem	17-21 Sept 2001	74	117
	24-28 Sept 2001	165	265
	1-5 Oct 2001	1135	1381
	8-12 Oct 2001	1107	1438
	15-19 Oct 2001	1722	2347
	22-26 Oct 2001	3911	5303
	29 Oct-2 Nov 2001	3425	4734
	5-9 Nov 2001	3640	4930
	3-7 Dec 2001	498	1872
Timberwest channel	21 Sep 2001	0	0
	28 Sep 2001	0	0
	03 Oct 2001	0	0
	14 Nov 2001	165	220
	3 Dec 2001	110	183
	11 Dec 2001	66	110
Weyerhaeuser channel	3 Oct 2001	0	0
	8 Nov 2001	14	28
	14 Nov 2001	16	64
	3 Dec 2001	24	60
South Englishman	Unknown	0	0
	Unknown	0	0
	2 Nov 2001	97	194
	27 Nov 2001	141	198
	10 Dec 2001	49	206
Morison Creek	19 Nov 2001	229	382
	4 Dec 2001	110	275
	14 Dec 2001	47	118
Centre Creek	19 Nov 2001	20	35
	24 Nov 2001	174	232
	5 Dec 2001	78	105
	13 Dec 2001	60	96

Table 7. Observed and estimated number of live chinook salmon spawners in the Englishman River and tributaries, 2001.

Location	Date	Observed number	Estimated number
Mainstem	17-21 Sept 2001	415	487
	24-28 Sept 2001	890	1192
	1-5 Oct 2001	1383	1640
	8-12 Oct 2001	1230	1657
	15-19 Oct 2001	1314	1746
	22-26 Oct 2001	584	722
	29 Oct-2 Nov 2001	277	395
	5-9 Nov 2001	86	123
	3-7 Dec 2001	0	0
Timberwest channel	21 Sep 2001	0	0
	28 Sep 2001	0	0
	03 Oct 2001	0	0
	14 Nov 2001	0	0
	3 Dec 2001	0	0
	11 Dec 2001	0	0
Weyerhaeuser channel	3 Oct 2001	0	0
	8 Nov 2001	0	0
	14 Nov 2001	0	0
	3 Dec 2001	0	0
South Englishman	Unknown	0	0
	Unknown	0	0
	2 Nov 2001	0	0
	27 Nov 2001	0	0
	10 Dec 2001	0	0
Morison Creek	19 Nov 2001	0	0
	4 Dec 2001	0	0
	14 Dec 2001	0	0
Centre Creek	19 Nov 2001	0	0
	24 Nov 2001	0	0
	5 Dec 2001	0	0
	13 Dec 2001	0	0

## Appendix A

### Coho AUC Escapement Estimate

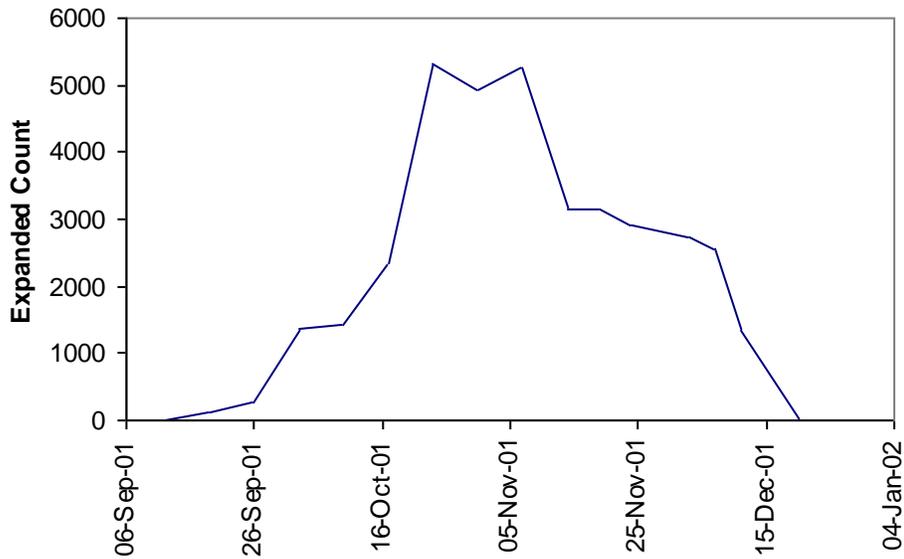


Figure 1. Area-Under the Curve plot for expanded coho counts for the Englishman River, 2001.

Area Under the Curve = 238950.5 fish - days

Assumed Survey Life = 30 days

Escapement Estimate =  $AUC / SL = 7965$  coho

### Chinook Survey Life AUC Calculation

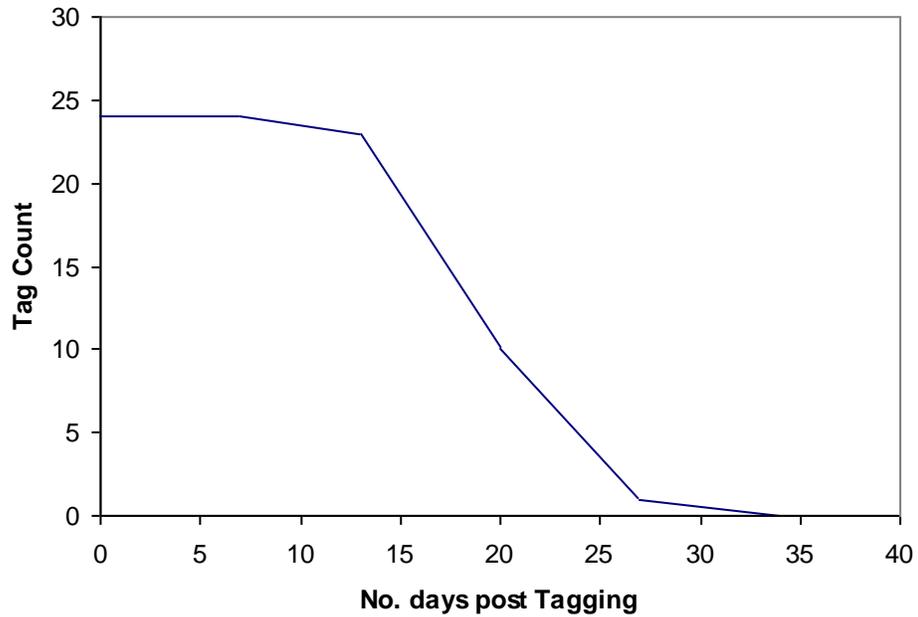


Figure 2. Area-Under the Curve plot for observed chinook orange tags for the Englishman River, 2001.

Area Under the Curve = 466.5 tag-days

No. of tags applied = 24

Survey Life = Area / No. of tags = 19.4 days

### Chinook AUC Escapement Estimate

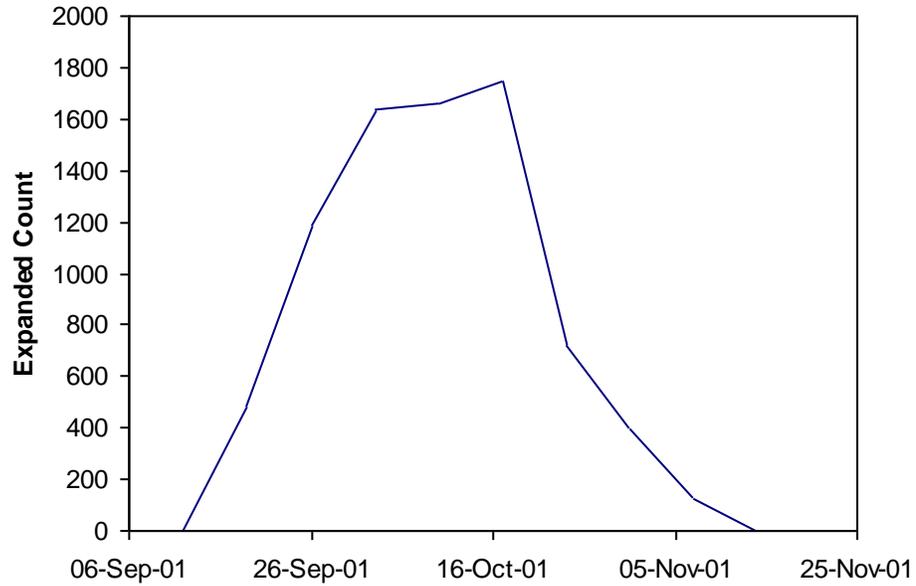


Figure 3. Area-Under the Curve plot for expanded chinook counts for the Englishman River, 2001.

Area Under the Curve = 55734 fish days

Survey life = 19.4 days

Escapement Estimate =  $AUC / SL = 2873$  chinook

## Appendix B

AUC escapements of coho salmon to selected creeks of east coast Vancouver Island.

Year	Black	Cowichan tribs	Trent	Tsable	Waterloo	Nile	Wilfred	Cowie	Nanoose	Bonell
2001	12100	1100	1195	3349	167	483	2417	491	963	117
2000	1114	634	1590	2512	147	518	874	617	843	83
1999	515	676	746	948	85	192	277	406	469	132
1998	7616	2386	1406	1068	107	227	477	357	386	91

2001 as % of 98-00 average

Average

393%	89%	96%	222%	148%	155%	445%	107%	170%	115%	194%
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Brood year change (1998-2001)

159%	46%	85%	314%	156%	213%	507%	138%	249%	129%	199%
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