Salmon Escapement to Englishman River, 2002

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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 one of the first watersheds to develop a recovery plan. 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 in 2002 were estimated to be: pink – 12,100, chum – 9,500, sockeye – 4, coho – 3,100, and chinook – 600. The Centre Creek coho escapement was estimated to be 232.

Fresh water survey lives were estimated to be: pink – 25.9 days, chinook – 16.1 days and coho – 20.5 days. A survey life could not be estimated for chum.

118 coded-wire tagged coho returned to Englishman River, and 33 returned to Centre Creek. A marine survival of 3.3% was estimated which is similar to other wild indicators (Black and Myrtle Creeks) and greater than hatchery indicators (Quinsam, Big Qualicum and Goldstream). Marine survivals are still trending upwards over the short term (4 years) but below near historic levels (10-15 years).

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 Canada (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 2001 are presented in Table 1.

The Englishman River flows into the Strait of Georgia at Parksville on Vancouver Island and drains roughly 324 km^2. 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 2002. Data collection was contracted to Community Fisheries Development Centre – Englishman River Enhancement. Funding and in-kind donations were received from the Pacific Salmon Endowment Fund, Fisheries and Oceans Canada, Community Fisheries Development Centre, and the Englishman River Enhancement Society.

Recommendations from the 2001 Report:

from Baillie and Young, 2002

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.

Methods

Population Estimate calculations

In the 2001 Englishman River Salmon Escapement Enumeration project an Area-under-the-Curve estimation technique was used to calculate the salmon escapement. This technique requires an accurate estimate of survey life, or the average length of time a fish is available to be enumerated. Due to weather conditions and limitations on observer efficiency during critical periods, we decided to use a mark-recapture method for escapement enumeration for the 2002 project. The equation used is the Chapman version of the Peterson formula as described by Ricker (1975). This formula adjusts for the overestimate bias of the original Peterson formula and provides an unbiased estimate of the population. The 95% confidence interval was calculated by multiplying the calculated standard error by 1.96 standard deviations.

Ideally the collection of organisms during the marking portion and the recovery portion of the project should be random throughout the population. Only one of these parts of the project needs to be random in order for the mark-recapture calculation to successfully estimate the population (Ricker 1975). We attempted to mark randomly by collecting all species once a week throughout the period of time when they are entering freshwater and at a location in the lower watershed where all escapement would be moving through. The carcass collection was conducted throughout the watershed and repeated weekly.

The continuing low levels of sockeye escapement are not appropriate for a mark recapture estimate therefore the field staff were asked to enumerate any sockeye spawners. The final escapement estimate would be the maximum count recorded, which would be a minimum estimate of the escapement.

Tagging

Tags were applied to fresh salmon that had recently entered the Englishman River. A 50 meter beach seine was used to capture spawners for marking. Seining was done in pools 300m downstream of the Highway 19A bridge and 50 m above the bridge. The fishing occurred one or two days per week from 28 August to 4 November 2002. The species, sex, fork length ($^{+}$/- 1cm) of each salmon was noted and a uniquely numbered anchor tag (Hallprint type TBA-1) was inserted lateral to the posterior insertion of the dorsal fin. An orange coloured tag was used for the first two weeks, and then a clear tag was used subsequently. A hole was punched in the right operculum as a secondary mark. Coho were examined for the presence of an adipose clip and tested with a Northwest Marine Technology wand detector for the presence of a Coded-Wire Tag (CWT).

Deadpitch Surveys

Carcass deadpitch surveys started during the week of 16-20 September and continued until 2-6 December 2002. For each carcass the species, sex, anchor tag number, operculum punch, and spawning status was noted. Each carcass was marked so that it couldn't be re-examined in error.

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. The Timberwest channel, Weyerhaeuser channel, South Englishman, Centre and Morison creeks were also surveyed.

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 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. Aluminum 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 green 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.

Survey life

Survey life is defined as the average length of time a salmon is available to be surveyed. When a creek is surveyed from the anadromous barrier down to the estuary, the survey life used would be equal to the stream life, or the average length of time a salmon is in fresh water. If a tributary or a segment were surveyed, then the survey life used would be the average length of time a salmon is within the survey reach.

This statistic is essential for calculating Area-Under-the-Curve (AUC) escapement enumeration and can be estimated several ways. In this project for each recovered identifiable anchor tag we took the time difference between the tag application and the tag recovery and averaged all recoveries for each species. Survey life statistics from Englishman River can be used in AUC calculations in other systems.

There are several sources of error with this method. An individual salmon may have entered the creek at any time prior to the date of tag application, therefore the 'clock was

ticking' on the amount of time they had been in fresh water. We attempted to control this source of error by conducting tagging sessions weekly, thereby limiting the error to one week prior to each tagging session. Similarly, the tagged carcass recovery would have an error associated with the length of time between the salmon dying and the deadpitch survey. Again we attempted to control this error by conducting the deadpitch surveys weekly.

We believe that the time shift that is caused by these two errors will be similar enough to cancel each other, or minimize the error around the survey life estimate.

Results

Pink

The estimated total escapement of pink salmon is 12,100, $^{+}$/- 1750. Table 2A presents the mark recapture data, by week, of the number of pink salmon marked, the number of carcasses examined for a anchor tag, and the number of tags recovered.

881 pink salmon were tagged over a four week period. 45.8% were female and 54.2% were male.

In addition to the 2319 carcasses noted there were 28 carcasses that the presence or absence of a tag could not be determined for a total of 2347. Carcasses were collected from all 26 sections in the mainstem as well as the Timberwest channel. 1353 carcasses (57.6%) were collected in the Timberwest side channel, 368 (15.7%) were in mainstem Sections 4-6, and 419 (17.9%) were in mainstem sections 10-14. 53.7% of the carcasses were identified as female.

Chinook

The estimated total escapement of chinook salmon is 600 $^{+}$/- 125. Table 2B presents the mark recapture data, by week, of the number of chinook salmon marked, the number of carcasses examined for a anchor tag, and the number of tags recovered.

316 chinook were tagged over the entire tagging period, from 28 August to 4 November 2002. 94.0% of these were tagged during the first three weeks in October. Females comprised 32.3% of this group however precocious males (jacks) and adult males were not distinguished in the data collection.

73 chinook carcasses were examined for presence of an anchor tag/operc punch. 37 carcasses had an anchor tag/operc punch and 33 carcasses were unmarked. Tag status could not be determined on 3 carcasses. Carcasses were collected from mainstem Sections 1 to 14 and the Timberwest side channel. 68.6% were found in mainstem sections 2 to 6. 40% of the carcasses were identified as female.

Chum

The estimated total escapement of chum salmon is 9,500 $^{+}$/- 2500. Table 2C presents the mark recapture data, by week, of the number of chum salmon marked, the number of carcasses examined for a anchor tag, and the number of tags recovered.

214 chum were tagged from 2 October to 4 November 2002. Females comprised 7.9% of the tagged group.

2344 chum carcasses were examined for presence of an anchor tag/operc punch. 52 carcasses had an anchor tag/operc punch and 2292 were unmarked. Tag status could not be determined on 2 carcasses. All marked carcasses were found up to 15 November period during which 605 carcasses were examined. Subsequently 1644 unmarked carcasses were examined. Carcasses were collected in all mainstem sections and tributaries. 32.2% of identified carcasses were described as female.

Sockeye

There were no sockeye captured during the tagging period. During the carcass deadpitch surveys a maximum of four sockeye adults were observed therefore this would be the minimum escapement estimate.

Coho

The estimated total escapement of adult coho salmon is 3,100 $^{+}$/- 800. Table 2D presents the mark recapture data, by week, of the number of coho salmon marked, the number of carcasses examined for a anchor tag, and the number of tags recovered.

888 adult (39.3% female) and 6 precocious males ("jacks") were tagged from 12 September to 4 November 2002. Two adult coho did not receive an anchor tag. Of these 890 coho adults, 34 (had coded-wire tags and 37 had adipose clips.

152 adult and 3 jack carcasses were examined for presence of an anchor tag/operc punch. 40 adult carcasses were marked, 101 adult and 3 jack carcasses were unmarked and there were 11 adult carcasses where tag status could not be determined. Carcasses were collected in tributaries and mainstem Sections 1 to 22 (51.5% in Sections 2-6). 36.4% of the adult carcasses were female.

Big Qualicum Hatchery reported two Englishman anchor tags among the 20,000 coho processeed at their facility. The estimated escapement to the Big Qualicum was 30,000 so an estimated 3 tagged coho entered Big Qualicum river. There were no tags reported from the French Creek Hatchery.

Survey Life

Survey lives for pink (25.9 days), chinook (16.1 days), chum (8.9 days), and coho (20.5 days) were calculated. The data are presented in Table 3.

Centre Creek

The Centre Creek fence was monitored through the project period. Water started flowing during storm events in early November. Coho and chum were enumerated through starting 11 November and continued until 26 November 2002. The fence was inundated at times and allowed unhindered passage of salmon.

130 adult and 3 jack coho were counted through. 33 adults (25.4%) were coded-wire tagged.

26 coho carcasses were examined for an anchor tag. 12 carcasses had a Centre Creek tag and 10 carcasses did not have a tag. Tag presence could not be determined on 4 carcasses.

The coho escapement to Centre Creek is estimated to be 232 $^{+}$/- 80. Using the CWT incidence rate on the coho enumerated at the fence we estimate the CWT marked escapement to be 59.

Discussion

Escapement enumeration for four of the five species of Pacific salmon (pink, chum, coho and chinook) was successful. The escapement estimate for sockeye is a minimum estimate, but any inference on the actual escapement is not supported by any field data. 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. The progeny of this brood returned in 2001 and continued the large escapement record for this brood line. 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.

Pink

The Englishman pink salmon stock has been supplemented since 1993 by the Quinsam River Hatchery (Bocking and Gaboury, 2001). In 2001 1.5 million pink fry were released. Prior to this enhancement activity the pink escapement was at extremely low levels. If the assumption that virtually all returns are the result of the fry release, then the survival rate would be 0.8%. This level of survival is within the range of observed rates, although at the lower end of the range (Heard, 1991). Although between 0.5 million and 1.5 million pink fry have been released each year, it was only the last two years that

resulted in any substantial return. The resulting progeny from these two years should assist in establishing a pink run.

Chinook

Chinook salmon production has been supplemented by the Englishman River Enhancement Society for eight years. Chinook fry have been reared to the three month stage and released into a pond that drains into the Timberwest side channel. The chinook fry migrate downstream immediately although some individuals reside for one year before smolting. Usually 250,000 to 300,000 fry are released although in 2000 680,000 fry were released.

None of the releases to date have been marked so the escapement cannot be divided into wild and enhanced origin. The 2003 release is planned to have a thermal mark applied so that the enhanced chinook will be distinguishable from the wild production when this brood starts to return in 2006.

Chum

All of the recovered tags were found in the first 27% of the carcasses examined in the deadpitch. This suggests that only the first part of the chum escapement were tagged. Since the deadpitch surveys were conducted throughout the spawning area and on a regular basis the recovery can be considered to be non-biased and therefore the mark recapture estimate is valid.

The survey life calculation must be examined. If the tags were only applied to the first part of the run then to accept the resulting survey life estimate we would have to assume that the survey life must be constant throughout the run. Koski (1975) reported stream life measurements of 8.8 and 11.2 days for early and late chum stocks in 1968, and 10.5 and 15.2 days for early and late chum stocks in 1969, indicating that there is a seasonal change in the average length of time a chum in freshwater to spawn. This suggests that the Englishman chum survey life estimate of 8.9 days cannot be applied to the whole chum population.

Coho

The 2002 return of 3100 coho is a sharp decline from the previous escapement in 2001, and a slight improvement on the brood line escapement in 1999. As was mentioned in Baillie and Young (2002) the large 2001 return was a consequence of the total ban on fishing exploitation in 1998. Although fishing restrictions are still in place, other brood lines have not responded.

In 2001 3790 coho smolts were coded-wire tagged at the Centre creek fence. Using the proportion of coded-wire tagged coho that were observed in the marking surveys, we estimate 118 coded-wire tagged coho returned to the Englishman River. If we assume an exploitation rate of 6% on non-adipose fin clipped coho (Kent Simpson, pers. com.) then we calculate that 8 coho were caught in external fisheries. Solving for marine survival in the equation gives a survival rate of 3.3%.

$$Survival = \frac{Catch + Escapement}{Smolts}$$

The marine survival as measured at Black Creek (1986-2002 return) is 7.4% (range 1.7% - 12.7%). Figure 1 shows the marine survival at Black Creek and the trends over the last 16 years. For comparison, Appendix B is the 2002 return marine survivals measured at two other Strait of Georgia wild coho indicators and three hatchery coho indicators. The marine survival of Englishman River is similar to the survivals of the two wild indicators. As can be seen by Figure 1, marine survivals are a fraction of the levels observed in the 1980s but here is an upward trend over the last four years.

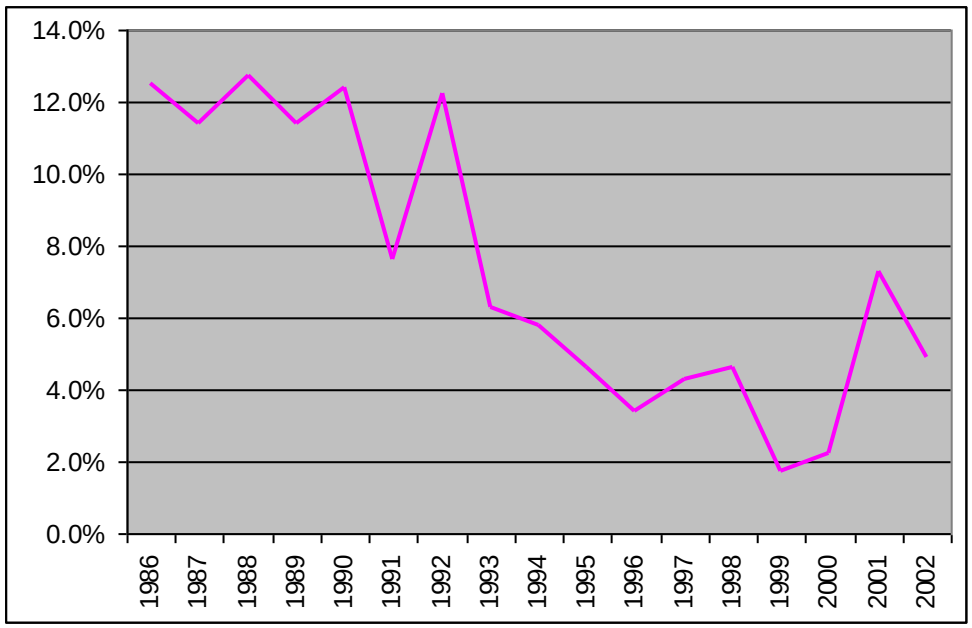

Figure 1. Marine survival of coho salmon at Black Creek, 1986 – 2002.

Not all CWT coho returned to Centre creek. The estimated CWT return to Centre was 33 adults (25.4% of total) while the whole system estimate was 118 (3.8%). This indicates that while there is only a moderate tendency for coho to return back to this system. They may also have emerged as fry in another part of the watershed and moved into Centre Creek to rear. These coho would receive a coded-wire tag when they leave in the spring. This does not effect our ability to measure marine survival except that adult recoveries must be done on a system wide basis.

Recommendations

Previous Recommendations.

1. Timing of surveys. This recommendation was for AUC estimation and therefore was not considered for the 2002 surveys.
2. Carcass recovery. This recommendation was following, and extended to all species.

3. Tagging during peaks of migration. This recommendation was also for AUC estimation therefore was not considered. The procedure for tagging for a mark recapture method is to tag randomly throughout the population. This was done for pink, chinook and coho, but not for chum.
4. This recommendation was not following for logistical reasons. The original pools that were used for collection are the main holding pools in the lower watershed, therefore the best location for collecting samples for tagging. There were only two tags reported from outside the watershed, so we are assuming that tag migration was not a problem in 2002.
5. This recommendation was followed.

Population estimates were achieved for all four main salmon species targeted in this project, as well as freshwater survey life estimates for three of the four species. Marine survival estimate for coho salmon was also successfully achieved. The only problem encountered was getting a survey life for chum salmon. In order to achieve this objective the tagging surveys would have to be extended by 2 weeks.

We recommend that if this project continues the same methodology be repeated, with an extension of the tagging effort by two weeks.

References cited

Baillie, S. J., B. Patten, J. Till, K. Simpson, W. Luedke, and P. Tschaplinski. 1999. Assessment of coho stocks on the west coast of Vancouver Island, 1998. Can. Stock Assess. Secret., Res. Doc. 99/166. 43 p.

Baillie, S. J., and C. Young. 2002. Salmon Escapement to Englishman River, 2001. Fisheries and Oceans Canada unpublished report. 23 pp.

Bocking, R. C., and M. Gaboury. 2001. Englishman River Watershed Recovery Plan, prepared for Pacific Salmon Endowment Fund Society. LGL Ltd. 9768 Second St, Sidney, BC. V8L 3Y8. *v* + 46 pp.

Heard, W. R. 1991. Life History of Pink Salmon, p 119 – 230. *In* : Groot, C. and L. Margolis (ed.). Pacific Salmon. UBC Press. University of British Columbia, Vancouver, BC.

Koski, K. V. 1975. The survival and fitness of two stocks of chum salmon (*Oncorhynchus keta*) from egg deposition to emergence in a controlled-stream environment at Big Beef Creek. Ph. D. theses. University of Washington, Seattle, WA. 212 pp.

Simpson, K., R. Semple, S. J. Baillie, B. Adkins, and S. Lehmann. 1999. Status of coho salmon stocks adjacent to the Strait of Georgia, including the lower Fraser River. Can. Stock Assess. Secret., Res. Doc. 99/133. 74 p.

Ricker, W.E. 1975. Computation and Interpretation of Biological Statistics of Fish Populations. Bull. Fish. Res. Board Can. 191: 382 p.

Tables

Table 1. Escapement of each salmon species to the Englishman River, 1953-2001, from DFO NuSEDS database. UNK = unknown, NO = none observed.

	Sockeye	Coho	Pink	Chum	Chinook
2001	11	8000	13500	10400	2900
2000	25	5280	1600	3500	1200
1999	20	2978	2500	25000	750
1998	UNK	1500	350	8000	UNK
1997	UNK	200	100	8000	20
1996	UNK	250	800	900	50
1995	UNK	UNK	UNK	2000	UNK
1994	NO	1150	NO	5500	NO
1993	30	246	UNK	1100	24
1992	UNK	440	2000	3500	40
1991	15	800	50	250	50
1990	10	1050	UNK	800	100
1989	30	200	UNK	1500	UNK
1988	30	250	UNK	3000	NO
1987	50	200	UNK	600	NO
1986	10	65	NO	2000	NO
1985	UNK	UNK	UNK	2500	UNK
1984	UNK	2000	UNK	2500	UNK
1983	UNK	UNK	UNK	200	UNK
1982	18	1000	3	2500	14
1981	UNK	300	UNK	400	NO
1980	UNK	300	100	1000	UNK
1979	UNK	1200	UNK	4000	UNK
1978	300	1500	10	6000	75
1977	25	1500	25	1500	25
1976	25	750	25	1500	25
1975	25	400	75	750	75
1974	25	1500	25	5000	25
1973	75	750	25	7500	75
1972	25	400	25	15000	75
1971	25	1500	25	3500	75
1970	25	1500	75	3500	75
1969	25	400	25	7500	75
1968	75	1000	100	6000	115
1967	20	285	NO	500	75
1966	25	1500	200	7500	25
1965	UNK	1500	NO	1500	75
1964	25	1500	NO	1500	25
1963	UNK	750	2	750	25
1962	NO	750	NO	3500	UNK
1961	25	750	25	3500	25
1960	25	400	200	3500	25
1959	1	750	1	3500	UNK
1958	25	750	400	15000	UNK
1957	25	3500	3500	7500	UNK
1956	25	1500	400	750	UNK
1955	25	750	750	1500	UNK
1954	UNK	1500	750	15000	UNK
1953	UNK	750	200	15000	UNK

Table 2A. Weekly counts of pink salmon tag data in the Englishman River, 2002.

Week	Number of anchor tags applied	Number of carcasses examined	Number of anchor tags recovered
26 - 30 Aug 2002	87		
2 - 6 Sep 2002	315		
9 - 13 Sep 2002	243		
16 - 20 Sep 2002	236	23	1
23 - 27 Sep 2002		420	25
30 Sep – 4 Oct 2002		828	64
7 - 11 Oct 2002		575	49
14 - 18 Oct 2002		473	29
21 - 25 Oct 2002			
28 Oct – 1 Nov 2002			
4 - 8 Nov 2002			
11 - 15 Nov 2002			
18 - 22 Nov 2002			
25 - 29 Nov 2002			
2 - 6 Dec 2002			
Total	881	2319	168

Table 2B. Weekly counts of chinook salmon tag data in the Englishman River, 2002.

Week	Number of anchor tags applied	Number of carcasses examined	Number of anchor tags recovered
26 - 30 Aug 2002	1		
2 - 6 Sep 2002	2		
9 - 13 Sep 2002	3		
16 - 20 Sep 2002	6		
23 - 27 Sep 2002			
30 Sep – 4 Oct 2002	162		
7 - 11 Oct 2002	81	4	4
14 - 18 Oct 2002	54	10	9
21 - 25 Oct 2002	4	30	15
28 Oct – 1 Nov 2002		20	8
4 - 8 Nov 2002	3	2	1
11 - 15 Nov 2002		3	
18 - 22 Nov 2002		1	
25 - 29 Nov 2002			
2 - 6 Dec 2002			
Total	315	70	37

Table 2C. Weekly counts of chum salmon tag data in the Englishman River, 2002.

Week	Number of anchor tags applied	Number of carcasses examined	Number of anchor tags recovered
26 - 30 Aug 2002			
2 - 6 Sep 2002			
9 - 13 Sep 2002			
16 - 20 Sep 2002			
23 - 27 Sep 2002			
30 Sep – 4 Oct 2002	7		
7 - 11 Oct 2002	9		3
14 - 18 Oct 2002	50	33	
21 - 25 Oct 2002	93	111	15
28 Oct – 1 Nov 2002	34	163	21
4 - 8 Nov 2002	21	145	10
11 - 15 Nov 2002		151	1
18 - 22 Nov 2002		342	
25 - 29 Nov 2002		1188	
2 - 6 Dec 2002		114	
Total	159	2247	50

Table 2D. Weekly counts of coho salmon tag data in the Englishman River, 2002.

Week	Number of anchor tags applied	Number of carcasses examined	Number of anchor tags recovered
26 - 30 Aug 2002			
2 - 6 Sep 2002			
9 - 13 Sep 2002	3		
16 - 20 Sep 2002	3		
23 - 27 Sep 2002			
30 Sep – 4 Oct 2002	74		
7 - 11 Oct 2002	148		
14 - 18 Oct 2002	132	3	3
21 - 25 Oct 2002	140	10	6
28 Oct – 1 Nov 2002	146	7	6
4 - 8 Nov 2002	248	3	2
11 - 15 Nov 2002		9	4
18 - 22 Nov 2002		7	2
25 - 29 Nov 2002		71	8
2 - 6 Dec 2002		11	3
Total	888	121	34

Table 3. Survey life of salmon species tagged in Englishman River, 2002.

Species	Number of tags applied	Number of identifiable tags recovered	Mean number of days between tagging and recovery
Pink	881	114	25.9
Chinook	316	27	16.1
Chum	214	41	8.9
Coho	894	24	20.5

Appendix A

Escapements of coho salmon to selected creeks of east coast Vancouver Island.

Year	Black	Cowichan tribs	Trent	Tsable	Waterloo	Nile	Wilfred	Cowie	Nanoose	Bonell
2002	4322	929	569	825	154	406	489	475	304	248
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

2002 as % of 98-01 average										Average
81%	77%	46%	42%	122%	114%	48%	102%	46%	235%	95%

Brood year change (1999-2002)										
839%	137%	76%	87%	181%	211%	117%	117%	65%	188%	204%

Appendix B:

Marine survival rates of wild and hatchery origin coho stocks in the Strait of Georgia.

Wild Coho Stocks			Hatchery Coho Stocks		
Englishman	Myrtle	Black	Quinsam	Big Qualicum	Goldstream
3.3%	2.8%	4.9%	1.3%	1.6%	0.4%