

Stock Assessment of Winter Steelhead Trout in Goldstream, Sooke, Trent and Tsable Rivers, 2004



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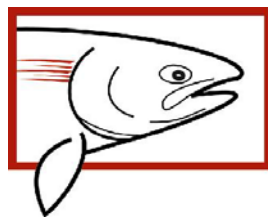
Scott Silvestri
Fisheries Technician
BC Conservation Foundation
Greater Georgia Basin Steelhead Recovery Plan

prepared for:

British Columbia Conservation Foundation
#206-17564 56A
Surrey, BC V3S 1G5

and:

Ministry of Water, Land and Air Protection
Vancouver Island Region
2080-A Labieux Road
Nanaimo, BC V9T 6J9



GREATER GEORGIA BASIN
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www.SteelheadRecoveryPlan.ca

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¹ Fish Culture Technician, Freshwater Fisheries Society of BC, Duncan, BC

² Standards/Guidelines Specialist, Ministry of Environment, Victoria, BC

³ A/Manager, Salmon and Steelhead Recovery, Ministry of Environment, Nanaimo, BC

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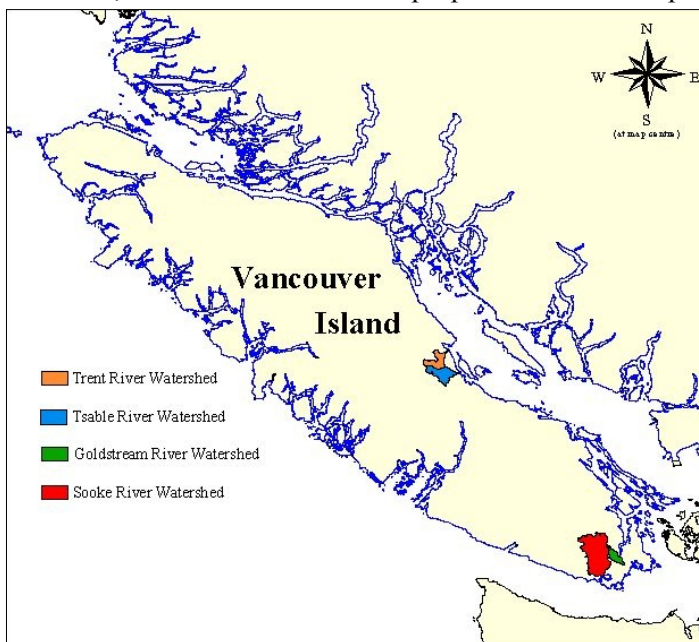
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1.0 INTRODUCTION

In 2002, the Pacific Salmon Foundation (PSF), in conjunction with the BC Ministry of Water, Land and Air Protection (MWLAP; renamed Ministry of Environment in May 2005), released the Greater Georgia Basin Steelhead Recovery Plan (GGBSRP; Lill 2002). The primary objective of the Plan is to stabilize and restore wild steelhead stocks and habitats on the east coast of Vancouver Island (ECVI), adjacent mainland inlets, and lower Fraser River, to healthy self-sustaining levels. A secondary objective of the GGBSRP is to maintain and restore angling opportunities, which benefit both local communities and the provincial economy.

On April 21, 2004, MWLAP released the draft *Steelhead Stream Classification-Policy and Procedure* (Appendix A). The policy states that hatchery fish can provide angling benefits, however the risks imposed to wild steelhead need to be managed in order to maintain wild steelhead stocks. Thus a stream's classification will default to wild unless specifically designated hatchery-augmented. Additionally, streams that are classified wild will be managed to maintain and protect indigenous stocks while providing an appropriate diversity of angling opportunities. Hatchery-augmented streams will be managed to maintain or develop new angling opportunities while managing the risks to wild steelhead. In systems where a population of steelhead has never existed, been extirpated, or is considered non-viable, hatchery augmentation using a nearby donor stock may be considered, for the purpose of creating a steelhead retention fishery.

Following guidelines in the draft policy document and in support of the secondary objective of the GGBSRP, MWLAP fisheries staff proposed that several possible retention fisheries be examined



on Vancouver Island. As a first step in the process, the BC Conservation Foundation (BCCF) was contracted to assess existing wild steelhead stocks in four candidate watersheds: Goldstream, Sooke, Trent and Tsable (Figure 1). This report describes the 2004 investigations and compares the results to provincially identified target levels of abundance.

Figure 1. Location of Goldstream, Sooke, Trent and Tsable rivers, Vancouver Island.

1.1 Goldstream River

The Goldstream River is located 16 km northwest of Victoria on Southern Vancouver Island and flows southeast from Goldstream Lake (also known as Goldstream Reservoir) to Goldstream Provincial Park, where it turns north and enters the ocean at Saanich Inlet. Draining 48.5 km², the

mainstem has an anadromous length of 4.5 km and only one tributary, Waugh Creek, that contains significant fish values. Niagara and Langford creeks are reported to be ephemeral with restricted fish access (McCulloch 2005).

The watershed contains three headwater lakes/reservoirs (Butchart, Lubbe and Goldstream) that lie within the Capital Regional District (CRD) Water Supply Area. The Goldstream Water Supply Area acts as a backup water source to the Sooke Reservoir during drought conditions or during annual maintenance and augments low flows in the Goldstream River for fish use. Stream flow is maintained at 0.16 m³/s from December through September and then increased to 0.5 m³/s in October and November to accommodate upstream migration and spawning (McCulloch 2005). The naturalized mean annual discharge (NMAD) is estimated at 1,400 L/s (R. Ptolemy, Standards/Guidelines Specialist, MoE, Victoria, pers. comm.).

In addition to populations of chum, chinook and coho salmon, the Goldstream River watershed supports resident and anadromous cutthroat and rainbow (steelhead) trout. Karanka (1973) reported that the Goldstream River was the most important and productive fish-producing stream in the CRD, from both a numbers and species perspective. Steelhead escapement data is not available for the Goldstream River, however steelhead abundance has been assessed periodically through snorkel survey observations since 1998 (Appendix B) and annually through the Steelhead Harvest Questionnaire since 1968 (Appendix C). Currently, steelhead stock status in the Goldstream River is identified as an “extreme conservation concern,” and the trend is “in decline” (Lill 2002). Salmon escapement data was collected by the Department of Fisheries and Oceans (DFO) from 1953-2004 (Appendix D).

The Goldstream River has a moderate baseflow alkalinity of 29 mg/L. Using this figure, modeling (Ptolemy 1993) suggests a predicted capacity for each steelhead size class of 196 g/Unit⁴. The steelhead habitat smolt capacity estimate for the Goldstream River is 750 smolts (based on actual smolt counts, Lill 2002).

1.2 Sooke River

The Sooke River is located 25 km west of the city of Victoria, on the southwest tip of Vancouver Island. The river flows south from Sooke Lake Reservoir and enters the Strait of Juan de Fuca at the town of Sooke. With an anadromous length of 7.3 km, the Sooke River drains approximately 340 km², including its most important sub-basin, De Mamiel Creek (16.5 km of anadromous length; Burt 2004).

Sooke Reservoir, with 93 Mm³ of water storage, provides 90% of the main water supply for the CRD. The river below Sooke Reservoir is flow controlled and has a NMAD of 3.0 m³/s, while NMAD in the lower river, above Charters Creek, is 11.6 m³/s (Burt 2004). Under a 2002 agreement between the CRD, Sooke FN and the fisheries agencies, target base flows are 10% of NMAD or 0.3 m³/s and 1.16 m³/s, respectively, however actual flow releases depend on water availability in Sooke and Deception reservoirs (Burt 2004). Current mean summer base flow on the Sooke River is approximately 7.1% of NMAD or 0.82 m³/s.

The watershed supports populations of chinook, coho, and chum salmon, as well as resident and anadromous rainbow (steelhead) and cutthroat trout (Lightly 1999). The upper watershed also

⁴ Unit = 100 m² of suitable habitat.

supports kokanee and Dolly Varden char. Steelhead escapement data is not available for the Sooke River, however steelhead abundance has been assessed periodically through snorkel surveys since 1983 (Appendix B) and annually since 1968 through the Steelhead Harvest Questionnaire (Appendix C). Currently, the Sooke Salmon Enhancement Society (SSES) conducts headwater fry stocking, requiring brood capture of up to five pairs of wild steelhead. The SSES has additional production targets of 100,000 coho fry (3-4 g) and 700,000 chinook fry (3 g) that are stocked into several reaches of the upper river (Glen Varney, Jack Brooks Hatchery Manager, Sooke, pers. comm.). Salmon escapement data was collected by DFO from 1953-2004 (Appendix D)

With a low baseflow alkalinity of 7.9 mg/L, predicted capacity for each steelhead size class in the Sooke River is 102 g/Unit. Only one steelhead smolt capacity estimate was located for Sooke River. Slaney (1981) used a habitat-based model developed for the Keogh River and calculated a capacity estimate of 3,002 steelhead smolts for the Sooke River.

1.3 Trent River

The Trent River is located seven kilometres south of Courtenay on the east coast of Vancouver Island. The river flows northeast from the Beaufort Range and enters the Strait of Georgia at the south end of Comox Harbour. The Trent River drains an area of 82 km² and has a mainstem anadromous length of 8.5 km. Additionally, Bloedel Creek adds approximately 400 m of anadromous length to the system. The mean annual discharge of the Trent River is approximately 3.0 m³/s, with summer base flow estimated at 2% of MAD or 0.06 m³/s (Lill 2002).

Effluent from the Cumberland sewage treatment facility enters the Trent River via Maple Lake Creek, which enters the mainstem approximately five kilometres above the mouth. A dramatic increase in primary productivity (algae and periphyton) and invertebrates (i.e., *Simulium sp.*, *Trichoptera sp.*, *Plecoptera sp.*, and *Ephemeroptera sp.*) is evident immediately downstream of Maple Lake Creek (J. Deniseger, Environmental Impact Biologist, MoE, Nanaimo, pers. comm.).

The Trent River supports populations of chum, coho, and pink salmon, as well as resident and anadromous rainbow (steelhead) and cutthroat trout. Steelhead escapement data does not exist for the Trent River and only one winter snorkel survey was located during our literature search (Appendix B). Steelhead Harvest Questionnaire data is available for the period 1968-1998 (Appendix C). Currently, Trent River steelhead are identified as an “extreme conservation concern,” and the trend is “in decline” (Lill 2002). Salmon escapement data is available from DFO for the period 1962-2004 (Appendix D).

Using Ptolemy’s alkalinity model (1993) and a value of 29 mg/L, predicted biomass is 195 g/Unit for each juvenile steelhead size class. The estimated steelhead smolt capacity for the Trent River is 1,650 smolts based on historic smolt counts (Lill 2002).

1.4 Tsable River

The Tsable River is located 22 km south of Courtenay on the east coast of Vancouver Island. The river flows west from Tsable Lake in the Beaufort Range and enters the Strait of Georgia near Buckley Bay. The watershed covers an area of 113 km² and the mainstem has an anadromous length of approximately 5.8 km. No tributaries with significant fish values enter the Tsable River below the anadromous falls.

The Tsable River watershed contains numerous headwater lakes, including Tsable, Beaufort, and Poum, with surface areas of 64.9, 32.3 and 23.1 hectares, respectively. The mean annual discharge of the Tsable River is 7.87 m³/s, with a mean summer flow (August) of 1.49 m³/s (Water Survey of Canada gauge 08HB024, 1960-2003). Additionally, the Tsable River has a seven-day low flow average of 0.334 m³/s (Clough 2002).

Similar to the Trent River, the Tsable River supports populations of chum, coho and pink salmon, as well as resident and anadromous rainbow (steelhead) and cutthroat trout. Steelhead escapement data does not exist for the Tsable River, though five snorkel surveys were completed in the winter of 2002⁵ (Appendix B) and Steelhead Harvest Questionnaire data is available from 1968-1999 (Appendix C). Currently Tsable River steelhead are identified as an “extreme conservation concern”, and the trend is “in decline” (Lill 2002). Salmon escapement data has been collected by DFO from 1953-2004 (Appendix D).

2.0 METHODS

Ideally, a river’s steelhead population is examined over a generation of adult returns (4-6 years for most ECVI streams). Under the constraints of a one-year investigation, only one adult escapement (year x) and its fry yield can be effectively assessed. Age 1+ and 2+ steelhead parr abundance can also be examined to infer spawner abundance in years x-1 and x-2. Adult and juvenile assessments were carried using the following methodology.

2.1 Adult Assessment

Snorkel surveys to enumerate adult steelhead were conducted in the mainstem anadromous portions of each watershed on five separate occasions. Bloedel Creek, a third order tributary of the Trent River was also surveyed. De Mamiel Creek, a third order tributary of the Sooke River, with significant coho values, could not be effectively snorkeled due to its small size. In the four watersheds studied, there were no other anadromous tributaries considered large enough to hold adult steelhead. Survey timing in each system was based on historical knowledge of steelhead returns to the watershed. All surveys commenced in early February with the exception of the Sooke River which started in mid January and continued until mid May. The Sooke River is known to experience a relatively strong “early” run of steelhead in January (Ron Ptolemy, Standards/Guidelines Specialist, MoE Victoria, pers. comm.). Surveys were conducted monthly when water conditions permitted. During peak run timing, an additional survey in mid April was scheduled for the Goldstream, Trent and Tsable rivers.

Surveys employed two snorkellers swimming in parallel lanes to maximize observer efficiency. In addition to counts by species, data collected included fish condition, sex, marks observed, estimates of weight and/or ocean age, distribution and redd location. Stream discharge, visibility and water temperature were also recorded using a Swiffer velocity meter (model 2100), a secchi disk, and a mercury hand held thermometer, respectively.

⁵ In 2001, Innergex Inc. proposed a run-of-the-river micro hydro project on the Tsable River approximately 300 m downstream of the anadromous falls. As a result, D.R. Clough Consulting performed an evaluation in 2002 of fish populations in the development area and downstream, including a series of winter steelhead snorkel surveys to determine spawning and holding areas.

Adult escapements were estimated for each watershed using the area-under-the-curve (AUC) methodology. Snorkel survey count data were plotted against a 151-day run timing (Jan 1-May 31). Observer efficiency, one of two key parameters in an AUC calculation, was estimated for each river based on wetted width and turbidity typically encountered during surveys and the type/quantity of cover afforded to adult fish. Adult residence time, the other critical AUC parameter was estimated for each stock based on historical surveys, past radio-telemetry studies in southwest BC streams (Goldstream, Nanaimo, Big Qualicum, Salmon, Puntledge, Cheakamus) and information provided by MoE regional biologists. These parameters may be numerically quantified using radio-telemetry and mark-recapture techniques, however, these costly components could not be considered within project budgets and were likely impractical given the small size of the stocks in question.

To better estimate residence time and observer efficiency in the Sooke River, SSES staff applied brightly coloured Floy® tags to angled fish and released them back to the river (those not kept for broodstock). Observations of marked fish were noted on subsequent snorkel surveys.

Steelhead Harvest Questionnaire (SHA) data for each system are presented as an indicator of historic abundance trends and briefly discussed to provide background and scope to the ECVI steelhead conservation issue.

2.2 Juvenile Assessment

Juvenile fish sampling was conducted using closed-site electrofishing techniques. Electrofishing sites in each watershed were located in suitable steelhead fry habitat (typically cobble/gravel riffles, <30 cm in depth, and <25 cm/second velocity) and spaced every 1-2 km along the anadromous length of each mainstem. Access in the Trent and Tsable rivers is relatively limited, resulting in sites that were less well spaced.

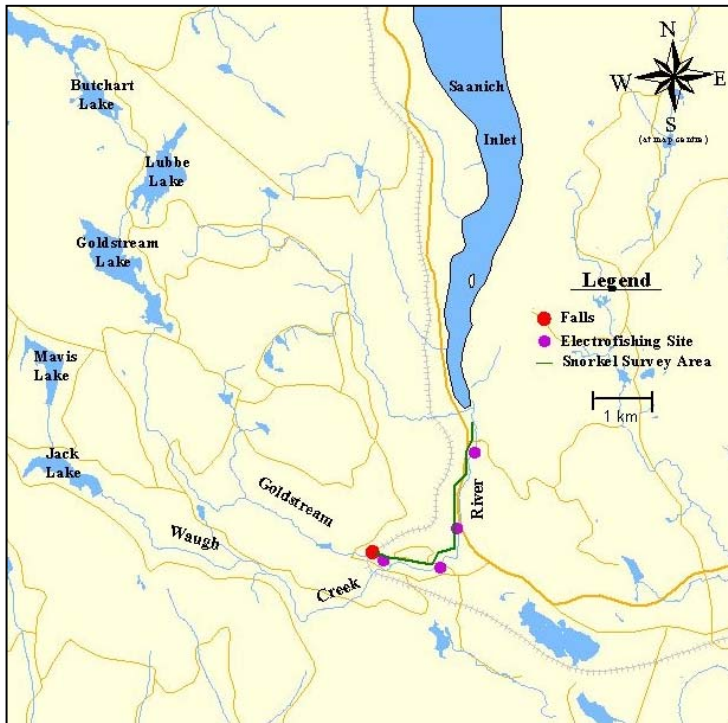
At each site, approximately 80 to 100 m² of habitat were enclosed with small mesh stopnets. Fish were removed with an electrofisher (Smith-Root model LR 24) using the standard 2-pass removal technique (deLeeuw 1981). Captured fish were measured for fork length (mm) and weighed (g) using a top loading scale (Ohaus model CS 200) accurate to 0.1 g. All sites were photographed and habitat parameters were documented following current Fisheries Branch techniques (methodology refined by R. Ptolemy, Standards/Guidelines Specialist, MoE, Victoria). Depth/velocity profiles were recorded following the removal of the stopnets. Stream velocities were measured using a velocity meter (Swoffer model 2100). Site populations were calculated using the Seber equation for two-pass removal and expressed as fry per unit (FPU; unit = 100 m²).

3.0 RESULTS

3.1 Goldstream River

Adult Assessment

Between February 4 and May 20, 2004, technicians snorkeled the Goldstream River five times to count adult steelhead (Appendix E). Surveys covered four kilometres of anadromous water from the falls in Goldstream Provincial Park to a take out 200 metres below the Mt. Finlayson Road



Bridge (Figure 2). Poor visibility from road runoff below the Highway 1 Bridge on March 5, resulted in a re-survey of the lower section on March 11, 2004.

Figure 2. Goldstream River watershed, with the anadromous falls, electrofishing sites and snorkel survey area illustrated.

Steelhead were observed on only two of the five snorkel surveys, with four steelhead counted in aggregate (Table 1). Chronic low flow conditions over much of the survey period may have reduced the upstream migration windows and residence time for returning steelhead, forcing the fish to enter the system for extremely short periods when conditions were more favourable. Jones (1972 and 1973) noted that in small streams in southeastern Alaska, the single most important factor influencing upstream migration of steelhead was rising water levels. Additionally, a radio telemetry study of steelhead in Goldstream River showed adult fish migrating between the estuary and the river with changes in river flow (Witt, Hunter and Harding 1979).

Table 1. Adult steelhead counts in the Goldstream River, February 4 – May 20, 2004.

Date	# of Steelhead Observed	Total Distance (km)	Steelhead Observed / km
4 Feb 04	3	4.0	0.75
5 Mar 04	0	2.0	0
11 Mar 04	0	2.8	0
16 Apr 04	1	4.0	0.25
20 May 04	0	4.0	0

Steelhead counts for each survey were plotted against time, expressed as days from the start of the run and area under the resulting curve was calculated to be equal to 131 fish-days (uncorrected) for the 2004 winter steelhead run (Figure 3).

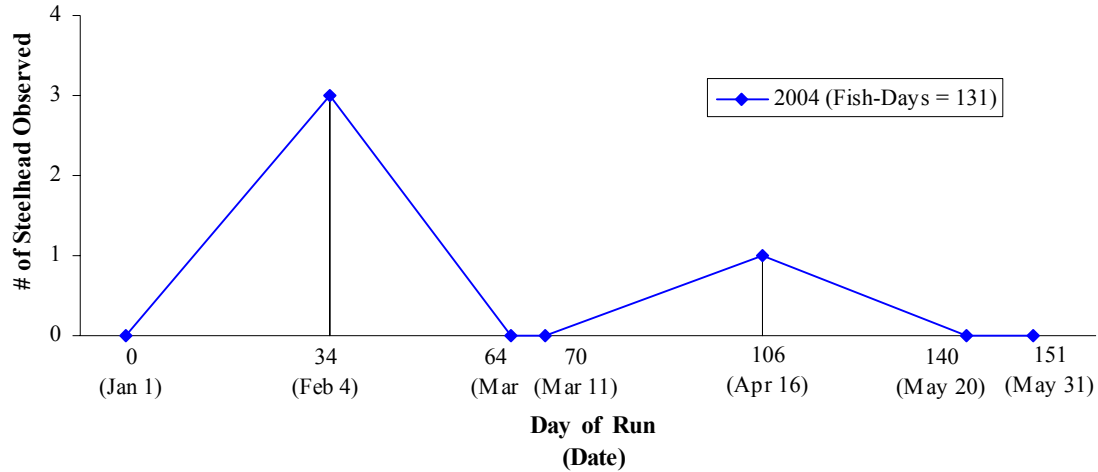


Figure 3. Steelhead counts versus run timing for the Goldstream River, February 4 – May 20, 2004.

Snorkel survey and radio-telemetry studies from southwestern BC rivers estimate observer efficiency at 22 to 80%. With respect to Goldstream River, its small size (compared to other steelhead systems) and typically low turbidity leads to higher survey confidence and supports a range of 60 to 80% observer efficiency. For the purposes of this study and in light of low flows throughout the study period, residence time in the Goldstream River for 2004 was estimated to be between 10 and 30 days, as no steelhead were observed during consecutive surveys. The resulting range in escapement was 5 to 22 steelhead (Table 2).

Table 2. 2004 AUC escapement estimates for winter steelhead in the Goldstream River.

Residence Time (days)	Observer Efficiency (%)				
	50	60	70	80	90
5	52	44	37	33	29
10	26	22	19	16	15
15	17	15	12	11	10
30	9	7	6	5	5
60	4	4	3	3	2

Mainstem discharge during surveys ranged from 0.297 to ~2.2 m³/s while visibility varied from 6.0 to 0.5 m (Appendix E). Visibility was typically reduced immediately above the Highway 1 Bridge crossing where a small tributary contributes highway runoff. Un-corrected mean daily discharge readings⁶ above Japan Gulch Reservoir varied from a maximum of 2.203 m³/s (January 28) to a minimum of 0.065 m³/s (April 13) for the study period (Figure 4) and showed that surveys appeared to be well-timed relative to seasonal fluctuations in the hydrograph.

⁶ Data provided by S. Gudavicius, P. Eng. Senior Engineer, Hydrology, Capital Regional District, Water Department, Victoria, B.C.

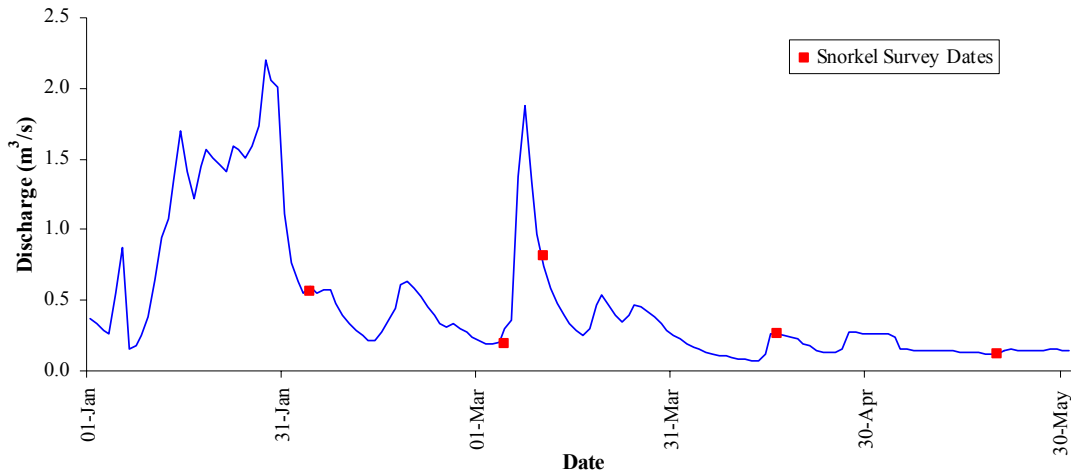


Figure 4. Uncorrected average daily discharge readings of the Goldstream River above Japan Gulch Reservoir from January 1 – May 31, 2004.

The number, species, size, origin, and distribution of resident fish were also documented during each snorkel survey (Appendix F). All resident fish confirmed for species were rainbow trout. Overall, low densities of resident rainbow trout were observed during Goldstream River surveys. Several resident fish were counted but not observed sufficiently to determine species or origin.

Generally, moderate densities of rainbow parr (yearlings and age 2+) were noted during snorkel surveys. These fish were concentrated in the upper river where habitat quality appeared highest.

Juvenile Assessment

Steelhead fry density data was collected from four sites on the Goldstream River from 110 m downstream of the falls to 150 m downstream of the Mt. Finlayson Road bridge. The resulting non depth/velocity adjusted steelhead fry geometric mean was 14.14 FPU (Figure 5; Appendix G). The highest and lowest densities of fry were observed at site 4 (32.3 FPU) and site 3 (5.5 FPU), respectively.

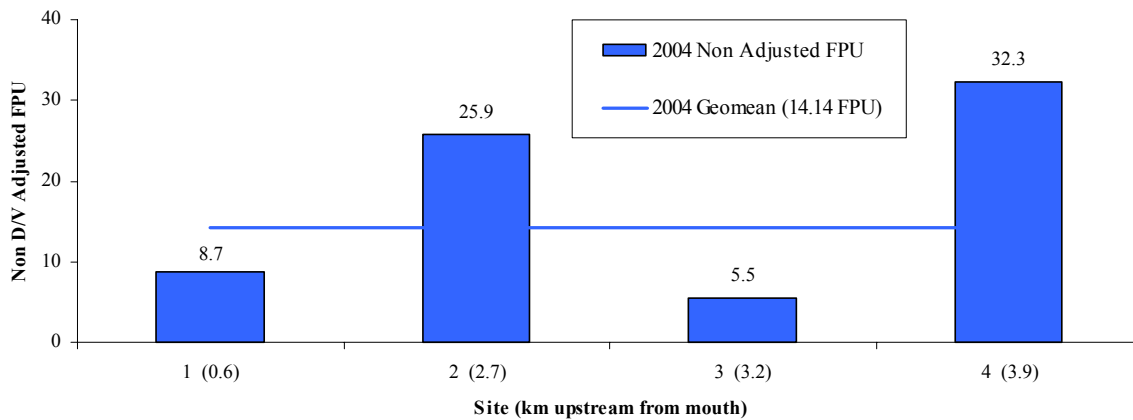


Figure 5. Non depth/velocity adjusted steelhead fry densities from four electrofishing sites in the Goldstream River in 2004.

Mean length, weight and condition factor of sampled fry were 56.7 mm, 2.06 g, and 1.084, respectively (Table 3). Biomass per unit for steelhead fry from all sampled sites averaged 35.21 g/Unit.

Table 3. Summary of steelhead fry data collected from four electrofishing sites in the Goldstream River in 2004.

Site # (Date Sampled)	Fry Statistics					
	# of Fry Sampled	Non D/V Adj. FPU	Mean Length (mm)	Mean Weight (g)	Biomass per Unit (g/100 m ²)	Mean K Factor
1 (6-Aug-04)	8	8.7	60	2.3	19.7	1.053
2 (12-Aug-04)	24	25.9	54	1.9	48.0	1.097
3 (6-Aug-04)	6	5.5	58	2.2	12.3	1.087
4 (9-Aug-04)	27	32.3	55	1.9	60.8	1.099
Mean	16	14.1*	57	2.1	35.2	1.084

* Denotes geometric mean

The length-frequency distribution of juvenile steelhead fry captured in the Goldstream River appears normal with a range of lengths between 42 and 72 mm (Figure 6). Only two parr were captured as habitats sampled were more suitable for fry. The total number of steelhead fry captured was 65.

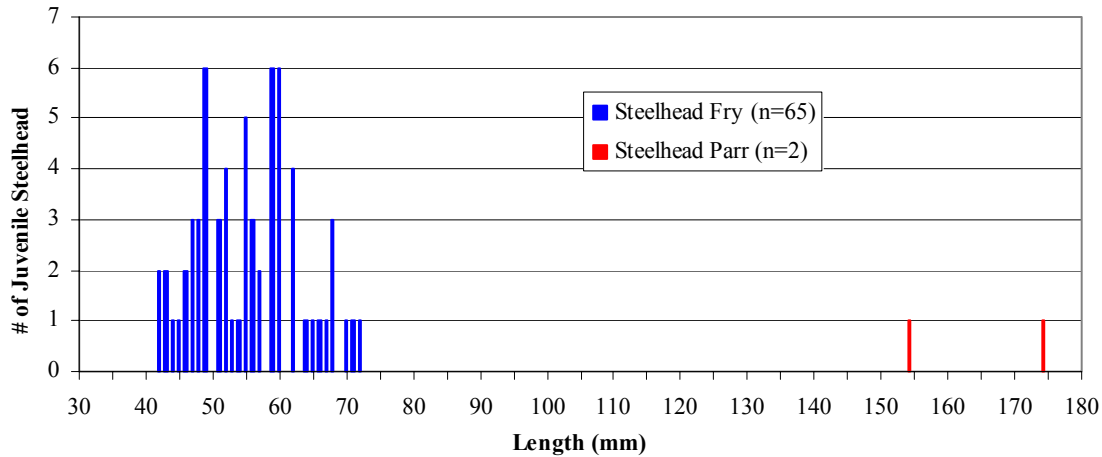


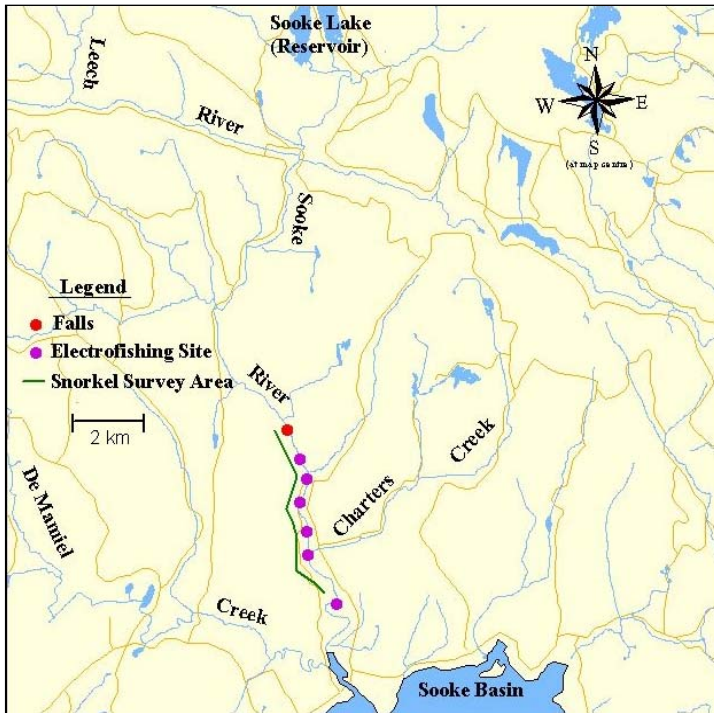
Figure 6. Length-frequency distribution of juvenile steelhead sampled from four sites in the Goldstream River in 2004.

3.2 Sooke River

Adult Assessment

Between January 6 and May 21, 2004, technicians snorkeled the Sooke River six times to count adult steelhead (Appendix E). Surveys generally covered 3.5 km of water downstream of the anadromous falls (Figure 7). Surveys occurred monthly from January to May, however high flows on March 11 reduced observer confidence and the river was re-surveyed on March 23. Steelhead

were observed on four of the six snorkel surveys, with a peak count of 10 fish on March 23 and a total of 25 steelhead counted in aggregate (Table 4).



Concurrent with the snorkel program, the SSES angled and removed 10 wild steelhead (five pairs) under permit for their headwater fry stocking program⁷. Angling for the stocking program commenced in late January and nine of 10 fish were in holding at the hatchery by February 19, suggesting a reasonable number of early run fish in 2004.

Figure 7. Sooke River watershed, with the anadromous falls, electrofishing sites, and snorkel survey area illustrated.

Table 4. Adult steelhead snorkel survey counts in the Sooke River, January 6 – May 21, 2004.

Date	# of Steelhead Observed	Total Distance (km)	Steelhead Observed / km
6 Jan 04	0	1.8	0
13 Feb 04	6	3.5	1.71
11 Mar 04	4	3.1	1.29
23 Mar 04	10	3.5	2.86
16 Apr 04	5	3.5	1.43
21 May 04	0	1.8	0

The intension of the Sooke River tagging program (Appendix H) was to allow a better estimate of observer efficiency and residence time. Unfortunately, tags applied were low in number, widely distributed temporally speaking, and were sometimes used to mark fish that could not be relied upon to remain in the system as part of the mark group (kelts, both from natural spawning and from hatchery brood stock releases). Thus, the proportion recaptured (i.e., tagged fish observed by snorkellers) could not be accurately determined. Additionally, SSES staff employed only one tag colour during the program, meaning that fish tagged in February could not be distinguished from those tagged in March or April (i.e., no insight regarding residence time).

Steelhead counts from each survey were plotted against time, expressed as days from the start of the run, to generate a total of 693.5 fish-days for the 2004 winter steelhead run (Figure 8). Results

⁷ 50% of the fry from this program are adipose fin clipped. All fry are released in the mainstem Sooke River above the anadromous barrier.

from the March 11 survey were excluded from the AUC calculation because of high stream flow (18.2 m³/s) and poor observation conditions.

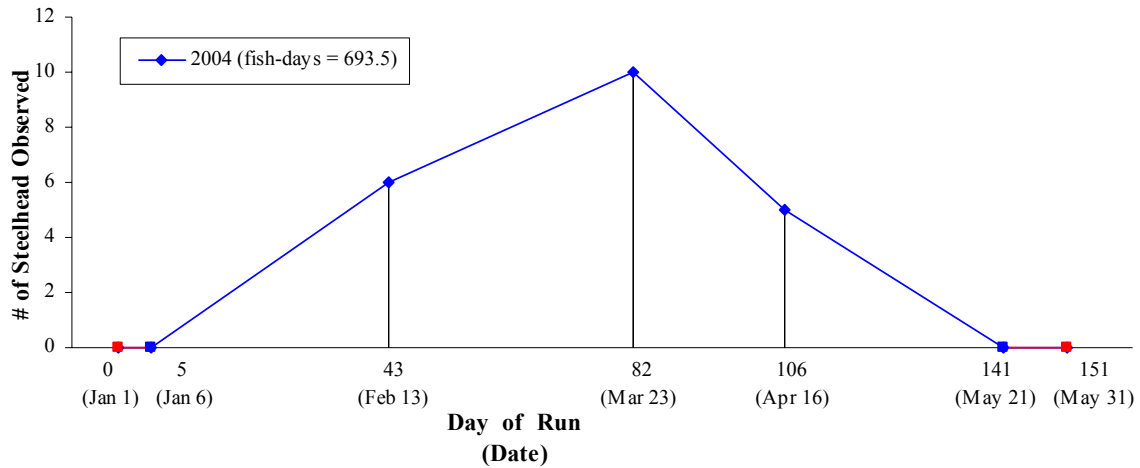


Figure 8. Steelhead counts versus run timing for the Sooke River, January 6 – May 21, 2004.

Based on provincial examples cited previously and on wetted width and typical conditions encountered on the Sooke River, observer efficiency was estimated to be between 40 and 60%. Estimated residence time of steelhead in the Sooke River in 2004 was between 30 and 50 days, based on maturation time of captured broodstock (G. Varney, pers. comm.).

Based on assumptions of 40 to 60% observer efficiency and 30 to 50 day residence time, the estimated range of escapement for the Sooke River in 2004 was 23 to 58 steelhead (Table 5). Because 10 steelhead captured for hatchery program were excluded from the river population during the second and third surveys (largest count), the estimated range of escapement should be considered conservative.

Table 5. 2004 AUC escapement estimates for winter steelhead in the Sooke River.

Residence Time (days)	Observer Efficiency (%)				
	30	40	50	60	70
20	116	87	69	58	50
30	77	58	46	39	33
40	58	43	35	29	25
50	46	35	28	23	20
60	39	29	23	19	17

Mainstem discharges on survey dates ranged from 1.01 to 18.24 m³/s and visibility from five to eight metres (Appendix E). Uncorrected mean daily discharge readings⁸ from the hydrometric station below Sooke Potholes parking lot varied from a maximum of 97.69 m³/s (January 30) to a minimum of 1.069 (May 21) for the run timing period (Figure 9).

⁸ Data provided by S. Gudavicius, P. Eng. Senior Engineer, Hydrology, Capital Regional District, Water Department, Victoria, B.C..

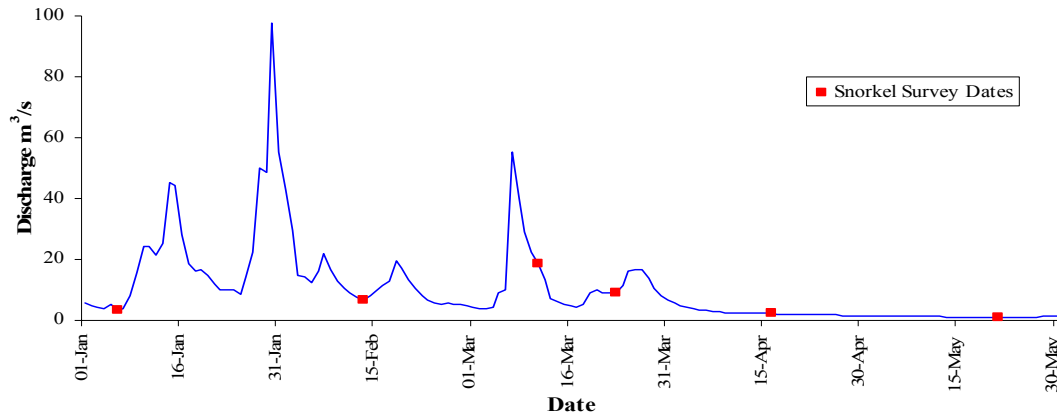


Figure 9. Uncorrected average daily discharge readings of the Sooke River below the Sooke Potholes parking lot. January 1 – May 31, 2004.

The number, species, size, origin, and distribution of resident fish were also documented during each snorkel survey (Appendix F). In total, three wild resident rainbow and six wild cutthroat trout were counted during the six snorkel surveys. Two other fish were counted but species and origin were not confirmed.

Generally, low densities of rainbow parr (yearlings and age 2+) were noted during surveys. These fish were concentrated in the upper river above the parking lot of the Sooke Potholes Provincial Park. High densities of newly emerged coho fry were observed on the last survey on May 21, 2004.

Juvenile Assessment

Steelhead fry density data was collected from six sites on the Sooke River from the tailout of the “Beer Bottle” pool to 200 m u/s of the Sooke River counting fence. The resulting mean (geometric mean) steelhead fry density (non depth/velocity adjusted) was 38.19 FPU (Figure 10, Appendix G). The highest density of fry was observed at site 5 (97.8 FPU), while the lowest density was observed at site 1 (19.2 FPU).

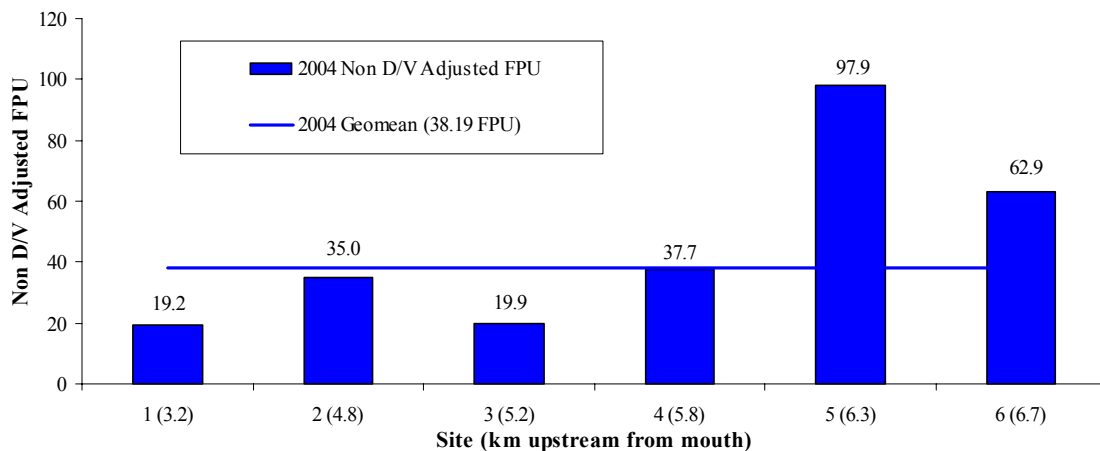


Figure 10. Non depth/velocity adjusted steelhead fry densities from six electrofishing sites in the Sooke River in 2004.

Mean length, weight and condition factor of sampled fry were 53.2 mm, 1.81 g, and 1.13, respectively (Table 6). Mean steelhead fry biomass per unit for all six sites was 72.58 g/Unit.

Table 6. Summary of steelhead fry data collected from six electrofishing sites in the Sooke River in 2004.

Site # (Date Sampled)	Fry Statistics					
	# of Fry Sampled	Non D/V Adj. FPU	Mean Length (mm)	Mean Weight (g)	Biomass per Unit (g/100 m ²)	Mean K Factor
1 (5-Aug04)	16	19.16	63	2.9	55.4	1.14
2 (5-Aug-04)	29	35.04	58	2.2	76.7	1.10
3 (5-Aug-04)	14	19.90	51	1.5	30.7	1.11
4 (4-Aug-04)	30	37.72	50	1.5	58.4	1.19
5 (4-Aug-04)	81	97.85	46	1.2	121.6	1.14
6 (12-Aug-04)	62	62.93	51	1.5	92.6	1.08
Mean	39	38.2*	53	1.8	72.6	1.13

* Denotes geometric mean

The length-frequency distribution of juvenile steelhead fry captured in the Sooke River appears normal with lengths ranging between 32 and 85 mm (Figure 11). Only three parr were captured as habitats sampled were more suitable for fry. The total number of steelhead fry captured was 233.

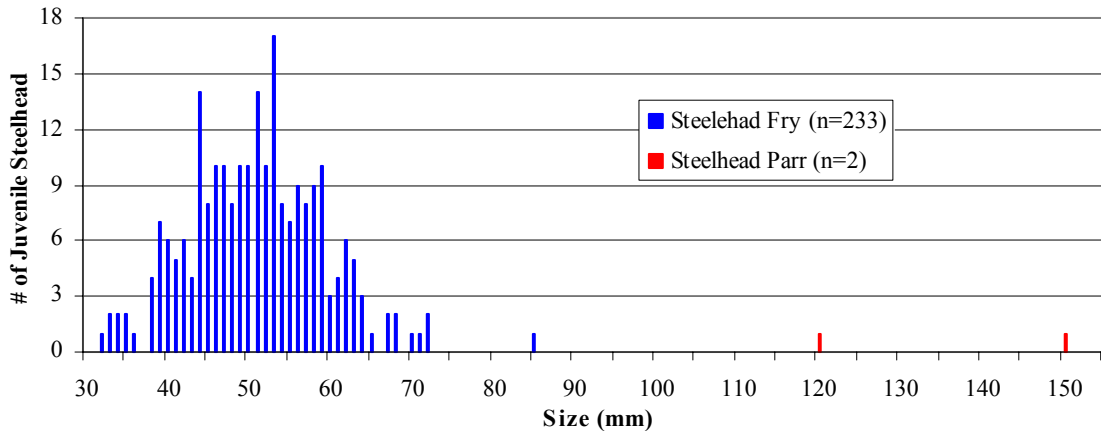


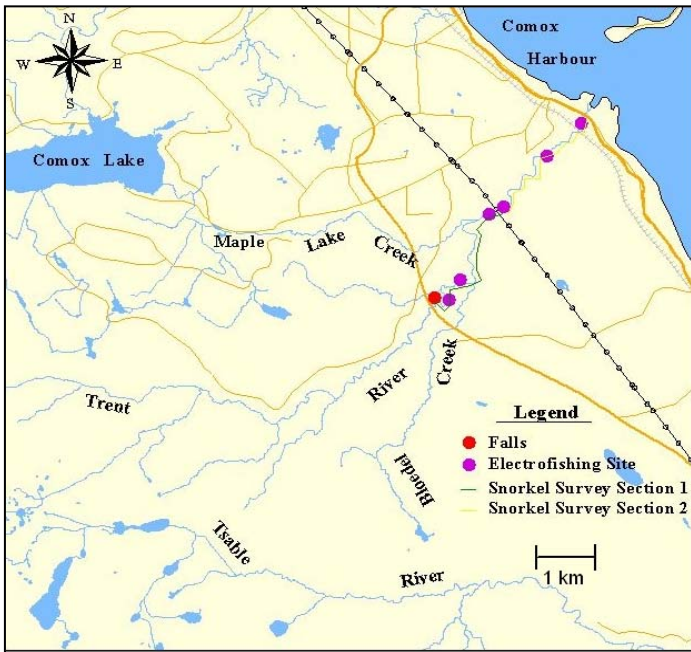
Figure 11. Length-frequency distribution of juvenile steelhead sampled from six sites in the Sooke River in 2004.

3.3 Trent River

Adult Assessment

Between January 26 and May 25, 2004, five snorkel surveys were completed to count Trent River steelhead (Appendix E). Surveys covered 8.5 km of water downstream of the anadromous falls (Figure 12). Surveys covered April peak timing well, but on average occurred every 30 days.

Measured mainstem discharges on survey dates ranged from 2.28 m³/s to 0.29 m³/s. Visibility ranged from two to eight metres (Appendix E). Daily discharge readings from a WSC



hydrometric station on the Tsable River (adjacent watershed) are included in Section 3.4. Steelhead were observed on the second, third and fourth surveys only, suggesting a relatively narrow migration window for the Trent River stock. A peak count of seven steelhead was observed on April 2 (Table 7).

Figure 12. Trent River watershed, with the anadromous barrier, electrofishing sites, and snorkel survey area illustrated.

Table 7. Adult winter steelhead snorkel survey count data for the Trent River, January 26 – May 25, 2004.

Date	# of Steelhead Observed	Total Distance (km)	Steelhead Observed / km
26 Jan 04	0	8.5	0.00
3 Mar 04	2	8.5	0.24
2 Apr 04	7	8.5	0.82
26-27 Apr 04	2	8.5	0.24
25 May 04	0	8.5	0.00

Steelhead counts from each survey were plotted against time, expressed as days from the start of the run, to generate a total of 312.5 fish-days for the 2004 run (Figure 13). The first and last days of the run were assumed to be January 1 and May 31, respectively, making the cumulative run time 151 days.

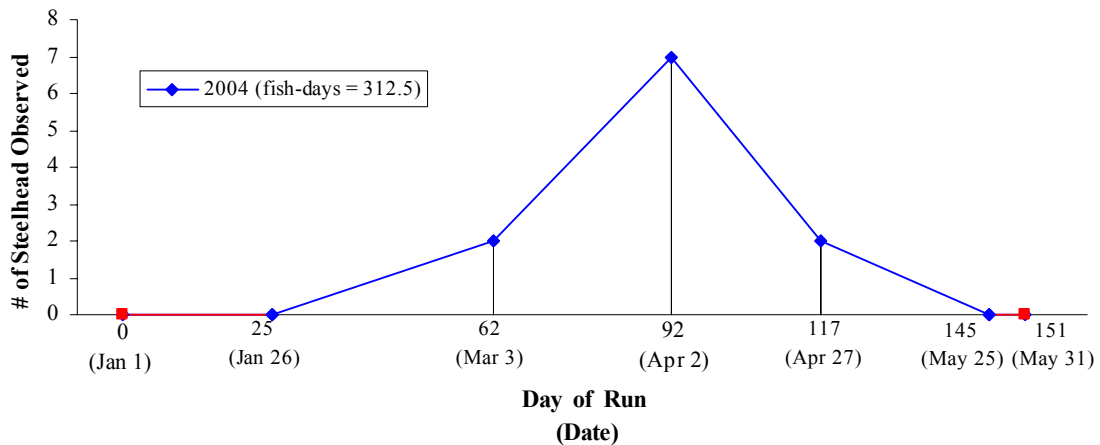


Figure 13. Steelhead counts versus run timing for the Trent River, January 26 – May 25, 2004.

Using provincial examples cited previously and considering stream width and typical conditions encountered on the Trent River, observer efficiency was estimated to be between 50 and 70%. Estimated steelhead residence time in the Trent River during 2004 was between 30 and 50 days, based on zero counts on the first and last surveys and observations of fish condition (i.e., maturity, signs of spawning) made during surveys. Assuming observer efficiencies of 50 to 70% and a residence time of 30 to 50 days, steelhead escapement estimates in the Trent River for 2004 ranged from 9 to 21 (Table 8).

Table 8. 2004 AUC escapement estimates for winter steelhead in the Trent River.

Residence Time (days)	Observer Efficiency (%)				
	40	50	60	70	80
20	39	31	26	22	20
30	26	21	17	15	13
40	20	16	13	11	10
50	16	13	10	9	8
60	13	10	9	7	7

The number, species, size, origin, and distribution of resident fish were also documented during each snorkel survey (Appendix F). In total, 10 wild resident rainbow and three cutthroat trout were observed during the five snorkel surveys.

Low densities of rainbow parr (yearlings and age 2+) were noted, mainly during April and May surveys. High densities of newly emerged coho fry were observed on the last survey on May 25, 2004.

Juvenile Assessment

Steelhead fry density data was collected from six sites on the Trent River from 250 m downstream of the anadromous falls to 120 m upstream of the Highway 19A bridge. Resulting non depth/velocity adjusted mean (geometric mean) steelhead fry density was 8.15 FPU (Figure 14; Appendix G). The highest density of fry was observed at site 3 (83.1 FPU), while the lowest density was observed at site 1 where no fry were captured.

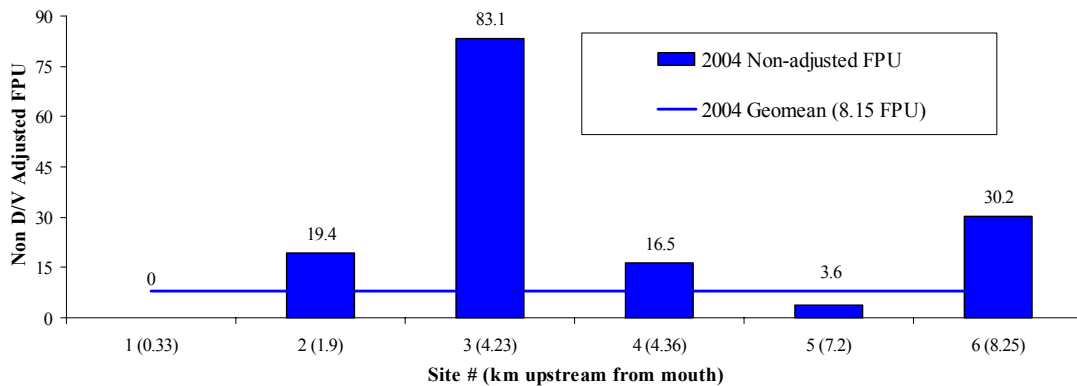


Figure 14. Non depth/velocity adjusted steelhead fry densities from six electrofishing sites in the Trent River in 2004.

Mean length, weight and condition factor of sampled fry were 56.61 mm, 2.30 g, and 1.12, respectively (Table 9). Mean steelhead fry biomass per unit for all six sites was 43.94 g/Unit.

Table 9. Summary of steelhead fry data collected from six electrofishing sites in the Trent River in 2004.

Site # (Date Sampled)	Fry Statistics					
	# of Fry Sampled	Non D/V Adj. FPU	Mean Length (mm)	Mean Weight (g)	Biomass per Unit (g/100 m ²)	Mean K Factor
1 (11-Aug-04)	0	0	0	0	0	0
2 (27-Sept-04)	16	19.4	70	4.7	90.5	1.31
3 (10-Aug-04)	100	83.1	46	1.1	94.3	1.12
4 (10-Aug-04)	12	16.5	54	1.7	28.5	1.05
5 (25-Aug-04)	2	3.6	63	2.6	9.5	1.04
6 (11-Aug-04)	23	30.2	50	1.4	40.9	1.05
Mean	26	8.2*	57	2.3	43.9	1.12

* Denotes geometric mean

The length-frequency distribution of steelhead fry captured in the Trent River shows the majority of fish between 40 and 55 mm, with a relatively high number of larger fry (>55 mm; Figure 15). The total number of steelhead fry and parr (likely age 1+ and 2+) captured was 153 and 23, respectively.

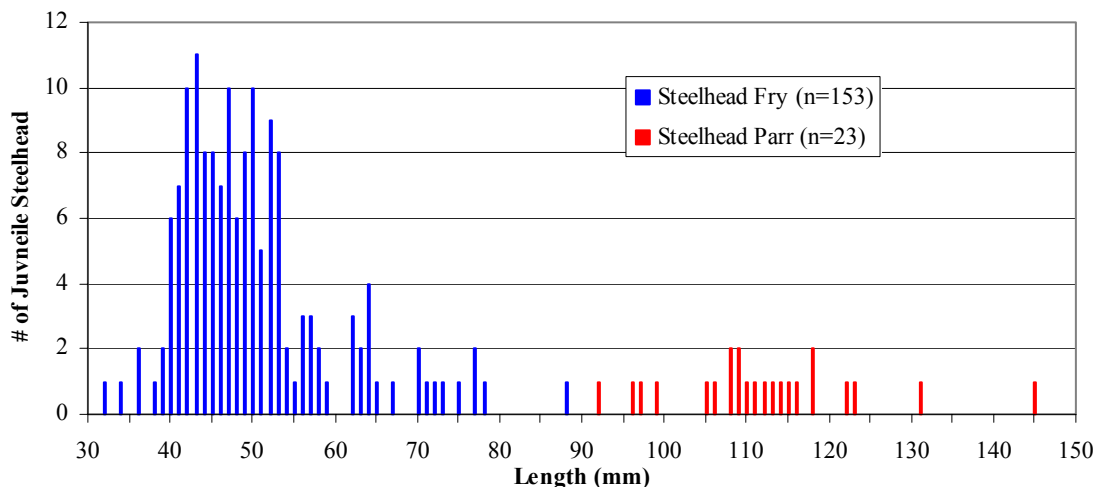
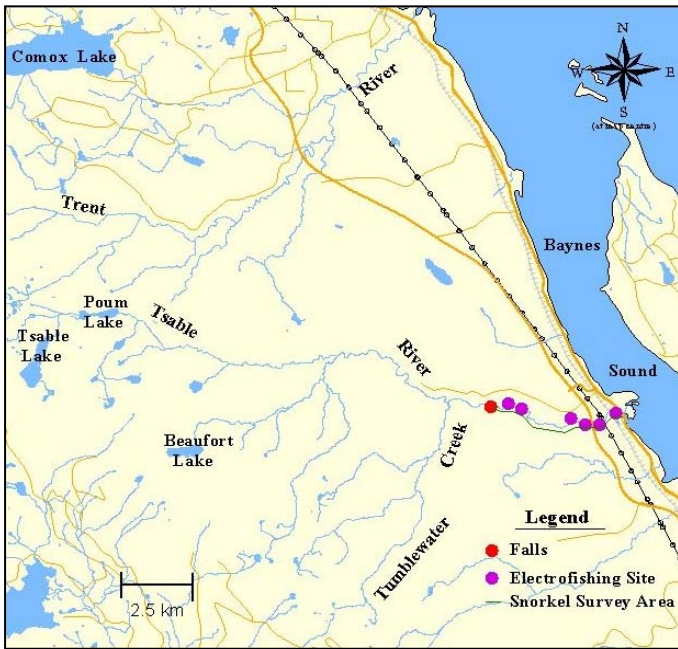


Figure 15. Length-frequency distribution of juvenile steelhead sampled from six sites in the Trent River in 2004.

3.4 Tsable River

Adult Assessment

Between January 27 and May 19, 2004, technicians snorkeled the Tsable River five times to determine steelhead returns (Appendix E). Surveys covered 5.8 km of water downstream of the anadromous falls (Figure 16) and occurred every 28 days on average. Two surveys were



completed in April to improve peak run coverage. A total of 11 steelhead were noted during the five surveys, with a peak count of six fish (1.03 steelhead/km) observed on April 1, 2004 (Table 10).

Figure 16. Tsable River watershed, with the anadromous falls, electrofishing sites, and snorkel survey area illustrated.

Table 10. Adult steelhead count data for the Tsable River, January 27 – May 19, 2004.

Date	# of Steelhead Observed	Total Distance (km)	Steelhead Observed / km
27 Jan 04	0	5.8	0
4 Mar 04	1	5.8	0.17
1 Apr 04	6	5.8	1.03
23 Apr 04	3	5.8	0.52
19 May 04	1	5.8	0.17

Steelhead counts from each survey were plotted against time, expressed as days from the start of the run, to generate a total of 273.5 fish-days for the 2004 steelhead run (Figure 17).

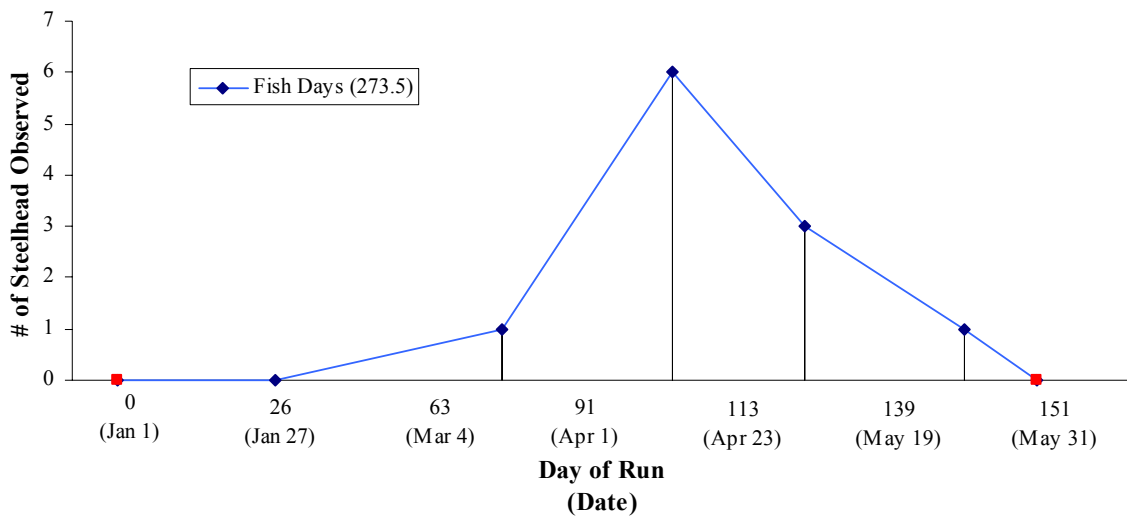


Figure 17. AUC results for snorkel survey series in the Tsable River, January 26 – May 25, 2004.

Using provincial examples cited previously and considering stream width and typical conditions encountered on the Tsable River, observer efficiency was estimated to be between 50 and 70%. Estimated steelhead residence time in the Tsable River during 2004 was between 30 and 50 days, based on observations of fish condition (i.e., maturity, signs of spawning) and duration between surveys. Assuming observer efficiencies of 50 to 70% and a residence time of 30 to 50 days, steelhead escapement estimates in the Tsable River for 2004 ranged from 8 to 18 fish (Table 11).

Table 11. 2004 AUC escapement estimates for winter steelhead in the Tsable River.

Residence Time (days)	Observer Efficiency (%)				
	40	50	60	70	80
20	34	27	23	20	17
30	23	18	15	13	11
40	17	14	11	10	9
50	14	11	9	8	7
60	11	9	8	7	6

Corrected average daily discharge⁹ on survey dates ranged from 8.34 to 3.55 m³/s measured at the Water Survey of Canada gauging station above the trestle bridge (Figure 18). Visibility ranged from two to eight metres (Appendix E).

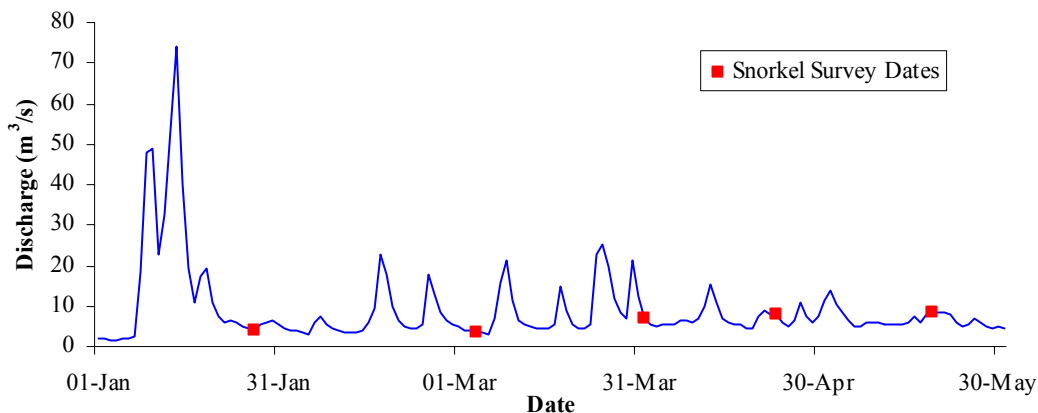


Figure 18. Corrected average daily discharge for the Tsable River above the trestle bridge, January 1 – May 31, 2004 (WSC data).

The number, species, size, origin, and distribution of resident fish were also documented during surveys (Appendix F). In total 14 wild resident rainbow and six cutthroat trout were counted, of which 70% were observed during the last survey in May.

Low densities of rainbow parr (yearlings and age 2+) and/or pre-smolts were noted only during the late April and May surveys. Low densities of coho smolts, pre smolts and newly emerged fry were also observed on the last two surveys.

⁹ Data provided by Russ Gregory, Area Head, Environment Canada, Nanaimo Sub Office, Nanaimo, B.C.

Juvenile Assessment

Steelhead fry density data was collected from six sites on the Tsable River from 200 m upstream the bb25 access point to the railway trestle bridge (upstream of the Highway 19A bridge). Resulting non depth/velocity adjusted mean (geometric mean) steelhead fry density was 5.09 FPU (Figure 19, Appendix G). The highest fry density was observed at site 3 (12.47 FPU), while the lowest density was observed at site 6 (1.12 FPU).

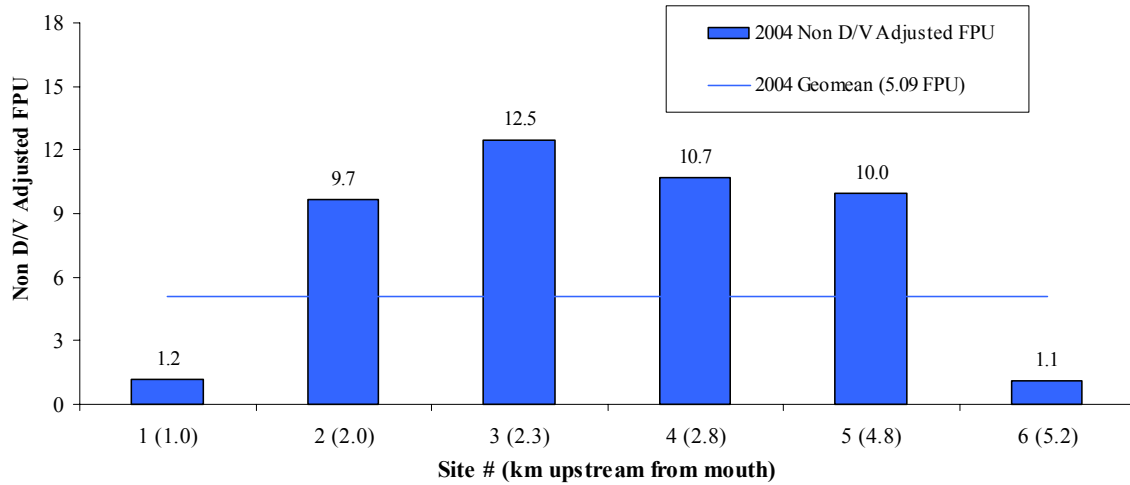


Figure 19. Non depth/velocity adjusted steelhead fry densities from six electrofishing sites in the Tsable River in 2004.

Mean length, weight and condition factor of sampled fry were 55.05 mm, 1.99 g, and 1.15, respectively (Table 12). Mean steelhead fry biomass per unit for all six sites was 16.29 g/Unit.

Table 12. Summary of steelhead fry data collected from six electrofishing sites in the Tsable River in 2004.

Site #	Fry Statistics					
	# of Fry Sampled	Non D/V Adj. FPU	Mean Length (mm)	Mean Weight (g)	Biomass per Unit (g/100 m ²)	Mean K Factor
1 (12-Aug-04)	1	1.2	55	1.8	2.2	1.08
2 (12-Aug-04)	7	9.7	56	1.9	18.7	1.08
3 (13-Aug-04)	9	12.5	56	2.0	25.1	1.13
4 (12-Aug-04)	7	10.7	58	2.4	25.4	1.18
5 (17-Aug-04)	8	10.0	56	2.5	24.9	1.35
6 (17-Aug-04)	1	1.1	49	1.3	1.5	1.10
Mean	6	5.1*	55	2.0	16.3	1.15

* Denotes geometric mean

The length-frequency distribution of juvenile steelhead fry captured in the Tsable River appears normal with fish between 45 and 68 mm (Figure 20). The total number of steelhead fry and parr captured was 33 and one, respectively.

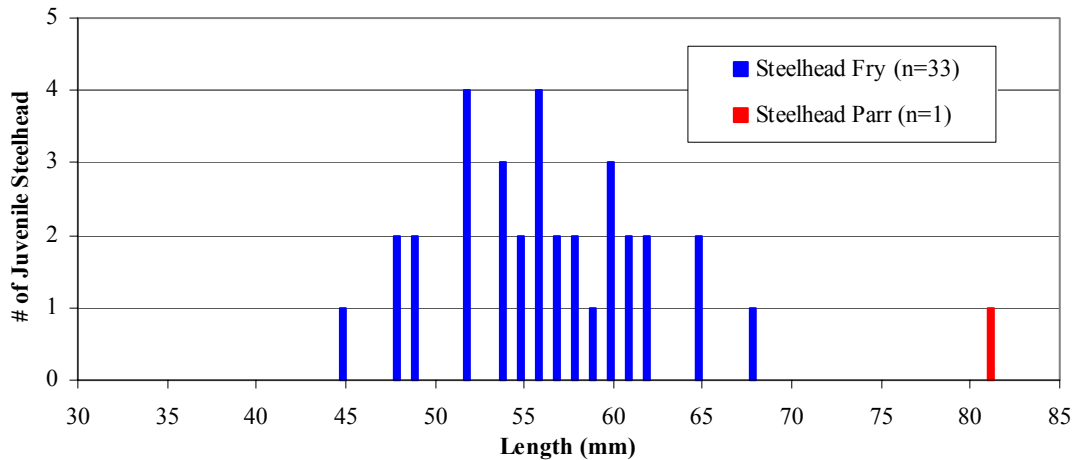


Figure 20. Length-frequency distribution of juvenile steelhead sampled from six sites in the Trent River in 2004.

4.0 DISCUSSION

The classification of wild steelhead stocks is primarily based on the estimate of the productive capacity of each watershed, with benchmarks determined by the Estimated Steelhead Habitat Smolt Capacity. Smolt estimates are converted to adult returns using biostandards for ocean survival. The Provincial Steelhead Conservation Policy classifies the level of adult returns based on the following provincial conservation limit references points (Lill 2002):

- **Routine Management Zone (RMZ):** Steelhead stocks are above 30% of habitat capacity in most years and are not threatened in terms of genetic or environmental distinctiveness. Wild stocks in this zone can withstand modest mortalities through catch and release fisheries without impacting minimum escapement needs;
- **Conservation Concern Zone (CC):** Stocks are estimated to be between 10% and 30% of habitat capacity with limited catch and release angling opportunities possible in the upper part of this range;
- **Extreme Conservation Concern Zone (ECC):** Stocks believed to be at 10% or less of habitat capacity and subject to likely extinction if they are in decline for more than one or two generations;
- **Special Concern (SC):** Mostly small stocks in probable need of conservation but for which little or no stock assessment information is available.

This policy does not address the average escapement requirements for each system as it does not account for the number of spawners required to generate the maximum smolt yield.

Past electrofishing protocol adjusted the fry population based on depth/velocity profiles using Habitat Suitability Index (HSI) curves developed in February 2001. Depth/velocity adjustments were not recommended for small streams with low summer base flows as fry are likely forced to use less suitable habitats (R. Ptolemy, Standards/Guidelines Specialist, MoE, Victoria, pers. comm.).

The Ptolemy alkalinity model (1993) for predicting habitat capacity, or biomass, of species per age class per 100m² of suitable habitat has been used by BCCF from 1998 to 2001. The calculation is as follows:

$$(\text{total alkalinity})^{1/2} \times 36.3 = \text{biomass (g) per 100m}^2$$

The model is still used by BCCF for internal analysis, including Allen Plots and ‘Percent of Predicted FPU’ and provides a fairly accurate, science-based capacity estimate. However, the model does not account for the increased demand by older life stages (parr and smolts) of habitat area. Additionally, late season biomass would be much higher than early season in underseeded habitats, assuming very low mortality over the growing season.

Comparing measured densities to developed target fry densities (2002) maybe more useful in determining stock status. This recognizes that smolt or parr production reaches an asymptote after a certain density is achieved (Wright 2004). Preliminary target fry abundances were developed for key Vancouver Island rivers (Campbell, Cowichan, Englishman, etc.), but have not been developed for the Goldstream, Sooke, Trent and Tsable rivers. Generally, target fry densities for these larger rivers are based on stream productivity and parr/smolt capacity, with targets of 50, 100, and 200 FPU for streams of low, moderate, and high productivity, respectively. Results from fry density studies in small streams (i.e., Snow Creek, WA; Carnation Creek, BC) suggests that target fry densities near 10 FPU, averaged over the entire wetted area of the stream, are sufficient to maximize parr and smolt production (R. Ptolemy, Standards/Guidelines Specialist, MoE, Victoria, pers. comm.). The four candidate streams share similar characteristics and can be classified as parr habitat limited due to low summer flows.

Measured fry densities in the studied streams are likely biased high as a result of electrofishing discrete meso-habitats preferred by fry. As a result, the data may not be comparable to density targets derived from total wetted area calculations. Further, a breakdown of total wetted area by meso-habitat (riffle, pool, glide, etc.) adjusted for suitability using representative transects and HSI curves would likely provide the most appropriate density targets. These data have not been collected for the study streams, and were not a part of the statement of work. Target estimates may be further developed for each system as the required data is gathered.

4.1 Goldstream River

SHA data for the Goldstream River indicate a decline in steelhead abundance during the late 1970s and early 1990s (Figure 21). Low angling effort and catch are evident in the records after 1992. Persistent low returns of adult steelhead to Goldstream River lead provincial fisheries staff to close the river to steelhead angling in December of 1999. The river has remained closed to sportfishing during the steelhead season (Dec. 1-May 31) since that time.

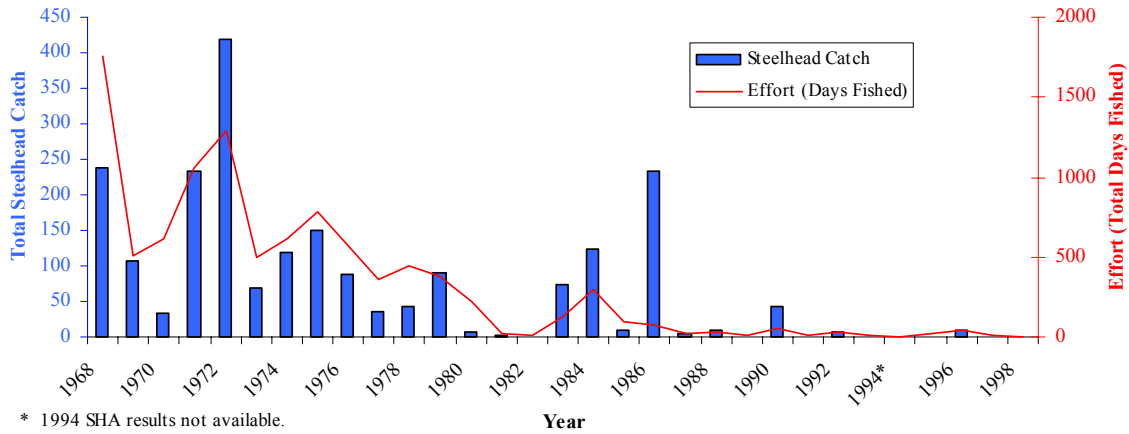


Figure 21. Steelhead Harvest Analysis data for the Goldstream River, 1968 – 1998.

Snorkel surveys to enumerate winter steelhead on the Goldstream River have been conducted by BCCF and/or provincial fisheries staff since 1998. Peak observed steelhead densities (steelhead/km) have remained very low over the period (Figure 22). The estimated steelhead habitat smolt capacity of the Goldstream River is 750, resulting in a return of 30 adults (7.5 fish/km), assuming a more realistic marine survival rate of 4%. Results in 2004 indicate a continued low level of spawner escapement to the Goldstream River.

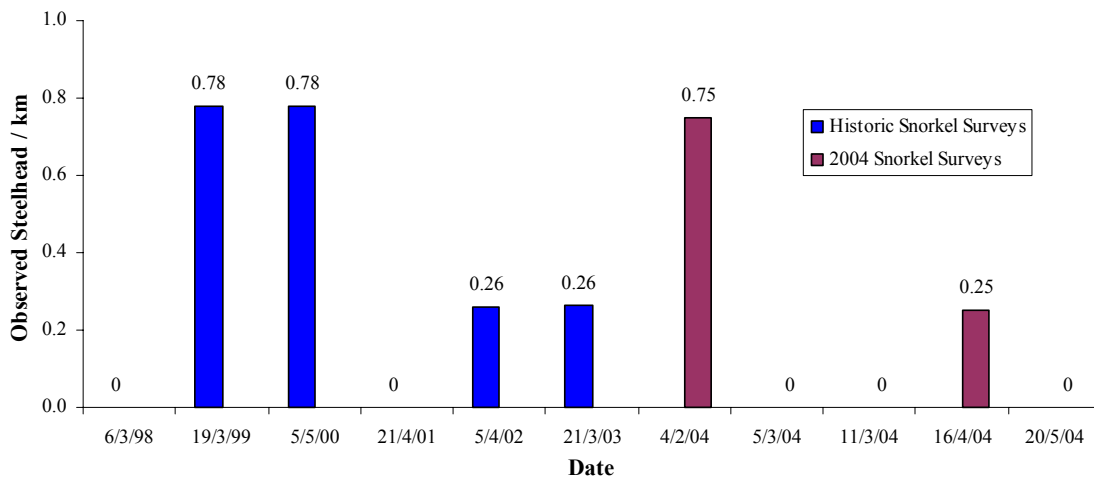


Figure 22. Peak adult steelhead densities (fish/km) observed during snorkel surveys of the Goldstream River, 1998-2004.

Using Symon’s equation for moderate survival¹⁰, fry to smolt survival rates for the Goldstream River are near 34%, given an average steelhead smolt age of 1.5 years. Using this value, the total number of fry required to reach smolt capacity would be 2,180 fry. Expanding this number of fry over the total wetted area of the Goldstream River, 200 units (4 km long x 5 m wide / 100m² per unit) requires an average density of 10.9 FPU to maximize smolt production. This value is similar to densities measured in Carnation and Snow creeks.

¹⁰ Symon’s equation for moderate survival is % survival = 10^(-0.78-0.38*SA)*100/0.13, where SA = smolt age.

In 2004, the non depth/velocity adjusted geometric mean for all four sampled sites was 14.14 FPU. A comparison of juvenile densities from two sites sampled in 2001 and 2004 indicates an increase in fry abundance in 2004 (Figure 23). Non depth/velocity adjusted FPU densities (geomeans) for the two sites in 2004 (28.9 FPU) were more than three times the densities observed in 2001 (9.5 FPU).

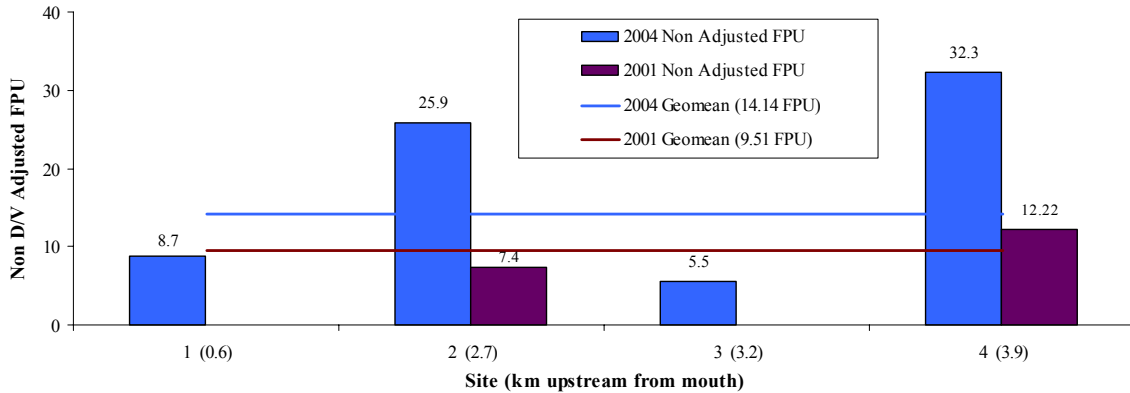


Figure 23. Non depth/velocity adjusted fry densities from the Goldstream River in 2004 (four sites) and 2001 (two sites). Geometric means for each year are also shown.

4.2 Sooke River

SHA data for the Sooke River indicate a decline in steelhead abundance during the early 1980s and the early 1990s (Figure 24). A significantly reduced level of angling effort and catch are evident in the records after 1992.

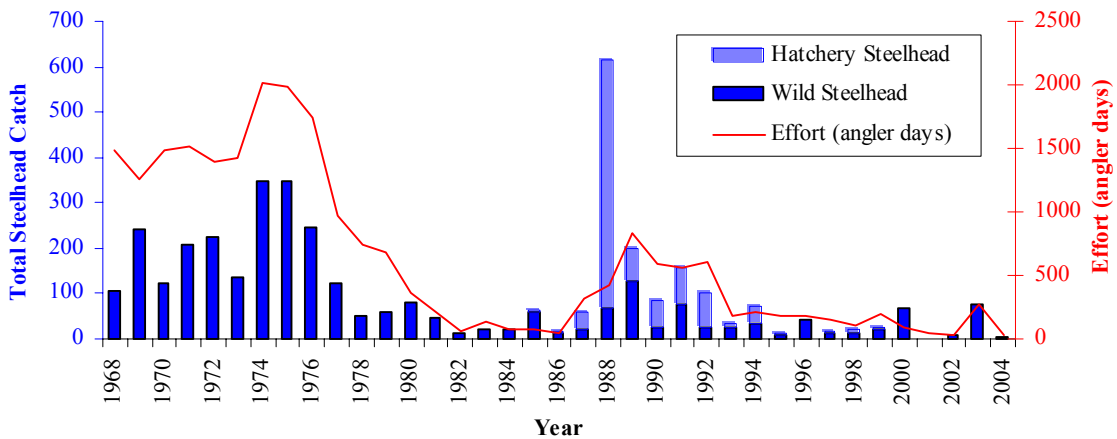


Figure 24. Steelhead Harvest Analysis data for the Sooke River, 1968-2004.

Snorkel surveys to enumerate winter steelhead on the Sooke River have been conducted by BCCF and/or provincial fisheries staff since 1983. Relative abundance estimates (peak steelhead/km counts) have remained very low over the period, except in 1988 when a large return of hatchery steelhead was observed (Figure 25).

Slaney (1981), derived a smolt capacity estimate of 3,002 smolts for the Sooke River (including De Mamiel Creek). Another smolt capacity estimate (mainstem only) can be determined by multiplying 2 smolts per unit¹¹ by an estimated 800 units (4 km of suitable parr habitat x 20 m wetted width / 100m² per unit), to reach a value of 1,600 smolts. This estimate is similar to a SHA-based model that predicts 1,985 smolts¹², using data from 1968-1972. At 4% marine survival these smolt estimates would generate returns ranging from 64 to 120 steelhead adults in the Sooke River.

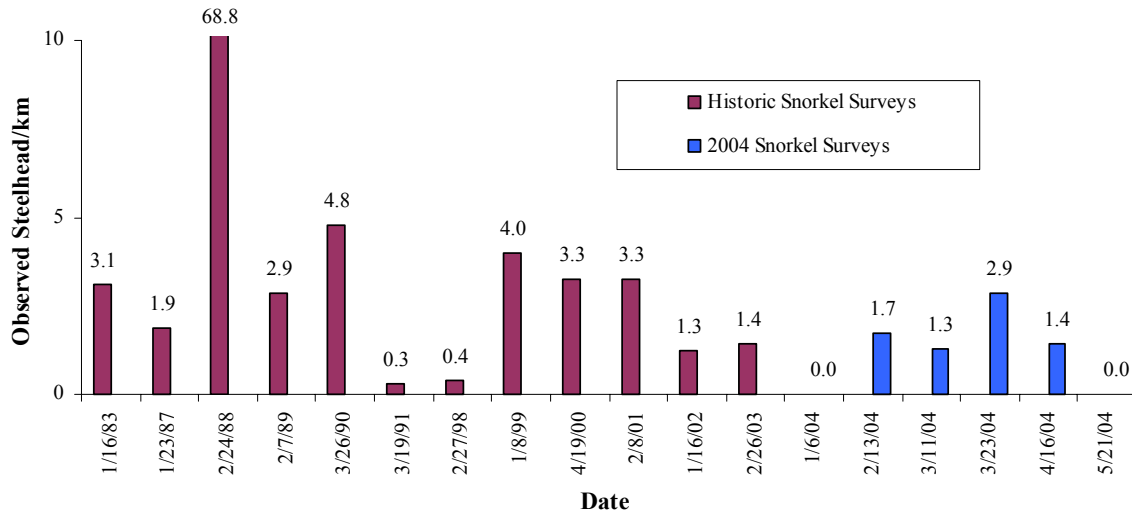


Figure 25. Peak adult steelhead densities (fish/km) observed during snorkel surveys of the Sooke River, 1983-2004.

Using the Symon's equation for moderate survival, fry to smolt survival rates for the Sooke River are near 22%, given an average steelhead smolt age of 2.0 years. Using this value, the total number of fry required to reach smolt capacity (1,985 smolts from mainstem estimate above) would be 9,023 fry. Expanding this number of fry over the total wetted area of the Sooke River, 800 units (4 km long x 20 m wide / 100m² per unit) requires a mean density through all meso-habitats of 11.28 FPU to maximize smolt production.

In 2004, the non depth/velocity adjusted geometric mean for all six sampled sites was 38.19 FPU. A comparison of juvenile densities from the six sites completed in 2004 to the same sites completed in 2000 and three sites completed in 2001 was also performed (Figure 26). Results vary from a high of 42.4 FPU (2000) to a low of 24.7 FPU (2001). It should be noted that the 2001 data represents sites 1, 5 and 6 only.

¹¹ 2 smolts per unit (100m²) is based on Keogh River standards of 7000 smolts generated from 3600 units.

¹² Mean reported harvest from 1968-72 divided by factor of 0.7, divided by 13% marine survival.

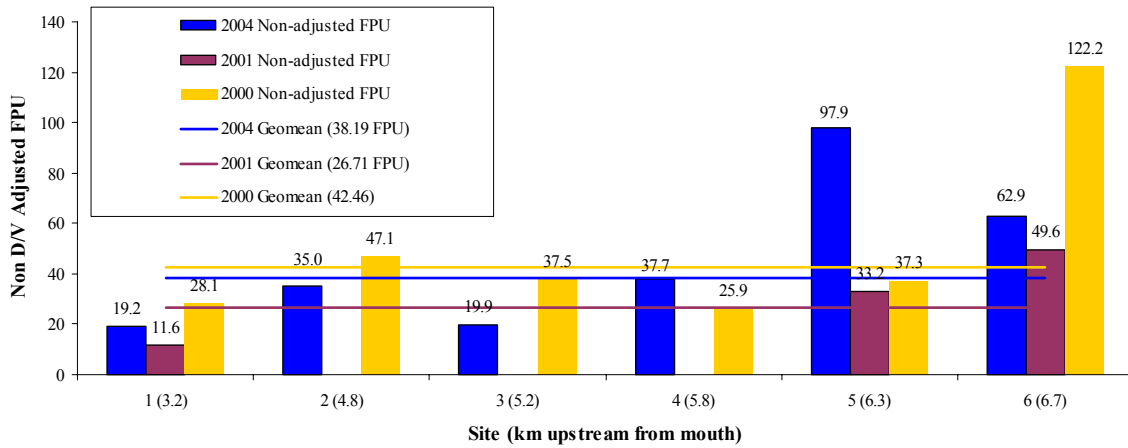


Figure 26. A comparison of non depth/velocity adjusted steelhead fry densities in electrofishing sites in the Sooke River in 2000, 2001 and 2004. Geometric means for each year are also shown. Sites 2, 3 and 4 were not sampled in 2001.

4.3 Trent River

SHA data indicate a decline in steelhead abundance during the early 1980s and the mid 1990s (Figure 27). A significantly reduced level of angling effort and catch is evident in the records after 1994. Persistent low returns of adult steelhead to the Trent River lead provincial fisheries staff to implement a seasonal sportfishing closure in 1999. Seasonal closures during the winter steelhead season (Dec. 1-May 31) have been in place since.

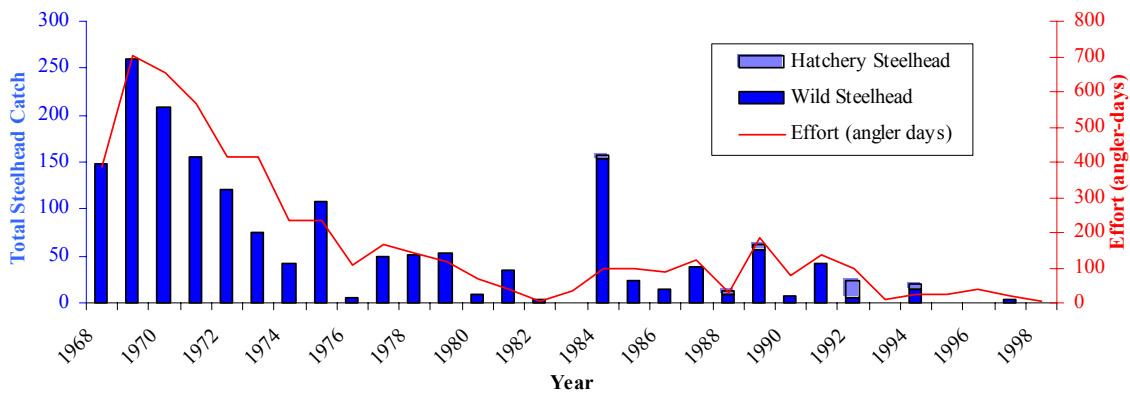


Figure 27. Steelhead Harvest Analysis data for the Trent River, 1968-1998.

One previous snorkel survey to enumerate winter steelhead on the Tsable River has been conducted by BCCF and provincial fisheries staff. Two adult steelhead were counted over 4.4 km on March 15, 2002. Given the survey’s timing, the observed abundance is similar to that documented in 2004 and suggests that low returns have been the norm for several years now.

The estimated steelhead habitat smolt capacity of the Trent River is 1,650 smolts (Lill 2002), resulting in a return of 66 adults (8.3 fish/km) assuming 4% marine survival. Fry to smolt survival rates for the Trent River are near 14% (Symon’s equation) given an average steelhead smolt age of 2.5 years. The total number of fry required to reach smolt capacity would be 11,538

fry. Expanding this number of fry over the total wetted area of the Trent River, 850 units (8.5 km long x 10 m wide / 100m² per unit) requires a density of 13.57 FPU to maximize smolt production.

In 2004, non depth/velocity adjusted steelhead fry densities from six sites on the Trent River averaged (geometric mean) 8.15 FPU. A comparison of juvenile densities from the six sites completed in 2004 to that of sites sampled in 2002 and 1988 shows high variability, but indicates an overall drop in abundance in recent years versus the late 1980's (Figure 29).

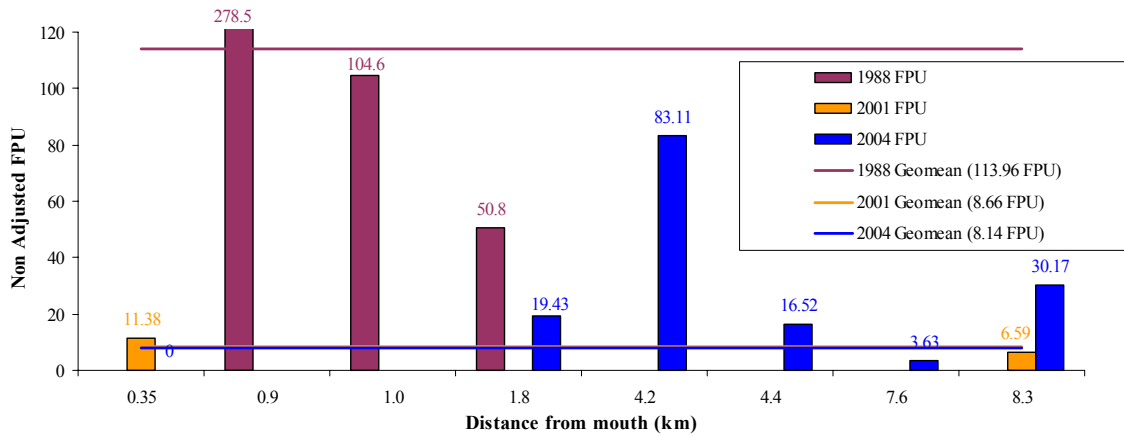


Figure 28. A comparison of non-adjusted steelhead fry densities in electrofishing sites on the Trent River in 1988, 2002, and 2004. Geometric means for each year are also shown.

4.4 Tsable River

Similar to the Trent River, SHA data for the Tsable River indicates a decline in steelhead abundance during the early 1980s and the mid 1990s (Figure 30). A significantly reduced level of angling effort and catch is evident in the records after 1994. Low returns lead provincial fisheries staff to implement seasonal (Dec. 1-May 31) sportfishing closures in 1999, that continue to the present.

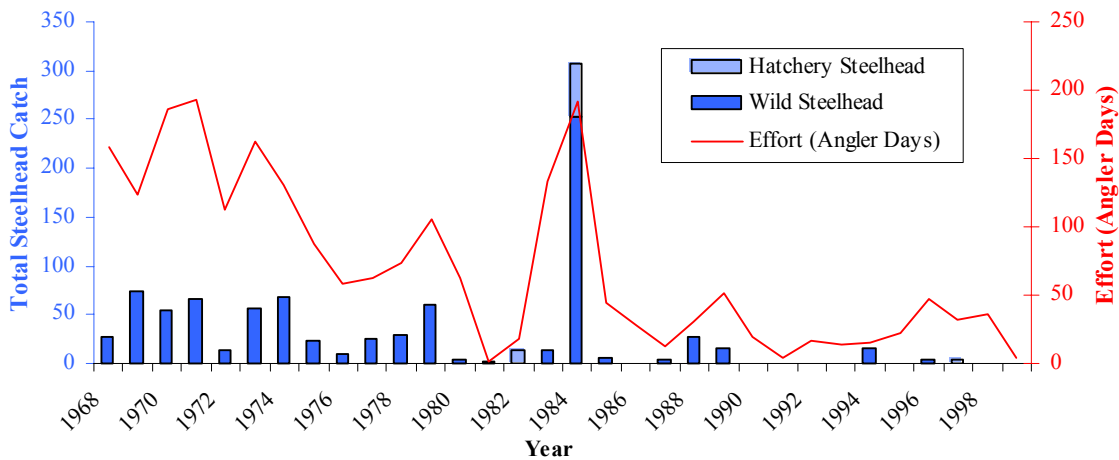


Figure 29. Steelhead Harvest Analysis data for the Tsable River, 1968-1999.

Previous snorkel surveys to enumerate winter steelhead have been performed on the Tsable River by BCCF and independent fisheries contractors in 2002 only (Figure 31). Results documented very low densities similar to 2004 and to results observed in the adjacent Trent River watershed.

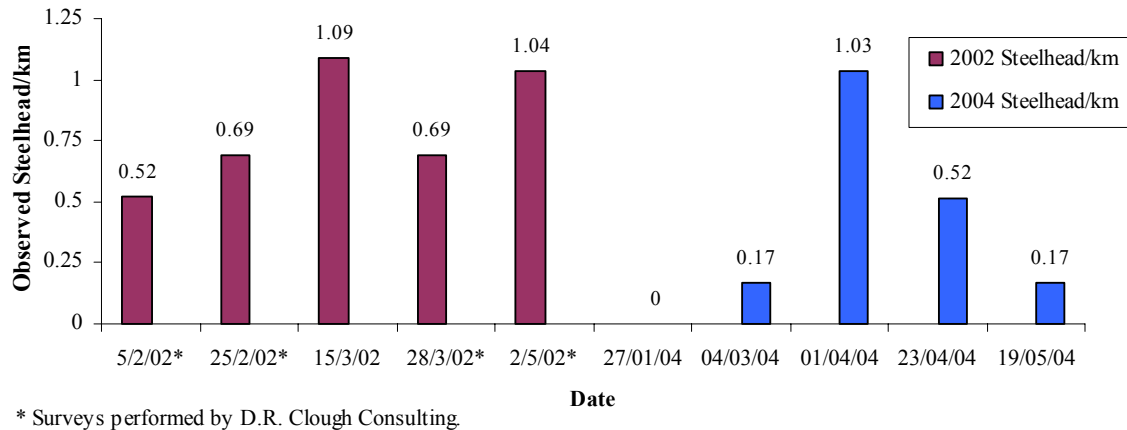


Figure 30. Adult winter steelhead snorkel survey results (fish/km) observed during snorkel surveys of the Tsable River in 2002 and 2004.

The estimated steelhead habitat smolt capacity of the Tsable River is 1,400 smolts (Lill 2002), resulting in a return of 56 adults (9.6 fish/km), assuming 4% marine survival. Similar to the Trent River, fry to smolt survival rates for the Tsable River are near 14% (Symon's equation), given an average steelhead smolt age of 2.5 years. Based on this, the number of fry required to reach smolt capacity would be 9,790 fry. Expanding this value over the total wetted area of the Trent River, 870 units (5.8 km long x 15 m wide / 100m² per unit) requires an estimated density of 11.25 FPU to maximize smolt production.

Non depth/velocity adjusted steelhead fry densities from six sites on the Tsable River in 2004 averaged (geometric mean) 5.09 FPU. In 2001, sites 1 and 2 were sampled, however no steelhead fry were captured in either site.

5.0 SUMMARY AND CONCLUSIONS

The Provincial Steelhead Conservation Policy identifies conservation limit reference points for medium and large streams based on their Estimated Steelhead Habitat Smolt Capacity. Smolt capacity estimates are then converted to adult return targets based on a ocean survival biostandard (historically 13%, though most experts agree ECVI stocks are now experiencing less than 4% survival). Generally, 4% marine survival is required for steelhead stock replacement (Lill 2002). Marine survivals of Keogh River (northern Vancouver Island) steelhead have fluctuated between 2 and 26% from the late 1970s to the late 1990s.

Information collected on small, parr habitat limited streams (i.e. Snow Creek and Carnation Creek) indicates a reduced spawner requirement to fully maximize parr and smolt production. Using Goldstream River as an example, the number of spawners required to fully maximize smolt production (capacity = 750 smolts) is likely near eight steelhead (four spawning pairs) or 7% of

target adult returns, given 20% repeat spawning (R. Ptolemy, pers. comm.). This correlates to a 1.1% marine survival rate if 750 smolts out-migrate.

Preliminary investigation into the four studied rivers identified current stock status as low in comparison to historic data. Definitive adult escapements could not be determined because observer efficiency and residence time could only be estimated. Steelhead fry density measures suggest the Goldstream and Sooke were likely at or near levels required to seed *total wetted area* and achieve smolt capacity estimates. However, caution is urged when comparing measured densities to total wetted area derived targets because the former were obtained from preferred habitats. Measured steelhead fry densities in the Trent and Tsable rivers indicate underseeding of fry in both systems as fry densities sampled in preferred habitats were lower than targets derived from total wetted area.

To further improve adult population estimates, additional funding would be required to all for a mark-recapture component and a calculation of observer efficiency and residence time. Future juvenile density investigations on these streams should strive to identify fry density targets based on meso-habitat suitability.

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Appendix A.

Steelhead Stream Classification and Policy Draft

**For Consultation and Discussion Purposes
Steelhead Stream Classification– Policy and Procedure (Draft April 21, 2004)**

Staff, Organizations directly affected:

Ministry of Water, Land and Air Protection
Ministry of Sustainable Resource Management
Ministry of Agriculture, Food and Fisheries
Freshwater Fisheries Society of British Columbia
Fisheries and Oceans Canada

Policy Statement:

Purpose: The use of hatchery steelhead (*Oncorhynchus mykiss*) can provide angling benefits, but may also impose risks to wild stocks. The overall purpose of this policy is to manage the risks in order to maintain healthy, self sustaining wild stocks.

It is the policy of the Ministry:

1. That all streams containing Steelhead will be classified as:
 - (a) wild; or
 - (b) hatchery-augmented.
2. That streams will be classified as wild unless specifically designated as hatchery-augmented.
3. That streams designated as “wild” will be managed to maintain and protect the abundance, distribution and genetic diversity of indigenous steelhead stocks in the province while providing angling opportunities when stock abundance permits.
4. That streams designated “hatchery-augmented” will be managed to maintain or develop new angling opportunities while minimizing the risks of genetic introgression and incidental mortality of wild indigenous steelhead.
5. That hatchery-augmentation will not be considered as a substitute for habitat conservation, habitat protection and habitat restoration.

Reason for policy:

- 1) To maintain the genetic diversity, general health, and long term viability of wild indigenous steelhead stocks.
- 2) To recognize the inherent risks of hatchery augmentation and to acknowledge the lack of scientific evidence to support the use of traditional hatchery practices to recover ‘at-risk’ stocks.
- 3) To allow for the maintenance and development of new steelhead angling opportunities in the province in appropriate locations.

- 4) To provide standard designations to support development of consistent management plans for steelhead stocks throughout the province.
- 5) To ensure that decisions with respect to the use of hatchery-augmentation are science based and consistently applied throughout the province.
- 6) To facilitate understanding and support for steelhead conservation, management and recovery strategies.

Definitions:

“**Wild**” steelhead streams – streams in which steelhead stocks and steelhead angling opportunities are sustained only by naturally produced indigenous fish. The historic stocking of hatchery fish does not preclude a wild designation if there is reasonable expectation that the indigenous stock remains intact or can be recovered within a reasonable time frame (x generations).

“**Hatchery - augmented**” steelhead streams – streams in which marked, artificially propagated steelhead are released for the purpose of creating angling opportunities. This includes any project where eggs are taken from adults, fertilized and incubated in a facility of any kind. It also includes trapping fry, parr or smolts and raising them for subsequent release or use as captive brood stock.

Wild stock status is expressed relative to the estimated capacity of each individual watershed to produce naturally spawning steelhead as follows:

- “**Routine Management**” -stocks exceed 30% of habitat capacity;
- “**Conservation Concern**” - stocks are 10% to 30% of habitat capacity;
- “**Extreme Conservation**” -stocks less than 10% of habitat capacity;
- “**Special Concern**” stocks are not well documented but believed to be very low.

Procedure

A.) Classification of Steelhead Streams

- The Ministry will classify provincial streams containing steelhead as “wild” or “hatchery - augmented” to meet steelhead conservation and management objectives.
- The primary objective is to maintain healthy, self-sustaining wild steelhead populations in British Columbia and, as such, the default classification will be “wild”. Criteria for classifying a stream as “hatchery-augmented” include:
 - i. systems which have been historically augmented and where continued augmentation is not considered to pose a risk to extant wild stocks or;
 - ii. systems where a wild stock has been depleted or otherwise reduced to the point that recovery is not considered possible within a reasonable time frame (x generations) or;
 - iii. systems where a steelhead population never existed and potential impacts to other native species have been evaluated and are considered minimal;

In all cases there must be a reasonable expectation of creating a viable angling opportunity in a cost-effective manner.

- Initial classifications and subsequent changes must be reviewed by the Anadromous Fisheries Committee who will make a recommendation to the Environmental Stewardship Division Management Committee (DMC) for decision.
- Requested changes to the designation of a steelhead stream will be directed to the accountable regional manager who will prepare an evaluation that includes management objectives, potential consequences and their likelihood and, performance indicators.
- A schedule of hatchery-augmented streams will be established and updated as required.

B. Management of Designated Steelhead Streams

The Ministry will manage designated provincial steelhead streams as follows:

“Wild” steelhead streams

- No hatchery augmentation will be permitted.
- Angling regulations are to be enacted that prohibit retention of unmarked steelhead by angling and minimize catch and release impacts
- Management priorities should be identified and implemented to maintain stock abundance in the “Routine Management Status”. When the stock status of wild steelhead populations are declining towards or have declined to “Conservation Concern” levels or lower, management prescriptions designed to recover stocks to the “Routine Management Status” should be developed.
- Management prescriptions should focus first and foremost on restoring stock abundance through improved stock management and/or habitat protection and habitat improvement that mimics natural habitat or enrichment of natural habitat.
- Where the requirement for a Recovery Plan (under the Accord for the Protection of Species at Risk or the *Species at Risk Act*) is identified for a steelhead stock or stock group, then it will be undertaken according to provincial policy and procedures. The use of conservation fish culture¹ designed to conserve with-in stock genetic diversity is an acceptable short term option (1 generation) if it is part of a provincially approved recovery plan.

¹ Conservation Fish Culture is a specialized and experimental form of hatchery intervention designed to prevent the extinction of a population or species while the root causes of population decline are ascertained and addressed. The primary focus of conservation fish culture is to protect the natural genetic integrity of the population. Such a program requires a carefully designed breeding plan and release strategy to mimic what would happen in the wild. These programs are planned to be “temporary”, usually lasting for one generation. A conservation fish culture program differs significantly from the traditional production hatchery program where the main objective is to provide for angling opportunities.

- Adult brood stock, smolts or parr may not be taken from wild steelhead streams for hatchery augmentation on other systems unless:
 - a) a risk assessment has been prepared by the proponent and approved by the Anadromous Fisheries Committee as an exception to the general practice of not transplanting steelhead between watersheds;
 - b) the status of the wild donor stock is in the Routine Management Status and;
 - c) approval is obtained from the Federal/Provincial Introductions and Transfer Committee.

Non-government partners and public involvement groups should be encouraged to undertake projects which promote wild stock recovery through, habitat protection and restoration or enrichment of natural habitat.

“Hatchery - augmented” streams

- All hatchery-augmented fish must be marked with at least an adipose fin clip and regulations enacted that will limit catch and release impacts as much as possible, and only permit retention by angling on marked hatchery-augmented fish.
 - Hatchery programs must be evaluated annually to confirm predicted program objectives and outcomes are being achieved for the augmented and neighbouring streams.
 - Hatchery augmentation, must follow current best practices for steelhead culture as established by the Freshwater Fisheries Society of BC and the Ministry of Water, Land and Air Protection.
- a) Where an indigenous steelhead population is extant in a stream that has been hatchery augmented to create a retention fishery for marked steelhead:
- A management prescription must be prepared that is designed to maintain indigenous populations and their habitats.
 - The management prescription must consider the consequences identified during the classification process and establish practices to minimize any potentially negative impacts on indigenous steelhead stocks.
 - This risk will be considered acceptable where there are expected to be significant angling benefits and the augmentation program is not expected to impact the overall health of wild-indigenous steelhead populations.
 - Management priorities should be identified and implemented to maintain the abundance of the wild-indigenous steelhead populations in the “Routine Management status. When the stock status of wild steelhead populations are declining towards or have declined to “Conservation Concern” levels or lower, management prescriptions designed to recover stocks to the “Routine Management Status” should be developed.
 - Management prescriptions should focus first and foremost on restoring stock abundance through improved management and/or habitat protection, habitat improvement that mimics natural habitat or enrichment of natural habitat.

- Unmarked steelhead adults from the same stream should be used for brood stock when sufficient wild stock are available and comprise the majority of annual spawning escapements.
 - Hatchery steelhead releases must be at locations and times where they will have minimum impact on wild fish.
- b) Where a wild population of steelhead has never existed, been extirpated, or is not sufficiently abundant to meet the accepted definition of a viable stock, a new population of steelhead may be considered for introduction through hatchery augmentation to create a steelhead angling opportunity.
- A management prescription must be prepared that considers consequences identified during the classification process and establishes practices to minimize any potentially negative impacts.
 - Marked steelhead brood stock from the closest available stream, which is part of the same stock grouping, is the preferred source for hatchery augmentation.
- c) Management prescriptions will be reviewed by the anadromous committee and submitted to the Environmental Stewardship Division Management Committee (DMC) for approval of their recommendation.

Appendix B.

Summary of current and historical snorkel survey data for the Goldstream, Sooke, Trent and Tsable rivers

Stream Name	Date	Survey Area	Approx. Dist. (km)	Steelhead Observed	Observed fish/km
Goldstream River	3/6/98 ¹	Falls - Estuary	3.85	0	0.00
	2/15/99	Falls - Estuary	3.85	1	0.26
	3/19/99 ¹	Falls - Estuary	3.85	3	0.78
	4/12/99	Falls - Estuary	3.85	0	0.00
	2/3/00	Falls - Estuary	3.85	0	0.0
	5/5/00	Falls - Goldstream Park	2.0	3	1.5
	4/21/01	Falls - Lower Br. in Park.	3.80	0	0.0
	4/5/02 ²	Falls - Estuary	3.85	1	0.3
	3/21/03	Falls - Mt. Finlayson Br. In Park	3.80	1	0.3
	2/4/04	Falls - 200 m d/s Mt. Finlayson Br.	4.0	3	0.8
	3/5/04	Falls - Hwy 1 Bridge	2.0	0	0.0
	3/11/04	150 m u/s campsite Br - Mt. Finlayson Br.	2.8	0	0.0
	4/16/04	Falls - 200 m d/s Mt. Finlayson Br.	4.0	1	0.3
5/20/04	Falls - 200 m d/s Mt. Finlayson Br.	4.0	0	0.0	
Sooke River	1/16/83	Canyon above Sandy Pool - Powerline	3.20	10	3.13
	1/23/87	Pot holes - De Mamiel Creek	5.30	10	1.89
	2/24/88	Pot holes - Smokey's Farm	2.50	172	68.80
	2/7/89	Canyon - Smokey's Farm	2.80	8	2.86
	3/26/90	Pot holes - Smokey's Farm	2.50	12	4.80
	3/19/91	Barrier Falls - Smokey's Farm	3.50	1	0.29
	2/27/98	Pot holes - Smokey's Farm	2.50	1	0.40
	1/8/99 ¹	Falls - Powerline (300m d/s Smokey's)	4.00	16	4.00
	4/19/00	Sooke Falls - Hydrolines	4.0	13	3.25
	2/8/01	Sooke Falls - Hydrolines	4.0	13	3.25
	1/16/02	Falls - Tidal Mark (John's Farm)	4.0	5	1.25
	2/26/03	Falls (Anad. Barrier) - Smokey's	3.5	5	1.43
	1/6/04	Falls (Anad. Barrier) - Water Tower	1.8	0	0.00
	2/13/04	Falls (Anad. Barrier) - Smokey's	3.5	6	1.71
	3/11/04	400 m d/s falls - Smokey's	3.1	4	1.29
	3/23/04	Falls (Anad. Barrier) - Smokey's	3.5	10	2.86
4/16/04	Falls (Anad. Barrier) - Smokey's	3.5	5	1.43	
5/21/04	Falls (Anad. Barrier) - Water Tower	1.8	0	0.00	
Trent River	3/15/02	Powerline Crossing - Mouth	4.4	2.0	0.45
	1/26/04	Falls - Highway 19A Bridge	8.5	0.0	0.00
	3/3/04	Falls - Highway 19A Bridge	8.5	2.0	0.24
	4/2/04	Falls - Highway 19A Bridge	8.5	7.0	0.82
	4/27/04	Falls - Highway 19A Bridge	8.5	2.0	0.24
	5/25/04	Falls - Highway 19A Bridge	8.5	0.0	0.00
Tsable River	2/5/02 ³	Anadromous Falls - Hwy (19a) Bridge	5.8	3	0.52
	2/25/02 ³	Anadromous Falls - Hwy (19a) Bridge	5.8	4	0.69
	3/15/02	Anadromous Falls - Inland Hwy 19 Bridge	4.6	5	1.09
	3/28/02 ³	Anadromous Falls - Hwy (19a) Bridge	5.8	4	0.69
	5/2/02 ³	Anadromous Falls - Hwy (19a) Bridge	5.8	6	1.04
	1/27/04	Anadromous Falls - Hwy (19a) Bridge	5.8	0	0.00
	3/4/04	Anadromous Falls - Hwy (19a) Bridge	5.8	1	0.17
	4/1/04	Anadromous Falls - Hwy (19a) Bridge	5.8	6	1.03
	4/23/04	Anadromous Falls - Hwy (19a) Bridge	5.8	3	0.52
5/19/04	Anadromous Falls - Hwy (19a) Bridge	5.8	1	0.17	

1. Survey by staff at Vancouver Island Trout Hatchery.

2. Survey by Victoria WLAP staff. An additional 2 dead steelhead were noted (predator mortalities).

3. Surveyed by D.R. Clough Consulting - 6966 Leland Rd. Lantzville B.C. V0R 2H0 Ph/Fax: 390 2901

Appendix C.

Steelhead harvest analysis data for the Goldstream, Sooke, Trent and Tsable rivers

STREAM NAME	YEAR	NO. ANGLERS	DAYS FISHED	WILD KEPT	WILD RELEASED	TOTAL WILD	HATCH KEPT	HATCH REL	TOTAL HATCH	TOTAL CATCH	CATCH/UNIT EFFORT
GOLDSTREAM RIVER	1968	269	1757	237	0	237	0	0	0	237	0.13
	1969	184	503	106	0	106	0	0	0	106	0.21
	1970	165	612	33	0	33	0	0	0	33	0.05
	1971	262	1056	190	43	233	0	0	0	233	0.22
	1972	251	1294	226	192	418	0	0	0	418	0.32
	1973	136	501	28	42	70	0	0	0	70	0.14
	1974	147	613	49	70	119	0	0	0	119	0.19
	1975	139	783	51	98	149	0	0	0	149	0.19
	1976	98	569	70	18	88	0	0	0	88	0.15
	1977	65	357	8	28	36	0	0	0	36	0.10
	1978	88	447	11	33	44	0	0	0	44	0.10
	1979	86	377	32	58	90	0	0	0	90	0.24
	1980	65	223	0	7	7	0	0	0	7	0.03
	1981	5	16	3	0	3	0	0	0	3	0.19
	1982	4	15	0	0	0	0	0	0	0	0.00
	1983	28	132	13	61	74	0	0	0	74	0.56
	1984	34	300	0	124	124	0	0	0	124	0.41
	1985	17	93	0	10	10	0	0	0	10	0.11
	1986	11	78	0	230	230	4	0	4	234	3.00
	1987	20	24	0	4	4	0	0	0	4	0.17
	1988	22	35	0	9	9	0	0	0	9	0.26
	1989	3	7	0	0	0	0	0	0	0	0.00
	1990	14	57	0	33	33	0	9	9	42	0.74
	1991	4	8	0	0	0	0	0	0	0	0.00
	1992	9	32	0	8	8	0	0	0	8	0.25
	1993	8	8	0	0	0	0	0	0	0	0.00
1995	9	19	0	0	0	0	0	0	0	0.00	
1996	7	41	0	0	0	0	10	10	10	0.24	
1997	6	6	0	0	0	0	0	0	0	0.00	
1998	5	5	0	0	0	0	0	0	0	0.00	

STREAM NAME	YEAR	NO. ANGLERS	DAYS FISHED	WILD KEPT	WILD RELEASED	TOTAL WILD	HATCH KEPT	HATCH REL	TOTAL HATCH	TOTAL CATCH	CATCH/UNIT EFFORT
SOOKE RIVER	1968	447	1488	107	0	107	0	0	0	107	0.07
	1969	398	1260	240	0	240	0	0	0	240	0.19
	1970	335	1478	121	0	121	0	0	0	121	0.08
	1971	419	1520	151	58	209	0	0	0	209	0.14
	1972	333	1398	189	37	226	0	0	0	226	0.16
	1973	318	1430	96	38	134	0	0	0	134	0.09
	1974	434	2018	259	90	349	0	0	0	349	0.17
	1975	320	1990	265	85	350	0	0	0	350	0.18
	1976	351	1743	162	84	246	0	0	0	246	0.14
	1977	270	965	66	56	122	0	0	0	122	0.13
	1978	237	749	25	28	53	0	0	0	53	0.07
	1979	237	675	29	29	58	0	0	0	58	0.09
	1980	125	362	15	67	82	0	0	0	82	0.23
	1981	47	208	0	47	47	0	0	0	47	0.23
	1982	18	62	0	14	14	0	0	0	14	0.23
	1983	52	134	0	22	22	0	0	0	22	0.16
	1984	28	75	0	21	21	0	0	0	21	0.28
	1985	33	81	0	59	59	0	3	3	62	0.77
	1986	24	45	3	11	14	0	4	4	18	0.40
	1987	80	323	0	20	20	32	8	40	60	0.19
	1988	108	422	0	66	66	119	429	548	614	1.45
	1989	159	838	0	127	127	41	30	71	198	0.24
	1990	108	597	0	24	24	14	47	61	85	0.14
	1991	111	568	0	77	77	15	66	81	158	0.28
	1992	119	604	0	27	27	31	42	73	100	0.17
	1993	74	186	0	26	26	4	4	8	34	0.18
	1994	51	215	0	36	36	25	10	35	71	0.33
1995	65	189	0	8	8	0	6	6	14	0.07	
1996	67	179	0	44	44	0	0	0	44	0.25	
1997	29	149	0	13	13	0	3	3	16	0.11	
1998	38	110	0	14	14	0	5	5	19	0.17	
1999	56	193	0	20	20	0	4	4	24	0.13	
2000	18	88	0	69	69	0	0	0	69	0.79	
2001	23	45	0	0	0	0	0	0	0	0.00	
2002	10	30	0	10	10	0	0	0	10	0.33	
2003	12	275	0	76	76	0	0	0	76	0.28	
2004	8	26	0	4	4	0	0	0	4	0.14	

STREAM NAME	YEAR	NO. ANGLERS	DAYS FISHED	WILD KEPT	WILD RELEASED	TOTAL WILD	HATCH KEPT	HATCH REL	TOTAL HATCH	TOTAL CATCH	CATCH/UNIT EFFORT
TRENT RIVER	1968	76	385	148	0	148	0	0	0	148	0.38
	1969	64	704	259	0	259	0	0	0	259	0.37
	1970	77	652	209	0	209	0	0	0	209	0.32
	1971	94	566	105	51	156	0	0	0	156	0.28
	1972	67	414	86	34	120	0	0	0	120	0.29
	1973	75	413	42	33	75	0	0	0	75	0.18
	1974	69	234	31	11	42	0	0	0	42	0.18
	1975	47	234	40	68	108	0	0	0	108	0.46
	1976	58	109	0	5	5	0	0	0	5	0.05
	1977	31	165	31	19	50	0	0	0	50	0.30
	1978	26	140	22	29	51	0	0	0	51	0.36
	1979	40	118	12	41	53	0	0	0	53	0.45
	1980	22	66	7	3	10	0	0	0	10	0.15
	1981	17	39	7	28	35	0	0	0	35	0.90
	1982	4	7	0	3	3	0	0	0	3	0.43
	1983	21	34	0	0	0	0	0	0	0	0.00
	1984	30	98	17	137	154	4	0	4	158	1.61
	1985	24	100	0	24	24	0	0	0	24	0.24
	1986	28	88	0	14	14	0	0	0	14	0.16
	1987	37	123	0	38	38	0	0	0	38	0.31
	1988	18	31	0	9	9	0	4	4	13	0.42
	1989	38	186	0	57	57	5	0	5	62	0.33
	1990	25	77	0	8	8	0	0	0	8	0.10
	1991	19	135	0	42	42	0	0	0	42	0.31
	1992	9	100	0	5	5	0	19	19	24	0.24
	1993	7	11	0	0	0	0	0	0	0	0.00
	1994	15	25	0	15	15	0	5	5	20	0.80
	1995	12	25	0	0	0	0	0	0	0	0.00
	1996	14	41	0	0	0	0	0	0	0	0.00
	1997	10	19	0	3	3	0	0	0	3	0.17
1998	5	5	0	0	0	0	0	0	0	0.00	

STREAM NAME	YEAR	NO. ANGLERS	DAYS FISHED	WILD KEPT	WILD RELEASED	TOTAL WILD	HATCH KEPT	HATCH REL	TOTAL HATCH	TOTAL CATCH	CATCH/UNIT EFFORT
TSABLE RIVER	1968	52	159	28	0	28	0	0	0	28	0.18
	1969	49	123	74	0	74	0	0	0	74	0.60
	1970	65	186	55	0	55	0	0	0	55	0.30
	1971	76	193	43	24	67	0	0	0	67	0.35
	1972	41	113	11	3	14	0	0	0	14	0.12
	1973	27	162	10	46	56	0	0	0	56	0.35
	1974	44	130	20	49	69	0	0	0	69	0.53
	1975	30	88	17	6	23	0	0	0	23	0.26
	1976	38	58	10	0	10	0	0	0	10	0.17
	1977	27	63	19	7	26	0	0	0	26	0.41
	1978	26	73	7	22	29	0	0	0	29	0.40
	1979	25	106	26	35	61	0	0	0	61	0.58
	1980	23	63	0	3	3	0	0	0	3	0.05
	1981	1	1	1	1	2	0	0	0	2	2.00
	1982	7	18	0	0	0	7	7	14	14	0.78
	1983	39	134	4	9	13	0	0	0	13	0.10
	1984	43	192	9	243	252	4	51	55	307	1.60
	1985	21	45	3	3	6	0	0	0	6	0.13
	1986	14	28	0	0	0	0	0	0	0	0.00
	1987	8	12	0	4	4	0	0	0	4	0.33
	1988	22	31	0	27	27	0	0	0	27	0.87
	1989	35	51	0	15	15	0	0	0	15	0.29
	1990	9	19	0	0	0	0	0	0	0	0.00
	1991	4	4	0	0	0	0	0	0	0	0.00
	1992	13	17	0	0	0	0	0	0	0	0.00
	1993	6	14	0	0	0	0	0	0	0	0.00
	1994	15	15	0	15	15	0	0	0	15	1.00
	1995	9	22	0	0	0	0	0	0	0	0.00
	1996	24	47	0	3	3	0	0	0	3	0.06
	1997	10	32	0	0	0	0	3	3	3	0.10
	1998	14	36	0	0	0	0	0	0	0	0.00
	1999	4	4	0	0	0	0	0	0	0	0.00

Appendix D.

Historic salmon escapement data for the Goldstream, Sooke, Trent and Tsable rivers

Stream Name	Year	Species		
		Chinook	Chum	Coho
Goldstream River	2004	128	UNK	3011
	2003	300	21400	1290
	2002	350	51000	421
	2001	500	62000	10258
	2000	75	10500	1256
	1999	9	25400	107
	1998	NO	40500	1300
	1997	3	42000	400
	1996	8	27500	275
	1995	30	22300	1400
	1994	106	45000	3000
	1993	50	22000	100
	1992	8	17000	12
	1991	15	34000	100
	1990	17	37354	54
	1989	14	14500	64
	1988	19	43500	295
	1987	45	53000	317
	1986	23	42000	104
	1985	16	16500	178
	1984	18	21000	260
	1983	12	14000	126
	1982	16	16000	232
	1981	4	32000	227
	1980	26	26000	312
	1979	23	8000	218
	1978	30	28500	225
	1977	25	7500	108
	1976	25	3500	200
	1975	75	1500	200
	1974	25	7500	578
	1973	25	7500	200
	1972	25	3500	200
	1971	25	3500	1500
	1970	25	7500	1500
	1969	25	8000	218
	1968	UNK	7000	542
	1967	40	7000	420
	1966	25	9800	615
	1965	25	12000	100
	1964	UNK	5500	2100
	1963	UNK	3500	400
	1962	25	7500	75
	1961	UNK	7000	450
	1960	UNK	2200	500
	1959	UNK	3500	400
	1958	UNK	7500	200
	1957	UNK	7500	75
	1956	UNK	3500	200
	1955	UNK	3500	75
	1954	UNK	15000	400
	1953	UNK	7500	200

Stream Name	Year	Species		
		Chinook	Chum	Coho
Sooke River	2004	UNK	UNK	UNK
	2003	UNK	UNK	UNK
	2002	754	50000	4501
	2001	743	60000	5000
	2000	368	3730	1008
	1999	700	8000	609
	1998	2400	80000	1200
	1997	1000	80000	350
	1996	618	60000	350
	1995	NO	NO	NO
	1994	29	20000	4
	1993	97	20000	22
	1992	128	45000	4
	1991	450	7000	UNK
	1990	800	8700	UNK
	1989	110	10000	UNK
	1988	250	60000	UNK
	1987	250	25000	UNK
	1986	112	40000	40
	1985	400	35000	9
	1984	400	12000	120
	1983	18	9000	UNK
	1982	3	8000	6
	1981	30	11000	UNK
	1980	36	14500	5
	1979	45	4500	40
	1978	6	9500	100
	1977	25	7500	75
	1976	30	3500	25
	1975	400	3500	200
	1974	200	15000	75
	1973	3500	75000	400
	1972	200	75000	200
	1971	750	15000	75
	1970	1500	35000	25
	1969	1500	35000	UNK
	1968	3500	35000	75
1967	1500	35000	25	
1966	750	7500	25	
1965	400	7500	25	
1964	750	35000	75	
1963	1500	7500	200	
1962	750	3500	400	
1961	200	3500	200	
1960	400	3500	200	
1959	200	15000	200	
1958	200	35000	200	
1957	25	15000	200	
1956	UNK	15000	25	
1955	25	35000	75	
1954	75	35000	200	
1953	UNK	35000	400	

Stream Name	Year	Species		
		Chum	Coho	Pink
Trent River	2004	UNK	UNK	UNK
	2003	UNK	UNK	UNK
	2002	544	305	62
	2001	84	2275	UNK
	2000	UNK	60	NO
	1999	450	746	NO
	1998	1300	1406	NO
	1997	1300	250	NO
	1996	250	300	25
	1995	350	700	25
	1994	500	600	50
	1993	500	1375	200
	1992	1000	450	150
	1991	500	1500	200
	1990	1500	748	75
	1989	150	1353	UNK
	1988	200	905	UNK
	1987	125	1045	UNK
	1986	40	1195	UNK
	1985	150	1109	2
	1984	50	800	0
	1983	1500	1000	150
	1982	90	325	3
	1981	1040	60	25
	1980	1000	250	35
	1979	450	200	50
	1978	3000	150	UNK
	1977	500	100	UNK
	1976	225	75	UNK
	1975	200	150	UNK
	1974	1500	300	UNK
	1973	325	150	UNK
	1972	1000	200	UNK
	1971	100	350	UNK
	1970	1200	1100	UNK
	1969	700	300	UNK
	1968	350	250	UNK
	1967	300	200	UNK
	1966	200	400	UNK
	1965	25	200	UNK
	1964	200	400	UNK
	1963	25	200	UNK
	1962	25	200	UNK

Stream Name	Year	Species		
		Chum	Coho	Pink
Tsable River	2004	9499	1428	UNK
	2003	6955	1135	UNK
	2002	5920	841	493
	2001	3443	3423	UNK
	2000	NO	29	350
	1999	3000	948	1300
	1998	5500	1068	130
	1997	4500	50	350
	1996	800	100	400
	1995	1200	400	2000
	1994	3000	300	1100
	1993	3000	385	1000
	1992	2300	300	200
	1991	900	300	5000
	1990	500	100	200
	1989	UNK	150	2500
	1988	600	350	UNK
	1987	450	30	3720
	1986	UNK	350	UNK
	1985	1000	150	50
	1984	2000	50	NO
	1983	2000	100	85
	1982	1200	250	40
	1981	8600	150	220
	1980	6200	400	350
	1979	1500	200	200
	1978	4000	275	25
	1977	2200	250	25
	1976	7500	75	30
	1975	400	150	10
	1974	6500	500	100
	1973	3500	200	25
	1972	16000	150	25
	1971	1100	500	100
	1970	7000	400	25
	1969	11500	215	50
	1968	21000	300	250
	1967	7000	350	200
	1966	7500	400	75
	1965	1500	200	NO
	1964	7500	400	NO
	1963	1500	200	25
	1962	750	200	1
	1961	3500	200	25
	1960	3500	200	75
	1959	7500	75	25
	1958	15000	400	75
	1957	7500	400	400
	1956	7500	400	75
	1955	3500	200	200
	1954	7500	400	200
	1953	7500	750	400

Appendix E.

Snorkel survey reports, 2004

FILE NOTE

Date: February 8, 2004
 File: 34560-20/SNORK
 xf: 34560-27/Golds

SNORKEL SURVEY REPORT
Goldstream River

DATE: February 4, 2004 (Start at 1100 hr and finish at 1320 hr)
 WEATHER: bright sunshine, 10 °C air temperature
 WATER TEMP.(°C): 5.1 @ 1350 hrs
 DISCHARGE (m³/s): ~2.2 (or 100% MAD)
 VISIBILITY (m): 2.5-3.0
 PERSONNEL: R. Ptolemy (MWLAP), B. Smith
 AREA: Falls to 200 m downstream of Mt. Finlayson Bridge in Goldstream Park
 Total Distance (~4.0 km)

1. Fish Observed:

Adults

A total of 3 wild steelhead were observed for a density of 0.75 fish/km. Size ranged from 2-3 kg (ocean age 2) and colour from bright to moderate. One female was observed in the Falls Pool; the other two fish (male and female holding together) were seen ~750 m downstream of the Highway 1 bridge crossing. Fish appeared in excellent health. No redds were noted.

2 rainbow trout @ 45+ cm (both male and very bright; one observed in Falls pool with female steelhead and the other ~1 km downstream of Falls Pool)

Juveniles

Given the time of year and low water temperatures a moderate abundance of rainbow parr (yearling and age 2+) and steelhead pre-smolts (dark coloured and still in over-wintering appearance) were observed in the upper half of the survey section. In total, over 40 were noted. Very low densities were noted in the lower half of the survey. Low densities of coho yearlings were observed in the upper half of the survey section. Patchy distribution (schools) of chinook fry (30-40 mm, wild) holding in run or pool tailout positions, particularly in the lower half of the survey section.

2. Notes

- No anglers or evidence of recent angling were observed (the river is closed to angling Dec 31-May 31).
- Marginal conditions for adult steelhead passage were observed. Flows appeared good for steelhead spawning, however, there were several shallow riffles and vertical drops at naturally occurring log dams in the upper section (above highway bridge) that would make passage difficult. The most obtrusive log dam was located ~100 m upstream of the Goldstream Park Campground Bridge. This dam was creating an excellent spawning pad, with substrate accumulating on its upstream side. Several old salmon redds (likely coho or chum) were noted at this site.
- Flows provided excellent channel coverage and parr habitat conditions. Flows have receded from previous highs (Jan.30) inferred from "real-time" stage-discharge data at Chemainus River. Flows were ideal for snorkeling and although water clarity was slightly compromised, the narrow channel widths allowed good coverage by two swimmers.
- Excellent steelhead parr habitat was noted above the highway crossing; lower reaches have a significant LWD deficit and could be enhanced with well-placed structures to improve habitat conditions for both juveniles and adults. WRP log structures don't appear to be very effective and are located along the stream margin rather than across the stream as the natural wood structures do. We noted several local source logs could be used as LWD structures, or moved to simulate natural LWD recruitment in the lower river.

Bsmith

Brad Smith
 Fisheries Technician
 BC Conservation Foundation

/dm
 sns(creek)

- cc: All Fisheries staff
 Steelhead Crew
 P. McCully, Manager, Goldstream River Hatchery, c/o DFO, Victoria
 D. Hayward, Acting Manager, Vancouver Island Trout Hatchery, Duncan
 R. Ptolemy, Fish Flow Specialist, MWLAP, Victoria
 P. Pauwels, District Conservation Officer, Victoria
 District Conservation Officers, Duncan
 Don McLaren, District Supervisor, Goldstream Park, BC Parks Branch

FILE NOTE

Date: March 9, 2004
 File: 34560-20/SNORK
 xf: 34560-27/Golds

SNORKEL SURVEY REPORT
Goldstream River

DATE: March 5, 2004
 WEATHER: 100% overcast, light rain, cool, 6 °C air temperature
 WATER TEMP.(°C): 4.5 @ 1330 hrs
 DISCHARGE (m³/s): Low winter flow
 VISIBILITY (m): 0.5-3.0 (increased sediment input at the Island Highway bridge decreased visibility)
 PERSONNEL: J.Craig, S. Silvestri
 AREA: Falls to Highway 19 bridge (~2.0 km)

1. Fish Observed:

Adults

None observed.

Rainbow/Cutthroat Trout

- 16 resident rainbow trout (10 @ 18-25 cm, 5 @ 25-35 cm, 1 @ 35-45 cm)

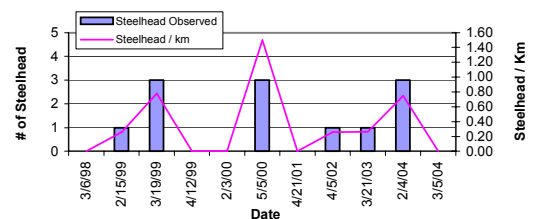
Juveniles

Moderate densities of rainbow parr (yearlings and age 2+) were observed during this survey. Seven steelhead pre-smolts were observed in the falls pool. Low densities of coho yearlings were observed in the upper section of Goldstream River.

2. Notes

- This snorkel survey is part of a steelhead stock assessment study in four Vancouver Island streams (Goldstream, Sooke, Trent and Tsable). This is the second of five snorkel surveys to be conducted on the Goldstream River for this project during the 2003/2004 winter steelhead season. The initial survey on February 4, 2004 observed three wild steelhead.
- The snorkel survey was terminated at the Island Highway bridge, as increased sediment from a small tributary reduced visibility to less than one meter.
- If condition and time permits, the Goldstream River will be re-surveyed next week.
- No anglers or evidence of recent angling were observed (the river is closed to angling Dec. 1-May 31).
- At the observed flow, steelhead migration conditions appeared poor, as passage would be difficult at several shallow riffles and vertical drops in the river above the Island Highway bridge.
- Rearing flows for rainbow/steelhead parr appeared fair with reasonable channel coverage and parr habitat conditions.
- The low flow conditions allowed for good coverage of all pools and runs by two snorkel surveyors.
- Snorkel surveys on the Goldstream River have been conducted regularly by WLAP and BCCF staff. Survey results from 1998 - 2004 are presented below.

Winter Steelhead Observations in the Goldstream River, 1998-2004



Scott Silvestri

Scott Silvestri
 Fisheries Technician
 BC Conservation Foundation

/dm
 sns(creek)

- cc: All Fisheries staff
 Steelhead Crew
 P. McCully, Manager, Goldstream River Hatchery, c/o DFO, Victoria
 D. Hayward, Acting Manager, Vancouver Island Trout Hatchery, Duncan
 R. Ptolemy, Fish Flow Specialist, MWLAP, Victoria
 P. Pauwels, District Conservation Officer, Victoria
 District Conservation Officers, Duncan
 Don McLaren, District Supervisor, Goldstream Park, BC Parks Branch

FILE NOTE

Date: March 15, 2004
 File: 34560-20/SNORK
 xf: 34560-27/Golds

SNORKEL SURVEY REPORT
Goldstream River

DATE: March 11, 2004
 WEATHER: Sunny and warm, air temp. 12.5°C
 WATER TEMP.(°C): 5.2 @ 1100 hrs
 DISCHARGE (m³/s): ~1.33 (staff gauge 0.495 m, discharge derived from WSC stage-discharge rule curve provided by R. Ptolemy)
 VISIBILITY (m): 3.0
 PERSONNEL: B. Smith, C. Wightman (MWLAP)
 AREA: 150 m upstream of Goldstream Provincial Park Campsite Bridge to Mt.Finlayson Bridge in Goldstream Park (~2.8 km)

1. **Fish Observed:**

Adults

No adult steelhead were observed.

Resident Rainbow/Cutthroat Trout

- 3 wild rainbow trout @ 25-35 cm

Juveniles

Moderate densities of rainbow parr/steelhead pre-smolts (17 yearlings and 12 age 2+) were observed between the start of the survey and the Highway 19 bridge. Only one parr (age 1+) was noted below the Highway crossing. Very low densities of coho yearlings were observed.

2. **Notes**

- This survey was a follow-up to the March 5 survey where poor visibility (caused by localized rainfall creating a plume of silted water entering at the highway bridge crossing) forced surveyors to abandon the swim at the Highway 19 crossing. Visibility on March 5 below the bridge was estimated at only 0.5-1.0 m. Conditions had returned to normal by the March 11 survey and coverage by two swimmers was adequate.
- High densities of caddis larvae and moderate densities of mayfly were noted throughout the survey, particularly between the Water Survey Gauge Station and the Highway 19 Bridge.
- Several fresh redds and/or possible test redds were located in the run 150 m upstream of the Goldstream Park Provincial Campsite Bridge. This section had been previously identified as one of the better steelhead spawning locations throughout the lower (anadromous) portion of the river. The site is further enhanced by a large LWD sweeper that crosses the entire river channel, causing spawning substrate to accumulate on its upstream side. However, the sweeper may also reduce steelhead passage, as it effectively creates a low-head dam that would be difficult to navigate past during low-moderate flows. This site would be a good location for one of four electrofishing sites to be completed in summer 2004.
- Flows appeared poor for steelhead migration, as passage would be difficult at several shallow riffles, low-head dams and vertical drops in the river above the Highway 19 Bridge.
- No anglers or evidence of recent angling were observed (the river is closed to angling Dec 1-May 31).



Brad Smith
 Fisheries Technician
 BC Conservation Foundation

/dm
 sns(creek)

- cc: All Fisheries staff
 Steelhead Crew
 P. McCully, Manager, Goldstream River Hatchery, c/o DFO, Victoria
 D. Hayward, Acting Manager, Vancouver Island Trout Hatchery, Duncan
 R. Ptolemy, Fish Flow Specialist, MWLAP, Victoria
 P. Pauwels, District Conservation Officer, Victoria
 District Conservation Officers, Duncan
 Don McLaren, District Supervisor, Goldstream Park, BC Parks Branch

FILE NOTE

Date: April 19, 2004
 File: 34560-20/SNORK
 xf: 34560-27/Golds

SNORKEL SURVEY REPORT
Goldstream River

DATE: April 16, 2004
 WEATHER: 100% OC, light rain, 9 °C air temperature
 WATER TEMP.(°C): 9.0 @ 1200 hrs
 DISCHARGE (m³/s): 0.297 (metered using swoffer)
 VISIBILITY (m): 6.0-4.0 (decreased at Highway 19 Bridge as result of rain)
 PERSONNEL: J. Craig, S. Silvestri
 AREA: Falls to 200 m downstream of Mt. Finlayson Bridge in Goldstream Park
 Total Distance (~4.0 km)

1. **Fish Observed:**

Adults

A total of 1 wild steelhead jack was observed for a density of 0.25 fish/km. The steelhead observed was approximately 40 cm in size and was bright in colour. The fish had a low condition factor and appeared in excellent health. 3 possible steelhead redds were observed, however, limited excavation revealed an absence of eggs.

Resident Rainbow/Cutthroat Trout

- 3 resident rainbow trout @ 20-30 cm (including a spawning pair holding above a small possible redd.
- 4 unidentified trout @ 25-35 cm.

Juveniles

Low to moderate densities of steelhead parr were noted during this survey. One cutthroat parr was also noted. Over 1000 coho pre-smolts were observed, including a group of approximately 800 at the falls pool. High densities of coho fry were observed along the stream margins.

2. **Notes**

- No anglers or evidence of recent angling were observed (the river is closed to angling Dec 31-May 31).
- Very low flow conditions (15 % MAD) were observed, with very poor conditions for adult steelhead migration. Numerous shallow riffles and vertical drops, as well as several logjams in the upper section of the survey would severely restrict adult movement upstream. Flows appeared poor for steelhead spawning. At the observed flow, very few adult holding pools in the lower section were present.
- Steelhead parr habitat in the section above the Highway 19A Bridge appears good, however, prime conditions at the time of the survey were reduced due to the low flows. Steelhead parr habitat in the lower river appears significantly reduced in comparison to the upper section as channel overwidening and simplification has occurred as a result of floods and/or channel "clearing" activities over the last 10-20 years.



Scott Silvestri
 Fisheries Technician
 BC Conservation Foundation

/dm
 sns(creek)

- cc: All Fisheries staff
 Steelhead Crew
 P. McCully, Manager, Goldstream River Hatchery, c/o DFO, Victoria
 D. Hayward, Acting Manager, Vancouver Island Trout Hatchery, Duncan
 R. Ptolemy, Fish Flow Specialist, MWLAP, Victoria
 P. Pauwels, District Conservation Officer, Victoria
 District Conservation Officers, Duncan
 Don McLaren, District Supervisor, Goldstream Park, BC Parks Branch

FILE NOTE

Date: May 31, 2004
 File: 34560-20/SNORK
 xf: 34560-27/Golds

SNORKEL SURVEY REPORT
Goldstream River

DATE: May 20, 2004
 WEATHER: Sunny, warm, 19 °C air temperature
 WATER TEMP.(°C): 13.0 @ 1230 hrs (Falls)
 DISCHARGE (m³/s): Low spring flows (~10 % of MAD)
 VISIBILITY (m): 4.0
 PERSONNEL: S. Silvestri, B. Smith
 AREA: Falls to 200 m downstream of Mt. Finlayson Bridge in Goldstream Park Total
 Distance (~4.0 km)

1. Fish Observed:

Adults

No steelhead were observed.

Resident Rainbow/Cutthroat Trout

- 4 wild resident rainbow trout (2 @ 15-20 cm, 1 @ 25-35 cm, 1 @ 35-45 cm).

Juveniles

Low densities of steelhead parr were noted during this survey. Over 1000 coho smolts were observed, including a group of approximately 500 at the falls pool. Fungus patches were noted on several coho smolts and four mortalities were observed (possibly due to fungus infections). High densities of coho fry were observed along the stream margins. A total of 43 steelhead parr were enumerated during this survey, with no smolts observed.

2. Notes

- No anglers or evidence of recent angling were observed (the river is closed to angling Dec 31-May 31).
- Very low flow conditions (10 % MAD) were observed, with very poor conditions for adult steelhead migration. Numerous shallow riffles and vertical drops, as well as several logjams in the upper section of the survey would severely restrict adult movement upstream. Flows appeared poor for steelhead spawning. At the observed flow, very few adult holding pools in the lower section were present.
- One possible redd was noted in the upper section of the survey.
- This snorkel survey is part of a steelhead stock assessment study on four Vancouver Island streams (Trent, Tsable, Goldstream and Sooke). This is the fourth snorkel survey conducted on the Goldstream River for this project during the 2003/2004 winter steelhead season. The initial stock assessment schedule called for five surveys to be completed this winter steelhead season, however, low water conditions have limited opportunities. A possible summer survey to enumerate parr may be considered.



Scott Silvestri
 Fisheries Technician
 BC Conservation Foundation

/dm
 sns(creek)

cc: All Fisheries staff
 Steelhead Crew
 P. McCully, Manager, Goldstream River Hatchery, c/o DFO, Victoria
 D. Hayward, Acting Manager, Vancouver Island Trout Hatchery, Duncan
 R. Ptolemy, Fish Flow Specialist, MWLAP, Victoria
 P. Pauwels, District Conservation Officer, Victoria
 District Conservation Officers, Duncan
 Don McLaren, District Supervisor, Goldstream Park, BC Parks Branch

FILE NOTE

Date: January 7, 2004
 File: 34560-20/SNORK
 xf: 34560-27/SOOKR

SNORKEL SURVEY REPORT
Sooke River

DATE: January 6, 2004
 WEATHER: Overcast, light snow, -2 °C air temperature
 WATER TEMP.(°C): 0.0 @ 1145 hrs
 DISCHARGE (m³/s): ~2.5 (Estimated)
 VISIBILITY (m): 8 m
 PERSONNEL: S. Silvestri, B. Smith
 AREA: Anadromous falls barrier to water tower d/s of the Parking Lot (1.8 km)

1. Fish Observed:

Adults

None observed.

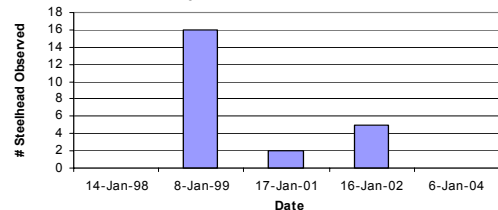
Juveniles

None observed.

2. Notes

- This snorkel survey is part of a steelhead stock assessment on four Vancouver Island streams (Trent, Tsable, Goldstream and Sooke). This is the first of five snorkel surveys to be conducted on the Sooke River for this project during the 2003/2004 winter steelhead season. This river is scheduled to be resurveyed the second week in February (water conditions permitting).
- The Sooke River Salmon Enhancement Society currently has 3 female steelhead (2 wild, 1 hatchery) in holding for broodstock at the Jack Brooks hatchery facility for its annual fry stocking program (G. Varney, pers. comm.).
- In the canyon section downstream of the falls, a layer of ice (up to three inches thick) was present for approximately 150 m. Observer efficiency was low over this section as surveyors could not effectively see through the broken ice.
- No anglers were observed.
- Evidence of recent angling was noted in the Potholes parking lot pool as one float and goeey-bob set-up was observed.
- January snorkel surveys have been conducted by BCCF and ministry staff four previous times on the Sooke River since 1998. The following graph outlines these survey results.

Winter Steelhead Observations during January Snorkel Surveys on the Sooke River, 1998-2004




Scott Silvestri
 Fisheries Technician
 BC Conservation Foundation

cc: All Fisheries staff
 Steelhead Crew

D. Hayward, Acting Manager, Vancouver Island Trout Hatchery, Duncan
 R. Ptolemy, Fish Flow Specialist, MWLAP, Victoria
 P. Pauwels, District Conservation Officer, Victoria
 G. Varney, Manager, Jack Brooks Hatchery, Sooke

FILE NOTE

Date: February 16, 2004
 File: 34560-20/SNORK
 xf: 34560-27/SOOKR

SNORKEL SURVEY REPORT
Sooke River

DATE: February 13, 2004
 WEATHER: 50% Overcast, 6°C air temperature
 WATER TEMP.(°C): 3.0 @ 1400 hrs
 DISCHARGE (m³/s): 6.291 (per CRD, based on 0.492 m staff gauge height)
 VISIBILITY (m): 6 m
 PERSONNEL: T. Massy, S. Silvestri
 AREA: Anadromous falls barrier to Smokey's Farm (3.5 km)

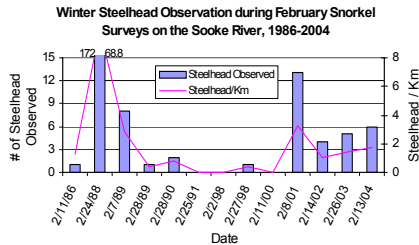
1. Fish Observed:

Adults

A total of 6 steelhead (3 wild, 1 hatchery, and 2 unknown) were observed for a density of 1.71 fish/km. Fish were bright to moderately coloured, with weights ranging from 3-6 kg. All steelhead were observed upstream of the Sooke Potholes parking lot, with two noted in the tailout of "Beer Bottle" pool and three observed halfway through the upper canyon section. No obvious redds were observed during the survey.

Resident Rainbow/Cutthroat Trout

- 2 wild resident rainbow trout (1 @ 25-35 cm, 1 @ 35-45 cm). Both resident rainbow trout were observed between the barrier falls and the Sooke Potholes parking lot.
- 3 wild cutthroat trout (2 @ 25-35 cm, 1 @ 35-45 cm). All cutthroat trout were noted in the section between the Sooke Potholes parking lot and Smokey's.
- 2 unknown trout were observed in the tailout of "Beer Bottle" pool. Neither size nor origin were determined for these two trout.



Juveniles

Several schools of rainbow/steelhead parr (18 in total) were observed during the survey. All juveniles were noted downstream of the Sooke Potholes parking lot. No other species were noted during this survey.

2. Notes

- This snorkel survey is part of a steelhead stock assessment study on four Vancouver Island streams (Trent Tsable, Goldstream and Sooke). This is the second of five snorkel surveys to be conducted on the Sooke River for this project during the 2003/2004 winter steelhead season. The initial survey on January 6, 2004 observed no steelhead downstream of the anadromous falls barrier. The next survey is scheduled for the second week in March (water conditions permitting).
- The Sooke River Salmon Enhancement Society currently has 9 wild steelhead (5 females and 4 males) in holding for broodstock at the Jack Brooks hatchery facility for its annual fry stocking program (G. Varney, pers. comm.).
- No anglers were observed.
- Evidence of recent angling was noted throughout the entire "open to fishing" section.
- February snorkel surveys have been previously conducted by BCCF and ministry staff 13 times on the Sooke River since 1986. The following graph outlines these survey results:

Scott Silvestri
 Fisheries Technician
 BC Conservation Foundation
 /dm
 sns(creek)

cc: All Fisheries staff
 Steelhead Crew
 D. Hayward, Acting Manager, Vancouver Island Trout Hatchery, Duncan
 R. Ptolemy, Fish Flow Specialist, MWLAP, Victoria
 P. Pauwels, District Conservation Officer, Victoria
 G. Varney, Manager, Jack Brooks Hatchery, Sooke

FILE NOTE

Date: March 25, 2004
 File: 34560-20/SNORK
 xf: 34560-27/SOOKR

SNORKEL SURVEY REPORT
Sooke River

DATE: March 11, 2004
 WEATHER: Sunny, warm, temperature 12°C
 WATER TEMP.(°C): 6.1 @ 1400
 DISCHARGE (m³/s): 18.242 (per CRD based on 0.715 m staff gauge)
 VISIBILITY (m): 5
 PERSONNEL: S. Silvestri, H. Wright
 AREA: 400 m d/s anadromous falls barrier to Smokey's Farm (3.1 km)

1. Fish Observed:

Adult Steelhead

A total of 4 steelhead (3wild, 1 unidentified) were observed for a density of 1.29 fish/km. Fish were bright to dark in colour, with weights ranging from 2-4 kg. Only one steelhead (wild male, 1 condition #3) was observed upstream of the Sooke Potholes parking lot. This fish was observed with an orange Floy™ tag near the dorsal fin (see notes section). Three steelhead (1 wild male, 1 wild unknown sex, 1 unidentified origin unknown sex) were observed downstream of the parking. None of these fish were Floy™ tagged and all were #1 in condition.

1 Condition: #1 = bright, #2 = moderately coloured, #3 = mid spawn, #4 = post spawn, #5 = undetermined

Rainbow/Cutthroat Trout

None were observed

Juveniles

None observed.

2. Notes

- This snorkel survey is part of a steelhead stock assessment on four Vancouver Island streams (Trent, Tsable, Goldstream and Sooke). This is the third of five snorkel surveys to be conducted on the Sooke River for this project during the 2003/2004 winter steelhead season.
- High river levels, as a result of natural inflows and the CRD releasing water from the Sooke Reservoir, resulted in low observer efficiency in upper section of the river. If time and condition permits, the river will be resurveyed within the next few weeks.
- The Sooke River Salmon Enhancement Society has Floy™ tagged nine steelhead as part of the current stock assessment study of Sooke River. Seven of the steelhead were tagged and released immediately by the Society's broodstock anglers. The two other steelhead were tagged and released back to the river after being used for broodstock for the headwater fry stocking program.
- No anglers were observed. Evidence of recent angling was noted throughout the entire survey section.

Scott Silvestri
 Fisheries Technician
 BC Conservation Foundation
 cc: All Fisheries staff
 Steelhead Crew
 D. Hayward, Acting Manager, Vancouver Island Trout Hatchery, Duncan
 R. Ptolemy, Fish Flow Specialist, MWLAP, Victoria
 P. Pauwels, District Conservation Officer, Victoria
 G. Varney, Manager, Jack Brooks Hatchery, Sooke

FILE NOTE

Date: March 23, 2004
 File: 34560-20/SNORK
 xf: 34560-27/SOOKR

SNORKEL SURVEY REPORT
Sooke River

DATE: March 23, 2004
 WEATHER: light rain
 WATER TEMP.(°C): 6
 DISCHARGE (m³/s): 8.7 per CRD (based on 0.542 m staff gauge)
 VISIBILITY (m): 5
 PERSONNEL: B. Smith, H. Wright
 AREA: Anadromous falls barrier to Smokey's Farm (3.5 km)

1. **Fish Observed:**

Adult Steelhead

A total of 10 steelhead (6 wild, 0 hatchery, 4 unidentified) were observed for a density of 2.9 fish/km. The observed male to female ratio was 1:1. Three orange floy tagged fish were noted, all of which were dark males. Except for 3 bright fecund females, and one obvious kelt, the fish appeared to be in spawning condition. The majority of the fish were fairly small 2-ocean adults ranging in size from 3-4.5 kg.

Rainbow/Cutthroat Trout

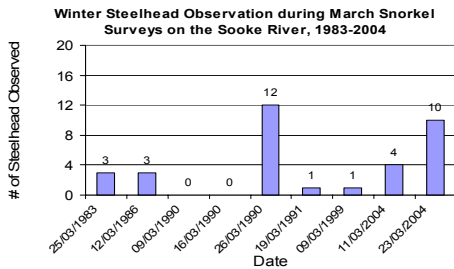
- 1 wild resident rainbow trout @ 25-35 cm
- 2 wild cutthroat trout @ 35-45 cm

Juveniles

None observed.

2. **Notes**

- This snorkel survey is part of a steelhead stock assessment on four Vancouver Island streams (Trent, Tsable, Goldstream and Sooke). This is the fourth of five snorkel surveys to be conducted on the Sooke River for this project during the 2003/2004 winter steelhead season. This river is scheduled to be resurveyed in early April (water conditions permitting).
- High river levels, as a result of the CRD releasing water from the Sooke Reservoir, resulted in low observer efficiency in upper section of the river, due to increased flow. If time and condition permits, the river will be resurveyed within the next few weeks.
- The Sooke River Salmon Enhancement Society has tagged and released a total of 11 steelhead; 9 with orange floy tags and 2 yellow tags (G. Varney, pers. comm.).
- No anglers were observed.
- The following graph outlines March snorkel survey results from 1983 to 2004. All surveys, except for 1983, were done from the anadromous barrier falls to Smokey's.



H. Wright

Harlan Wright
 Fisheries Technician
 BC Conservation Foundation
 cc: All Fisheries staff
 Steelhead Crew
 D. Hayward, Acting Manager, Vancouver Island Trout Hatchery, Duncan
 R. Ptolemy, Fish Flow Specialist, MWLAP, Victoria
 P. Pauwels, District Conservation Officer, Victoria
 G. Varney, Manager, Jack Brooks Hatchery, Sooke

FILE NOTE

Date: April 18, 2004
 File: 34560-20/SNORK
 xf: 34560-27/SOOKR

SNORKEL SURVEY REPORT
Sooke River

DATE: April 16, 2004
 WEATHER: partially overcast, 15°C air temperature
 WATER TEMP.(°C): 10.7 @ 1500 hrs
 DISCHARGE (m³/s): 2.3 cms (0.355 staff gauge height)
 VISIBILITY (m): 6+
 PERSONNEL: R. Ptolemy, B. Smith
 AREA: Anadromous falls barrier to Smokey's Farm (3.5 km)

1. **Fish Observed:**

Adult Steelhead

A total of 5 steelhead (4 wild, 1 unidentified origin) were observed for a density of 1.43 fish/km. One fish was observed in the falls pool, a pair (in mid-spawn condition) was noted 25 m upstream of the fishing boundary, and the other two fish were observed below the Sooke Potholes parking lot. Colour ranged from moderate to dark, and size from 2.5-5.5 kg. One orange Floy-tagged fish was noted, a small, dark post-spawn buck, immediately downstream of the parking lot. Fungus, predator marks and/or spawning characteristics (swollen vents, concave abdomens, tattered fins) were noted on each fish. A total of 10 steelhead redds were observed throughout the section, predominantly in pool tailouts with suitable substrate. A few smaller trout redds were also noted.

Resident Rainbow/Cutthroat Trout

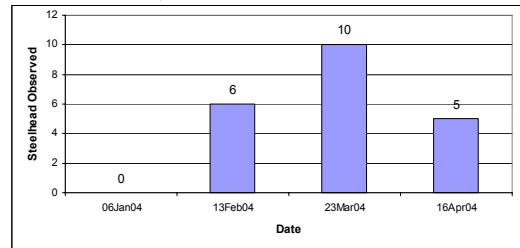
- 1 wild cutthroat trout @ 25-35 cm

Juveniles

A low density of rainbow parr were observed in suitable riffle habitat with moderate gradient and higher velocity flows. A few newly emerged fry (likely coho) were observed in stream margin and off-channel habitats.

2. **Notes**

- No anglers were observed. A new spinner was noted in the pool adjacent to the Sooke Potholes parking lot. Other broken-off gear was noted between the fishing boundary and the parking lot.
- This snorkel survey is part of a steelhead stock assessment on four Vancouver Island streams (Trent, Tsable, Goldstream and Sooke). This is the fifth snorkel survey conducted on the Sooke River during the 2003/2004 winter steelhead season. This river is scheduled to be resurveyed in late April or early May (water conditions permitting). Results from four of the surveys are displayed in the chart below (the March 11 survey was hampered by high water resulting in very poor observer confidence, and thus data is not included in the chart):



- The following notes are excerpted from an email by R. Ptolemy following the survey:
 The flow conditions on the Sooke River were low (about 20%mad or 2.3 cms). Flows were not conducive for either spawning or passage. It was an excellent rearing flow, however, stream temperature was above 10 °C, but we saw few steelhead parr in prime habitats. This may be a system where nocturnal counts of parr may be in order for future juvenile stock assessments (CRD Water Contract). I noticed that last October's flood event has deposited a huge amount of sand/gravel material (bedload) in the middle reaches. This has inundated prime boulder habitats near "Smokey's". The riffle/rapid habitats below the falls remain high quality areas for steelhead parr.

B. Smith

Brad Smith
 Fisheries Technician
 BC Conservation Foundation
 cc: All Fisheries staff
 Steelhead Crew
 D. Hayward, Acting Manager, Vancouver Island Trout Hatchery, Duncan
 R. Ptolemy, Fish Flow Specialist, MWLAP, Victoria
 P. Pauwels, District Conservation Officer, Victoria
 G. Varney, Manager, Jack Brooks Hatchery, Sooke

FILE NOTE

Date: May 31, 2004
 File: 34560-20/SNORK
 xf: 34560-27/SOOKR

SNORKEL SURVEY REPORT
Sooke River

DATE: May 21, 2004
 WEATHER: partly overcast, mild, 15 °C air temperature
 WATER TEMP.(°C): 14.8 @ 1330 hrs (water tower)
 DISCHARGE (m³/s): 1.011 cms (per CRD based on 0.277 m staff gauge height)
 VISIBILITY (m): 6+
 PERSONNEL: S. Silvestri, B. Smith
 AREA: Anadromous falls barrier to water tower (~1.8 km)

1. **Fish Observed:**

Adult Steelhead

No steelhead were observed.

Juveniles

Low densities of rainbow parr were observed and no steelhead smolts were noted. High densities of coho fry were observed in stream margins and off-channel habitats.

2. **Notes**

- No anglers or evidence of recent angling were observed.
- This snorkel survey is part of a steelhead stock assessment on four Vancouver Island streams (Trent, Tsable, Goldstream and Sooke). This is the sixth snorkel survey to be conducted on the Sooke River during the 2003/2004 winter steelhead season. The initial stock assessment schedule called for five assessments to be performed, however, high water conditions on the March 11 survey required the river to be re-surveyed on March 23.
- 8 redds were observed during this survey. All redds were noted in the area between the barrier falls and the Sooke Potholes parking lot.
- On dead fish (unconfirmed species) was observed approximately 400 m below the anadromous barrier. Only half the fish remained and appeared large enough to be an adult steelhead. The entire surface of the remaining fish was covered in fungus.
- A peak count of 10 steelhead (2.86 fish/km) was observed on March 23, 2004. Results of the six snorkel surveys completed during the 2003/04 winter steelhead season can be observed in the chart below:



Scott Silvestri
 Fisheries Technician
 BC Conservation Foundation
 cc: All Fisheries staff
 Steelhead Crew
 D. Hayward, Acting Manager, Vancouver Island Trout Hatchery, Duncan
 R. Ptolemy, Fish Flow Specialist, MWLAP, Victoria
 P. Pauwels, District Conservation Officer, Victoria
 G. Varney, Manager, Jack Brooks Hatchery, Sooke

FILE NOTE

Date: January 28, 2004
 File: 34560-20/SNORK
 xf: 34560-27/TRENT

SNORKEL SURVEY REPORT
Trent River

DATE: January 26, 2004
 WEATHER: 100% overcast, light rain, 4° C air temperature
 WATER TEMP.(°C): 3.0 @ 1600h
 DISCHARGE (m³/s): low-moderate winter flow
 VISIBILITY (m): 4.5 – 2.5 (reduced below Cumberland sewage treatment discharge tributary)
 PERSONNEL: upper section: M. McCulloch, B. Smith
 Lower section: S. Silvestri, H. Wright
 AREA: upper section: Barrier falls to powerline crossing (4.1 km)
 lower section: Powerline crossing to highway 19A bridge (4.4 km)
Total distance surveyed : 8.5 km

1. **Fish Observed:**

Adults

No adult steelhead were observed.

Juveniles

No juveniles were observed.

2. **Notes**

- No anglers or evidence of recent angling were observed (this stream is closed to angling Dec 1-May 31).
- Access to the upper section was achieved by walking down the river to the falls from the Inland Island Highway bridge. Access to the right bank of the powerline crossing was gained from the powerline road off Bayton Mainline, which is located 5.3 km south of the lower Trent River bridge on Highway 19A.
- Primary productivity increased dramatically halfway through the upper section as effluent from the Cumberland sewage treatment facility entered via a left bank tributary downstream of Bloedel Creek. High primary productivity (as evident from the periphyton that coated the river substrate) was likely responsible for the high abundance of Simuliid larvae that covered most of the rocks in the riffle areas. Other invertebrates noted in moderate densities included Caddis, Stonefly and Mayfly larvae.
- Several recent slides were noted in the lower section of the survey. Slide areas were typically high shale banks easily eroded with resulting inputs of large woody debris and fresh sediment.
- The habitat in the upper 2/3 of the survey section was relatively stable with channel widths of 10-20 m. Pool frequency and quality were fair with adequate holding water for adult steelhead. A moderate amount of woody and boulder cover was present, proving reasonable parr habitat. Spawning habitat was also limited in this section of the watershed as substrate type typically consisted of slate and shale bedrock, with little accumulation of suitable spawning gravel.
- The lower 1/3 of the river was much less confined and had a significantly higher accumulation of fines and small gravels. The channel braided several times in the lower 400 m.

Scott Silvestri
 Fisheries Technician
 BC Conservation Foundation
 /dm
 sns(creek)
 cc: All Fisheries staff
 Steelhead Crew
 P. Law, Urban Habitat Biologist, MWLAP, Nanaimo
 Conservation Officer Service, Campbell River

FILE NOTE

Date: March 8, 2004
 File: 34560-20/SNORK
 xf: 34560-27/TRENT

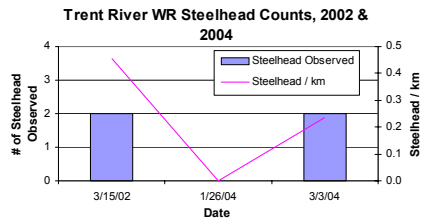
SNORKEL SURVEY REPORT
Trent River

DATE: March 3, 2004
 WEATHER: 100% overcast, light rain, 7° C air temperature
 WATER TEMP.(°C): 4.0 @ 1200h
 DISCHARGE (m³/s): 2.28 (metered using Swoffer d/s trestle foundation)
 VISIBILITY (m): 4.5 – 2.5 (reduced below Cumberland sewage treatment discharge tributary)
 PERSONNEL: upper section: M. McCulloch, H. Wright
 Lower section: J. Craig, S. Silvestri
 AREA: upper section: Barrier falls to powerline crossing (4.1 km)
 lower section: Powerline crossing to highway 19A bridge (4.4 km)
Total distance surveyed : 8.5 km

1. Fish Observed:

Adults

A total of two wild steelhead (both females) were observed for a density of 0.24 fish/km. Fish were bright to moderately coloured and ranged in size



from 2.5-4.0 kg. Both steelhead appeared to be 2 year ocean fish and were observed in the lower survey section.

Rainbow/Cutthroat Trout

- 1 wild rainbow trout @ 25-35 cm
- 1 wild cutthroat trout @ 25-35 cm

Juveniles

1 rainbow/steelhead parr was observed in the upper survey section.

2. Notes

- The following snorkel survey is part of a steelhead stock assessment study on four Vancouver Island streams (Trent, Tsable, Goldstream and Sooke). This is the second of five snorkel surveys to be conducted on the Trent River for this project during the 2003/2004 winter steelhead season. No steelhead were observed on the initial survey on January 26, 2004. The river is scheduled to be re-surveyed in the last week of March, or in the first week of April (water conditions permitting).
- No anglers or evidence of recent angling were observed (this stream is closed to angling Dec. 1-May 31).
- No obvious redds were observed during this survey.
- Access to the upper section was achieved by walking down the river to the falls from the Inland Island Highway bridge. Access to the right bank of the powerline crossing was gained from the powerline road off Bayton (Van West) Mainline, which is located 5.3 km south of the lower Trent River bridge on Highway 19A.
- Several fresh slides were noted in the upper and lower survey sections, as many banks have become unstable, causing inputs of LWD, SWD and sediment.
- Bloedel Creek enters the Trent River ~ 2 km downstream of the anadromous falls and increased flow in the mainstem by approximately 20%.
- A left bank tributary entering the upper section, with effluent from the Cumberland sewage treatment facility, increased flow in the mainstem by approximately 25%. Primary productivity increased noticeably in the Trent River downstream of this tributary. High densities of Simulid, Caddis, Stonefly and Mayfly larvae were observed through the remainder of the upper and lower survey.
- One of the steelhead observed was a two-toner.
- Snorkel survey observations of winter steelhead in 2002 and 2004 are presented in the graph below.

Scott Silvestri
 Fisheries Technician
 BC Conservation Foundation
 /dm
 sns(creek)
 cc: All Fisheries staff
 Steelhead Crew
 P. Law, Ecosystems Biologist, MWLAP, Nanaimo
 Conservation Officer Service, Campbell River

FILE NOTE

Date: April 19, 2004
 File: 34560-20/SNORK
 xf: 34560-27/TRENT

SNORKEL SURVEY REPORT
Trent River

DATE: April 2, 2004
 WEATHER: Sunny, warm, air temperature 9° C
 WATER TEMP.(°C): 3.0 @ 0945hrs (Hwy 19A Br.)
 DISCHARGE (m³/s): 2.156 (metered using Swoffer d/s trestle foundation)
 VISIBILITY (m): 8.0 – 2.5 (reduced below Cumberland sewage treatment discharge tributary)
 PERSONNEL: upper section: S. Silvestri, H. Wright
 Lower section: M. McCulloch, B. Smith
 AREA: upper section: Barrier falls to powerline crossing (4.1 km)
 lower section: Powerline crossing to highway 19A bridge (4.4 km)
Total distance surveyed : 8.5 km

1. Fish Observed:

Adults

A total of seven wild steelhead (4 males, 3 females) were observed for a density of 0.82 fish/km. Fish were bright to dark in colour (see condition table below) and ranged in size from 2.5-5.0 kg. Two paired-up groups of steelhead were observed in the upper section of the survey. One group was observed near the falls (~250 m downstream), while the second group was observed near the powerlines.

Condition ¹	1	2	3	4	5
#	2	0	3	2	0
%	29	0	42	29	0

Rainbow/Cutthroat Trout

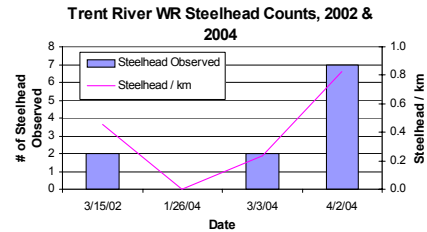
4 wild rainbow trout (3 @ 18-25 cm, 1 @ 45 + cm)

Juveniles

Low densities of rainbow/steelhead parr were observed in both survey sections.

2. Notes

- This snorkel survey is part of a steelhead stock assessment study on four Vancouver Island streams (Trent, Tsable, Goldstream and Sooke). This is the third of five snorkel surveys to be conducted on the Trent River for this project during the 2003/2004 winter steelhead season. Two steelhead were observed during the previous survey on March 3, 2004. The river is scheduled to be re-surveyed in two weeks time (water conditions permitting).
- No anglers or evidence of recent angling were observed (this stream is closed to angling Dec. 1-May 31).
- No obvious redds were observed during this survey.
- Bloedel Creek enters the Trent River ~ 2 km downstream of the anadromous falls and was surveyed from the falls (~ 350 m above the Trent River confluence) to the Trent River.
- Snorkel survey observations of winter steelhead in 2002 and 2004 are presented in the graph below.



Scott Silvestri
 Fisheries Technician
 BC Conservation Foundation
 /dm
 sns(creek)
 cc: All Fisheries staff
 Steelhead Crew
 P. Law, Ecosystems Biologist, MWLAP, Nanaimo
 Conservation Officer Service, Campbell River

FILE NOTE

Date: April 30, 2004
 File: 34560-20/SNORK
 xf: 34560-27/TRENT

SNORKEL SURVEY REPORT
Trent River

DATE: April 26th and 27th, 2004
 WEATHER: April 26th: Sunny, warm, air temperature 20° C
 April 27th: 75% o.c., light rain, air temperature 14° C
 WATER TEMP.(°C): 7.0 @ 0945hrs (Hwy 19A Br.)
 DISCHARGE (m³/s): low spring flows (~2.5 m³/s)
 VISIBILITY (m): 8.0 – 3.0 (reduced below Cumberland sewage treatment discharge tributary)
 PERSONNEL: upper section: S. Silvestri, B.Smith
 Lower section: S. Silvestri, B. Smith
 AREA: upper section: Barrier falls to powerline crossing (4.1 km)
 lower section: Powerline crossing to highway 19A bridge (4.4 km)
Total distance surveyed : 8.5 km

1. Fish Observed:

Adults

A total of two wild steelhead (1 male, 1 unknown) were observed for a density of 0.24 fish/km. Fish were moderate to dark in colour (see condition table below) and ranged in size from 2.5-4.0 kg. The male steelhead had small patches of fungus on its side and appeared to be in post spawning condition. Both steelhead were observed in the upper survey section.

Condition ¹	1	2	3	4	5
#	0	0	1	1	0
%	0	0	50	50	0

Rainbow/Cutthroat Trout

- 3 wild rainbow trout (2 @ 18-25 cm, 1 @ 25-35 cm)
- 2 wild cutthroat trout @ 45 + cm

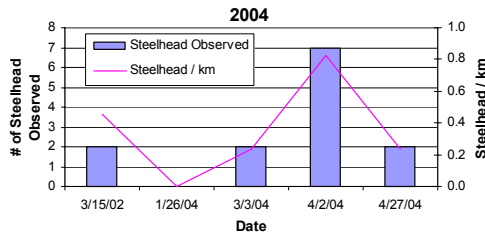
Juveniles

Low densities of rainbow/steelhead parr were observed in both survey sections. Several steelhead smolts were observed during this survey.

2. Notes

- This snorkel survey is part of a steelhead stock assessment study on four Vancouver Island streams (Trent, Tsable, Goldstream and Sooke). This is the fourth of five snorkel surveys to be conducted on the Trent River for this project during the 2003/2004 winter steelhead season. Seven steelhead were observed during the previous survey on April 2, 2004. The river is scheduled to be re-surveyed in two weeks time (water conditions permitting).
- A fairly fresh "Spinning Glow" was observed in a run near the trestle bridge (this stream is closed to angling Dec. 1-May 31).
- No obvious redds were observed during this survey.
- Snorkel survey observations of winter steelhead in 2002 and 2004 are presented in the graph below.

Trent River WR Steelhead Counts, 2002 & 2004



Scott Silvestri

Scott Silvestri
 Fisheries Technician
 BC Conservation Foundation
 /dm
 sns(creek)
 cc: All Fisheries staff
 Steelhead Crew
 P. Law, Ecosystems Biologist, MWLAP, Nanaimo
 Conservation Officer Service, Campbell River

FILE NOTE

Date: May 31, 2004
 File: 34560-20/SNORK
 xf: 34560-27/TRENT

SNORKEL SURVEY REPORT
Trent River

DATE: May 25, 2004
 WEATHER: 100% overcast, light rain, air temperature 14° C
 WATER TEMP.(°C): 13.0 @ 1400 hrs (Hwy 19A Br.)
 DISCHARGE (m³/s): 0.288 (metered using Swiffer, 20 m above old bridge foundation)
 VISIBILITY (m): 7.0 – 3.0 (reduced below Cumberland sewage treatment discharge tributary)
 PERSONNEL: Upper section: B.Smith, H. Wright
 Lower section: J. Craig, S. Silvestri
 AREA: Upper section: Barrier falls to powerline crossing (4.1 km)
 Lower section: Powerline crossing to Highway 19A bridge (4.4 km)
Total distance surveyed : 8.5 km

1. Fish Observed:

Adults

No steelhead were observed.

Rainbow/Cutthroat Trout

- 1 wild resident rainbow trout @ 18-25 cm

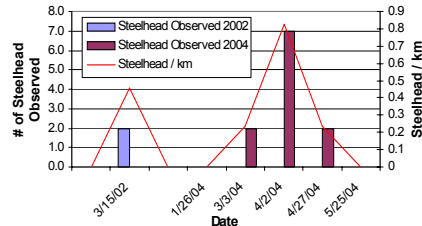
Juveniles

Low to moderate densities of rainbow/steelhead parr were observed during the survey. Low water conditions appeared to concentrate fish in the small number of suitable riffles/pools. Low numbers of steelhead smolts were observed near woody cover during this survey. High densities of coho fry were observed in stream margin habitat.

2. Notes

- This snorkel survey is part of a steelhead stock assessment study on four Vancouver Island streams (Trent, Tsable, Goldstream and Sooke). This is the fifth and final snorkel survey to be conducted on the Trent River for this project during the 2003/2004 winter steelhead season.
- No anglers or evidence of recent angling were observed (this stream is closed to angling Dec. 1-May 31).
- Three steelhead redds were observed. Two redds in the lower survey section were confirmed steelhead redds as alevin were discovered at both sites. These two redds appeared to have similar characteristics (substrate type and depth, size, water depth and velocity, egg development stage) and were approximately 75-100 m apart. It is possible that both redds were from the same female.
- At the observed flow, very few quality adult holding pools were noted in both survey sections.
- Two age classes of rainbow/steelhead parr appeared in the lower survey section, as a definite size distinction was observed in these fish (not including steelhead smolts).
- High numbers of three-spine stickleback were noted in small pools in the lower survey section. Large schools (~250-300 fish) were observed in some pools.
- The peak count for all surveys completed during the 2003/04 winter steelhead season was seven steelhead (0.82 fish/km) on April 2. During a survey on March 15, 2002, two steelhead (0.45 fish/km) were observed from the powerline crossing to the Hwy 19A Bridge. All snorkel survey observations of winter steelhead in 2002 and 2004 are presented in the graph below.

Trent River winter steelhead counts, 2002 & 2004



Scott Silvestri

Scott Silvestri
 Fisheries Technician
 BC Conservation Foundation
 /dm
 sns(creek)
 cc: All Fisheries staff
 Steelhead Crew
 P. Law, Ecosystems Biologist, MWLAP, Nanaimo
 Conservation Officer Service, Campbell River

FILE NOTE

Date: January 28, 2004
 File: 34560-20/SNORK
 xf: 34560-27/TSABLE

SNORKEL SURVEY REPORT
Tsable River

DATE: January 27, 2004
 WEATHER: 100% overcast, light rain, 6° C air temperature
 WATER TEMP.(°C): 2.5 @ 1530h
 DISCHARGE (m³/s): 3.91 (metered using Swiffer at WSC station), 0.762 m (staff gauge height)
 VISIBILITY (m): 4.0
 PERSONNEL: S. Silvestri, H. Wright
 AREA: Anadromous barrier falls to Highway 19A Bridge (5.8 km)

1. Fish Observed:

Adults

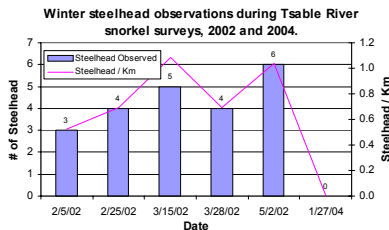
No adult steelhead were observed.

Juveniles

No juveniles were observed.

2. General Notes

- The following snorkel survey is part of a steelhead stock assessment study on four Vancouver Island streams (Trent Tsable, Goldstream and Sooke). This is the first of five snorkel surveys to be conducted on the Tsable River for this project during the 2003/2004 winter steelhead season. The river is scheduled to be re-surveyed the last week in February or the first week in



March (water conditions permitting).

- No anglers were observed (this stream is closed to angling Dec 1-May 31).
- A relatively fresh Jensen Egg set-up was noted in a run above the Inland Island Highway bridge.
- Access to the start of the survey was gained by turning south off the Tsable River Mainline onto Holiday Mainline and parking near the bridge over the Tsable River. The falls (~600 m downstream of this bridge) was reached by traversing ~400 m along the top of the north bank.

3. Habitat Notes

- The first kilometer of river is "canyonized" with small cascades and shallow bedrock pools. Pool frequency appeared good over this section with pool quality (i.e. deep holding pools) being fair. Spawning substrates were quite limited in this section of river.
- The river downstream of the canyon was generally confined and relatively stable. Instream woody cover appeared relatively limited and occurred in areas without slate/bedrock substrates. Parr habitat was moderately abundant, and its quality was good (boulder and cobble substrates with interstitial spaces). Pool frequency appeared fair with an adequate number of quality holding pools. Spawning gravel was moderately abundant, with quality varying from poor (in areas of sand/shale in-filling), to good (around the inland highway bridge).
- The side channel near the inland highway bridge appeared to be functioning well as it was receiving adequate flow from the mainstem.
- Snorkel survey observations of winter steelhead in 2002 and 2004 are presented in the graph below.
- The Tsable River is scheduled to be re-surveyed the last week in February or the first week in March (dependant on water conditions).

Scott Silvestri
 Fisheries Technician
 BC Conservation Foundation
 /dm
 sns(creek)

cc: All Fisheries staff
 Steelhead Crew
 P. Law, Urban Habitat Biologist, MWLAP, Nanaimo
 Conservation Officer Service, Nanaimo

FILE NOTE

Date: March 8, 2004
 File: 34560-20/SNORK
 xf: 34560-27/TSABLE

SNORKEL SURVEY REPORT
Tsable River

DATE: March 4, 2004
 WEATHER: Mainly sunny, mild, 7° C air temperature
 WATER TEMP.(°C): 4.5 @ 1300 hrs
 DISCHARGE (m³/s): 3.504 (metered using Swiffer at WSC station), 0.749 m (staff gauge height)
 VISIBILITY (m): 5.0
 PERSONNEL: S. Silvestri, H. Wright
 AREA: Anadromous barrier falls to Highway 19A Bridge (5.8 km)

1. Fish Observed:

Adults

A total of one wild male steelhead was observed for a density of 0.17 fish/km. The steelhead was observed halfway through the survey (~2.5 km downstream of the falls) and was slightly coloured, with an estimated weight of 2.5 kg. No dorsal fin was present on the steelhead and the wound appeared fresh, as no healed scar tissue was noted.

Rainbow/Cutthroat Trout

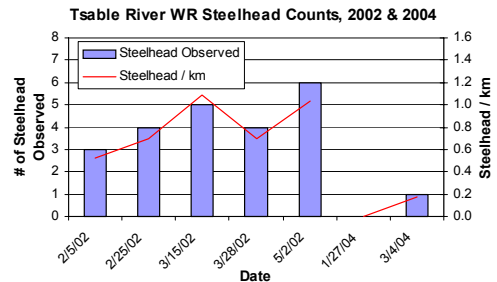
- 1 wild rainbow trout @ 25-35 cm

Juveniles

No juveniles were observed.

2. Notes:

- This snorkel survey is part of a steelhead stock assessment study on four Vancouver Island streams (Trent, Tsable, Goldstream and Sooke). This is the second of five snorkel surveys to be conducted on the Tsable River for this project during the 2003/2004 winter steelhead season. No steelhead were observed on the initial survey on January 27, 2004. This river is scheduled to be re-surveyed One steelhead was observed during the last survey on March 4, 2004. The river is scheduled to be re-surveyed during the last week of March or in the first week of April (water conditions permitting).
- No anglers or evidence of recent angling were observed (this stream is closed to angling Dec. 1-May 31).
- No obvious redds were noted during this snorkel survey.
- Access to the start of the survey was gained by turning south off the Tsable River Mainline onto Holiday Mainline and parking near the bridge over the Tsable River. The falls (~600 m downstream of this bridge) was reached by traversing ~400 m along the top of the north bank.
- Snorkel survey observations of winter steelhead in 2002 and 2004 are presented in the graph below.



Scott Silvestri
 Fisheries Technician
 BC Conservation Foundation
 /dm
 sns(creek)

cc: All Fisheries staff
 Steelhead Crew
 P. Law, Ecosystems Biologist, MWLAP, Nanaimo
 Conservation Officer Service, Nanaimo

FILE NOTE

Date: April 7, 2004
 File: 34560-20/SNORK
 xf: 34560-27/TSABLE

SNORKEL SURVEY REPORT
Tsable River

DATE: April 1, 2004
 WEATHER: Sunny, warm, 9° C air temperature
 WATER TEMP.(°C): 3.0 @ 1230 hrs (falls), 4.0 @ 1530 hrs (Hwy 19A bridge)
 DISCHARGE (m³/s): 5.687 (metered using Swoffer at WSC station), 0.858 m (staff gauge height)
 VISIBILITY (m): 6.0
 PERSONNEL: S. Silvestri, H. Wright
 AREA: Anadromous barrier falls to Highway 19A Bridge (5.8 km)

1. Fish Observed:

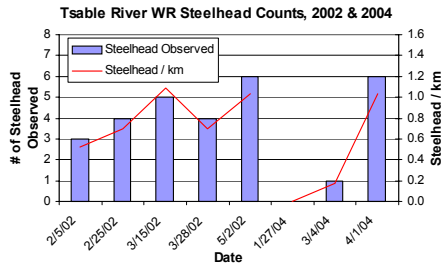
Adults

A total of six wild steelhead (2 males, 2 females, 2 unknown) were observed for a density of 1.03 fish/km. The steelhead were evenly distributed throughout the survey, with several paired-up fish noted. Steelhead ranged in weight from 2-5 kg and were bright to dark in colour. (see condition table below). The steelhead observed during a survey on March 4, 2004 was observed near the Inland Island Highway Bridge. This male steelhead was distinguished by its missing dorsal fin. One small female kelt (approximately 2 kg) was observed holding in the back-eddy of a pool halfway through the survey section. Three steelhead appeared to be nearing mid spawn condition.

Condition ¹	1	2	3	4	5
#	1	1	3	1	0
%	17	17	50	17	0

Rainbow/Cutthroat Trout

1 wild male rainbow trout @ 25-35 cm (fungus on head)



Juveniles

No juveniles were observed.

2. Notes

- This snorkel survey is part of a steelhead stock assessment study on four Vancouver Island streams (Trent, Tsable, Goldstream and Sooke). This is the third of five snorkel surveys to be conducted on the Tsable River for this project during the 2003/2004 winter steelhead season. One steelhead was observed during the last survey on March 4, 2004. The river is scheduled to be re-surveyed in two weeks time (water conditions permitting).
- No anglers or evidence of recent angling were observed (this stream is closed to angling Dec. 1-May 31).
- No obvious redds were noted during this snorkel survey.
- The male steelhead with no dorsal fin observed during the last survey was re-observed near the Inland Island Highway Bridge.
- River conditions in the upper section of the survey were higher than normal. The staff gauge height (0.858 m) measured during this survey should be considered the maximum river height for future snorkel surveys (in terms of safety and observer efficiency).
- D.R. Clough Consulting observed a peak count of six steelhead on May 2, during a series of swims in 2002.
- Snorkel survey observations of winter steelhead in 2002 and 2004 are presented in the graph below.

Scott Silvestri
 Fisheries Technician
 BC Conservation Foundation
 /dm
 sns(creek)
 cc: All Fisheries staff
 Steelhead Crew
 P. Law, Ecosystems Biologist, MWLAP, Nanaimo
 Conservation Officer Service, Nanaimo

FILE NOTE

Date: April 30, 2004
 File: 34560-20/SNORK
 xf: 34560-27/TSABLE

SNORKEL SURVEY REPORT
Tsable River

DATE: April 23, 2004
 WEATHER: Sunny, warm, 15° C air temperature
 WATER TEMP.(°C): 5.0 @ 1200 hrs (falls)
 DISCHARGE (m³/s): Moderate spring flows, 0.89 m (staff gauge height)
 VISIBILITY (m): 5.0
 PERSONNEL: S. Silvestri, B. Smith
 AREA: Anadromous barrier falls to Highway 19A Bridge (5.8 km)

1. Fish Observed:

Adults

A total of three steelhead (2wild, 1 hatchery) were observed for a density of 0.52 fish/km. Steelhead ranged in weight from 2-4 kg and were bright to dark in colour (see condition table below). One male steelhead was observed near the anadromous falls while one pair was observed near the Inland Island Highway Bridge. The male near the Inland Island Highway Bridge was of hatchery origin as no adipose fin was present.

Condition ¹	1	2	3	4	5
#	1	1	0	1	0
%	33	33	0	33	0

Rainbow/Cutthroat Trout

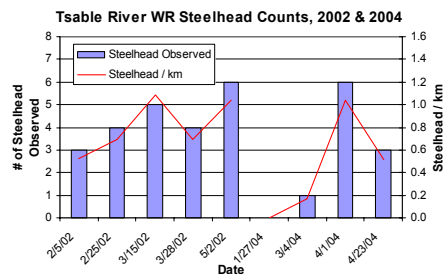
- 3 wild rainbow trout (2 @ 18-25 cm, 1 @ 25-35 cm).
- 1 wild cutthroat trout @ 25-35 cm.

Juveniles

Low numbers of rainbow/steelhead parr were observed. Several small schools of coho fry and smolts were observed.

2.0 Notes

- This snorkel survey is part of a steelhead stock assessment study on four Vancouver Island streams (Trent, Tsable, Goldstream and Sooke). This is the fourth of five snorkel surveys to be conducted on the Tsable River for this project during the 2003/2004 winter steelhead season. Six steelhead was observed during the last survey on April 1, 2004. The river is scheduled to be re-surveyed in two weeks time (water conditions permitting).
- No anglers or evidence of recent angling were observed (this stream is closed to angling Dec. 1-May 31).
- No redds were noted during this snorkel survey.
- High densities of caddis, mayfly and simuliid larvae were observed.
- River conditions in the upper section of the survey were high, with conditions being marginal for steelhead observations in this section. Because access to the falls is limited, snorkel surveyors enter the river channel approximately 600 m upstream of the anadromous falls. The flows at the observed staff gauge height (0.89 m), in conjunction with the canyonized habitat of the section, made for unsafe swimming conditions from the river access point to the anadromous falls.
- D.R. Clough Consulting observed a peak count of six steelhead on May 2, during a series of swims in 2002.
- Snorkel survey observations of winter steelhead in 2002 and 2004 are presented in the graph below.



Scott Silvestri
 Fisheries Technician
 BC Conservation Foundation
 /dm
 sns(creek)
 cc: All Fisheries staff
 Steelhead Crew
 P. Law, Ecosystems Biologist, MWLAP, Nanaimo
 Conservation Officer Service, Nanaimo

FILE NOTE

Date: May 27, 2004
 File: 34560-20/SNORK
 xf: 34560-27/TsABLE

SNORKEL SURVEY REPORT
Tsable River

DATE: May 19, 2004
 WEATHER: 50% O.C., warm, 15° C air temperature
 WATER TEMP.(°C): 8.5 @ 1300 hrs (Hwy 19A Bridge)
 DISCHARGE (m³/s): Moderate spring flows, 0.875 m staff guage height (~6.5 m³/s)
 VISIBILITY (m): 5.0
 PERSONNEL: J. Craig, S. Silvestri
 AREA: Anadromous barrier falls to Highway 19A Bridge (5.8 km)

1. Fish Observed:

Adults

A total of one wild male steelhead was observed for a density of 0.172 fish/km. The one steelhead (approximately 3.5 kg) was observed halfway through the survey and was dark in colour (mid spawn). This steelhead was observed on two previous surveys (March 4 and April 1) and was identified by a missing dorsal fin. The fish was last observed near the Inland Island Highway Bridge.

Rainbow/Cutthroat Trout

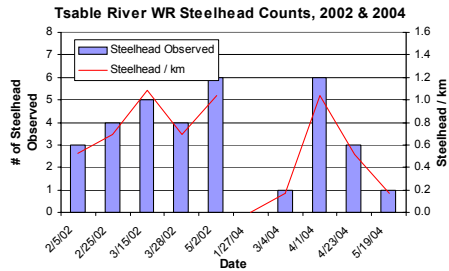
- 9 wild rainbow trout (6 @ 18-25 cm, 3 @ 25-35 cm)
- 5 wild cutthroat trout (3 @ 25-35 cm, 2 @ 35-45 cm)

Juveniles

Low densities of rainbow/steelhead parr were observed during the survey. Several small groups of steelhead smolts were observed (13 in total). Coho fry appeared to be emerging with several small schools noted. Low numbers of coho smolts were also observed.

2. Notes

- This snorkel survey is part of a steelhead stock assessment study on four Vancouver Island streams (Trent, Tsable, Goldstream and Sooke). This is the last of five snorkel surveys to be conducted on the Tsable River for this project during the 2003/2004 winter steelhead season. Three steelhead were observed during the last survey on April 23, 2004.
- No anglers or evidence of recent angling were observed (this stream is closed to angling Dec. 1-May 31).
- One possible redd was noted during this snorkel survey.
- High densities of caddis, mayfly and simuliid larvae were observed.
- D.R. Clough Consulting observed a peak count of six steelhead on May 2, during a series of swims in 2002.
- Snorkel survey observations of winter steelhead in 2002 and 2004 are presented in the graph below.



Scott Silvestri
 Fisheries Technician
 BC Conservation Foundation
 /dm
 sns(creek)
 cc: All Fisheries staff
 Steelhead Crew
 P. Law, Ecosystems Biologist, MWLAP, Nanaimo
 Conservation Officer Service, Nanaimo

Appendix F.

Incidental resident trout observations during snorkel surveys in the Goldstream, Sooke,
Trent and Tsable rivers, 2004

Stream Name	Date	Size (cm)											
		Wild Rainbow Trout				Wild Cutthroat Trout				Unidentified Trout			
		15-25	25-35	35-45	45+	15-25	25-35	35-45	45+	15-25	25-35	35-45	45+
Goldstream River	04-Feb-04				2								
	05-Mar-04	10	5	1									
	11-Mar-04	3											
	16-Apr-04		3								4		
	20-May-04	2	1	1									
Sooke River	06-Jan-04												
	13-Feb-04		1	1			2	1			1	1	
	11-Mar-04												
	23-Mar-04		1					2					
	16-Apr-04						1						
Trent River	21-May-04												
	26-Jan-04												
	03-Mar-04		1				1						
	02-Apr-04	4			1								
	26,27-Apr-04	2	1						2				
Tsable River	25-May-04	1											
	27-Jan-04												
	04-Mar-04		1										
	01-Apr-04		1										
	23-Apr-04	2	1				1						
19-May-04	6	3				3	2						

Appendix G.

Historic and 2004 closed site electrofishing data for the Goldstream, Sooke, Trent and Tsable rivers

Stream Name	Year	Site #	Mean Weight (g)	Non D/V Adj'd FPU ¹	D/V Adj'd FPU ¹	Predicted FPU	% of Predicted
Goldstream River	2001	1	3.22	7.40	9.79	60.63	16%
		2	5.28	12.22	16.24	36.99	44%
		Mean	4.25	9.51	12.60		
	2004	1	2.26	8.73	11.62	86.5	13%
		2	1.85	25.88	29.01	105.3	28%
		3	2.24	5.48	8.48	87.0	10%
4		1.88	32.31	49.20	103.6	47%	
Mean	2.05	14.14	19.37				
Sooke River	2000	1	3.58	28.06	35.56	28.5	125%
		2	4.52	47.10	53.47	22.5	237%
		3	4.72	37.53	58.07	21.6	269%
		4	5.16	25.90	26.72	19.8	135%
		5	4.43	37.34	39.36	23.0	171%
		6	1.94	122.20	151.33	52.5	288%
	Mean	4.06	42.46	50.99			
	2001	1	2.87	11.57	16.90	35.6	47%
		5	1.81	33.17	34.07	56.4	60%
		6	0.91	49.64	84.26	111.7	75%
	Mean	1.86	26.71	36.47			
	2004	1	2.89	19.16	64.68	35.27	183%
		2	2.19	35.04	46.55	46.58	100%
		3	1.54	19.9	29.24	66.08	44%
		4	1.55	37.72	42.13	65.93	64%
		5	1.24	97.85	131.29	82.07	160%
		6	1.44	62.93	76.49	70.64	108%
	Mean	2.17	38.19	57.79			
Trent River	1988	.9 ²	0.43	278.5			
		.10 ²	0.54	104.6			
		.18 ²	1.25	50.8			
		Mean	0.74	113.96			
	2001	1	5.32	9.56	24.45	36.76	67%
		2	2.90	6.59	11.04	67.41	16%
	Mean	4.11	7.94	16.43			
	2004	1	0	0	0	0	0%
		2	1.13	19.43	28.97	172.35	17%
3		1.73	83.11	120.88	113.13	107%	
4		4.66	16.52	24.67	41.97	59%	
5		2.61	3.63	4.63	75.01	6%	
6		1.36	30.17	47.07	144.17	33%	
Mean	2.30	8.15	11.11				
Tsable River	2001	1	0		0		
		2	0		0		
		Mean	0		0		
	2004	1	1.80	1.21	1.57	79.40	2%
		2	1.93	9.70	19.64	74.00	27%
		3	1.98	12.47	22.19	72.18	31%
		4	2.37	10.71	19.76	60.35	33%
		5	2.50	9.95	13.93	57.10	24%
		6	1.30	1.12	1.47	109.93	1%
	Mean	1.98	5.09	8.08			

Notes: 1 Mean FPU values are geometric means. To calculate a geometric mean, values must be > 0.

For the purpose of the calculations, any zero (0) values were assumed to be 0.1.

2 Site numbers in the Trent River in 1988 represent the distance in km upstream of the mouth.

Stream Name	Stream Code	Site #	Site Description	Site Reference (km)	UTM Code
Goldstream River	920-211900	1	150 m d/s Mt. Finlayson Rd. bridge	0.35	459182, 5367888
		2	30 m u/s Hwy 1 bridge	2.7	459182, 53678879
		3	Campground bridge	3.45	458258, 5367655
		4	110 m d/s falls	3.9	458258, 5367654
Sooke River	930-022100	1	200 m u/s counting fence	3.2 (0.3*)	447831, 5361378
		2	60 m u/s Charters Creek	4.8 (1.9*)	447248, 5362527
		3	600 m u/s Charters Creek	5.2 (2.3*)	447241, 5362800
		4	WSC station	5.8 (2.9*)	447132, 5363652
		5	Sooke Potholes parking lot	6.3 (3.4*)	447293, 5364105
		6	Tailout of "Beer Bottle" pool	6.7 (3.8*)	447159, 5364482
Trent River	920-545800	1	120 m u/s Hwy 19 bridge	0.33	360462, 5500492
		2	Union Bay FS road off Van West ML	1.9	359542, 5499553
		3	200 m d/s powerline	4.23	358437, 5498342
		4	50 m d/s powerline	1.36	358230, 5498343
		5	Coho seine pool	7.6	357204, 5496461
		6	250 m d/s falls	8.6	357006, 5496096
Tsable River	920-527600	1	Railway trestle crossing	1	366811, 5486604
		2	Inland Island Hwy bridge (elk fencing)	2	366052, 5486167
		3	300 m u/s Inland Island Hwy bridge	2.3	365823, 5486147
		4	150 m d/s s/c intake	2.8	365586, 5486305
		5	200 m d/s bb25 access point	5.4	363579, 5486815
		6	200 m u/s bb25 access point	5.8	363266, 5487026

*Brackets refer to distance upstream from high tide mark in river.

Appendix H.

Sooke River steelhead tagging summary, 2004

Captured Date	Released Date	Floy Tag #	Floy Tag Colour	Number of Tags	Floy Tag Location	Steelhead Sex	Steelhead Length (cm)	Steelhead Girth (cm)	Release Location
14-Feb-04	14-Feb-04	66-92-01125	Orange	1	Behind Dorsal	Female (kelt)	76	33	Sooke River
14-Feb-04	14-Feb-04	66-92-01124	Orange	1	Behind Dorsal	Male	63	31	Sooke River
15-Feb-04	15-Feb-04	66-92-01123	Orange	1	Behind Dorsal	Male	61	33	Sooke River
17-Feb-04	17-Feb-04	66-92-01122	Orange	1	Behind Dorsal	Female (kelt)	61	30	Sooke River
24-Feb-04	24-Feb-04	66-92-01121	Orange	1	Behind Dorsal	Male	66	31	Sooke River
09-Feb-04	06-Mar-04	66-92-01120	Orange	1	Behind Dorsal	Male (kelt)	69	34	Sooke River
25-Jan-04	06-Mar-04	66-92-01119	Orange	1	Behind Dorsal	Female (kelt)	77	38	Sooke River
06-Mar-04	06-Mar-04	66-92-01118/17	Orange	2	Behind Dorsal	Male	61	28	Sooke River
06-Mar-04	06-Mar-04	66-92-01116	Orange	1	Behind Dorsal	Male	62	31	Sooke River
n/a	27-Mar-04	92878	Orange	1	Behind Dorsal	Female (kelt)	61	31	Sooke River
n/a	27-Mar-04	92879	Orange	1	Behind Dorsal	Female (kelt)	61	31	Sooke River
n/a	27-Mar-04	92880	Orange	1	Behind Dorsal	Female (kelt)	61	30	Sooke River
n/a	27-Mar-04	92881	Orange	1	Behind Dorsal	Male (kelt)	66	34	Sooke River
n/a	27-Mar-04	92882	Orange	1	Behind Dorsal	Male (kelt)	72	35	Sooke River
n/a	27-Mar-04	92883	Orange	1	Behind Dorsal	Male (kelt)	63	28	Sooke River
27-Mar-04	27-Mar-04	92884	Orange	1	Behind Dorsal	Male	64	29	Sooke River
28-Mar-04	28-Mar-04	92885	Orange	1	Behind Dorsal	Male	77	41	Sooke River
02-Apr-04	02-Apr-04	92886	Orange	1	Behind Dorsal	Male	69	33	Sooke River
02-Apr-04	02-Apr-04	92887	Orange	1	Behind Dorsal	Female	61	31	Sooke River

Appendix I.

Project budget summary

British Columbia Conservation Foundation
Project Summary Statement of Expenditures

Today's Date : 10-Dec-05
Regional Contact: Pat Stephenson

CLIENT NAME : Deborah Gibson CLIENT AGENCY: BCCF ADDRESS : 206 17564 56A Avenue CITY, PROVINCE Vancouver, B.C. POSTAL CODE : V3S 1G3 TEL. NUMBER : 604-576-1433 FAX NUMBER : 604-576-1482	PROJECT NAME BCCF PROJECT # 130443/130511 CLIENT CONTRACT # TOTAL CONTRACT 30000.00 FEES 3900.00 CARRY-OVER OR SUBSIDY
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------

Steelhead Stock
Assessment In
Select VI
Streams

GL ACC'T. EXPENDITURE	AMOUNT
3050 Fees Earned	3451.32
4050 Equipment Rental	
4051 Other Charges	
4055 Coordinator/Mgmt Charges	
4056..5030 Contract wages	23119.40
5110 Sub Contracts	
5115 Premises Rent	
5210 Equipment > 100	542.27
5220 Equipment < 100	
5230 Equipment Repairs	
5235 Rentals	160.00
5240 Communications	
5245 Computer Costs	
5300 Materials/Supplies/Courier	40.03
5400 Project Publications	0.00
5500 Vehicle Operating Costs	15.00
5520 Transportation	
5530 Vehicle Rental	708.15
5540 Mileage (only)	24.30
5545 Travel Costs/Fuel	1116.13
5550 Accommodation/Food	62.13
5555 Allowances	30.00
5560 Per Diem (only)	663.00
5600 Miscellaneous	
5700 Training / Safety	
5750 Employee Advances	
5800 GST	<u>68.27</u>
Total Project Costs	<u>\$30,000.00</u>