Slocan River Rainbow Trout Population Assessment: 2005

Prepared By:

Peter J. Corbett, RPBio
Mirkwood Ecological Consultants Ltd.
P.O. Box 138
Winlaw, B.C. V0G 2J0

(250) 226-7249 or pcorbett@idmail.com

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Executive Summary

Monitoring of the Slocan River rainbow trout (*Oncorhynchus mykiss*) population began in 1985. In 1993 the river was closed to angling based on previous assessments that demonstrated the population was in severe decline. Since the closure, the population has increased but still displays a high variability in population size and structure. This variability may be explained in part by the variability of summer water temperatures, whereby in certain years a temperature threshold is exceeded causing trout mortality and/or a reduction in fitness. The one consistency in the data is that the Lemon Creek index site produces a significantly greater number of trout in all age/size classes than any of the other index sites.

Acknowledgements

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- Gerry Oliver; for all of his work on the Slocan River and for sharing his data and knowledge with others,

- John Bell and Jeff Burrows; for finding the time to assist with the underwater counts and for their continued support for conservation efforts on the Slocan River.

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1.0 Introduction

Monitoring of the Slocan River rainbow trout (*Oncorhynchus mykiss*) population began in 1985. In 1993 the river was closed to angling based on previous assessments that demonstrated the population was in decline. The population has shown signs of recovery since 1993 with variable increases measured during subsequent assessments. The population has never dropped below 1993 levels. The objectives of the 2005 assessment where twofold; 1) to continue monitoring the population to assist with stock management and the development of angling regulations and, 2) to measure the success of restoration efforts undertaken on the Slocan River.

2.0 Methods

The methodology was developed by G.G. Oliver and Associates (Oliver, 2001).

Statistical comparison between years and sites was calculated using a single classification ANOVA (Sokal and Rohlf, 1981).

Assessments were conducted between September 1st and September 26th, 2005.

3.0 Results and Discussion

As seen in previous assessments, the results of the 2005 enumeration indicated that the Lemon Creek index site significantly ($p<0.001$) supported the greatest number of total trout (290/km) and the greatest number of catchable trout over 30 cm (68/km). The lowest number of total trout encountered was at the Crescent Valley site with13 trout/km, of which only 4 trout/km were over 30 cm in fork length. A comparison between all sites in 2005 can be seen in Figure 1 and 2 below. Based on these results, it is evident that the upper portion of the river in the vicinity of Lemon Creek has by far the best capability to support trout.

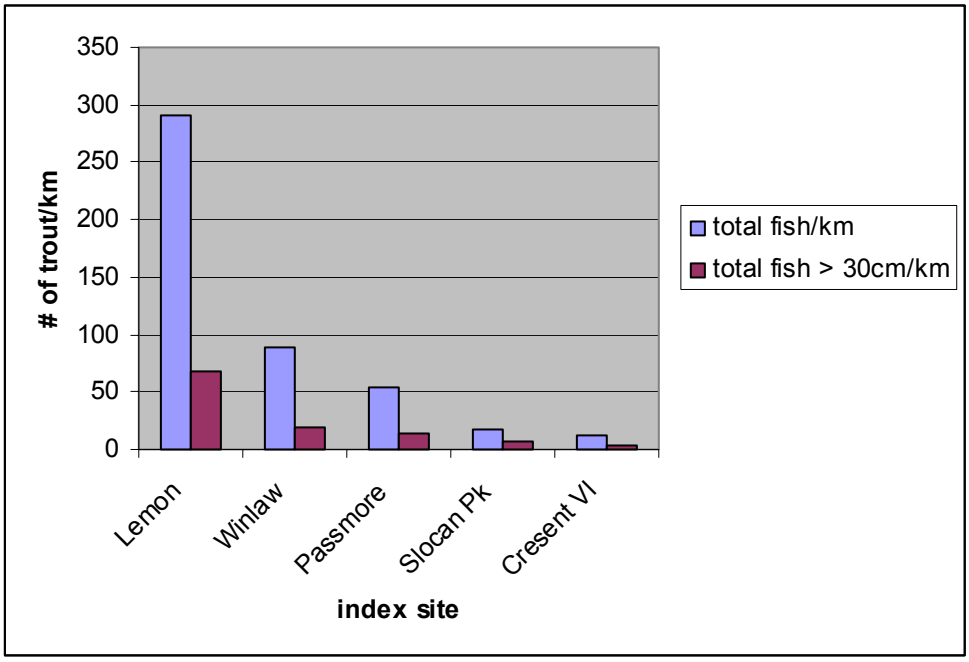

Figure 1. A comparison of total trout and total catchable trout (>30cm) at the five index sites on the Slocan River sampled in 2005.

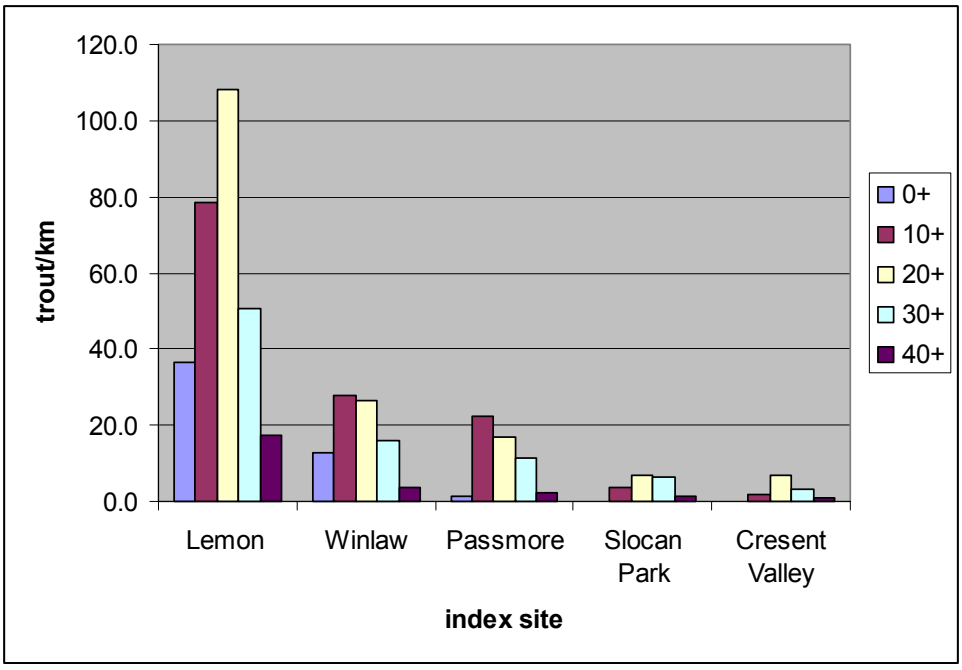

Figure 2. A comparison of the number of trout/km by each size class for all 5 index sites in 2005.

A further breakdown of just the catchable trout/km observed in the five index sites in 2005 can be found in Figure 2. The 99% confidence level is also indicated for each site.

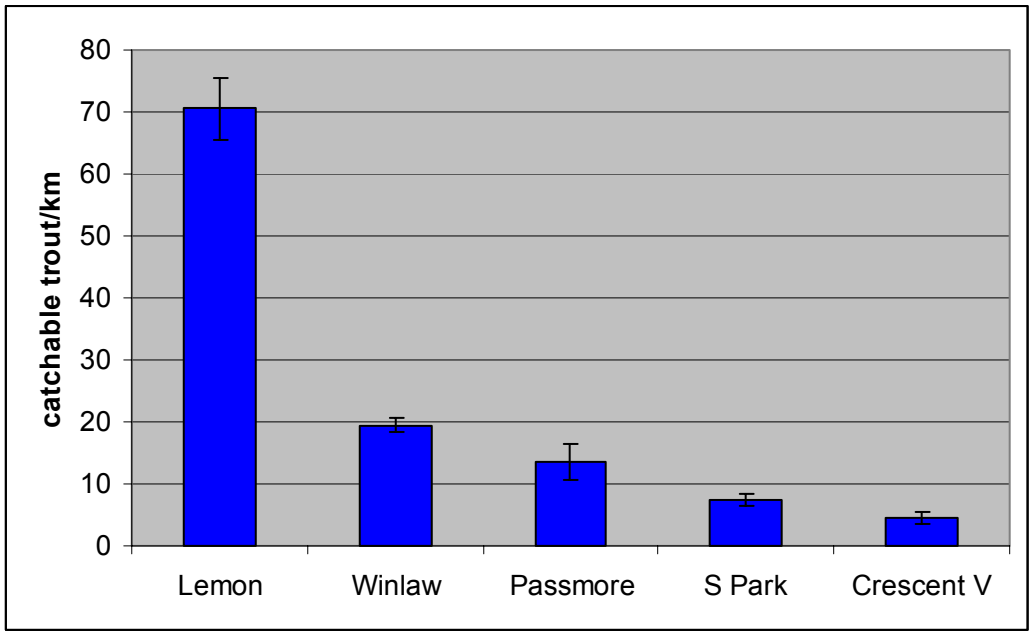

Figure 3. Catchable trout/km for all index sites in 2005 with the 99% confidence level sampling error bars showing the sampling variation between the two passes for each site.

A comparison between years of total trout and total catchable trout over 30 cm in fork length are presented in Figures 3 and 4 below. Once again a fairly high degree of variability is evident for both between years and between sites.

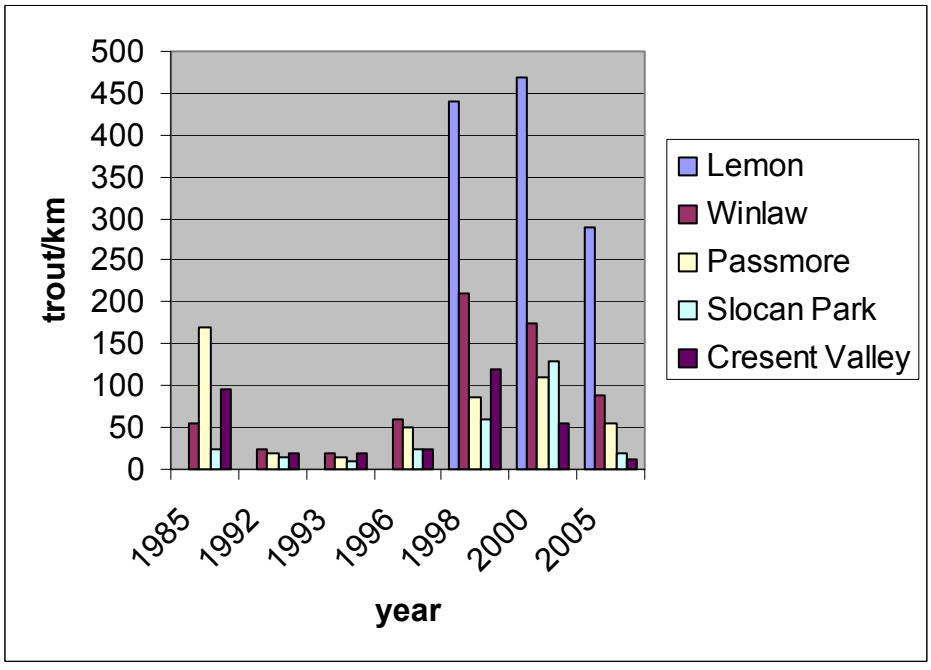

Figure 4. The total number of trout/km across all index sites on the Slocan River for all assessments conducted since 1985. No data for Lemon Creek is available prior to1998.

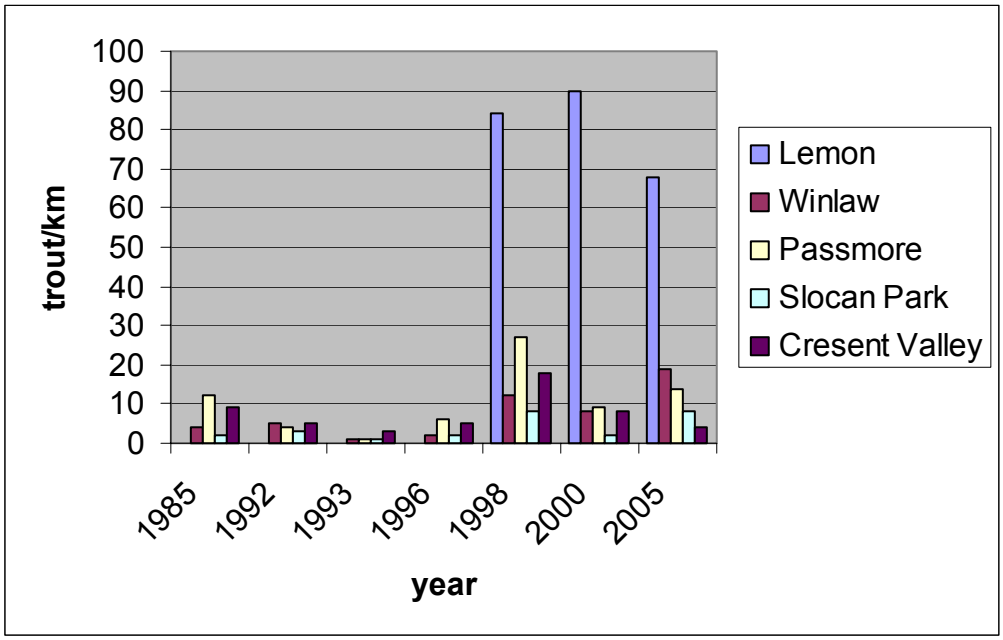

Figure 5. The total number of catchable trout (>30 cm in length)/km across all index sites on the Slocan River for all assessments conducted since 1985. No data for Lemon Creek is available prior to1998.

While a high degree of variability does exist in the data, with the population results between years being considered significantly different ($p<0.002$), some trends may be evident. It would appear that there were less catchable trout in the river in 2005 compared to the peak in1998 and that 1993 still remains the lowest count of catchable trout. (see Figure 5). This analysis excludes the Lemon Creek index site because data only exists for the last three sample periods.

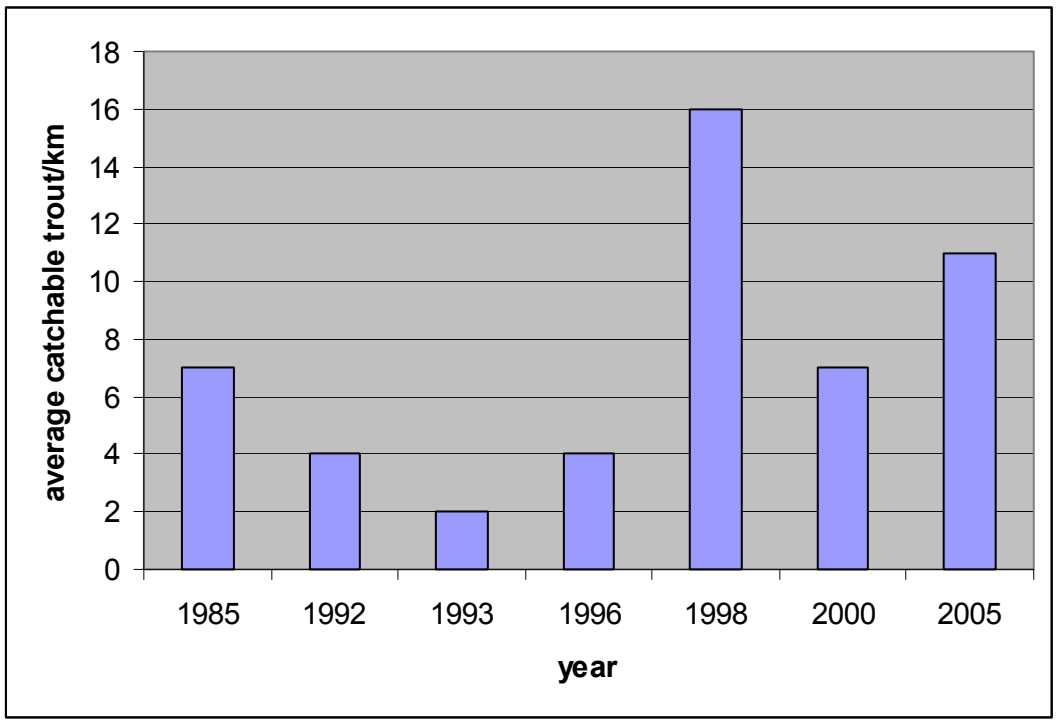

Figure 6. The average combined catchable trout/km of all the index sites, (excluding Lemon Creek), for each year.

Some of this variation may be explained by tracking hot and dry summer conditions over the years. Trout display stress when exposed to warm water, with optimum growth conditions being between 10-14 degrees Celsius (Ford et al, 1995). Numerous fisheries researchers and managers have felt that warm summer temperatures on the Slocan River have caused negative impacts to the trout population. The summers of 1988, 1990 and 1991 were very hot and could have led to the decline in the population in the early 90s (see Figure 7). For the purpose of this discussion, warm summers where those with average August high temperatures to be over 26.5 degrees Celsius as determine through Environment Canada archives for Cranbrook, B.C. (local data does not cover the early years of the study; however the later years shows the same patterns). Subsequently this was followed by a period of relatively cooler summers until a period of warm conditions began again in 1998 followed by 2000, 2001 and 2003. This may have contributed to the decline in stocks experienced after the peak in 1998 and leading to a slow recovery as experienced at present. Caution must be used when interpreting such trends due to the lack of annual water temperature data and population estimates that is needed to more accurately correlate a cause and effect.

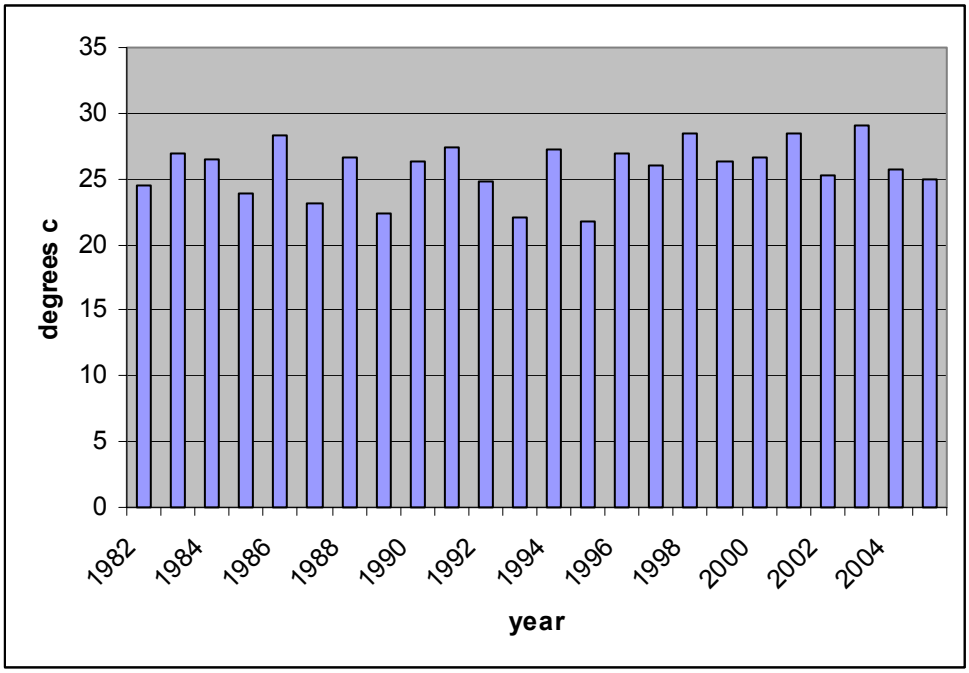

Figure 7. The average daily high temperature for the month of August for the corresponding years of the study (Environment Canada, Cranbrook weather station)

Water temperatures may also affect fish distribution. Warm temperatures may have a tendency to concentrate trout in the cooler portions of the river whereby cooler temperatures may see fish have a more widespread distribution. In Figure 4, it is evident that during the summer of 2000 (considered to be a warm year) there were more fish in the Lemon Creek index site than on any other sampling year yet the other index sites were considered to have fewer fish than usual. This redistribution of fish may also be the reason for such variability in fish numbers. When we look at the average number of fish > 30cm/km for the years with Lemon Creek data, we see no significant difference in the trout population (see Figure 6). This may be a critical point and shed light on past interpretations of the data. Without data for the Lemon Creek index site, it is difficult to interpret how severe the decline in the population was in the early 1990s and how quickly it may have recovered. This must also be viewed with caution until further sampling can be completed in the future to determine the validity of this potential trend.

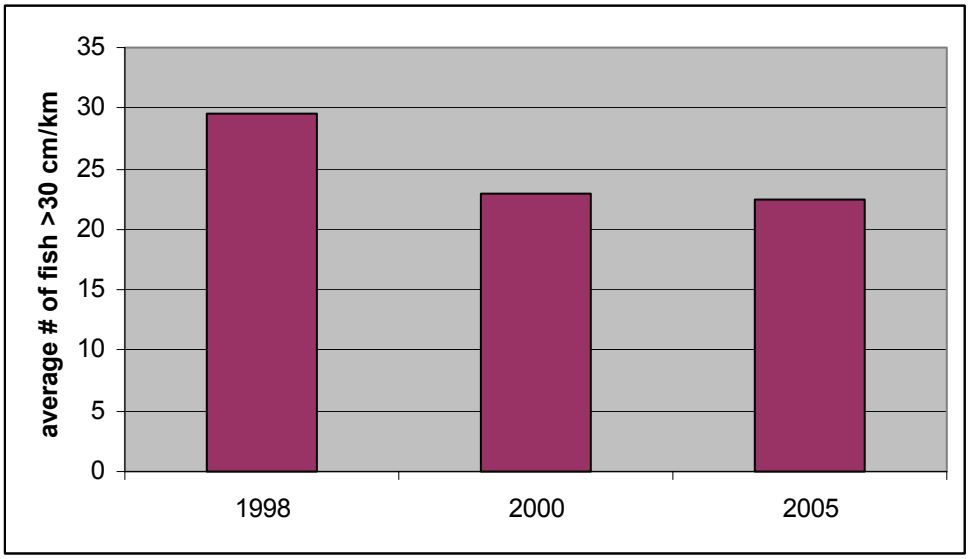

Figure 8. The average number of catchable trout across all index sites for the years that include the Lemon Creek site data.

Although the population in 2005 was not at its highest, the Winlaw index site had more catchable trout than previously documented. While monitoring the in-stream structures below the Winlaw rapids did not show substantial evidence of direct utilization (Corbett, 2006), the overall improvement to habitat in the index site may be realized, thereby increasing the site's ability to support catchable trout.

4.0 Conclusion

While the population has recovered from the low of 1993, there still appears to be much variability within the population between sites. The population between years does look like its stabilizing (figure 6); however with no data between sample years, we do not know what the short term trends have been. In order to better understand this variability and therefore better appreciate the outcome of both opening the river to angling and the development of restoration projects, a more comprehensive monitoring strategy should be developed. With the gaps in the data it is difficult to determine if the population is in decline or recovery at any sampling point since there is no data from the previous year. Continuous environmental monitoring of the river is needed in conjunction with an annual trout population assessment. Better resolution of our data will greatly assist with determining population trends and the causes of this variability. This will in turn lead to better management of the river resources.

To meet these needs, I would recommend changing the trout assessments to a single pass. The variability between the results of the two passes does not warrant the extra cost and effort required. In addition, we have looked at the effectiveness of reducing the number of swimmers used to cover the river (Corbett, in prep). Other researchers have conducted similar tests (Burrows and Neuman, 1995) and have come to the same conclusions. We have determined that 3 qualified divers can successfully cover the river, especially if the focus is not on counting swim-up fry and fingerlings. I would also recommend doing a

complete float of the river to assess all trout habitat in order to better understand fish distribution in the river. The index sites could still be a subset of this larger count so that comparisons between years can still be conducted.

5.0 References

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6.0 Appendices

Appendix A. Summarized Data 2005

Average # of fish based on a two pass count

fish >30cm/km

	1985	1992	1993	1996	1998	2000	2005
Lemon					84	90	67.5
Winlaw	4.3	5.2	0.9	2.6	12.2	7	19.5
Passmore	11.8	4.3	1.1	6.1	25.9	9	13.5
Slocan Park	2.1	3.5	0.6	2.4	7.9	2	7.5
Crescent V	8.9	4.8	2.2	5.6	18	7	4.5

total fish/km

	1985	1992	1993	1996	1998	2000	2005
Lemon					422	468	290
Winlaw	52.6	28.3	13.9	60	205.7	176	89
Passmore	168.9	14.6	10	49.3	88.6	106	54.5
Slocan Park	24.4	11.5	7.1	24.4	56.8	133	18
Crescent V	97.8	17.8	18.9	21.9	114.9	59	13

Appendix B. Raw Data 2005

Lemon Creek

site:	Lemon	spp:	rb	temp:	11-19	
pass:	1	sechi:	13.66	distance:	1.5	
lane	0+	10+	20+	30+	40+	50+
1	46	62	40	31	14	1
2	23	52	52	21	4	0
3	2	7	11	7	0	0
3	0	9	9	5	0	0
expanded	1	11	13	8	0	0
4	0	3	6	2	0	0
5	7	21	41	9	1	2
totals	77	149	152	71	19	3
total rb:	471	total catchable rb		93		
rb/km:	314	catchable/km:		62		

site:	Lemon	spp:	rb	temp:	11-19	
pass:	2	sechi:	13.66	distance:	1.5	
lane	0+	10+	20+	30+	40+	50+
1	4	27	68	37	9	0
2	7	13	60	16	2	0
3	8	13	9	9	6	0
3	8	13	9	9	6	0
expanded	11	17	12	12	8	0
4	3	8	6	4	6	0
5	8	21	25	11	4	1
totals	33	86	171	80	29	1
total rb:	400	total catchable rb		110		
rb/km:	267	catchable/km:		73		

Summary	0+	10+	20+	30+	40+	50+
totals 1 pass	77	149	152	71	19	3
totals 2nd pass	33	86	171	80	29	1
mean	55	118	162	76	24	2
total rb:	436	total catchable rb		102		
rb/km:	290	catchable/km:		68		

Winlaw

site:	winlaw	spp:	rb	temp:	17 C	
pass:	1	sechi:	7.85	distance:	2.3	
lane	0+	10+	20+	30+	40+	50+
1	24	10	15	8	0	0
2	5	11	8	3	0	0
3	0	6	8	5	2	0
3	0	6	8	5	2	0
expanded	0	8	11	7	3	0
4	0	7	12	10	4	0
5	0	21	10	7	1	1
totals	29	57	56	35	8	1
total rb:	185	total catchable rb		43		
rb/km:	80	catchable/km:		19		

site:	winlaw	spp:	rb	temp:	17 C	
pass:	2	sechi:	7.85	distance:	2.3	
lane	0+	10+	20+	30+	40+	50+
1	22	31	17	6	0	0
2	2	7	13	2	0	0
3	3	6	7	4	2	0
3	3	6	7	4	2	0
expanded	4	8	9	5	3	0
4	0	9	11	16	2	0
5	0	16	16	9	2	1
totals	28	71	66	38	7	1
total rb:	211	total catchable rb		46		
rb/km:	92	catchable/km:		20		

Summary	0+	10+	20+	30+	40+	50+
totals 1 pass	29	57	56	35	8	1
totals 2nd pass	28	71	66	38	7	1
mean	29	64	61	37	7	1
total rb:	198	total catchable rb		45		
rb/km:	86	catchable/km:		19		

Passmore

site:	passmore	spp:	rb	temp:	19 C	
pass:	1	sechi:	8.58	distance:	2.8	
lane	0+	10+	20+	30+	40+	50+
1	1	2	4	7	4	0
2	0	13	7	0	1	0
3	1	1	8	9	2	0
3	0	11	16	9	0	0
expanded	1	8	16	12	1	0
4	0	6	12	3	0	0
5	0	6	10	10	4	0
totals	2	35	49	32	10	0
total rb:	128	total catchable rb		42		
rb/km:	46	catchable/km:		15		

site:	passmore	spp:	rb	temp:	19 C	
pass:	2	sechi:	8.71	distance:	2.8	
lane	0+	10+	20+	30+	40+	50+
1	0	49	10	13	1	0
2	4	4	4	3	0	0
3	0	0	3	0	0	0
3	0	4	7	1	1	0
expanded	0	3	7	1	1	0
4	0	8	13	6	0	0
5	3	25	12	9	1	0
totals	7	89	46	32	3	0
total rb:	176	total catchable rb		34		
rb/km:	63	catchable/km:		12		

Summary	0+	10+	20+	30+	40+	50+
totals 1 pass	2	35	49	32	10	0
totals 2nd pass	7	89	46	32	3	0
mean	4	62	47	32	7	0
total rb:	152	total catchable rb		38		
rb/km:	54	catchable/km:		14		

Slocan Park

site:	s park	spp:	rb	temp:	16-19	
pass:	1	sechi:	8.1	distance:	3.4	
lane	0+	10+	20+	30+	40+	50+
1	0	4	4	7	1	0
2	0	3	13	5	1	0
3	0	2	4	5	0	0
3	0	2	4	5	0	0
expanded	0	3	5	7	0	0
4	0	1	5	0	0	0
5	0	15	11	5	0	0
totals	0	26	38	24	2	0
total rb:	90	total catchable rb		26		
rb/km:	26	catchable/km:		8		

site:	s park	spp:	rb	temp:	10	
pass:	2	sechi:	8.8	distance:	3.4	
lane	0+	10+	20+	30+	40+	50+
1	0	0	3	4	1	0
2	0	0	0	6	3	0
3	0	0	0	2	0	0
3	0	0	0	2	0	0
expanded	0	0	0	3	0	0
4	0	0	2	2	1	0
5	0	0	3	4	1	0
totals	0	0	8	19	6	0
total rb:	33	total catchable rb		25		
rb/km:	10	catchable/km:		7		

Summary	0+	10+	20+	30+	40+	50+
totals 1 pass	0	26	38	24	2	0
totals 2nd pass	0	0	8	19	6	0
mean	0	13	23	21	4	0
total rb:	61	total catchable rb		25		
rb/km:	18	catchable/km:		7		

Crescent Valley

site:	cresent V	spp:	rb	temp:	12	
pass:	1	sechi:	10	distance:	2.7	
lane	0+	10+	20+	30+	40+	50+
1	0	1	6	5	2	0
2	0	3	4	0	1	0
3	0	0	3	0	0	0
3	0	0	3	0	0	0
expanded	0	0	4	0	0	0
4	0	0	3	0	1	0
5	0	1	1	1	0	0
totals	0	5	18	6	4	0
total rb:	33	total catchable rb		10		
rb/km:	12	catchable/km:		4		

site:	cresent V	spp:	rb	temp:	12	
pass:	2	sechi:	10.2	distance:	2.7	
lane	0+	10+	20+	30+	40+	50+
1	0	4	7	2	1	0
2	0	1	7	8	1	0
3	0	0	1	1	0	0
3	0	0	1	1	0	0
expanded	0	0	1	1	0	0
4	0	0	0	0	0	0
5	0	0	4	0	0	0
totals	0	5	19	11	2	0
total rb:	38	total catchable rb		13		
rb/km:	14	catchable/km:		5		

Summary	0+	10+	20+	30+	40+	50+
totals 1 pass	0	5	18	6	4	0
totals 2nd pass	0	5	19	11	2	0
mean	0	5	19	9	3	0
total rb:	35	total catchable rb		12		
rb/km:	13	catchable/km:		4		