Status of Fish Habitat in Small East Coast Vancouver Island Streams 1999 – 2003

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April 2007

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Acknowledgements

We sincerely thank the stewardship groups that conducted the USHP fish habitat assessments on their creeks. The dedication of these volunteers to this work has to a much better understanding of the status of fish habitat on Vancouver Island.

We are also indebted to Lew Carswell for his work summarizing the USHP data and Doug Featherston for providing a map of the study area.

Abstract

A 1993 State of the Environment Report recognized that rapid urban growth was placing major demands on the natural resource base of Vancouver Island and in view of the sheer physical constraints of the area, issues regarding fish and wildlife resources may be more serious here than elsewhere in the province (Ministry of Environment, Lands and Parks, 1993). In fact, the impacts of development on fish and wildlife habitat have become especially acute on the east coast of the Island, which is not only the most heavily populated area on Vancouver Island, but also the fastest growing. A 1999 assessment of the state of fish habitat on the east coast by Reid et al., found seriously degraded fish habitat in most of the streams examined. In the present study, we examined the amounts of critical fish habitat components in almost 90 east coast Vancouver Island streams and found that the majority had only fair, or even poor quality fish habitat, especially in the regional districts between Nanaimo and Victoria. Among the most critical habitat parameters limiting fish production were the amount of instream cover, especially in the form of Large Woody Debris (LWD), restricted flow during the summer fish-rearing period, and excessive amounts of sediment in the bed material. Based on these results, we suggest that past legislation was ineffective in protecting fish habitat, and the Streamside Protection Regulation designed to address those shortcomings is still deficient in some areas. We recommend community-based long-term monitoring, and flow protection legislation to address legislative gaps to ensure fish habitat protection within the rapidly developing Vancouver Island region.

Introduction

The Georgia Basin, which is comprised of the Lower Mainland and Vancouver Island, makes up less than 3% of the total area of British Columbia, yet nearly two-thirds of the provincial population lives here and it is one of the fastest growing regions in North America (Owen 1994). Approximately 20% of the population of the basin live on Vancouver Island, with 90% centered along the east coast (BC Stats, 2007). Not only is this the most heavily populated area on the island, but the population within this narrow band of land is growing. Between 1986–2006, the population of the east coast grew by almost 40% and it is projected to increase by a further 20% by 2026, bringing the number of people living in this roughly 20,000 km^2 strip of land to more than 800,000 (Owen, 1994; BC Stats, 2007).

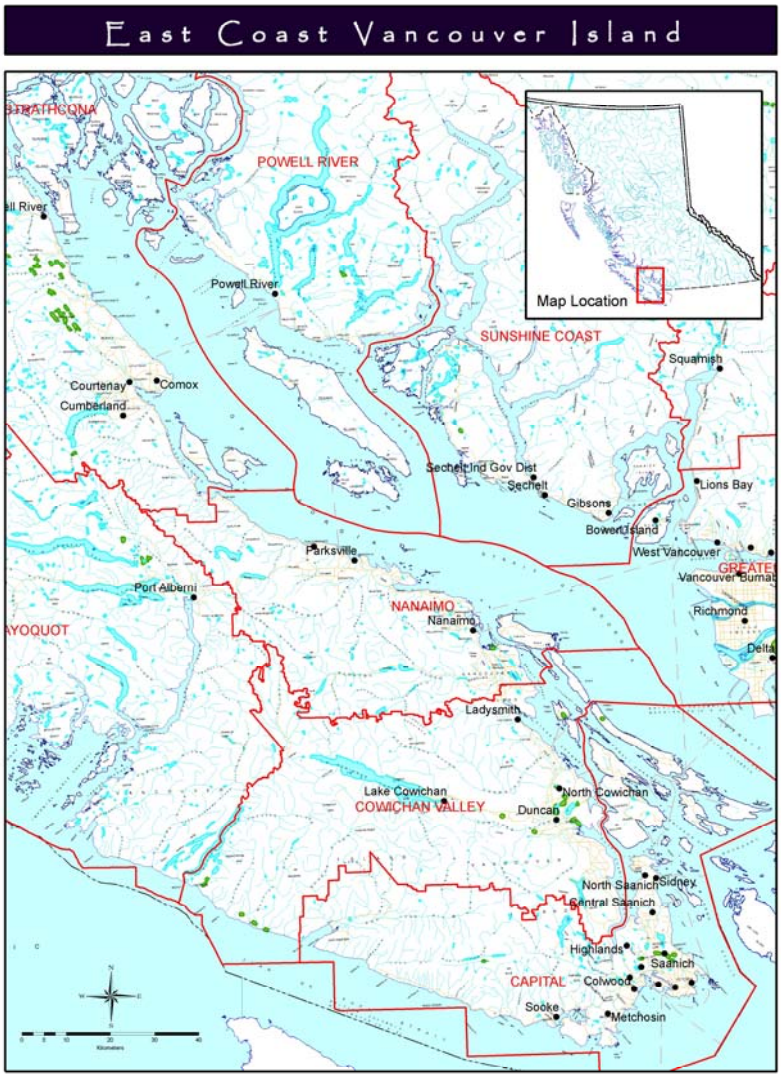
At one time more than 300 small streams stepped their way south from Campbell River to Sooke along the east coast of Vancouver Island. These narrow riverine corridors, most less than 5 meters wide, were the backbone of freshwater habitat for cutthroat trout(Oncorhynchus clarki) and coho salmon (O. kisutch), but as the east coast became increasingly developed, many of these once highly-productive habitats were reduced to straightened, denuded channels. As Rosenfeld and Roberge, 2000 point out, small streams are often viewed by planners, resource managers and the public as inconsequential when it comes to fish habitat and fisheries values and, as such, are undervalued in planning exercises. Such has been the case on the east coast of the Island where poor land use has either attributed to, or in some cases been entirely responsible for the irreversible loss of small stream habitats.

In their 1993 State of the Environment Report, the Ministry of Environment recognized that rapid growth was placing major demands on the natural resource base of Vancouver Island and in view of the sheer physical constraints in this area, issues of fish and wildlife resources may be more serious here than elsewhere (Ministry of Environment, Lands and Parks 1993). That same year, the provincial government initiated the Sensitive Ecosystems Inventory (SEI) of the east coast and found that natural areas and habitats were fast disappearing. In fact, <8% of the entire study area could be considered relatively natural, and many of those areas had already been substantially degraded by fragmentation, human use and introduced species (Kirkby, 1999). With respect to fish, recent State of the Environment reports classify approximately 80% of Vancouver Island as having either conservation, or extreme conservation concerns (Kirkby, 1999). And while this classification is based on an analysis of steelhead stock data, the same issues which have affected that species, such as alteration and loss of habitat and flow, and stream blockages, can be applied to trout and salmon habitat in small east coast streams as well. A study by Reid et al. in 1999 found the fish habitat of almost 60% of the small streams examined had sustained impacts from development including reductions in cover, rearing area, clean substrate, flow and riparian vegetation. It is not surprising, therefore, that coastal cutthroat trout which rear in these streams, are now Blue-Listed (Ministry of Sustainable Resource Management, 2002).

Our study builds on the earlier work by Reid et al. (1999) and examines the state of riparian and instream fish habitat in small streams on the east coast of Vancouver Island between Campbell River and Sooke (Figure 1). Our objectives were to:

1. classify the instream and riparian habitat of small streams along the east coast as good, fair or poor based on a comparison of habitat components to a series of published biostandards;
2. quantify the amount of good, fair and poor instream and riparian habitat of small streams within each Vancouver Island regional district; and,
3. provide recommendations for protecting remaining small stream habitat within the Vancouver Island region.

Figure 1. Study area.



Methods

Between 1996–2003, stewardship group volunteers assessed the amount and quality of fish habitat in approximately 90 small streams between Campbell River and Sooke on Vancouver Island (Appendix 1). Funding for these assessments was provided by the Urban Salmon Habitat Program (USHP), a Ministry of Environment-funded stewardship program implemented in the Georgia Basin and aimed at providing volunteers with technical support and financial resources to assess, restore and educate others about small streams within the Georgia Basin. Volunteers followed stream assessment procedures outlined in the Urban Salmon Habitat Program Assessment Procedures for Vancouver Island, which was developed using Resource Inventory Committee (RIC) standard techniques (Michalski et al., 1998).

Volunteers assessed streams during the low-flow period between August and September to account for the fact that smolt production is positively correlated with stream discharge, and that an estimated 90% of east coast Vancouver Island streams suffer from low discharge in the summer (Wickett, 1951). Stewards walked each stream starting at the mouth and continuing to the headwaters and measured the total amount of wetted area, pool area, instream cover, Large Woody Debris per Bankful Channel Width (LWD/BFW), and type and percent of substrate. In addition, volunteers identified and quantified the type and percent of categories of land use and riparian components, including the length of altered sites, land use type, depth of vegetation, slope and stability. The results of each assessment were summarized electronically in an Excel database provided by the Ministry of Environment.

We combined and summarized the raw data from the Excel spreadsheets and compared the results for individual habitat parameters to the biostandards developed for assessing the quality of habitat for stream rearing salmonids (Table 1) (Koning and Keeley, 1997). We used data from 64 of the surveyed streams to analyze instream habitat, and data from 84 assessments to assess riparian habitat. The difference in the number of streams resulted from stewardship groups having different objectives when they undertook their assessment. For example, some groups took only instream measurements if they were developing a long-term instream restoration plan, while other groups performed both instream and riparian habitat assessments if they were also providing data to local governments for riparian mapping. In determining our final data set, we discarded assessments which were incomplete, missing critical numbers, or where results were suspect, for example where percentages exceeded 100.

Instream Habitat

We divided areas into regional districts, then averaged the percentages and ratings for each stream habitat component to determine overall ratings and classifications for individual habitat parameters, streams and regional districts (Table 2). In all cases, we divided ratings totals into 3 categories corresponding to poor, fair and good with the

highest numbers corresponding to the poor classification. We summarized the lengths of each reach classified as poor, fair and good and combined these to determine the linear lengths of streams falling within each classification.

Riparian Habitat

Volunteers had noted the percent of each type of land use along the stream and the USHP Excel program calculated an overall land use value based on that data. We divided the total land use value for all streams into 3 levels corresponding to poor, fair or good condition. We then summarized the linear length of altered sites along the stream, and reported the total percent of each type of land use for streams falling within the poor classification.

Table 1. Biostandards and ratings for instream fish habitat parameters (from Johnston and Slaney 1996; Michalski et al., 1998).

Habitat Parameter	Biostandard (of reach except where noted)	Classification
Pools	>55%	Good
	40 – 50%	Fair
	<40%	Poor
Instream Cover	>20%	Good
	6 – 20%	Fair
	0 – 5%	Poor
Large Woody Debris	>2 pieces/Bankfull channel width	Good
	1 – 2 pieces/Bankfull channel width	Fair
	<1piece/Bankfull channel width	Poor
Fines	<10%	Good
	10 – 20%	Fair
	>20%	Poor
Wetted Area	>90%	Good
	70 – 90%	Fair
	<70%	Poor
Land Use	Exposed, industrial, roads, commercial, livestock/farm, golf course	Poor
	Residential, lawns, farm/grass	Fair
	Natural	Good
Altered Sites	Any alteration to the natural riparian habitat – total length in meters.	

Table 2. East coast Vancouver Island small streams between Campbell River and Sooke by Regional District used in the analysis of instream and riparian quality (N=84)*.

Campbell River (n=16)
Kingfisher West (i)
Kingfisher East
Lamalchi Creek
Larwood Creek
Menzies Creek Upper (i)
Menzies Creek Lower (i)
Newman Creek (i)
Nunns Creek Upper (i)
Nunns Creek Lower (i)
Oyster Bay Stream 5 Low (i)
Oyster Bay Stream 5 Up (i)
Oyster Bay Stream 6 (i)
Oyster River (i)
Simms Creek
Willow Creek
Woods Creek (i)

Courtenay/Comox (n=29)
Ackinclose Creek (i)
Apple Creek (i)
Black Brook (i)
Chef Creek (i)
Courtenay No Name (i)
Deep Bay Creek
Happy Creek (i)
Hart Creek (i)
Jamison Creek (i)
Jenkins Creek (i)
Kitty Coleman Creek
Little River (i)
Millard Creek – Lower (i)
Millard Creek - Upper (i)
Piercy Creek Lower (i)
Piercy Creek Upper (i)
Piercy Creek Tributary #7 (i)
Piercy Creek Tributary #8 (i)
Portuguese Creek (i)
Riverbend Creek (i)
Roy Creek (i)
Scales Creek
South Nash Creek
Spence Creek (i)
Sully Creek
Thames Creek (i)
Tweedy Creek (i)
Valens Brook
Winter Creek

Nanaimo (n=12)
Beach Creek
Benson Creek
Bloods Creek
Chase River
Departure Bay Creek
Grandon Creek
Haslam Creek Lower
Haslam Creek Upper
Shelly Creek
Stray Creek
Thatcher Creek
Westglade Brook

Cowichan Valley (n=9)
Beaver Creek 1 (i)
Beaver Creek 2 (i)
Bings Creek (i)
Bonsall Creek
Money's wetland (i)
Porter Creek (i)
Somenos Creek (i)
Treffery Creek (i)
Whitehouse Creek

Victoria/Gulf Islands (n=18)
Ayum Creek (i)
Blackburn Creek (i)
Bullocks Creek
Cusheon Creek (i)
Descanzo Bay Creek (i)
Duck Creek (i)
Fulford Creek (i)
Ganner Creek (i)
Georgeson Creek
Greig Creek (i)
Jack Creek (i)
Maple Creek
Madrona Creek
McAfee Creek (i)
Murchison Creek (i)
Stowe Creek (i)
Walker Creek
Weston Creek (i)

* = all streams have riparian habitat;
(i) = indicates instream available.

Results

Habitat Classification – East Coast Vancouver Island

Overall, east coast streams were rated as fair when both instream and riparian habitat were considered, but both Nanaimo and Victoria/Gulf Islands regional districts were poor/fair, while Cowichan was poor overall (Table 3). Most regional districts received a fair rating for instream habitat, with only Cowichan and Victoria/Gulf Islands receiving poor ratings. Cowichan also received a poor rating for riparian habitat, as did Nanaimo.

With respect to instream habitat, all but Cowichan had good instream cover and most other parameters were rated as fair for all districts (Table 3). Streams in all regional districts had poor amounts of cover in the form of Large Woody Debris (LWD) (Figure 2) and excessive amounts of sediment (Figure 3). While all regional districts had poor amounts of wetted area (Figure 4), the pool habitat within these areas was rated as good (Figure 5).

Table 3. Values and ratings for instream and riparian habitat parameters measured in east coast Vancouver Island streams between 1996-2003 by regional district (N=84).

	Campbell River	Courtney/ Comox	Nanaimo	Cowichan	Victoria/Gulf Islands	East Coast Vancouver Island
Instream Habitat						
% Pool Area	56.6	44.6	47.2	61.1	43.4	50.6
Rating	2.1	2.9	2.8	2.7	3.3	2.8
Classification	Good	Fair	Fair	Fair	Fair	Fair
LWD/BFW	0.3	0.9	1.1	0.3	1.3	0.8
Rating	4.8	3.6	3.7	5	4.2	4.3
Classification	Poor	Poor	Poor	Poor	Poor	Poor
% Instream Cover	36.2	36.3	30.7	25.2	16.9	29.1
Rating	1.4	1.8	1.9	3	2.2	2.1
Classification	Good	Good	Good	Fair	Good	Good
% Fines	56	57.7	42.4	59	44.1	51.8
Rating	4.8	4.7	4.5	5	4.4	4.7
Classification	Poor	Poor	Poor	Poor	Poor	Poor
% Wetted Area	55	57.4	57.6	53.8	52.7	55.3
Rating	4.5	4.8	4.6	4.4	4.4	4.5
Classification	Poor	Poor	Poor	Poor	Poor	Poor
Instream Ratings	17.7	17.9	17.5	20.1	18.5	18.3
Classification	Fair	Fair	Fair	Poor	Poor	Fair
Riparian Habitat						
Landuse Value	14	16	49	20	18	23.3
Classification	Fair	Fair	Poor	Poor	Fair	Fair
Overall Classification	Fair	Fair	Poor-Fair	Poor	Poor-Fair	Fair

Instream Ratings and Classifications		Land Use Ratings and Classifications	
1.0--2.5	Good	1—10	Good
2.6--3.5	Fair	11—20	Fair
3.5--5.0	Poor	>20	Poor

Figure 2. Comparison of LWD/BFW in each regional district compared to the east coast Vancouver Island average and good and poor biostandards (N=64).

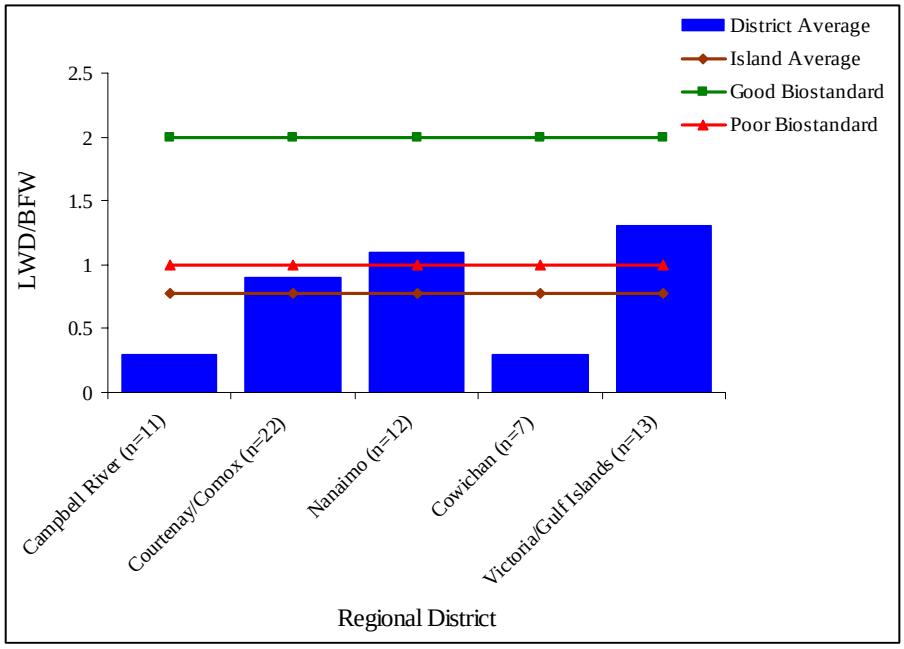


Figure 3. Comparison of percentage of sediment in each regional district compared to the east coast Vancouver Island average and good and poor biostandards (N=64).

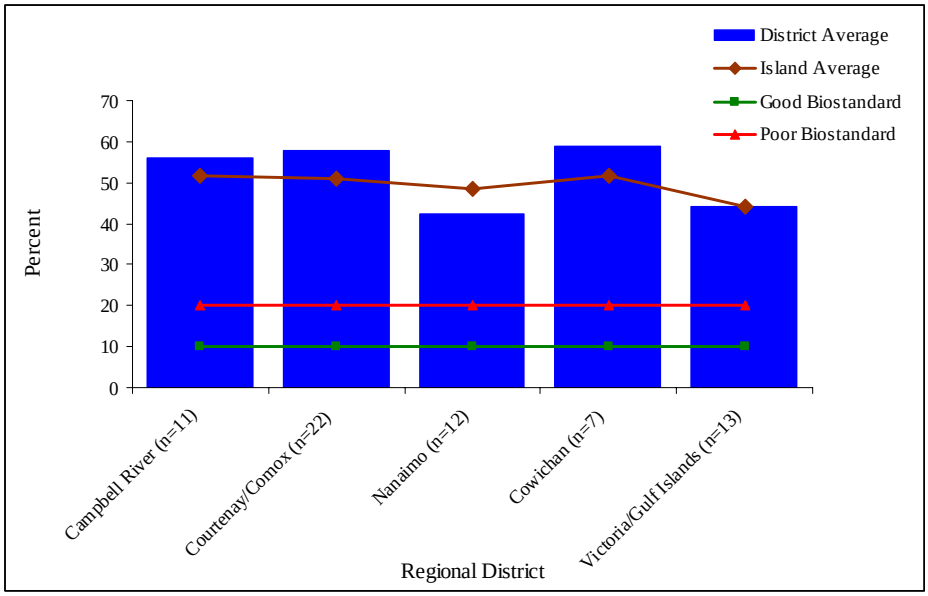


Figure 4. Comparison of percentage of wetted area of each regional district compared to the east coast Vancouver Island average and good and poor biostandards (N=64).

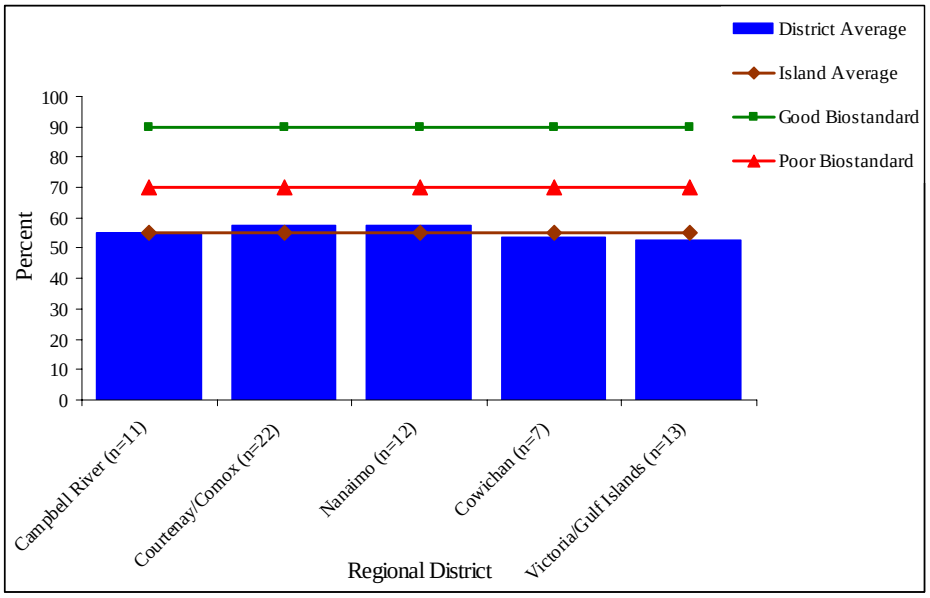
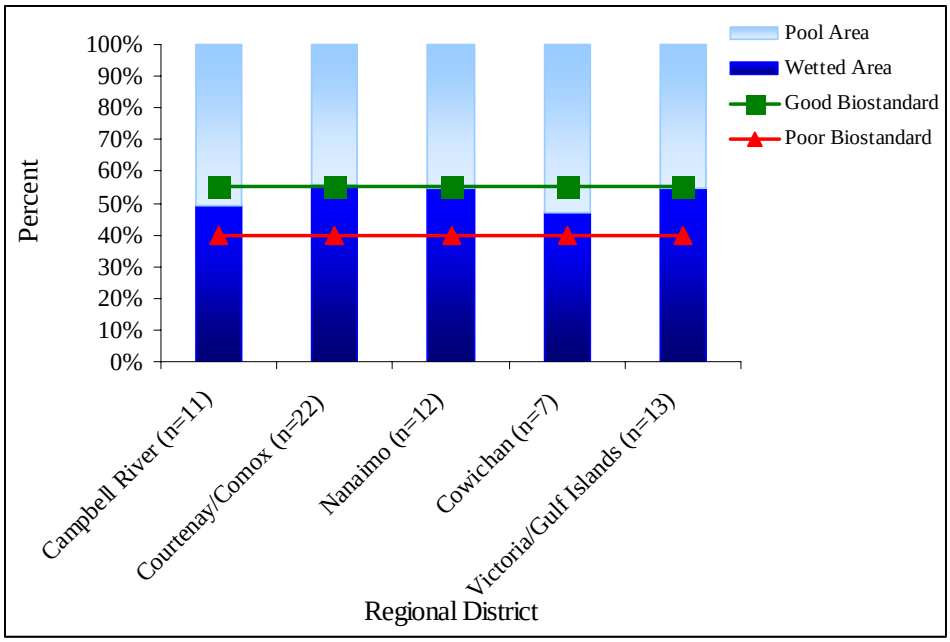


Figure 5. Comparison of percentage of wetted area of each regional district to the east coast Vancouver Island average and good and poor biostandards (N=64).



Habitat Classification – Streams

We compared streams within each regional district to the Vancouver Island average and the biostandards for good and poor habitat and present that information by regional district in Figures 6-30.

Within regional districts, instream cover in the form of LWD and amounts of sediment were consistently rated as poor and, therefore, as primary factors limiting fish production. Many streams, especially in the Courtenay/Comox and Nanaimo regional districts had no LWD cover, while streams in all other regional districts consistently fell below the poor classification for that parameter. Moreover, each regional district had at least some streams which approached 100% sediment in their bed material, and most streams fell well below the poor classification for this parameter as well. With few exceptions, mostly in the northern-most regional districts, streams also fell short of the poor classification with respect to wetted area.

Figure 6. Percent pools in Campbell River Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

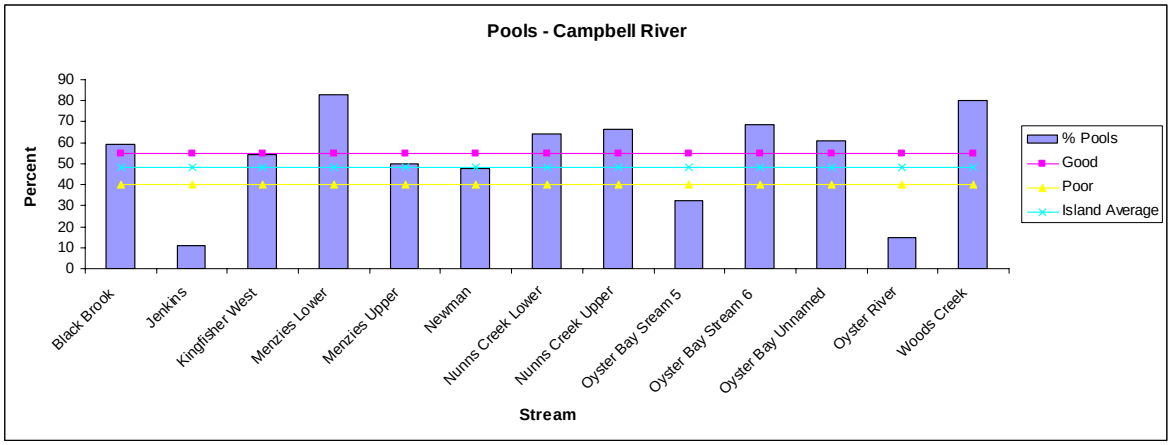


Figure 7. Large Woody Debris/Bankful Channel Width of Campbell River Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

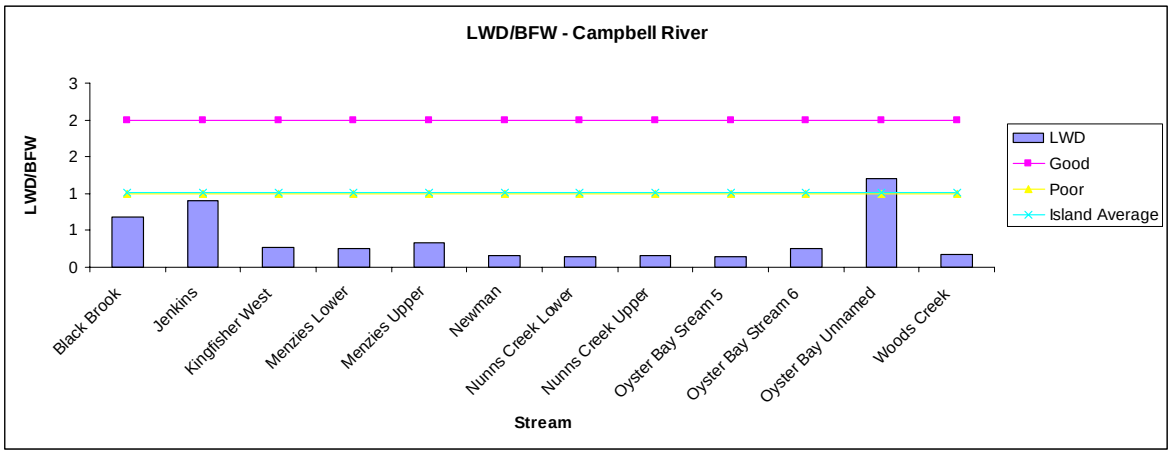


Figure 8. Percent instream cover in Campbell River Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

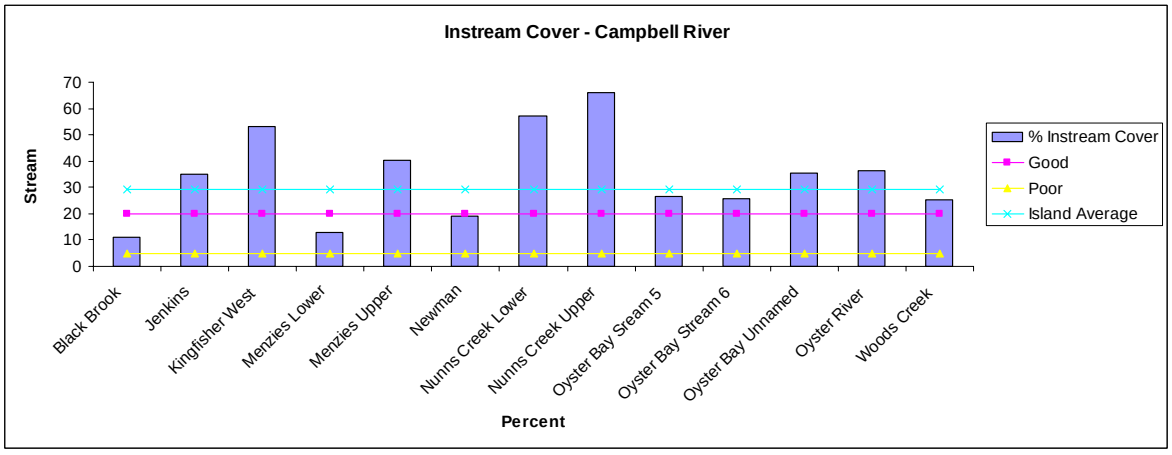


Figure 9. Percent fines in Campbell River Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

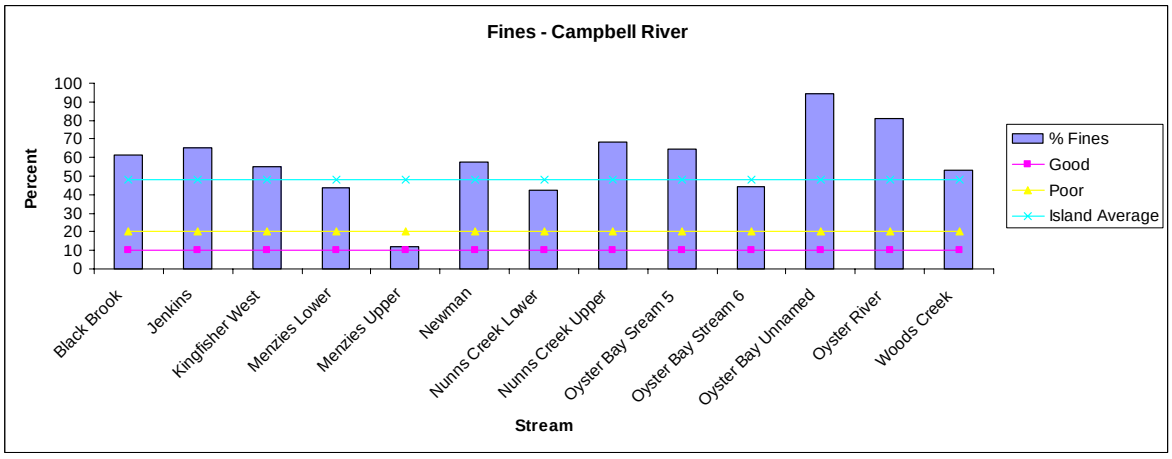


Figure 10. Percent wetted area of Campbell River Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

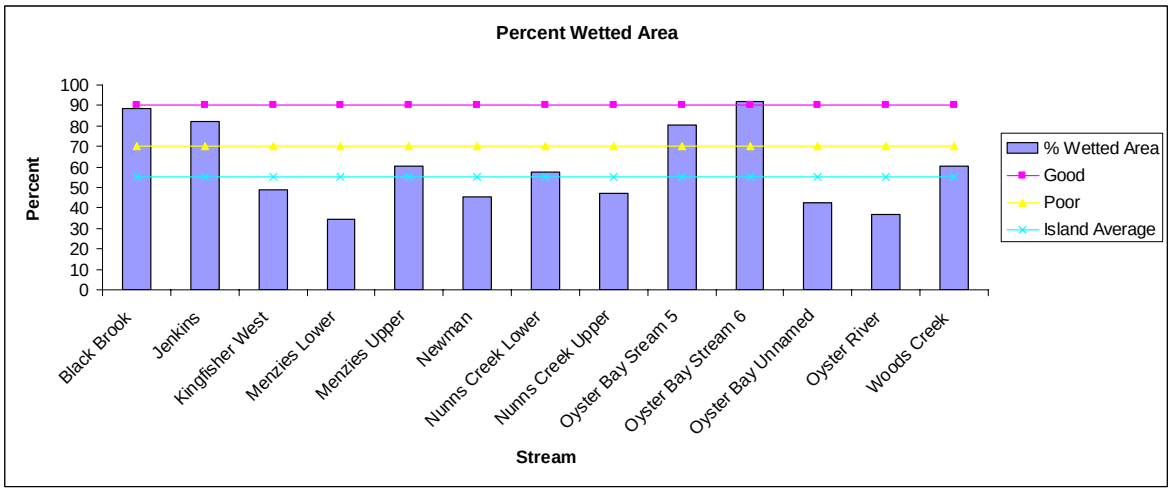


Figure 11. Percent pool area in Courtenay/Comox Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

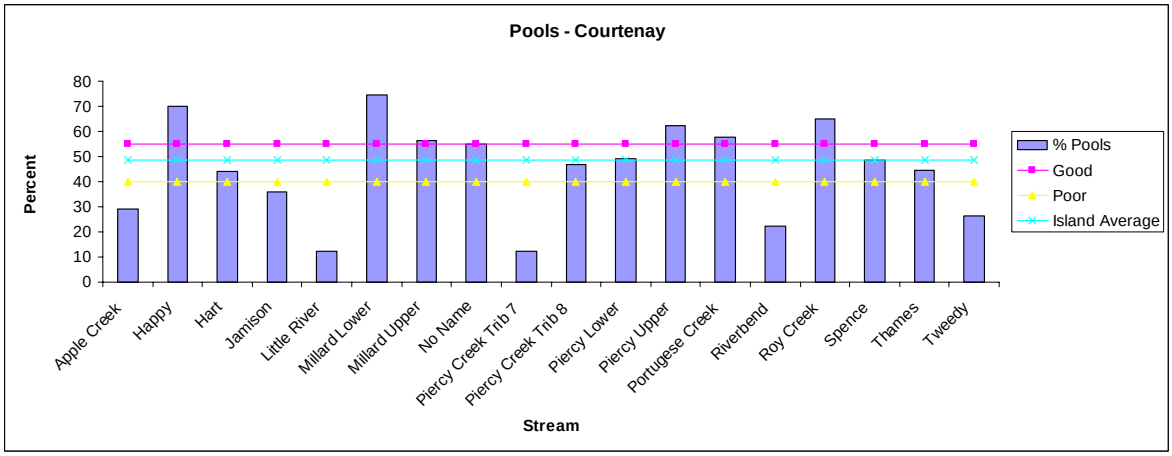


Figure 12. Large Woody Debris/Bankful Channel Width of Courtenay/Comox Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

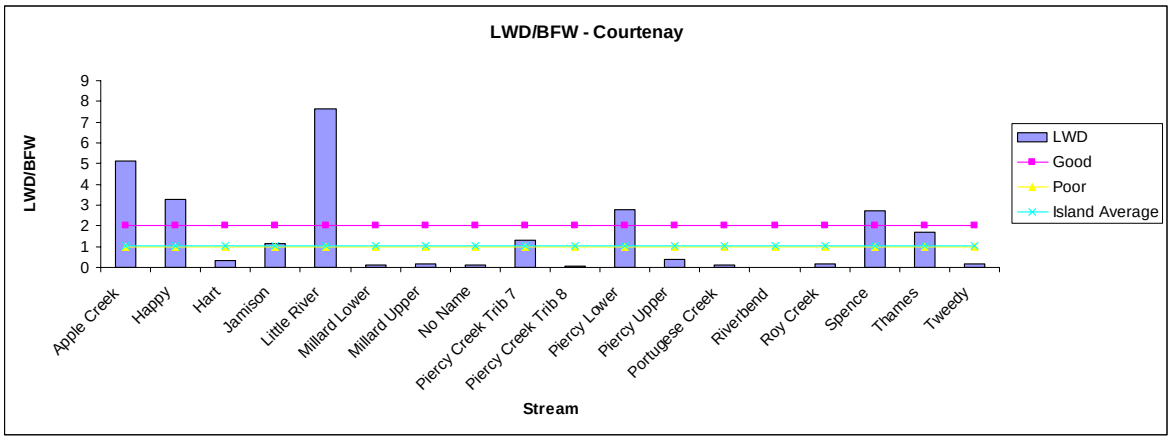


Figure 13. Percent instream cover in Courtenay/Comox Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

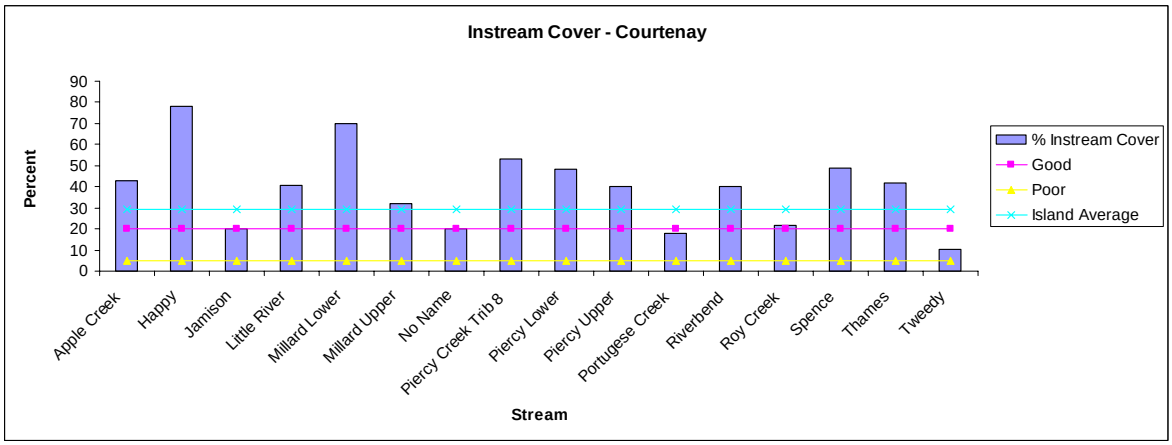


Figure 14. Percent fines in Courtenay/Comox Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

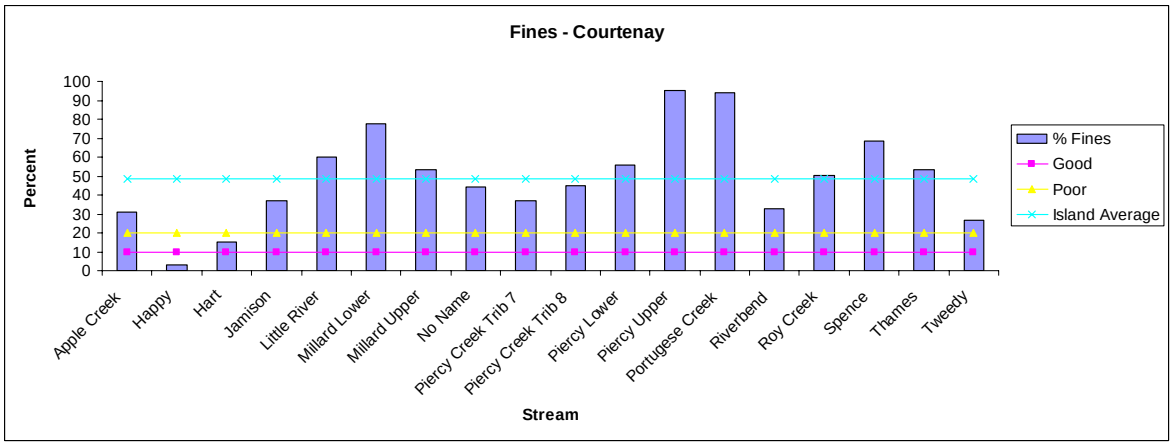


Figure 15. Percent wetted area in Courtenay/Comox Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

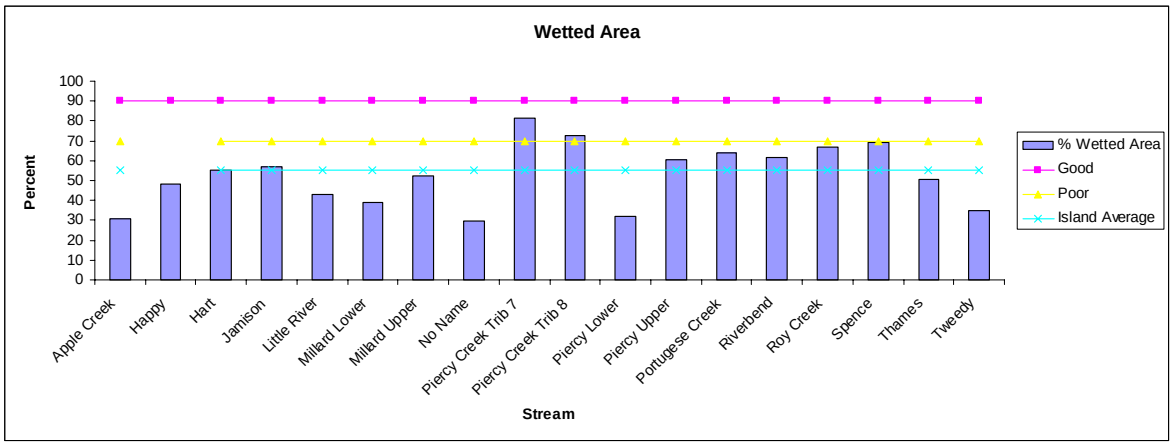


Figure 16. Percent pools in Nanaimo Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

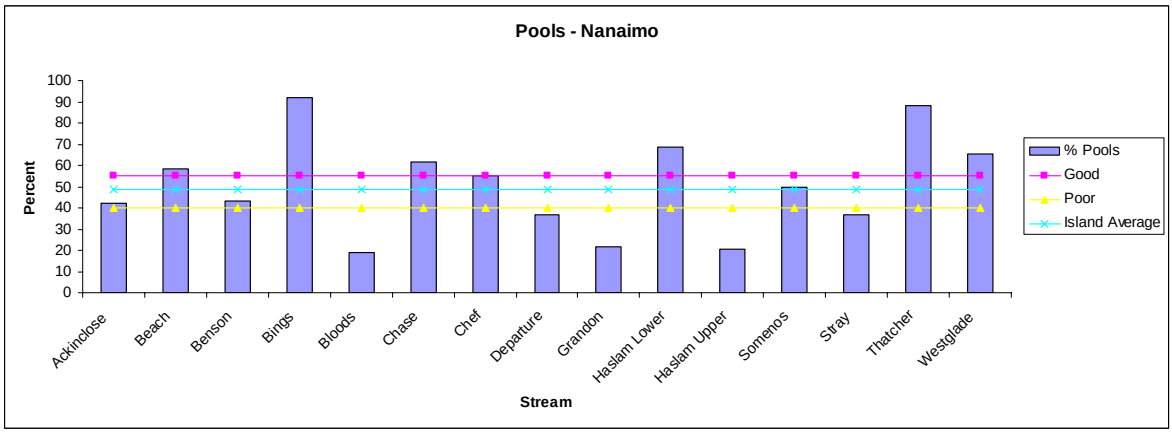


Figure 17. Large Woody Debris/Bankful Channel Width of Nanaimo Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

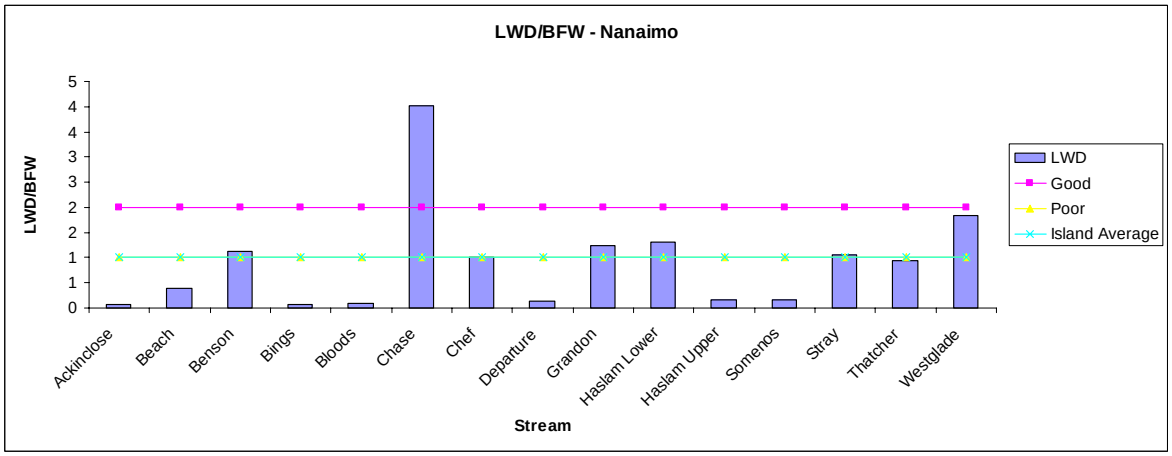


Figure 18. Percent instream cover in Nanaimo Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

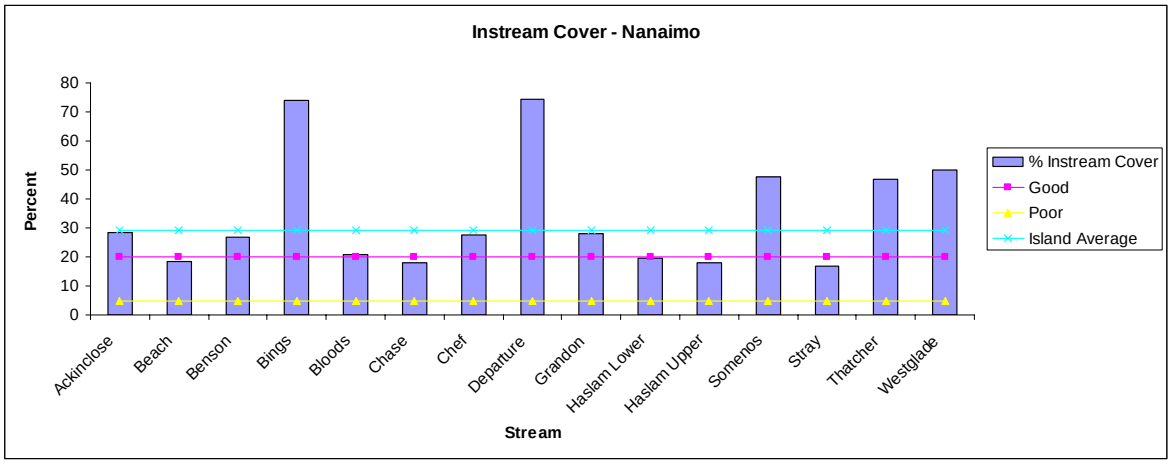


Figure 19. Percent fines in Nanaimo Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

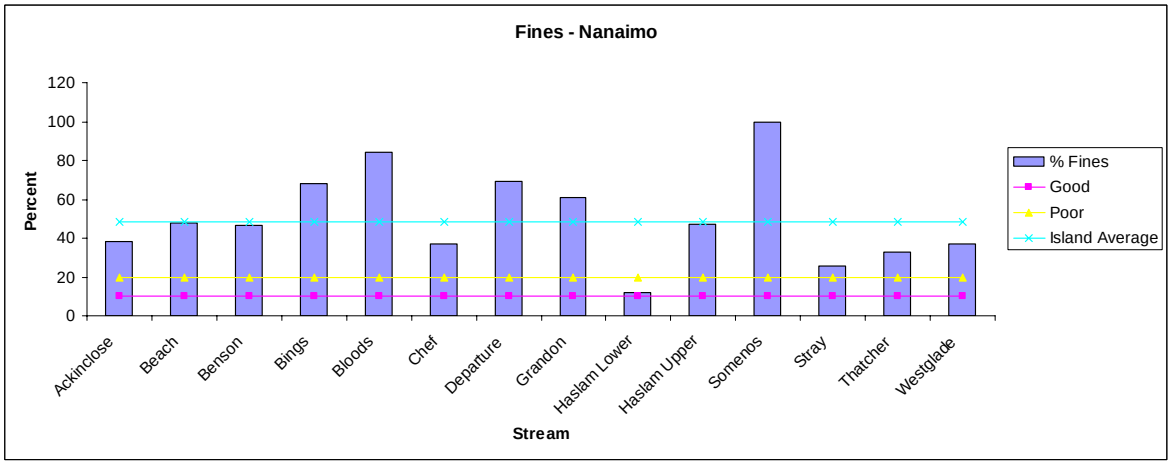


Figure 20. Percent wetted area of Nanaimo Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

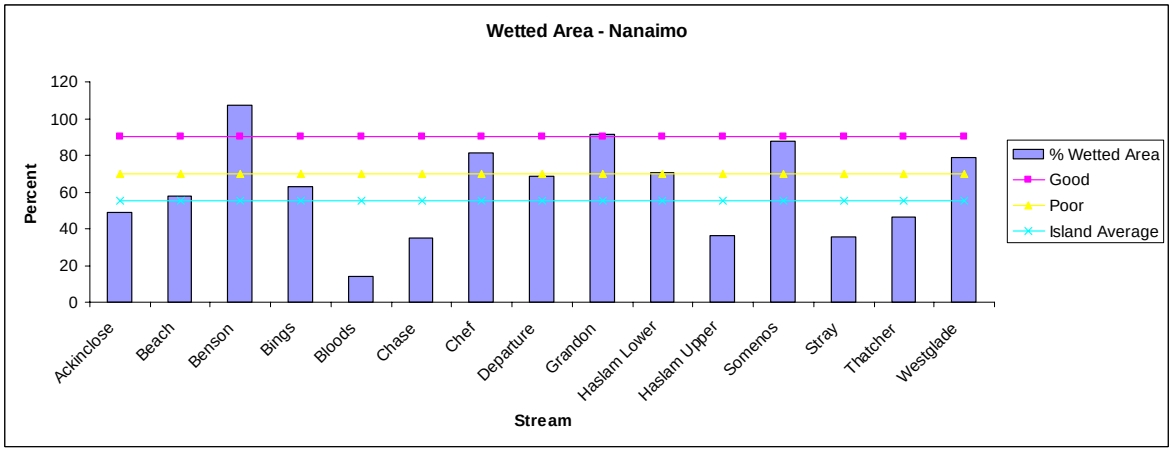


Figure 21. Percent pools in Cowichan Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

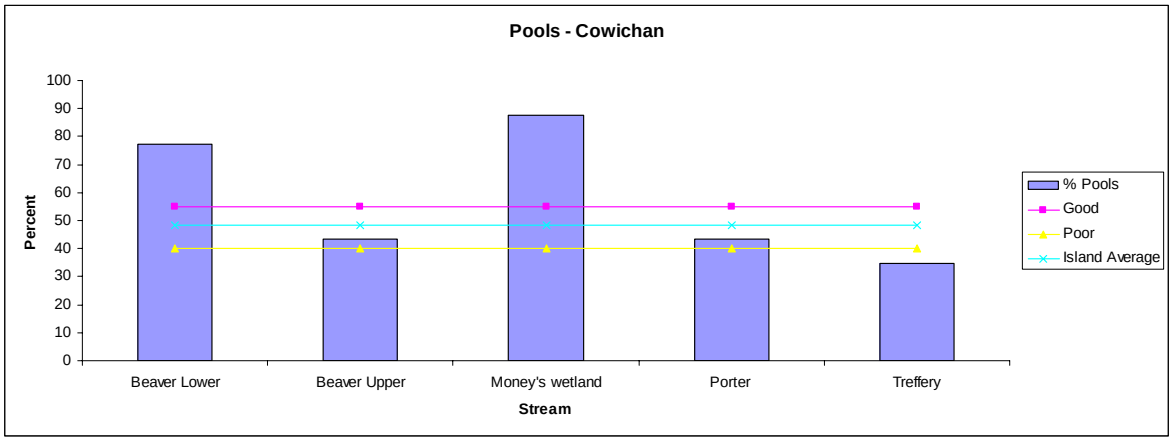


Figure 22. Large Woody Debris/Bankful Channel Width of Cowichan Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

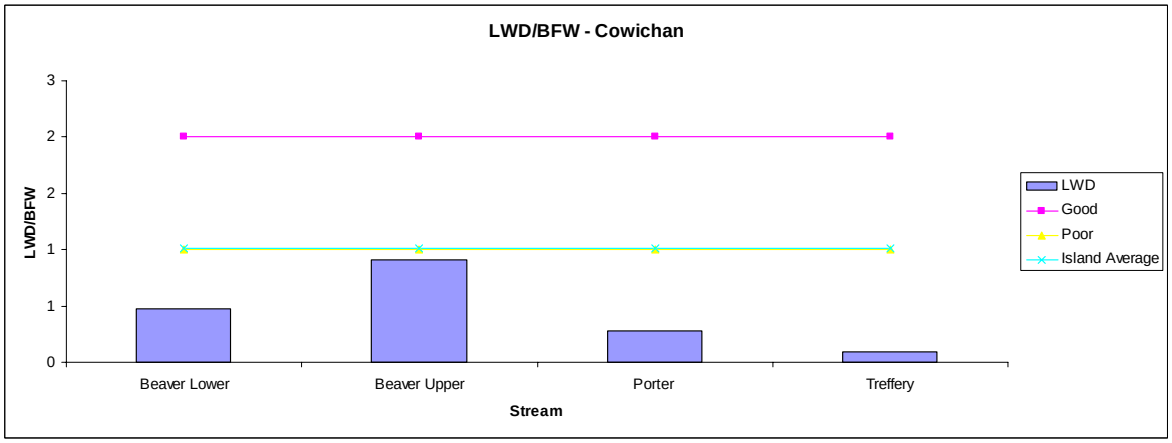


Figure 23. Percent instream cover in Cowichan Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

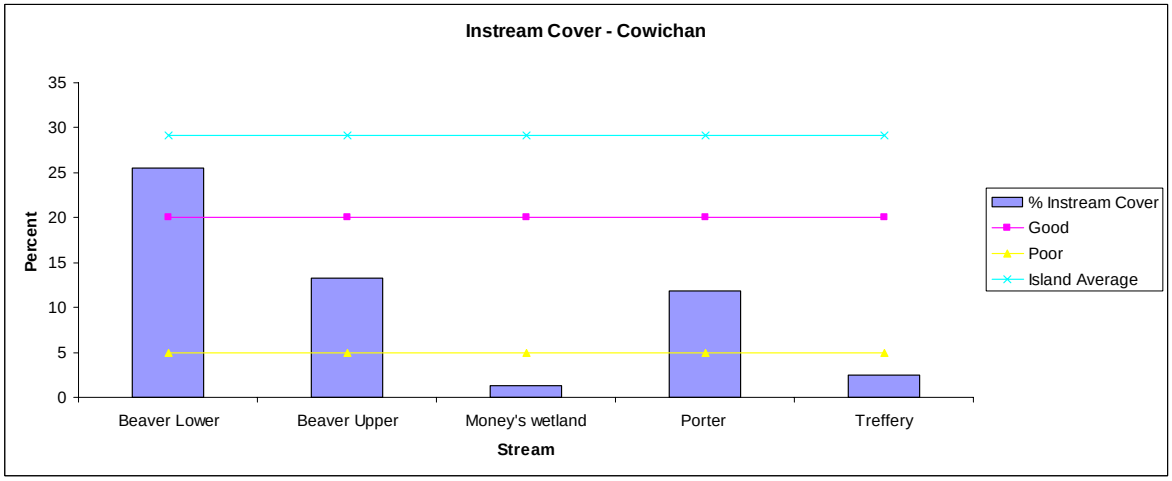


Figure 24. Percent fines in Cowichan Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

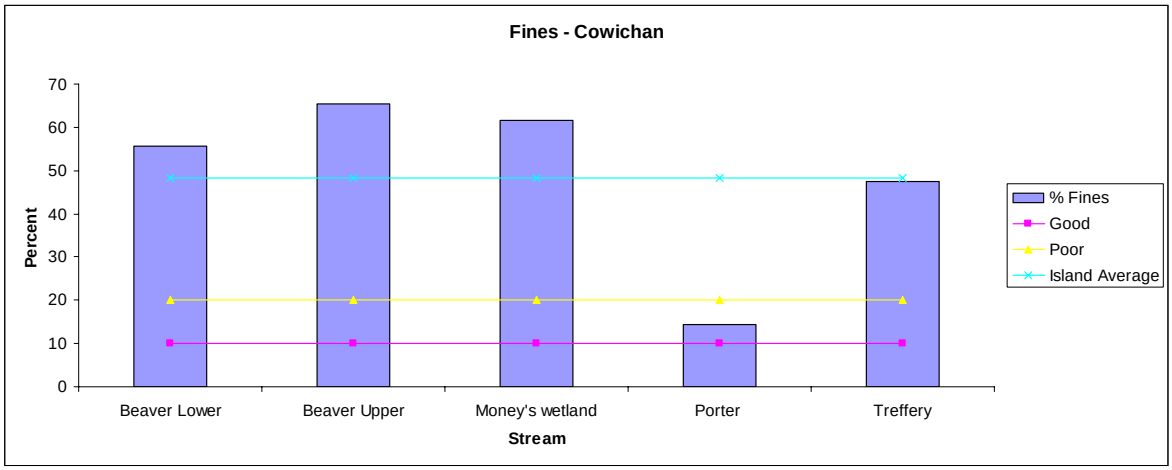


Figure 25. Percent wetted area of Cowichan Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

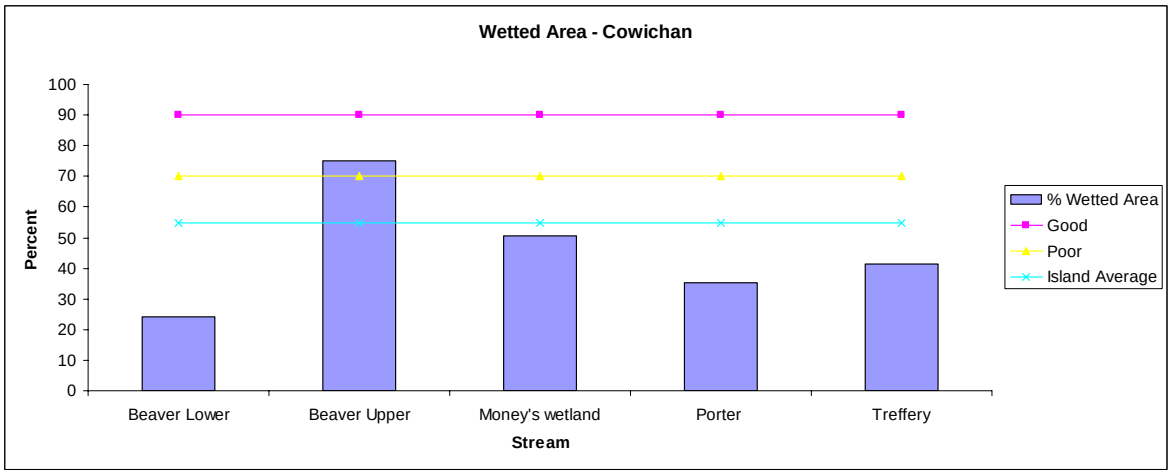


Figure 26. Percent pools in Victoria/Gulf Islands Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

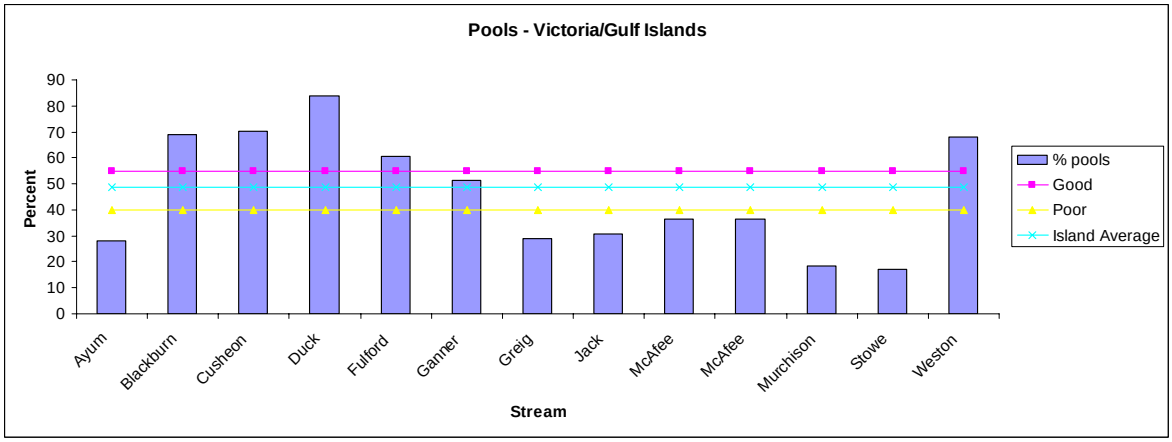


Figure 27. Large Woody Debris/Bankful Channel Width in Victoria/Gulf Islands Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

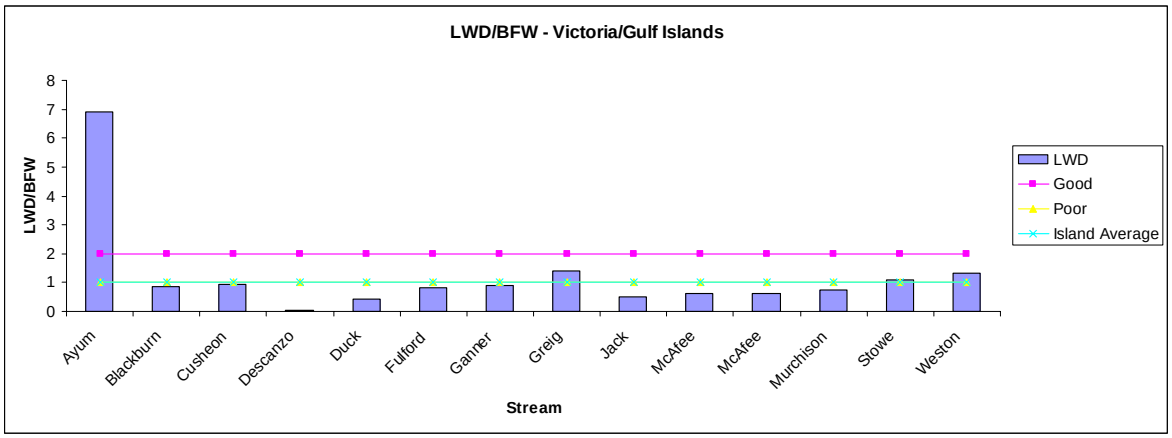


Figure 28. Percent instream cover in Victoria/Gulf Islands Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

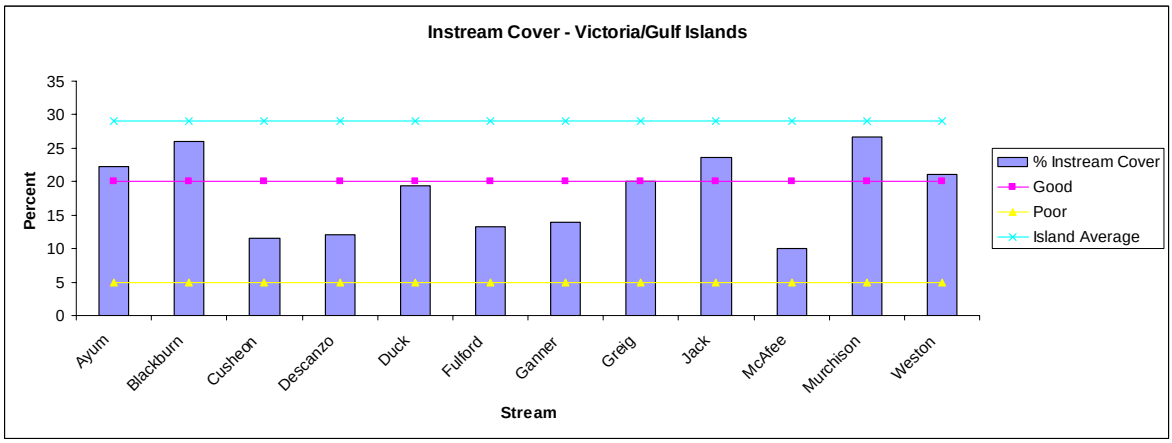


Figure 29. Percent fines in Victoria/Gulf Islands Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.

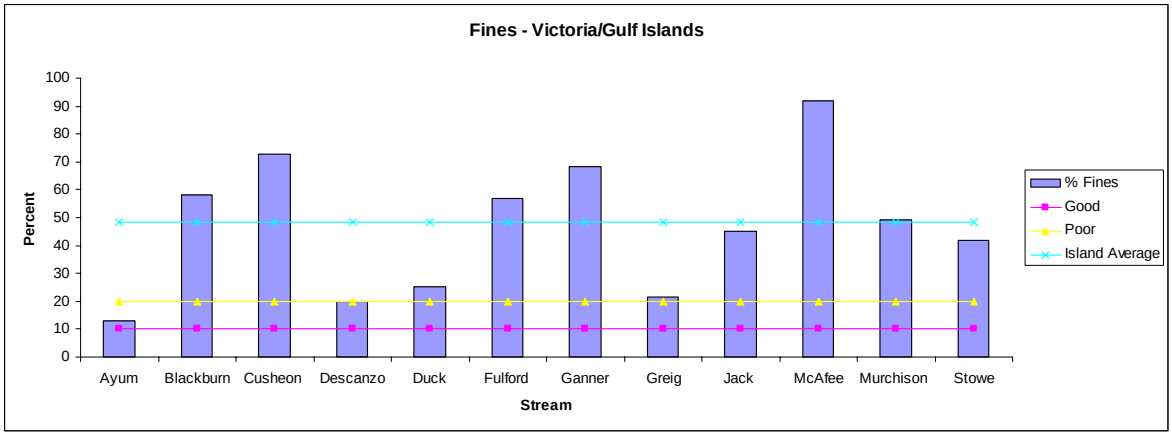
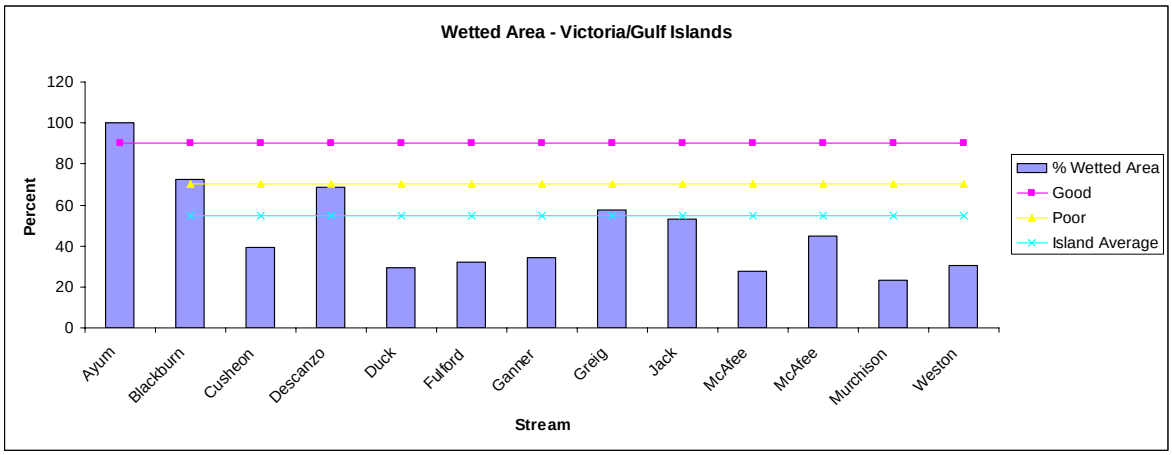


Figure 30. Percent wetted area of Victoria/Gulf Islands Regional District streams compared to Vancouver Island average and biostandards for good and poor habitat.



We present the quantitative measures and corresponding ratings for individual streams in Table 4. Cowichan, the only regional district which rated as poor overall, had poor ratings for land use and all instream parameters with the exception of percent pool area and instream cover which both rated as fair. Within this regional district, all streams received poor ratings for both the amount of LWD/BFW and sediment, and all but two streams received poor ratings for percent wetted area.

Nanaimo and Victoria/Gulf Islands were both rated as poor-fair overall, and both of these regional districts were rated as poor for the amount of LWD/BFW, percent wetted area and sediment. Nanaimo also received a poor rating for riparian habitat while Victoria/Gulf Islands received a fair rating. Ninety percent of streams in the Nanaimo district were rated as poor for both percent wetted area and sediment. In Victoria/Gulf Islands, 85% of streams were rated as poor for wetted area; 77% were rated as poor for the percentage of sediment and 70% were poor with respect to the amount of LWD/BFW. Nanaimo received a poor rating for riparian habitat, while Victoria/Gulf Islands received a fair rating for that parameter.

Campbell River and Courtenay/Comox both received overall ratings as fair, but both regional districts also rated as poor with respect to the amount of LWD/BFW, percent wetted area and sediment. Ninety percent of the streams assessed in each of these regional districts received poor ratings for the amount of sediment, and 90% of the streams in Courtenay/Comox rated as poor for percent wetted area. While both regional districts had good instream cover, only Campbell River had good percent pool area. Both districts had fair ratings for riparian habitat.

Table 4. Amounts and classifications for individual instream and riparian habitat parameters for east coast Vancouver Island streams.

Regional District and Stream	% Pool Area	Rating	Class	LWD/BFW	Rating	Class	% Instream Cover	Rating	Class	% Fines	Rating	Class	% Wetted Area	Rating	Class	Total Ratings	Instream Class	Landuse Value	Riparian Class	Overall Classification
Campbell River (n=16)																				
Kingfisher East	-	-		-	-		-	-		-	-		-	-		-	-	24	Poor	-
Kingfisher West	54.3	1	Good	0.3	5	Poor	53.0	1	Good	55.0	5	Poor	49.1	5	Poor	17	Fair	13	Fair	Fair
Lamalchi Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	Fair	-
Larwood Crek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	Fair	-
Menzies 1999	49.9	3	Fair	0.3	5	Poor	40.2	1	Good	12.3	3	Fair	60.6	1	Good	13	Fair	17	Fair	Fair
Menzies Creek 1998	83.1	1	Good	0.3	5	Poor	12.8	3	Fair	43.8	5	Poor	34.4	5	Poor	19	Poor	9	Good	Fair
Newman Creek	47.6	3	Fair	0.2	5	Poor	19.2	3	Fair	57.3	5	Poor	45.2	5	Poor	21	Poor	8	Good	Fair
Nunns Creek 1998	64.0	1	Good	0.1	5	Poor	57.2	1	Good	42.5	5	Poor	57.3	5	Poor	17	Fair	13	Fair	Fair
Nunns Creek 1999	66.5	1	Good	0.2	5	Poor	66.2	1	Good	68.3	5	Poor	47.4	5	Poor	17	Fair	12	Fair	Fair
Oyster Bay Stream 5 1997	32.5	5	Poor	0.2	5	Poor	26.5	1	Good	64.5	5	Poor	80.2	3	Fair	19	Poor	5	Good	Fair
Oyster Bay Stream 6 1997	68.5	1	Good	0.3	5	Poor	25.8	1	Good	44.2	5	Poor	92.0	5	Poor	17	Fair	9	Good	Fair
Oyster Bay Stream 1999	14.6	5	Poor	0.0	5	Poor	36.2	1	Good	81.3	5	Poor	36.8	5	Poor	21	Poor	18	Fair	Poor-Fair
Oyster River	61.1	1	Good	1.2	3	Fair	35.3	1	Good	94.5	5	Poor	42.3	5	Poor	15	Fair	6	Good	Fair
Simms Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33	Poor	-
Willow Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22	Poor	-
Woods Creek	80.0	1	Good	0.2	5	Poor	25.3	1	Good	53.0	5	Poor	60.2	5	Poor	17	Fair	7	Good	Fair-Good
Averages	56.6	2.1	Good	0.3	4.8	Poor	36.2	1.4	Good	56.0	4.8	Poor	55.0	4.5	Poor	17.5	Fair	14	Fair	Fair
Total Ratings Ranges: 13-15; 16-18; 19-21																				
Courtney/Comox (n=29)																				
Ackinclose Creek	42.2	3	Fair	0.1	5	Poor	28.4	1	Good	38.1	5	Poor	48.8	5	Poor	19	Poor	8	Good	Fair
Apple Creek	29.1	5	Poor	5.1	1	Good	42.8	1	Good	31.2	5	Poor	30.8	5	Poor	17	Fair	8	Good	Fair-Good
Black Brook	59.0	1	Good	0.7	5	Poor	11.0	3	Fair	61.5	5	Poor	66.4	5	Poor	19	Poor	9	Good	Fair
Chef Creek	55.0	3	Fair	1.0	3	Fair	27.4	5	Poor	36.8	5	Poor	81.3	5	Poor	21	Poor	30	Poor	Poor
Courtenay No Name Creek	55.2	1	Good	0.1	5	Poor	20.0	1	Good	44.4	5	Poor	29.4	5	Poor	17	Fair	8	Good	Fair-Good
Deep Bay Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	Poor	-
Happy Creek	70.1	1	Good	3.3	1	Good	78.3	1	Good	2.9	1	Good	48.0	5	Poor	9	Good	16	Fair	Fair-Good
Hart Creek	44.0	3	Fair	0.3	5	Poor	1.9	5	Poor	15.2	3	Fair	55.4	5	Poor	21	Poor	18	Fair	Poor-Fair
Jamison Creek	35.9	5	Poor	1.2	3	Fair	19.8	3	Fair	36.8	5	Poor	57.2	5	Poor	21	Poor	12	Fair	Poor-Fair
Jenkins Creek	11.2	5	Poor	0.9	5	Poor	35.0	1	Good	65.0	5	Poor	82.3	5	Poor	21	Poor	6	Good	Fair
Kitty Coleman Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21	Poor	-
Little River	12.1	5	Poor	7.7	1	Good	40.4	1	Good	59.7	5	Poor	42.8	5	Poor	17	Fair	4	Good	Fair-Good
Millard Creek Lower	74.5	1	Good	0.1	5	Poor	70.2	1	Good	77.4	5	Poor	38.7	5	Poor	17	Fair	19	Fair	Fair
Millard Creek Upper	56.3	1	Good	0.2	5	Poor	32.3	1	Good	53.3	5	Poor	52.2	5	Poor	17	Fair	12	Fair	Fair
Piercy Creek Lower	62.5	1	Good	0.4	5	Poor	40.0	1	Good	95.0	5	Poor	60.4	5	Poor	17	Fair	22	Poor	Poor-Fair
Piercy Creek Upper	49.1	3	Fair	2.8	1	Good	48.1	1	Good	55.5	5	Poor	32.2	5	Poor	15	Fair	26	Poor	Poor-Fair
Piercy Creek Tributary #7 1997	12.5	5	Poor	1.3	3	Fair	7.2	3	Fair	36.8	5	Poor	81.3	3	Fair	19	Poor	10	Fair	Poor-Fair
Piercy Creek Tributary #8 1997	47.0	3	Fair	0.1	5	Poor	53.3	1	Good	45.0	5	Poor	72.4	3	Fair	17	Fair	5	Good	Fair
Portugese Creek	57.8	1	Good	0.1	5	Poor	17.8	3	Fair	94.2	5	Poor	63.7	5	Poor	19	Poor	32	Poor	Poor
Riverbend Creek	22.4	5	Poor	0.0	5	Poor	40.0	1	Good	32.5	5	Poor	61.7	5	Poor	21	Poor	11	Fair	Poor-Fair
Roy Creek	65.2	1	Good	0.1	5	Poor	21.7	1	Good	50.3	5	Poor	66.6	5	Poor	17	Fair	37	Poor	Poor-Fair

Regional District and Stream	% Pool Area	Rating	Class	LWD/BFW	Rating	Class	% Instream Cover	Rating	Class	% Fines	Rating	Class	% Wetted Area	Rating	Class	Total Ratings	Instream Class	Landuse Value	Riparian Class	Overall Classification
Scales Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	Good	-
South Nash Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	Fair	-
Spence Creek	48.4	3	Fair	2.8	1	Good	48.6	1	Good	68.4	5	Poor	69.0	5	Poor	15	Fair	28	Poor	Poor-Fair
Sully Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	Good	-
Thames Creek	44.6	3	Fair	1.7	1	Good	41.6	1	Good	53.1	5	Poor	50.3	5	Poor	15	Fair	28	Poor	Poor-Fair
Tweedy Creek	26.3	5	Poor	0.2	5	Poor	10.5	3	Fair	26.5	5	Poor	34.8	5	Poor	23	Poor	16	Fair	Poor-Fair
Valens Brook	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	Good	-
Winter Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22	Poor	-
Averages	44.6	2.9	Fair	0.8	3.6	Poor	35.9	1.8	Good	57.3	4.7	Poor	56.9	4.8	Poor	17.9	Fair	14	Fair	Fair
Total Ratings Ranges: 9.0-13.0; 13.1-18.0; 18.1-23.0																				
Nanaimo (n=12)																				
Beach Creek	58.3	1	Good	0.4	5	Poor	18.3	3	Fair	47.6	5	Poor	57.8	5	Poor	19	Poor	97	Poor	Poor
Benson Creek	43.1	1	Good	1.1	3	Fair	26.8	1	Good	46.7	5	Poor	100.0	1	Good	11	Good	21	Poor	Fair
Bloods Creek	19.0	5	Poor	0.1	5	Poor	21.0	1	Good	83.9	5	Poor	13.9	5	Poor	21	Poor	6	Good	Fair
Chase River	61.6	1	Good	4.0	1	Good	18.1	3	Fair	3.0	1	Good	34.9	5	Poor	11	Good	198	Poor	Poor
Departure Bay Creek	36.6	5	Poor	0.1	5	Poor	74.5	1	Good	69.4	5	Poor	68.6	5	Poor	21	Poor	7	Good	Good
Grandon Creek	21.4	5	Poor	1.2	3	Fair	28.0	1	Good	60.6	5	Poor	91.6	5	Poor	19	Poor	12	Fair	Poor-Fair
Haslam Creek Lower	68.6	5	Poor	1.3	3	Fair	19.5	3	Fair	11.7	3	Fair	70.8	5	Poor	19	Poor	78	Poor	Poor
Haslam Creek Upper	20.6	1	Good	0.2	5	Poor	18.2	3	Fair	47.4	5	Poor	35.9	5	Poor	19	Poor	76	Poor	Poor
Shelly Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	Good	-
Stray Creek	36.6	5	Poor	1.1	3	Fair	16.8	3	Fair	26.0	5	Poor	35.7	5	Poor	21	Poor	15	Fair	Poor-Fair
Thatcher Creek	87.9	1	Good	0.9	5	Poor	47.0	1	Good	32.9	5	Poor	46.3	5	Poor	17	Fair	46	Poor	Poor
Westglade Brook	65.5	1	Good	1.8	3	Fair	49.9	1	Good	37.2	5	Poor	78.4	5	Poor	15	Fair	17	Fair	Fair
Averages	47.2	2.8	Fair	1.1	3.7	Poor	30.7	1.9	Good	42.4	4.5	Poor	57.6	4.6	Poor	17.5	Fair	49	Poor	Poor-Fair
Total Ratings Ranges: 11-14; 14.1-17.9; 18-21																				
Cowichan (n=9)																				
Beaver Creek 1	77.3	3	Fair	0.5	5	Poor	25.5	3	Fair	55.7	5	Poor	24.1	3	Fair	19	Poor	11	Fair	Poor-Fair
Beaver Creek 2	43.5	3	Fair	0.9	5	Poor	13.3	3	Fair	65.5	5	Poor	75.2	3	Fair	19	Poor	14	Fair	Poor-Fair
Bings Creek	91.7	1	Good	0.1	5	Poor	74.0	1	Good	68.3	5	Poor	62.8	5	Poor	17	Fair	6	Good	Fair-Good
Bonsall Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	53	Poor	-
Money's Wetland	87.4	1	Good	0.0	5	Poor	1.3	5		61.7	5	Poor	50.4	5	Poor	21	Poor	3	Good	Fair
Porter Creek	43.4	3	Fair	0.3	5	Poor	11.9	3	Fair	14.3	5	Poor	35.3	5	Poor	21	Poor	60	Poor	Poor
Somenos Creek	50.0	3	Fair	0.2	5	Poor	47.5	1	Good	100.0	5	Poor	87.6	5	Poor	19	Poor	10	Fair	Poor-Fair
Treffery Creek	34.5	5	Poor	0.1	5	Poor	2.5	5		47.6	5	Poor	41.3	5	Poor	25	Poor	6	Good	Fair
Whitehouse Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	Fair	-
Averages	61.1	2.7	Fair	0.3	5.0	Poor	25.2	3.0	Fair	59.0	5.0	Poor	53.8	4.4	Poor	20.1	Poor	20	Poor	Poor
Total Ratings Ranges: 17-19.0; 19.1-20.9; 21-25																				
Victoria/Gulf Islands (n=18)																				
Ayum Creek	28.2	5	Poor	6.9	1	Good	22.2	1	Good	12.9	3	Fair	100.0	1	Good	11	Good	16	Fair	Fair-Good
Blackburn Creek	69.0	1	Good	0.9	5	Poor	26.0	1	Good	58.0	5	Poor	72.7	5	Poor	17	Fair	10	Fair	Fair
Bullocks Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	Fair	-

Regional District and Stream	% Pool Area	Rating	Class	LWD/BFW	Rating	Class	% Instream Cover	Rating	Class	% Fines	Rating	Class	% Wetted Area	Rating	Class	Total Ratings	Instream Class	Landuse Value	Riparian Class	Overall Classification
Cusheon Creek	70.0	1	Good	0.9	5	Poor	11.6	3	Fair	72.9	5	Poor	39.0	5	Poor	19	Poor	34	Poor	Poor
Descanzo Bay Creek	1.1	5	Poor	0.0	5	Poor	12.0	3	Fair	20.0	3	Fair	68.4	5	Poor	21	Poor	68	Poor	Poor
Duck Creek	83.9	1	Good	0.4	5	Poor	19.4	3	Fair	25.0	5	Poor	29.5	5	Poor	19	Poor	14	Fair	Poor-Fair
Fulford Creek	60.7	1	Good	0.8	5	Poor	13.3	3	Fair	56.8	5	Poor	32.3	5	Poor	19	Poor	49	Poor	Poor
Ganner Creek	51.2	3	Fair	0.9	5	Poor	14.0	3	Fair	68.3	5	Poor	34.1	5	Poor	21	Poor	14	Fair	Poor-Fair
Georgeson Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	Fair	-
Greig Creek	29.0	5	Poor	1.4	3	Fair	20.0	1	Good	21.5	5	Poor	57.3	5	Poor	19	Poor	8	Good	Fair
Jack Creek	30.6	5	Poor	0.5	5	Poor	23.6	1	Good	45.3	5	Poor	53.1	5	Poor	21	Poor	15	Fair	Poor-Fair
Madrona Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	Good	-
Maple Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	Good	-
McAfee Creek	36.3	5	Poor	0.6	5	Poor	10.0	3	Fair	91.7	5	Poor	44.6	5	Poor	23	Poor	10	Fair	Poor-Fair
Murchison Creek	18.5	5	Poor	0.7	5	Poor	26.7	1	Good	49.2	5	Poor	23.0	5	Poor	21	Poor	17	Fair	Poor-Fair
Stowe Creek	17.2	5	Poor	1.1	3	Fair	0.0	5	Poor	41.7	5	Poor	100.0	1	Good	19	Poor	10	Fair	Poor-Fair
Walker Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	Fair	-
Weston Creek	68.0	1	Good	1.3	3	Fair	21.0	1	Good	9.5	1	Good	30.4	5	Poor	11	Good	11	Fair	Fair-Good
Averages	43.4	3.3	Fair	1.3	4.2	Poor	16.9	2.2	Good	44.1	4.4	Poor	52.7	4.4	Poor	18.5	Poor	18	Fair	Poor-Fair

Quantity of Poor, Fair and Good Habitat

We present the lengths of instream and riparian habitat classified as poor, fair and good in each regional district in Table 5, and the classifications and lengths of individual streams in Appendix 2. Of the over 500 km of streams assessed, approximately 16% of that length was rated as good, 40% as fair and almost 45% as poor. With respect to instream habitat only, poor and fair ratings were found in almost equal proportion at approximately 45%, while good instream habitat accounted for only 12% of the total. A similar percentage of riparian habitat was rated as poor, while 36% was rated as fair and almost 20% as good.

Within regional districts, Courtenay/Comox, Nanaimo and Victoria/Gulf Islands all had just less than 20% of their overall lengths rated as good, however, both Nanaimo and Victoria/Gulf Islands had over 50% of their assessed lengths rated as poor. At almost 65%, the Cowichan had the highest length of overall habitat rated as poor (Table 5).

Victoria/Gulf Islands had the highest percentage of instream habitat rated as good (34%), while neither Campbell River nor Cowichan had any length of instream habitat rated as good (Table 5). While each of these regional districts did have some lengths of riparian habitat rated as good, they were also the lowest in terms of the amount of good habitat by length overall.

Table 5. Length of stream habitat by regional district classified as poor, fair and good compared to standard biostandards.

	Instream Habitat							Riparian Habitat							Instream and Riparian Habitat						
	Total Length Assessed (m)	Poor (m)	Poor (%)	Fair (m)	Fair (%)	Good (m)	Good (%)	Total Length Assessed (m)	Poor (m)	Poor (%)	Fair (m)	Fair (%)	Good (m)	Good (%)	Total Length Assessed (m)	Poor (m)	Poor (%)	Fair (m)	Fair (%)	Good (m)	Good (%)
Campbell River	43,322.0	10,521.6	24.3	32,800.4	75.7	0.0	0.0	52,723.8	17,842.4	33.8	28,242.6	53.6	6,638.8	12.6	96,045.8	28,364.0	29.5	61,043.0	63.6	6,638.8	6.9
Courtney/Comox	104,938.1	40,422.9	38.5	62,536.2	59.6	1,979.0	1.9	132,734.5	58,465.2	44.0	32,070.2	24.2	42,199.1	31.8	237,672.6	98,888.1	41.6	94,606.4	39.8	44,178.1	18.6
Nanaimo	39,270.3	19,238.1	49.0	7,373.2	18.8	12,659.0	32.2	35,781.2	26,844.5	75.0	7,986.7	22.3	950.0	2.7	75,051.5	46,082.6	61.4	15,359.9	20.5	13,609.0	18.1
Cowichan	10,261.1	9,696.1	94.5	565.0	5.5	0.0	0.0	5,851.0	383.0	6.5	4,404.0	75.3	1,064.0	18.2	16,112.1	10,079.1	62.6	4,969.0	30.8	1,064.0	6.6
Victoria/Gulf Islands	41,007.9	27,009.7	65.9	0.0	0.0	13,998.2	34.1	41,417.9	15,343.0	37.0	24,715.6	59.7	1,359.3	3.3	82,425.8	42,352.7	51.4	24,715.6	30.0	15,357.5	18.6
East Coast Vancouver Island	238,799.4	106,888.4	44.8	103,274.8	43.2	28,636.2	12.0	268,508.4	118,878.1	44.3	97,419.1	36.3	52,211.2	19.4	507,307.8	225,766.5	44.5	200,693.9	39.6	80,847.4	15.9

Discussion

There are a number of elements that contribute to good habitat for stream-rearing salmonids including deep pools to provide resting areas and cover from predators, adequate flow to ensure clean, oxygenated water and drift food items, cover including overhanging vegetation, undercut banks, LWD and boulders, and clean substrate including proper sized gravel for spawning (Lister and Genoe 1970, Bustard and Narver 1975, Griffith 1980, Bison et al. 1981, Bjorn and Reiser 1991). In addition, and perhaps one of the most overlooked components of healthy, productive fish habitat, is a stable, well-vegetated riparian zone. These areas are not only among the most diverse, dynamic, and complex biophysical habitats within the watershed (Johnson et al., 2001), but are also directly responsible for protecting streams and supplying many of the components of the macro habitat critical to rearing cutthroat trout and coho salmon.

We examined data collected between 1996 – 2003 and, by that time, small streams on the east coast of Vancouver Island already had limited quantities of fair, or even poor quality fish habitat. For example, the bed material of some streams on the southern portion of the Island, from Nanaimo to Victoria-Gulf Islands, approached 100% sediment, while the average percentage of instream cover such as LWD was well below 1 piece per bankful channel width. More northern streams in the Courtenay/Comox and Campbell River regional districts did not fare much better, achieving only fair classifications in the amount and quality of key fish habitat components. Sediment in many of these streams was again over 50%, indicating seriously compromised riparian zones. Wetted area throughout the study area averaged only approximately 60% - a result of land use impacts compounding a historic naturally low flow regime (Reid et al., 1999). All told, small streams on the east coast of Vancouver Island could best be described as having only fair quality fish habitat, and much of that with a distinct lack of pools and cover, particularly LWD, large amounts of sediment packed into bed materials; denuded and eroded or entirely absent riparian zones, and altered flow patterns resulting in extreme low flows during the critical summer salmonid rearing period.

Existing Legislation to Protect Fish Habitat

Over time, there have been a number of legal instruments to protect fish and fish habitat in BC. For example, in Section 35(1) of the federal *Fisheries Act* it is an offence to carry on work that results in the harmful alteration or destruction of fish habitat, while Section 35 enables the Minister to require plans where a person proposes to carry on work that is likely to result in habitat alteration. At the provincial level, the *Fish Protection Act* outlines requirements for fish habitat protection including: Section 5 which enables the protection of flows for fish; Section 7 which covers the production of recovery plans for fish populations; and Section 10 which outlines fish and fish habitat considerations in water management plans. Unfortunately, as pointed out by Taves (1998), these sections are entirely discretionary and as such could amount to little if any protection for fish (Reid et al., 1999). Clearly this seems to have been the case

under both federal and provincial legislation given that by 2003, east coast Vancouver Island streams were falling well short of having even fair quality fish habitat, and most of that seriously compromised in the most crucial of elements.

In January 2001, the provincial government passed the Streamside Protection Regulation (SPR) pursuant to Section 12 of the *Fish Protection Act*. By requiring local governments to protect streamside protection and enhancement areas (SPEAs), the SPR attempts to proactively address the issue of habitat loss – something the federal *Fisheries Act* and the pre-existing development approval referral process had not been able to adequately do (Grant, 2001). However, as pointed out by Grant (2001), the biggest reason for concern with the SPR is that there are no compliance and enforcement mechanisms to compel local governments to follow the regulation. Kyle (2001) further notes that local governments have five years within which to establish SPEAs and until those are established, development and subdivision of all kinds could proceed under existing bylaws. That time frame has already passed and as a result, stream habitat may be even more degraded than when the present study was completed. Kyle (2001) also points out that setbacks are the jurisdiction of the Board of Variance which has no statutory requirement to protect SPEAs (Kyle, 2001). Clearly, there are some critical omissions or loopholes in the new legislation which could seriously jeopardize already imperilled fish habitat in the Vancouver Island region, and particularly on the rapidly developing east coast.

Ensuring Fish Habitat Protection under Existing Legislation

In their 1999 review of the status of fish habitat in east coast Vancouver Island watersheds, Reid et al. outlined a number of suggestions for protecting small streams. Based on the concerns identified by Grant (2001) and Kyle (2001), we have adapted the suggestions made by Reid et al., and recommend:

1. Establishing long-term community stream monitoring programs on index streams in each regional district on the east coast of Vancouver Island;
2. Enabling stewardship-group developed watershed management plans to guide Development Permit Areas and Official Community Plans;
3. Implementing legislation restricting water extraction during critical times;
4. Implementing stewardship and local government-based public awareness and landowner contact programs.

Establish long-term community stream monitoring programs on Index Streams

Long-term monitoring is essential for detecting environmental changes and measuring the success of resource management programs. According to Johnson et al. (2001) habitat is the basis of most impact assessments and resource inventories, many species management plans, mitigation planning, and environmental regulation in Washington State. In addition, benchmarks of improved and stabilized habitat conditions

are used as de-listing criteria in species recovery plans under the *Endangered Species Act*, the provincial Red and Blue Lists, and the Canadian COSEWIC ranking (Johnson et al., 2001).

As a result of the USHP habitat assessments, the Ministry of Environment now has a database containing detailed, quantitative data for instream and riparian habitat parameters from approximately 90 streams between Campbell River and Sooke. This data pre-dates the implementation of any SPEAs and, therefore, provides an extremely valuable baseline against which to monitor the effectiveness of the Streamside Protection Regulation and any subsequent enforcement efforts. We suggest a small number of streams from each regional district be chosen from the USHP database and that these index streams be the subject of community stewardship-based long-term monitoring programs. A limited number of key parameters including amount of sediment, wetted width and riparian depth can be easily measured and tabulated by volunteers and this information then provided to the regional district and senior government authorities to determine both the effectiveness of the protective measures, and compliance with them. Given only basic equipment is required, and measuring the parameters is straightforward, this program will be a very inexpensive means of monitoring the status of fish habitat on the east coast of Vancouver Island and the new regulations designed to protect it. In addition, this will be an easy and rewarding way to engage local citizens in long term fish and fish habitat protection along the rapidly growing east coast.

<u>Enable stewardship-group developed watershed management plans to guide Development Permit Areas and Official Community Plans</u>

In 1999, Reid et al., suggested that stewardship groups form partnerships with local governments and together they complete long-term watershed management plans that can be articulated into official community plans (OCPs). Grant (2001) notes that since the Streamside Protection Regulation applies to local government powers under the *Local Government Act*, the designation of streamside protection and enhancement areas through development permit areas (DPAs) in OCPs seems to be the most logical implementation procedure. She further notes that one of the advantages of having streamside protection and enhancement areas designated in DPAs is that fish habitat protection is considered up front, proactively before any development takes place (Grant, 2001).

We suggest that stewardship-based advisory boards be established during the development or review of an OCP, and that these boards be charged with developing long-term watershed management plans including general measures for protecting riparian and instream areas. Based on these plans, the local government can then develop DPAs to be incorporated into the OCP. This will be an ideal way to involve local citizens in developing proactive measures to protect streams and stream-side habitat, and will also help ensure those measures are adhered to over the long term because those same citizens will then monitor the streams, even informally, to ensure their recommendations are followed. As Grant (2001) notes, citizen groups have a role in watch-dogging local

government decisions and that job does not stop when bylaws are in place. We agree with Grant and suggest that formally involving stewards in the OCP process is an ideal way to engage private citizens in stream protection.

Implement legislation restricting water extraction during critical times

Low flow has long been recognized as a problem on Vancouver Island (Water Survey of Canada, 1975). Low flow resulted in Reid et al. (1999) classifying spawning and rearing habitat as severely degraded in over 70% of streams assessed and led these researchers to conclude that most of the 600 small streams on the east coast of the Island had similar water quantity problems. The consequence of long-term forest development, which has occurred in almost 70% of east coast watersheds, and a natural low-flow regime is that small streams on Vancouver Island have reduced habitat capacity making them particularly vulnerable to any additional development within their watersheds (Reid et al., 1999). It is critical, therefore, that this most basic component of fish habitat be given first priority in stream protection plans.

Under Section 5 of the *Fish Protection Act*, the Water Manager may consider the impact on fish and fish habitat when making water licencing decisions. Unfortunately, however, this section is entirely discretionary and, therefore, to protect flows, we suggest Region 1 re-establish the now discontinued Regional Water Management Branch policy which stated that extractive demands only be allowed when the natural mean monthly flow is >60% Mean Annual Discharge (MAD) (Ministry of Environment, 1996). As pointed out by Reid et al. (1999), this policy would ensure flows for fish are recognized as equal to the needs of an expanding human population particularly if elevated to that of enforceable legislation. Furthermore, we suggest that stewardship groups apply for licences to protect stream flows for streams which are highly sensitive because of a natural low flow regime, and are also subject to development. This is possible under Section 8 of the *Fish Protection Act* which states that a licence for the protection of stream flow can be issued by the Lieutenant Governor to an organization that may not otherwise be eligible as a licencee under Section 7 of the *Water Act*. Under Section 7, the Crown and municipalities are eligible for licences, however, stewardship groups are not, therefore, we suggest that stewardship groups pursue this option to ensure some level of stream flow protection, particularly on more sensitive streams.

Implement stewardship and local government-based public awareness and landowner contact programs

Many stewardship groups working on stream assessment and restoration activities are confronted with a general lack of knowledge on the part of watershed residents about the importance and sensitivity of streams (Shepp and Cummins, 1997). Often the general public does not understand their connection to small streams and the associated ecosystem, yet this understanding is critical to the success of long-term protection efforts (Reid et al. 1999).

In 1999, Reid et al. suggested that volunteers host neighbourhood information sessions and/or landowner contact programs focused on the importance and sensitivity of riparian and instream habitat. While these researchers suggested that landowner contact projects be done in concert with restoration projects, we suggest that these types of endeavours be implemented as stand-alone programs with the sole purpose of raising the general understanding of fish and stream habitat, and the options for private land stewardship where applicable. We also suggest these projects be implemented as partnerships between stewardship groups and local governments whereby both organizations develop the project approach, the stewardship group provides the volunteers, and the local government provides the resources to implement the project. Given it is the general public who ultimately, if informally, monitors the changes in the environment within their communities, it is absolutely critical that private citizens understand the importance and sensitivity of stream habitat and all of its component parts. Public awareness projects implemented by local government-stewardship group partnerships will accomplish that objective. In fact, as noted by Reid et al. (1999), increasing the public's knowledge regarding small stream habitat may be the most important activity that stewards and local governments can undertake to protect streams for the future. We believe this is especially crucial now given the east coast's already degraded and rapidly diminishing small stream habitat, and the prediction of unabating urban development in this fragile and resource-limited strip of land within the Vancouver Island region.

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Appendices

Status of Fish Habitat in Small East Coast Vancouver Island Streams 1999 – 2003

Appendix 1 Stewardship groups that conducted Urban Salmon Habitat Program fish habitat assessments used in this study.

Campbell River
Denman Island Conservancy Association
Discovery Coast Greenways Land Trust
Haig-Brown Kingfisher Creek Society
Oyster Bay Streamkeepers
Oyster River Watershed Management Committee
Penelakut Tribe
Storey Creek Golf and Recreation Society
Willow Creek Enhancement Society

Courtney/Comox
Comox Valley Project Watershed Society
Fanny Bay Salmonid Enhancement Society
Hart Creek Watershed Committee
Little River Enhancement Society
Millard/Piercy Watershed Stewards
Tsolum River Streamkeepers

Nanaimo
Malaspina University Collage RMOT Program
Mid-Vancouver Island Habitat Enhancement Society
Nanaimo Area Land Trust
Nanaimo Field Naturalists
Nanaimo Fish and Game Protective Association
Nile Creek Enhancement Society
Qualicum Beach Streamkeepers
Trout Unlimited Canada; Nanaimo Chapter

Cowichan
Chemainus First Nation
Cowichan Estuary Preservation Society
Cowichan Lake Salmonid Enhancement Society
Somenos Marsh Wildlife Society
Valley Fish and Game Club

Victoria/Gulf Islands
Galiano Conservancy Association
Heartlands Conservancy Society
Island Stream and Salmon Enhancement Society
Society for the Protection of Ayum Creek

Appendix 2 Classification of Stream Lengths by Regional District

Regional District and Stream	Instream Classification	Riparian Classification	Overall Classification	Length Assessed (m)
Campbell River (n=10)				
Kingfisher West	Fair	Fair	Fair	2,641.3
Menzies Creek - Lower	Fair	Fair	Fair	12,348.3
Menzies Creek - Upper	Poor	Good	Fair	3,579.0
Newman Creek	Poor	Good	Fair	4,861.6
Nunns Creek - Lower	Fair	Fair	Fair	6,640.0
Nunns Creek - Upper	Fair	Fair	Fair	6,613.0
Oyster Bay Stream 5	Poor	Good	Fair	2,081.0
Oyster Bay Stream 6	Fair	Good	Fair	4,557.8
Willow Creek	-----	Poor	-----	17,842.4
Woods Creek	Fair	Good	Fair-Good	14,949.0
Courtney/Comox (n=24)				
Apple Creek	Fair	Good	Fair-Good	5,472.4
Black Brook	Poor	Good	Fair	2,617.2
Chef Creek	Poor	Poor	Poor	6,541.3
Courtenay No Name Creek	Fair	Good	Fair-Good	456.0
Deep Bay Creek	-----	Poor	-----	2,730.0
Happy Creek	Good	Fair	Fair-Good	1,979.0
Hart Creek	Poor	Fair	Poor-Fair	3,810.0
Jamison Creek	Poor	Fair	Poor-Fair	3,160.2
Jenkins Creek	Poor	Good	Fair	410.0
Kitty Coleman Creek	-----	Poor	-----	14,555.9
Little River	Fair	Good	Fair-Good	24,037.0
Millard Creek Lower	Fair	Fair	Fair	14,517.8
Millard Creek Upper	Fair	Fair	Fair	949.5
Piercy Creek Tributary #7	Poor	Fair	Poor-Fair	2,151.2
Piercy Creek Tributary #8	Fair	Good	Fair	216.0
Portugese Creek	Poor	Poor	Poor	17,750.5
Riverbend Creek	Poor	Fair	Poor-Fair	937.0
Roy Creek	Fair	Poor	Poor-Fair	7,456.0
Scales Creek	-----	Good	-----	3,266.0
South Nash Creek	-----	Fair	-----	1,520.0
Spence Creek	Fair	Poor	Poor-Fair	2,998.5
Thames Creek	Fair	Poor	Poor-Fair	6,433.0
Tweedy Creek	Poor	Fair	Poor-Fair	3,045.5

Regional District and Stream	Instream Classification	Riparian Classification	Overall Classification	Length Assessed (m)
Valens Brook	-----	Good	-----	5,724.5
Nanaimo (n=11)				
Beach Creek	Poor	Poor	Poor	4,418.0
Benson Creek	Good	Poor	Fair	2,246.0
Bloods Creek	Poor	Good	Fair	241.0
Chase River	Good	Poor	Poor	10,413.0
Departure Bay Creek	Poor	Good	Good	709.0
Grandon Creek	Poor	Fair	Poor-Fair	1,689.1
Haslam Creek Lower	Poor	Poor	Poor	8,185.0
Shelly Creek	-----	Good	-----	2,294.0
Stray Creek	Poor	Fair	Poor-Fair	3,996.0
Thatcher Creek	Fair	Poor	Poor	3,382.5
Westglade Brook	Fair	Fair	Fair	3,990.7
Cowichan (n=7)				
Beaver Creek	Poor	Fair	Poor-Fair	1,384.0
Bings Creek	Fair	Good	Fair-Good	565.0
Bonsall Creek	-----	Poor	-----	383.0
Money's Wetland	Poor	Good	Fair	499.0
Porter Creek	Poor	Poor	Poor	4,478.7
Somenos Creek	Poor	Fair	Poor-Fair	3,020.0
Treffery Creek	Poor	Good	Fair	314.4
Victoria/Gulf Islands (n=14)				
Ayum Creek	Good	Fair	Fair-Good	11,842.2
Cusheon Creek	Poor	Poor	Poor	6,890.0
Descanzo Bay Creek	Poor	Poor	Poor	751.0
Duck Creek	Poor	Fair	Poor-Fair	3,424.0
Fulford Creek	Poor	Poor	Poor	7,702.0
Ganner Creek	Poor	Fair	Poor-Fair	625.6
Greig Creek	Poor	Good	Fair	949.3
Jack Creek	Poor	Fair	Poor-Fair	1,186.0
Maple Creek	-----	Good	-----	410.0
McAfee Creek	Poor	Fair	Poor-Fair	257.8
Murchison Creek	Poor	Fair	Poor-Fair	3,924.0
Stowe Creek	Poor	Fair	Poor-Fair	1,300.0
Walker Creek	-----	Fair	-----	1,230.0
Weston Creek	Good	Fair	Fair-Good	2,156.0