

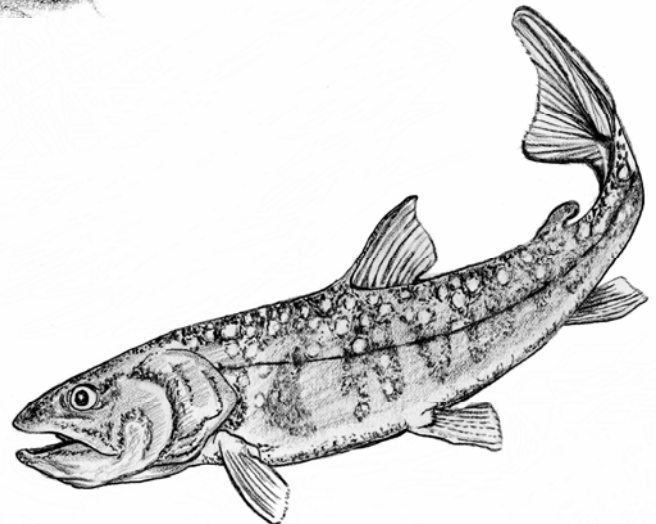
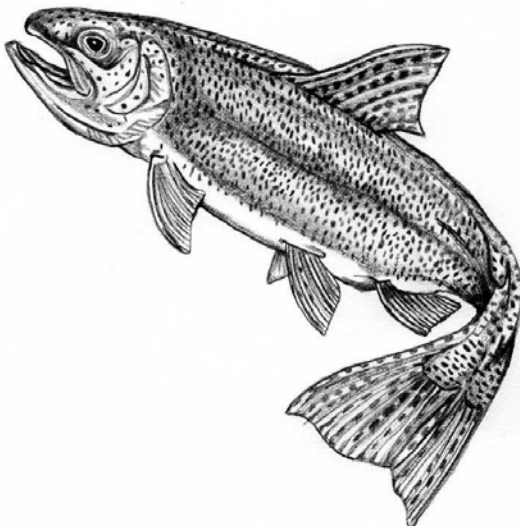
Vancouver Island Blue Listed Freshwater Sportfish Recovery Plan



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George Reid and Tracy Michalski

1.0 Introduction

One goal of the Ministry of the Environment is to maintain and restore the ecological diversity of fish and their habitats (Ministry of Environment, 2005). In addition, a major priority of the Ministry, as outlined in the Ministry Service Plan, is species at risk (Ministry of Water Land and Air Protection Service Plan, 2003/04). That priority was reinforced by the Director of Environmental Stewardship Division in an August 2005 email that stated priority activities include supporting species of concern/species at risk (Benton, S., 2005). As the only two Blue-listed freshwater sportfish in the Vancouver Island Region, both coastal cutthroat trout (*Oncorhynchus clarki clarki*) and Dolly Varden char (*Salvelinus malma*) qualify under these criteria as Fisheries Section priorities.

In 1994, the BC Conservation Data Center listed coastal cutthroat trout and Dolly Varden char as Blue-listed to comply with the global listing by the Nature Conservancy of Canada (BC Conservation Data Center, 2005; Pollard and Down 2001). This classification means that although these species are not immediately threatened, their status is of concern because of characteristics that make them particularly sensitive to human activities or natural events (BC Conservation Data Center, 2005).

A decline of Dolly Varden in the Vancouver Island Region had been suspected for some time prior to its Blue-listing and in order to provide additional protection for this species, the Region implemented catch-and-release only regulations. In 2002, the Region also implemented a detailed study on Dolly Varden to determine the status and general life history of stocks in the Lower Campbell Lake watershed. The preliminary results of that study, which showed a decline in stocks and a decrease in modal length, led to an application for Habitat Conservation Trust Fund (HCTF) money to develop this long-term recovery plan.

1.1 *General Species and Fishery Information*

Vancouver Island has one of the major concentrations of Dolly Varden and coastal cutthroat in the province. Dolly Varden are mainly found north of Campbell River and along the west coast, while cutthroat trout are found throughout the Island. While the Ministry has stocked cutthroat extensively and undertaken restoration of these stocks, particularly in urbanized island watersheds, Dolly Varden has never been enhanced and as such is the only native, wild freshwater salmonid in the region.

Both species can be divided into three types: anadromous forms found in a few coastal rivers; adfluvial forms found in over 90 lakes in the region; and fluvial forms found in many headwater streams. Only the adfluvial forms are subject to major, regional sport fisheries and their production is especially sensitive to fishing pressure because lake production here is limited by naturally oligotrophic conditions (Reid, 1984). In addition, island streams are relatively short with steep gradients as a result of the mountainous terrain. Consequently spawning areas are limited for both adfluvial and fluvial forms, and rearing area is limited for fluvial stocks of both species. Finally, the region has a

high number of habitat problems associated with poor land use practices, which have accelerated freshwater habitat deterioration and contributed to declines of resident forms of both cutthroat and Dolly Varden.

Dolly Varden and cutthroat trout both exhibit complicated life histories, but data to determine the stock status across the region for either species is largely unavailable. In 2002, Michalski initiated creel and Dolly Varden surveys in the Lower Campbell Lake watershed to determine the status of these stocks. She focused on this area because it constitutes one of the Island's major fisheries, and because data and information existed for baseline comparisons. Her findings showed that Dolly Varden stocks in the area had declined, particularly in the decade preceding the study, and that the average size of fish had also declined. Based on this information, in 2004, the region identified the development of a Dolly Varden Recovery Plan as a staff priority and Michalski received funds from the HCTF to develop that plan. In 2005, regional fisheries staff suggested expanding the plan to include resident cutthroat trout because of the similarities between both species life histories, the overlap of their habitats, and the pressure experienced by both in high use lakes. The following document is the result of that amalgamation. The objectives of this Vancouver Island Blue-listed Sportfish Recovery Plan are to:

1. Provide long-term guidance to aid the recovery of resident adfluvial freshwater stocks of Dolly Varden char and coastal cutthroat trout in the highest use areas in the Vancouver Island region; and,
2. Provide strategies to protect and restore these species at risk and their habitats.

1.2 General Information Regarding Recovery Plans

A recovery plan is a template for the recovery of a threatened or endangered fish species to where it is secure and self-sustaining (Duke, et. al., 1996; National Marine Fisheries Service, 1996). These plans should describe the process by which the decline of a species or stock could be reversed, and known threats to its long-term survival are substantially reduced or eliminated. An effective recovery plan should:

- establish priorities, objectives and time frames for reducing major factors responsible for species declines;
- identify actions to protect and restore habitat where habitat condition is a factor of decline;
- outline a monitoring program to measure progress toward each recovery objective.

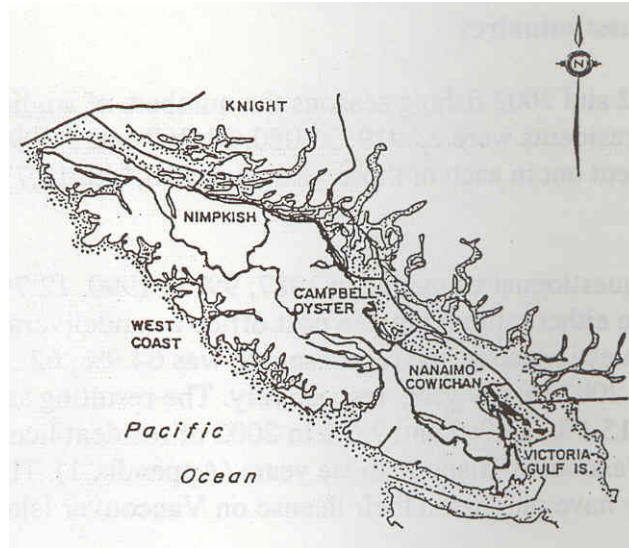
Fisheries management and recovery plans, including the Vancouver Island Regional Fisheries Management Statement by Reid (1984) and A Recovery Plan for East Coast Vancouver Island Steelhead Trout by Lill, et. al. (2002), were completed for the Vancouver Island Region. In addition, management and recovery plans for bull trout (*S. confluentus*) were developed for Alberta (Post et. al., 2001); Alaska (Ripley, 2001) and Oregon (Lohr, et. al., 2001). We used these documents, as well as guidelines identified by the National Marine Fisheries Service, to develop our recovery plan for Dolly Varden and cutthroat trout on Vancouver Island. This plan identifies the highest priority areas

within the region in which to concentrate recovery strategies, and defines management prescriptions for implementation of those strategies over a 5-year time frame. Year 1 focuses on implementing biophysical surveys, habitat restoration, public awareness initiatives and monitoring programs. Year 2 and beyond focuses on implementing restoration, public awareness and education initiatives, and fostering interest by anglers and the public toward Dolly Varden and cutthroat trout. We emphasize public and angler involvement in our projects because, based on studies by agencies including Trout Unlimited, it's evident that fostering public and angler interest in a species leads to client stewardship of that species. In some cases, researchers have even credited a reverse in species decline to the heightened public interest and increased stewardship from public involvement initiatives (Post et. al., 2001). Finally, in order to further build awareness and ensure concerns of all stakeholders are included, we highly recommend the implementation of this recovery plan be guided by a Steering Committee with membership from government, industry, the general public and anglers.

2.0 Methods

Our first step in developing this plan was to identify the highest priority Planning Units (PUs) in the region (**Figure 1**). Vancouver Island Region biologists have historically used PU boundaries which coincide with the regional biogeoclimatic zones when examining areas of angling pressure, catch and fish distribution and developing subsequent management actions including stocking and restoration.

Figure 1. Vancouver Island Region boundary and planning units (PU).



2.1 Identifying High Priority Lakes in each Planning Unit

We identified all lakes in each PU that had responses from the 1986, 1989, 1992 and 2002 Vancouver Island Lakes Questionnaire (VILQ). The objective of the VILQ was to determine angler catch and fishing effort by Island anglers for individual lakes within the region (P. Law 1990; A. Aitzhanova, D. W. Rimmer, & P. Law, 2002; A. Aitzhanova & D. W. Rimmer, 2003). Based on lake and stream surveys conducted by regional biologists or contractors, we then selected those lakes known to have sympatric populations of Dolly Varden and coastal cutthroat trout. We listed only those lakes in this plan to ensure cost effectiveness of the restoration prescriptions we recommended. Once we had a list of lakes, we reviewed the existing data and identified data gaps and the work required to fill the gaps. We then used that information to identify recovery plan prescriptions and projects.

2.2 Prioritizing Planning Units

We developed a table for each PU summarizing the total catch, total angler effort, and angler success (Appendix 1-3). We then prioritized each PU by ranking it from 1 – 5 based on total catch, total angler effort, and angler success by lake. The PU with the highest angler effort and catch received a ranking of 1 reflecting the popularity of the

lake and, therefore, the angling pressure placed on the stocks. The PU with the second highest angler effort and catch received a 2, and so on to a maximum of 5. We reversed the ranking for angler success so that the lowest angler success received a rank of 1 to reflect possible angler impacts and low stock sizes. We added the ranks by PU for the three factors to determine a total score. The PU with the lowest total score was ranked as the highest priority, and the PU with the highest total score became the lowest priority. Once we identified the highest priority PUs, we listed each of the Dolly Varden and cutthroat lakes within the PUs, then prioritized each of those lakes.

2.3 *Prioritizing Lakes within Planning Units*

We followed the same procedure of reviewing catch, effort and success and assigning scores to lakes as we had for PUs, so the lakes with the highest angler effort and catch and lowest success received rankings of 1. We used this process to prioritize the top 10 lakes within each PU (**Appendix 4, 5, 6**). Because this is a long-term plan, and to ensure our predictions of the highest priority areas would continue to be areas of concentration in the future, we examined potential angling and catch trends in each PU to the year 2010 (**Appendix 7**). To determine if the specific lake catches and angling effort were stable, increasing or declining, we calculated the average number of angler days, angler catch and catch/angler day for the four years of questionnaire data and then compared that to our projected number. We used a conservative estimate of +/- 25 % to rank each of the three variables: catch; effort; and success. For example, if the ratio fell between 0.74 and 1.25, we ranked the variable as stable. If the variable was > 1.25, we ranked it as increasing (+), and if the variable was < 0.75, we ranked it as declining (-) (Reid, G., Michalski, T., and S. Rimmer, 2005).

2.4 *Identifying Recovery Strategies for High Priority Lakes*

Prior to developing recovery plans, we reviewed the ministry files to confirm the presence of Dolly Varden and coastal cutthroat in both the lake and tributary streams in the target lakes. We then identified restoration plans for only those tributaries where both species had been identified in stream tributary surveys. We developed assessment and restoration plans based on the procedures identified in Slaney and Martin (1997) for those areas where both species were confirmed. We suggested fish assessments to confirm fish in those tributaries where one or both species was not identified. Finally, we reviewed each ministry lake file to determine if any restoration plans had already been identified and incorporated those into our detailed plans.

2.5 *Study Limitations and Biases*

1. The Vancouver Island Lakes Questionnaire did not ask anglers to break down their catch by species; consequently our data includes all salmonids caught. This bias was identified in the planning stages of the project and during the plan review by both D. Rimmer, (Vancouver Island Small Lakes Biologist) and R. Ptolemy (Standards/Guidelines Specialist). This data is the only data available Island-wide for angler catch, effort and success, and it was replicated over a series of years so

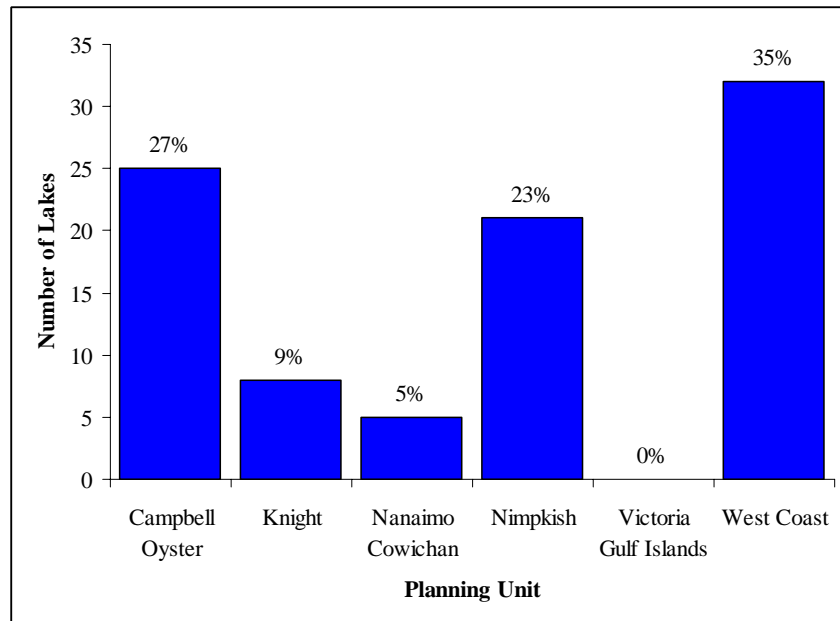
comparisons and projections could be made, however. Following discussions with both reviewers, including a review of our objectives and how the data would contribute to fulfilling that objective, we agreed this was the most appropriate approach and data set to use. We have made recommendations for changing the questionnaire in the future so that individual species catch is identified.

2. The numbers we used to determine priorities are subject to the regular bias associated with any angler survey questionnaire and the data may be overestimated. This approach was developed in consultation with D. Rimmer during the planning phases of this project however, and again given our objectives and the fact that we were most concerned with the lakes where anglers fished, their relative catch, and the relative number of days fished, this bias was considered as minor. In addition, the bias is likely the same for the majority of lakes and, therefore, the results are equally biased across the study and, therefore, our results are comparable.

3.0 Results

The Vancouver Island Region has 91 reported sympatric Dolly Varden and coastal cutthroat lakes in five Planning Units (**Figure 2**). The West Coast Unit accounts for 35% of the lakes, the Campbell Oyster 27 % and the Nimpkish 23%. There are no identified Dolly Varden/cutthroat trout lakes in the Victoria/Gulf Island PU.

Figure 2: Number and percent of Dolly Varden and coastal cutthroat trout lakes by Planning Unit in the Vancouver Island Region (source: Ministry of Sustainable Resource Development; Fish Inventory Files, 2005).



3.1 Angler Effort by Planning Unit

Three PUs account for roughly 95% of the angling days on adfluvial Dolly Varden/coastal cutthroat lakes (**Table 1**). The Campbell Oyster PU contained 42% of the total angling effort, followed by the Nanaimo Cowichan PU with 29% and the West Coast PU with 24%. Less than 1% of the total angler days in the region are associated with the Knight PU. The Nanaimo/Cowichan PU, which has only five lakes containing Dolly Varden/coastal cutthroat, had the second highest number of angler days in two of the four years the VILQ survey was undertaken, but had the second most angler days when the four year survey results were added. (**Appendix 2; Table 1**).

Table 1. Total number of angler days for lakes containing Dolly Varden/cutthroat trout for each Vancouver Island Planning Unit. Data is a summary taken from the Vancouver Island Lakes Questionnaire, 1986, 1989, 1992 and 2002 (Appendix 2).

Planning Unit	1986	1989	1992	2002	Total	%
Campbell Oyster	24905	25737	32437	40033	123112	42
Knight	0	19	47	31	97	0
Nanaimo Cowichan	18122	19009	28490	19010	84631	29
Nimpkish	2570	4520	4059	2876	14025	5
West Coast	13265	19644	17551	21082	71542	24
Total	58862	68929	82584	83032	293407	100

3.2 Angler Catch by Planning Unit

A total of 506,800 sportfish were reported caught from Island lakes containing adfluvial Dolly Varden/cutthroat trout (**Table 2**). Of that total, 95% came from three PUs: 55% from the Campbell/Oyster; 22% from the West Coast; and 18% from Nanaimo/Cowichan. The Knight PU accounted for less than 0.01% of the total catch of adfluvial Dolly Varden/cutthroat trout from the region. Lakes from the Campbell/Oyster PU accounted for the largest catch every year the survey was undertaken, with the West Coast contributing the second highest three out of four survey years.

Table 2. Total catch of freshwater sportfish for lakes containing Dolly Varden/cutthroat trout for each Vancouver Island Planning Unit. Data is a summary taken from the Vancouver Island Lakes Questionnaire, 1986 -2002 (**Appendix 3**).

Planning Unit	1986	1989	1992	2002	Total	%
Campbell Oyster	49780	84382	69447	77073	280682	55
Knight	0	38	119	260	417	0
Nanaimo Cowichan	21310	20232	27677	22407	91626	18
Nimpkish	4660	8399	6159	2843	22061	4
West Coast	23680	34044	25914	28344	111982	22
Total	99430	147095	129316	130927	506768	

3.3 Angler Success by Planning Unit

The Knight PU had the highest angler success for adfluvial Dolly Varden/cutthroat trout lakes in the region averaging 4.27 fish/angler day (**Table 3**). This number is variable when examined by year because of the low angler effort associated with this PU. There is very little variation in the catch/day for Campbell/Oyster lakes compared to other lakes in the region. The PU with the lowest catch/day was the Nanaimo/Cowichan with an average of 1.93 fish/day, followed by the Nimpkish at 2.08 fish/day, the Campbell/Oyster at 2.33 fish/day, and the West Coast at 2.48 fish/day.

Table 3. Angler success (fish/day) by planning unit for fish caught in lakes containing Dolly Varden/cutthroat trout in the Vancouver Island Region. The data is a summary taken from the Vancouver Island Lakes Questionnaire, 1986 - 2002 (**Appendix 1**).

PU	1986	1989	1992	2002	Average
Campbell Oyster	2.23	2.4	2.27	2.42	2.33
Knight		3	1.5	8.3	4.27
Nanaimo Cowichan	1.57	1.84	2.48	1.84	1.93
Nimpkish	2.43	2.05	2.54	1.29	2.08
West Coast	2.53	2.36	1.91	3.12	2.48

3.4 Vancouver Island Planning Unit Priorities

In **Table 4**, we show the PUs ranked from highest to lowest priority based on where anglers fish, the number of fish they catch, and how successful they are. The Campbell/Oyster is by far the most important PU in the region, ranking highest in total angler catch and effort and third in angler success. The Nanaimo-Cowichan Unit, which had the lowest angler success, ranked as the second highest priority, followed by the West Coast which ranked second in catch and effort. Given that angler success was high in this PU however, it ranked lower than Nanaimo/Cowichan. The Knight PU was the lowest priority in all three criteria.

Table 4. Planning Unit Priority based on angler catch, angler success and angler effort. Data was derived from the Vancouver Island Lakes Questionnaire, 1986-2002. Points reflect the priority of each criterion. The lower the points, the higher the priority (P=priority). (The PU with the highest catch and angler days received a rank of 1. The PU with the lowest catch/angler day received a rank of one. The others were then ranked in order).

Planning Unit	Catch	P	Catch/ angler day	P	Angler Days	P	# Pts.	Overall Priority
Campbell Oyster	280682	1	2.33	3	123112	1	5	1
Nanaimo Cowichan	91626	3	1.93	1	84613	2	6	2
West Coast	111982	2	2.48	4	71542	3	9	3
Nimpkish	22061	4	2.08	2	14022	4	10	4
Knight	417	5	4.27	5	78	5	15	5

3.5 Dolly Varden/Cutthroat Trout Lake Priorities

The highest priority adfluvial Dolly Varden/cutthroat lakes with respect to angler effort were in the Campbell/Oyster, Nanaimo/Cowichan and West Coast PUs (**Table 5**). Five of the eight highest ranked lakes are located in the Campbell/Oyster PU and the angling

effort on each of these five lakes is on four reservoir systems affected by BC Hydro operations. Two of the highest ranked lakes are in the West Coast PU and one is in the Nanaimo/Cowichan PU.

Anglers caught a total of 422,000 fish from lakes in the three highest priority PUs during the four years the Ministry conducted the VILQ survey. Fifty-four percent of the total fish caught came from the Upper Campbell, Campbell and Buttle lakes system in the Campbell/Oyster PU. Upper Campbell Lake had the highest catch with a reported 46,320 fish caught (**Table 5; Appendix 4**). With anglers capturing a cumulative total of 69,882 fish from Cowichan Lake however, this lake had both the highest catch on the Island and was the highest priority lake in the Nanaimo/Cowichan PU. Taken together, Upper Campbell and Cowichan Lake accounted for 28% of the total catch within the highest priority lakes. Sprout Lake had the highest catch within the West Coast PU.

Despite having the highest catches, Cowichan Lake also had the poorest catch/angler day likely reflecting the fact that this heavily-fished, easily-accessible lake is closest to the highest populated areas of Vancouver Island (**Table 9**). Although Sproat and Great Central lakes reported catches of 27,273 and 17,755 fish respectively, or 45% of the total fish caught, both of these lakes also had low success rates relative to other areas.

Table 9. Dolly Varden/cutthroat trout lake priority for the three most important Planning Units in the Vancouver Island region based on catch, effort, and angler success.*

■ First priority lakes □ Second priority lakes

Lake	PU	Catch	P	Angler Days	P	Catch/day	P	Total pts.	Overall Priority
Cowichan	NC	69882	1	74126	1	0.94	1	3	1
Sproat	WC	27273	6	26006	2	1.05	2	10	2
Comox	CO	30444	5	18476	4	1.64	11	20	3
Wolf	CO	18809	7	12410	7	1.52	10	24	4
Great Central	WC	16755	9	11739	8	1.43	7	24	4
Upper Campbell	CO	46320	2	19559	3	2.37	21	26	5
Campbell	CO	39527	3	15781	5	2.5	22	30	6
Buttle	CO	38600	4	12714	6	3.04	22	32	7
Second	NC	12233	11	6673	10	1.83	16	37	8
Victoria	WC	16157	10	7278	9	2.22	18	37	8
Fry	CO	8720	20	6284	12	1.39	6	38	9
Muchalat	WC	4976	21	4545	15	1.09	3	39	9
Alice	WC	11610	13	6559	11	1.77	15	39	9
Beavertail	CO	16905	8	6081	13	2.66	22	43	10
Mesachie	NC	502	22	418	21	1.2	4	47	11
Brewster	CO	12033	12	4636	14	2.6	22	48	12

Lake	PU	Catch	P	Angler Days	P	Catch/day	P	Total pts.	Overall Priority
Fairy	WC	2566	22	2047	22	1.25	5	49	13
McLaughlin	WC	661	22	451	22	1.47	8	52	14
Echo	CO	9039	18	3947	16	2.29	19	53	15
Roberts	CO	2770	22	1847	22	1.5	9	53	15
Nahmint	WC	2369	22	1436	22	1.65	12	56	16
Dickson	WC	9586	15	3149	19	3.04	22	56	16
McCreight	CO	10638	14	2792	20	3.81	22	56	16
Mclvor	CO	3238	22	1945	22	1.66	13	57	17
Quinsam	CO	9404	17	3271	18	2.88	22	57	17
Wokas	CO	3416	22	1985	22	1.72	14	58	18
Willemar	CO	8664	22	3464	17	2.5	22	61	19
Crest	WC	1239	22	595	22	2.08	17	62	20
Fourth	NC	8491	19	3189	21	2.66	22	62	21
Ash	WC	2229	22	968	22	2.3	20	64	22
Gray	CO	4097	22	1714	22	2.39	22	66	23

* Lake priority determined by adding priority ranks for: catch effort and poor success. A priority score of 22 was assigned to lakes that fell above the top 20 lakes in each category. All lakes that appear on the list were ranked in one of the criteria hence they show up in another criterion with a rank of 22.

3.6 Projected Trends in Vancouver Island Dolly Varden Lakes

Our analysis of projected angler days shows that the number of angler days in the Nanaimo/Cowichan peaked in 1992, then declined to 1980s levels in 2002 (**Table 7**). The number of angler days in the West Coast PU remained relatively constant, but the Campbell/Oyster PU increased by 38% since 1986. In projecting the number of angler days to the year 2010, we predict the Nanaimo/Cowichan will see very little increase in angler days, the West Coast PU will increase at a slightly faster rate, but the Campbell/Oyster PU will increase by roughly 20% over 2002 levels.

Table 7. Projected number of angler days on Dolly Varden /coastal cutthroat lakes in the Nanaimo-Cowichan, Campbell Oyster and West Coast planning unit's to 2010. The projection is based on the Vancouver Island Lakes Questionnaire data, 1986 – 2002.

Planning Unit	1986	1989	1992	2002	Projected 2010	%
Campbell Oyster	24905	25737	32437	40033	48302	51
Nan/Cowichan	18122	19009	28490	19010	21548	23
West Coast	13265	19644	17551	21082	24558	26
Total	56292	64390	78478	83601	94408	

The Campbell Oyster will also see a significant increase in the catch of fish by the year 2010 (**Table 8**). A total of 62% of the catch of sportfish and 51% of the angler effort will come from this PU by the year 2010. The total catch in all three PU's will increase by approximately 14,000 with roughly 11,000 (78%) from the Campbell/Oyster PU, 2000 from Nanaimo/Cowichan, and 1000 from the West Coast.

Table 8. Projected total catch of freshwater sportfish for lakes containing Dolly Varden/coastal cutthroat in the Nanaimo Cowichan, Campbell Oyster and West Coast Planning Units. The projection is based on the Vancouver Island Lakes Questionnaire, 1986 -2002 (**Appendix 3**).

Planning Unit	1986	1989	1992	2002	Projected 2010	%
Campbell Oyster	49780	84382	69447	77073	88409	62
Nanaimo/Cowichan	21301	20232	27677	22407	24453	17
West Coast	23680	34044	25914	28344	29373	21
Total	94761	138658	123038	127824	142235	

4.0 Recommendations

4.1 General

We were unable to break out the catch of Dolly Varden, cutthroat trout and rainbow trout from the Vancouver Island Lakes Questionnaire data. As a result, we used total reported catch and, when developing lake specific plans, assumed that Dolly Varden/cutthroat trout would be covered in all habitat restoration activities implemented. While this approach allowed us to meet our objectives, it would be useful to be able to isolate the catch of each species by lake if this data is to be used for meeting other fisheries management objectives. For example, when managing recreational fisheries and fish populations, managers need specific information about where people fish, when they fish, and what species they are fishing for. Specific information on spatial and temporal variation on fisheries quality and quantity is necessary to focus on areas of high use and assist in determining fish population status. This information also assists in weighing trade-offs between different scenarios involving future restoration, evaluating the outcomes of different strategies and actions, and devising scientifically accountable and cost effective solutions to management actions.

The Vancouver Island Lakes Questionnaire is a cost effective way of assessing angler use and catch to determine if there is a shift in angler distribution catch and success. The information derived from the questionnaire also provides a way of projecting what future lake fisheries will look like, and this data can also be used to set general area and lake specific regulations. Furthermore, it can be used when looking at future enhancement measures to maintain angling opportunity on high use waters. In order to provide the information needed to accomplish the above noted objectives, **we recommend:**

- 1. Continuing the VILQ every three years;**
- 2. Asking anglers to break down their catch by species;**
- 3. Including an analysis of questionnaire data to define future angler use and catch over a five-year planning horizon.**

After a long history of neglect, misunderstanding and misuse leading to stock declines and even extirpation, Dolly Varden are beginning to stabilize and even increase in some jurisdictions. Unfortunately, it wasn't until many stocks had reached, in some cases, irreversibly low levels that fisheries managers implemented protective regulations and management actions. In some jurisdictions, these actions came too late; stocks were lost and unique fishing opportunities squandered. But in other areas, including Alberta and Oregon, there has been a reverse in stock status and angler interest. A number of managers in these regions credit this turn-around to the implementation of both fish management actions, and angler awareness programs (Colpitts, 1993).

In BC, cutthroat trout and Dolly Varden are Blue-Listed and studies at Lower Campbell Lake suggest that resident stocks of Dolly Varden in this high-use area are declining (Michalski, 2006). The region implemented a catch-and-release regulation for the species in the late 1990's but it may not have been in effect long-enough to have had an

impact on declining stocks (Michalski, 2006). Therefore, even in the absence of any other management actions, **we recommend:**

- 4. Maintaining the catch-and release regulation for Dolly Varden; and**
- 5. Implementing public and angler awareness programs to educate about the status, habitat and ecological requirements of Dolly Varden and cutthroat trout.**

In Alberta, angler-awareness projects implemented by Trout Unlimited Canada (TUC) have been instrumental in raising awareness regarding char, and educating about all sport fishing resources and what anglers must do to conserve them (Blake, 1997). We suggest the Ministry build partnerships with non-government organizations to implement awareness programs and in particular with Trout Unlimited Canada, because their mandate is consistent with that of the BC government regarding these two Blue-Listed species, and because of TUC's long and successful history with these types of projects.

Our plan provides a blueprint for the restoration of Blue-listed sportfish in the heaviest fished lakes in the Vancouver Island region. It lays out strategies to restore the habitat of these species and that of other sympatric salmonids. In order to meet Ministry objectives, particularly those relating to increasing the number of partnerships to conserve species and their habitats, we suggest that clients and other stakeholders be involved in the implementation of this recovery plan. **We therefore recommend:**

- 6. The Ministry establishes a Blue-listed Sportfish Recovery Plan Steering Committee which meets annually to monitor the implementation of this plan, review plan progress and recommend additional specific management projects.**

Committee membership would be at the Ministry's discretion but we recommend, at a minimum, a cross section of the Vancouver Island angling public and the forest industry, and representatives from First Nations; BC Hydro; BC Forest Service; and BC Parks.

Given the low angler effort and catch in both the Nimpkish and Knight PUs, we have not recommended recovery work in either of these areas in the immediate future. **We do however recommend:**

- 7. A review of Nimpkish and Knight PUs in 2010 to determine if effort and catch have increased significantly and if these areas warrant attention at that time; and**
- 8. A review of the priorities of all PUs at five year intervals to include new data and information, update data requirements, and adjust priorities and lake specific plans where required.**

Table 10. General Recommendations and Activities

Activity	Year				
	2006	2007	2008	2009	2010
1. Conduct Vancouver Island lake questionnaire every three years.	X			X	
2. Incorporate cutthroat and rainbow trout, Dolly Varden, and bass species breakdowns in the Vancouver Island Lakes Questionnaire.	X				
3. Analyze VILQ data to define future use and catch over a five-year time-horizon		X			X
4. Maintain the catch-and release regulation for Dolly Varden	ongoing				
5. Implement public and angler awareness programs for Dolly Varden and cutthroat trout.	X				
6. Establish a Blue-listed Sportfish Recovery Plan Steering Committee to implement and monitor the Blue-listed Sportfish Recovery Plan.	X				
7. Review Nimpkish and Knight effort and catch data to determine if individual plans should be developed.					X
8. Review all Planning Unit priorities every five years and adjust or make changes to the lake specific plan if required.					X
9. Implement a bi-annual snorkel monitoring program on key streams in top three Planning Units	X		X		X
10. Analyze existing Vancouver Island nutrient-addition data to determine if this is an option for improving Blue-listed species size and production.		X			
11. All restoration of Dolly Varden through habitat restoration rather than hatchery introductions.	ongoing				
12. No introduction of hatchery cutthroat into areas with resident wild stocks.	ongoing				
13. Dolly Varden/cutthroat habitats given priority in protection and development discussions.	ongoing				
14. Develop Dolly Varden/cutthroat trout protection guidelines.	X				

In order to gather temporal and spatial population data on Dolly Varden and coastal cutthroat trout **we recommend:**

- 9. The Ministry implements a snorkel monitoring program on several key streams in the three top priority Planning Units. Key streams are listed in the individual lake plans in this document. This work could be carried out by Ministry personnel at minimal cost.**

A nutrient-addition program was implemented in several Vancouver Island lakes within the Campbell-Oyster PU in the mid-1990s. Unfortunately the data for these experiments was never compiled and therefore it is unclear as to whether nutrient additions were successful. Given that nutrient-addition projects in other areas of the province have shown increases in species complexes involving kokanee and Dolly Varden, **we recommend:**

- 10. The Vancouver Island nutrient-addition data be analyzed to determine if this is a viable option for improving Dolly Varden and/or cutthroat size and production.**

At a minimum, data and information from the above analyses would help define where and how to implement other nutrient-addition studies aimed specifically at the kokanee-Dolly Varden associations in lakes within the Campbell/Oyster PU.

We also recommend that:

- 11. All restoration of Dolly Varden stocks be strictly done through habitat restoration initiatives rather than hatchery introductions.**

Dolly Varden is one of the only remaining pure wild species of salmonid on Vancouver Island. Stocks of this Blue-listed species and those of resident cutthroat trout depend on stream habitat for their continued viability and, as such, habitat restoration is of the highest importance. We therefore urge the Ministry to refrain from any hatchery introductions of Dolly Varden. **We further recommend:**

- 12. The Ministry not introduce hatchery cutthroat in areas which contain resident wild stocks.**

Moreover, because both Dolly Varden and cutthroat trout are Blue-listed and priorities according to the Ministry goals and objectives, **we recommend:**

- 13. Giving priority to the habitats of Dolly Varden and cutthroat trout in all protection and development discussions with watershed stakeholders and other agencies; and**
- 14. Developing protection guidelines specifically aimed at resident Dolly Varden and cutthroat trout stocks, which can be incorporated into Best Management Practices, disseminated at development-focused discussions and used as reference during habitat infraction investigations.**

4.2 Individual Lake Recovery Plans

We outline lake and stream specific prescriptions aimed at the restoration of Dolly Varden and resident cutthroat trout in the highest priority lakes in Vancouver Island in the following tables. Our prescriptions will also benefit rainbow trout which, in all cases, utilize the same key streams as our two target species. We have outlined current stock status based on the VILQ data and stock population trends. Note there will be some variability because our trend analysis is based on 4 years of data over a 15 year period. Nonetheless, this data does establish a baseline against which to measure future stock and effort changes as restoration prescriptions are implemented. Also note that specific fish inventory does not exist for some key streams, but in all of the following areas lake and angler surveys have recorded the presence of Dolly Varden and cutthroat trout. Where stream fish inventory does not exist for one species, we have suggested that the key streams be inventoried to determine the presence of that species before initiating restoration planning and work. Finally, we have included potential project partners wherever possible.

5.1 Lake Planning

Lake Planning

Lake: Cowichan **Planning Unit:** CO **Lake Priority:** 1 **PU Priority:** 2

Land Use: Forestry is the major land use around the lake. Urbanization is a problem at the mouths of the key streams.

Stock Status: Stable X Increasing__ Declining __Unknown__

Angling Effort Trend: Stable X Increasing__ Declining__ Projected (2010) 17592

Catch Trend: Stable X Increasing__ Declining __Projected (2010) 16289

Catch/angler day Trend: Stable X Increasing_ Declining _Projected (2010) 1.08

Key streams: Sutton Creek, Nixon Creek, Cottonwood Creek, Robertson Creek.

Species Present: Dolly Varden char, cutthroat and rainbow trout, coho and chum salmon.

Suggested 5 year Plan: Habitat Restoration of Key Dolly Varden/cutthroat streams.

Activity	Year				
	2005	2006	2007	2008	2009
Conduct a Level 1 Fish Habitat Assessment for Sutton, Cottonwood, Robertson and Nixon creeks.	X				
Prepare a priority ranking of restoration activities for each creek and reach	X				
Develop Level 2 prescriptions and structure design and costs for priority reaches		X			
Implement restoration prescriptions for priority reaches			X	X	X
Monitor structure effectiveness for priority reaches				X	X
Monitor fish populations for prescription effectiveness				X	X

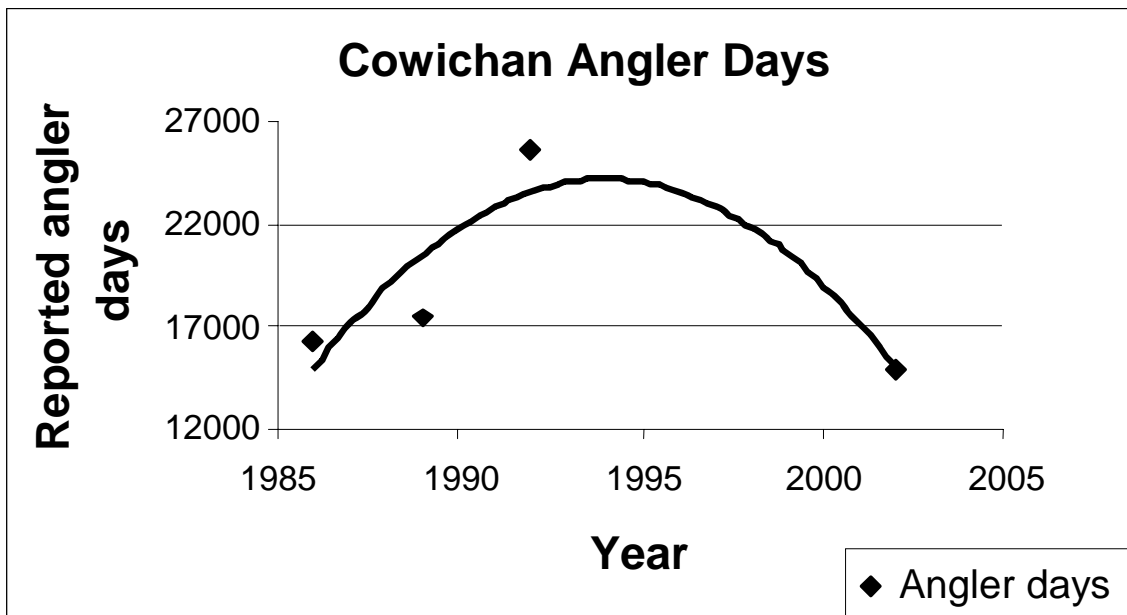
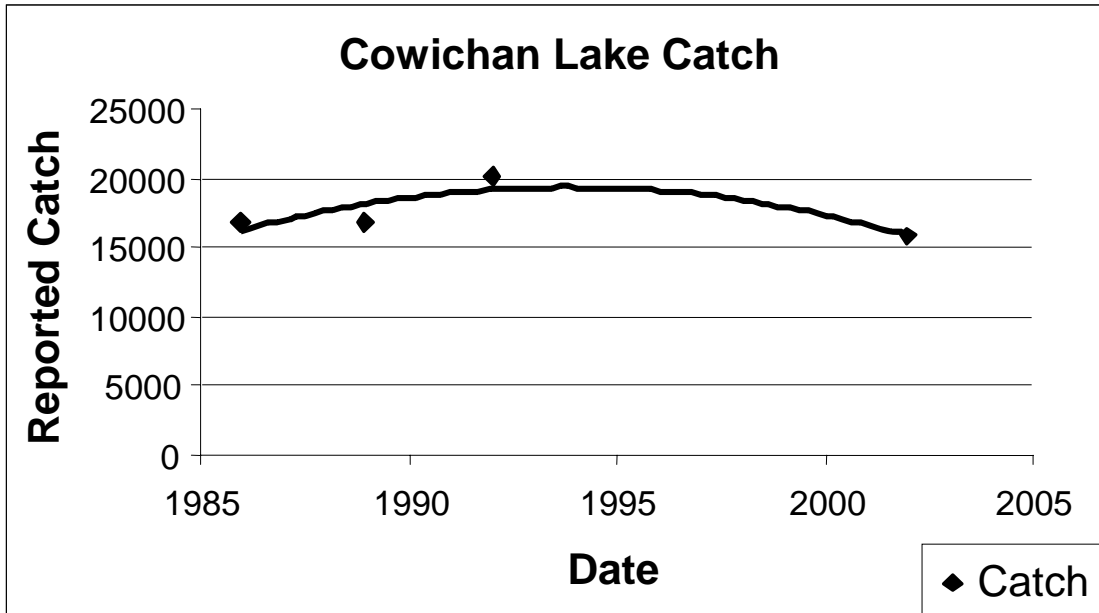
Projected Costs: 2005 - \$10,000; 2006 - \$20,000

Potential Partners: TimberWest, Hancock Forest Group, HCTF, Fisheries and Oceans Canada.

Public Involvement: Lake Cowichan Rod and Gun Club, Lake Cowichan Enhancement Society. These two groups to implement the prescriptions identified in the assessments. Cost sharing with the partners.

First Nations: First Nations of South Island Tribal Council, Mill Bay, BC, Cowichan Lake Band.

Figure 3 & 4. Trends in the number of angler days and angler catch for Cowichan Lake. Trend is calculated from data taken from the Vancouver Island Lakes Questionnaire, 1986 – 2002.



Lake Planning

Lake: Sproat **Planning Unit:** WC **Lake Priority:** 2 **PU Priority:** 3

Land Use: Logging throughout the watershed. All tributaries have been logged. Lakeshore development, particularly on the Klee (West) Arm.

Stock Status: Stable X Increasing __ Declining __ Unknown__

Angling Effort Trend: Stable__ Increasing X Declining __ Projected (2010) 8246

Catch Trend: Stable__ Increasing X Declining __ Projected (2010) 9672

Catch/angler day: Stable X Increasing__ Declining __ Projected (2010) 1.05

Key Streams: Unknown (Taylor River, Sutton Creek Gracie Creek) Dolly Varden noted in lake catches but not in lake tributaries.

Species Present: coho salmon and cutthroat and rainbow trout.

Suggested 5 year plan: Note: abandon plan if Dolly Varden are not found in the key streams.

Activity	Year				
	2005	2006	2007	2008	2009
Conduct fish inventory of key Dolly Varden creeks	X				
Conduct a level 1 Fish Habitat Assessment for Taylor River, and Sutton, Gracie and Clutesi creeks if Dolly Varden present.		X			
Prepare a priority ranking for each creek and reach.		X			
Develop Level 2 prescriptions and structure design and costs for priority reaches.		X			
Implement restoration prescriptions for priority reaches			X	X	X
Monitor structure effectiveness for priority reaches.				X	X
Monitor fish populations for prescription effectiveness				X	X

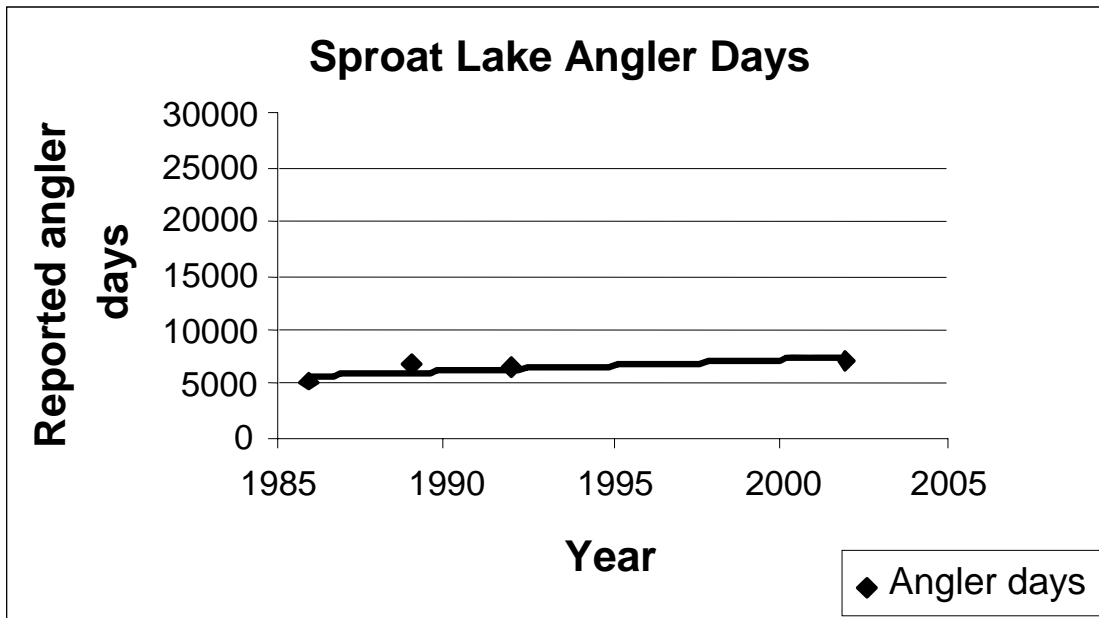
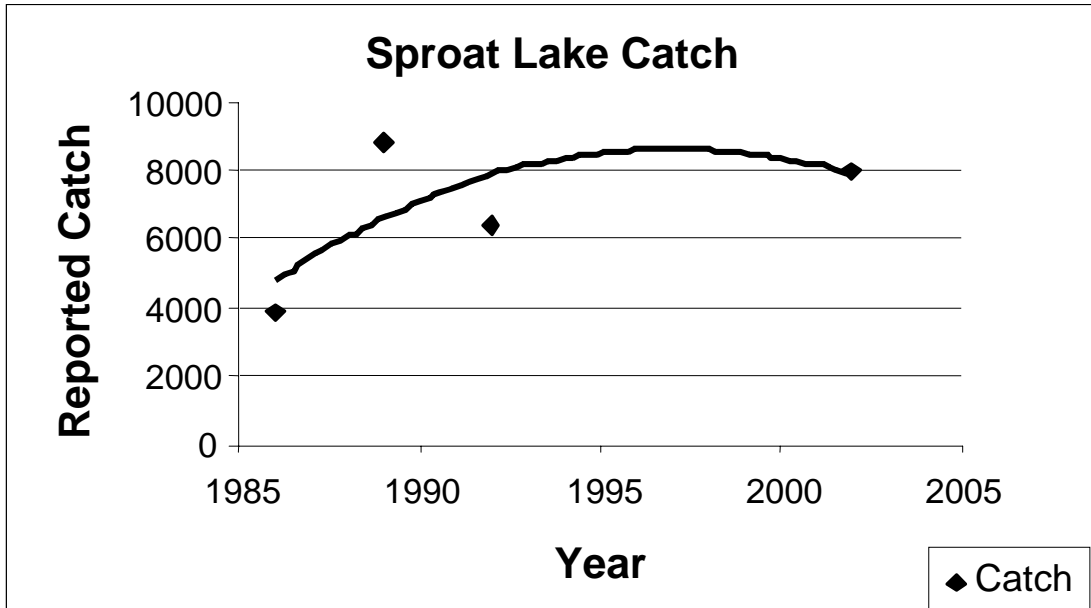
Potential Partners: Alberni Valley Sportsman's Association, Alberni Natural History Society, Brascan Corporation.

First Nations: Nuu-Chah-Nulth Tribal Council, Mowachaht Band, Opetchesht Band

Estimated Costs: 2005 - \$5000.

Public involvement Potential: Low in the first year. Possible to partner with First Nations who have an active fisheries group.

Figure 5 & 6. Trend in angler catch and angler days for Sproat lake, West Coast PU. Trend data is calculated from Vancouver Island Lakes Questionnaire 1986-2002.



Lake Planning

Lake: Comox **Planning Unit:** CO **Lake Priority:** 3 **PU Priority:** 1

Watershed: Puntledge

Land Use: Logging is the main land use. B C Hydro dam at the outlet of the lake.

Species Present: coho, chinook, rainbow and cutthroat trout, Dolly Varden,

Stock Status: Stable X Increasing __ Declining __ Unknown__

Angling Effort Trend: Stable__ Increasing X Declining__ Projected (2010) 8908

Catch Trend: Stable__ Increasing X Declining__ Projected (2010) 11358

Catch/angler day Trend: Stable X Increasing__ Declining __ Projected (2010) 1.28

Key Streams: Cruickshank River, Rees Creek, Erick Creek

Species Present: Dolly Varden char, cutthroat and rainbow trout and coho salmon.

Suggested 5 year Plan: Habitat Restoration of Key Streams.

Activity	Year				
	2005	2006	2007	2008	2009
Conduct a level 1 inventory on Rees and Erick creeks.	X				
Confirm Dolly Varden use in the main Cruickshank River	X				
Prepare a priority ranking for restoration in Rees and Erick creeks	X				
If Dolly Varden present in Cruickshank River, conduct a level 1 inventory		X			
Develop level 2 prescriptions for priority reaches in Rees and Erick creeks		X			
Implement restoration prescriptions for priority reaches in Rees and Erick creeks.			X	X	X
Conduct a level 2 inventory of Cruickshank River (DV present)			X		
Implement restoration prescriptions for priority reaches in the Cruickshank River				X	X
Monitor structure effectiveness in Rees and Erick creeks.				X	X
Monitor fish populations for structure effectiveness.				X	X

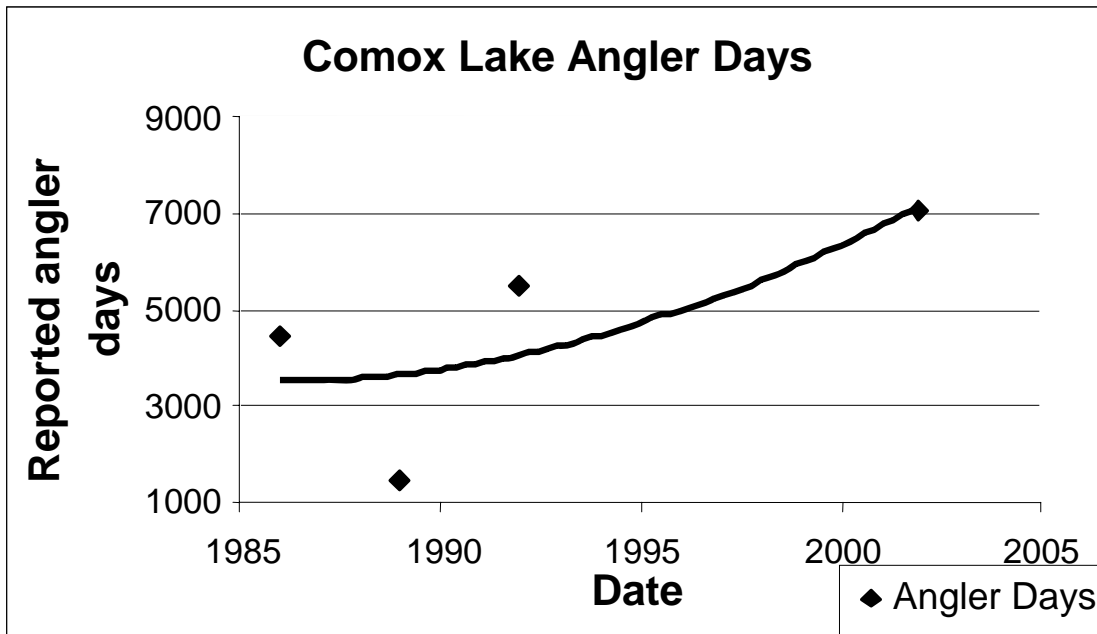
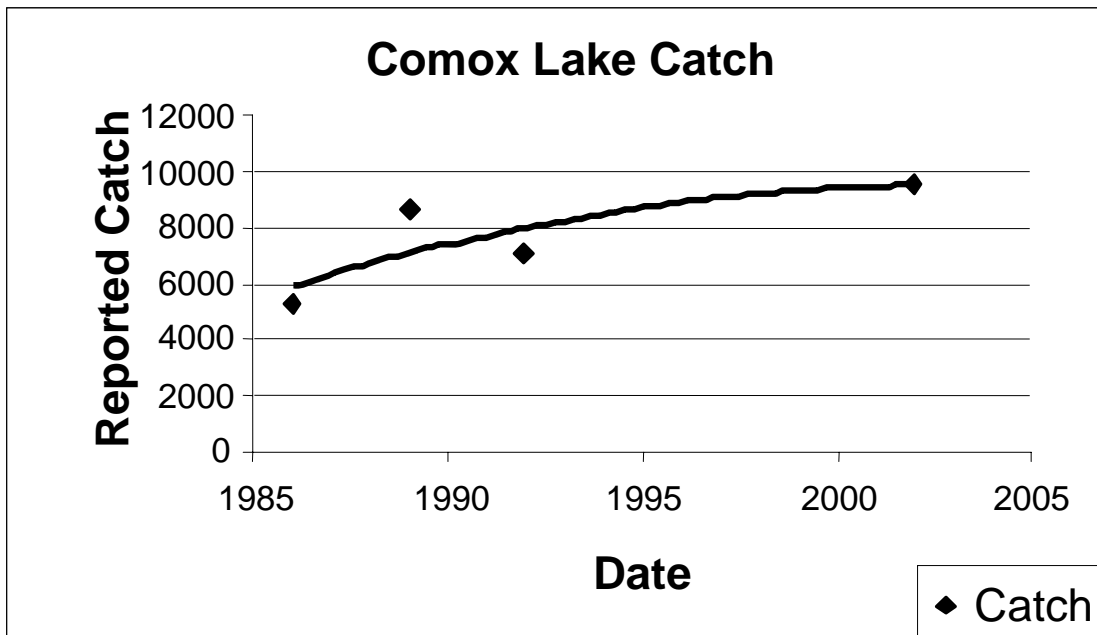
Potential Partners: BC Hydro, HCTF, TimberWest, Hancock Forest Group, Courtenay-Comox Fish and Game Protective Society.

First Nations: Kwakiutl District Council, Comox Band.

Estimated Costs: 2005 - \$15,000, 2006 - \$30,000

Public involvement Potential: Low in the first year but high in the following year. The Courtenay Fish and Wildlife Protective Association is very active and have exhibited a willingness to become involved.

Figure 7 & 8. Trend in angler catch and angler days for Comox Lake, Campbell Oyster PU. Trend data is calculated from Vancouver Island Lakes Questionnaire 1986-2002.



Lake Planning

Lake: Wolf Lake **Planning Unit:** CO **Lake Priority:** 4 **PU Priority:** 1

Watershed: Tsolum River

Species Present: Dolly Varden, cutthroat trout, rainbow trout, kokanee, stickleback.

Land Use: Logging. Area surrounding the lake is in mature second growth. Dam at the outlet of the lake to supply water to Tsolum River (Fisheries and Oceans Canada).

Stock Status: Stable X Increasing __ Declining __ Unknown__

Angling Effort Trend: Stable X Increasing__ Declining__ Projected (2010) 3269

Catch Trend: Stable X Increasing__ Declining __ Projected (2010) 3851

Catch/angler day Trend: Stable X Increasing_ Declining _Projected (2010) 1.28

Key Streams: Headquarters Creek.

Species present: Dolly Varden char, cutthroat and rainbow trout, coho, kokanee and pink salmon.

Suggested 5 year Plan:

Activity	Year				
	2007	2008	2009	2010	2011
Conduct level 1 and 2 assessments of Headquarters Creek.	X				
Prepare priority ranking for restoration in Headquarters Creek.	X				
Develop level 2 prescriptions for priority reaches in Headquarters Creek.	X				
Implement restoration prescriptions for priority reaches in Headquarters Creek.		X	X		
Monitor structure effectiveness in Headquarters Creek.				X	X
Monitor fish populations for structure effectiveness.		X	X	X	X

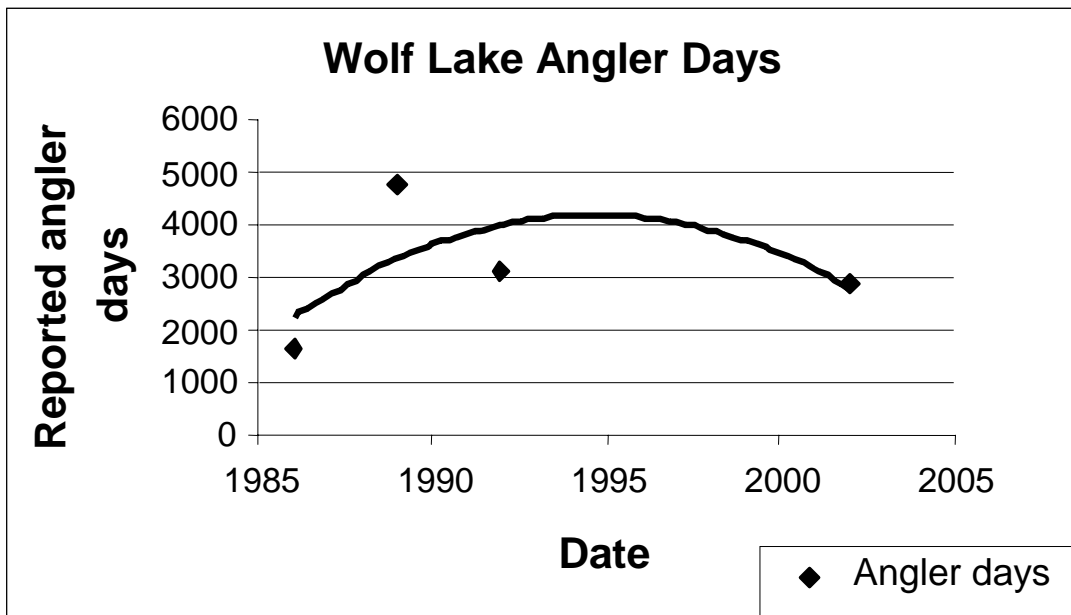
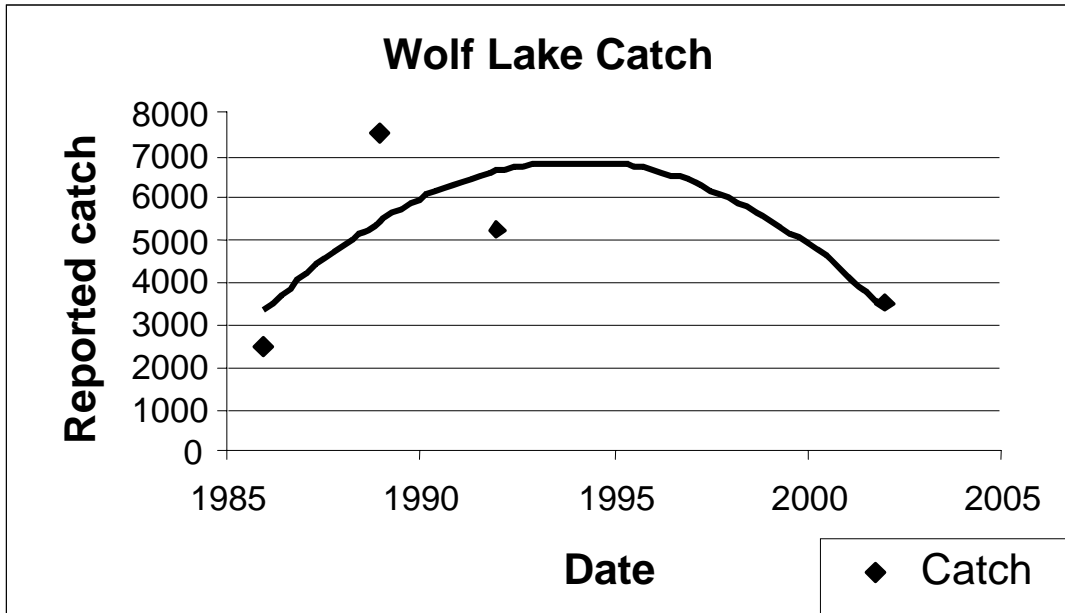
Potential Partners: TimberWest, HCTF

First Nations: Kwakiutl District Council, Comox Band

Estimated Costs: 2007 - \$30,500.

Public involvement Potential: Medium. Courtenay Fish and Game Protective Association could install stream structures. This club has a lot of experience at doing this type of work. Their involvement should reduce cost by 50%.

Figure 9 & 10. Trend in Wolf Lake angler catch and angler days, Campbell Oyster PU. Trend data is calculated from Vancouver Island Lakes Questionnaire 1986-2002.



Lake Planning

Lake: Great Central **Planning Unit:** WC **Lake Priority:** 5 **PU Priority:** 3

Watershed: Stamp River

Land Use: Logging. Robertson Creek hatchery and an Atlantic salmon hatchery located at the lake outlet. Dam at the lake outlet.

Stock Status: Stable Increasing X Declining Unknown

Angling Effort Tend: Stable Increasing X Declining Projected (2010) 8908

Catch Trend: Stable Increasing X Declining Projected (2010) 11358

Catch/angler day Trend: Stable X Increasing Declining Projected (2010) 1.28

Key streams: McBride Creek, Drinkwater Creek. Note: Dolly Varden have been noted in lake surveys but not in key streams.

Other Species: cutthroat and rainbow trout, sockeye and coho salmon.

Suggested 5 year Plan: Note: abandon plan if Dolly Varden not present in the key streams.

Activity	Year				
	2007	2008	2009	2010	2011
Fish surveys of McBride and Drinkwater creeks to establish Dolly Varden presence.		X			
If D.V. present, conduct level 1 & 2 inventory on McBride and Drinkwater creeks.			X		
Develop level 2 prescriptions for Drinkwater and McBride creeks.			X		
Implement level 2 prescriptions for Drinkwater and McBride creeks.				X	
Monitor structure effectiveness for Drinkwater and McBride creeks.					X
Monitor fish populations for structure use.					X

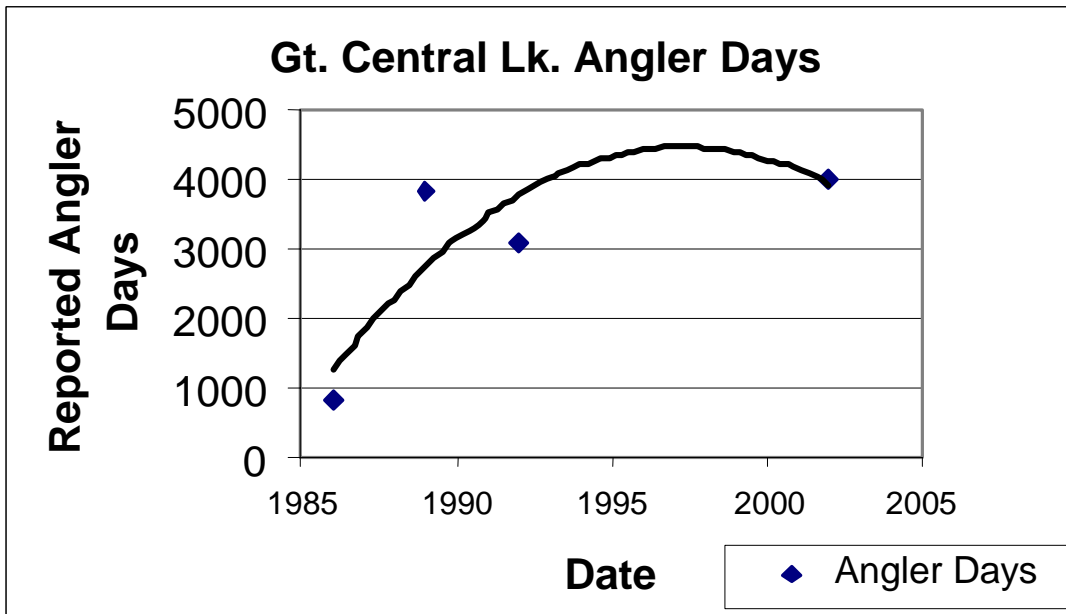
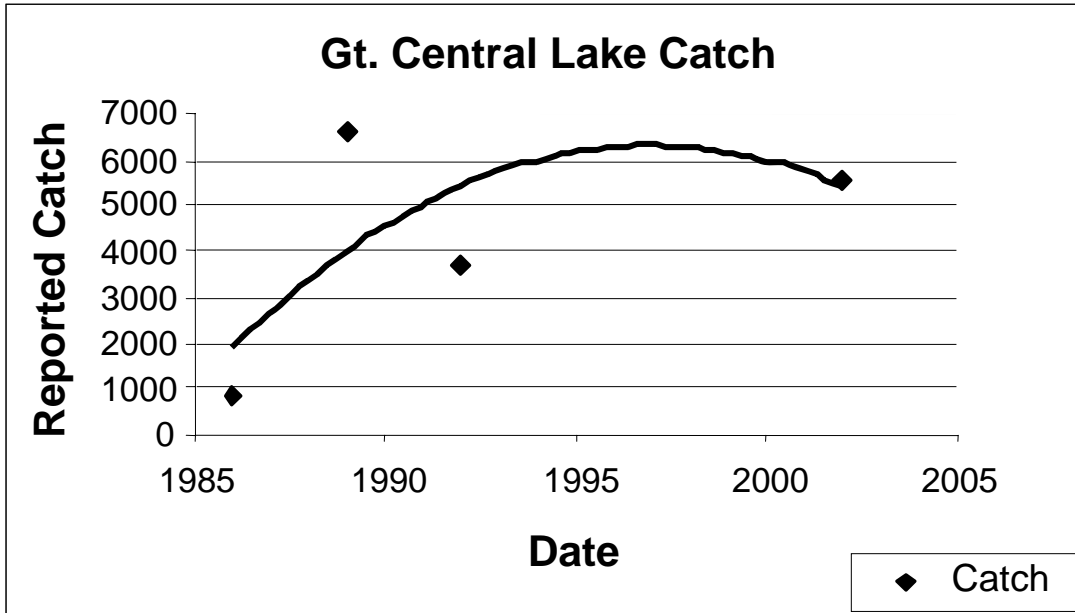
Potential Partners: BC Hydro, Brascan, BC Parks

First Nations: Nuu-Chah-Nulth Tribal Council, Mowachaht/Opetchesaht Bands.

Estimated Costs: 2008 - \$7000

Public involvement Potential: Low for first year. Potential for First Nation's fisheries group to undertake the work.

Figure 11 & 12. Trend in Great Central Lake angler catch and angler days, West Coast PU. Trend data is calculated from Vancouver Island Lakes Questionnaire 1986-2002.



Lake Planning

Lake: Upper Campbell Lake **Planning Unit:** CO **Lake Priority:** 6 **PU Priority:** 1

Land Use: Logging, Hydro, mining in Strathcona Park

Stock Status: Stable X Increasing __Declining __Unknown__

Angling Effort Trend: Stable X Increasing__ Declining__ Projected (2010) 4521

Catch Trend: Stable X Increasing__ Declining __ Projected (2010) 11,438

Catch/angler day Trend: Stable X Increasing__ Declining __Projected (2010): 2.39

Key Streams: Elk River, Tolowis Creek, Filberg Creek, Cervis Creek.

Species Present: Dolly Varden char, cutthroat and rainbow trout (M.S.R.M).

Suggested 5 year Plan: Major restoration now taking place on the Elk River under the Bridge Coastal program. Suggest that integration with that program take place.

Activity	Year				
	2006	2007	2008	2009	2010
Integrate with Bridge Coastal to ensure Dolly Varden restoration is included in Elk River plan.	X				
Level I assessment of key streams.	X				
Level 2 assessments of key streams.		X			
Implement restoration prescriptions for key streams.			X		
Monitor fish use of structure installed in key streams.				X	
Monitor structure effectiveness in key streams					X

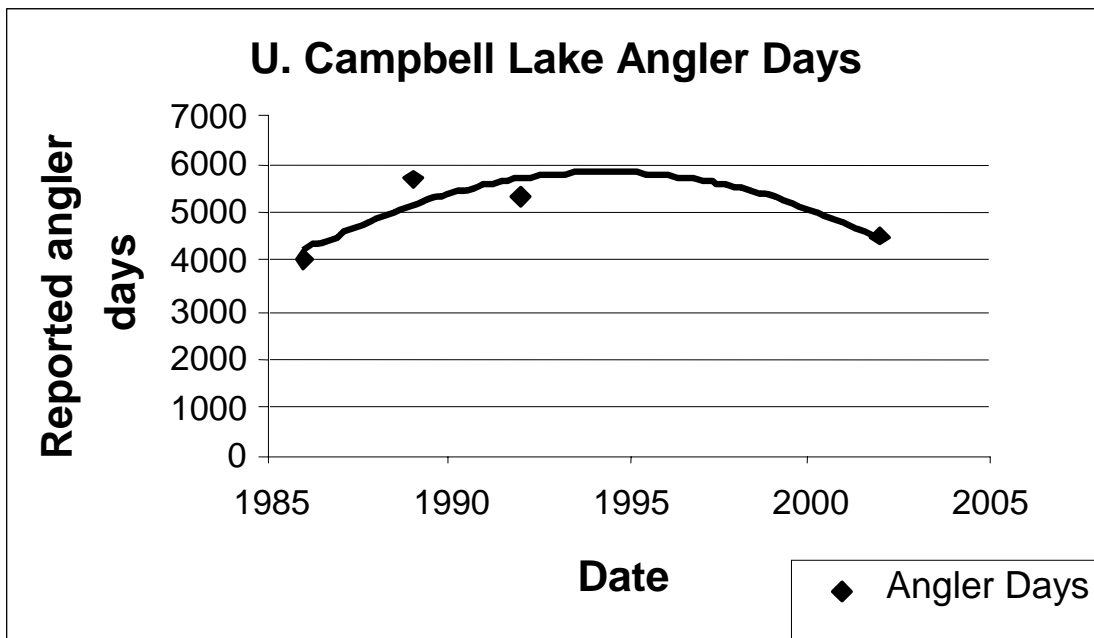
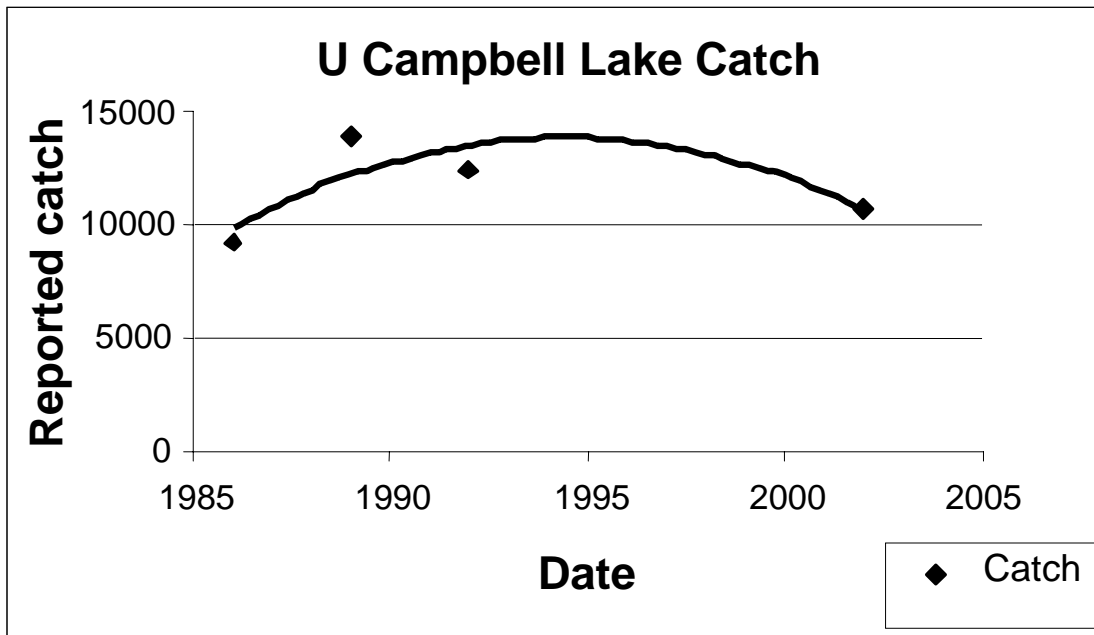
Potential Partners: BC Hydro, BC Parks, TimberWest

First Nations: Kwakiutl District Council, Campbell River Band.

Estimated Costs: \$10,000 (2006)

Public involvement Potential: Medium. Campbell River Fish and Wildlife Association. BC Hydro Bridge Coastal program.

Figure 13 & 14. Trend in Upper Campbell Lake angler catch and angler days, Campbell Oyster PU. Trend data is calculated from Vancouver Island Lakes Questionnaire 1986-2002.



Lake Planning

Lake: Lower Campbell Lake **Planning Unit:** CO **Lake Priority:** 7 **PU Priority:** 1

Land Use: Logging, minor lakeshore development, Hydro.

Stock Status: Stable X Increasing Declining Unknown

Angling Effort Trend: Stable Increasing X Declining Projected (2010) 8311

Catch Trend: Stable Increasing X Declining Projected (2010) 16,003

Catch/angler day Trend: Stable X Increasing Declining Projected (2010) 1.93

Key Streams: Fry Creek, Miller Creek, Beavertail creek, Greenstone Creek, unnamed creeks into Campbell Lake.

Species Present: Dolly Varden char, cutthroat and rainbow trout, kokanee

(1) Suggested 5 year Plan: Augment low flows in Fry Creek. (Eakins Hydrological Consulting 2005)

Activity	Year				
	2005	2006	2007	2008	2009
Augment low flow (Eakins 2005). Proceed to negotiate with BC Hydro on flow structure. Proposal to BC Hydro.	X				
Design and construct the flow release structure at the outlet of lake.	X	X			
Operate and monitor flow releases.			X	X	X

Potential Partners: BC Hydro, Brascan, BC Forest Service.

First Nations: Kwakiutl District Council, Campbell River Band.

Estimated Costs: Unknown, surveys required to determine cost of flow release structure.

Public involvement Potential: High. Campbell River Fish and Wildlife Association (operate and monitor flow releases). Note: an honorarium of \$2000 should be given the club to offset weekly visits to maintain the flows and read the gauge.

(2) Suggested 5 year Plan: Stream restoration of Fry Creek. Level 1 and 2 inventories are complete on Fry and Miller creeks. Both these streams are diversion streams into Lower Campbell Lake. Restoration of Fry Creek will benefit fish populations in four lakes including Brewster, Gray, Whympier and Lower Campbell (Fry Lake) lakes. (Northwest Hydraulics, 2002)

Activity	Year				
	2006	2007	2008	2009	2010
Prepare a proposal to Bridge Coastal on Fry Creek Restoration (Northwest Hydraulics)	X				
Instream restoration in priority reaches		X	X	X	
Monitor structure use and effectiveness			X	X	X
Undertake level 1 and 2 assessments of Miller Creek*.				X	X

Potential Partners: BC Hydro, BC Forest Service.

Native Bands: Kwakiutl District Council, Campbell River Band

Estimated Costs: \$0 – 2005.

Public involvement Potential: High. *Potential to work with the Campbell River Wildlife Association on stream restoration. This would reduce costs.

(3) Suggested 5 year Plan: Restore fish passage. Unnamed creeks (#20, 21, 23, 29 Lough report 2003),

Activity	Year				
	2005	2006	2007	2008	2009
Confirm sites block fish passage.	X				
Develop plan to remove the blockages and prepare funding proposal (HCTF)	X				
Remove the barriers and introduce Dolly Varden		X	X		
Monitor fish use upstream of the barriers			X	X	X

Potential Partners: BC Hydro, BC Forest Service.

Native Bands: Kwakiutl District Council, Campbell River Band

Estimated Costs: \$0 – 2005, \$15,000* 2006

Public involvement Potential: High. *Potential to work with the Campbell River Wildlife Association on culvert/barrier removal. This would reduce costs.

(4) Suggested 5 year plan: Lake fertilization of Brewster Lake. Stomach analysis of gillnet caught Dolly Varden in Brewster, Gray, and Fry lakes indicates that snails are a major food source of Dolly Varden (Michalski 2005). Fertilization may increase snail production and make more of these invertebrates available to Dolly Varden, thereby enhancing the population and growth rate. This should be treated as an experiment and a detailed assessment should be done if it proceeds.

Activity	Year				
	2006	2007	2008	2009	2010
Meet with staff at UBC to lay out project details	X				
Develop plan to fertilize Brewster Lake and develop funding proposal (HCTF) or BC Hydro.	X				
Initiate lake fertilization		X	X		
Monitoring program including creel, netting, snorkel and invertebrate surveys.		X	X	X	X

Potential Partners: BC Hydro, BC Forest Service.

Native Bands: Kwakiutl District Council, Campbell River Band

Estimated Costs: \$0 – 2005, \$15,000* 2006

Public involvement Potential: High. *Potential to work with the Campbell River Wildlife Association on the creel survey and contracting workers with the Campbell River native band to do the fertilization.

(5) Suggested 5 year plan: Introduction of LWD. The Campbell River below Strathcona dam is a major spawning area for Dolly Varden, and cutthroat and rainbow trout. All of these species rear in that area for 1 – 3 years before recruiting to the lake. At present, the channel is devoid of any LWD. The installation of this cover type would increase rearing capacity in the area and recruitment of fish to the lake sportfishery.

Activity	Year				
	2006	2007	2008	2009	2010
Meet with staff at BC Hydro and determine potential Constraints e.g. area, and amount.	X				
Develop funding proposal (Bridge Coastal) to install the LWD.	X				
Install LWD structure along the banks and in the stream		X	X		
Monitoring program to determine fish use of the structures.		X	X	X	X

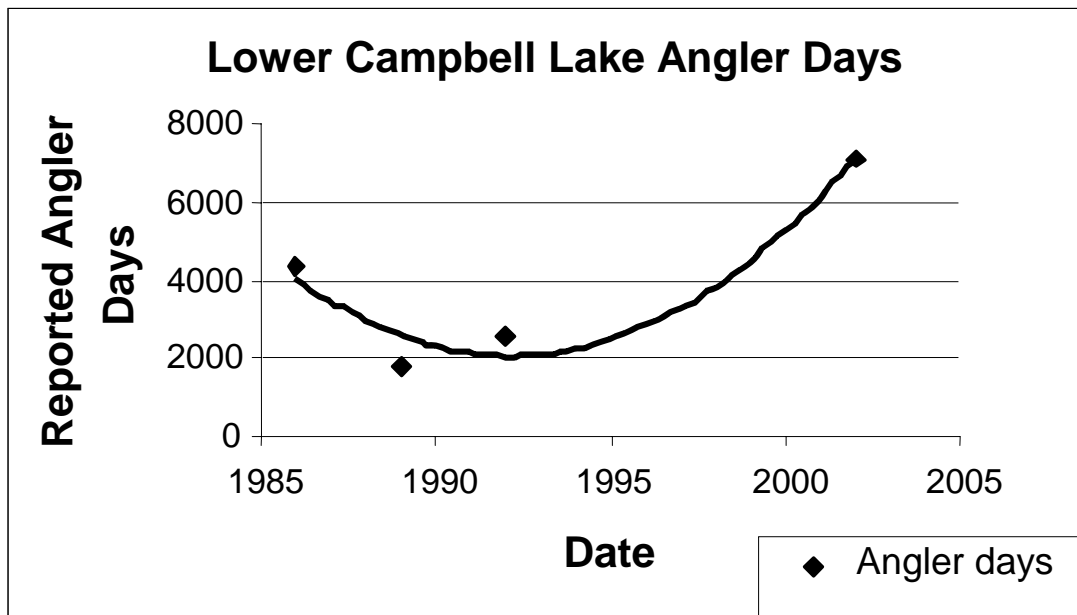
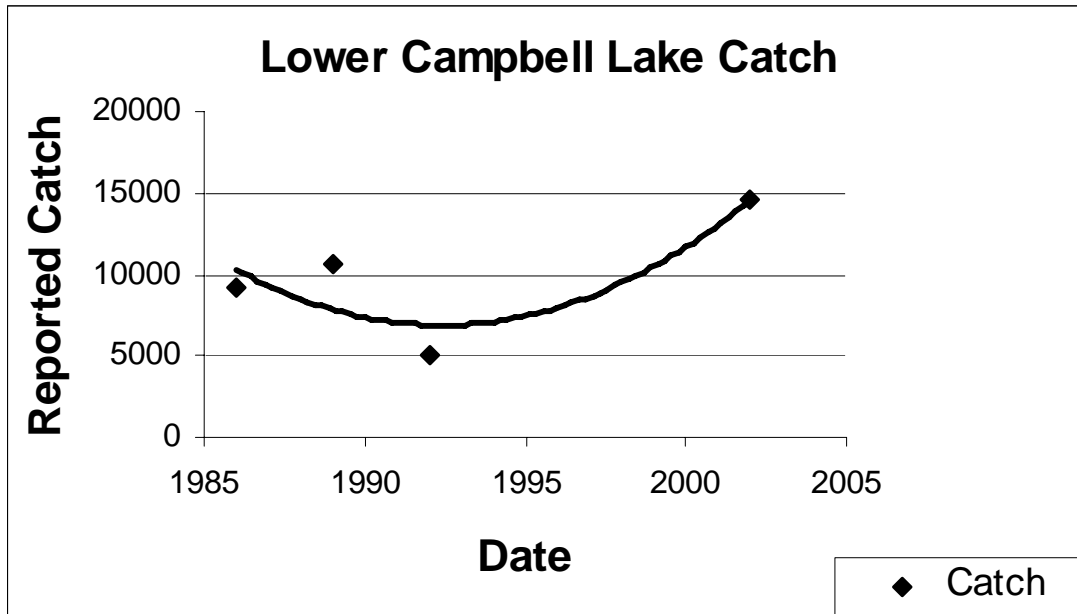
Potential Partners: BC Hydro, Forest Industry (supply LWD)

Native Bands: Kwakiutl District Council, Campbell River Band

Estimated Costs: \$0 – 2005, \$25,000* 2006

Public involvement Potential: High. *Potential to work with the Campbell River Wildlife Association on the installation of the LWD and/or contracting workers from the Campbell River native band.

Figure 15 & 16. Trend in Lower Campbell Lake angler catch and angler days, Campbell Oyster PU. Trend data is calculated from Vancouver Island Lakes Questionnaire 1986-2002.



Lake Planning

Lake: Buttle Lake **Planning Unit:** CO **Lake Priority:** 8 **PU Priority:** 1

Land Use: Park, mining, logging.

Stock Status: Stable Increasing Declining Unknown

Angling Effort Trend: Stable Increasing Declining Projected (2010) 5811

Catch Trend: Stable Increasing Declining Projected (2010) 14654

Catch/angler day Trend: Stable Increasing Declining Projected (2010): 2.52

Key Streams: Thelwood Creek, Price Creek.

Suggested 5 year Plan: Public Education Program. There is potential to view rainbow trout spawning, fish habitat components and stream ecological processes in the Thelwood valley. No restoration is recommended at this time.

Activity	Year				
	2008	2009	2010	2011	2012
Undertake level 1 and 2 assessments of Thelwood Creek.				X	X
Develop public education proposal with School District, BC Parks and BC Hydro (fish focus).	X				
Public meetings on education proposal.		X			
Implement Public Education proposal.			X		
Monitor public visits to education sites.				X	X

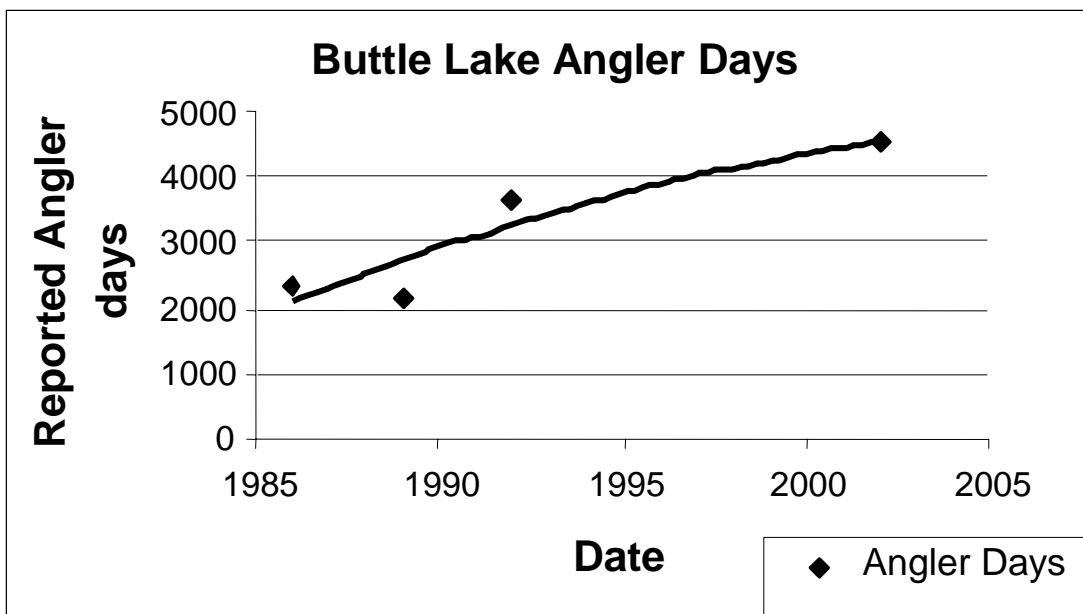
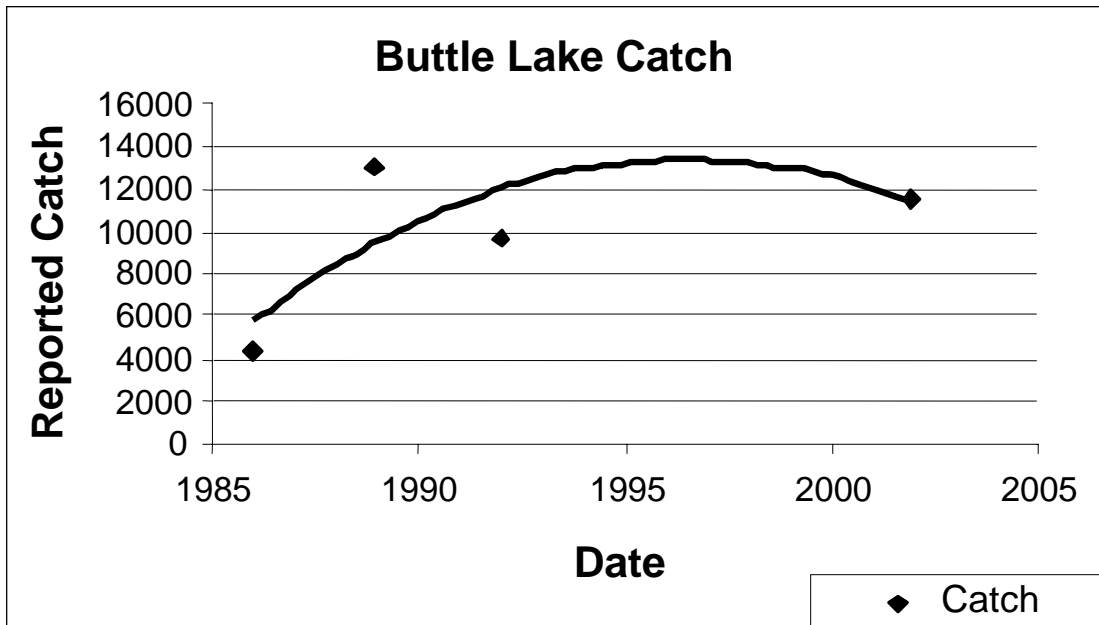
Potential Partners: BC Hydro, BC Parks, Strathcona Park Lodge, Campbell River and Gold River school districts, Habitat Conservation Trust Fund.

Native Bands: Kwakiutl District Council, Campbell River Band

Estimated Costs: 2008 - \$5000 (seed money from Bridge Coastal program)

Public involvement Potential: High. Thelwood Creek is entirely within Strathcona Park. Public education potential is high.

Figure 17 & 18. Trend in Buttle Lake angler catch and angler days, Campbell Oyster PU. Trend data is calculated from Vancouver Island Lakes Questionnaire 1986-2002.



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7.0 Meetings and Reviews

Date:	March 15, 2005
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In Attendance:	George Reid; Skip Rimmer; Tracy Michalski
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Objective:	Discuss trend parameters to set criteria for prioritizing lakes using Vancouver Island Lakes Questionnaire data.
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Outcome:	Decided to use estimate of +/- 25 % to rank catch; effort; and success. For example, if the ratio fell between 0.74 and 1.25 we ranked the variable as stable. If the variable was > 1.25 we ranked it as increasing (+), and if the variable was < 0.75 we ranked it as declining (-) .
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Date:	July 21, 2005
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In Attendance:	George Reid; Skip Rimmer; Tracy Michalski
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Objective:	Discuss comments and suggestions by Skip Rimmer on first draft of Dolly Varden Plan
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Outcome:	Skip raised the concern that the Lakes Questionnaire data was not split up according to species so our data and results includes all salmonids caught. We agreed that the benefit of using this data is that it is available Island-wide for angler catch, effort and success and it was replicated over a series of years so comparisons and projections can be made. We reviewed the objectives of the study including how the data would contribute to fulfilling that objective and agreed this was the most appropriate approach and data set to use. We also agreed to make recommendations in the plan for changing the questionnaire in the future so that individual species catch is identified.
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Date:	August 31, 2005
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In Attendance:	Dick Heath; Bob Hooton, Craig Wightman, Skip Rimmer, George Reid; Tracy Michalski;
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Objective:	Presentation regarding the Lower Campbell Lake and HCTF Dolly Varden Plan projects;
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Outcome:	Reviewed the history of the project and the plan, and discussed concerns regarding the fact that the data includes all species and that there are inherent biases in questionnaire surveys. We reviewed our discussions with Skip regarding the inclusion of all species and agreed that in the future, the region should consider asking anglers to break their catch by species if possible. With respect to bias – including recall bias and anglers overestimating their catch, we acknowledged that those biases exist in questionnaires. Given our study objectives and the fact that we were most concerned with the lakes where anglers fished, their relative catch and the relative days they fished, we considered this bias as standard and minor but also agreed to account for it in the plan. The group decided that, because both Dolly Varden and cutthroat are both Blue-listed and that they have overlapping niches, the plan be expanded to include both. We agreed to expand the plan into a Blue-listed species plan.
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Date: August 31, 2005

In Attendance: Ron Ptolemy – comments via email

Subject: Review of Blue-Listed Species Plan

Outcome: Concerns included the fact that there are a lot of statistics in the draft but no indication of the precision of estimate; the catch trends do not indicate how catch has changed with regulations – there is the same problems and issues with Steelhead Harvest Analysis. Many concerns focused on Cowichan Lake but could be applied throughout including: if we have a sense of what the historic catch and how this relates to large lake productivity expectations? Also, the concern that the data is for all species; recommending restoration based on streams if the fishery itself is a primary factor for stock decline; do we have a good assessment of what number and size of DV or CCT migrants it takes to sustain a healthy fish population in lakes?

George's response to Ron's concerns included the following: the objectives in developing this plan were first to identify the highest use Dolly Varden lake fisheries in the region and use three criteria in which to rank the lakes, i.e., angler effort, angler catch and angler success, to ensure that restoration efforts were focused on high effort sport fisheries and allow those efforts be prioritized. Skip Rimmer, Tracy and I met to discuss and we agreed this was the best approach. Cutthroat trout were later added into the plan at the suggestion of the Regional Manager, Dick Heath, and Craig Wightman and Skip Rimmer when Tracy and I presented our preliminary findings.

One other point on the questionnaire design. The questionnaire was designed by Paul Healy (Ministry Statistician) and reviewed by Eric Parkinson before we sent it out. We depended on their expertise. It was modeled after the steelhead questionnaire except we sampled a larger cross section of anglers. I personally would be reluctant to change it other than to break out the species.

Date: February 9, 2006

In Attendance: Eric Parkinson – comments via email

Subject: Review of Blue-listed Species Plan

Outcome: Eric's comments included that the plan looked good for the specified lakes; effort estimates are reasonable and correlate well with a model based on lake size and angler behaviour. His key issues were that conservation plans generally try to achieve protection of a depreciative sample of population types and that priority setting uses angler questionnaire data, restoration focuses on habitat. While habitat improvement can compensate for the effects of over-harvest, poor habitat conditions are not necessarily correlated with fishing pressure.

Comments were reviewed; no changes to plan required.

8.0 Appendices

Appendix 1

Catch/angler day by planning unit for lakes containing Dolly Varden in the Vancouver Island Region. Information is summarized from the Vancouver Island Lakes Questionnaire 1986 – 2002.

Name	P U	Angler Days '86	Angler Days '89	Angler Days '92	Angler Days '02
Amor	CO	3.9	2.7	3.4	1.7
Beavertail	CO	2.6	2.3	3.6	2.8
Boot	CO	2.5	3.6	3.2	1.1
Brewster	CO	2.7	2	1.9	2
Buttle	CO	1.8	2.4	2.7	2.5
Campbell	CO	2.1	1.9	2	2.1
Comox	CO	1.2	1	1.3	1.4
Drum	CO	1.5	2.4	3.7	1.9
Echo	CO	1.6	2	1.1	2
Forbush	CO	5.1	2.2	0.5	4.5
Fry	CO	1.5	1.7	1.3	0.7
Gray	CO	1.7	2.7	1.7	2
John hart	CO	0.8	1.1	0.8	2.4
Keta	CO	3.7	3.7	4.1	6
McCreight	CO	3.4	5.1	2.7	2.7
McIvor	CO	2	0.9	1.2	2.1
Mirror	CO	1.6	1.7	1.4	3.5
Paterson	CO	1.6	3	3.8	2.5
Quinsam	CO	2.2	5.4	2.7	3.3
Roberts	CO	2.2	1.7	1.3	1.3
Stewart	CO	1.7	2.4	3.6	5
Upper Campbell	CO	2.3	2.4	2.3	2.4
Willemar	CO	2.8	2	3	2
Wokas	CO	1.7	2	1.7	1.5
Wolf	CO	1.5	1.6	1.7	1.2
Ave. c/f		2.228	2.396	2.268	2.424
Canyon	KN				
Devereux	KN		0.0		
Glendale	KN				
Kakweiken	KN				
Laura	KN				
Seabird	KN				
Stafford	KN		6	0.0	8.3
Tom Browne	KN			3	
Ave. c/f			3	1.5	8.3

Name	P U	Angler Days '86	Angler Days '89	Angler Days '92	Angler Days '02
Blackjack	NC	0.27	2.6	5.7	2.5
Cowichan	NC	1.04	1	0.8	1.1
Fourth	NC	3.4	2.8	2.5	2.3
Mesachie	NC	1.4	0.8	0.7	2
Second	NC	1.76	2	2.7	1.3
Ave. c/f		1.574	1.84	2.48	1.84
Claude Elliot	NM	3	4.3	10.8	0.0
Crowman	NM	1.2	1.5	5	
Haihte	NM				
Hoomak	NM	3.2	2.1	3.7	3.8
Hustan	NM	4	2	1.3	0.5
Ida	NM	3.5	2.7	1.6	0.1
Joes	NM				1.3
Kains	NM	4.2	0.3	3.3	1.5
Keogh	NM	1.2	2.5	2.1	0.5
Lake of the Mountains	NM				
Misty	NM	2	0.8	2	
Nahwitti	NM	0.5	2.6	1.9	1
O'Connor	NM	1.8	6.2	2.5	1.1
Quatse	NM	1.1	2.3	0.3	1
Rooney	NM	2.7	1.8	2.3	1.9
Schoen	NM	1.7	0.8	0.9	4
Shushartie	NM				
Songhees	NM	4.8	1	1.3	
William	NM	4			0.3
Wolfe	NM	1.2	0.25	0.4	0.5
Woss	NM	1.2	1.7	1.3	1.9
Ave. c/f		2.43	2.05	2.54	1.29
Alice	WC	1.9	1.7	2.3	1.4
Angora	WC				
Ash	WC	1.7	2.5	1.7	1.3
Benson	WC	4.6	4.1	1.8	1.6
Blue	WC				
Clayoquot	WC				
Crest	WC	1.6	1.6	2.5	1.4
Darlington	WC		1.4	0.5	4
Dickson	WC	2.4	3.6	3.5	2.3
Ellen	WC				
Ellswick	WC				0.0
Fairy	WC	1.2	0.9	0.6	2.8
Francis	WC	3.2	1.6	5.3	3
Great Central	WC	1	1.7	1.2	1.4

Name	P U	Angler Days '86	Angler Days '89	Angler Days '92	Angler Days '02
Hobiton	WC	0.5	0.8	0	0.0
Iron	WC	6.1	5.1	2.8	5.4
Kathleen	WC	1.6	4.6	1	1.4
Kite	WC				2
Maggie	WC	1.9	1.3	2.8	2.4
McLaughlin	WC	1.8	1.4	1.5	1.4
Megin	WC	2.9	1.6	0.6	2.1
Moore	WC	1.7	3.3	1.5	
Muchalat	WC	1.3	1.1	1	1
Nahmint	WC	1.4	1.1	1.8	1.7
Sara	WC	6	2	5.5	10
Silburn	WC				
Sooke	WC	1.5	1.5	0.9	2.5
Sproat	WC	0.7	1.3	1	1.1
Toquart	WC	3.5	1.3	1.1	
Twaddle	WC	4.5	8.3	3.1	14
Victoria	WC	5.3	2.8	1.9	2.1
Zeballos	WC				0.0
Ave. c/f		2.53	2.36	1.91	2.65

Appendix 2

Angler days by planning unit for lakes containing Dolly Varden in the Vancouver Island Region. Information is summarized from the Vancouver Island Lakes Questionnaire 1986 – 2002.

Name	PU	Angler Days '86	Angler Days '89	Angler Days '92	Angler Days '02
Amor	CO	445	942	497	250
Beavertail	CO	1025	1986	1497	1573
Boot	CO	40	101	199	219
Brewster	CO	895	529	1285	1927
Buttle	CO	2355	2179	3649	4531
Campbell	CO	4340	1784	2563	7094
Comox	CO	4450	1446	5517	7063
Drum	CO	40	68	166	260
Echo	CO	865	297	775	2010
Forbush	CO	145	52	278	313
Fry	CO	845	225	2026	3188
Gray	CO	530	566	139	479
John Hart	CO	45	131	238	104
Keta	CO	45	113	66	115
McCreight	CO	550	1103	649	490
McIvor	CO	385	280	530	750
Mirror	CO	115	60	152	83
Paterson	CO	25	12	33	219
Quinsam	CO	450	1305	1026	490
Roberts	CO	255	358	609	625
Stewart	CO	50	256	298	31
Upper Campbell	CO	4000	5707	5331	4521
Willemar	CO	875	1097	1013	479
Wokas	CO	475	364	802	344
Wolf	CO	1660	4776	3099	2875
Total Angler days		24905	25737	32437	40033
Canyon	KN	0	0	0	0
Devereux	KN	0	13	0	0
Glendale	KN	0	0	0	0
Kakweiken	KN	0	0	0	0
Laura	KN	0	0	0	0
Seabird	KN	0	0	0	0
Stafford	KN	0	6	7	31
Tom Browne	KN	0	0	40	0
Total Angler days		0	19	47	31

Name	PU	Angler Days '86	Angler Days '89	Angler Days '92	Angler Days '02
Blackjack	NC	45	113	46	21
Cowichan	NC	16222	17370	25649	14885
Fourth	NC	640	584	1007	958
Mesachie	NC	220	107	60	31
Second	NC	995	835	1728	3115
Total Angler days		18122	19009	28490	19010
Claude Elliot	NM	55	78	26	
Crowman	NM	25	60	13	10
Haihte	NM	0	0	0	0
Hoomak	NM	135	83	60	0
Hustan	NM	30	745	146	94
Ida	NM	55	36	199	21
Joes	NM	0	0	0	396
Kains	NM	110	24	152	63
Keogh	NM	215	638	338	21
Lake of the Mou	NM	0	0	0	177
Misty	NM	75	24	33	0
Nahwitti	NM	155	751	179	0
O'Connor	NM	330	471	404	188
Quatse	NM	90	107	79	104
Rooney	NM	45	149	99	0
Schoen	NM	490	513	755	10
Shushartie	NM	0	0	0	563
Songhees	NM	30	6	26	10
William	NM	15	0	0	0
Wolfe	NM	80	72	424	31
Woss	NM	635	763	1126	115
Total Angler days		2570	4520	4059	1073
					2876
Alice	WC	1960	1509	1205	1885
Angora	WC	0	0	0	0
Ash	WC	225	209	159	375
Benson	WC	380	382	325	677
Blue	WC	0	0	7	0
Clayoquot	WC	0	0	7	0
Crest	WC	25	101	344	125
Darlington	WC	0	95	26	63
Dickson	WC	865	1145	649	490
Ellen	WC	0	0	7	0
Ellswick	WC	0	0	0	10
Fairy	WC	490	447	412	698

Name	PU	Angler Days '86	Angler Days '89	Angler Days '92	Angler Days '02
Francis	WC	50	227	113	10
Great Central	WC	840	3816	3093	3990
Hobiton	WC	120	30	0	10
Iron	WC	0	197	126	135
Kathleen	WC	50	54	132	94
Kite	WC	0	0	0	10
Maggie	WC	210	352	79	115
McLaughlin	WC	60	137	66	188
Megin	WC	35	30	33	104
Moore	WC	70	78	13	0
Muchalat	WC	1020	1258	954	1313
Nahmint	WC	125	244	609	458
Sara	WC	15	6	73	10
Silburn	WC	0	0	0	0
Sooke	WC	115	239	46	229
Sproat	WC	5230	6798	6728	7250
Toquart	WC	100	239	66	0
Twaddle	WC	85	95	219	729
Victoria	WC	1195	1926	2053	2104
Zeballos	WC	0	30	7	10
Total Angler days		13265	19644	17551	21082

Appendix 3

Angler catch by planning unit for lakes containing Dolly Varden in the Vancouver Island Region. Information is summarized from the Vancouver Island Lakes Questionnaire 1986 – 2002.

Name	PU	Catch '86	Catch '89	Catch '92	Catch '02
Amor	CO	1715	2588	1702	417
Beavertail	CO	2675	4442	5444	4344
Boot	CO	100	370	636	250
Brewster	CO	2455	3154	2497	3927
Buttle	CO	4330	12993	9735	11542
Campbell	CO	9140	10638	5093	14656
Comox	CO	5265	8623	6993	9563
Drum	CO	60	405	609	500
Echo	CO	1420	1771	1775	4073
Forbush	CO	735	310	623	1417
Fry	CO	1285	1342	3728	2365
Gray	CO	880	1556	682	979
John Hart	CO	35	143	179	250
Keta	CO	165	417	272	688
McCreight	CO	1890	5653	1775	1320
McIvor	CO	770	239	656	1573
Mirror	CO	185	101	219	292
Paterson	CO	40	36	126	552
Quinsam	CO	995	4049	2735	1625
Roberts	CO	565	620	762	823
Stewart	CO	85	614	1066	156
Upper Campbell	CO	9210	13906	12464	10740
Willemar	CO	2475	2200	3020	969
Wokas	CO	795	716	1384	521
Wolf	CO	2510	7496	5272	3531
Total Catch		49780	84382	69447	77073
Canyon	KN				
Devereux	KN				
Glendale	KN				
Kakweiken	KN				
Laura	KN				
Seabird	KN				
Stafford	KN		38	0.0	260
Tom Browne	KN			119	
Total Catch		0	38	119	260
Blackjack	NC	165	36	265	52

Name	PU	Catch '86	Catch '89	Catch '92	Catch '02
Cowichan	NC	16910	16869	20113	15990
Fourth	NC	2175	1610	2550	2156
Mesachie	NC	310	89	40	63
Second	NC	1750	1628	4709	4146
Total Catch		21310	20232	27677	22407
Claude Elliot	NM	165	334	285	0.0
Crowman	NM	30	89	66	
Haihte	NM				
Hoomak	NM	435	179	219	354
Hustan	NM	120	125	166	10
Ida	NM	195	95	325	52
Joes	NM				83
Kains	NM	470	6	325	31
Keogh	NM	255	1574	722	83
Lake of the Mou	NM				
Misty	NM	150	18	66	
Nahwitti	NM	85	1962	344	188
O'Connor	NM	615	2916	1013	115
Quatse	NM	95	250	26	
Rooney	NM	120	274	225	10
Schoen	NM	835	417	675	1042
Shushartie	NM				42
Songhees	NM	145	6	33	
William	NM	60			10
Wolfe	NM	95	18	152	63
Woss	NM	790	136	1517	760
Total Catch		4660	8399	6159	2843
Alice	WC	3700	2582	2755	2573
Angora	WC				
Ash	WC	390	525	272	1042
Benson	WC	1780	1586	596	1073
Blue	WC				
Clayoquot	WC			99	
Crest	WC	40	161	861	177
Darlington	WC		137	13	250
Dickson	WC	2110	4079	2272	1125
Ellen	WC			0.0	
Ellswick	WC				0.0
Fairy	WC	595	400	258	1313
Francis	WC	160	364	596	31
Great Central	WC	850	6631	3722	5552
Hobiton	WC	65	24		0.0
Iron	WC	400	1008	351	729
Kathleen	WC	80	244	126	135

Name	PU	Catch '86	Catch '89	Catch '92	Catch '02
Kite	WC				21
Maggie	WC	400	465	225	271
McLaughlin	WC	105	197	99	260
Megin	WC	100	48	20	219
Moore	WC	120	256	20	
Muchalat	WC	1345	1437	934	1260
Nahmint	WC	210	274	1093	792
Sara	WC	90	12	397	104
Silburn	WC				
Sooke	WC	170	364	40	563
Sproat	WC	3905	8897	6450	8021
Toquart	WC	350	304	73	
Twaddle	WC	380	298	675	729
Victoria	WC	6335	3751	3967	2104
Zeballos	WC		0.0	0.0	0.0
Total Catch		23680	34044	25914	28344

Appendix 4

Lake priority for angling effort (angler days) in the top 10 Dolly Varden lakes in the Campbell Oyster and West Coast Planning Units and top 5 lakes in the Nanaimo Cowichan Planning Unit. Vancouver Island Lakes Questionnaire 1986 – 2002.

Lake	PU	Angler Days	Percent (rounded)	Priority
Upper Campbell	CO	19559	19	1
Comox	CO	18476	18	2
Campbell	CO	15781	15	3
Buttle	CO	12714	12	4
Wolf	CO	12410	12	5
Fry	CO	6284	5	6
Beavertail	CO	6081	5	7
Brewster	CO	4636	4	8
Echo	CO	3947	4	9
Willemar	CO	3464	4	10
Cowichan	NC	74126	88.00%	1
Second	NC	6673	8	2
Fourth	NC	3189	4	3
Mesachie	NC	418	0.5	4
Blackjack	NC	225	0.3	5
Sproat	WC	26006	36	1
Great Central	WC	11739	16	2
Victoria	WC	7278	10	3
Alice	WC	6559	9	4
Muchalat	WC	4545	6	5
Dickson	WC	3149	4	6
Fairy	WC	2047	3	7
Nahmint	WC	1436	2	8
Twaddle	WC	1128	2	9
Maggie	WC	756	1	10

Appendix 5

Lake priority for catch in the top 10 lakes in the Campbell Oyster and West Coast Planning units, and top 5 lakes in the Nanaimo-Cowichan Unit. Vancouver Island Lakes Questionnaire. 1986-2000.

Campbell Oyster Planning Unit

Lake	Catch*	Percent/PU	Priority
Upper Campbell	46320	20	1
Campbell	39527	17	2
Buttle	38600	16	3
Comox	30444	13	4
Wolf	18809	8	5
Beavertail	16905	7	6
Brewster	12033	5.5	7
McCreight	10638	4.5	8
Quinsam	9404	4	9
Echo	9039	4	10

Nanaimo-Cowichan Planning Unit

Lake	Catch	Percent / PU	Priority
Cowichan	69882	76	1
Second	12233	13	2
Fourth	8491	9	3
Blackjack	518	0.5	4
Mesachie	502	0.5	5

West Coast Planning Unit

Lake	Catch	Percent / PU	Priority
Sproat	27273	28	1
Great Central	16755	17	2
Victoria	16157	16	3
Alice	11610	12	4
Dickson	9586	10	5
Benson	5035	5	6
Muchalat	4976	5	7
Fairy	2566	3	8
Nahmint	2369	2	9
Ash	2229	2	10

Appendix 6

Lake priority for Dolly Varden lakes exhibiting the lowest angler success rates in the Campbell Oyster, West Coast and Nanaimo Cowichan Planning Units. Vancouver Island Lake Questionnaire, 1986-2002.

Lake	PU	Catch/angler day	Priority
Cowichan	NC	0.99	1
Sproat	WC	1.03	2
Muchalat	WC	1.1	3
Comox	CO	1.23	4
Mesachie	NC	1.23	5
Great Central	WC	1.33	6
Fairy	WC	1.38	7
Nahmint	WC	1.5	8
Wolf	CO	1.5	9
McLaughlin	WC	1.53	10
McIvor	CO	1.55	11
Roberts	CO	1.63	12
Echo	CO	1.68	13
Wokas	CO	1.73	14
Crest	WC	1.78	15
Ash	WC	1.8	16
Megin	WC	1.8	17(Park)
Second	NC	1.94	17
Campbell	CO	2.03	18
Grey	CO	2.03	19
Brewster	CO	2.15	20

Appendix 7

Stock status, projected angler days, catch and catch/angler day for the top 10 Dolly Varden lakes in the Campbell Oyster and West Coast planning units, and the top 4 lakes in the Nanaimo Cowichan planning unit. The projected number of angler days, fish caught and angler success is for the year 2010. S = Stable, + = increasing trend and - = declining trend.

Lake	PU	Projected Angler days	Trend	Projected Catch	Trend	Projected Catch/day	Trend	Stock status 2010
Cowichan	NC	16186	S	17471	S	1.08	S	S
Sproat	WC	8246	+	9672	+	1.05	S	S
Comox	CO	8908	+	11358	+	1.28	S	S
Wolf	CO	3269	S	3851	S	1.17	S	S
Great Central	WC	5446	+	7418	+	1.52	S	+
Upper Campbell	CO	4791	S	11438	S	2.39	S	S
Campbell	CO	8311	+	16004	+	1.93	S	+
Buttle	CO	5811	+	14654	+	2.52	S	+
Second	NC	4244	+	5881	+	1.27	-	S
Victoria	WC	2589	+	83	-	0.3	-	-
Fry	CO	4583	+	3373	+	0.74	-	-
Muchalat	WC	1394	+	1118	S	0.83	S	S
Alice	WC	1753	S	2030	-	1.16	-	-
Beavertail	CO	1778	S	5433	S	3.06	S	S
Mesachie	NC	0	-	0	-	2.2	+	-
Brewster	CO	2527	+	4488	+	1.77	S	+
Fairy	WC	780	+	1588	+	3.43	+	+
McLaughlin	WC	215	S	314	+	1.22	S	S
Echo	CO	2585	+	5280	+	2.04	S	S
Roberts	CO	852	+	852	S	1	-	S
Nahmint	WC	695	+	1236	+	1.97	S	S
Dickson	WC	234	-	429	+	2.32	+	+
McCreight	CO	403	-	482	-	1.2	-	-
McIvor	CO	960	+	1985	+	2.07	+	+

Lake	PU	Projected Angler days	Trend	Projected Catch	Trend	Projected Catch/day	Trend	Stock status 2010
Quinsam	CO	507	-	1834	S	3.62	S	S
Wokas	CO	374	S	540	-	1.44	S	S
Willemar	CO	300	-	458	-	1.53	-	-
Crest	WC	228	+	400	+	1.51	-	S
Fourth	NC	1189	+	2313	S	1.7	-	S
Ash	WC	430	+	1286	+	1	-	S
Gray	CO	365	S	879	-	2.41	S	S