Reality Stewardship

Survival of the Fittest for Community Salmon Groups

Report to the Vancouver Foundation and
Pacific Fisheries Resource Conservation Council

Brian Harvey and David Greer

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EXECUTIVE SUMMARY

Over the past decade, governments at the federal and provincial levels have encouraged B.C. communities to get involved in salmon habitat stewardship. Until very recently governments provided many funding and technical support programs. But, as this report is written, that funding has largely dried up, the salmon are little better off than they were a decade ago, and many community groups can be excused for feeling the rug has been pulled out from under them. The disappearance of HRSEP, HCSP, Forest Renewal and Fisheries Renewal represent a loss of approximately $66 million in annual funding for salmon stewardship, almost overnight. If the budgets of the habitat biologists and engineers in DFO continue to decrease, what has devolution really achieved beyond a short-term frenzy of activity, the rise and fall of some local organizations, and the gutting of DFO's own programs and funding?

Many players have been involved in salmon stewardship in B.C. over the past decade. Community groups are just one. This report tries to look fairly at the contributions and achievements of community groups, in the context of other players and changing policies on salmon conservation and management.

This report first looks at the tools used by community groups to restore salmon habitat over the past decade, in the context of DFO's stewardship model, in which a network of Community Advisors assist in project selection, fundraising, partner coordination and the provision of technical support services from within the agency. We conclude that, for projects using off-channel, riparian and instream restoration or enhancement, and for fish culture, there has been an almost complete lack of monitoring, which leaves a data gap that is unlikely to maintain bureaucratic confidence in the enterprise. The most important kind of evaluation, monitoring for effects on the ecosystems utilized by salmon, is almost non-existent. Unfortunately, because of scientific uncertainty about many aspects of the salmon's life, attempts to "restore" habitat are themselves in the nature of experiments. Planning these attempts as such would go a long way toward ensuring that lessons learned are not lost. As things stand now, a sense of community empowerment and the political brownie points generated by many projects may be the only demonstrable successes.

We consider a number of restoration projects in and around urban areas. Were these projects worth doing? In terms of numbers of salmon, maybe not. However, the location of the streams means that their payoff in awareness and inculcation of a stewardship ethic is far bigger than their size would suggest. For these projects and for many others like them, success is measured in awareness, not numbers of salmon. The role of local hatchery projects in involving communities is also examined, and we conclude that perpetual enhancement is not a message stewards should be receiving. Instead, they should be considering the real limiting factors behind a stock's decline. A project to construct and operate an enumeration fence at Kirby Creek on Vancouver Island is analyzed as a case study where a multiple-partner effort to generate vital long-term stock assessment data collapsed through reliance on short-term funding. The "Community Advisor model" that has been so successful for community groups partnerships often includes local Indian Bands as partners, but there are also many examples of habitat stewardship where the position and role of the Band is central and where funding available only to Bands is key; the report looks at several of these projects.

The report then turns to what may be in store for community salmon stewardship in the next decade. One-stop shopping for salmon habitat projects is a thing of the past, and projects that are basically feel-good exercises may be a luxury the system can no longer afford. To survive at all will require a new approach to fund raising, with skills that many community groups don't yet

have. The report offers suggestions for community group "survival of the fittest" in this new climate.

A major factor is the shift to recovery planning, a conservation approach embodied in the new *Species at Risk Act* and now being applied to salmon populations within and outside the SARA process. *Ad hoc* salmon stewardship is going to give way to better-planned efforts that will compete according to a new set of rules. Recovery plans represent the kind of detailed, results-based, long term planning that's been missing from community projects, and can bring together the "amateurs" and the "professionals" so that both can contribute rather than fight over funding. Recovery planning is attractive to funders, who can see evidence of consultation and priorities. Recovery planning is not the only valid approach to salmon conservation, but it is a force that community groups need to become familiar with.

Finally, the report addresses the difficult questions of devolution and the relevance of community salmon stewardship. Which streams or stocks received attention in the past (and from whom), how were those decisions made, and does the same rationale still make sense? We present maps of community projects that demonstrate the expected clustering around urban centers and a few major river systems, and suggest that, in a time of reduced funding, it is important for community efforts (on the one hand) and government strategies for management and conservation (on the other) to be on the same page. So far, there hasn't been any relationship between the projects communities do and the management decisions that drive the fisheries. This disconnect between community habitat restoration and salmon management suggests that habitat restoration in B.C. hasn't been based on comprehensive planning. There have been fewer restoration projects in outlying, unpopulated areas of the province, and there has been no evidence of any planned relationship between the selection of restoration projects and achieving DFO's management and conservation objectives.

The good news is that volunteers represent a pool of enthusiasm and a conduit to greater public awareness. They are currently undergoing a trial by fire in B.C., but those groups that emerge need to be encouraged to contribute where they can really make a difference, and discouraged from mounting projects that are going to implode. Unfortunately, "feast or famine" funding does not build capacity. B.C. stewardship groups, for salmon and for other wildlife and ecosystems, are now in the midst of a re-grouping exercise that will see the disappearance of many and a consolidation of strengths to survive on less money. We propose two basic kinds of project which we believe reflect the realities of funding, manpower and interest in the province. They are *ecosystem*/*awareness projects* and *management projects*. Both are well suited to inclusion in recovery plans, but they serve two different purposes that should not be confused.

The report concludes with a series of recommendations that amount to a new set of survival skills for community groups. They are:

- Forming consortia with fund-raising and management skills and local political support
- Getting on board the recovery planning ship before it sails without them
- Speaking out and raising awareness
- Defining data-gathering objectives right from the start
- Running hatchery programs with both eyes open to agency management plans and policies

I. PROLOGUE: A BAD SEASON FOR THE VANCOUVER CHINOOKS

Imagine the "B.C. salmon team" as a football team. Maybe they're called the Vancouver Chinooks. The Chinooks' roster is initially made up of professionals—some more skilled than others, but all of them paid. The players all have the same coach and the same owner and they use the same playbook, the list of strategies and techniques for defeating their opponents.

Real football teams use passing plays, running plays, kicking plays, all of which are constantly updated by the coaching staff and their "scouts" who study the results and make adjustments. The plays used for salmon stewardship include in-stream restoration, riparian restoration, hatchery enhancement and surveys, and they change too, depending on the results of research.

Alas, the Vancouver Chinooks have a string of losing years. So management does what real-life team managers have probably always dreamed of doing when the boos began to rain down on them from the stands: they turn around and say to the fans making the most noise, "OK, you guys come down here on to the field, we'll give you a suit and a helmet and see how well you do. And by the way,"—here they turn to their old players—"you, you, and you, you're out of a job. You'll be handing the ball to Joe Fan here. Shake hands, and good luck." With that, the manager walks off the field and leaves his coach to make the best of it. The whistle blows, Joe Fan pulls on his helmet and runs onto the field next to his new teammates, bursting with pride. That was stewardship in the early nineteen nineties.

What happens next? Either the new-look Chinooks learn to play well together or they don't. Maybe they accept the situation, work hard, play as a team, have a winning season. Or maybe they dissolve in bickering and mutual distrust. As long as there's still money for a football and some uniforms, they've got a fighting chance. That was stewardship until about 1999.

But management calls a team meeting halfway through the season and says to the fan-players, "Nice work guys, but we can't afford uniforms for you any longer. Gonna have to suck it up and play in your T-shirts. Go get 'em."

Is this the situation of salmon stewardship in B.C. today? Have the Chinooks lost their uniforms? Do they even have a coach anymore? Can the team get its old players back or have the ex-pros all retired, opened sports bars and put on thirty pounds? How long should the Chinooks management expect their enthusiastic amateurs to tolerate getting banged up for nothing?

Answering these questions is what this report is about.

II. WHY THIS REPORT WAS WRITTEN

Salmon stewardship is an endeavour that touched many public and private organizations in British Columbia over the past decade. World Fisheries Trust, the organization responsible for writing this report, was only one of them. Nevertheless, our role in salmon stewardship, modest though it was, is important in the genesis of the report, and worth clarifying at the outset.

In the mid-1990s it seemed that every newspaper in coastal B.C. was running stories on the "collapse" of the commercial salmon fishery and the endless friction over how to divide what remained between commercial fishermen, recreational anglers, and First Nations. The average person reading these articles could be forgiven for thinking there were no salmon left at all. So few years after the collapse of the Atlantic cod fishery, salmon shortages made for excellent press.

The 1990s also saw a boom in community salmon stewardship in B.C. More precisely, stewardship peaked between 1992, when public awareness about biodiversity got a boost from the signing of the international Convention on Biological Diversity, and 2002, when funding for community involvement began to dry up.

World Fisheries Trust's involvement in salmon stewardship

The present report on community salmon stewardship covers roughly this period of ferment, from 1992 to 2002, and World Fisheries Trust was keen to write it. Why? What interest or expertise does WFT have in the many attempts by community groups to "bring back the salmon" (an unfortunate phrase that, as we will see, is the cause of much confusion over what has really been accomplished)?

The answer is simple: WFT was part of the phenomenon. We were not a "community group" or society dedicated to preserving salmon, but we *were* an organization that had what it took to do field work in this area in the 1990s: a provincial tax number, a willingness to raise money, and a little technical competence. These requirements are, unfortunately, listed in order of importance.

Our main salmon stewardship project was the construction of a counting fence on Kirby Creek, one of DFO's indicator streams[1] on south Vancouver Island. How did we get started? We approached the local DFO Community Advisor, declared our willingness to get involved, and received a list of projects of interest to DFO. From this list we chose Kirby Creek, mainly for proximity and what looked like manageable financial requirements. Next we were introduced to a DFO habitat biologist and a DFO engineer, with whom we walked the area and discussed "our" project. Another DFO biologist laid out the kinds of data the fence would need to be able to collect, and in a month or so we received a set of plans and specifications.

This was heady stuff. At the time, WFT had two PhDs and one BSc on staff, but none of us had training in salmon habitat restoration or salmon management. One of us used to be a commercial fisherman, but that's as close as we came. But DFO accepted us as important partners, and introduced us to some other community partners, including the local salmon enhancement society and a group of displaced fishermen funded through another federal department.

What about the money? DFO contributed the time its advisors and technical experts spent on the project, as well as some materials; WFT raised the rest. It was a typical funding mix: the Shell Environmental Fund; Western Forest Products; Scott Plastics (a local Victoria company); the Canada Trust Friends of the Environment Foundation. Contacts and legwork helped—the $6,000

from Canada Trust came from three different chapters of the Foundation, which meant three presentations in three cities. Plenty of dedication there.

WFT's role then shifted to managing the construction of the fence, with the fishermen providing the crew. The local salmon enhancement society was somehow lost in the shuffle. The fence was completed in 1997, a beautiful thing. The fishermen got a contract from DFO to monitor the fence and provide DFO with data, and WFT produced a newsletter that got distributed along the Island by Thrifty Foods.

We more or less forgot about Kirby Creek after that, and decided to try some salmon work where we had a little more direct technical expertise, this time using funding from HRSEP, Fisheries Renewal B.C. and Weyerhaeuser to do genetic mapping of sockeye stocks in Kennedy Lake, the largest lake on Vancouver Island. This was a community project too, in the sense that the aims were thrashed out through a long series of community meetings in Clayoquot Sound whose aim was to restore the sockeye fishery on Kennedy stocks. This time our partners included several First Nations, a local salmon enhancement society, an experienced technical consultant, and an NGO. As before, DFO had a key role in determining technical goals, setting sampling strategy and interpreting results. WFT spent three years on this project, producing a genetic map of twelve sockeye stocks that has great utility in helping plan the kinds and extent of enhancement of the various genetic groups in the watershed.

What were the long-term results of these two projects? The sockeye genetic map for Kennedy Lake is out there and available for any planned enhancement, but the coalition of community groups, fishermen, First Nations and scientists that called for it has fragmented. The body replacing it, which worked so hard to become a "delivery agent" for the late lamented FsRBC, is now re-inventing itself as a non-profit society with a new fundraising strategy. The watershed management plan that was to have included planned enhancement of Kennedy stocks was never completed.

Kirby Creek was even more of a disappointment. Data were collected for DFO for four years, before funding problems and internal re-organizations limited the ability of the fishermen's group to collect more. The fence has now been dismantled.

Those two projects, plus the experience of being part of the community salmon stewardship boom in general, are the reasons WFT was keen to accept funding from the Vancouver Foundation and the PFRCC to create the present report. We've seen many successes over the last decade, and the opportunity to take part in events like the annual Streamkeepers Conference has always been inspiring. But our experience raised questions too. For Kirby Creek, we wondered, what was WFT's real role? Were we just a fundraiser? Why did the local salmon enhancement group end up on the outside looking in? And, since DFO provided all the technical expertise, why couldn't they just build and operate the fence themselves? After Kennedy Lake, we wondered whether it was a good idea to spend so much time and money on studying a system where the community process was as fragile as the salmon stocks themselves.

Both projects were "successful." They filled their stated aims. People received training, data were generated. Nobody questions the importance of these data and their role in salmon management. The fact remains, however, that the problems with Kirby coho and Kennedy sockeye are long-term, and work done to study and preserve these stocks needs to be done in an environment where the important groups and sources of funding don't just come and go. What WFT did was over with in just a few years.

In the end, we concluded that our own experience didn't mean the stewardship movement was a waste of time and money. It didn't mean that the technical measures taken were the wrong ones, although any project related to habitat or enhancement has to accept that techniques change as our understanding of the biological systems evolves.

What did become obvious, though, was that projects conceived and carried out by partnerships have the strengths and weaknesses of group efforts: enthusiasm and fundraising ability may initially be high, but when partnerships collapse the lack of leadership is painfully obvious. Community-led habitat projects began to look very interesting to us not in terms of what they set out to achieve, but for the way those goals were approached. Most troubling of all was the suspicion that, when funding collapsed or coalitions flew apart, there was no guiding hand left to ensure that life went on.

To return to the Vancouver Chinooks analogy, if you hand the ball off to somebody and elect simply to run interference, what happens if the guy with the ball pulls a hamstring? To stretch the analogy further, does the team even have a coach? A general manager? Or are the players just making it up as they go along?

Evaluating the contribution of community groups

Who *are* the players in salmon stewardship? The community stewardship model that we describe in Section VI means there are a lot more of these than there used to be. Before the 1980s, there was really only one team—government. Government provided the money and government people did the work. Now government is still there, but during the last two decades bits of their old responsibilities have broken off and landed with:

- Community groups (usually non-profit, purpose-driven societies with varying degrees of staffing and infrastructure but including a pool of committed volunteers);
- A pool of bodies funded through government employment initiatives (i.e., bodies that earn a wage);
- Consultants (biologists or engineers whose careers have been built in salmon habitat or enhancement work);
- NGOs interested if not expert in salmon habitat work but wanting to be involved as part of their larger conservation portfolio (and because there was money in it);
- First Nations with a concrete stake in stewardship and a desire for training.

This is a volatile mix, and all of these players have been heavily involved in salmon stewardship in B.C. over the past decade. Within the past few years, virtually all of the major government funding for salmon habitat stewardship has evaporated, leaving most of them without a paycheck and sparking a scramble to find new funding and new ways of operating. For some, the loss of government support has been the signal to fold the tents for good. The challenge of this report is to look fairly at the contributions and achievements of the community groups themselves, and in the end to try to answer the question: has it been good for the salmon? For the people? Maybe even for both?

Evaluating the role of community groups in salmon stewardship is a very different thing from evaluating the various practices that make up stewardship. Restoration, enhancement, assessment and research all use a variety of technical tools, and their efficacy in restoring salmon has been measured scientifically and will continue to reflect the findings of science. The issue is not, "does

salmon habitat restoration work?" because the answer to that question is already known: despite the frustrations of applied science and the difficulty of rigorously evaluating the biological effects (both of which will be reviewed in Section VIII) fisheries biologists and engineers have developed a suite of techniques that *do* provide dramatically improved living conditions for salmon during the freshwater migratory portion of their life cycle. The proper application of these methods is a bigger question than ever before, but we have to assume that most of the methods "work."

The real question is, "how do community groups contribute to the well-being of salmon, and how can they keep contributing?" That is a more difficult question, because the number of variables affecting the final outcome is so great: multiple project partners, multiple restoration techniques, location of restoration, effects from elsewhere in the watershed, effects of fisheries management, even the effects of climate.

This report will examine not only the physical and biological evidence of success but also the social effects of directly involving people in salmon habitat restoration. The devolution of salmon stewardship is a social and biological experiment, so we will look not only for evidence of improved fish habitat, and even (though this is harder to document) more fish, but also for signs that a healthy stewardship ethic has been encouraged.

Previous reports, and this one

Reports by Paish (1997) and PFRCC (2001) provide valuable analyses of the pros and cons of community-group stewardship. Paish tends to favour advocacy and cautions against the creation of redundant bureaucracies in community groups, while the PFRCC report spotlights the achievements of community groups at different levels, working generally in an urban setting. Both reports predate the collapse in funding and the proclamation of the landmark *Species at Risk Act* (SARA), which, we argue later, will profoundly change the character of all stewardship activities. The two reports' differences and similarities are now moot. As the present report is written, salmon stewardship in B.C. is heading into uncharted territory.

The terms of reference for this report are to evaluate the contribution of community groups to salmon habitat stewardship. The emphasis on habitat is presumed to stem from the firmly held conviction that "habitat loss" is the main culprit behind salmon declines (a conviction that has more than a little to do with people's proximity to freshwater habitat and their ability to "do something about it"). It technically means ignoring the huge volunteer role in fish *culture*, as well as any community actions to affect the amount of fishing on a particular stock. Unfortunately, ignoring advocacy ignores what many community groups do even if they don't explicitly set out to. We have generally stuck to community group involvement in habitat restoration, but we do touch on hatcheries as well, because the "community hatchery" has been one of the building blocks of stewardship from the beginning. We also take the occasional liberty simply to observe the kinds of projects community groups have been involved in and look for insights into the general stewardship theme.

This report looks critically at the tools used by community groups over the past decade, and attempts to evaluate performance. WFT's own experience with the Kirby Creek enumeration fence is offered in enough detail to suggest some lessons. In the second part of the report we go beyond what has happened in the past to look at what may be in store for community salmon stewardship in the next decade. To do this we cover the important issues of funding and recovery planning, and we raise the troubling question of the overall relevance of community salmon projects to official policies on conservation and management.

III. IMPACTS ON SALMON

The extraordinary life cycle of the six species of Pacific salmon has earned the fish a unique place in several North American cultures, but may also be responsible for its present precarious position. No other group of fish ranges so widely, from the uppermost reaches of small freshwater tributaries to the fringes of the North Pacific. The range of habitats used by salmon over their lifetime is vast, including upstream gravel beds, midstream refugia, estuaries, nearshore and oceanic regions. Salmon can be found anywhere along a ten thousand kilometre aquatic gradient sometime during their lives, which means that if they're not already occupying a habitat that's under some kind of pressure they soon will be.

Not all of the salmon species have the same habitat requirements (coho, for example, can colonize creeks so narrow they never see a chinook; sockeye have their own unique use for lakes), but it's safe to say that they're all under pressure from harvest and habitat loss. To which must be added the effects of pollution, climate change and, some have argued, the genetic consequences of decades of hatchery-based enhancement.

But the Big Two are harvest and habitat, and it's the second of these that has been the area in which community groups have been involved the most. After all, there's a limit to what the ordinary person can do to affect harvest, but people with a passion for salmon can roll up their sleeves and "restore" streams and wetlands so that salmon regain the freshwater habitat lost to a long list of bad resource management practices. Restoration of habitat is an immensely appealing strategy ("if you build it, they will come"), and at its best is a common sense response to the obvious effects of development on wetlands, streams, estuaries and watershed processes.

Community groups have certainly been encouraged to get involved in habitat stewardship, and until very recently governments in Canada provided many funding and technical support programs to facilitate public involvement. But, as this report is written, that funding has largely dried up, the salmon are little better off than they were a decade ago, and many community groups can be excused for wondering whether the whole thing was a waste of time. Certainly any group of concerned, enthusiastic citizens contemplating the creation of a society that will go out and do good things for salmon habitat is in a much different position from a similar group starting out a decade ago. More than one such group has probably wondered whether their time might not have been better spent picketing the Minister's office to reduce fishing.

Science and salmon

When fishery calamity strikes, the media and public appetite for "explanations" is, for a time, insatiable. Management agencies and academics have been (quite rightly) hounded for answers to why the Atlantic cod stocks plummeted, and why certain stocks of Pacific salmon have declined enough to put whole fisheries out of business and pull the economic rug out from under coastal communities.

Some answers can be given confidently, such as the obvious effects of freshwater habitat loss. Some answers are painful for agencies to produce, such as the effects of management decisions that allowed smaller stocks to be collateral damage in the aggressive harvest of a few large stocks. But what many people don't realize is that many answers don't even exist yet, because our understanding of the ecosystems salmon inhabit is far from complete. This is not an excuse for close-mouthed agencies, it is the reality of the scientific method.

Item: The wide genetic range of salmon populations has been recognized for many years, but it is only the last decade that has seen a flowering of DNA fingerprinting studies that puts numbers to the genetic difference between one stock and another. Those numbers can be the basis of better management plans.

Item: The role of bears and other wildlife in distributing nutrients along salmon streams is new evidence for adopting a more "ecosystem based" approach to management. Yet the research demonstrating the bears' role is quite recent.

Item: Survival of salmon at sea is now known to be much more than a matter of how many adults are harvested or eaten by natural predators. Yet the scientific understanding of what causes drastic shifts in ocean survival is still at a very early stage.

Item: Salmon are supposed to be predictable, but sometimes they're not. When, in 1995, the late run of sockeye stocks began entering the Fraser River weeks ahead of their "normal" schedule, freshwater mortality soared to the point where some stocks are in danger of extinction. Why? We don't know yet.

Salmon are not the only fish whose lives are still the object of research. In fact, they're among the best-known. Nevertheless, the end result of scientific uncertainty about many aspects of the salmon's life is that attempts to "restore" habitat are themselves in the nature of experiments. As we point out later in this report, viewing and planning these attempts as such would go a long way toward ensuring that lessons learned are not lost. We raise the issue here to emphasize, right from the start, that the many actions in which community groups are involved rest not on a solid rock of irrefutable dogma but on the shifting sands of an evolving understanding about how salmon live and die in complex ecosystems.

IV. WHAT IS SALMON STEWARDSHIP?

Most dictionaries define stewardship as "the office of a steward", and "steward" itself as "one who manages another's property, finances, or other affairs", "one who is in charge of the household affairs of a large estate, club, hotel, or resort," or variations on "an attendant on a ship or airplane."

DFO's Stewardship Website refers to "Canadians…caring for our land, air and water, and sustaining the natural processes on which life depends." Figuring out how the word "stewardship" has come to connote guardianship and wise management of natural resources would be an interesting etymological project, but what's important for this report is that somehow the word has jumped the bounds of management of "another's" property or affairs, clear to an altruistic motive, namely taking care of nature. The term "wise stewardship" wouldn't have made much sense with the original definition (unless one meant a sort of kindly butler), but it's heard all the time now. "Bad" stewardship presumably now means the same as "no stewardship," although it could also mean blindly forging ahead with the wrong idea or method.

Fisheries is no stranger to the coining of new meanings for old words ("fishers", for example, used to be small mammals), so let's accept the change in the meaning of stewardship and assume that stewardship of salmon means something like "managing salmon habitat and fisheries in a way that sustains them." It includes things like regulating and allocating harvest, maintaining spawning and rearing habitat, performing enabling research, and promoting understanding and informed decision-making through awareness and education programs.

Who can be salmon stewards? In the old days, between the coming of white men and the moment when drops in salmon stocks became news, stewards were overwhelmingly from government fisheries departments and First Nations, with a minor role for resource companies and a few rod and gun clubs. When salmon stocks began to dwindle (especially a few, well-publicized ones) and advocates for better salmon management began to poke at government, the ranks of the stewards began to expand to include non-profit organizations, the many small societies created solely to "bring back the salmon," and a cadre of consultants. By the mid-nineteen nineties, all of these stewards were working together on rivers throughout the province of B.C., the result of a deliberate policy decision by government to share the salmon workload. Community groups involved in salmon stewardship have thus always been part of a complex mix of players.

The zeal of community stewards to "do something" about the sorry condition of salmon habitat, especially rivers, is a collectively mighty force. At its most fervent, it can defy logic: there is even a determined effort to promote the greening of the Los Angeles River, a canyon of concrete best known for starring in movies like Chinatown and Terminator 2.[2]

Touchy-feely stewardship

One can't spend much time in the company of habitat biologists and engineers without picking up the occasional references to "touchy-feely" salmon projects—those that make people feel good but don't have much of a biological effect. But, as one habitat biologist said, "People want to do stuff. Do you stand back or do you encourage them?" Or, from a Community Advisor, "Do you do the research, or do you just go out and fix the problem? What's the cost of doing nothing?" The consensus among these professionals seems to be that any project, even one that has no demonstrable effects on salmon numbers, is still valuable for confirming to the community that there is something to care about.

Salmon stewardship fulfils all the requirements of "think globally, act locally." Working on a degraded salmon stream is empowering, not to mention educational, and it is surely not cynical to note that these attributes are appealing to bureaucrats and politicians whose survival may depend on showing results for public dollars. The down side, however, is that such projects officially encourage dilettantism, and professionals in any field have always had an uncomfortable relationship with amateurs. (Imagine, for example, a drastic downsizing of highways ministries and an army of eager road-building and bridge-repairing volunteers hitting the pot-holed highways every weekend. Professional engineers might not be impressed).

As we shall see later, however, with the drastic reduction in funding for salmon stewardships, projects that are basically feel-good exercises may be a luxury the system can no longer afford. At the very least, the rhetoric of touchy-feely stewardship has probably had its day.

Stewardship vs advocacy

It is tempting to distinguish habitat stewards from advocates, who appear to use a completely different set of tools. In this view, advocates agitate, prod, badger and educate, while stewards work quietly in the field. This distinction works reasonably well for groups that are primarily avowed advocates and use the tools of public awareness to create change. Some advocacy groups take on field work, but most have a critical lack of technical expertise that forces them to contract out.

But stewardship groups, especially today, are often forced into advocacy in order simply to survive, and the line between stewardship and advocacy will likely become even more blurred. Beating the bushes for core funding requires advocacy in the form of forceful presentations of problems and solutions. Fundraising requires advocacy. Any group attempting to "clean up" a stream that flows through several municipalities and private land will not get to square one without the ability to cajole and convince. In a time when paid "project coordinators" have disappeared, advocacy is going to be much more of a fact of life for volunteer groups—even if physical disconnection from the fish and a need to read up on regulations are the prices they have to pay. For this report we will continue to refer mainly to stewards, but the beliefs and convictions that have always motivated them will likely be expressed much more forcefully.

The community steward as Superfan

One of the most remarkable things about community salmon stewards is their determination, a quality any volunteer needs in spades and one that can sometimes keep a project afloat all by itself.

Blayney Scott was a commercial fisherman before he founded Scott Plastics of Victoria. For many years, the company's biggest sellers were sport-fishing products. The salmon provided, and Blayney sold a lot of Scotty downriggers, but he didn't forget.

Fred Jordan worked for Fisheries and Oceans in Nanaimo. Back in the 1980s, at the tail end of the boom in mega-hatcheries for salmon production, Fred had the idea of making a *micro*-hatchery, small enough to fit in a backpack. He machined a prototype out of chunks of Plexiglass, nicknamed it the Salmon Condominium, and tried it out in a local stream. There wasn't much to it—some plastic plates with a lot of little cavities for salmon eggs—but it seemed to work. Fred buried the thing in the river, down in the gravel, and the baby fish swam out when they were ready.

Fred's employer thought the salmon condos were too small to make a difference. Blayney didn't. He thought they were just the thing for putting back some of the salmon he had spent so many years catching—small scale, yes, but dirt cheap and the fish were born in the river, not in a fibreglass tank. He decided to make some. He made a deal with DFO in 1994 so that he could develop the idea, and before long the boardroom table at Scott Plastics was covered in Plexiglass and plans and the dried peas they used to simulate salmon eggs.

Blayney paid for everything. Making a mould for a plastic part costs a lot of money, and the mould he came up with was elegant but fiendishly complicated. He spent hours loading the little cavities with peas, and his staff indulged him. Blayney had a roomful of incubators moulded and he was forever sending them out to contacts he'd made through the DFO Community Advisers. If you wanted to try a dozen, wherever you were, you got them delivered to your door, for free. And he couldn't stop modifying them, adding refinements and making them in different colours and sizes for different salmon species.

But did the Jordan-Scotty Incubator work? Blayney sent out questionnaires with each shipment and he kept every response in a big cardboard box in his office. He never lost his enthusiasm, but there was one thing that bothered him terribly about the responses, and that was that most of them came from outside Canada. Our fisheries agencies were proving hard to shift from the view that the incubators were way too small-scale to have any real impact. Blayney was always baffled by this, and a little bit wounded. "After all," he would say, "We're giving the darn things away!"

But he persevered. By 1999, Scott Plastics was sending incubators not only to the U.S. Pacific Northwest but overseas too, to Great Britain, Japan, Denmark, Sweden, New Zealand and Australia. Despite the lukewarm response from Canadian fisheries agencies, the Pacific Salmon Foundation together with the HSBC Bank began a program for sponsoring incubators and collecting the results of their use.

Blayney died in 2000, well before the Salmon Foundation's project got off the ground, and it will be a long time before the jury returns a verdict on the incubator he believed in so passionately. Like any other restoration or enhancement technique, the incubator has to post results over the long term, and that takes time and research. It certainly hasn't been embraced within DFO. More interestingly, Blayney's persistence, justified or not, resulted in an object that personified community stewardship, because it could be given to individuals—the ultimate stewards—who could go out to rivers and put their own personal stamp on bringing the salmon back. Maybe, ten years from now, the Jordan-Scotty Incubator will have been rigorously shown to make no discernible difference at all—that's up to whoever does the research. But it's unlikely to be eclipsed as an example of what one determined person can do when they set their mind to "saving salmon." Throughout this report, the example of Blayney Scott should always be kept in mind, because it typifies the commitment—misguided or not—that is at the heart of community stewardship.

V. WHO'S LEGALLY RESPONSIBLE FOR SALMON HABITAT?

A landowner in B.C.'s interior lets his cows wander into a river that flows through his property. His neighbour, a bit of a blackguard, pumps some water out for irrigation. Up a nearby tributary, a blissfully ignorant fisherman wades in and hooks into something big.

Habitat gets altered, fish get caught. Whose responsibility is it? The farmers are probably contravening a few federal and provincial Acts related to habitat, but it may not be clear who's enforcing them. If the fisherman catches a steelhead he's playing by provincial rules; if he's far enough downriver and gets a bite from a coho that's still feeding, DFO's rules apply. The problem is, both fish use the same habitat. And if the waters flow through Native traditional territory, aboriginal rights or treaty negotiations may come into play.

Legislation and policy

There's plenty of federal and provincial legislation on fisheries and fish habitat (which are two *very* different things).[3] Canada has the *Fisheries Act*, the *Canadian Environmental Assessment Act*, and the *Oceans Act*. B.C. has the *Environmental Assessment Act*, the *Environment and Land Use Act*, the *Environmental Management Act*, the *Fish Protection Act*, the *Forest and Range Practices Act* (which replaced the Forest Practices Code), the *Forest Land Reserve Act*, the *Municipal Act*, the *Waste Management Act*, the *Water Act* and the *Wildlife Act*.

That's a lot of Acts, and many of them are analyzed in detail by Rosenau and Angelo (1999), who include a very useful account of the decision process that occurs when activities are likely to have an impact on fish habitat.[3] In a nutshell though, how do all these pieces of legislation work to protect salmon and their habitat? Who's really responsible for the mess the cows make in spawning beds or the fish caught just around the corner?

As we said, *fisheries* and *fish habitat* are two different things. Acts and policies about fisheries are about managing a resource, while those concerning habitat deal with the 'home' of that resource. Many Acts tend to deal with both sides of this coin, but it's always useful to remember the distinction, especially when habitat is lost.

The Fisheries Act

The Constitution Act of 1867 gave authority for protection of coastal and inland fisheries to the federal government. A year later, Parliament passed the original *Fisheries Act*. Since most salmon habitat issues are in fresh water, it's important for people concerned with salmon habitat restoration to realize what happened next. Over time, Canada delegated various freshwater fisheries management responsibilities to various provinces. In B.C., delegation is an informal arrangement under which the Province manages all non-anadromous species (in the case of salmon, this means landlocked ones like rainbow trout). Borders have not always been clear, especially regarding habitat in privately held or provincial Crown lands, so there has been a good deal of stepping on toes over the years.

The *Fisheries Act*, which has been much amended since the original 1868 version, is still the basis for habitat protection and restoration in B.C. The relevant section for community groups restoring habitat is Section 35 (1), added in 1976, which states that

> *"No person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat."*

Section 35(2) goes on to detail provisions under which such alteration, disruption or destruction *can* be authorized by the Minister or done under regulations made by the Governor in Council, and provides for enforcement and fines when those boundaries are exceeded. Clearly there are cases where harm is acceptable and where it's not, so it's helpful to look at actual DFO *policy* (as opposed to legislation) on habitat conservation.

DFO policies relevant to fish habitat

The DFO Policy for the Management of Fish Habitat [4] has as its guiding principle the idea of "no net loss" of the productive capacity of habitats. Under this principle, the Department will:

> *"strive to balance unavoidable habitat losses with habitat replacement on a project-by-project basis so that further reductions to Canada's fisheries resources due to habitat loss or damage may be prevented…The principle is intended to guide departmental officials and other interested parties, and should not be interpreted as a statutory requirement to be met at all costs and in all circumstance."*

Clearly this policy is (1) aimed at habitat that produces fisheries resources (that is, productive stocks that are harvested), and (2) it's not mandatory. These conclusions are borne out by the First Goal of the policy, which is Fish Habitat Conservation:

> *"The level of protection given to habitats under this goal will take into consideration their actual or potential contribution to sustaining the nation's fisheries resources, as defined in this policy, and in accordance with local fisheries management objectives."*

In other words, habitats that produce stocks important to fishing receive priority protection. The Second Goal (Fish Habitat Restoration) is consistent with this economic bias:

> *"Rehabilitate the productive capacity of fish habitats in selected areas where economic or social benefits can be achieved through the fisheries resource."*

There is also, however, a draft Wild Salmon Policy which tempers the fishery-first tone of the policy for habitat. The Wild Salmon Policy, developed partially in response to alarming declines in many salmon stocks during the 1990s, emphasizes "conservation first" in the protection of salmon biological diversity. In reality, though, the policy has effectively been sidelined by the coming into force of the new *Species at Risk Act* (SARA), which is now driving the choices on how to decide which salmon populations should be protected and at what levels (see Section XIII for a discussion of the implications of SARA for salmon stewardship).

Trying to get on the same page

So far we have a *Fisheries Act* that says habitat destruction is forbidden except when it's authorized, a federal policy on habitat that works toward no net loss of habitat that's important to fishing, another policy that says "conservation is number one," and a new act on species at risk. And that's only the federal side of a situation that has two levels of government (Canada and B.C.) sharing the task of protecting and restoring habitat.

In an effort to bring some order to the sharing of responsibilities, the two governments signed the Canada-B.C. Fish Habitat Management Agreement in 2000. The Agreement has some importance for community groups interested in salmon stewardship. It provides for improved coordination between the two levels of government on projects designed to improve fish habitat protection in the province and is mainly intended to reduce duplication, increase coordination, and develop co-

operative arrangements related to fish habitat. Perhaps the biggest bonus is providing a way for the two governments to cooperate on watershed planning.

But what does the Fish Habitat Management Agreement do to clarify responsibility for the actual on-the-ground work that needs to be done to restore habitat? The agreement streamlines administrations between the two levels of government, but the authority to make regulations or legal decisions doesn't really change. The last objective of the agreement *is* important, however, because it links the federal and provincial governments with "local governments, First Nations, industries and non-government organizations to enhance the protection of fish habitat." The role of community groups in habitat restoration would seem to be fully acknowledged and even promoted here.

Including all those groups might seem to be a good thing, unless there isn't any money for them to do the job. The province of B.C. has reduced funding for habitat work, DFO continues to reduce its stock assessment budget, and most of its funding for community salmon restoration has dried up. Given the background of declining stocks and recovery strategies, a cynic might be forgiven for thinking that this part of the agreement brings to mind a couple of bickering parents agreeing to hand over the car keys to their teenager, but leaving the tank empty. And one could hardly blame them—they're too busy trying to keep the wheels from falling off the car to worry about who's driving it.

VI. THE B.C. SALMON STEWARDSHIP MODEL

It might be tempting for a community group that's lost its funding to view government's promotion of community stewardship as a smokescreen for lack of action on harvest, but the truth is less sinister. Salmon are species with complex life cycles and are vulnerable to so many threats that even the best science today is still incapable of explaining what has happened to some stocks. There are just too many variables at work, and some of them, like climate change, are themselves elusive and poorly understood. The entire decade of the 1990s was a period of great ferment for salmon fisheries in B.C., and media were quick to feature reports of drastic declines in many of the province's several thousand distinct genetic stocks.

But not all stocks were declining, and the demise of many was never so clear-cut as the wholesale collapse of the Atlantic cod fishery—the case that is most often advanced as the *ne plus ultra* of bad fisheries management. Yes, there was overharvest of many stocks and collateral damage to small ones, but there were also complex and unfolding effects of changing ocean survival and even the genetic legacy of nearly a hundred years of salmon enhancement.

Where do community groups fit into this confused picture? There was one thing everyone agreed on: the effects of bad land use on freshwater salmon habitat were incontrovertible. In many cases the streams and rivers used by salmon flowed past, even through, cities and towns where there were people itching to do something about salmon. Stewardship, in the sense of "taking care" of something, was applicable to habitat loss in practical ways that just weren't available for other impacts. The average person could lend a hand cleaning up a stream a lot more easily than he could affect the deliberations of a cross-border allocation committee. And so the empowering of local community groups began.

Not just another conservation movement

Concerned citizens have always been involved to some degree in "conservation" of wildlife, and historically salmon has received its share of attention. The 1960s and 1970s saw a surge in public concern about the impacts of human activities on the balance of nature, thanks in part to books like Rachel Carson's *Silent Spring*. But the salmon stewardship movement that began in the late 1980s and peaked in the late 1990s was inspired by more complex motivations than traditional conservation—where a threatened species, for example, is protected and fought for solely on the basis of its intrinsic value to mankind. Salmon stewardship arose as a popular movement that saw salmon not just as ecosystem and cultural icons but also as resources to be nurtured and ultimately harvested. Hence the players in salmon stewardship were a far more diverse crew than the old-style crusaders for charismatic species like snowy owls and marmots, and included sports fishermen, commercial fishermen and schoolchildren. They also included First Nations, perhaps the group with the most complex relationship with salmon in B.C.

Inclusion has been steadily increasing. For example, The Coquitlam River Watershed Management Plan of 1970 included a single public group—the Port Coquitlam Fishing and Hunting Club. Now, in 2004, the comparable body is the B.C. Hydro Consultative Committee for the Coquitlam-Buntzen Water Use Plan, which includes nine societies, four First Nations, a half-dozen private citizens and all levels of government.

The salmon stewardship phenomenon was also far from spontaneous. While it was stimulated by declines in salmon numbers and obvious destruction of habitat, there was a concerted effort by government to coordinate and encourage activities. And really there was little choice in the matter, because government controlled most of the approaches to salmon recovery: they had the

expert biologists and stream geomorphologists; they had the latest information on numbers of adults and juveniles and how many fish were being harvested; and although fisheries management is changing to include input from more stakeholders, government still had the last word in deciding who fished, when, and how.

The role of education

The system that evolved (the "new Vancouver Chinooks" team, to recall the analogy with which we began this report) reflected an unprecedented devolution of what had been government responsibility to a varied group of concerned citizens. Harvest, from the first, was "off limits." Advocacy campaigns on harvest and allocations went on as before, but government blessing went to the on-the-ground work of salvaging adequate freshwater and estuarine habitat.

A key element in the new system, and one that has never been significant in any other kind of conservation campaign, was education. Throughout the salmon-bearing parts of North America over the past fifteen years, elementary schoolchildren were taught about the salmon life cycle and often made field trips to nearby streams or hatcheries. In B.C. the main tool was DFO's *Salmonids in the Classroom* program, often including facilities right in the school where fertilized salmon eggs could be incubated and hatched.

Salmonids in the Classroom had two flaws and one great strength. The first flaw was (and is) the unintentional fostering of the notion that all salmon come from hatcheries. Although community advisors and teachers go out of their way to stress that incubators are there to bring nature into the classroom, and all the teaching on life cycles plainly makes it clear where salmon really come from, the appearance of fertilized eggs in the classroom and their incubation over a period of months is what the children see. The child who concludes that this is the natural order of things is no different from the one who grows up thinking milk comes from cartons in the fridge. Public aquaria face the same paradox of teaching about nature by displaying things outside their natural environment, and finding the right balance is a perennial challenge.

The second flaw is the concentration on salmonids. There is a risk that concentrating on salmon and its life cycle instills "single species thinking"—just the opposite of the ecosystem or multi-species approach that present-day fisheries departments are struggling to adopt. Salmon are an important "keystone" species in many B.C. ecosystems, and a stronger emphasis should be made on promoting ecosystem health as the way to conserve all species, including salmon. Recently, the curriculum has been updated to be more ecosystem-oriented, and a new program slowly making its way into classrooms in the province seems to be filling this need as well: *SeaQuaria in Schools*, promoted by the SeaChange Society, puts living marine ecosystems into classrooms and provides teaching tools that complement *Salmonids in the Classroom*.[5]

But the strength of *Salmonids in the Classroom* far outweighs any minor confusion about the salmon facts of life, because what the program was created to achieve, and what it has clearly done over the years, is instill a sense of stewardship. Caring for the salmon eggs, even if they came from a hatchery, is an emotional commitment for children, and when the eggs are liberated the children continue to care about their fate.

DFO's stewardship model

Although the federal government was by no means the only level of government involved in partnerships on salmon habitat restoration, the system evolved by the Department of Fisheries and Oceans is the most developed and the one that most clearly illustrates the principles of

devolution. Other models, particularly the way in which DFO and the Province of B.C. work with First Nations, have some major differences.

DFO's stewardship model, the one we will consider most often in this report, is based on a crucial linkage between the technical expertise within the government department (biologists, geomorphologists, engineers) and the manpower outside government (community groups). There are obvious reasons for trying to put the two together, chief among these being the local knowledge, commitment and labour pools that community groups have. Many existing groups already had long histories in the service of conservation or sports fishing, although the adoption of the stewardship model for partnerships also stimulated the creation of many new organizations attracted by the prospect of funding for goals that their members had agreed on as worthwhile.

The job of government biologists and engineers is sometimes difficult in this model, because they become advisers to groups that may have no real experience in the technical aspects of restoration. As for the professional consultants themselves, who used to perform many of the technical tasks for DFO, the stewardship model's greater reliance on volunteers or "retrained" workers paid from other sectors has meant a drop in income for some of the smaller firms.

There is also a geographic context to the model that is important and delineates it from, for example, the model used for First Nations. By definition, most "community groups" are clustered around human towns and cities, so their involvement in habitat work naturally favours locations that are within reasonable car travel from home. Many projects, in fact, are on streams that flow through or very near to cities (so-called "urban streams"). What this means is that restoration in more remote areas gets less attention from community groups. We go into this phenomenon, and what it means for the relevance of community projects, in Section XIV.

Community Advisors

The link between volunteer enthusiasm and technical expertise is embodied by a network of regional community advisors or CAs. The CAs have the job of putting community groups together with DFO experts to work on particular habitat problems; they also have to facilitate partnerships between groups and help find funding.

DFO's Community Advisors love their jobs. There is low turnover. Their overall mandate is to listen to what the community "wants" and make it happen (even if, as we saw in the case of Kirby Creek and WFT, sometimes the community needs to be given some help deciding what it wants). Many CAs have fish culture backgrounds that can reflect the hatchery philosophy that predominated until recently, and in fact a preponderance of stewardship projects still have some sort of hatchery component: of 313 projects managed by CAs for which activity type is listed, 135 include hatcheries (43%). Over the past decade, though, the trend has been for more community effort on habitat issues, and in some regions hatcheries are simply the "hook" to get communities involved.[6] The kinds of projects managed by a CA reflect the region and its demographics.

In many respects the CAs are like matchmakers, with the added complication that they need to arrange marriages between multiple partners who may often have competing agendas. They get involved in the permitting, design and construction of restoration structures, as well as their operation. Because the CAs respond to community wishes they can be involved in a very wide variety of projects, from educational programs in schools to marine mammal watches to the kinds of salmon habit restoration described in this report. As one community spokesman put it, "CAs are the glue. If we lose them we lose everything."[7] The CAs are also bellwethers of changes in fisheries management philosophy—or should be. Their ability to make sure these changes are

reflected in the projects they're responsible for is affected by their own backgrounds and the region they work in.

Today's CAs are working in a climate that is undergoing a fundamental shift, from technical inputs and single species management to a time when endangered species (including salmon) and their official recovery plans are front and centre. A generation raised on hatcheries and hands-on stream restoration is giving way to one more familiar with ecosystems and biodiversity and this strength needs to be tapped to meet the challenges to come. The rise of SARA is seen by some as displacing government support for SEP, and it is unclear how future programs for recovering salmon will be integrated with past SEP-funded programs. As one Community Advisor put it, "Money will go to SARA, and work on rivers will have to go through that process." Whether this means that volunteers won't be getting their feet as wet as in the past remains to be seen, a subject we return to later in Section XIII on recovery planning.

The CA's job is difficult because he or she essentially shapes the project and is responsible for ensuring that it fits some kind of rational plan. In the best of all possible worlds, such a plan would be at the watershed level. In the worst scenario the plan doesn't exist at all, or only in the files of an overworked CA. The CA represents the "corporate memory" about the project, the centralized knowledge of what's going on in different watersheds. This is one of the dangers of devolution, namely the loss of any centralized body of experience and the dependence on many satellites to operate in the absence of any overall, evolving, constantly refined plan.

The Community Advisors do not serve simply to "transfer DFO technology" to community groups who want to get their hands dirty. They are also positioned to feed community watershed knowledge to DFO biologists and engineers, alerting the agency to potential projects that could more easily be accomplished in-house. An example is the side channel construction done below the water storage dam on the Seymour River outside North Vancouver. In this project, DFO acted on recommendations from the Seymour River Salmon Society and invested in machine rental for approximately three weeks to construct highly successful off-channel habitat that is believed to have doubled the productivity of the watershed.[8]

Stewardship Coordinators

Until recently, Stewardship Coordinators provided a different level of networking for fisheries projects. These people, whose positions were eliminated in March 2003 with the demise of the Habitat Conservation Stewardship Program, worked with communities where people's lives directly affected fish and fish habitat, with the potential for frequent conflicts between these people and the enforcement arm of DFO. This was in contrast to many urban groups for whom fish habitat was a "weekend passion." The Stewardship Coordinators played an important role in helping such people figure out ways to minimize their own impacts on fish/fish habitat, and helping them improve those values without detrimental impact to their personal and working lives. Information, education, personal relationships and dialogue were key themes, with the result being a more pro-active and cooperative approach to habitat use.[9]

Whatever the flaws of the stewardship model outlined here, it's the one that community groups have been operating under in B.C. for at least a decade. Two of the biggest influences on how well that model will continue to function have been the *supply of money for projects* and the appearance on the scene of the new *Species At Risk Act* (SARA). We consider both of these developments later in the report. Now, though, it's important to look at what's been accomplished over the past decade using the model just described.

VII. HABITAT RESTORATION—AN OVERVIEW

In British Columbia, restoration of salmon habitat has largely been a response to the effects of poor logging practices, hydroelectric power generation, agriculture and human settlement. Although many human activities have contributed to the deterioration of salmon habitat, forestry is the most pervasive both in variety of impacts and in geographic area affected. The effects of forestry on salmon habitat have been extensively and recently reviewed,[10] and it's no surprise that better forestry practices mean less habitat damage. One obvious way of achieving this would be to make the level of resource use (allowable annual cut) an output of the planning process rather than an input.[11] In addition, much will depend on how well the forest industry meets its stream-protection obligations under the new "results-based" *Forest and Range Practices Act*—another step in the devolution of government authority in the management of fish habitat. The hazards of replacing a regulatory with a results-based approach are discussed in a recent detailed critique of this act, which concluded that it has been virtually impossible to determine whether results related to hydrology, water quality and riparian habitat have in fact been achieved (Moore 2002).[12]

Although forest management practices have undoubtedly improved in the past decade, it pays to be humble in evaluating their effectiveness in minimizing damage to stream ecosystems. Too often, forest managers have been heard to boast, "We don't do it that way any more—we have better ways of protecting the environment now"—only to discover that science isn't quite so sure and that the "new way" turns out to be not much better. The Clayoquot Sound Scientific Panel provided ample demonstration of that reality. It is also important to remember that forestry is not the only culprit: while large programs like Forest Renewal B.C. targeted watersheds damaged by past forest harvest activities, many of the habitat restoration projects funded by other programs have been on streams damaged by hydroelectric and other kinds of development.

Declines in salmon abundance are obvious if not universal, and habitat damage is there for all to see. Restoration work has been performed in B.C. since the 1970s in an attempt to repair habitat damage and recover some habitat functions that salmon need in order to survive in these streams. Now, the new *Species At Risk Act* (SARA) is likely to spark even greater concern about "what to do about salmon habitat" as individual stocks are listed, because each listing will trigger the creation of a specific rescue strategy and action plan. The same thing happened with the enactment of the US *Endangered Species Act.*[13]

Should recovery plans developed for SARA continue to emphasize habitat restoration? Should community groups still be involved, or can they contribute in better ways? What are the real results of $200 million in spending by the Province of BC (Watershed Restoration Program) and the millions spent by the Government of Canada on habitat restoration over the past two decades? Questions like these make it the perfect time to take a closer look at habitat restoration, its overall performance, and where it fits in the new world of salmon recovery.

Times change

There is an early Woody Allen movie called "Sleeper," in which Woody wakes up after being cryogenically preserved for a century. Reorientation in the society of the future has some surprises. A white-coated scientist debriefing the bemused time traveller is astounded at what passed for healthful foods in the 1970s: "Donuts and hot fudge were believed to be bad for you? Precisely the opposite of what we now know to be true!"

How will people look at today's habitat restoration techniques a hundred years from now? Will they be shown to have done the job, or will they appear as quaint as Woody's aversion to

"unhealthy" foods? The question is especially important when you consider that, for the past decade or so, the practitioners of those habitat methods have included a steadily increasing component of volunteers from community groups. Using flawed methods would be bad enough; foisting them on credulous and enthusiastic volunteers would be worse.

And methods are anything but perfect. Riprap, for example, is a technique that's coming in for criticism. Riprap is chunks of rock piled along stream banks to reduce erosion and flooding. But does it restore or enhance fish habitat? The current consensus appears to be "not as well as we thought"; riprap alone comes nowhere near to replacing natural vegetation for stabilizing stream banks, and in fact inhibits revegetation. Stream banks don't develop the undercuts they need, and they don't grow the right kinds of trees, and the end result is the loss of salmonid habitat. The stream can no longer maintain a dynamic steady state and the aquatic ecosystem is altered. So now it seems that, after decades of dumping rock along stream banks, lateral stream erosion, like donuts and hot fudge in the late twenty-first century, is now considered to be a good thing.[14] Riprap is still the standard engineering technique for protecting dikes, roads, railways, and buildings from the erosive power of nearby streams, but we've learned that it won't work for any old bank that is simply doing what stream banks do, continuously falling down as the stream wanders across its floodplain.

Of course, techniques evolve, and habitat restoration techniques are no exception. What's worrying is that stream restoration techniques are so rarely evaluated and the time scale for their effects is so long. The monitoring of salmon habitat methods is complex, multi-leveled and extremely long-term, with the not unexpected result that it seldom gets done. For stream restoration techniques to evolve we need to continually evaluate what is being done, why it is being done and the effects on the ecosystem.

What does the track record of riprap have to do with the effectiveness of community groups? Simply that, in any examination of the role and performance of these groups, one needs to be careful not to shoot the messenger. Community groups have been given tools, and have applied them enthusiastically and in good faith; if we are going to assess those people's performance fairly we have to look first at the tools themselves.

And the technical advisors to community groups should make no mistake: community groups themselves are keenly interested in how well the tools work. This interest may not be so strong in the early going (when any help is gratefully accepted) but when money starts to dry up and projects wither and die, morale is at risk. Right now, community groups are reeling from what they consider a mixed message on hatcheries: "First you tell us hatcheries are the answer, now some say they're bad." The disillusionment with hatcheries could easily be repeated with restoration without more attention to planning projects in such a way as to demonstrate positive results. The decision to forgo any significant monitoring of community projects—a decision taken within DFO and reflecting the "sunset" nature of so many funding programs involving community groups—could have the unpleasant result of making it impossible to point to any hard, quantitative evidence that the process works.

Habitat restoration methods—a brief survey

This report is mainly about the contribution of community groups to the maintenance of high quality salmonid habitat. For such groups, the desired result is usually 'more salmon', but it's important to realize that not all restoration projects have that goal exclusively in mind. The B.C. Watershed Restoration Program, for example, explicitly desired multiple benefits that included not only "improvement in fish stocks" but also "provision of technical community employment",

"growth of stream restoration consulting firms" and "short-term employment for displaced forest workers."

To make our investigation manageable we have to set some restrictions on the kinds of restoration and enhancement activities considered. We have thus limited our survey to the following methods that are included under the general heading of "Restoration/enhancement" in the Fisheries Project Registry.[15] The term "restoration" describes the return of habitat to a pre-disturbed condition; "enhancement" means the improvement of a portion of degraded habitat. In reality one shades into the other. The categories we will consider are:

- Off-channel restoration/enhancement
- Riparian (river bank) restoration/enhancement
- Instream restoration/enhancement
- Fish culture

We exclude another important category, "Upslope restoration/enhancement," with some trepidation, because it may be the most important of the lot—we'll discuss this more in our sections on protection and watershed planning. However, the bulk of community activity does not take place in the upper reaches of watersheds, even though the prevailing belief is now that the time and effort spent on treating the symptoms on individual streams would be far better invested in watershed-wide planning. We also do not discuss newer methods such as strategic placement of hatchery salmon carcasses to make up nutrient deficits, because they too are only beginning to be taken up by community groups.

Fish culture—breeding salmon and releasing fry or smolts—does nothing for salmon habitat and would seem illogical to consider in a report on the effects of community groups on habitat stewardship. The reality, however, is that a great many community groups entered the salmon stewardship field through operating small hatcheries, so any discussion of the contribution of these groups would be incomplete without a discussion of hatcheries. And hatchery operations have changed over the period considered in this study (1992–2002), as awareness of the importance of conserving genetic diversity has begun to percolate through fisheries agencies and trickle down to people in the field.

Habitat restoration is only one tool in the rehabilitation of healthy freshwater ecosystems, and many projects combine several techniques. In real life, the problems of streams cannot be fixed by one-shot solutions, but can respond spectacularly to a multi-layered approach, especially one that combines restoration methods with other forms of stewardship. Salmon production on the Stave River, for example, increased dramatically following a combination of flow augmentation, hatchery inputs and gravel channeling. Only the last one is "restoration," and it would be hard to isolate the effects of any of these interventions.[16] The Coquitlam River is another good example where flow augmentation and off-channel habitat worked together.[11]

Salmon habitat restoration treats symptoms of a bigger disease, and like all such treatments is open to the objection that lasting results and better long-term economies are only going to be obtained by tackling the disease itself (in this case, bad land-use practices that reflect society's tolerance for environmental damage). When community groups first began to mobilize to "take action" on salmon declines they can hardly have been unaware of the folly of band-aid solutions, but the practical options for their involvement at a basic, hands-on and satisfying level were a lot closer to bandaging than to prevention. Environmental advocates argued for better land use, but most community groups just wanted to wade in and get involved with their hands. Of the options

described below, the easiest and most fool-proof was hatcheries, followed by instream restoration, then riparian and off-channel work. The technologies for all of these methods were those that were available through fisheries agencies, the portal through which community groups entered the new field of salmon habitat restoration.

Off-channel restoration/enhancement

Description: Off-channel habitats include sloughs, wetlands, estuarine areas and parts of streams that are isolated by culverts or other man-made obstacles. Estuaries can be restored, enhanced or created. They are important rearing areas for young salmonids and are usually restored by reconnection, removal of isolating structures, and creation of new ponds and wetlands.[17] Creation of new channels, including spawning habitat, connected to the main stream is another popular kind of off-channel restoration. Off-channel habitat has a good track record in British Columbia; examples include newly productive areas of the Cheakamus, Coquitlam and Seymour rivers.[18,19] The Coquitlam River is a good example of a severely degraded river that responded to creation of off-channel habitat in conjunction with flow augmentation.

Drawbacks: Optimal depth, design and morphology of off-channel habitats are often unknown; stream hydrology can interact unpredictably with reconnected or new habitat; key processes that maintain newly created habitat (e.g., estuaries) may be lacking.[20] Species vary in their use of off-channel habitat.

Riparian restoration/enhancement

Description: Riverbank trees provide shade and large woody debris in addition to stabilizing banks and discouraging erosion. Restoration of river bank areas damaged by logging or other activities relies mainly on silviculture, fencing to keep livestock from grazing too close to streams, or changing grazing patterns so that vegetation has time to recover.

Drawbacks: Silviculture treatments take decades to mature, and the newly planted stands need constant maintenance.[21] Choice of tree species has often proved to be inappropriate.

Instream restoration/enhancement

Description: Instream restoration has the longest history in North America. Streams that have been "simplified" by bad land-use are often engineered by adding logs, boulders, rock-filled bulwarks called gabions, weirs and spawning gravel. Many of these structures alter stream flow and provide cover for fish.

Drawbacks: Failure rates and persistence in streams vary greatly,[22] so that fish benefits may be temporary. All instream additions are vulnerable to floods, especially those structures that form resistance to channel-forming forces. Most monitoring concentrates on whether the new structures have the desired physical results, and there are few biological evaluations of the results of instream restoration. Most artificial structures are added only to smaller streams (less than 20 m across). Species differ in their response to instream structures. For example, coho seem to respond better to addition of wood structures than do the other salmon species.[23]

Fish culture

Description: Broodstock adults collected from the stream to be enhanced or another water body are artificially spawned to produce young salmon that are nurtured in a hatchery until ready for outplanting into streams. Collection of local broodstock is becoming more common than simply transferring hatchery stocks from another watershed.

Drawbacks: Distribution of non-native populations may genetically overwhelm local populations, and an emphasis on hatcheries as solutions to low fish numbers draws funding away from habitat

restoration and the prevention of damage in the first place. The entrenching of the idea of hatcheries as a solution rather than a tool may be hard to overcome.

Community groups' love affair with hatcheries

Hatchery projects have long been a standard in the community group repertoire, and many CAs have a background in fish culture. In the first half of the 1990s, for example, a high percentage of the projects funded through the Pacific Salmon Foundation were for maintaining local hatchery programs. Hatcheries give an excellent bang for the buck: they are hands-on, they are easily run by volunteers using proven, simple technology, and they engage all levels of the community, including non-government funders, by demonstrably putting fish into rivers. Hatcheries are especially suited to retired volunteers who enjoy balancing the chores of tending incubators and seeding streams with relaxing times in the hatchery clubhouse. The long-running school program *Salmonids in the Classroom* has always had a popular incubation component that familiarizes children with the techniques of hatchery enhancement, and community-run hatcheries would appear to deliver the goods to concerned citizens wanting to do their part. A look at DFO's published list of Community Projects confirms this bias: of 313 projects for which activity type is listed, 135 include hatcheries (43%).

But do they have a role in the new world of salmon recovery? Like habitat restoration techniques, hatcheries are now under the microscope. Hatcheries are worth a closer look in this report not only because they have been so important in the history of salmon volunteerism in B.C, but also because their present status offers a glimpse of what happens when volunteers are encouraged to use a technology that falls out of favour.

Deliberate release of salmonids into the environment happens for two reasons:

- Fisheries augmentation (make more salmon to catch); and
- Conservation (rebuild threatened populations or replace extinct ones).

Fisheries releases are historically the more common in B.C. and other countries, and generally have been done to mitigate the impacts of habitat loss.[24] Hatcheries producing salmon to boost fisheries have a very long history in B.C. By 1910, the total output of such facilities was 500 million fish, equivalent to today's output by SEP. There were very large hatcheries on the Skeena, Central Coast, Rivers Inlet, Vancouver Island, and on the Fraser River.25 The intention of such large-scale hatchery programs was and is to produce fish to be caught, not for returning salmon to escape the nets or weirs and spawn naturally. Those that do are not believed to contribute to the abundance of naturally spawning populations, although the problem of surplus spawners is beginning to be considered a serious (and controversial) one.[26]

Hatcheries also have a role in conservation. Both the Sakinaw and Cultus Lake recovery programs have a fish culture component as short term support for populations under threat of extinction while long term efforts are made to deal with underlying causes. Community groups are often involved in conservation hatchery programs designed to supplement depleted natural populations. Surprisingly, there is little evidence of sustainably increased abundance of juvenile or adult natural-origin salmon from the reproduction of hatchery-origin adults[33,27] (here, sustainable means once hatchery releases cease). This is a very important point to consider when thinking about the heavy past involvement of community groups in hatcheries: have volunteers always clearly understood whether their facility is there to enhance a stock for exploitation or to rebuild a damaged one? If the hatchery was for rebuilding it would theoretically pull back once the stock rebounded; if for maintaining adequate escapement for harvest, the hatchery may well

be operating forever. In that case, is perpetual enhancement the message stewards should be receiving? Or should they be considering the real limiting factors behind a stock's decline?[28] Unfortunately, examples of sustainable community hatchery successes like the program for chum salmon on the Coquitlam River[29] are the exception in B.C., not the rule.

There is a lively research effort devoted to quantifying the genetic and behavioural effects of hatchery-origin salmon on wild populations.[33,30] Results of this research spell the beginnings of hatchery reforms that would have been unthinkable to volunteers dumping transplanted salmon fry into their local river a decade ago. Some stocking practices here in BC are now suspected to have been detrimental to native populations, offsetting some of the benefits of simple population increase. A healthy discussion of fish culture risks and benefits is apparent in hatchery circles (although genetic marker studies of long-enhanced populations have also showed several where there seems to be no lasting genetic effect).[31,32]

Wise choice of broodstock is an obvious first step. In Canada, almost all hatchery programs are now based on adults gathered from the stock being rebuilt or from a nearby watershed from a genetically related population. Such programs can have impressive results, for example the recuperation of Puget Sound spring chinook, although the long-term results remain to be seen.[33] The fear that supplemental hatchery-produced adults will drag down the genetic fitness of threatened or endangered populations has much more resonance now that such stocks are beginning to be listed under SARA, and there has been more detailed discussion of mating strategies for fish culture programs for endangered populations such as the Sakinaw and Cultus sockeye salmon. DFO's Habitat and Enhancement Branch has drafted new policies on enhancement that reflect this reconsideration of the role of hatcheries and the PFRCC has recently commissioned a review of interactions between wild and hatchery-produced fish.[34]

The bottom line to all this ferment around hatcheries, for community groups and any other group wishing to stay involved, is not unlike that for habitat restoration. People need to be especially careful that the technique they are using—supplementation hatchery or in-stream engineering, it doesn't matter—is not simply treating symptoms. If, as new evidence seems to show, a hatchery program can be terminated before the original problems have been solved, the population may actually end up in worse shape than it was before. Nobody wants to be involved with a program like that, but the reality is that many are.

VIII. MONITORING HABITAT RESTORATION: IS THERE A TRACK RECORD?

Most restoration projects are expected to benefit fish habitat for twenty years or less.[35] It's not that restored habitat can't contribute benefits for longer, it's simply that we don't have the long term data to prove it. The important question is asked: are those twenty years worth enough to justify the investment today? Without long term monitoring, how will we ever know?

A recent report by the US General Accounting office considers US federal agency actions to recover Columbia River salmon and steelhead. The report looks at all the actions taken by federal and associated agencies (including community groups) between 1982 and 2001, done for a combined cost of $3.3 billion. Based on testimony from federal agencies, it concludes that:

> *..."the data to isolate and quantify the effects of recovery efforts on returning fish populations are generally not available because of numerous factors. These factors include large natural yearly fluctuations in salmon and steelhead populations, changing weather and ocean conditions, the length of time it takes for project benefits to materialize, and the multiyear life cycles of the fish."*

In other words, there has been insufficient monitoring of results. The best assurances that can be offered are summed up below:

> *"While they cannot quantify or isolate the benefits of individual actions, agencies' officials are confident that the composite recovery actions taken to date are having positive effects, generally improving the conditions for freshwater survival and ultimately resulting in higher numbers of returning adult salmon and steelhead than would have occurred otherwise."*[36]

Spending over $3 billion with no scientifically verifiable results is hardly the key to future investment, no matter how confident agency officials are. This should be a very loud wakeup call, although the recent pledge by the US federal government to increase Pacific salmon habitat funding by a further $10 million makes one wonder if the political need to spend money outweighs the lack of results.[37] Similar concerns have already stimulated some Canadian groups to try and assess their restoration results, for example the monitoring strategy created by the Thompson Basin Fisheries Council, Adams Lake and Neskonlith Bands, the Stream Restoration Site Assessment Procedure (SRSAP).[38] But while there is some attention to biological monitoring the SRSAP concentrates on physical habitat assessment, and its use to date has emphasized physical performance.[39]

Projects aimed at increasing numbers of adult salmon need monitoring over *at least* three life cycles. The need for monitoring is being addressed somewhat through the new recovery planning process stimulated by SARA. However, the kind of monitoring recommended so far appears to be mainly fry, smolt and adult counts. After a decade of heavy investment in restoration projects in British Columbia, the recent drastic cutbacks in funding for community participation in such projects only serves to highlight what was already a well-recognized problem by the mid 1990s, namely the question of whether the sense of community empowerment and the political brownie points generated by such projects were the only demonstrable successes. Critics of widespread, patchwork restoration projects on socially important lowland streams had long pointed out the risk of ignoring upland, watershed-level problems and the ecosystem processes that led to the loss of instream capability in the first place.[40] The same critics argue that, without better land use practices, habitat restoration was bound to fail, and that it is virtually impossible to engineer ourselves out of the problem when natural salmon habitat is the result of self-organizing, rather

than engineered, processes.[41] Rightly or wrongly, they also argue that the provincial government's shift from a regulatory to a "results-based" Forest Practices Code provides even less assurance that timber harvesting practices ensure salmon habitat protection.

For all these reasons, the time seems right for a serious look at the performance of salmon habitat restoration projects. But if one is tempted to think that the fact that scientists are generally uneasy about the lack of monitoring means the situation is going to change any time soon, it's sobering to look at the agenda for a recent "largest annual technical salmon conference in the Pacific Northwest." The Fourth Annual Northwest Salmonid Recovery Conference, a four-day event held in November 2003 and funded by a consortium of US and Canadian government and industry donors, is organized to "foster a sense of stewardship" and "provide current fisheries science and successful solutions." In four days of papers there is listed only one presentation on evaluation of biological communities.

Many projects haven't been followed up

Watershed restoration involves engineering, and marriages between engineering and biology have always been rocky. Hydroelectric dams, for example, are marvels of engineering that demonstrate our remarkable ability to move things around in nature, but fish remain unimpressed. Habitat restoration, with its rocks and gabions and artificial meanders, is easy to assess if all you are looking for is whether the structures are still in place five, ten, or twenty years down the road. In fact, that's what most of the few assessment studies consist of, and even these are flawed because twenty years only covers four or five generations of salmon.

Of all the restoration categories we have described, salmon hatcheries clearly "work" best if what you want is the immediate result of more salmon: fry are produced, they go into streams, spawners return in a few years and the visceral satisfaction of actually adding fish where there were none is undeniable. More will be said about the pros and cons of hatcheries in a later section. But what about the physical methods for riparian, off-channel and instream restoration? How well do they work? While most of the available information on the persistence of instream structures indicates they last less than twenty years, there are very few published scientific evaluations of the biological effects of those structures.

How well a restoration project has performed involves a process of monitoring. Monitoring can be grouped into two broad categories:

- implementation (did the structure get built?) and
- effectiveness (how well did it work?)

Studies that only do implementation or physical monitoring may be useful for funders interested in whether their money was spent and for tracking whether the DFO "No Net Loss" habitat requirement has been met. Implementation monitoring is used to measure whether industry has adequately compensated for unavoidable habitat impacts and for many of the less complex habitat restoration projects. But is it enough?

Effectiveness monitoring is more difficult, especially when it goes beyond answering the purely physical question of whether the restoration project actually increased or improved salmon habitat. There is some literature on this topic, showing that although many restoration structures perform well there is also copious evidence of failure.[42] But monitoring for effects on the ecosystems utilized by salmon is almost non-existent, even though it's the results obtained by biological monitoring that convince funders. It's this biological monitoring—as opposed to

monitoring the success and failure of physical structures—that provides the best measure of success or failure of a habitat project. The situation is compounded by the lack of any standardization of criteria for biological monitoring, and unfortunately by the affiliations of the authors, who may work for an organization with a vested interest in demonstrating such ephemeral results as "fish production benefits" derived from little more than calculations based on observations of the number of juveniles in a stream or the surface area of spawning gravel.

In general the literature on salmon habitat restoration has a sobering lack of long term evaluation of the results of restoration projects. As this report is written, the field seems to be at the stage where most authors are quick to point out the urgent need for better (or any!) monitoring, but few have approached the task. Only government can put in place the programs and the resources needed for such costly and intensive investigations. A DFO biologist makes the understatement, "Often, it is not possible or practical to measure the response of the population for various reasons."[43] Another example is a recent report on a wetland restoration project in Washington State, which begins by labelling previous projects in the area as "community successes…but the biological benefits are minimal", and then goes on to describe an ongoing restoration project with no evidence of any biological evaluation.[44]

Some writers are predisposed toward the rosy view. A recent in-house "performance evaluation" of a number of B.C. restoration projects notes that data on performance of instream structures are more available for U.S. projects, then goes on to give the selected B.C. projects high marks based only on the physical persistence of the structures, and with no mention of any evaluation criteria.[45]

Projects can fail, especially when the limiting factors for the ecosystem are not well understood. Common pitfalls include excessive reliance on professional judgement without examining basic assumptions; oversimplification of complex ecological situations; and focusing on only one life history stage.[46] Lack of understanding and control over the natural processes in a watershed may be the biggest single cause of project failure. The general lack of monitoring not only means we don't know if a project has succeeded, it also means we lose the opportunity to learn why it failed. Unfortunately there is a tendency for "bad" results to go unreported, despite the fact that such results are invaluable for the learning process. And it's especially discouraging for the development of good restoration science when a large government program like the B.C. Watershed Restoration program is terminated before the planned systematic evaluation of the hundreds of projects was completed.

Why is there so little scientific monitoring?

Why isn't long term monitoring included in all habitat restoration projects? We might as well ask any number of other pointed questions: Why do we harvest hundreds of stocks of salmon and monitor the health of so few? Why do we wait until the last possible minute to develop recovery plans for stocks that have plainly been declining for years?

Monitoring costs money, and it's long term. The types of restoration work that stewardship groups were funded to perform was applied science, not new science. The kind of rigorous monitoring that provides solid, publishable results is probably of little interest to most community groups, and beyond the technical capacity of many. Different jurisdictions may have different reasons for the lack of monitoring, but one unavoidable explanation in B.C. is that the stewardship programs sanctioned by government were always meant to be supported by funding with a built-in "sunset clause." Monitoring was deliberately left out of the package.

The effect of this decision on volunteers is probably still sinking in, because volunteers accepted the technical package offered to them. One CA put it this way: "DFO encouraged people to get involved, without expecting any measured results. Everyone knows this—except the volunteers." It's also important to distinguish between plain, common-sense, gut-feel monitoring and science. In many cases, habitat has manifestly been improved, and the numbers of salmon seen spawning, or fry observed in trapping expeditions, are clearly on the rise. Only a pedant or a fool would walk along the Seymour River off-channel and deny that the project has been good for salmon. And, when questioned about monitoring of project results, many groups will reply that some monitoring has been done. Unfortunately, this monitoring normally ranges from occasional stream walks or fry trapping to the more rigorous but still basic kinds of monitoring prescribed by the Streamkeepers Federation.

The problem is, common sense and fry trapping don't provide verifiable proof of any long term effect, and their lack could unfortunately be used as justification for more cost-cutting. This does not mean that every habitat restoration program has to be a scientific experiment with publishable results but, as we will argue later, enough projects need to generate solid data to maintain bureaucratic confidence in the enterprise.

In the real world, the cost of monitoring (and it *is* expensive) has to be balanced against the potential benefits that many people feel flow from restoration. Understanding ecosystems is a long, complex process, and we may never know all the ramifications of actions we take to help salmon. Making decisions with less than scientific certainty is part of the "precautionary principle," which states that where there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation. An argument for better monitoring thus should not become an argument for "no more restoration until we're absolutely certain it will work."

Kinds of monitoring

It's necessary to have some criteria for assessment. A crude but useful split is between "physical" and "biological" responses to restoration.

Physical monitoring

Stream habitat characteristics like width, stability, depth, particle size and flow all combine to produce a particular mix of riffles, rapids, pools, and meanders that provide the various micro-habitats salmon need throughout their lives. Physical results of stream engineering are relatively easy to measure: did the engineering do its job? Are all those weirs, LWD, rocks, trees, diverters, and side channels still there? Are they still creating riffles, shade, refuge, spawning habitat? Or have they eroded, washed away in floods, filled up with sediment, been carted away by vandals?

Most evaluations are heavily weighted toward physical monitoring. The consultant's report on the performance of the Habitat Restoration and Salmon Enhancement Program (HRSEP), for example, rates restoration projects according to how well they met their "stated objectives", which were primarily physical. The major complication in measuring physical response is the time span necessary to provide any useful assessment. Someone has to be prepared to visit and revisit restored sites for at least a decade and probably much longer, because the catastrophic floods that can severely damage restoration structures occur at widely spaced intervals. This doesn't mean that visits have to be made every year, but there has to be some kind of schedule. One study that looked at the persistence of concrete instream structures built in the 1930s and 1950s in California concluded that loss or damage to the structures often created new problems that themselves needed restoration attention; in other words, over time, they did more harm than

good.[47] The point here is not that instream structures are flawed, because the design and placement is constantly improving. Rather the point is that it took 30–50 years for the damage to be evident. This is very long-term monitoring.

Assessing habitat rather than the things living in it is tempting because it's manageable. But it makes the same assumption as the corn farmer made about Shoeless Joe's famous baseball field: if you build it, they will come. Once you accept that assumption, a pre-project habitat assessment can be used to justify spending millions on in-stream structures for habitat compensation or restoration, with no idea of the ensuing biological response and no plans to measure it. Unfortunately, among the many things a purely physical habitat assessment often "leaves out" are such simple things as chemical contamination, temperature, dissolved oxygen. It doesn't take into account any interactions at the ecosystem level (such as predator-prey relationships) or harvesting. As one critic of habitat-only assessment put it, drawing inference on biological condition based on habitat alone would be "like a doctor's examining your home to see if you are sick."[48]

Biological monitoring

What about measuring biological responses? Assessment of biological response also means long-term monitoring. The 4–5 year salmonid life cycle and the large variation in abundance between years demand a minimum of a decade's monitoring, and probably much more, before it's possible to say whether the project has had any lasting effects on salmon numbers.[49] And this is not the only reason biological monitoring is difficult: restoration affects entire stream and riparian ecosystems whose study is difficult and whose functioning is still not understood even in the undisturbed state. Finally, biological monitoring for the desired effect of "more salmon" goes against the fundamental principles of science in that the experiment is rarely a controlled one. If there is no net effect on the resident salmon population after twenty years of monitoring, does this mean that the restoration is to blame, or that any of a host of other factors (harvest, disease, climate) has erased any possible gains? Nature and the average budget rarely provide biologists with side-by-side streams where one can be restored and the other left as a true "control area."

Counting salmon may not be enough

A first, and counter-intuitive, principle is that monitoring biological effectiveness of restoration projects by simply counting juvenile or adult salmon doesn't necessarily reflect the long term capacity of the system. Common sense suggests counting juvenile or adult salmon—after all, they were the target of the project, weren't they? But population size, even in pristine areas, varies for a number of reasons that aren't necessarily related to stream habitat. Separating the human effects on populations from sample variation and natural variation is hard, because human and natural events interact.[50] Consider a restored estuary, a place where young salmon rest and feed on their way to the ocean, and through which adults swim on their way upstream to spawn. Although juveniles may stay from hours to weeks depending on species and size, both life stages are essentially transitory visitors, and the estuary is a migratory pathway whether it's healthy or not. A large number of juveniles in the restored estuary is better than no juveniles, but doesn't tell nearly as much about the health of the area as would a comprehensive biological study of the many trophic levels that interact there year-long.

And that kind of study is costly and very labour-intensive.[51] For juveniles, it involves measuring productivity and the kind and number of prey organisms, how available those organisms are to feeding salmon (a function of such things as tidal elevation, hiding places, and cues that attract salmon), and how successfully the salmon forage and grow. The task is even more daunting when you realize that the specific habitat needs of juvenile salmon in estuaries are not well known, and that reference sites for such a study are hard to find.[52] Yet the emphasis on counting juveniles

remains (probably because it's easy for community groups to do), with no thorough evaluation of the response of spawners to instream structures or estuarine modifications. Furthermore, most studies cease after five years or so, and the results are generally inconsistent with large variations between the species.[53] In the end, the big picture may only reveal itself through a combination of simple counting and more complex scientific studies.

The Index of Biological Integrity (IBI)

What kinds of things should ideally be measured to tell whether a restoration project has worked? A great deal of research has gone into developing an index of biological integrity (IBI) that is reached by sampling many biological attributes. Because the IBI is derived from observations at different trophic levels it can provide a far better measure of the ability of the ecosystem to support salmon—much better than just counting fish. As one might guess from the number of different aquatic ecosystems, there are many regional indices—each one tailored to the geographic peculiarities of the location in question. Some IBIs are based on fish, others on invertebrates (especially benthic or bottom-living ones), and some on a combination of both groups. Most combine measurement of 8–12 different variables to produce the final result, much the way a laboratory analysis performs many blood tests to help a doctor make a diagnosis. Variables are grouped in categories like species richness, species composition, trophic composition, community structure and the condition of individuals. The idea of these multimetric indices is that they are sensitive to the main factors that degrade water resources (water quality, habitat structure, flow regime, energy sources and biotic interactions).[54]

Like any such index, the IBI is open to the criticism that it places too much reliance on numbers and statistics, but a graph of IBI values over time can dramatically reflect the results of management decisions and restoration. Many managers and scientists question how well volunteers can perform such complex sampling, but one study comparing the performance of volunteers and professionals on the benthic index of biological integrity (B-IBI) showed very little difference in the results provided by the two groups, despite greater professional ability in taxonomic identification.[55]

A fundamental flaw in monitoring design

Often, monitoring is planned but never actually done. The explanation may lie in the conceptual framework of the design of the project. If a restoration project is thought of as "adaptive management" that can be directed by the results of post-project monitoring, there is a risk that monitoring is thought of as an add-on from the outset. It can thus be omitted, explaining why so many projects contain a well-intentioned monitoring component that is fuzzy at the outset and disappears once the physical work is done. No more adaptive management, and the burden of proof of harmful effects of bad management is on the ecosystem itself.

An alternative view is to accept that monitoring and restoration are scientific experiments that need to be based on hypotheses that can be tested. In this view, monitoring is just part of the overall experiment, and it's planned that way.[56] Monitoring programs are thus designed as scientific experiments that test the hypothesis that a particular management action will work. Ignoring this principle ignores the scientific method, on which our knowledge of salmon, their ecosystems and management are supposedly based.[57]

IX. WHERE STEWARDSHIP SHINES: URBAN STREAMS

The plight of many declining salmon stocks is not just habitat-related; even when habitat loss is significant it has to be remembered that restoration may not solve the problem. Many stocks are affected by so many multiple variables in addition to habitat loss (fishing and environmental change are two big ones) that adding more freshwater habitat may make no difference to salmon numbers. An extreme example would be Cultus Lake sockeye, a unique population that has plummeted so far and so fast in recent decades that it is likely to be officially listed as endangered under SARA. Habitat loss is not the main reason for the decline of this stock, but even if it were, few biologists would agree that spending money on restoration would make much difference in the face of high exploitation rates, pre-spawning mortality and low ocean survival—the three big reasons why the stock is now endangered.

Does that mean that habitat projects on severely troubled streams or stocks are not worth doing? One way of answering this question is to look at the results of stewardship projects on urban streams, where obstacles to salmon recovery seem insurmountable. What we will find is that "worth doing" depends on how you measure success.

Reay Creek

Reay Creek flows from the Victoria Airport to the ocean near Sidney, B.C. In 1982 there was industrial pollution, poor gravel, and no summer water flow, with only stickleback and sculpin present. A series of restoration projects funded by DFO, FsRBC and participating partners has resulted in establishment of a modest coho run and colonization by sea-run cutthroat trout. Capital projects were contributed by various levels of government and the Airport Authority. Spin-off benefits are important to note because they represent the catalytic effect of a small project. In addition to improving fly fishing in the local bay, for example, the creek is used as a release site for six local schools and forms part of the local streamkeepers Science Program, and a working model of the airport watershed is being developed as a teaching tool. Residents in the area have adopted a stewardship attitude and feel the creek has enhanced their quality of life.

Brunette River and Upper Tributaries of Burnaby Lake

Burnaby Lake discharges into the Brunette River and then into the Fraser. The decade-old Burnaby Lake System Project was created in order to protect, inventory, monitor and enhance the natural resources of the Brunette River Watershed. It includes a variety of community projects including riparian planting, fish and wildlife inventories, stream and terrestrial habitat mapping, monitoring and invasive species control programs, hatchery programs, fishway construction, instream and off channel habitat restoration, education and awareness programs and local community events.

Like Musqueam Creek (see below), this watershed is close to a university campus and has been much-studied over the years. Restoration and other projects are done through a community partnership that includes the B.C. Institute of Technology, the City of Burnaby, Greater Vancouver Regional District, Ministry of Water, Air and Land Protection, Fisheries and Oceans Canada, community organizations, stewardship groups and local business. This kind of partnership was deliberately built in order to ensure long term community support, and technical projects include riparian planting and bank stabilization. However, biological monitoring is sporadic or preliminary,[58] and the main benefits are probably in awareness and education through engaging stakeholders and the community.[59] Enhancement of the environment (water quality,

fisheries, wildlife) is a key aim, and spinoffs in increased recreational use and land values are anticipated and welcomed. Any resurgence in numbers of salmon would be considered a benefit of environmental improvements and seem likely to be measured qualitatively rather than rigorously. To date, chum and coho salmon have been successfully re-established in the watershed through a hatchery program operated by the Sapperton Fish and Game Club. Chum salmon in particular have increased their numbers since then and are self sustaining. Efforts are now being made to bring back pink salmon into the watershed.

Spanish Banks, Mosquito Creek and the B.C. Hydro Salmon Stream

Spanish Banks is a heavily used stretch of sandy beach in Vancouver. It is fortuitously situated in having the watershed largely in parkland. Removal of a prominent culvert and some limited riparian and instream work have succeeded in providing a functioning stream that, once kick-started with chum fry from schools, now makes it possible for adult fish to return and spawn. Signage informs visitors of the local habitat issues.

Mosquito Creek in North Vancouver is also within municipal parkland, but is bigger than Spanish Banks Creek. Restoration has been much more extensive, involving creation of several kilometres of side channel. Enhancement has not been necessary, and the production now comes from an increased run of coho. As with Spanish Banks, the work was accomplished by a consortium of volunteers and DFO technical advice, coordinated by the local CA.

The logical extension of this philosophy is the B.C. Hydro salmon stream, a totally man-made salmon habitat constructed by the Vancouver Aquarium in 1998. The short stretch of man-made river exemplifies important habitat features and showcases restoration technologies, and functions as rearing habitat for hatchery-produced fry. Adult salmon are now returning regularly to the river mouth, and the attraction is a justifiably popular one. Linkages with school programs, mini field trips and online resources provide many opportunities for amplifying the stewardship message. The only drawback is the one already identified for the use of incubators in the *Salmonids in the Classroom* program, namely that the ability to create a functioning salmon stream using bulldozer and morpholine-imprinted hatchery fry sends a message that engineering can be the answer to all habitat problems. A thoughtfully designed interpretation program at the Aquarium takes this "drawback" and turns it into a learning tool about the limits of man's abilities.

Were these urban projects worth doing? In terms of numbers of salmon, maybe not. But the Reay and the Brunette River projects illustrate the importance of community stewardship projects as rallying points for the community rather than saviours of urban salmon stocks that have been decimated for so long and are subject to so many insults that their recovery to historic size is unrealistic. Neither Spanish Banks nor Mosquito Creek are going to make any significant impression on the overall number of salmon returning to the Georgia basin. "Bringing back the salmon", for these rivers, is satisfying emotionally but not practically. It's not about creating large numbers of salmon for a fishery. However, the location of the streams means that their payoff in awareness and inculcation of a stewardship ethic is far bigger than their size would suggest. For these projects and for many others like them, success is measured in awareness, not numbers of salmon.

X. Aboriginal Involvement In Salmon Habitat Stewardship

Native ties to salmon are fundamentally different from those of, say, a group of community volunteers or a sport fishing association keen to enhance local rivers. Native people historically relied on salmon for sustenance, and salmon occupy a central position in Native mythology from the coast to deep into the B.C. interior. The "CA model" that has been so successful for community groups partnerships often includes local Indian Bands as partners, but there are also many examples of habitat stewardship where the position and role of the Band is central and where funding available only to Bands is key.

The experiences of these Native-led projects offer some interesting lessons. Projects can range in size from small and localized (e.g., Musqueam Creek) to long-term fisheries recuperation and co-management strategies that reflect the Native community's management role (e.g., the Skeena Fisheries Program; Nimpkish River) and receive funding support under the Aboriginal Fisheries Strategy. The two projects discussed below illustrate only two of many possible approaches and are an extremely small sampling of the kinds of stewardship projects in which First Nations are involved. It's interesting to note that, where SARA-listing is concerned, First Nations have been not always been receptive to listings of terrestrial species, but highly favourable toward aquatic ones. Listing of both the Sakinaw and Cultus sockeye stocks, for example, has been strongly pushed by concerned First Nations.

Musqueam Creek

Musqueam Creek arises in the University Endowment Lands and runs through the Musqueam Indian Reserve in south Vancouver. It has received media attention as the "last wild salmon run in Vancouver." The creek supports extremely low numbers of salmon (mainly coho and chum) and has been much degraded, including extensive use of culverts that pose almost insurmountable barriers for migrating adults and juveniles.

In the late 1990s, the Musqueam Indian Band and the David Suzuki Foundation agreed to work together to restore riparian and instream habitat and to raise awareness of the creek and its significance. Restoration included some riparian planting and culvert removal, and attempts were made to count returning adults. The Suzuki Foundation provided technical consulting on restoration and volunteers, but mainly concentrated on outreach, developing educational materials and events that raised awareness within the Musqueam geographic area on stewardship issues like storm sewer use. Media coverage was extensive, including a national profile of the Musqueam Band fisheries director.

The project is unusual in having been done largely independently of DFO. Technical input on restoration was obtained from Suzuki or outside consultants, and in the later stages of the project the policy of both the Band and the Foundation was to not involve DFO. Outplanting of chum fry from a neighbouring creek, for example, was halted by the Band. DFO does however remain involved in other projects in the area, as part of the multi-stakeholder Musqueam Creek Committee, whose accomplishments include flow augmentation in low water periods.[60]

What are the results of this high profile effort on a small urban stream? The uneasy relationship with DFO undoubtedly complicates any attempts at monitoring, and there are no formal reports available to the public. The Suzuki Foundation is no longer involved in freshwater habitat restoration.[61] Yet the Band continues to work energetically, raising funding for planting, culvert removal and signage. Anecdotal reports of coho returns suggest some improvement,[62] and the DFO Community Advisor attached to the flow augmentation project does occasional fry trapping. The overwhelming benefit, however, would seem to be in creating local awareness of salmon stewardship, as well as more general awareness of urban streams and the peculiar challenges they face. Like so many projects, though, the Musqueam project lives from year to year on episodic

funding, and while the clout of a large organization like the Suzuki Foundation can kick-start awareness dramatically, the project needs to be sustainable once this partner is no longer involved.

Coldwater River

The Nicola Valley in the interior of B.C. is far from any large urban centre but has traditionally sustained interior First Nations with salmon stocks that migrate up the Fraser and Thompson rivers. Some of these stocks, especially Thompson coho, have been critical conservation concerns over the last decade. Since 1995, coho fishing in the lower Fraser has been restricted for conservation reasons and First Nations further restricted their coho fisheries in 1996.

The Nicola Watershed Stewardship and Fisheries Authority (NWSFA) represents the interests of seven First Nations in sustainable management of local fisheries. NWSFA's approach to stewardship has included the long-running hatchery at Spius Creek as well as many projects to recuperate damaged habitat, create off-channel habitat and apply traditional knowledge. The Authority is a partner in the recently developed Recovery Strategy for the Coldwater River, a tributary of the Nicola River and an important system for coho, chinook, and steelhead salmon.[63]

The Coldwater Recovery Strategy developed by the Pacific Salmon Foundation reflects a multi-stakeholder recovery planning approach. The plan has been designed and funded through the Salmon Endowment Fund (PSEF), the remaining significant block of funding for salmon habitat projects that has been earmarked for larger projects rather than small, stand-alone community efforts. Recovery Plans adhere to a format that includes background on the species and their status, known information gaps, potential for recovery, recovery goals and activities, implementation schedule and funding requirements, and a plan for monitoring and assessment.[64] The PSEF approach to recovery planning is similar to Stage II of the Watershed-based Fish Sustainability Planning Guidelines (WFSP) and there are many similarities to the approach being adopted for recovery plans emerging out of Canada's new "species at risk" legislation (SARA; see Section XIII). Local stewardship groups with an interest in the Coldwater River watershed and its anadromous fish stocks were involved throughout the planning process. The Coldwater Recovery Plan includes both habitat protection and habitat rehabilitation. Protection of critical riparian habitats will be pursued within the watershed, particularly in the Coldwater River mainstem.

How does the strategy used on the Coldwater differ from that used on the Musqueam? Both are highly significant for First Nations; both streams run through traditional territories. However, the Musqueam is a very small urban stream, and the major benefits from restoration work have been to increase awareness—not unlike the other urban projects described in the preceding chapter. The Coldwater, on the other hand, is larger and has the potential to contribute significantly to First Nations fisheries and for this reason may merit a more intensive strategy. Like Kirby Creek (below), the Coldwater is also an indicator stream, and the Recovery Plan recommends monitoring and assessment protocols that furnish management-quality data. This kind of foresight increases not only the likelihood of learning from experience, but also adds value by providing management agencies with usable data.

While one could argue the pros and cons of the two very different approaches taken by First Nations on these two different streams, it is more productive to think of them as representing two ways of increasing salmon stewardship. One is done on a shoestring budget that changes from year to year and the other has dedicated funding. They are not interchangeable. They also offer important clues to the kinds of stewardship projects that are likely to persist in the new funding climate in British Columbia. As we will argue later, projects that are part of a comprehensive recovery plan, like the one for the Coldwater, may have the edge in the coming decade.

XI. CASE STUDY: KIRBY CREEK

The Kirby Creek Enumeration Fence, already referred to in the Introduction to this report, offers many lessons about the way salmon stewardship played out in the last decade. The fence was built in 1997 and decommissioned in 2002 after an operating life of only five years and expenditures of around $300,000. The project was funded by multiple donors and shared by a variety of local partners including DFO, NGOs, fishermen's employment/training organizations and volunteers. Its brief history provides some important lessons for the design of future stewardship projects.

1996: Project conception and fundraising. World Fisheries Trust selected the Kirby Creek Counting Fence project from a list of possible projects provided by DFO South Vancouver Island Community Advisor Tom Rutherford. The Kirby Creek fence was high on DFO's list because the stream was a historic coho provider and the fence would permit Kirby Creek to serve as one of three indicator streams on Vancouver Island. A fence would permit gathering comprehensive adult escapement data for coho and other species (including steelhead, in which the Province of B.C. has a management interest) and could be adaptable for smolt counts.

WFT chose the project based on its obvious utility to DFO and its convenient location less than an hour from Victoria. A rough concept was developed and costed out. WFT raised cash contributions from Canada Trust Friends of the Environment Foundation, Shell Environment Fund, Western Forest Products and Scott Plastics Ltd. DFO agreed to contribute an unspecified cash amount toward construction as well as a significant in-kind donation, and WFT contributed some staff time.

1997: Construction and first operating year. The fence was built according to technical specifications furnished by DFO and based on topography, stream characteristics and the kind of data desired by DFO. Several stream walks were done and the resulting design was executed under the overall direction of WFT.

Physical labour was provided by South Island Streams (SIS), a Vancouver Island group receiving funding under HRDC to employ displaced fishermen. The Sooke Salmon Enhancement Society, a volunteer group that was one of the original partners in the Kirby Creek project, agreed to step down from the project and were not involved in either construction or operation of the fence until 2001, when they played a minor role. The withdrawal of this volunteer group established SIS and its successors as managers of the fence through its operating life.

In the fall of 1997, counts of adult salmon passing through the fence were made by SIS, operating in conjunction with the Community Fisheries Development Centre (CFDC). The data were provided to WFT, and both organizations used the same data in their annual reports on the fence. The data included numbers, sex, and lengths of adult coho and chum passing through the fence; tagging and tag recovery upstream; numbers of fish recovered below the fence; daily fence log including water levels and temperatures; and observations from regular stream walks. The data were invaluable to DFO Stock Assessment and seen as the beginning of a comprehensive data series from this important indicator stream.

1998: Enumeration. In the spring of 1998, the fence was adapted for smolt enumeration to provide expanded data to DFO. Smolt and adult enumeration was carried out by CFDC-SIS under technical direction from DFO, and WFT was no longer involved. Many valuable data were gathered, including information on steelhead use of the stream and demonstration of the feasibility of starting a coded wire tagging program to help estimate ocean survival. Funding,

including payment of salaries of the workers, was provided by DFO through the HRSEP program and directly from Stock Assessment. Some minor modifications to the fence were made by CFDC.

1999 and 2000: A change in organizations. The role played until now by CFDC-SIS was assumed by a new organization, the Coastal Environmental Restoration Co-operative Association (CERCA). Smolt and adult counts were made using funding from HRSEP, Stock Assessment and the Pacific Salmon Foundation.

2001: Funding reduced. Smolt and adult counts, by CERCA with volunteer assistance from the Sooke Salmon Enhancement Society as funds for worker salaries began to dry up. DFO Stock Assessment provided funding.

2002: End of data collection. Smolts and adults were counted by CERCA using remaining DFO Stock Assessment funding. DFO was unable to continue to fund further data collection after this season and requested permission from WFT (who had purchased the initial fence materials) to remove components and deploy them where there was still sufficient funding to collect data.

2003: Decommissioning. The fence panels are in storage. Kirby Creek is no longer a functioning indicator stream although DFO personnel are still doing swims to monitor escapement and people from CERCA continue the stream walks. The two remaining indicators providing assessment data for all of Vancouver Island are Black Creek and Carnation Creek.

Analysis

Kirby Creek was a historic producer of coho, chum and steelhead. The most recent recorded escapements, before commencement of the fence project, were for 1985. The location of the creek, and the support of the landowner through whose property it exits, made Kirby an attractive choice for an indicator stream that could provide DFO with high quality, comprehensive data on escapement, run timing and productivity. These data were invaluable for management of Southern Vancouver Island coho and chum. Such data however require tagging, tag recovery and routine stream walks, and the adult enumeration component is much more demanding than smolt counts and less suited to volunteers.

The Kirby Creek fence provided comprehensive data to DFO, including crucial estimates of ocean survival using results from coded wire tagging, for less than five years before funding restrictions shut it down. For a species with a three year life cycle, five years of data represent only the beginning of the kind of time series needed to inform wise management. The amount of monitoring at Kirby is now reduced to stream walks and swims, the lowest level of assessment and a far cry from the comprehensive data collection the fence was to provide.

The approximate total budget to build and operate the fence for five years, not including significant in-kind contributions from DFO staff, was $300,000. Why was a project this big not sustainable? The obvious answer is that there was no long term commitment to operation of the fence. Adult enumerations as performed on a fence like Kirby Creek are more suited to paid labour than to volunteers, but that paid labour was, in the end, too expensive. By building the fence using the partnership model, DFO gambled on external funding to keep it going. Unfortunately, removal of stock assessment from A-base DFO funding meant reliance on stewardship program funding (like HRSEP or FsRBC) or outside funding, both of which eventually dried up.

What lessons can be learned?

First, for projects that are essentially designed to provide data, the manpower to collect the data needs to be secured over the long term. There is a clear lesson here for any restoration project that requires maintenance or monitoring (and this means most of them). The question needs to be asked: are such projects appropriate for "contracting out" to volunteers and societies who only have year-to-year funding? If more than a minor commitment of time and funds are required, the answer is probably no.

Second, a positive outcome of the project was recognition of the ability of volunteers to do smolt counts. The DFO biologists who were responsible for the Kirby fence now rely on a large and growing group of enthusiastic volunteers for annual smolt counts on Vancouver Island (there are ten such groups at present), and are even introducing some adult enumeration (eight volunteer groups are now involved). Without these groups, given the disappearance of adequate funding for stock assessment, these counts would simply not get done.[65] There is, of course, a risk to this approach, namely that internal DFO funding priorities will reflect this success—in other words, if community groups can do the enumeration, why budget for staff? As we will argue later in this report, the whole issue of "how much devolution" revolves around the sustainability of a system that depends heavily on outside (especially volunteer) help.

XII. THE BOTTOM DROPPED OUT: FUNDING FOR COMMUNITY PROJECTS

The 1990s were good times for community salmon stewardship in British Columbia. Three key developments helped foster a favourable funding climate. First, public and government awareness of sustainable development and the importance of biodiversity took a big jump with the holding of the Rio Summit on the Environment and the signing of the global Convention on Biological Diversity. The extraordinary biodiversity represented by B.C.'s Pacific salmon populations began to be officially recognized, and by the mid-1990s the word itself even began to be used in formal DFO communications to the media.

Second, a lot of those same salmon stocks began to decline, so much so that fisheries began to be curtailed, society entered the painful process of deciding when and by how much, and the loss of habitat was clearly identified not only as a major threat to salmon but also one that ordinary people could lend a hand in reducing.

Finally, governments in many developed countries, and certainly in Canada, began to discover the advantages of devolution—handing off to non-government organizations some of the tasks that used to be exclusively government's.

Then—and now

Given forces and events like these, money for non-government groups to get involved in saving or restoring salmon habitat (and, by extension, a key part of B.C. biodiversity) began to flow. The venerable federal-provincial Salmon Enhancement Program, in business since 1977, became the stepping stone, technical advisor and mentor to many more funding programs that encouraged the participation of communities in salmon enhancement or habitat restoration. The main ones that specifically provided grants to community groups and partnerships were:

Federal government programs:

- Habitat Restoration and Salmon Enhancement Program (HRSEP)
- Habitat Conservation and Stewardship Program (HCSP)
- SEP Community Economic Development Program
- SEP Public Involvement Program

Provincial government programs:

- B.C. Urban Salmon Habitat Program
- Fisheries Renewal B.C. (Salmonid Renewal Program)
- Forest Renewal B.C. (Watershed Restoration Program)

Other government programs, some of them substantial, provided funding for salmon research, conservation and management; these included the Fraser River Action Plan, the Aboriginal Fisheries Strategy, the B.C. Hydro Bridge Coastal Fish and Wildlife Restoration Program and the Pacific Salmon Commission. None of these programs targeted community groups as recipients; except for the Fraser River Action Plan and the BC Hydro Program, all still have money. There are still scattered, smaller programs like the Public Conservation Assistance Program operated by the province of B.C. (100K), and the Habitat Conservation Trust Fund continues to support fish-

related projects along with many other habitat and wildlife conservation targets. The Habitat Stewardship Program managed by the Canadian Wildlife Service is specifically linked to the *Species At Risk Act* (SARA) and targets officially designated species and populations.

But of the seven heavy hitters listed above that were the engines for community participation, only the SEP Community Economic Development Program (which provides small grants, mostly to operate hatcheries) and the SEP Public Involvement Program remain. The rest, which fuelled the majority of community-based salmon habitat projects, evaporated in 2002 and 2003. The disappearance of HRSEP, HCSP, Forest Renewal and Fisheries Renewal represent a loss of approximately $66 million in annual funding for salmon stewardship, almost overnight. And there is no indication that any of these programs will be revived or reincarnated. At the federal and provincial levels, government has effectively promoted devolution of many of its erstwhile responsibilities for salmon habitat, and then pulled the funding away from groups who had taken on the challenge.

The Pacific Salmon Endowment Fund, a $30 million federal contribution, is hardly a replacement; the approximately $1.5 million in actual cash for projects is earmarked for activities contained in watershed-scale recovery plans in three priority regions (Thompson-Shuswap, Georgia Basin and Central Coast) and does not specifically serve community group projects that aren't part of such a plan. The fund will be applied only to selected watersheds over the next decade. An example is the Coldwater River Recovery Plan, discussed in Section XIII. The $30 million PSEF principal is managed by the Vancouver Foundation, while the interest generated to pay for projects is allocated by the Pacific Salmon Foundation. The Pacific Salmon Foundation, in existence since 1987, remains the only major funding link with SEP that actively encourages participation of volunteers. Despite its long history of funding small, relatively independent enhancement and restoration projects, the PSF has wholeheartedly embraced the concept of recovery planning in the last few years and is responsible for an impressive number of recovery strategies (seven so far) for regions the foundation has identified as important.[66]

Alternative (non-government) funding sources

With the funding roof falling in so resoundingly, are there any options for community groups to keep the rain out? Foundations have traditionally supported communities and encouraged volunteers in many fields, but Canadian foundations tend to be relatively small and focused. In the Pacific Region, the Vancouver Foundation has supported a number of excellent salmon-related projects within its Environment Program, but it serves a much broader constituency than just people who care about fish, with other major programs in education, social justice and the arts.

A much larger number of US foundations have strong programs in Washington, Oregon and Alaska and have made forays into B.C. salmon issues. However, these foundations, while having deep pockets by Canadian standards, tend to emphasize conservation and ecosystem preservation on a watershed scale, often through policy change, scientific research and advocacy. Access to B.C. community groups for small projects restoring salmon habitat is essentially non-existent.

Canada certainly has a few well-known environmental organizations, but these are either non-granting (like the David Suzuki Foundation) or, like the World Wildlife Fund until it took the major step of creating an office in B.C. in 2003, not active in west coast fishery issues. That leaves small grants from industry, often channeled through foundations set up to encourage community participation. Examples of such foundations that will support salmon work include the Shell Environmental Fund, the Canada Trust Friends of the Environment Foundation and the

Mountain Equipment Co-op Environmental Fund. Many businesses also give directly to community groups based on a good corporate 'fit' with the project; examples include Thrifty Foods, Van City Savings, and resource companies that quietly contribute to projects that in some way relate to company operations and philosophy.

While not all the money has dried up, and there will probably even emerge new sources, the fact remains that one-stop shopping for salmon habitat projects is a thing of the past. To get any of this non-government money requires a whole new kind of approach to fund raising, with skills that many community groups don't yet have.

XIII. SHOW US YOUR RECOVERY PLAN!

The community stewardship model used in B.C. for the last decade featured funding for projects that were championed by communities, with enabling technical guidance from professional habitat biologists and engineers, and community advisors acting as mentors. This pattern will likely change, and not just because of a withdrawal of funding. The more important development is the shift in Canada to formal recovery planning. Recovery planning is a process for dealing with species at risk, but the philosophy behind it, the tools used, and its cost mean that it will profoundly affect the way Canadians approach any kind of conservation. Recovery planning is the approach embodied in the *Species At Risk Act*, but it will also be applied to populations and species that are not formally listed under SARA. Recovery planning is not necessarily the "answer" for community salmon conservation, but groups that ignore the process risk being shunted to the sidelines.

The 'old' system for dealing with species at risk

Until quite recently, plans for the recovery of threatened or endangered species in Canada were developed under an agreement between federal, provincial and territorial wildlife ministers. This agreement, the Accord for the Protection of Species at Risk, was signed in 1996. It stipulated that the three jurisdictions work together to produce two kinds of document that will be used to rebuild threatened populations: a *Recovery Strategy* and an *Action Plan*.

The species or populations to receive this attention were those that were designated "Endangered" or "Threatened" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). An existing voluntary agreement for the Recovery of Nationally Endangered Wildlife (RENEW) took on the implementation of the Accord, and has evolved to become the organization responsible for coordinating recovery planning in Canada. RENEW is formally a Secretariat operating out of the Canadian Wildlife Service headquarters in Ottawa. The problem with this cobbled-together system was the lack of any over-arching legislation for the protection of endangered species in Canada, which left the issue of responsibility perpetually cloudy.

The Species at Risk Act (SARA)

After several years of debate and delay, the new federal *Species at Risk Act* (SARA) was finally proclaimed in the summer of 2003. The legislation not only lays out specific steps for recovery planning and implementation, it makes the federal government legally accountable for seeing that they are done. SARA complements other wildlife legislation in Canada and is based on a science-driven assessment process.

Listing a species or population as Extirpated, Endangered or Threatened under Schedule 1 of SARA is based on recommendations in a COSEWIC Status Report for the species. Once the species makes it from COSEWIC to SARA, the "competent minister" must prepare a Recovery Strategy and an Action Plan within a strict time frame, and containing standard provisions. There are two "competent ministers": Environment (which encompasses Parks Canada) and Fisheries and Oceans. Except for species in national parks, recovery planning for all aquatic species is the responsibility of the Minister for Fisheries and Oceans.

There were 47 listed aquatic species or populations when SARA came into force in June 2003. The interesting wrinkle for salmon conservation is that COSEWIC and SARA can list not only an entire species, but also a specific *population* of that species if it is genetically or geographically

distinct. This is actually much more than a wrinkle, because without it SARA would have little relevance for salmon in Canada.

Finally, salmon biodiversity is recognized

Each of the Pacific salmon species is made up of many genetically distinct populations—a rough way to visualize these is to assume that each population returns to its own specific river to spawn. These genetically unique populations correspond very roughly to what are often called "stocks"—a term that's used for developing fishing plans. The chances of an entire Pacific salmon species becoming extinct or endangered are slim, partly because the species is really a collection of populations that are widely distributed up and down the coast, so that the risk to the species is spread out over a very large area.

Having so many different populations, each adapted to its own geographic location (stream or lake) is a brilliant evolutionary strategy for making sure the species as a whole survives. Each population is like a soldier in a very large army, and as long as nobody objects to losing a few soldiers, the army persists. Up until the mid-1990s, fishing plans for B.C. salmon were created under exactly this philosophy: if you're going after one of the big, productive stocks and you intercept some fish from a small, weak stock that just happen to be swimming alongside your targets, that's acceptable collateral damage. A good example is the Cultus sockeye population, which co-migrates alongside the much bigger Weaver and Adams stocks. Fishing on the big stocks, combined with unusually high freshwater mortality, has nearly wiped out the tiny Cultus stock.

The SARA wrinkle is that suddenly the loss of even one salmon 'soldier' is unacceptable. The whole species doesn't have to be at risk, but if COSEWIC decides that one of its member populations is and the population becomes SARA-listed, a Recovery Strategy *has* to get written for that population and the Minister has to make sure the Strategy gets done. Whether the Recovery Strategy actually recommends stopping fishing on the population is a matter for the recovery team to agonize over; the main importance for community stewardship is that, for the first time, there is actually a formal designation of salmon stocks that are threatened or endangered, and a strict series of steps that have to be followed to rebuild those stocks. This has never happened before.

How many Pacific salmon populations are actually SARA-listed in Canada? Right now, none. But both the Sakinaw sockeye and the Cultus sockeye we've already mentioned are likely to be, and an entire complex of interior Fraser coho populations that comprises five geographic sub-groups is at the same stage in the listing process. Quite a few other populations are attracting recovery planning attention on the assumption that, sooner or later, COSEWIC and SARA will list them too. Recovery strategies will probably be created for all of them, whether they are officially listed or not.

Lessons for community stewardship

What does all this recovery planning have to do with community stewardship? If you look at what's contained (what *has* to be contained) in a Recovery Strategy and Action Plan, the answer is pretty clear. *Strategies* have to review the known status and trends in population and distribution, the mathematical likelihood of extinction, the biological limiting factors and threats and the critical habitat for the population; they have to state quantitative, verifiable recovery objectives that will return the population to a self-sustaining level. *Action Plans* spell out the actual activities and what they will cost. Both documents are mostly created by multi-

disciplinary, multi-stakeholder recovery teams. Taken together, they represent precisely the kind of detailed, results-based, long term planning that's usually been missing from community projects of the kind described in this report, and at its best the approach brings together the "amateurs" and the "professionals" in plans where both contribute rather than fighting for the same funding. Recovery planning is attractive to prospective funders, who can see evidence of consultation and priorities and can pick sub-projects to fund with the belief that these fit into a coordinated plan.

Recovery planning isn't all that new—the World Wide Fund for Nature (WWF) has insisted on recovery plans for decades as a condition for funding. But it's now the fastest changing area in wildlife conservation. Workshops on recovery planning are becoming more frequent (for example, at the Species at Risk Conference in Victoria in March 2004),[67] where more than four hundred people showed up for a day-long workshop on recovery planning—a clear sign of where the money will be going. The recovery planning model is still being developed, and there will be versions used by different bodies. For salmon, for example, the approaches now being used by DFO and by the Pacific Salmon Foundation have some differences. The model will no doubt be modified over the years, but the important thing is that it exists, and already it is being applied with a will.

The actual (and considerable) work of writing the strategy and the action plan that accompanies it is often done by paid consultants. A cadre of people and organizations—public and private—with expertise in recovery planning is already emerging, and it needs to be remembered that Action Plans are a blueprint for what's actually going to happen in the field for a particular stock—including restoration. In the years to come, bureaucrats will be more and more sensitive to the language and implications of species at risk planning, and community groups will need to be up to speed in this area if only to avoid proposing projects that conflict with recovery plans. At the very least, community groups need to understand that, once a species or stock is "listed" under SARA, there are new rules for the kind of work that can be undertaken. Eventually, if something isn't in a recovery plan it probably will have less chance of getting funded. Certainly the whole process of recovery planning will take up much more of the time of DFO habitat and assessment biologists who have traditionally helped out with community projects. Recovery Strategies prepared for SARA have to meet deadlines, and they are already piling up. In B.C. alone, there are 48 such strategies due in 2006.

For salmon, all of this activity means that the *ad hoc*, "get a government grant and pull on your boots" kind of stewardship is going to give way to better-planned efforts that, because they must fit into a new bureaucratic system, are going to compete according to a new set of rules. And those efforts all have a price tag, so that inevitably the money for salmon recovery is going to flow toward activities that are contained in a formal recovery plan. A clear example is the Habitat Stewardship Program managed by the Canadian Wildlife Service. This block of stewardship funding is specifically linked to the *Species At Risk Act* and targets officially designated species and populations. It is potentially applicable to community projects on salmon populations, but only within the context of a comprehensive recovery plan.

Is recovery planning "the answer" that makes other approaches obsolete? Not at all, but it is an approach that is rapidly gathering adherents and attracting money. SARA itself deals only with a small number of salmon populations that are in very poor shape, and it's unreasonable to assume that recovery plans are going to be written for every population in the province that could use some help. What can communities do to support this process while not forgetting about the thousand or so other salmon populations that SARA or other formal recovery plans won't help?

One way is to become familiar with the large investments in planning that SARA and other processes will make in a few watersheds so they can learn to be more effective in their own.

The lessons for community groups are: (1) realize that listed or about to be listed populations are going to receive more attention; (2) if you want to be part of salmon conservation, get familiar with SARA and recovery planning or you'll miss the party; and (3) better still, be familiar with specific activities in existing Action Plans and contribute your own ideas to upcoming ones.

XIV. SHOULD RESTORATION BE LINKED TO MANAGEMENT?

In times of reduced funding, people re-examine their priorities. Community salmon stewardship groups need urgently to decide where to concentrate their efforts because, with less money to go round, fewer projects are going to be funded. In the section on Recommendations we make some suggestions about how groups can survive on less money, but the issue of "which project to fund" really goes beyond just the involvement of communities in salmon restoration. What's really needed is a hard look at which streams or stocks received attention in the past (and from whom), how those decisions were made, and whether the same rationale makes sense in the coming decades. Who really "chose" the projects community groups got involved in, and how relevant were these projects to decisions being made about salmon management and conservation? Providing any but the most preliminary answers to these questions is well beyond the scope of the present report, but some general observations are worth making.

Salmon biodiversity: managed or not?

Virtually the entire province of B.C. is laced with rivers, and the range of the six Pacific salmon species covers almost all of British Columbia west of the Continental Divide and in the Arctic drainage. The extraordinary biodiversity represented by the thousands of populations of Pacific salmon using all this freshwater habitat is a source of fascination not only to biologists but also to many in the general public, but it poses an enormous challenge to those charged with actually managing fisheries.

Government actively manages only a small number of the thousands of salmon stocks that exist. Census data available for making management decisions are often incomplete even for those stocks, and the vast majority of the salmon biodiversity in B.C. is neither actively managed nor assessed. The dilemma of management has always been balancing biological diversity against harvest value, and the historical result is that the incidental harvest of "small" or "weaker" stocks in mixed-stock fisheries has placed severe pressure on many of them. Much of the historic biological diversity of B.C.'s salmon stocks has already been lost.[68]

Since the late 1990s, managers have struggled to strike a more conservation-oriented balance between the economic needs of fisheries on "big" stocks and the need to maintain small stock biodiversity. Unfortunately, they are doing so in the absence of many critical data on the stock status of big and small runs. Fisheries managers today are like generals told to implement a battle plan with only the most rudimentary knowledge of how many troops they have. In battle as in salmon management, lack of information leads to disasters.

Location of community projects vs location of biodiversity

What do biodiversity and the trends in management have to do with community stewardship projects? In our view, especially in a time of reduced funding for communities, it is becoming important for community efforts (on the one hand) and government strategies for management and conservation (on the other) to be on the same page. A look at where community projects have been taking place over the past decade would suggest that, until now, they haven't even been in the same book. In other words, there hasn't been any relationship between the projects communities do and the management decisions that drive the fisheries.

The number of community groups involved in salmon habitat restoration projects shot up with the expansion of funding programs in the early 1990s. Some idea of the extent of community group participation is provided by the Fisheries Project Registry (FPR), a computer map and database system developed by DFO and B.C. Fisheries in 1999. FPR tracks data on projects that restore habitat, enhance salmon stocks, map streams and habitat, assess salmon stocks and generally attempt to improve watershed stewardship. Most involve community groups.

As discussed in Chapter XIII, projects may fail to meet their objectives for reasons such as vanishing funding or collapsing partnerships, and the general absence of long-term monitoring and scientific assessment throws into question the effectiveness of those that are completed. But there is a bigger picture: does the geographic scope of community group projects put salmon habitat restoration to work where it's really needed?

As Maps 1–4 illustrate, stream restoration and enhancement projects registered with the FPR are predominantly located near urban areas or cluster around the Fraser and Skeena watersheds. This isn't surprising: two-thirds of the population of B.C. lives in the lower mainland, and most other communities are scattered along major river systems in the south of the province. Naturally, community groups focus on streams that are accessible and important to local people. And streams close to settled areas *have* historically been the hardest hit as a result of a combination of urban development, industrial activity, agriculture and dam construction.

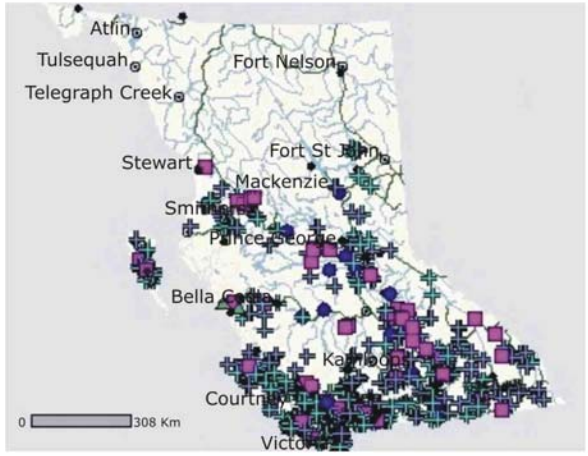
Nevertheless, salmon habitat has suffered throughout the province, not just near cities or on major rivers. Forestry in particular has a wide reach. Does the energy expended in all these projects really amount to a significant contribution to the overall preservation of salmon biodiversity in B.C.? There are clearly many more streams in B.C. than those touched on by projects registered in the FPR. Put bluntly, is there any point to restoring a local salmon run if the fish are going to get gobbled up year after year in a mixed-stock fishery that's been planned with full knowledge and acceptance of this eventuality?

The disconnect between community habitat restoration and salmon management which is hinted at by the FPR maps suggests that habitat restoration in B.C. hasn't been based on comprehensive planning. Consequently, many of the streams receiving attention have been identified as important by community groups based on local criteria. As a result, there have been fewer restoration projects in outlying, unpopulated areas of the province, and there has been no evidence of any planned relationship between the selection of restoration projects and achieving DFO's management and conservation objectives.

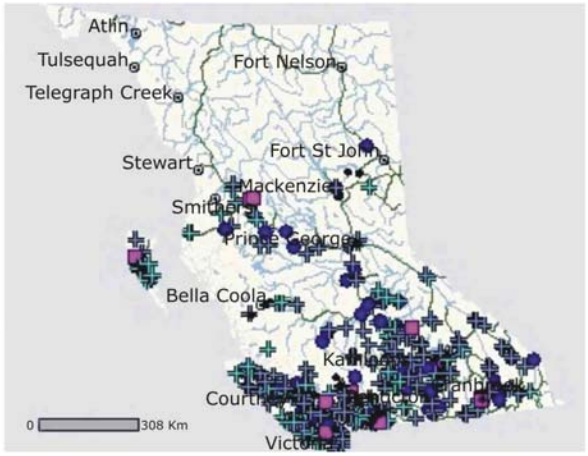
Many would argue, and we agree, that the main benefit of many small community projects is awareness: people learn more about salmon, and this fosters a stewardship ethic all the way from elementary school on up. But in a time of reduced funding, is society going to continue to pay for this kind of education? The slashed budgets for stewardship programs available to communities would seem to say 'no.' The time when community advisors and habitat biologists could say, "the project may not have much of an overall effect on salmon biodiversity but it's good for people" may have passed. This may not be entirely a bad thing: by the same token, the time when critics could argue that broad support for urban salmon habitat projects was a convenient and harmless way of keeping salmon-lovers occupied and out of the bigger issues of assessment and allocation is probably gone too.

Maps 1–4.

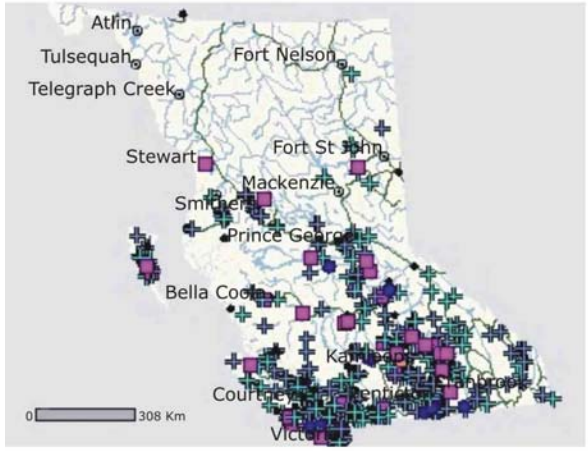
Map 1. Instream restoration projects



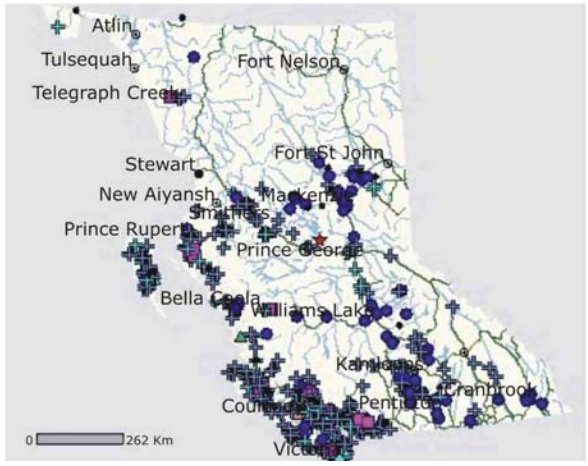
Map 2. Spawning habitat and off channel restoration projects



Map 3. Riparian restoration projects



Map 4. Hatchery projects



Source: Fisheries Project Registry

Making community projects more relevant to management and conservation

Should community groups abandon their passion for salmon? Not at all. As we suggest later in this report, there are many strategies to make groups more effective with less funding, and to get them linked up with the trend to formal recovery planning that is profoundly changing how salmon stewardship is done in this province. There is another path, too, and one that takes advantage of the huge boost in awareness provided by so many projects in the past. If community groups really feel "we acted in good faith and restored habitat and now the rug has been pulled from under us" then they should use the experience they've gained and work toward ensuring that any further such projects are part of a rational plan that includes management and conservation. Salmon groups have a long way to go before they catch up to what was achieved by public pressure in forestry, but they are in a good position to start. Some of the changes they might work toward would include:

Management of salmon stocks in B.C. based on knowledge about their status

As an American Fisheries Society review indicated as long ago as 1966, and as borne out more recently in an independent report on the north and central coasts,[69] there has been virtually no assessment of the health of salmon populations in the northern half of the province. Stock assessment budgets in general continue to shrink. Moreover, the ability of government to monitor impacts of human development on salmon habitat has become more limited with the shift from regulatory to results-based environmental protection.

To apply stock-recruit analysis of large and small stocks, a method which is mainly used for Fraser sockeye and some coho stocks and probably provides the greatest degree of confidence, the stock's status needs to be evaluated using estimates of abundance and productivity. Both require accurate counts of spawning adults, knowledge of how many fish were caught in the fishery, and an idea of the survival of other life stages. Currently, such data for the small stocks that represent much of the province's salmon biodiversity are almost completely absent. As we point out later, however, there is already a trend toward stewardship groups actually helping obtain these data (we term these "management" projects). Counting fish may not be as sexy as placing large woody debris, but it's probably more important in the long run.

Common criteria for applying habitat restoration methods to streams in B.C.

Over the past decade there have been many restoration projects done but little attempt to fit them to any criteria or standards. Criteria for using a particular restoration method in a given region should reflect documented results from other projects (in other words, monitoring), as well as fisheries management and conservation policies for the area.

There are already some signs of progress. The federal and provincial governments have moved towards a more comprehensive approach to watershed planning through initiatives such as Watershed-based Fish Sustainability Planning (WFSP). There's a similar need for a more comprehensive approach to restoration planning, including mechanisms for doing restoration in the regions of the province where it's needed. Salmon in less populated regions of the province may be largely "out of sight, out of mind" at present, but any reconciliation of sustainable fisheries and conservation needs to take them into account—and needs to take into account the fact that salmon range far beyond the territory in which community groups are active.

XV. Devolution And Its Consequences

Devolution means the transfer of authority, rights or responsibilities from the state to non-governmental bodies such as local communities or user groups.[70] Successful devolution is like raising children to be independent: it works, but you can never totally walk away from it. Bad devolution is like sending them out into the world and washing your hands.

A slow start to habitat conservation

Through the nineteenth and most of the twentieth century, salmon were so abundant that little attention was paid to conserving their freshwater habitat. Although it began to become apparent after the 1950s that many salmon populations were slumping, it took a long time for governments to acknowledge that habitat degradation might be part of the problem. Scientific understanding of salmon habitat needs was shaky, and with so many potential causes of damage to a watershed, it was hard to point a finger at anyone who should be responsible for fixing the problem.

A complicating factor was that government management of natural resources showed little recognition of the interdependencies of ecosystems. Ignoring those relationships perpetuates what Hardin described as the tragedy of the commons—the tendency of resource users to value benefits to themselves more highly than the potential cost of damage to common property.[71] Adoption of the ecosystem approach, as is now beginning to happen, is a natural outcome of advances in scientific understanding and is also rooted in the sustainable development debate that emerged in the late 1980s. More recently, Canada's ratification of the Convention on Biological Diversity (CBD) has created a higher level of commitment to sustaining aquatic ecosystems. Doing so requires more than efforts to avoid future harm; it also means making efforts to repair past damage. Once the CBD was signed in 1992, habitat restoration was more than just something a citizens' group could do if they wanted to; it was now the responsibility of government to ensure that it happened.

Watershed-based planning

Using the ecosystem approach means watershed-level planning. It also requires integrating protection and restoration and making sure watershed users protect salmon habitat. It may be as pointless to isolate the components of successful stewardship (protection, restoration, education, advocacy) from one another as it is to work on an isolated section of stream. DFO has been slowly integrating its planning, protection, restoration and management activities but, as illustrated below, different levels of government are a long way from reading from the same song sheet.

The National Watershed Stewardship Report defines stewardship as "promoting, monitoring and conserving" ecological health and biodiversity.[72] With government resources stretched thinner, careful consideration needs to be given to how community groups can contribute most effectively. Is habitat restoration the most important thing they can do? Should community groups help monitor the impacts of development on habitat, given the continuing trend towards deregulation and the absence of government resources for monitoring and enforcement? What should be their part in public education? Each of these roles might ordinarily be considered the responsibility of government, but limited resources mean at least some level of devolution. The question is, has it been devolution that works?

Making devolution work

Regardless of which tasks government decides community groups can undertake, it's crucial to plan well if devolution is to achieve its objectives. In British Columbia, the most prominent recent example of devolution of traditional government roles is the transfer to community Health Authorities of responsibilities for many health care services. Under this model, Health Authorities set priorities for delivery of health care based on budgets allocated by government. Health Authorities are required to meet government standards for quality of care, and government conducts ongoing evaluations. Government also stays involved in the development and analysis of statistical and other information needed for Health Authority decision-making. Volunteers are crucial both in the delivery of services and as members of Health Authority boards.

Critics point out that the system is chronically under-funded, that some services fall through the cracks, and that volunteer capacity is stretched to the breaking point. Cynics might say that politicians were more interested in getting complaints about the health care system out of their hair. Whatever the reason, it's a permanent arrangement. Just as important, it's a system that was comprehensively planned and continually funded. Is this the case with devolution of salmon stewardship?

In natural resources management, one of the main reasons for devolution is better management of common property. Those arguing for devolving management to the local level point out that communities have the commitment to make good decisions about what goes on their backyard, they can use a wealth of local knowledge, and they can get the job done more efficiently than a distant government. Devolution of fisheries management responsibilities to the community level is out of the question insofar as salmon are not a local resource—a salmon run may migrate practically the breadth of the province and across the ocean. But handing over some responsibility for restoration of salmon habitat was another question—community groups were more than willing to take on that task. What lessons can be learned from comparing the carefully planned devolution of health care services with the encouragement of community groups to do salmon restoration and enhancement? What went wrong with salmon stewardship?

Strike One: No planning

Devolution of health care services was preceded by comprehensive planning to ensure that regional needs were understood and that structures to deliver the services were adequate. By contrast, support for community involvement in restoration initiatives was largely an *ad hoc* response to a persistent and widespread problem. Restoration projects through the 1990s weren't tied into the broader spatial context of watersheds, and they were isolated from other components of fisheries management and habitat protection.

Comprehensive planning needs to include: (a) securing co-operation of all stakeholders; (b) ensuring access to information and filling information gaps; (c) setting priorities and developing management strategies; and (d) long-term monitoring and evaluation. Watershed-based Fish Sustainability Planning (WFSP), which was initiated in 2001 partly out of concern that habitat restoration projects were being done without considering wider impacts on watersheds, attempts to meet these planning goals. The process is still being implemented, with a new federal and provincial workplan produced in 2003.[73]

Strike Two: No government cooperation

The province of B.C. has a clear mandate to oversee delivery of health care services. In contrast, the division of federal and provincial authority for fisheries and fish habitat makes co-operation an ongoing challenge. There has always been tension between the federal role of protecting fish

habitat and the provincial role of managing resource use. For example, architects of the "fish first" approach of WFSP assume that watershed plans will feed into land use planning processes such as Sustainable Resource Management Planning, but the increasing provincial emphasis on economic over environmental sustainability is cause for skepticism.

Ultimately, the success of restoration programs may reflect the degree of federal-provincial cooperation. If government intends to rely on community groups for the success of restoration initiatives, it follows that the community groups' confidence will depend on the different levels government standing behind restoration and protection efforts. The federal government is still a long way from implementing the Convention on Biological Diversity, and it remains unclear what implications this will have for provincial land and resource use policies and practices.

Strike Three: Not enough expertise

Medical expertise is the foundation for delivery of health care. In the devolution of habitat restoration responsibilities, community expertise in achieving restoration goals has not been a major priority. Too often, enthusiasm has seemed the most important attribute. Granted, scientific understanding of what is needed for successful restoration has a long way to go. Nevertheless, as we show elsewhere in this report, it is questionable whether enough attention has been paid to community groups' technical know-how.

Strike Four: No money

It may seem like stating the obvious, but devolution of government responsibilities cannot succeed without dependable and continual funding. In the case of health care, funding is a perennial point of contention, but at least there's an annual budget. Funding for salmon habitat restoration started out well but has fallen off the list of government priorities. Even assuming that it is appropriate for restoration to be done largely by volunteers, funding is needed to support community group infrastructures, provide training, ensure the availability of relevant information, and provide for monitoring and assessment.

XVI. The Future Of Salmon Stewardship In B.C.

The past decade of salmon stewardship in B.C. illustrates not only the effects of devolution of government responsibility but also, in a broader sense, how societies go about cleaning up the messes they create. In North America and Europe there is a long tradition of citizen involvement in bringing attention to bureaucratic or political lapses that have resulted in environmental and social catastrophe. Citizens have also become deeply involved in actually righting what they perceive to be wrongs, according to an understood social contract that encourages or at least tolerates challenges to authority.

Many people got involved in salmon stewardship because they believed that improvement in land use would mean society's forgoing economic opportunities if salmon habitat were to be saved, and that could take a long time. They saw salmon populations dwindling and disappearing before their eyes, and decided to take action *now*. This is a reactive approach, and it's not unique to volunteers: the first real action taken on endangered Cultus sockeye was to preserve the existing gene pool by a captive breeding fish culture program. In both cases, there needed to be something to conserve if the long term effort was to be successful.

Communities felt they needed to act, not wait until the jury was in on all the pros and cons of hatcheries and habitat restoration. Hatcheries provided fish right now; restoration provided more fish in a few years; and planting a tree to shade a stream and then fall over and provide large woody debris will take a lifetime or two. Communities had to believe that the benefits from these projects would last at least long enough for the next generation to have something to work with, but they were more interested in action than in guarantees.

Amateurs and professionals

Many kinds of volunteers become involved in salmon stewardship, including people with advanced training in related fields like engineering or geology. The majority, however, are not salmon or salmon habitat biologists. The process of diving in to "make a difference" often involves people without relevant technical training getting involved in highly technical issues. There are two general scenarios that can play out. In one, a "crusader" faces an uphill battle against bureaucratic stonewalling and professional disdain. In the other, government actually encourages citizen involvement.

An example of the first scenario is the controversy around sea lice and the role of salmon farms in facilitating their spread to wild stocks (see PFRCC Report 2002).[74] In this case, a determined non-professional argued strongly and skillfully for one interpretation of some preliminary research. Through a protracted and costly process of media exchanges and stakeholder meetings, the agency most closely tied to the issue (DFO) invested in additional research to obtain solid scientific evidence—research that is still in progress. The relevance to salmon stewardship is this: whose responsibility was this research in the first place? Was it more expensive in the end for government to step in and do the research "properly"? Is this an example of the risks of leaving monitoring up to citizens?

The second scenario occurs when government actively encourages citizen involvement in "repairing damage"—as DFO has done with salmon habitat. In this scenario, volunteers are encouraged to use technical tools that used to be the province of professionals. Is this the better approach, and is it the first time such a social experiment has been tried, or are there other fields where we can look for lessons?

As a matter of fact, there are, and the best example is a very long-running one: foreign aid. From CUSO or the Peace Corps to the massive government-funded aid projects that all developed countries support, the whole field of overseas development assistance represents a massive outpouring of government money into the hands of private citizens, university researchers, and contractors who want, variously, to make a difference or to make money. Nowhere has more money been spent on outsiders' involvement in complex technical and social problems; unfortunately, nowhere has more money been wasted. The zeal, ignorance and cultural mindsets of aid project managers have proven, time and again, that development dilettantes do more harm than good.

The boom in salmon stewardship was different in scale only; the overall aim—to clean up some serious messes—was identical. So was the dependence of funding priorities on politics. Aid agencies are constantly struggling to come up with better ways of ensuring, and especially measuring, results. If this sounds familiar, it should, because it's the same problem salmon stewardship has. Those involved in planning the next phase of community salmon stewardship (if there is one) would do well to comb the history of "development aid" for ways to avoid making the same mistakes.

The situation habitat stewards find themselves in today is similar to that of ex-recipients of foreign aid, with one critical difference: the projects they were doing were in many cases the kinds of activities a government agency (in this case DFO) used to do but decided to devolve. Now that the temporary funding is gone, what happens to the work? Streams still need restoration (some of them do, anyway); salmon still need help. If the volunteers feel the rug has been pulled out from under them they will burn out and fall by the wayside, or concentrate their efforts on short-term projects that can be funded by industry or small foundations. If the remaining habitat biologists and engineers in DFO no longer have their budgets, what has devolution really achieved beyond a short-term frenzy of activity, the rise and fall of a lot of local organizations, and the gutting of DFO's own programs and funding? It's true there is something to be said for stable, modest funding over "feast or famine", but will the technical experts still be on staff when their "work force" reorganizes and achieves that stability? Will their experience go out the door along with the commitment of thousands of burned-out volunteers?

The importance of coordination and core funding

HRSEP and other programs were set up as short-term programs with one important goal being the sustainability of organizations that arose to take on projects. The reality, of course, is that "non profit" kinds of activities require core funding for administration, and as any international development donor knows, programs without solid local administration rarely persist beyond the cutting of the last aid cheque. Unfortunately, "feast or famine" funding hardly builds capacity (although it can provide near-instant political results). While there is much concern about this sad fact and many new strategies are being tried, project sustainability is still an elusive goal.

During the period when there *were* generous government programs like HRSEP, FsRBC and the Urban Salmon Habitat Program, volunteer groups enjoyed not only the technical assistance of DFO habitat biologists and engineers (brokered through the CAs) but also in many cases the luxury of unofficial but often full-time coordinators paid out of those funds. There were thus no less than three levels of "expert" facilitation available to groups who wanted to make a difference.

The loss of government programs has thinned the ranks of coordinators considerably. A good example is seen in the cluster of streamkeeper projects in the Saanich Peninsula near Victoria. Two of the projects, on Wsikem and Ten Ten Creeks, once enjoyed the services of two full-time

coordinators whose salaries were paid by HRSEP and whose operating costs were an in-kind contribution of DFO's Institute of Ocean Sciences. These coordinators had received formal restoration training and worked with volunteer groups, the local CA, and habitat biologists not only to carry out physical and biological programs on the streams but also to promote the projects, raise counterpart funding, and link with like-minded groups in the area to form a network of projects. One such linked project was the rehabilitation of Reay Creek, an urban stream (discussed earlier in Section IX).

The two paid positions that held the Wsikem and Ten Ten projects together are now gone. One person remains at IOS, without salary, and devotes his time to the Peninsula Streams Society, a new umbrella organization that pulls together eight volunteer groups to attract support for improving aquatic ecosystems in the area. But without a coordinator, how long will groups like Peninsula Streams last before burnout? How long will they be able to maintain relationships with government, First Nations and industry? Such an organization already represents a pooling of several smaller groups to make fundraising more effective (this is one strategy that will be used more and more). But that pooling means administration.

The goals of organizations like Peninsula Streams are unassailable but the new society faces the classic startup challenges at a time when funding has constricted to a grab-bag of small foundation and industry sources. As anyone starting a non-profit knows and every bureaucrat seems to forget, organizations need core funding to survive. Core funding pays the operating costs outside of strictly project costs, and even if the project costs are heavily defrayed by volunteer labour the coordinator's job has to be supported.

Coordinators' jobs are largely (often depressingly!) administrative, with ten days in the office for every volunteer's day in the field—but this administrative burden is the reality for any organization that hopes to persist. A "simple" riparian planting job, for example, can easily involve complex planning, including protracted negotiations with landowners who need to be convinced it's in their best interests to allow volunteers into their fields. Keeping volunteers motivated and recruiting new faces are time-consuming tasks; the general public asks questions that need to be answered, and if there is to be any networking between local groups someone has to pull the strings. It isn't realistic to expect community groups to pool their resources in the lack of a stable administrative system to keep the pool from going dry.

A scramble to adapt

Conservation and stewardship capacity in B.C. is now compromised. Cutbacks and layoffs of ENGO staff are happening on an unprecedented scale, along with burnout and frustration.[75] B.C. stewardship groups, for salmon and for other wildlife and ecosystems, are in the midst of a re-grouping exercise that will see the disappearance of many and a consolidation of strengths to survive on less money.

It is not only government programs like HRSEP that have vanished; the contributions of foundations may also be tenuous. In the US, whose foundations have invested heavily in B.C. salmon habitat, a significantly reduced pool of foundation dollars led the Brainerd, Bullitt, Harder, Lazar and Wilburforce Foundations to advise their client NGOs that foundation dollars for the environment are at the lowest level in the past ten years, and likely to be even lower in 2004.[76] This constriction of funding has a significant trickle-down effect on fieldwork: teaching programs, for example BCIT's Fish, Wildlife and Recreation Program, supply trained people to do watershed restoration in the province, but this and other programs will face an uphill battle if there is no work for their graduates.

In the absence of any significant new funding, how can community salmon stewardship continue to get done? Networking and the formation of umbrella organizations or coalitions like the Peninsula Streams Society is one strategy. Groups that normally compete for resources could work together and share a resource such as a Stewardship Coordinator, although making such collaboration a requirement may exacerbate cultural differences. Such "clearing house" arrangements have caused conflict within the environmental sector in B.C. and, as we pointed out earlier, they need some administrative glue (read, "core funding") to keep them together.

The common concerns of many B.C. environmental non-profits have resulted in several new initiatives. For salmon stewardship, efforts like the Vancouver Foundation's Watershed Education and Resource Centre may be able to help groups buck the trend to less collaboration and more fragmentation. In another example, an *ad hoc* group has formed out of the *Leading Edge Conference* (July 2003 in Victoria). Conference participants discussed the groundwork for a provincial and federal action plan to address the problem of funding. Goals include developing a strategic action plan to improve capacity-building and expand core funding opportunities for ENGO/stewardship organizations and thereby secure longer-term funding and financial stability to move the environmental agenda forward in Canada. Unfortunately, an observer at this conference couldn't help noticing that the overwhelming emphasis of discussion was on survival of the organizations themselves, while the issue of whether their actual results were being monitored was more or less ignored.

Salmon stewardship projects of the future

Politicians and bureaucrats love to see volunteers getting their hands dirty, and they love to have their pictures taken alongside them. Stream clean-ups and riparian planting are incontrovertible evidence of citizen passion and government facilitation. The problem is, most volunteers have minimal training and there are only so many clean-ups to go around. Many more restoration projects involve bulldozing gravel from one place to another, which is not well suited to volunteers unless they own a bulldozer, and the real job of assessment (beyond fry counts and adult enumeration) is beyond the interest and capability of many volunteer groups.

But volunteers represent a pool of enthusiasm and a conduit to greater public awareness. They are currently undergoing a trial by fire in B.C., but those groups that emerge need to be encouraged to contribute where they can really make a difference, and discouraged from mounting projects that are going to implode.

As we have stressed throughout this report, the wholesale shift to "recovery planning thinking" means that community groups cannot avoid aligning their projects with existing recovery plans, or ensuring that their concerns are somehow reflected in the deliberations of future recovery planning teams.

Two kinds of projects

The drop in government funding for salmon habitat stewardship has already caused chaos and restructuring among volunteer groups, HRDC-funded employment groups, non-profit societies and small biological consulting firms who relied on income from proposals to now-defunct programs. What kinds of strategies are likely to work in this new climate? We propose two basic kinds of project that we believe reflect the realities of funding, manpower and interest in the province. They are *awareness projects* and *management projects*. Both are well suited to inclusion in recovery plans, but they serve two different purposes that should not be confused.

Ecosystem and awareness projects

These are generally located near cities and towns. They involve volunteer groups creating partnerships with municipalities and industry to restore watersheds to a functioning state and in so doing raise the quality of life for local people. They focus on providing the conditions for healthy aquatic ecosystems, not salmon production, and are designed so that any increase or appearance of salmon is a measure of a healthy ecosystem, not a primary goal. Above all, ecosystem/awareness projects should accomplish what their name implies—a deliberate transfer of lessons learned and stewardship ethic to local people through signage, events and linkage with school programs. These kinds of projects are about the process, not the result.

Of the projects discussed in this report, good examples of ecosystem/awareness projects would be Musqueam Creek, Spanish Banks Creek and Mosquito Creek. These kinds of projects are well suited to coalitions using the smaller funding sources like industry and industry-sponsored foundations, and can sustain themselves over time with opportunistic funding.

Management projects

These may be close to cities but they are more likely to be on watersheds that have the capability of producing significant numbers of salmon or harbour salmon stocks of particular conservation or biodiversity importance. Salmon production or conservation is a goal; or, in cases where numbers of salmon will never be large, the generation of data that can be used in sustainable management will be the goal. Management projects have strong links to management agencies, including DFO, the Province of B.C. and First Nations, so the partners must be technically capable of collecting data. Management projects make a strong link between "outside" manpower from the community and agency technical experts, and will be planned comprehensively from a watershed level. They include the use of restoration technologies as well as supplementation hatcheries, broodstock programs, enumeration and comprehensive, long-term monitoring. The idea behind management projects is that they provide agencies with long-term data and help maintain institutional memory. They require long term, committed funding and professional support from senior governments.

Management projects are results-driven. The Kirby Creek Enumeration Fence, discussed in depth as a case study in this report, is a good example of a management project.

XVII. RECOMMENDATIONS

One does not have to talk to many community advisors, volunteers or funders to realize that a stage of community-based salmon habitat stewardship is coming to an end. As one partner put it, "the lucrative period is over."[77] Many community groups have disappeared; others are in survival mode, and many volunteers are feeling disillusioned and burnt-out. However, reports of the death of community salmon stewardship have been greatly exaggerated. The kinds of projects that happen in B.C. over the next decade, and they way they are chosen, managed and funded will simply be different from those in the 1990s, and so will the organizations doing them.

With one exception the following recommendations are aimed at groups that want to keep working with salmon in their communities, and that are willing to change the way they operate if it means that their dedication to the salmon can continue to find an outlet. The exception? We strongly recommend that long term funding for DFO's stock assessment program be secured, to ensure uninterrupted indices of stock status. Monitoring of project results will be very hard without the ability to count salmon. Credible information is critical to monitor the long term effects of fisheries, economic and industrial development, human settlement, enhancement, habitat restoration, and stewardship on the health of salmon populations and the ecosystems that sustain them.

Create consortia with political support

Like other stewardship groups, community salmon stewards will be competing for less money in coming years. The balance between funding sources will likely change, with less coming from government. Foundations and the private sector will be looking for evidence that applications represent a true community of interests on an organizational scale that can handle well planned, well managed projects. Groups that are able to present regional packages with a central coordinator may have an advantage.

Because communities include business people, bureaucrats and politicians, long term results depend on nurturing their political support for projects, and can have the kind of multiplier effect that will be sorely needed in a time of reduced funding. Grants come to an end; properly monitored projects have to keep going; local political support helps.

Be part of the plan

Recovery planning is changing the face of salmon conservation and the role of communities. Habitat restoration is likely to be placed in the context of watershed-scale recovery plans. Recovery plans will consume more and more government time and money in coming years, and communities that ignore the process and its tools risk having their projects marginalized. Consortia of community groups with a 'point person' who can be responsible for knowing about SARA and representing local projects to recovery planning teams within and outside government will have an advantage.

Community groups need to review and comment on existing salmon recovery plans, and learn how to create their own. Above all they need to be vigilant and involved, if recovery planning is not to become a closed shop that does lip service to the interests of community groups but in reality portions out the work of recovery to insiders.

Speak out and raise awareness

Telling people about your project is a lever that is not used nearly enough by community groups. Bigger conservation organizations have learned the power of public awareness and have the experience to create and promote tools ranging from simple brochures to long term campaigns. Community groups can multiply their impact on fellow citizens and funders by forming alliances with such larger groups and building the necessary funding into their proposals. The arrangement should be a win-win: large groups benefit from being associated with a project they don't have to fund, and the small group gets exposure. Providing web content to an established site (e.g., the Vancouver Aquarium's AquaNews) is one easy way to do this.

Advocacy does not have to be negative. At its best, advocacy piques the interest of powerful sectors of society, educates them about issues they don't normally have time for, and eventually secures their genuine, rather than grudging, support.

Advocacy is also a legitimate tool to encourage agencies to fulfill their responsibility for salmon assessment and sustainable management. In the absence of any new funding for salmon stewardship, community groups have other options.

Define data-gathering objectives right from the start

If the project is about collecting data that agencies can use in management (for example, for stock assessment) the link to the agencies needs to be defined and the necessary human resources secured. Year-to-year reliance on short-term programs, especially those for employment, torpedoes the chances for generating useful data, which normally have to be on an extended time series. Continuity is lost as funding programs come and go, and people need to be retrained. Hiring a contractor doesn't have to mean displacing community people if the project is planned right from the start.

Run hatchery programs with both eyes open

Doggedly adding fry to rivers without any idea of the actual expectations for recruitment or the stock's eventual ability to be self sustainable will eventually become a thing of the past. Community groups keen to operate hatcheries should be aware of management plans for the stock they are enhancing, and how such plans fit in with evolving government policies (e.g., Wild Salmon Policy or recovery planning). Hatcheries have to fit in with other actions taken to speed salmon, habitat and ecosystem recovery.

LIST OF ABBREVIATIONS

CA	Community Adviser
DFO	Fisheries and Oceans Canada
CFDC	Community Fisheries Development Centre
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
FsRBC	Fisheries Renewal BC
HCSP	Habitat Conservation and Stewardship Program
HRSEP	Habitat Restoration and Salmon Enhancement Program
IBI	Index of Biological Integrity
PFRCC	Pacific Fisheries Resource Conservation Council
PSEF	Pacific Salmon Enhancement Fund
RENEW	Recovery of Nationally Endangered Wildlife
SARA	Species at Risk Act
SIS	South Island Streams
SRSAP	Stream Restoration Site Assessment Procedure
WFT	World Fisheries Trust
WWF	World Wide Fund for Nature

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