Pacific Salmon: Status of Stocks and Habitat

INTRODUCTION TO THE PACIFIC FISHERIES RESOURCE CONSERVATION COUNCIL (PFRCC)
The Honourable John Fraser, Chair, PFRCC

Thank you to Simon Fraser University, and to all of you who have agreed to take part in these deliberations today. You are concerned about the fish, which is what this is all about. The Pacific Fisheries Resource Conservation Council will be making its first report public on June 8th. Following that, copies of the report will be available at the Conservation Council office and on the PFRCC web site: http://www.fish.bc.ca

As a boy growing up in the town of Powell River, I visited friends of my parents who owned a property of some acres in what is now the dense urban center of Westview, part of the municipality of Powell River. There was a creek there and that is where I learned to fish and caught my first trout. Many years later I went back to Powell River to practice law, and I went out to see that marvelous place which I held in my memory. However, like so many streams in so many places, as humans encroached, it was gone. It was probably underground in a pipe somewhere, but that lovely spot is no more.

The other thing that I want to reflect on is, when I was a lad growing up on this coast, while the abundance of salmon and steelhead fluctuated, very few people would have then predicted that we would face the agonizing reappraisal of our management, and of our hopes for the future with respect to salmon, as we have had to do in the last few years.

Before the 1984 election, I remember raising in the House of Commons the problems Fisheries and Oceans Canada was then reporting, not just on chinook, but also coho.

You will recall that in 1984 and 1985 we entered into the Canadian-American Pacific Salmon Fisheries Agreement with our American friends, and the first thing we had to do was initiate a complicated system of restricting the catch of chinook, while trying to rebuild these stocks. For a number of years, the agreement worked fairly well, but it eventually broke down.

Before we signed the agreement, it was my obligation to meet with some members of the provincial government. I met with one Cabinet minister and said, "Look, you have representatives on the negotiating team, but I have to tell you that if the federal government approves the treaty that has been worked out, it is going to have some serious effects for the province of B.C."

Now this may seem surprising today, but at that time, that Minister said, "Well, it's not really our concern; it's a federal matter." I agreed that constitutionally it was, but that it was essential not only to the economy of this province, but also to what we think of ourselves as people in this province, and our association with the salmon.

Later, when we had to bring in restrictions on chinook catches, he and others were, of course, outraged. And that is not because he was a bad man, but because until then it had not really occurred to him, and his colleagues, and a lot of other people, that the fishery in BC, "the great salmon fishery," is
not something that just locks itself conveniently up into a constitutional framework. It belongs to all of us.

How did the Pacific Fisheries Resource Conservation Council get started? It really began in 1994 because we had two episodes of “missing” sockeye on the Fraser River, and the federal government appointed a board of inquiry, of which I was chair. In our report (Fraser River Sockeye 1994: Problems and Discrepancies), a number of recommendations were made. They were all accepted by the federal government. However, one was accepted rather conditionally, and that one was for the establishment of a conservation council. Here are the comments of our report at that time: “Having discussed current institutional arrangements at some length, we believe that the objective of sustainable fisheries management would be advanced by the creation of an independent body which, for the purposes of discussion, we call the Pacific Fisheries Conservation Council. The Council would act as a public watchdog agency with no vested interest except the health of the fish and their habitat. While the Board sees merit in the suggestion of the government of B.C. that such an agency be created with hands-on regulatory responsibilities, that concept would require more time and complex negotiations, before it could be implemented. In the meantime, the council we conceive could be put in place with less difficulty, and would operate more through moral suasion than direct regulation.”

It is also important to note that the provincial and federal governments, having put behind them the notions of a decade before that this was a federal matter that didn’t really involve the provinces, entered into an agreement - the 1997 Canada-B.C. Agreement on the Management of Pacific Salmon Fishery Issues. This agreement stated that “both governments agree to establish a Pacific Fisheries Resource Conservation Council, which would advise the Council of Fisheries Ministers - provincial and federal – (also established under this Agreement) on conservation and long-term sustainable use of salmon resources and habitat. Reports will be released to the public at the same time they are submitted to the Council of Fisheries Ministers. Both governments would appoint the members of the Pacific Resource Conservation Council, and operating costs will be shared equally.”

It is a fact, which I do not wish to comment upon any further other than to record it, that the federal and provincial governments were unable to agree on the constitution of the Council, its members, or when it was to be announced. The reality is that Minister of Fisheries and Oceans, Mr. David Anderson, announced last autumn, the formation of the Pacific Fisheries Resource Conservation Council, unilaterally. The Council was announced publicly, and the members were named. The members accepted the responsibilities that went with this, fully aware and much regretting the fact that the provincial government was not involved at that time, but hoping that that would come in the future.

I want to make it very clear that the Council is about the fish. It is the hope of every member of this Council that there will soon be provincial representation on it. I can say to you that while there have been some difficulties at a certain level between the two governments, we have been working closely and well with a number of people in the provincial system. In fact, with respect to the habitat section of our upcoming report, we owe an enormous amount to Marvin Rosenau of the BC Ministry of Environment, Lands and Parks, who has worked so diligently and effectively with us.

The Council is made up of a number of people from diverse backgrounds representing components of the fisheries, such as First Nations, commercial fisheries, habitat and science. The members are as follows:

Mark Angelo,  
BC Heritage Rivers  
Mary Sue Atkinson,  
Seymour Creek Hatchery  
murray chatwin,  
Ocean Fisheries Ltd.  
Terry Glavin,  
Fisheries Writer/ Researcher  
Paul LeBlond,  
Canadian Ocean Frontier Research Foundation  
Rick Routledge,  
Mathematics and Statistics,  
Simon Fraser University  
Don Ryan,  
Gitxsan  
Carl Walters,  
Fisheries Centre, University of British Columbia  

Ex Officios:  
Dick Beamish,  
Pacific Biological Station,  
Fisheries and Oceans Canada  
Fred Fortier,  
BC Aboriginal Fisheries Commission  

At first we had a great deal of difficulty with the terms of reference. At issue was how independent this Council was really going to be. After extensive and sometimes not altogether easy discussions, we now think we are about as independent as we can be, keeping in mind the fact that the budget comes from the federal government. This is important because the credibility of this council is not just going to depend on the content and substance of our reports, but also on being seen to be, and in fact, operating independently of either level of government.

The following is an excerpt from our Report, to be released on June 8th, which describes the essence of what this council is all about. What we have said is that there are some principles upon which we are acting and they are consistent with the mandate, but these are our own views: “The Pacific Fisheries Resource Conservation Council
promotes public accountability in the conservation of biologically-diverse and abundant Pacific fish populations, as well as the health of the eco-systems upon which they depend. The Council provides governments and the general public with objective information regarding the state of the Pacific fisheries resource and fisheries habitat, and the Council promotes and encourages an integrated ecosystem approach to fisheries management, responsible public and private stewardship of marine resources and fish habitat, and public awareness of the importance of marine biological diversity, sustainability in fisheries management regimes and fishing practices, and the cultural, recreational and economic values associated with the Pacific fishery."

We have also reviewed the literature of our own province and people, and have adopted, in our own language, the observations of a discussion paper by Brian Riddell, a highly respected scientist with Fisheries and Oceans Canada’s biological sciences branch. We have taken from a paper he wrote a few years ago, "Spatial Organization of Pacific Salmon: What to Conserve," the following:

"These principles are summarized as follows:

• In the absence of proof, Pacific salmon habitats should be protected, and salmon fisheries managed, from the premise that separate spawning populations are genetically different, and valuable to the long-term production of the resource.

• To avoid a too-narrow focus on specific conservation problems, fisheries should be managed, and habitat protection priorities should be assigned, in a way that takes into account long-term trends in abundance, and insures the maximum spatial distribution of sub-populations to preserve individual stocks.

• Priority should be given to maintaining groupings of fragmented populations, and races, and to maintaining contiguous distributions between these populations and races, in order to maintain gene flow. Every effort should be made to maintain genetic inheritance, and variation within enhanced populations, and to prevent their genetic impacts on salmon populations that have not been enhanced. Salmon populations that have not been enhanced, and habitat areas have not been disrupted, should be protected over a broad spatial range. Special emphasis should be placed on protecting salmon populations with unique or atypical traits, particularly traits uniquely developed for local conditions."

That is where the Council is coming from. I repeat, our concern and mandate is to report on the state of the stocks of the fish - the salmon - and the habitat. Very early in the considerations of this council, our recommendations made it clear that we were not involved in in-season management - and our mandate makes that clear as well - it is not our place to get involved in allocation, or the length or depth of nets, or the buyback of boats, or a number of other matters, all of which are important, but are matters for one or both of the levels of government to address. What our task is, is to try to explain to the public and to the governments the state of the stocks, not just "species," but the stocks of all the species, and the habitat.

In trying to do this, it is important that everybody understand, and this means all British Columbians, even those who have not yet examined the complexities, that we have not only got to tell what we know, but we have also have to be very clear in telling what we don't know. One can infer, using one's intellect, scientific background and experience, a great deal from some things we know, but if we don't keep in mind what we don't know, we are removing from our considerations part of what has to go into the equation.

For a long time there has been a tendency to tell the public just the good things about what is known, very little about what we don’t know, with information often couched in such a way that it has made it difficult for ordinary people to understand the reality of what is occurring, not just because of pressures from Fisheries and Oceans Canada, or a provincial department, but also from industry and others. Therein lies the real danger.

Our task was to decide how to meet our initial obligation, which was to release an annual report. We asked ourselves: How much can we cover? We decided to do an intensively careful analysis and exposition, not only of the state of the habitat, but also the institutional and governmental relationships that exist to do anything about it. That forms a whole background paper in itself. We also looked at the whole question of the state of the stocks up and down the coast, and that also forms a background paper. Further, we addressed the whole question of the Fraser River sockeye, and that forms a background paper, and another on the coho.

In addition, there is also the beginning of an analysis of institutional arrangements. Therein lies not only some of the problem, but of course, some of the hope.

As well as these background papers, the Report will have as a separate part, but built on the work done in the background papers, a report summarizing all of these matters. It will also make some recommendations and will list, in addition to that, a very long list of matters of importance that we looked at, which at the moment fall short of specific recommendations, but may form part of the recommendations to come. Through the recommendations we are trying to get at the real problem; that is, ensuring that we conserve and manage the fisheries
properly, and deal realistically with habitat. Moreover, the recommendations have been designed to be couched in such terms that a minister and a government can look at them and determine that we may have to do some things that we haven't been doing - but at least these things are do-able.

When we get to the issue of what's do-able, we have the issue of resources. As some of you who are my age or older will remember, once upon a time we had fisheries officers up and down this coast in considerable numbers. We had creeks and lakes that were looked at; people actually went to them. Today, because of cuts and restraints and reduction of budgets and resources - and this applies to habitat as well - we are having to make decisions on, in many cases, at least in the aggregate, less information than we had many years ago. And one can conclude that there is nothing you can do about it.

However, I am not so sure. I leave this with you to think about. It could be argued that if the public of BC had better knowledge and understanding of the complexities of the fisheries and the habitat situation, and how difficult the management of these things really is, and if they had full appreciation of what the constraints in resources imposed some years ago were going to do to the capacity of those left in the department to do their duty, there might well have been enough public support so that much of that wouldn't have happened. Ultimately, the support required to enable those charged with specific responsibilities within the provincial or federal governments, has got to come from the public. Ministers have got to know that the public supports the resources required to do the job properly. But the public will never know unless they get the facts. And unless they hear from some independent source. And that is part of what Council aspires to do – inform the public and the government of what we know and what we can infer from the facts we have, and also to be able to explain that there is a great deal we do not know. The fact that what we do not know is a hindrance to doing the effective management that is required. There is a direct link between what the public knows and understands, and what a minister can argue for around a Cabinet table.

There is another aspect to this. We have spent a great deal of time trying to get some kind of joint understanding with our American friends, both in Alaska, and in Washington and Oregon, and the Native Americans, about what we ought to do. Some of that has been made more difficult by rhetoric, and sometimes worse than rhetoric. Certainly the rhetoric has not been confined to just one side or the other. We see our role as working very closely with our American neighbours on the conservation aspects of the total fisheries population of the Pacific west coast, not just of B.C. and Canada, but the states to the south, and Alaska. Ultimately, we cannot manage our fishery without taking these things into account. We also have to persuade our American friends, especially to the north, that they ought not to try to manage their fishery without taking everything into account. For example, you can argue ‘equity’, but suppose we really went after the equity principle without caring what happens to the fish. For awhile we might get more fish bound for Washington and Oregon, or at least we could have, some years ago. But there are hardly enough now to make it worthwhile. This approach just confounds the whole notion of conservation and the sustainability of fish populations.

Finally, with respect to this Council, it has a mandate to draw on universities, government departments, scientific groups and others. But ultimately, the Council is going to depend on the support of a great many people who live along the coast, riverways, and watersheds. We want to establish, ultimately, a database, or at least a system of access to data, which not only takes into account the information we can get from indexed streams and test fisheries, and reports from both sports and commercial fisheries, but also what people who live in all these places know about what is happening. That is going to require a great deal of effort, and will be very much a part of our activities. The Council belongs to all of you, and we welcome the opportunity to work with everybody who puts the fish first.

**STATUS OF SALMON STOCKS IN BRITISH COLUMBIA**

**Coastwide overview of stock status, highlighting concerns for some coho:** Rick Routledge, member, PFRCC; Institute of Fisheries Analysis, Simon Fraser University

I shall be previewing some of the findings of the Pacific Fisheries Resource Conservation Council. The Conservation Council mandate covers all species of salmon, including steelhead. It also includes salmon ecosystems. We can explore such issues as seal and whale predation, salmon-herring interactions, and Atlantic salmon impacts. However, this talk will focus on stock status, with particular emphasis on coho and sockeye.

I'll begin with a summary reproduced from the 1996 American Fisheries Study Report. This is old information now, but every time I look at it, I still get a shock. It remains timely. On the right hand side of Figure 1 is a column of percentages of stocks that the report classified as either extinct or at high risk of extinction. These are percentages of those stocks whose status they felt they could ascertain. As you can see, at the top of the list is coho, at 19%. This ought to come as no surprise, but I get very cold comfort from the other figures down below. In
particular, sockeye is at 15%, and I'm starting to be more concerned by that figure than the 19% one for coho. I'll come back to that later.

Figure 1. British Columbia Species at Risk

Figure 2 shows that, for all species but pink and chum, they couldn't assess the status of 40% to over 50% of the stocks. These will likely have been the smaller and less productive stocks. The true extinction risks are probably understated by the previous table. Thanks to extra work done last year in response to the coho crisis, we now have better short-term information on coho, but there are still huge gaps even for that species-gaps with potentially important consequences.

In addition, Don Hall and others reexamined the evidence for the West Coast of Vancouver Island stocks and concluded that the American Fisheries Study may have underrated the risks for other reasons as well. Whatever the risks are, they are substantial.

Figure 2. Stocks with Unknown Status

Coho

I now turn to coho. This map (not included in these proceedings) summarizes stock status by region. The province is divided into Coho Assessment Units as delineated in a recent Fisheries and Oceans Canada report. These Assessment Units correspond roughly to the Evolutionarily Significant Units used in the U.S. Each of these

<table>
<thead>
<tr>
<th>Species</th>
<th># Stocks</th>
<th>% Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinook</td>
<td>866</td>
<td>53%</td>
</tr>
<tr>
<td>Coho</td>
<td>2594</td>
<td>49%</td>
</tr>
<tr>
<td>Steelhead</td>
<td>867</td>
<td>48%</td>
</tr>
<tr>
<td>Sockeye</td>
<td>917</td>
<td>40%</td>
</tr>
<tr>
<td>Pink</td>
<td>2169</td>
<td>31%</td>
</tr>
<tr>
<td>Chum</td>
<td>1625</td>
<td>29%</td>
</tr>
<tr>
<td>All</td>
<td>9038</td>
<td>41%</td>
</tr>
</tbody>
</table>

The colour orange describes units with severely weakened stocks, and I have put the Georgia Basin in this category. Although there were some improvements, especially in the north, many stocks declined, especially in the central basin. Although these coho do not appear to be depressed to as dangerously low levels as those in the Thompson and Upper Skeena, they have been declining dramatically, and continued to do so even last year under almost no fishing pressure. Marine survival remains very low. Furthermore, there are major information gaps, even in the Lower Mainland. Although there was reasonably good coverage in the 1998 surveys, there are virtually no 1995 records in Lower Fraser tributaries for comparison. It is therefore impossible to tell whether or not these Lower Fraser stocks are still declining.

<table>
<thead>
<tr>
<th>Coastal Georgia Basin Coho</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Some improvements, especially in the North.</td>
</tr>
<tr>
<td>• Continuing declines in the central basin, with many stocks declining even in virtual absence of fishing pressure.</td>
</tr>
<tr>
<td>• Marine survival remains very low.</td>
</tr>
<tr>
<td>• Information gaps even in Lower Mainland.</td>
</tr>
</tbody>
</table>

I used the colour yellow to designate areas that have some notably weakened stocks. I've highlighted Johnstone Strait. Some stocks in this region, including the Keogh, Nimpkish and Tsitika, had very strong returns last year. However, returns further to the south were less encouraging. In 15 of 29 systems that were surveyed in the area in both 1995 and 1998, estimated abundances were down.

<table>
<thead>
<tr>
<th>Johnstone Strait Coho</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Strong recoveries in northern part of region.</td>
</tr>
<tr>
<td>• Abundance generally down in more southerly parts.</td>
</tr>
</tbody>
</table>

The Queen Charlottes have also been coloured yellow. This is primarily because many stocks in the southern portion appear to have declined to dangerously low levels. In the national park reserve, there are 71 identified coho spawning areas. Of these, there are records of 36 survey results from 1998. No coho were observed in 21 of these. In addition, 30 of the 71 streams were surveyed in both 1998 and 1988. Within this group, the proportion of zero counts increased from 30% in 1988 to 50% in 1998.
QCI National Park Reserve
- 71 identified coho spawning areas.
- Records of 36 survey results from 1998.
- No coho recorded observed in 21 of these.
- 30 or the 71 streams surveyed in both 1998 and 1988. Within this group, the proportion of 0 counts increased from 30% in 1988 to 50% in 1998.

The West Coast of Vancouver Island has been coloured green, indicating uncertainty over smaller stocks. This might surprise some people in that there is evidence of strong recovery on surveyed stocks. However, most of the available information there is on larger systems. In particular, much of the 1998 data come from surveys that were already being conducted on chinook. It was cost-effective to extend surveys already being conducted on chinook to cover the coho migration season as well. But chinook use bigger rivers, and there is therefore a lack of information on smaller rivers, some of which might be less productive and more prone to habitat damage. Hence, there is considerable uncertainty about the status of the smaller stocks.

WCVI Coho
- Evidence of strong recovery on surveyed stocks.
- Shortage of evidence on smaller, potentially less productive stocks.

The whole Central Coast from Cape Caution up to the North Coast has very poor-quality data. This to me is a perilous situation. It’s one thing to have isolated little stocks here and there for which you don’t have adequate information to be able to assess their status. One might argue that temporary; spotty extinctions are not a serious conservation threat if healthy stocks in the vicinity could be relied upon for natural re-colonization. For that reason, it is probably not necessary to inspect every stream each year. But we need to know whether or not there are healthy stocks in every region, and to have a solid indication of the numbers of severely depressed stocks. This is particularly critical when, for example in the Kitimat area, there are indications that the stocks may well have declined dramatically.

Central Coast Coho
- Mixed signals.
- Intensive surveys show increases.
- Visual surveys suggest widespread depleted abundance in both large and small spawning areas.
- Status is largely unknown.

This figure (not included in these proceedings) shows some older evidence pointing to serious conservation concerns. Many of the smaller coho stocks in the Bella Bella area showed evidence of having declined by the early 1990s.

Figure 3 shows details for the Kakushdish River, once thought to be the most productive coho system in the region. To my knowledge, the system has not been surveyed for coho since the last record on this graph. The stock may well still be severely depressed.

![Figure 3. Kakushdish Creek Coho Spawning Estimates](image)

**Figure 3. Kakushdish Creek Coho Spawning Estimates**

There is also a serious shortage of reliable data over much of the North Coast. The more northerly stocks appear moderately depressed but stable. By contrast, there are indications of possible widespread, substantial depletions in outer coastal areas to the south. Furthermore, in the Nass River, stocks above the fishway appear to have declined from parent-generation levels.

The only area that I coloured white (relatively healthy coho stocks) was the northernmost, Transboundary Rivers area.

North Coast Coho: Coastal
- Shortage of reliable data.
- Indications of possible widespread, substantial depletions in outer coastal areas to the south.
- Upper Nass Coho: Stocks above fishway appear to have declined from parent-generation levels.

**Sockeye**
I want to speak briefly about Fraser sockeye, primarily to set the stage for the upcoming panel discussion. I’ve identified four areas that received considerable attention last summer. First, there was debate about the escapement targets. Many felt that they were too high. The 1998 season came at the end of a long and successful rebuilding period. Two generations back, in 1990, escapements were particularly high. When the next generation returned, in the turbulent summer of 1994, escapements were generally lower. Some of you will remember quite well the events of 1994. I certainly do.

Figures 4 and 5 show a comparison of the estimated escapements for 1990 and 1994 vs. the targets for 1998. These are presented by major run-timing group.

For the first two groups, the Early Stuart and Early Summer, the targets were close to the 1990 levels.

The Summer Run target was considerably above the 1990 estimate. This is in keeping with long-term goals, including a strategy to probe the capacity of Quesnel Lake to support a large sub-dominant run as well as a large dominant-year run.

The Late Run target was somewhat lower than the estimated 1990 escapement, in keeping with some emerging evidence that a smaller number of spawners may be able to fully seed the habitat. The question of optimal escapement targets for both the Summer and Late runs is highly controversial. Underlying the controversy are major sources
of uncertainty, including our incomplete understanding of the interactions between sockeye and the lake ecosystems, issues of weak-stock protection, and fluctuating ocean conditions. Then came the extraordinarily warm, sunny summer weather. Vancouver had the warmest average July-September air temperatures in 61 years of records. It was wonderful for people who enjoy outdoor summer activities, but it was tough on fish that typically start to show adverse physiological effects at 17-18°C. By July 1, the Hells Gate water temperature broke the daily record set in 1941. It went on to surpass over one-third of all the previous daily records through to September 30. On August 3, it set a new all-time high of 21.2°C.

These unprecedented high water temperatures were predicted to cause severe stress and pre-spawning mortality in migrating sockeye. More fish were therefore let up the river in an attempt to provide a buffer. No one really knew how many would die. It came as no surprise to me, and I don't think to anybody else, that there were discrepancies between fish passage at Mission and the up-river estimates - 8.6 million at Mission vs. only 5.2 million up-river, for a discrepancy of 3.4 million. Yet the source of some of these discrepancies remains obscure. Much work has been done by competent scientists both from the Pacific Salmon Commission and Fisheries and Oceans Canada in an attempt to understand what happened. They reported their findings at a meeting of the Fraser Panel.

With the exception of the Early Stuart Run, it appears impossible to understand completely the fundamental sources of these discrepancies. It is clear, however, that this run experienced a massive setback from the effects of hot water. There were carcasses in the river, the fish that arrived were in bad shape, and their fertilization rate was poor. Everything seems to point to difficulty with warm water conditions. For the later runs, there is no plausible explanation that is consistent with all the evidence. 1994 levels. The Summer Run came in about at target, though still below the interim rebuilding goal. There was certainly no massive over-spawning compared to what at least some people think is a reasonable escapement goal. The Late Run was set back again to around 1994 levels.

Figure 4. Escapement Targets

Figure 5. Escapement Targets

Figure 6 shows that this led to a major conservation setback for the Early Stuart Run. Nobody is at fault, unless you think, as I strongly suspect, that this is an early warning of troubles we'll have with increased temperatures from global warming - then it's everybody's fault, and we'd all better be thinking about it very hard.

Figure 6. Early Stuart Run

Figures 7 to 9 show spawning ground estimates for the other run-timing groups. It is important to keep in mind that these are escapement targets and estimates at the end of a very long and successful rebuilding period, so the situation is not quite as bad as one might perceive from these graphs. The target for the Early Summer Run was to rebuild it to 1990 levels. It was set back to about the

-7-
We should also keep in mind that, even if the stock finally succeeds in rebuilding, it will have taken over half a century since the dam was removed. It can take a very long time for a lost sockeye stock to rebuild. This is an important point that I shall return to shortly.

Another serious concern is that Fraser River sockeye have been very well monitored compared to just about any other stock on the Coast, and this makes them vulnerable to budget cuts. I'm very concerned that those budget cuts might take such a deep bite; we'll lose the capacity to monitor Fraser sockeye as well. I now turn briefly to other sockeye stocks. Consider this figure (not shown here). All the stocks on the left have something in common - they're extinct, with the possible exception of Redfish Lake sockeye. A few sockeye have been straggling back to Redfish Lake in recent years. They have been collected for use in a captive breeding program. On the right are listed stocks that have declined to the point where they're no longer economically viable. They're all sockeye stocks. I left a few blanks which some of you could easily fill in.

I want to highlight one of these - Rivers Inlet sockeye (Figure 11). This system was once the second or third largest sockeye producer on the B.C. coast. In the 1980s, there was an attempt to increase the spawning escapement.

Escapements did increase in the early years, but then in the 1990s, the stock seems to have collapsed. This calamity may turn out to be greater than the loss of the Upper Adams sockeye.

Why does it matter that we preserve biodiversity? I shall attempt to summarize the reasons through what I call the “Five E’s.”

<table>
<thead>
<tr>
<th>Why Preserve Biodiversity?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Five E’s</td>
</tr>
<tr>
<td>Ethical</td>
</tr>
<tr>
<td>Economic</td>
</tr>
<tr>
<td>Ecological</td>
</tr>
<tr>
<td>Evolutionary</td>
</tr>
<tr>
<td>Emotional</td>
</tr>
</tbody>
</table>

First, there are ethical reasons that to some people are overriding. The human destruction of other lifeforms is to some people simply unacceptable as a matter of principle.

There are also important economic reasons. Small stocks can be of unique value to tourism and sport fishing. They can also collectively make a surprisingly large contribution to total abundance. Anyone who has wondered how a VISA bill could possibly have become so large in a month when no major purchases were made will appreciate how small bills, or fish stocks, can add up to substantial amounts. Numerous small stocks also provide protection against downturns in major stocks, such as occurred after the Hells Gate and Babine slides. There is geological evidence of major slides on the Fraser in the past, and a site for a major potential slide has been...
identified on the Fraser not far from Lillooet.

Small salmon stocks may also play an important ecological role. Pink salmon may be an important part of the food chain for more economically valuable stocks. They can also serve as repositories for ancient and invaluable genetic information - information that may well prove crucial in providing adaptability in a changing environment (evolutionary). This is particularly important as we move ever closer to the potential crisis of global warming.

This information can literally be thousands of years old. Thompson River coho carry a genetic legacy from when they first migrated back into the watershed at the end of the last ice age. The Thompson was, at that time, temporarily blocked by an ice dam. The backed-up waters found a new outlet down the Okanagan Valley to the Columbia River. Coho appear to have migrated into the Thompson via this temporary access route. The record of this history is recorded in their genes. It is literally as old as the post-glacial clay beds around Kamloops that were laid down at the same time. If we lose the Thompson River coho, we lose a 10,000-year-old legacy.

Finally, there are strong emotional reasons for preserving small stocks. Local stocks have enormous significance not only to aboriginal communities, but also to people of all racial backgrounds. Higher-profile stocks, such as the Upper Fraser chinook, are internationally famous. Tourists come from all over the world to see these fish as they attempt to leap over Rearguard Falls near Yellowhead Pass.

In this presentation, I have highlighted some crucially important information gaps. There are also many difficult questions that scientists have to turn their minds to very quickly. We still have an incomplete understanding even of what it is that we need to protect. The Americans have a jump on us, partly because they ran into serious conservation difficulties a little earlier than we did. Until we can figure out what it is that we have to protect, we won’t know what sorts of stock and habitat assessments will be required. Hence this is a fundamentally important question. There are many others.

In addition, we must keep on trying to figure out what rebuilding goals we need to put in place; this is again a very challenging question. We even lack vital information on past run sizes.

Finally, we need to somehow regain the capacity, which I would argue we have lost, to gauge our success in meeting fundamental conservation objectives. These objectives must include, not only the protection of irreplaceable genetic information from permanent loss, but also the rebuilding of our stocks to the level of abundance we inherited.

**Escapement policy for Fraser River sockeye - panel discussion:**

**Ken Wilson**, Stock Management coordinator, Fraser River Aboriginal Fisheries Secretariat

I will provide a very brief overview of the perspective that I bring to the escapement goal policy discussions for Fraser sockeye.

Fraser River sockeye, as all of us know, support perhaps the largest commercial fisheries in BC; they are harvested by over 100 First Nations within, and by more in areas outside, the Fraser River, and they support a growing sports fishery.

Fraser sockeye originate in hundreds of separate spawning areas throughout the Fraser. Sockeye bound for the Stewart River will be in the river some time in the next few weeks. They will be followed by early summer stocks and summer stocks that will peak through August, and late sockeye will move into the river in September. So it is a very long time period during which the fish migrate and we have the standard mixed stock situation where stocks are harvested together.

Although hundreds of sockeye stocks enter the Fraser River, we consider that only about 20 of these stocks play a really significant role in management. Out of the hundreds of stocks in the Fraser these are the key. And yet, not all of these stocks are actively managed, which is to say that our fisheries are not regulated to control the escapement of each of these stocks. In fact, only a small handful of these stocks, three or four depending on the year, will be actively managed. The remainder will be managed passively and what that really means is that our escapement policy is what is left over after we have implemented our harvest policy.

Our harvest policy wasn’t, at least until recently, based on the idea of maximum sustainable yield. Yet I think we have always understood that there is no magical number of sockeye salmon that will provide the greatest future catch, in any particular year, for any particular spawning area. Even if there was, we cannot regulate each individual escapement or spawning ground, because we don’t harvest these stocks separately - we harvest them as mixed stock groups. It was that sort of dilemma that led my old supervisor, Dr. Peter Larkin, to write an epitaph for the concept of maximum sustainable yield back in the 1980s. However, if maximum sustainable yield is dead, it has survived pretty well. In fact, it is very seldom that you will have a discussion about Fraser sockeye escapements where the concept of maximum sustainable yield doesn't show up, and you would be lucky to escape today without seeing one or more stock recruit curves in the associated data.

However, I think that we're trying to do a lot more than maximize the long-term yield when we manage
Fraser sockeye. We all want to make sure that our weak stocks persist, and that they're not genetically impoverished. We certainly don't want to see the extinction of important sockeye stocks. We also have an obligation to ensure that First Nations have access to the fish that they need. Some First Nations in the upper reach of the Fraser have access to only one or two stocks of sockeye. And for these First Nations, it's the size of the return to their area that really matters, not the overall return to the Fraser River.

With regard to the Fraser River it is clear that the First Nations people fishing on the Fraser Basin above Prince George may have a very different perspective on sockeye rebuilding and our success in that regard, than someone who's fishing in the lower Fraser or even in Johnstone or Juan de Fuca Straits. People above Prince George for example are mostly concerned about the fish that go by their nets and they would see relatively few fish.

While it's true that people have different views on the best escapement policy for Fraser sockeye, depending on where they live and how they fish, it should come as no surprise that there's no simple technical solution, no right answer, and no biologist that can really tell you the right way to manage Fraser sockeye. In my view, the greatest challenge is to develop a common vision of the future - one that comes the closest to meeting all of our needs. If we can agree on the values we're trying to promote through managing Fraser sockeye, then I think that the technical problems can be solved. Obviously, this isn't an invitation for Fisheries and Oceans Canada to further reduce the already very small budgets that are available to do the kinds of work that people like myself and people in Fisheries and Oceans Canada do.

What it is, is a call for action. I think we need to spend our time trying to reach some common ground, with some clear sense of direction, some clear objective in managing Fraser sockeye.

**Wayne Saito, Fisheries and Oceans Canada**

I will make a very brief presentation on the spawner escapement policy that Fisheries and Oceans Canada, and more importantly the International Pacific Salmon Fisheries Commission and the Fraser River Panel, have practised in recent years.

First, I will provide a brief history of the events associated with the Fraser River sockeye including: recent developments, the current situation, future prospects, and some of the key issues that might limit us from achieving success. Interestingly enough, perhaps Ken and I do have some common thoughts.

In 1913, a devastating slide resulted in large chunks of the Fraser River being blocked at Hells Gate. This was a very significant year - it is marked in all the annals of history associated with Fraser River sockeye management and well-documented in an excellent publication by John Roos, that provides a comprehensive history of the Fraser River sockeye. This event only highlights the problems that were then largely associated with unsustainable fishing practices and destruction of fish habitat through logging practices. From 1913 to the late 1970s, efforts were largely directed at restoring migration passage conditions to recover the runs.

Importantly, of course, in 1937, the United States and Canada agreed to share in the sockeye, in the management and the catch, as well as the restoration of the passage conditions. It is important to know that through that period of time, while the efforts to rebuild the runs were underway, it was recognized that it was very important to maintain all those important fisheries that Ken touched on, whether it be First Nations, commercial or recreational.

From the late 1970s through to the 1990s, it was recognized by some of my Fisheries and Oceans Canada colleagues and some of the managers who were assisting the International Pacific Salmon Fisheries Commission at that time, that we were gaining significant improvements in survival and hence, production rates, and as well, some of the latent rebuilding potential that the Fraser River represented could be realized.

Some bold steps were taken back then. Prior to the 1970s, there was largely a fixed escapement goal policy. Targets were set annually, and if the targets could easily be met while allowing the fisheries to proceed, then those targets were then achieved using that methodology. If the returns were larger than forecast most escapement targets were achieved as a product of the larger returns, and the balance was taken as catch. In the late 1970s through to the 1980s, the bold step was a change in the pattern of that relationship. Members of the International Pacific Salmon Fisheries Commission and industry at large that presided at the Pacific Salmon Treaty were approached with a proposition to invest some of what we catch as escapement. The return could support both the current fisheries and increased future catches; that is, both situations could be accommodated. The Fraser Action Plan was also helpful in two important areas: first in consolidating the acquired knowledge and information that we did have with respect to the management of Fraser River sockeye and all Fraser River salmon, and second in proposing an integrated salmon management strategy that would be of benefit to all the people and all the users of Fraser River salmon.

What has happened since then? From 1990 through to 1998 we have had a series of years of poor survival conditions. I think most of
us are familiar with El Nino; perhaps it's El Nino, perhaps it's global warming. Regardless, we've had our share of unfortunate circumstances. Dr. Routledge has explained some of the circumstances that were present between 1939 and 1998.

We have also had a series of years of extreme in-river migration conditions. The conditions experienced in 1998 typify some of the extremes that managers have to cope with. In 1997 it was just as atypical, but this time it was extreme high water levels. In 1992 and 1994 there were very high water temperatures. Therefore, atypical discharge conditions and ocean conditions have plagued us, both as managers and as users of the resource, for a number of years.

We have also had catch-sharing issues to deal with and problems in sharing with our neighbours, friends, and with those people to whom we have constitutional responsibilities. In addition we have had confusion and conflicts on how we manage Fraser River sockeye in terms of the escapements. For example, what is an escapement goal versus an escapement target? I think this is a very important question to present. It could be any measure that simply says yes, we are satisfied with the state of that stock, and its relationship with the habitat it occupies. The annual escapement target is a measure that gives us the ability to maintain and recognize that there are users of the resource in addition to the importance of the resource.

There is also a very important question that has arisen in recent years with respect to the role of government versus stakeholders. The stakeholder community has participated in the consultative process, perhaps not enough, and certainly not soon enough with respect to how we manage the resource. But discussions are progressing. We have had some very extensive discussions within the Fraser River Panel dealing with some of the scientific as well as process issues. However, we have not yet emerged from that process to begin to deal with some of these same questions with our American neighbours to the south. We have also had discussions with the fishing industry itself and our consultations with First Nations have been ongoing.

We are establishing in 1999 an escapement management strategy that we hope to announce soon. Most importantly, we are undertaking a comprehensive review to consolidate all of the information and knowledge we have about Fraser River sockeye. We can then use this information to examine our escapement goals and production policies. We hope that such a process will be put in place this fall or perhaps early in 2000. Some of the key issues we will be dealing with are:

1. We all need to agree on the stock management strategy.  
   • There is scientific support, and analysis to support, various options or positions that we can take with respect to what is appropriate, but we need to agree upon them.

2. We need to ensure that all stocks and species will benefit from that strategy.  
   • This is not a matter where we can focus only on Fraser River sockeye. As managers we have long recognized that and as part of the art of the possible, we are trying to balance all of these multiple objectives.

3. We need to take into account the concerns of all the stakeholders in addition to those who use the salmon, and other important elements of the environment.  
   • And we cannot dismiss the importance of our American friends to the south, or First Nations friends that we have more than an obligation towards. We have to take into account all those people. It's not going to be easy, but it can be done. For that I remain an optimist.

Arnie Narcisse, co-chair, BC Aboriginal Fisheries Commission

Thank you all for coming. I met a lot of you in January 1998 when we co-sponsored the first Speaking for the Salmon program. We recognized then that there were a lot of problems that needed to be solved. What can we do? There is the myriad of issues that I mentioned then, ranging from ocean conditions to fisheries management. Unfortunately, I think, and a lot of people knowledgeable about the ‘big picture’ would probably agree, that things have not improved to any sufficient degree.

The Fisheries and Oceans Canada document regarding the Fraser River sockeye escapement targets for 1999 talks about the fact that there are two main issues to decide on this year in terms of whether we prosecute fisheries: 1) to restock the rebuilding trend from relatively low escapement levels in 1995, by fishing at the rebuilding strategy recommended 65-70% harvest rate, or 2) to implement harvest rates below 65-70%, to keep the rebuilding rate more on track with the progress made prior to 1995. The former strategy would allow less restrictive harvest options than the latter, meaning higher catches, but it would lengthen the period of rebuilding to an as yet undefined cost of lost yields from future returns. It basically boils down to: Do we swallow the bitter pill now, and make those sacrifices that will ensure the long-term survival of Fraser River sockeye? Or do we hope that by foolishly continuing to prosecute fisheries at the higher levels of 65-70%, we might be able to achieve this long-term sustainability?

We talked about these high exploitation levels for the coho stocks as recently as 20 years ago. Ken Wilson then predicted that by the year 2000 coho would be commercially extinct - not extinct as a fish, but commercially extinct. I am sure that those of you in the commercial sector now fully
recognize this; you cannot be accessing coho like you were at one time. Many of you probably embarked on those fisheries that were taking high exploitation rates in the earlier years - and now 20 short years later, we face this extinction risk. My people, whose name literally translates to “the people of the creeks,” recognize this problem. I was glad to see there was some credence given to local knowledge and that people realize that it is important to listen to those who have been watching the creek for such a long time. In fact, I think this is what needs to be done, in the dearth of fiscal capacity at both the federal and provincial levels where they are no longer able to monitor and enforce all of these fisheries.

So what do we do in the face of that? We cannot continue with the high exploitation rates that we presently have, especially with the habitat degradation. And we cannot hope to continue taking high levels of fish with the knowledge that their spawning grounds are continuously being deteriorated by logging, urban, and agricultural activity, not to mention the atmospheric conditions.

My preference is not to point my finger, and instead to do something about it. We are working with people like Bob Cox from the province trying to address the high water temperatures that we’re experiencing in the rivers and creeks of the Interior. These temperatures, in the 19- 21°C range, are lethal to salmon. For example, we have asked the forest industry to come to the table where we have described the problem and pointed out that they are a big part of it. Unless they change those cutting practices, and natural watercourses are once again allowed to flow where they have to, these problems are going to continue, and continue until there are no more fish left. Similarly, if municipalities are allowed to continually thumb their noses at the regulatory agencies and build right up to the waterways, and clear everything out to allow for more housing, there will be the extinction of our salmon stocks.

Therefore, there are a range of issues that need to be addressed. I want to reference comments that my good friend Ron MacLeod made at a Speaking for the Salmon meeting regarding putting sufficient spawners must be put on productive grounds. When the fish get back to the spawning grounds their bed has got to be made, the lights have got to be dimmed, and the conditions have got to be just right for them to do their business. They cannot arrive in a half-dead condition, due to the stress they encountered along the way.

With the high snow packs that we’ve got still up in the hills right now, we very well may face the same conditions that we did in 1997 when we had those high water levels, which in combination with the warm temperatures, led to the stress that negatively affected the ability of the fish to reproduce once they arrived at the spawning ground. We’ve got to ensure that in addition to saying that “x” number of fish get there, we do our darnedest to make sure that conditions are right when they get there.

Murray Chatwin, Member, Fraser Panel, Pacific Salmon Commission

I will begin by pointing out that I am wearing three hats today. In no particular order, I am a member of the Fraser Panel of the Pacific Salmon Commission, a member of the Pacific Fisheries Resource Conservation Council, and an employee of a fish processing company. The common goal of all three is, the fish come first. It has been my belief for 30 years that without the fish, there is no need for me.

Having said that, and having looked at the list of panel members, I will address the question of escapement policy for Fraser River sockeye from an industry perspective. (By industry I mean the traditional commercial industry.) You probably remember the demonstrations by the commercial fleet last fall in Victoria and Campbell River, claiming lost fishing opportunities and over-escapement. This belief was, in part fueled by an in-season potential escapement estimate of 7.8 million. Since the final escapement estimate was 4.5 million and the goal was 6.77 million, we clearly didn’t miss any fishing opportunities. I should tell you that the 1998 escapement was the third highest for all cycles since 1948. I am going to suggest that the escapement target was the problem. Industry believes that 6.77 million was too ambitious a step in the rebuilding process. Table 1 describes the recent productivity for this cycle.

<table>
<thead>
<tr>
<th>Year</th>
<th>Spawners</th>
<th>Return</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982</td>
<td>3.95 million</td>
<td>6.0 million</td>
<td>4.05</td>
</tr>
<tr>
<td>1986</td>
<td>3.5 million</td>
<td>21.5 million</td>
<td>6.1</td>
</tr>
<tr>
<td>1990</td>
<td>5.9 million</td>
<td>16.6 million</td>
<td>2.8</td>
</tr>
<tr>
<td>1994</td>
<td>3.0 million</td>
<td>7.45 million</td>
<td>2.5</td>
</tr>
<tr>
<td>1998</td>
<td>4.5 million</td>
<td>Not avail.</td>
<td>NA</td>
</tr>
</tbody>
</table>

Table 1. Escapement Target

Furthermore, I’m going to suggest that it is time to review the rebuilding process.

The rebuilding process began with the signing of the Pacific Salmon Treaty in 1985 when Canada took over management of Fraser River sockeye and pinks. Under the Fraser Annex of the Pacific Salmon Treaty, Canada could expect to accrue the benefits of rebuilding. Therefore, government and industry agreed to forego catch in order to explore the production potential of the Fraser system. In the early years, of course, the experiment appeared to be working. Mother Nature was kind to us and the benefits did accrue to Canada. However, in the early ’90s things changed. Returns per spawner declined and, in the view of industry, foregone catches were partially reallocated to the U.S., following the expiry of the Annex. Most participants - users, managers and scientists - believe it is time for a complete evaluation of rebuilding policies of the past dozen years.
This should begin with an analysis of what we have learned about cyclic dominance. There have always been two schools of thought on this issue. If cyclic dominance exists (that there is a biological or ecological mechanism which may cause negative productivity effects between cycles), then there may be limits to potential rebuilding or in fact risks to rebuilding of dominant lines. If cyclic dominance does not exist (dominance is explained by historical accident or fishing pressure on low cycles), then large dividends may be expected from lowering exploitation rates to increase escapements over all cycles. A superficial look at escapements and subsequent returns over the rebuilding period, suggests that cyclic dominance concerns may be valid. Those who believe so go so far as to advise backing off on dominant and sub-dominant lines and concentrating on rebuilding production on smaller stocks. As a corollary to this, there is also a risk to the strength and diversity of smaller stocks, as a result of building and harvesting major stocks. Similarly, there is a risk to weak stocks of other species, specifically coho and steelhead. Clearly, these concerns lead us to the conclusion that a review is in order.

Of more immediate interest to industry is the setting of the “interim goal” for 1999. Table 2 describes the productivity for this cycle.

<table>
<thead>
<tr>
<th>Year</th>
<th>Spawners</th>
<th>Return</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>0.9 million</td>
<td>6.2 (mil)</td>
<td>6.7</td>
</tr>
<tr>
<td>1979</td>
<td>1.35 million</td>
<td>5.0 (mil)</td>
<td>3.7</td>
</tr>
<tr>
<td>1983</td>
<td>0.95 million</td>
<td>7.4 (mil)</td>
<td>7.8</td>
</tr>
<tr>
<td>1987</td>
<td>1.87 million</td>
<td>11.3(mil)</td>
<td>6.5</td>
</tr>
<tr>
<td>1991</td>
<td>3.29 million</td>
<td>3.4 (mil)</td>
<td>1.05</td>
</tr>
<tr>
<td>1995</td>
<td>1.72</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 2. Interim Goal

The initial suggested goal of Fisheries and Oceans Canada was slightly over 3 million. In other words, they suggest we go back to the step we achieved in 1991 that returned one-to-one. Industry on the other hand thinks that a target similar to that achieved in 1987 and 1995 would be appropriate, pending the long term. This would be driven by a Chilco escapement goal of 500,000, which has produced the best returns on this cycle. In proposing this target, however, we have to acknowledge caution in the event that resulting harvest rates impact on smaller stocks. Typically, management is based on five or six actively managed stocks. Co-migrating stocks are passively managed. However, if harvest rates on these stocks become excessive, fishing plans are adjusted. Finally, in making this argument we also have to acknowledge that it may lead to very limited harvest on late stocks in 2000.

This alternate approach was developed by a sub-committee of the Fraser Panel, with analysis by Fisheries and Oceans Canada stock assessment staff. It was felt that it would not compromise either conservation (second highest escapement for the cycle), or rebuilding goals. Where you go next will flow from the review.

Discussion on Status of Salmon Stocks in British Columbia

A participant from T. Buck Suzuki Environmental Foundation posed the following questions: Regarding the Horsefly stocks and rebuilding efforts, it has been said that because of forestry concerns, there is no more spawning ability. The spawning areas are used, and we’re losing habitat. My question to Wayne is: How does this fit into the rebuilding equation? The second question pertains to the second biggest system, the Skeena. Is it true that the Alaskans will be fishing those stocks despite the facts that they need a million getting back to the spawning grounds and that we only expect about 600,000?

Wayne Saito replied that, with respect to the issue of the Horsefly, logging has had an impact on this river and the quality of the spawning environment. Those logging practices occurred 20 or 30 years ago. In his estimation, the Horsefly River, for as long as the vigilance is continued, has the capacity to support a large number of spawners, and he has not seen any direct evidence in recent years to suggest that the spawning capacity is less than it was 10 or 12 years ago.

On the issue of the Skeena River, the rebuilding target is in the range of 950,000 or one million. That represents the same kind of value system as the Fraser River, when we suggest that we want to rebuild the Horsefly River to 1.5 or 2 million spawners. By any definition, that does not represent a situation where the health, viability or genetic diversity of the sockeye stocks are at risk. This is an important distinction to make.

The moderator noted that she had an opportunity last year to go to the Horsefly during the spawning period and to observe fisheries renewal and forest renewal activities there - the recontouring of the mountain, reclaiming of massive clearcuts, re-routing of many of the waterways. What she was most profoundly impressed with was the way in which Fisheries and Oceans Canada, and the BC Fisheries and Forestry Departments were working together on the ground in complete harmony. As far as she could see there was not a single space that was not filled with two fish. Her thoughts on this, in the Ron MacLeod school of “preparing for spawning”, are that the lights were down, the bed was prepared, and Smoky Robinson was playing.

A participant from Community Futures in Powell River commented that throughout the presentations he continued to hear the term “management strategy.” There is an awareness that there is a diversity of genes within the various populations of salmon, but there is also a diversity of habitat, and habitat diversity requires a diversity of management strategies. Diversity of strategies means that no one group can take it all upon themselves. He is aware from working on both the east and
west coasts, that some of the best experts are the people who live in the communities that are directly affected. They have the most to gain, and most to lose, from management decisions. He asked if someone could offer an opinion on the need to enter into co-management agreements with these communities and to look at home-grown solutions for some of the problems as well as the need that Fisheries and Oceans Canada and the provincial Department of Fisheries enter into serious partnership agreements with communities so that we can actually look for solutions and have those particular communities do some of the policing, managing and care-taking, so that there aren’t any more streams lost to forestry.

Ken Wilson responded that he agrees completely. In his view, the key questions are not technical. The technical expertise exists to provide support to people that want to manage their resource. The real issue is agreeing on a common set of values that we are trying to promote through management. If we can set clear objectives for management, then we can make progress, but as long as we are all pulling in different directions and arguing about who ultimately has to take responsibility for management, we are going to continue to have the kinds of spotty management that we have now, with ongoing over-fishing problems, weak stocks, and lots of disagreement on how the pie needs to be shared. In the final analysis, until communities are involved, we are going to have difficulty making progress on this issue.

Amie Narcisse referred to the initiative under the Regional Aquatic Management Society on the west coast of Vancouver Island, and their desire to look after their own backyard, similar to the initiative of the Nicola Watershed Authority. Local knowledge can and should complement mainstream science.

Murray Chatwin commented that the PFRCC Report deals with that subject in depth.

A sports fisherman asked how Fisheries and Oceans determines the maximum amount of spawner capability on each system?

Wayne Saito responded that technically and biologically there is a finite point at which a salmon habitat can support a spawning population, and beyond that, by any definition, there would be over-escapement. In most salmon habitat systems managed and observed throughout British Columbia, over-escapement is rare. Do we have the capacity to measure that now? It is his belief that we are trying to do that. He noted that the group of scientists that work on Fraser River sockeye, or other salmon issues, will be getting together this fall or winter in a major workshop. It is his hope that they can bring all this information together, with the knowledge of what the capacity of the streams and lakes are (the lakes are very important as well to sockeye populations). He would be surprised if we could explicitly define it now, even as part of the workshop, because salmon production is a function of not just the physical habitat, but also the ocean climate - and things change. So we can give a snapshot of where we think things are now but, he noted, things can change.

A sports fisherman noted that there was no over-escapement on last year’s returns because they didn’t know how much the system could handle. He suggested that perhaps it isn’t known if there is an over-escapement unless the system collapses. He cited the example of one system in Alaska where the target for escapement was increased twofold and ever since then there have been no fish. He expressed his concerns about putting more fish into the system when there’s only so much it can support.

Wayne Saito noted that there would be a presentation on Wild Salmon Policy later in the program. He also noted that it is important to understand that Fisheries and Oceans is not apathetic to the situation, in fact it is quite the opposite. But there are limitations to the number of issues Fisheries and Oceans Canada can address at any one time. It is his hope that the Wild Salmon Policy will provide a template, a blueprint for the future.

The moderator noted that many of us recognize the serious situation in the Central Coast, which has over the years become more so, partially as a result of reduced resources to do the job.

A member of the Tsimshian Nation complimented the Conservation Council for undertaking such a tremendous task, given the limited resources that they have. He directed a question to Rick Routledge: What about the absence of statistics from Areas 6 and 7 in the Central Coast? Where are those statistics, and how soon are we going to expect to see them?

Another observation was directed to Ken Wilson and Murray Chatwin: “You talk about passive and active management. There is another management that industries use, and that is management to the Golden Rule. No longer can we depend on industry for their investment. And this cannot be used as an excuse by the industry because every corporation in this country, every person that has invested in fishing gear, licenses, and salmon, all take the same risk.” Further he noted that is was a good thing that we are all here, and addressing the problems we have with the possible extinction of some salmon stocks.

Rick Routledge answered by saying that the quick response is that it’s not going to come directly from the Conservation Council. The Council is not going to be able to mount a massive effort in remote places such as Areas 6 and 7, to produce the kind of data referred to. However, it can identify a need, and can certainly work with people like you, to try to develop better
institutional arrangements. He noted that John Fraser was talking about developing some kind of information base within the Council itself which can take information from people along the coast. It is going to take a lot of coordination and a lot of effort from Fisheries and Oceans Canada. That in turn is going to cost money and there is no magic formula for producing money for these kinds of things. It is his hope that the Council, through highlighting these kinds of issues, will bring enough public concern, from people like yourself, that will provide for better funding opportunities - and as John Fraser was mentioning earlier in the program, a better opportunity for the minister to go to the Cabinet and say: Look, this is a serious situation, the public is aware of it, we must deal with it.

Ken Wilson noted that he was not trying to suggest that passive management is necessarily bad, although he would argue that the more stocks that we actively manage, the better off we’re likely to be in the long term, at least because we have clearly-stated objectives for those stocks. It is his opinion that we focus too much on trying to manage yields as if we really understood the relationship between the number of fish that reach the spawning grounds, and the number of fish that subsequently return. We have some ideas, but it is not a clearly-defined relationship, and it is his belief that it’s a bit presumptuous for managers to pretend they understand the biology of these fish well enough to set precise escapement goals and attempt to manage them. He believes that we have to be a little more humble about our approach to management, and accept that we’re managing for many things other than generating wealth. We’re also trying to be stewards of the resource.

**STATUS OF HABITAT**

**Salmon habitat in the Lower Mainland:** Otto Langer, Fisheries and Oceans Canada

I am going to cover the status of salmon streams, or streams generally, in the lower Fraser Valley, and I probably will not fall into the category that John Fraser categorizes a lot of us bureaucrats as being; that is, overly positive. My presentation will probably indicate that there are some lower points, in terms of some of the challenges we’re facing in the lower Fraser Valley.

This is a view of the Lower Fraser Valley and it shows us that this watershed is approximately 23 million hectares. I am going to be commenting on only 0.6% of the area of this giant salmon production machine; this river system produces 60% of all salmon in British Columbia.

Looking at the small area in the lower end of the Fraser River, and if we include the Harrison system, it’s about 3% of the Fraser Basin; and we produce well over 80% of our pink, 80% of our chinook, 50% of our coho, and almost 100% of our chum salmon. Undoubtedly it is a very productive part of the world from the point of view of salmon production. Within this area (about 100 miles from Hope to the ocean) and including the Harrison system, it’s about 3% of the total basin.

I will be restricting most of my comments to the North Shore streams, to Hope, and then down to the American border and the ocean. That is what I call the settlement area of the Fraser Basin, the lower Fraser Valley, about 0.6% of the basin area. Yet it is an extremely productive area, with hundreds of salmon and trout streams. We have in our database over 650 streams for this part of the world. There is an abundance of marsh area, fresh water and inter-tidal marsh areas. It is also of global significance as part of the world; that is, it is not just a salmon system. I’ll probably go overboard as a salmon person, stressing salmon, but let’s not forget the biodiversity that this important lower Fraser area supports. In addition to the other animals and plants supported by this system there are people.

The human population is building quickly – there are about 2 million people in the lower Fraser basin right now and projections are that by 2020, there will be about 4 million. The thought of imposing a further doubling of the population in the lower Fraser River, should ring a lot of alarm bells in terms of sustainability of a lot of our stream habitats.

The problem we’re dealing with in the lower Fraser is really no different than what we see on the east coast of Vancouver Island and the Puget Sound area. When we start looking at this whole Georgia depression area, we are dealing with about 6 million people – that’s a lot of people. The BC Roundtable put out a report several years ago which indicated that if we don’t change our zoning growth rates, we will have urban sprawl from Olympia, Washington right up to Hope, and on Vancouver Island from Sooke all the way up to Campbell River.

Yet this is a very important area for streams and salmon. When we look at what 6 million people can do to a watershed, not only to the physical habitat but also to air and water quality, in addition to the contributions to global warming, it is very worrying. Today I will only be touching on water quality, and the majority of my presentation will relate to the physical habitat, the riparian zones, gravel, and bank stability.

We have to look back at history to understand why we are in a bit of a mess in the lower Fraser. This is an area that was all marshland a little over 100 years ago, and by looking at the Royal Surveyor maps, we can quite easily plot in what was inter-tidal. We had over 2000 hectares of inter-tidal habitat on the north arm of the Fraser River, and the Lulu and the Vancouver side; by 1938 this was down to 200 hectares, 10% of that, and in 1999 there is only about 100 hectares of...
inter-tidal habitat on the north arm of the Fraser River. So you can see we’re living with quite a legacy.

As I mentioned, water quality is also an issue. We have about 2 million people discharging waste into the lower Fraser River. Tom Northcote, who did extensive collections in the lower Fraser in the early 1970s, observed that he couldn’t remember any fish that live in the river for prolonged periods of time having tumours. Now it is not at all uncommon to see fish with tumours. I would say that this is an indication that we are putting something more into the river than we did many years ago.

This figure (not included in these proceedings) describing the conversion of natural land types is taken from a Canadian Wildlife Services publication and based on the early surveyor maps. It tells us a lot. In 1880 in the lower Fraser Valley, there was a large amount of seasonally-flooded meadow, and a lot of bog and tree-shrub cover. Of course all of this has been converted into farmland or urban industrial lands and that alone summarizes the shift in land use, and why our streams are under tremendous pressure. This is an extremely important unit for the production of salmon. As well all of the salmon have to move through this corridor. If we look for ‘undisturbed sites’, although there are a few here and there, there are not many right in the lower Fraser Valley. So this is a substantially altered eco-system.

About six years ago we started putting together a map of the lost streams for the Greater Vancouver area, and we have now expanded that to include the lower part of the Lower Fraser Valley. In this map (not included in these proceedings) you can see which proportion of the streams no longer exist – if we look at all streams in the Lower Fraser Valley, including the Harrison system, this is over 3000 km of significant streams. In the settlement areas from the North Shore mountains to the American border, this is about 1400 km of streams and if we measure the length of all the streams that have disappeared or gone underground we’ve lost about 600 km of streams. If we add these numbers together that’s about 28% of all salmon streams that have now disappeared – they are no longer on a map – they are no longer on the surface. This is quite an impact. When we look at a map like this, we have some appreciation of the pressures we’re up against.

One of my old bosses has challenged me as have members of the public, saying, well that’s great, telling us about what streams are lost but we would like to see a map of what the status of present streams is. In response we began this exercise about three years ago. We divided the lower Fraser Valley, the American border through here, into a Langley to Steveston section, including Sea Island, from Abbotsford airport up to Hope, and then we went from Hope down to the Stave River area, and from the Stave river into West Vancouver-Vancouver. For that survey we looked at each of over 500 streams, and documented the water quality. We looked at watersheds where 50% of the watershed had been denuded, and there was no likelihood that it would be replanted. We looked at streams where 33% of the riparian vegetation had been removed (had been channelized). We also looked at the effective impervious area, or total impermeable area, a reasonably similar concept - in a sense the amount of rooftops, and pavement of the watershed. If we didn’t have some of the data yet, or the stream was right in the middle of an urban jungle, we considered that a threat. If over 50% of the water had been diverted, that was another threat, and so on. We then took all of these threats and made the measurements on over 600 streams. If a stream was exposed to one threat, it was called a threatened stream; if it was exposed to two or more threats, it was considered an endangered stream. If it didn’t have a significant threat, it was considered a wild stream.

In the Steveston to Langley area, there is a tremendous amount of urbanization, with only small amounts of riparian vegetation left, such as Cougar Canyon Creek in North Delta. There are also tremendous storm water problems - sometimes you wonder if the storm water discharge is not greater than the remnant stream. It’s hard to believe that there are small streams that you cannot see most of the year, but when it rains, they flood quite quickly, and you can see the encroachment on the edge of the floodplain. The Salmon River is a good example of the recreational, urban and agricultural pressures — this is a slow, meandering stream, which warms up in the summer, and has a scarcity of riparian vegetation. Overall we found that 98% of the streams in this area were considered endangered with only 2% threatened, and of course we were not able to find any wild streams in this area. This is probably the worst case scenario in the Lower Mainland.

If we move upstream from the Abbotsford airport to Hope, we have another city developing; it wants to be another Vancouver. As little as 10 years ago, streams were still being put underground in this area. Thank goodness we have got that practice stopped. An example is Fishtrap Creek, with in-stream detention built into the system. There are tremendous agricultural pressures here - as you drive up the Trans-Canada highway, you see farmlands everywhere. We actually found a fair number of wild streams in this area, mainly around the upper Chilliwack. Threatened streams were only about 15%, with 75% considered to be endangered.

Moving over to the north side of the river, from Hope down to the Stave River, there is the Harrison system, and because we have fairly large systems with a low population in this area, we found a fair number of wild streams. But there is a tremendous amount of
agriculture here, and more recently there is another concern - gravel removal. We did not score the main stem of the Fraser, we only looked at tributaries flowing into the Fraser River in the study. Here 20% of the streams are considered wild, 35% threatened, and about 50% endangered.

Moving downstream to the North Shore environment we have to take into consideration that this area has a significant number of dams: the Alouette, the Seymour, and the Capilano. Over the years, even places like Lynn Creek has had > 50% of its stream length channelized. Yet a lot of people probably look upon Lynn Creek as a fairly wild stream. There has been a tremendous amount of development on the North Shore mountains, and this has had a significant impact on salmon streams, with ongoing sediment problems. This is an issue more in the mountain-type areas than on the Lower Mainland — ongoing sedimentation, with almost any form of development, from gravel pits to housing subdivisions. Here there are a fair number of wild streams, many of them having a fairly steep gradient. They have no housing, and are behind watershed fences, but a lot of these do not have salmon in them. Once again almost half the streams are endangered.

To summarize all the data for Lower Mainland streams there are: 15% wild, 23% threatened, and 62% endangered streams. What are the impacts? The significant impacts are: riparian loss, channelization, amount of pavement in the watershed, and water quality concerns.

Why do we have this problem? We have been at this business for 20-30 years now, protecting streams. We’ve done an audit of six urban streams to better understand what’s wrong with our conditions. Why aren’t they being applied?

One of the best case scenarios is Hoy Creek where there has been ten years of building. We looked at the application conditions, which Fisheries and Oceans would have applied to the development. The results showed that we could not determine compliance in 13% of the cases, in 40% of the cases there was compliance, and in almost 50% of the cases there was minimum to significant non-compliance. So that is part of the problem – the lack of an ethic. You go through the effort of looking at all these building plans, specifying conditions, and then half the time they’re ignored. Here is another example: we went to the provincial Lands Titles Act, and looked in Surrey at 261 lots. 185 of these lots had a land covenant on them, advising people that they should not encroach into the ravine or near the stream, and yet in 75% of the cases, there was encroachment into the covenant. This indicates that there is no enforcement taking place. When we look at the neighbouring lots, with no covenants, there’s only a 70% encroachment. So it seems like the harder we try, the more we lose.

Where are we in terms of stream protection? We Canadians have to appreciate that prior to 1977 there was no law in Canada to protect fish habitat. So we’ve been at this for only about 22 years. In 1977, Section 35 was added to the Fisheries Act. We had pollution protection provisions right back to the B.N.A. Act. Land development guidelines were developed to give industry guidance and they were developed in cooperation with the province, partnership building in the early 1990s. Also ‘no net loss’ was added right about this time, which has helped create a framework for the federal government to be held more accountable. Then we started stressing education with action plans in the early 1990s.

There are some positive things out there – not everything is negative. Burnaby took the lead in the early 1970s with a ravine by-law to prevent the ravines from being filled in. For example, Eagle Creek, looks great, although it is probably great for the birds but not that effective for fish because we’ve done little to contain the storm water runoff from the industrial sub-division, the single-family areas, or the recreation areas. Storm water detention is being built. And stewardship has taken hold; the awareness is greater than ever.

In conclusion, I think we are doing better. We’ve gone from significant and rapid net loss of habitat in the ‘60s and ‘70s, and prior to that to a slower net loss, but we’re still losing. Gains are offset by the growth rate. This work is very complex and we need better tools. There has to be greater cooperation, greater integration, and partnerships - we can do a lot better job there. Although I think that we’re gaining a lot in that area one that I don’t think we’re doing an adequate job in is simple enforcement. Finally, I think we need a conservation ethic and it’s very difficult to create an ethic. We have to promote stewardship to new levels.

Changes to flow regimes in dammed rivers: Marvin Rosenau, Ministry of Environment, Lands and Parks

I will focus on the restoration of flows for fish downstream of dams. As you are all aware, water is a fundamental component of fish habitat and the abundance, quality, and timing of the flows is critical to the protection and production of fish. But water is also very important for humans, and we often find that human uses and fish uses come into conflict. Humans use water for consumption, agriculture, hydro-electric power, and others. It is the hydro-electric component that I will discuss today.

Water, as per the Canadian constitution, falls under provincial jurisdiction. That is, the provincial governments have control over the usage and licensing of water by humans and their interests. In British Columbia, the legislation that underpins this authority is the
BC Water Act. It is a complex piece of law that goes back about 100 years. Specific to the BC Water Act, the one thing that has distressed people in recent years is the lack of protection for fish. Nevertheless, some of the engineers and water managers issuing water licenses are starting to take fish flow and habitat issues into consideration.

Another piece of legislation that is very important with respect to water use and allocation is the federal Fisheries Act, specifically, Section 22. This Act, which unfortunately is essentially a reactive piece of legislation, requires that fish and ova be protected in terms of minimum flows. Of note, the Water Act and Fisheries Act are two pieces of legislation that come into conflict from time to time and this creates some interesting legal battles.

It should be noted that the new provincial Fish Protection Act is complimentary legislation that the provincial government is currently putting into place to protect fish in many of these flow regards. It is hoped that some of the provisions within that Act will provide protective fish flows.

With respect to fish and hydro-electric power, in the last few years there has been quite a bit of public consternation with regard to how BC Hydro has been operating its hydro-electric system. However, at the political level, and through the public’s urging, BC Hydro has been nudged along to provide new initiatives and new flows for fish downstream of dams for the protection of these aquatic ecosystems. I have been involved in some of these flow negotiations within the Lower Mainland and can report that some of the fish-stock recoveries that have occurred have been quite dramatic. Other flow initiatives for the protection of fish will take some time to understand because of our lack of baseline data and the time it takes to get a fish-population response.

There are some very old projects in the Lower Mainland and a number of these are located on the Stave/Alouette River Watersheds. Hydro-electric power was developed here around the turn of the century. At Stave Lake the power station went in about 1911, and the dam went in in 1923 where it backed up Stave Lake into a reservoir. In 1930, another dam and powerhouse was put in downstream of Stave Falls at Ruskin, damming the lower river as well. A third powerhouse is located between Alouette Reservoir and Stave Reservoir.

These projects were quite sophisticated for their time but in terms of fish flows, the projects were not fish friendly. For example, downstream of the Ruskin project, at night when the lights were off, the power production would stop and no flows or very low flows would be released down the Stave River. Alternatively, during the daytime, a lot of water would be released to generate power. This on-off, sort of scenario was viewed by the fisheries agencies and BC Hydro as being very bad for fish.

Sometime around the mid 1980s, Fisheries and Oceans Canada and BC Hydro got together and decided there was a problem with regard to how the water is being turned on and off, and decided to try to resolve the flow issues. Of note, the area downstream of the dam is an exceedingly gravel-rich area and thought to have high potential for salmon spawning. Although the estimated escapement was 20-30,000 chum salmon, with just a smattering of other species of fish, it was felt that the habitat was grossly underutilized and that the returns could be substantially increased if the water flows downstream of the dam were made more fish friendly.

Fisheries and Oceans Canada started the initiative by enhancing some of the Lower Stave River side channels that had degraded over time and re-contouring the river to provide better spawning habitat. They also provided some hatchery augmentation of chum salmon fry to kick start the recovery. Furthermore, BC Hydro changed its operating regime in order to maintain the flows downstream of the Ruskin power project in the area where the fish were spawning. The mode of operation included a scenario that ensured that there wasn’t too much, or too little, water during the period of time when the fish were either spawning, or the eggs and alevins were incubating in the gravel. Initially the primary target fish of this restoration initiative was chum salmon and although historically it has been an important commercial species on the Stave in recent years, it has also become a very important sport species. Other species such as chinook and coho have also been enhanced in this stream downstream of the Ruskin Dam and are benefiting from the new flows that BC Hydro is now releasing.

In terms of the recovery of fish downstream of Ruskin Dam, it is estimated that the numbers of wild spawned chum salmon adult escapement to the Stave River increased from about 20-30,000 before this work had been undertaken, to over 200,000 with a recent record of over half a million fish in 1998. This recovery is felt to be an unqualified success in terms of flow recoveries.

Another hydro-electric flow issue that I have been working on extensively was the Cheakamus River. In the early 1990s, the Ministry of the Environment, BC Hydro and the Fisheries and Oceans Canada got together and started a dialogue about the appropriate flow regimes in the Cheakamus, a tributary of the Squamish. Historically the Cheakamus was a very fish-rich river, but in the late 1950s it was dammed for hydro-electric power production. At the time there were probably escapements in the hundreds of thousands, maybe even half a million, pink salmon.
However, in the intervening 20 or 30 years that species went extinct and other species of salmon declined substantially as well. It was the view of the agencies that much of the decline had to do with the damming of the river and these changes in flow regime probably had a major impact. In fairness, and as Hydro points out, the cause of the declines had not been completely the result of the flow regimes; other habitat issues and over-fishing, were at fault as well. Nevertheless, all parties including BC Hydro still felt that changes to flows for the protection of fish were an issue that still had to be dealt with. As a result, BC Hydro, Fisheries and Oceans Canada, and BC Fisheries, negotiated over a number of years a flow regime that matches the shape of the natural hydrography but allows BC Hydro to retain, on average, the amount of water that it is entitled to by its water license. Previous to this BC Hydro had been exceeding its water license allocation for most years. The flow regime also matches the among-season and within-season natural flow regime, albeit at a lower level (45% of the previous day’s inflow). Currently, this negotiated flow regime is being reviewed from a biological perspective.

Further to the work that has been undertaken on the Cheakamus River, BC Hydro and the fisheries agencies have been directed by the federal and provincial governments to undergo a water-use planning process for all of BC Hydro’s existing hydro-electric projects around the province. We’re trying to come to grips with what is the best balance between economics and fish, and First Nations and other user groups. These water-use planning exercises will develop fish-flow regimes for many of the hydro-electric projects and associated water licenses that are going to be reviewed. The time frame for much of this will occur over the next five years and they are essentially covering off all licenses and projects around the province.

The Cheakamus River is one of the priority BC Hydro projects for the Water Use Planning process. As part of this exercise, BC Hydro is also coming up with interim flows for about ten of its high-fish-value watersheds, including the Campbell, Puntledge, Bridge and Coquitlam Rivers. These will be stop-gap measures until the agencies and BC Hydro come up with the final negotiated-flow regimes.

Nicola Watershed Stewardship and Fisheries Authority (NWSFA) initiatives: Arnie Narcisse, manager

Earlier I mentioned some of the issues regarding habitat concerns that we’re facing up in the Nicola Watershed, and the fact that we’re dealing with the logging industry and agricultural communities, and other stakeholders. Briefly, the NWSFA program revolves around a restoration effort on the chinook and coho populations that are resident in the Nicola Watershed. We use smolt-imprinting ponds and we have a number of strategically located side channel rearing refuge areas. In addition, we do some protection work. Therefore, our program includes a habitat protection and enhancement and creation effort, basically based on the requirements of any local region. Along the whole Nicola system, from Spences’ Bridge all the way up to the Upper Nicola Reserve, we have a series of side channels where the fish can duck off and be free of the high water.

To go on from that brief overview of the NWSFA program, I will highlight the habitat component of the program. About five to six miles upstream of the city of Merritt, we carried out some protection efforts using bank stabilization methods. In these slides you can see that we have laid down filter cloth, covered the cloth with large stones, and towed in large rocks. What this does is prevent the fine substrate from coming back into the system.

Another project that we took on is in the Coldwater River. We were concerned about the land eroding and going back into the river, and compromising the redd situation. We used the same procedures here for bank stabilization, using large boulders, because in this case the system is very volatile; once that rain hits the snow, it just comes down. (We lost our smolt pond in 1995 because of that.)

It requires big equipment to carry out these procedures, and this is very expensive, leaving us little money to deal with the other aspects of the project - so we are trying to get out of this business.

We also did some work at Cheddar Ranch, about four to five miles upstream of Merritt, using different techniques including a combination of hard rock riprap and bio-engineering and basic tree revetment. The tree revetment logs stick out and serve as velocity breaks, providing some refuge and cover for the little guys.

At Sherman’s Access we carried out, in conjunction with the Fisheries and Oceans Canada, the placement of Ajax blocks. Basically, these are almost a three-D jigsaw puzzle, serving the same purpose as hard rock riprap, but allowing you to manually move them so that you don’t need to have big excavators towing in large rocks. We have found this to be a bit more cost effective. It not only provides small crevasses for the little guys to duck in and out of, but also serves as a velocity break.

We also recognized that the bank stabilization work we were doing needed to be complimented by repairing the vegetation. Therefore, we built a greenhouse down at Shackin Reserve. It has about 26,000 plants, mostly paper birch, river birch, Barclay willow, red osier dogwood, Sitka alder, mountain alder, and black cottonwood, some grown from seed. This was a very ambitious project, our ‘creation’ effort, where we literally create habitat. We did
some testing prior to and after this project and the results show that before our work there were only a few sculpins, some invertebrates, and basically no salmonids. However, we now have a balance of almost a 50-50 ratio of salmonids and non-salmonids.

We have done some work with people in the logging industry as well, such as with our project on slide rehabilitation at Home Creek. This major slide resulted in siltation in some of the fish-bearing streams. In this case we excavated trenches in the slide area, drove in stakes, tied live cottonwood bundles to these, and allowed them to sucker up naturally. We have carried out numerous other projects, including a habitat enhancement project where we enhanced a natural side-channel by placing some large, woody debris and overdhangs to create more of that ‘bedroom’ that we’re talking about.

**Discussion on Status of Habitat**

A participant raised the question of the flow rate in the Stave River, and Marvin Rosennau replied that the range is usually between 30-100 cubic meters per second. The participant noted that he wanted to highlight this because of the high incidence of fry stranding in the Stave, related to the flow rate fluctuation, water level, and tidal influence that occurs on the Stave. He suggested that production in the Stave River might be higher if they could keep a more consistent flow. Marvin Rosennau replied that there is a water-use plan currently underway for the Stave Watershed, which includes the Kwantlen First Nation and it is a very detailed kind of exercise where these things are being looked at closely.

A participant commented on Otto Langer’s demonstration on the flow of the Fraser River, the large number of fish stocks that go through the Vancouver-Lower Mainland area, and the horror show of events that have occurred along the banks there as the result of habitat degradation. He noted that we should also consider how this impacts the fish. He described recent research that shows that chinook salmon and other fish that feed in these estuarine habitats pick up contaminants such as polychlorinated biphenols, polycyclic aromatic hydrocarbons, and others. This impacts the fish immune system, so that these fish can no longer handle bacterial challenges, and as a result, it sets them up for a large mortality risk. He suggested that this might come to the fore in the future as one of the major problems for salmonids.

Another participant noted that we should also be looking at the differences between rehabilitating sockeye, and coho and that in fact, there is a dramatic difference between the two species. Whereas juvenile sockeye reside in lakes, in a more or less stable environment, coho spend their early lives in the streams of their birth. With such massive changes in water flow and temperature, he suggested that it becomes very difficult for the rehabilitation of coho.

The moderator noted that the Fraser Basin Council considers the Alouette River to be one of the great templates of shared management in that it involves not only MELP, Fisheries and Oceans, and Environment Canada, but also Corrections Canada. She noted that there is a ‘two years less a day’ prison there and the prisoners are part of the process. In addition, the community was part of the process particularly in the way that they negotiated with BC Hydro to increase the flow of water to 100 cubic metres per second. She noted that this has resulted in spring salmon being placed in that river by children at the local school. The eagle population has also been re-created. She cited this as an excellent example of what people can do when they get together.

**NEW BC GOVERNMENT POLICY DIRECTIONS**

**Progress on Canada - BC Agreement:** Bill Valentine, Deputy Minister, BC Ministry of Fisheries

I want to talk about the need for new directions regarding management of Pacific salmon, particularly about two issues I think are significant; the April 1997, Canada-British Columbia Agreement on the Management of Pacific Salmon Fishery Issues and, because it’s timely, the approach of the province to salmon treaty negotiations.

I want to persuade you of three things.

The problems we are having in our current relationship with the federal government could be avoided if we were to put our collective effort into developing the new relationship envisaged by the Canada-BC Agreement. In order to effectively respond to the complex problems before us, a new kind of inter-jurisdictional cooperation is required between all levels of government.

While we have made some progress on the habitat issues, the lack of commitment to fully implement the agreement has seriously limited potential benefits.

Finally, the Pacific salmon treaty negotiations need to result in new coast-wide rules that guarantee effective conservation.

When a new provincial government was elected in 1992, three significant but closely related public policy issues required concerted attention:

- Resource management generally did not enjoy a high level of public confidence
- Long-term land use planning
- Our relationship with First Nations people was not working

Broad provincial initiatives to address these issues resulted in new public processes (e.g. Land and Resource Management Plans, Protected Areas) and arrangements (Treaties with First Nations).

The Canada-British Columbia Agreement reflects the need for new institutional understandings. It is more that a polite under-standing
or memorandum of understanding. It was an agreement reached after a year of negotiation with representatives of the federal government, which fundamentally said that if we’re going to address these three fairly compelling changes, we need to look at the relationship we have with the federal government to more effectively plan and manage natural resources.

Fundamentally, the Province came to understand that you could not address long-term land use planning and resource management effectively within the context of old relationships. While the jurisdiction for fish resides with the federal government, the province wanted to pursue new comprehensive arrangements that would benefit the fish within existing jurisdictional authorities. From the Province’s perspective, we had exhausted a relationship that was not working. The Province took a very strong position, right from the very beginning, that this was about an enhanced relationship.

I also want to acknowledge that we were aware that First Nations expressed concern that this change not fetter federal responsibilities, particularly Section 35 obligations. British Columbia entered into an agreement with the Aboriginal Fisheries Commission, to ensure there was a vehicle for consultation on policy issues.

We also wanted to remind the federal government that this was not an agreement about redistributing federal authority, but that the comprehensive authority of the federal government also came with a comprehensive responsibility to thoroughly consult, prior to making significant policy decisions.

It is not a shift in authority; it is a shift in the way we relate to one another that respects the division of authority that exists. It’s a test of the evolution of federalism in Canada. Simply put, many of the shortcomings we identified in our relationship with resource management, land use planning, and our relationship with First Nations, we also found in our relationship with the federal government.

The Canada-British Columbia Agreement outlines a number of important new initiatives:

- Creation of a Canada-B.C. Council of Fisheries to coordinate all policy initiatives in the Pacific salmon fishery
- Agreement to jointly review and co-ordinate all policy initiatives in the Pacific salmon fishery
- Creation of federal-provincial Pacific Fisheries Resource Conservation Council, after consultation with stakeholders
- Agreement for better coordination and integration of programs through the establishment of a Fisheries Renewal Advisory Board
- Agreement to build an improved, effective consultation system that actively involves fishery stakeholders and communities in advice and decision-making

There has been some progress with the agreement. At a recent meeting of the Council of Fish Ministers, we agreed on an information sharing protocol. The Fisheries and Oceans Canada and BC Fisheries have done some very extensive work on fisheries inventory.

Ministers also signed a steelhead protocol which addresses the management of steelhead fisheries.

One particular project where there is a great sense of pride for both federal and provincial staff is the recent creation of the fisheries project registry.

Unfortunately, the comprehensive new relationship that was envisioned has not occurred. The enhanced role for the Province has not materialized. The creation of a Fisheries Renewal Advisory Board and a jointly established Pacific Fisheries Resource Conservation Council was not achieved. However, the door is still open.

At the recent Council of Fish Ministers meeting, senior officials were directed by the Ministers to renew our work, to see if in fact we can take the initial steps to try to bridge the gaps and establish a more constructive working relationship.

Both federal and provincial staff have continued to make progress through working groups on important issues. Although our broader relationship may have been coloured by some tension, at a staff level the compelling nature of some of the issues have resulted in some very constructive work.

What needs to change?

First, we need to continue developing more effective coordinated partnerships. We have a long ways to go; there are too many divergent and ad hoc Fisheries programs.

Fisheries Renewal BC has demonstrated with the Salmon Renewal Program the success of a regional/community based stewardship model. These kinds of partnerships have proven to be very constructive and could be a model and vehicle for coordinated delivery of federal and provincial programs.

We need to take a look at consolidating programs, focussing our expenditures and achieving greater coordination between all levels of government, which includes First Nations and communities.

We need to take a look at the mechanism for prioritizing and coordinating funding. We find in many instances that our funding allocations in fact conflict, and that we do not agree on priorities.

We need to give focus to habitat work in BC through a single window, coordinating the work and initiatives of provincial and federal agencies.
Finally, while there has been some work, we have more to do to improve information sharing. The Canada-BC Agreement is the vehicle to focus those energies.

I would now like to talk about Pacific Salmon treaty negotiations. I want to reaffirm that the Province of British Columbia recognizes that a treaty with the United States is vital to the management of Pacific salmon stocks. The Province continues to support the principles of the Pacific Salmon Treaty and the need to address the problems with ocean interceptions.

As I noted when I began my remarks, the Province is calling upon the parties currently involved in government-to-government negotiations to come to agreement on a new set of coast-wide conservation rules to protect salmon that are subject to interceptions. A comprehensive, coast-wide agreement is required.

When the Parties entered into the treaty in 1985, the solution to dealing with the threat of expanding ocean interception fisheries was not to eliminate these fisheries, but rather a pragmatic approach to balance interception fisheries by ensuring that each country would receive benefits equal to production. This was intended to address the overfishing issue (conservation) and provide a long-term vehicle to make adjustments to fisheries.

This approach is consistent with the United Nations convention law that recognizes that countries of origin have primary interest in those stocks. But since the Treaty was signed we have seen a significant decline in the status of some stocks, and broad public support for more selective fisheries. There is broad recognition by Canadian fishers, coastal communities, and First Nations that this is simply no longer about balancing interception fisheries. The world’s changed. Both countries must move to a greater reliance upon their own stocks. This will encourage a commitment to manage for recovery of stocks, since the benefits will return to the country of origin.

British Columbia embraces the move to more selective fisheries, and away from mixed-stock fisheries. There has already been a serious change in the conduct of Canadian fisheries. We need to see the same kind of change on a coast-wide basis, particularly in Alaska.

It is now about the elimination of offshore, distant, interception fisheries, to ensure that our managers have the tools to bring our own stocks back. It is no longer acceptable, in the public management of this fishery, to take a look at this simply from the perspective of trying to balance fisheries. That doesn’t mean we will not have some interception fisheries. We understand that. But the whole direction of fisheries is to reduce ocean fisheries by providing the country of origin with greater access to its own stocks.

A comprehensive long-term arrangement will require the phasing out our indiscriminate mixed-stock fisheries. This is particularly true for Alaska.

I thank you, and thank the moderator for your time. The points I wanted to make were three-fold. I would like to reinforce those.

The Canada-BC Agreement can work if both governments support it. It is not dead, the opportunity is still before us. There’s been substantial work conducted under the Agreement, but there is a lot more we could do.

British Columbia wants to see a consistent coast-wide set of conservation rules.

Fish Protection Act: Bob Cox, BC Ministry of Environment, Lands and Parks

I am going to describe the Fish Protection Act, and highlight some of the areas we are working on, especially those designed to improve and introduce new water management legislation and policy into the provincial regime.

You might wonder why someone from the Ministry of the Environment Lands and Parks (MELP), and not from Fisheries, is talking about a Fish Protection Act. This is because most of the legislation is actually amendments to the Water Act, which is managed by MELP, so that is the relationship to fisheries. I should say also that we are working very closely with both the Ministry of Fisheries and Fisheries and Oceans Canada on many of these issues.

The Fish Protection Act is part of the overall BC Fisheries Strategy. Some of the other initiatives in this Strategy include Fisheries Renewal, the Watershed Restoration Program, and the Urban Salmon Habitat Program. The Fish Protection Act was passed in July 1997, but only certain sections were proclaimed at that time. We are phasing in the other sections of the Act. This approach relates to our capacity to deliver. We wish to ensure that the sections we do bring in to force can be delivered in an effective fashion. We are also undertaking extensive consultation around this overall process. We
want to make sure that when sections are brought forward into law there is a high degree of support and comfort, at least as much as we can gain through that form of consultation.

What are the primary goals of the legislation? Certainly, ensuring water for fish. That seems basic, but the Water Act itself goes back over 100 years and was primarily set up to protect water rights for mining activities. It was and still is primarily allocative legislation. We are trying to change that approach to bring more of a fisheries management component into water allocation decisions.

<table>
<thead>
<tr>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Ensuring water for fish</td>
</tr>
<tr>
<td>• Protecting and restoring habitat</td>
</tr>
<tr>
<td>• Focusing on riparian habitat</td>
</tr>
<tr>
<td>• Empowering local government</td>
</tr>
</tbody>
</table>

There are a number of provisions within the legislation that deal with protecting and restoring habitat. Our focus, certainly, is on riparian habitat, and this focus is captured in the section on directives for streamside protection which are designed to empower local government to use the regimes for riparian management within their area of control. Otto Langer’s presentation pointed out some complexities of riparian management.

Now for some highlights within the legislation. There is a provision to ensure that there are no new bank-to-bank dams on 14 identified rivers. This section is now in force. There is also a creative sentencing provision in force, which allows judges to direct fines toward habitat restoration. There are a number of sections that deal with better protection of water flows, managed through water planning and drought reduction orders. Stream flow protection licenses also allow groups to obtain licenses to protect in-stream flows for fisheries and habitat purposes - a new concept within the water management regime in BC. The Act also allows the designation of sensitive streams, one of the higher priority initiatives, and one I will speak to in more detail, and the stream-side protection policy directives, which is what Iona Campagnolo talked about, and which is primarily focused around empowering local government to protect riparian habitat within their jurisdiction.

<table>
<thead>
<tr>
<th>Highlights</th>
</tr>
</thead>
<tbody>
<tr>
<td>• No new bank to bank dams</td>
</tr>
<tr>
<td>• Better protection for water flows</td>
</tr>
<tr>
<td>• Water planning approach</td>
</tr>
<tr>
<td>• Streamflow protection licences</td>
</tr>
<tr>
<td>• Designation of ‘sensitive streams’</td>
</tr>
<tr>
<td>• Streamside protection policy directives</td>
</tr>
</tbody>
</table>

The ‘sensitive streams’ designation is under Part 6 of the Act. A sensitive stream is defined as one in which there is a population of fish at risk, either due to inadequate flow of water, or degradation of fish habitat. Once designated, the highest priority in assessing applications for water withdrawal or works in and about a stream will be the sustainability of the fish population at risk. The water manager-comptroller must ensure that there are no significant adverse impacts on the fish population at risk, before issuing a license or approval for works. There is also a reverse onus provision within that section, which says that the applicant will be required to provide the information that will allow the regional water manager to determine whether there will or will not be a significant impact. In the past, it has mainly been the agencies that have been required to provide information to show that a specific proposal will have a negative impact. The regulations which will support this requirement will be structured so that the level and detail of information required will increase with the amount of water applied for, or with the complexity of the size and nature of the works in and about a stream.

<table>
<thead>
<tr>
<th>Sensitive Stream Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Population of fish at risk due to inadequate flow of water or degradation of fish habitat</td>
</tr>
</tbody>
</table>

• Highest priority will be sustainability of fish
• Reverse onus provision
• 15/16 candidate sensitive streams on first round
• Recovery Plans

We are looking at a first round of designated sensitive streams going forward to Cabinet at the beginning of next month. The first round will encompass 15 and possibly a 16th stream, most of which are located on the East Coast of Vancouver Island and the Lower Mainland. We are looking at adding the Salmon River at Salmon Arm in the first round of designations. We will be speaking to a public forum in Salmon Arm on June 17th, to ensure that we are fully aware of the concerns within that area before we formally add it to the list.

Another provision in the Act, under Section 7, allows for the development of recovery plans on streams designated as sensitive under the Act. Part of the provisions in Section 7 requires a public participation process in developing those plans. Recovery plans are going to have to be very flexible. The presentations today have highlighted the complexity of the whole management structure, and the activities and interests within watersheds. The objective is not to develop another planning process if it is not required. Our intent is to build a template for a recovery plan, one that would comprise all the potential elements necessary to meet fish protection and recovery objectives.

Operationally, however, we may find that within a particular watershed a number of fish recovery activities are already occurring. We intend to piggyback on those activities, while using the recovery plan template to identify gaps in the existing process. We could then work to plug these components into the existing activities. We intend to work with the people who are already operating, and who have a long history in these watersheds, hopefully assisting them by
providing additional tools and support.

Where a recovery plan has been designated by Cabinet, we also have the ability to restrict the issuance of licenses, permits, approvals, etc., under other enactments— with the specific exemption of the Forest Practices Code, and Forest and Range Acts. The intent here would be to limit activities in other sectors which could waylay us in achieving the objectives of the recovery plan. Also, there is the opportunity within the legislation for Cabinet to direct funding from Forestry Renewal BC and Fisheries Renewal BC to assist in developing and implementing recovery plans.

The urban streamside protection policy directives are under Part 12 of the Act.

- Urban Streamside Protection
  - Requires consultation with UBCM
  - Applies to new or redeveloped industrial commercial and residential development
  - Establishes performance based objectives
  - Based on stream classification
  - Priority areas East Vancouver Island, Lower Mainland and parts of Interior

The streamside protection directives will apply to new, redeveloped industrial, commercial or residential development. This section of the Act mandates that directives may only be established after consultation with the Union of BC Municipalities (UBCM). This process is ongoing. We have just completed a workshop and presentation with the UBCM looking at the Fish Protection Act, as well as a whole range of environmental legislation that is being developed that may impact local government. The streamside directives will establish performance-based objectives that local government will be required to incorporate into zoning or rural land-use bylaws. Local government will have the ability to meet or beat the objectives of the directives by using the variety of powers available to them under the Municipal Act. These powers were recently broadened through changes to the Municipal Act under Bill 26, passed in late 1997.

There are presently a number of initiatives under way to determine the efficacy of draft directives. These involve development of stream classification systems and a review of the availability and accessibility of supporting information. A number of pilot projects will be undertaken over the summer. Results of the pilots will be used to modify the draft directives where necessary. The priority areas for implementation of the policy directives are on the east coast of Vancouver Island, and the Lower Mainland. This reflects past and ongoing expansion of urbanization in these areas, and the resulting impacts on fish habitat.

Section 5 of the Act provides the authority to make regulations in respect to water licensing and approvals for works in and about a stream on all streams not designated as sensitive under Section 6.

- Water Allocation Rules
  - Formalizing and bringing consistency to many existing policies and practices
  - Increasing level of certainty by clearly defining requirements and potential issues
  - In general streams may require: habitat streamflow data and analysis; water license conditions to protect fish habitat; and monitor impact

While Section 6 says that the regional water manager must consider the impact on fish, under Section 5, he may consider fish and fish habitat concerns in licensing decisions. However, there is one twist here, in that the regulations under Section 5 permit identification of streams and circumstances where the regional water manager must consider the needs of fish and fish habitat. This subset of streams does not carry the same weight as streams designated as sensitive under Section 6 of the Act, as recovery plans can only be developed for streams designated under Section 6.

The new provisions under Section 5 bring into the regulatory regime many areas that have been dealt with previously from a policy perspective. This will provide a much firmer base for regional water managers to deal with those issues. It also provides a more consistent approach across the province with policies and practices, and increases the level of certainty for proponents, allowing them to understand what the requirements are up front on these streams, and what they need to provide to ensure that fisheries impacts can be addressed.

So where are we in the process?

As I indicated, we are phasing in the legislation over time, to ensure that we have carried out adequate consultations on the initiatives, and have a capacity to bring these forward in an effective manner.

As mentioned, the first sensitive stream designations will be going to Cabinet in July; those will hopefully include the Salmon River, after we have completed the consultations. There will be ongoing consultations with stakeholder groups around the development of the regulations and the recovery plan template. With the stream-side protection policy directives, we will be undertaking a series of pilots this summer, to make sure the approach that has been developed in consultation with local government, Fisheries and Oceans Canada, and the BC Ministry of Fisheries is, in fact, one that is going to work. After the pilots, there will be some minor re-tooling to make it work more efficiently. Reporting on the pilots will take place at the UBCM meeting in September.

What are the next steps with the legislation? We are looking at a
second round of stream designations, and completion of the recovery plan template and the regulations for Sections 5 and 6 of the Act to go forward for approval this December. We will be focusing the second round of designations on the southern Interior, which was not represented in the first list of 15 streams. Implementation of the streamside protection policy directives is proposed to go forward in the spring of 2000, after we have had time to assess the pilots, and make any needed changes. 

What are some of the key challenges in bringing these initiatives forward?

Key Challenges
- Ensuring ongoing funding and support
- Improving program efficiencies
- Harmonizing with Federal initiatives
- Partnering
- Ensuring enforcement and compliance
- Obtaining First Nations consultation and input

Ensuring ongoing funding and support is one reason we’re taking it more slowly than some people would like. Yet we have to make sure anything we bring forward can be implemented in this time of scarce resources. One way to accomplish this is by improving program efficiencies, working closely with the Ministry of Fisheries, and with Fisheries and Oceans Canada, municipalities, and local government, where appropriate. I think Bill spoke of harmonizing with the new directions that Fisheries and Oceans Canada is going forward with for their habitat auxiliaries and stewardship coordinators. We have to ensure that we are doing the best with the resources we have. If we look at the gross numbers it looks like a lot of money, but there is a lot of work to be done out there, and we certainly do not have as much as the job requires. With regard to partnering, I do not think I can say any more on this issue - people have mentioned it throughout the day. We simply all have to work together with all the various groups that are out there doing lots of good work, and try to support them with the tools that are going to enable them to do the job.

Compliance has also been mentioned earlier - we have to do a better job of ensuring that what we do bring forward is being implemented on the ground. I do not think any of the agencies would say that they do enough monitoring of compliance and enforcement. Again, this takes resources, and we will have to be more effective with what we have.

We also have to work with First Nations, as mentioned on numerous occasions today. First Nations have a strong interest in fish and fish habitat, and we are working closely in setting up a consultation program with First Nations through Fred Fortier and the Aboriginal Fisheries Commission.

Discussion on New BC Government Policy Directions
A participant urged British Columbia and Canada to get their acts together and protect fish together all over the province. She noted that the fish have to come first.

She also raised the issue of the Forest Practices Code which has had severe restrictions, meaning that we only protect the larger fish streams, while smaller streams have virtually no protection. Yet she noted, that is where critical coho habitat is declining. She addressed the whole issue of private land logging that has not been addressed and questioned the new ‘Standards’ of the Forest Practices Code that are going to apply on private land, because they will not protect fish. She suggested that the ‘phasing in’ of the Fish Protection Act might not be soon enough, given the number of fish streams that are endangered now. She raised concerns about municipalities not being sympathetic to protection of stream banks, and a pro-development influence on city councils.

In response, Bill Valentine noted that at a Governor’s summit in Washington state which he recently participated in, there was a clear reminder that if you are going to solve these problems, particularly because so many of them are habitat related you have to make sure that you involve all the stakeholders who can offer their part of the puzzle to finding the solution. He suggested that right now what we have is a kind of broken record and that we need to go back and examine how much flexibility exists for those that have jurisdiction to open up some doors, to be able to really engage and come to grips with the problems.

He also noted that the promise of the BC Canada Agreement is not being fulfilled. If there was substantial support from both governments, it could address these issues. However, he noted that it is his belief that until the inter-governmental relationship issue is addressed, efforts are going to be somewhat separate and ad hoc. However currently there are efforts underway to solve these problems.

One participant questioned the delay on the part of the provincial government in implementing or even investigating new fisheries. Bill Valentine replied that the provincial government is currently dealing with the whole issue of trying to develop more effective adjustment and transition strategies for people who are impacted by the salmon fishery revitalization plan, and as part of this, they are working to become more focussed as an agency. This is why they are moving so slowly on policies such as new fisheries development.

A question was raised about the upper Pitt River and why MELP has approved a gravel pit which may destroy 2000 wild coho. Concerns were expressed about the Fraser River, where gravel is presently being mined directly from
the river, and the on-going siltation of the Coquitlam River. The moderator replied that there is a process dealing with gravel management which is about half-completed. Bob Cox noted that he was aware of these issues, that they are managed out of the regional office in Surrey, and that he would follow up on each situation.

A participant noted that the Englishman River on the east coast of Vancouver Island is potentially a major coho producing river, and yet it is threatened not only by dams and development along the river, but also the fact that groundwater is being eaten up by development that reduces flows into the nearby creeks and rivers. He questioned when regulations on flow rates for fish will be brought into effect and how the issue of groundwater is being dealt with?

Bob Cox replied that there are no provincial regulations managing groundwater at the present time. He also noted that although the regulations coming into place this December do not specifically include the Englishman River, there is an opportunity for people to make their case to the next round of designations. He further noted that the actual stream flow protection licenses are not contemplated in the first round of regulations, and they will be part of the ‘phased in’ approach to implementing the Act.

**STATUS OF STOCKS AND HABITAT IN OTHER REGIONS OF THE NORTHEAST PACIFIC**

**Washington and Oregon:**

**Status of Pacific salmon in Washington and Oregon**

Laurie Weitkamp, National Marine Fisheries Service, Northwest Fisheries Science Center, Conservation Biology Division

I will be addressing the status of Pacific salmon (*Oncorhynchus* spp.) in Washington and Oregon. I will discuss the status in the context of the U.S. Endangered Species Act (ESA, ESA of 1973 as amended 16 U.S.C. 1531 *et seq.*), because it is the framework under which comprehensive assessments of salmon status have most recently been done. At present, listed fish inhabit nearly every West Coast basin, from southern California to the Canadian border. The only exceptions are several basins on the Washington coast, and even some of those basins have species that are candidates for listing.

Because I’ll be talking about Pacific salmon status in the context of the ESA, there are a few ESA-related definitions that you should know. An *endangered species* is “any species which is in danger of extinction throughout all or a significant portion of its range” (ESA §3[6]), while a *threatened species* is “any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range” (ESA §3[19]). Once a species is listed, there are severe restrictions on it’s *take*, which is defined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct” (ESA §3[19]). *Take* also includes any modification or degradation to a listed species’ habitat (50 CFR 217.12, 50 CFR 17.3).

There are two details that the National Marine Fisheries Service (NMFS) considers for Pacific salmon under the ESA that are unique to the ESA status review process. First, NMFS policy (*Federal Register* 56 [20 November 1991]: 58612) emphasizes the status of natural fish, which are defined as the progeny of naturally spawning fish. Pacific salmon are unique among species considered for protection under the ESA because of the widespread production of hatchery fish, which intermingle with, and are often indistinguishable from, naturally produced fish. The NMFS policy is consistent with the mandate of the ESA to conserve threatened and endangered species in their native ecosystems. Under this policy, NMFS does not view fish in hatcheries as a substitute for conserving naturally-spawning fish in their native streams.

The second detail that NMFS considers for Pacific salmon under the ESA is the type of conservation units used, called evolutionarily significant units (ESUs). Under the Act, vertebrates may be listed by biological species, named subspecies, or distinct population segments (DPS); regardless of the category used for listing, all are treated equally under ESA. The Act provides little guidance about how to define DPSs, except that they “interbreed when mature” (ESA §3[15]). Consequently, NMFS developed the ESU policy specifically to define DPSs for Pacific salmon. To be considered an ESU, a population or group of conspecific populations must meet two criteria. First, it must show substantial reproductive isolation from other populations. Second, it must represent an important component of the evolutionarily legacy of the species. In this context, the *evolutionary legacy* of a species is the genetic variability that is a product of past evolutionary events and that represents the reservoir upon which future evolutionary potential depends. The key question with respect to these criteria is, If the population became extinct, would this represent a significant loss to the ecological/genetic diversity of the species? With this policy, NMFS intends to preserve the major building blocks of each salmon species.

When considering the status of Pacific salmon populations, it is important to remember that each species completes its life cycle in a slightly different way, and these differences make each species more or less susceptible to human activities. For example, sockeye salmon are dependent on lakes in which fry rear for one or more years. In the Columbia River basin, access to lakes has been blocked, resulting in a dramatic
decline in Columbia River sockeye salmon. At the turn of the century, the Columbia Basin was home to over 20 sockeye salmon populations with a total escapement of 2 to 3 million fish. As the number of accessible lakes declined due to blocked access, so has the number of sockeye salmon populations. At present, there are three remaining populations with a total escapement of about 20,000 fish, and the sole remaining Snake River population is at critically low abundance. In contrast, species like chum and pink salmon leave freshwater shortly after emergence, making them less susceptible to human activities in freshwater. Pink and chum salmon populations tend to be much healthier than species from the same drainages that spend longer in freshwater.

When determining the status of an ESU, a variety of information is considered, such as: absolute numbers of fish, historical abundance and carrying capacity, trends in abundance, factors causing variability, threats to genetic integrity, recent events, and other risk factors. This diverse array of information is used to determine what type of trajectory the ESU as a whole is on—is it going up, down, or staying relatively constant? However, determining the status of an ESU is rarely as easy as just considering numbers of fish. For example, there are often considerations of whether an ESU is at risk if all populations are relatively healthy except for one population, which happens to be far larger than any other and is clearly declining. Similarly, what is the risk to an ESU when only a few populations are clearly in trouble, but those same populations are the only ones of a certain life history type, such as spring chinook salmon or summer steelhead? These are some of the difficult questions that need to be addressed in order to assess the status of an ESU.

Let me say a few words about risk assessment and hatchery production, because it’s a major issue for nearly every ESU that’s been evaluated. The effects of artificial production on wild populations may be grouped into three general categories. First, there are ecological effects, factors such as predation, competition, disease transmission, or the attraction of predators. Second, there may be genetic effects due to the introgression of non-local genes into a wild population, which may decrease the overall fitness of the wild population. Third, there are risks to sustainability—if a naturally spawning population is composed of both naturally and hatchery-produced fish every generation, would the population be sustainable if the influx of hatchery fish stopped?

Unfortunately this experiment has rarely been conducted, but it’s a question that repeatedly arises in evaluating ESU status. One of the largest problems with evaluating the risks from artificial production is that the potential for impacts is huge—most major basins have hatcheries—but the actual impacts to wild populations are largely unknown. Various lines of evidence are considered to indicate the potential for hatchery impacts when evaluating risks to wild populations, such as stock histories, numbers, locations and stages of fish planted, incidence of hatchery fish in natural spawning areas, but the true risks to wild populations remain a great source of uncertainty.

Let me now talk about the status of salmon populations. As you’re probably well aware, most Columbia River salmon ESUs are not doing very well and are listed as threatened or endangered species. There are a few ESUs that are not at risk of endangerment or extinction, but many more are at very low population levels or rapidly declining. Although most people traditionally associate Columbia River salmon problems with the mainstem dams, the problems are not restricted to populations that must pass these dams. Lower Columbia River ESUs of steelhead, chinook, and chum salmon have all been listed, while lower Columbia sea run cutthroat are proposed for listing and coho salmon are candidates for listing—these are all ESUs below the first mainstem dam.

As an example of the status of lower Columbia River salmon, the coho salmon Oregon Production Index (OPI) is an index based in large part on lower Columbia River hatchery populations, but also includes Oregon and California hatchery and natural populations. Marine survival for OPI has dropped from around 7% in the 1970s to 3% in the 1980s to 0.5% since 1994 (Fig. 12). This means that in the 1970s, it took approximately 15 smolts entering the ocean for every returning adult. At present, it takes 200 smolts for every returning adult—reflecting an order of magnitude decrease in productivity during the marine phase of the life cycle.

As marine survival for OPI has declined, so have abundances for populations that contribute to it. For example, the numbers of coho salmon observed in lower Columbia River index streams has dropped from tens or hundreds of fish per mile to a complete absence of fish in recent years (Fig. 13).
Coho salmon in two lower Columbia River tributaries, the Clackamas and Sandy rivers, have been highly variable but have averaged about 2,000 and 700 coho salmon, respectively, since the 1960s (Fig. 14). In recent years, however, there has been a sharp decline. Of particular concern is that both populations appear to be losing a year class—returns in 1990, 1993, and 1996 have been extremely low. In addition, a recent study looked at the origin (hatchery or natural) of coho salmon in natural spawning areas on the Washington side of the lower Columbia River. Of the 425 coho salmon carcasses sampled, only 12 fish were of natural origin. The fact that many hatchery strays were seen—over 100 fish per mile in one reach—yet the incidence of wild fish was extremely small and located farthest from hatcheries, meant that the success of these abundant hatchery strays at producing future generations was essentially zero. Obviously, this is a considerable cause for concern.

The salmon populations along the Oregon Coast exhibit both flat and declining trends. Some species, such as coho salmon, are in poor condition and are listed as a threatened species under the Act. For example, despite a complete closure of ocean fisheries beginning in 1994, coho salmon escapements have continued to decline and have been below replacement in recent years. In contrast, Oregon Coast chinook salmon populations are relatively healthy, with escapements into index areas averaging 100 to 200 fish per mile in recent years.

Along the Washington coast, both coho and chinook salmon are relatively abundant. This being said, however, there is some concern about the status of coho salmon populations in southwest Washington. In particular, widespread hatchery releases, especially of unmarked fry and fingerlings, have made it difficult to determine whether natural populations are truly self-sustaining. In contrast, Ozette Lake sockeye salmon, on the north Washington coast, are listed as a threatened species because of low escapements (< 1,000 fish) and declining trends, despite the termination of commercial fisheries in 1974.

In Puget Sound, some salmon species are relatively healthy, while others are now listed. For example, pink, fall-run chum, and sockeye salmon, steelhead, and sea-run cutthroat trout are all considered by NMFS to not warrant listing (See for example, Figure 15). Puget Sound coho salmon are candidates for listing, not because of their low abundance or downward trends, but because of concerns about hatchery interactions, high harvest rates in mixed stock fisheries, degraded habitat, and a rapid decline in adult body size. Puget Sound chinook salmon, on the other hand, have experienced clearly downward trends in many populations, have chronically been below escapement goals in recent years, and were recently listed as a threatened species. As an example, Figure 16 provides estimates of productivity (recruits per spawner) and harvest rate information for the Skagit River chinook salmon population, one of the major Puget Sound populations. Since 1989, recruits have more or less been below replacement, despite declining harvest rates.
Finally, let me say a few words on restoration and recovery plans. NMFS is currently undertaking an large effort to develop recovery plans so that some day listed Pacific salmon will no longer require the protection of the ESA. As part of this process, NMFS has identified critical components of restoration plans, as well as elements of successful recovery. In a document entitled “Working guidance for comprehensive salmon restoration initiatives on the Pacific Coast,” NMFS identifies three components required for a successful restoration strategy. They are: 1) substantive protective and conservation elements, 2) a high level of certainty that the strategy will be reliably implemented, including necessary authorities, commitments, funding, staffing, and enforcement measures, and, 3) a comprehensive monitoring program. In the document, NMFS also defines successful restoration as increased abundance of naturally spawned fish to self-sustaining levels, but only when there is a broad distribution of fish throughout the ESU and genetic diversity that is consistent with natural evolutionary processes.

One recovery plan that is gaining a lot of attention in recent months is the Tri-County Plan. This Plan, in response to the Puget Sound chinook salmon listing, is being developed by Snohomish, King, and Pierce counties, the cities of Seattle, Bellevue, Everett, and also includes tribal and other representatives. The geographic area covered by this plan includes the major urban areas of Puget Sound, as well as the Stillaguamish, Snohomish, Lake Washington, Duwamish, Puyallup, Nisqually and Deschutes River basins. The short-term objectives of this plan are to develop measures that will be incorporated into a 4(d) rule. Under Section 9 of the ESA, the taking of listed species—harming, harassing, or killing them—is prohibited except by certain exemptions. A 4(d) rule is a blanket exemption, under section 4 of the ESA, that allows certain activities to occur that might cause incidental take, while steps are being taken to minimize, compensate for, or eliminate the take, and allows flexibility that isn’t possible through the traditional permitting process. Eventually, it is expected that many elements in the Tri-County plan will be incorporated into the recovery plan for Puget Sound chinook salmon.

Although it’s still under development, the Tri-County plan has several important elements. For example, it’s based on the individual river basin, with the recognition that each basin has its own set of challenges. There’s also coordination and communication among all levels, from watershed councils and school groups, all the way up to the Governor of the State of Washington. There’s a huge effort at public outreach and involvement—I personally believe that landowners and local communities must be involved in the process and believe in a restoration strategy if it’s to succeed. The plan also includes building an inventory of activities that are potentially adversely affecting salmon, and ways to deal with those activities, and as well as monitoring and adaptive management.

Clearly, many Pacific salmon populations along the U.S. West Coast are having serious problems. Many populations are receiving federal protection under ESA, and others, while not at risk of endangerment or extinction, are far from healthy. There are obviously very large differences between U.S. and Canada, such as the political structures, economic bases, and distribution and density of people. When it comes to restoring Pacific salmon in the U.S. or Canada, however, there appear to be far more similarities than there are differences. We Americans have learned many lessons the hard way about what works and what doesn’t work for protecting fish. I strongly encourage you to foster communication and cooperation with those of us south of the border so that you can work with us and learn from our mistakes, rather than making them all over again.

---

1 This document is available on the NMFS Northwest Region webpage at http://www.nwr.noaa.gov/, under ESA listings, Reports and publications, Conservation efforts.

2 More information on the Tri-County plan can be found at the website at http://www.salmon.gen.wa.us/

Alaska - Managing for Escapement in Southeast Alaska:
Ben van Alen, Alaska Department of Fish and Game

Commercial harvests of salmon in Southeast Alaska (SEAK) in the 20th Century, and elsewhere in the state for that matter, generally follow a buildup to a high period early in the century, a low period mid-century, and a high period late in the century (Figure 17).

![Graph showing salmon harvest data]

Figure 17. Annual commercial harvest of salmon in Southeast Alaska, 1878-1998.

This high-low-high harvest pattern has been associated with decadal scale shifts in climatic-oceanographic conditions (Beamish and Bouillon 1993; Francis and Hare 1994; Hare and Francis 1995; Mantua et al. 1997) and a general expectation that future harvests will return to an extended low abundance level.

Salmon survivals are influenced by annual, cyclic, and decadal scale fluctuations in climate and ocean conditions, but the influence that management for escapements and habitat quality have had on returns has been largely overlooked. This paper assesses the interrelationship of environmental and anthropogenic factors, which influenced the decline in harvests (production) in the mid-1900s, and now drive the strong returns in the 1980s and 1990s. I also assess our understanding of the factors that limit coho, pink and sockeye production, our ability to manage for optimal escapements, and my expectations for the future production of SEAK salmon. Our mission as salmon biologists is to simply determine what factors limit the production of salmon and act on those over which we have some control. Short of curbing greenhouse gas emissions and other pollutants, there is precious little we can do about climate-ocean processes and their effect on salmon survival. Thus, our focus is on protection of the freshwater/early marine habitat used by spawning, rearing, and migrating salmon, and on managing for escapements that are naturally distributed and at levels believed to optimize salmon production and use. We are simply taking advantage of the surplus production potential inherent with salmon.

The production of wild salmon is dependent, first, on the quality and quantity of the spawning, rearing, and migration habitat, and secondly, on the quality and quantity of the escapement (Baker et al. 1996; Gregory and Bisson 1997; Van Alen in press). Natural variability in climatic and oceanographic conditions have a universal influence on survivals but historic high levels of production are only possible if the habitat is intact and if there are sufficient numbers of eggs in the gravel to benefit from favorable survival conditions when they occur (Figure 18). Thus, in terms of salmon management, we must strive to maintain escapements at a high enough level that they are not an obvious constraint on salmon production. Assuming no rearing limitations in the ocean phase of salmon, our aim is simply to maximize the number of healthy juveniles that migrate out to sea.

The strategy for maximizing production varies by species and system but I will make some general conclusions for coho, pink, and sockeye salmon in SEAK. For coho salmon, escapements in recent years, and perhaps all through history, have sufficiently seeded the available rearing habitat. Competition for space and food among coho juveniles limits the number produced from each system with little apparent over-compensatory mortality. Thus, production is primarily dependent on natural variability in survivals (Figure 19), and we simply manage for escapements of at least X. History has shown that widespread reductions in our traditional pattern of exploitation are only needed when runs are exceptionally small.

For pink salmon, 38 years of spawn-recruit data show that recruits are positively correlated with spawners up to a point, and then negatively correlated with spawners at the highest escapement levels (Figure 20). Superimposition of reds, limited carrying capacity in the early marine environment, and predator fields are the likely over-compensatory factors. Thus, we should manage for pink escapements to each stock group of at least X and probably not more than Y. This escapement goal range should be relatively broad to account for imprecision in spawn-recruit estimates, imprecision in management, abundance-based management of co-migrating species, and the desirability to continue to observe the recruitment response over a range of spawners. Limitations in gear and processing capacity have made it practically impossible to constrain escapements within the desired range in large run years. At present, these extreme escapements probably pose the greatest risk to maintaining harvestable returns. Since statehood (1959), local managers, without the aid, or encumbrance of, quantitatively-based escapement goals, run forecasts, and management models, have effectively managed passing-and local-stock seine and gillnet fisheries to achieve well distributed and abundant escapements of pink (and chum) salmon. Aerial surveys have proven invaluable for assessing the adequacy of escapements, because pink and chum production is widely distributed among 2500+ streams in the region.
Figure 18. Hypothetical example of the influence that natural and managed perturbations of the environment and escapements have on the production and sustainability of salmon. Production (and sustainability and perhaps biodiversity) of salmon is optimized (maximized) at the center of the distribution (A) where the environment is consistent, the habitat is pristine, and escapements are naturally dispersed in space and time and at MSY levels (Ricker 1954, B). Conversely, salmon production, and sustainability, decreases if there are extreme environmental conditions, loss of salmon habitat, and poor quality and quantity of the escapement (C) due to overfishing or interbreeding with hatchery fish (Reisenbichler 1997).

Figure 19. Abundance and marine survival of wild coho salmon in Southeast Alaska. (from L. Shaul, ADF&G, personal communication)

Figure 20. Return per spawner data for pink salmon in Southeast Alaska, plotted by return year, 1982-1998, with modeled prediction for 1999.
For sockeye salmon, we should also manage for escapements of at least X and probably not more than Y. However, Ricker stock-recruit curves should be used cautiously since the input of marine nutrients from carcasses helps maintain the productivity (return per spawner) of sockeye systems for future generations. Ideally, assessments of habitat capacity and historical production levels will also factor into assessments of escapement goals. Rebuilding escapements, and in turn production, in a chronically under-escaped system is particularly difficult because the sockeye’s freshwater rearing requirements make it most prone to over-compensatory mortality. For coastal sockeye systems in particular, we need to better understand the relationship among escapement, nutrient input from carcasses, and resulting production.

Intensive, competitive, and poorly regulated seine, trap, gillnet, and troll fisheries over-harvested whole runs or temporal segments in pre-statehood years. Overfishing began with the first commercial salmon fisheries when barricades, traps, and nets were used in an unregulated effort to capture nearly all sockeye salmon returning to the many small island/coastal streams (Bean 1889). Moser (1899) pointed out that the pack was dominated by sockeye salmon until 1889 and that, only 10 years later, it was dominated by pink-salmon because “all the streams within 70 to 80 miles of the canneries have been scoured [of sockeye salmon] with all the gear that could be devised or used.” Sockeye and summer chum runs were the first to be overfished and have not rebuilt to historical levels. Pink, coho, and chinook stocks are now at historical high abundance levels.

Oceanwide, interdecadal shifts in environmental conditions help explain some of the variability in SEAK salmon production. The Pacific Decadal Oscillation Index (Mantua et al. 1997) and an Aleutian Low Pressure Index generally fit the high-low-high harvest pattern but deviations by species and stock were obvious. Increased returns of pink salmon in the 1980s and 1990s were correlated with increases in sea surface temperatures and winter air temperatures (Figure 20). However, escapements were also trending upward during these years. If favorable environmental conditions were primarily responsible for the increased returns in the 1980s and 1990s, then why was there a long period of declining returns of pink and other salmon species in the 1940s and early 1960s when these environmental parameters were also trending upward? I suspect that favorable environmental conditions in these years did not compensate for the cumulative effects of past overfishing.

I conclude that active management since Statehood to improve and maintain the distribution and abundance of escapements, and generally favorable climate-ocean conditions, are the principal factors contributing to the strong returns in recent years. Furthermore, if we maintain escapements at current levels, and continue protecting the habitat, then I expect salmon returns (harvests) to vary with natural fluctuations in the environment, but averaging much higher than they were in the 1950s, ‘60s and early-‘70s. Southeast Alaska is near the middle of the natural range of Pacific salmon; anomalous climate-ocean conditions are more likely to reduce survival of stocks to the East and West.

References


Hare, S. R., and R. C. Francis. 1995. Climate change and salmon production in the northeast Pacific Ocean. in R.J. Beamish , editor. Climate change and northern fish populations. Canadian Special Publication of Fisheries and Aquatic Sciences 121:357-372.


Van Allen, B.W. in press. Status and stewardship of salmon stocks in Southeast Alaska. Pages ??-?? in
Discussion on Status of Stocks and Habitat in other areas of the Northeast Pacific

A participant asked the question: If there was no border between southeast Alaska and northern British Columbia, and therefore you could manage that fishery of southeast Alaska without concern for which country the fishermen would benefit, would the interception policies that are presently followed, in places like Noyes Island be the same, or would they be different, in order to maximize the benefit on high-value species like sockeye to fishermen of that area?

Ben van Alen replied that management without borders, to maximize the abundance, would raise the questions of how to allocate the harvest and escapement goal. He noted that a large part of allocation has been based on historical rights to fish, certain areas and times. He suggested that ‘what is fair?’ is an issue which is coming under strong consideration in the treaty negotiations. He noted that from his perspective (in the northern boundary area) it could be appropriate to fish a little harder, or actually, in the large run years, the inside users would stand to benefit the most from that production. However, he commented that it would probably evolve much like it did in the past.

The participant commented on the enormous abundance of enhanced pinks in southeast Alaska and that the fishery was deliberately taking place in offshore, big stock areas, in order to facilitate the management of that particular fishery. He raised the question: If the high value sockeye belonged to southeast Alaska, would Alaska still manage the low-value pink fishery in the way that they do now?

Ben van Alen replied that they would take reasonable care to make sure that all the stocks are there in good abundance but that this is a tough question to answer with obvious political overtones that he would prefer to avoid.

A commercial fisher observed that the United States has spent more money than Canada will probably ever have available to spend on salmon enhancement. Further, that while they have wasted much of the funding, to their credit, they have told us about their mistakes, and moreover, to the credit of Canada’s Fisheries and Oceans Canada, it has tried to benefit by not making those same mistakes. He addressed Ben van Alen with the question: You said how well everything is going in Alaska, and described how good your management is - and that is what your Governor said last spring but two months later, he declared part of Alaska a disaster area. Would you comment on that, please?

Ben van Alen commented that although western Alaska returns were much lower than anticipated they were not really disastrous in terms of the biology of the fish. There were enough back that escapements could be maintained well within target levels. He noted that this is an example of a management system that worked; that they had got used to harvests of 25 - 35 million sockeye in Bristol Bay, and when the harvest went to 10 - 12 million, as in the last couple years, that was a hard pill to swallow. He stressed that again we have to keep in mind that this is all part of natural variation in the environment.

A comment was made that Canada should take note of the new initiatives being presented south of the border with regard to development on private lands.

Laurie Weitkamp replied that although in the general sense there is a lot of work going on, under the Oregon Plan, the governor has stated that there will be no new laws until it has been determined whether existing laws are working or not. She noted that the Tri-County program - a very large initiative currently underway - is asking the questions: What is it that we are doing? Is it working? Are we really doing what we think we are doing? She stressed the importance of evaluation, and to not just assume that things are happening the way they were planned; then to change the regulations if need be. She pointed out that there are many regulations, at the county, state and federal levels (for example, the Clean Water Act), that have teeth in them, if you want to put teeth into them. And further that it is not just a matter of putting into effect new regulations, but instead an issue of enforcing what is already there. She noted that this involves land-use planning, such as the state Growth Management Act, all the way through to poaching problems. In terms of the National Marine Fisheries Service (NMFS) it has only three officers for the states of California, Washington, Oregon, and Idaho, to protect against poaching of listed fish, so there also has to be a buy-in by the people who live next to those streams to recognize that they are their fish and the need to protect them.

A commercial fisherman from northern BC thanked Laurie Weitkamp for her presentation and ‘for putting a real and easy to understand face on our very nasty problems’. He also thanked Arnie Narcisse for his presentation and noted his pleasure ‘to think that somebody really does care and is doing something very positive upstream’. He suggested that it would be very helpful if these presentations were available to the people in his region.

Laurie Weitkamp commented that, within the United States, even with the example of the Oregon Plan that has been up and running for the last 2-3 years, the Tri-County group is essentially starting from scratch.

She noted that they often fail to see what they have in common and instead concentrate on their differences; for example, coastal
and rural versus urban habitat. She suggested that communication is the key and because we have similar problems we can learn from each other.

Finally, she noted that the fish don’t pay particular attention to political boundaries.

A participant raised the question of the zero mortality status on the Upper Skeena coho, and yet 30% of these coho are taken by Alaska’s fishing fleet, and asked why Alaska isn’t moving to the kind of selective fishing, and avoidance and catch and release techniques, that would ensure that the Skeena coho get back to where they need to go?

Ben van Alen replied that they are working with Canadian counterparts through the Pacific Salmon Commission process, the northern boundary technical committee, in particular, to do a joint assessment of the status of the northern boundary area coho, and the Skeena and Upper Skeena coho are a large part of this work. He agreed that it is certainly worth taking a hard look at the information to assess what degree of action is warranted. He noted that Alaska shares the same concerns and that they have in the past taken, and will take, management actions to pass coho, as needed.

A commercial fisher questioned whether there are any statistics available about how much Canadian fishermen take of the Alaska fish that enter through Dixon Entrance and go up through the Alaska’s river systems.

Ben van Alen replied that there is a data gap there - on the Canadian side of the border. There have not been any stock identification programs, at least consistent ones over time, so there are no direct estimates. He noted that they have a rough reconstruction from work carried out annually since 1982 in southeast Alaska and this includes estimates of stock composition, and nation of origin of the sockeye harvested in Alaskan fisheries.

He concluded that this is a data gap that both countries recognize, and it is his hope that in the future there will be programs in place on both sides of the border to assess the stock composition of the harvest, and other things that you have to do to assess run strength in-season and manage for escapements.

The participant asked whether Alaska has considered cutting back on the efficiency of their commercial fishing operations.

Ben van Alen replied that there isn’t any direct effort to reduce fishing power.

NEW FISHERIES AND OCEANS CANADA POLICY DIRECTIONS

Wild Salmon Policy: A New Direction: Ron Kadawaki, Acting Head, Stock Assessment Division, Science Branch

Introduction
I am going to talk about a work in progress; the Wild Salmon Policy - A New Direction. We're currently in the process of preparing a draft document for consultation. There's thinking going on in the Department; there's obviously thinking going on amongst the people in this room, and outside. This is an issue that I think is not only a fishing-related issue, but one that has broad appeal and interest. The Department is certainly going to be looking for a broad range of input into this important piece of policy.

Background
When I say a new direction, many of you will have picked up, either before this meeting or outside this room, a document released last October, entitled A New Direction for Canada's Pacific Salmon Fisheries. It describes broad policy issues associated with the new approach to management and conservation of Pacific salmon fisheries. Among the conservation principles that were enunciated in that document, conservation of Pacific salmon stocks is the primary objective, and will take precedence in managing the resource. We talk about other kinds of activities related to Pacific salmon, such as harvest and habitat, utilization around Pacific salmon habitat. Conservation is to be the primary objective; we have to take a precautionary approach to fisheries management. As a number of people have mentioned already today (and John Fraser in his initial remarks), we have to recognize that there are a lot of things that we don't know about Pacific salmon - a lot of uncertainty, not just data gaps, about what's going to be happening in the near and distant future. Our management has to take into account that kind of uncertainty.

We must continue to work toward a net gain in productive capacity for salmon habitat. As Otto Langer mentioned this morning, we’ve slowed down the loss, but we’re not yet in a position, at least on the Lower Mainland here, to talk about a net gain. However, that's something we need to work towards, and we recognize that a wild salmon policy and conservation of Pacific salmon, involves not just the animals themselves but their habitats. As Ben van Allen points out, habitat is the foundation on which our salmon production is based.

Finally, again as a number of speakers have pointed out, an ecological approach will guide Fisheries and Oceans management in the future.

These conservation principles aren’t new. They certainly aren’t new to people that have been involved in fisheries management and conservation activities, but they are enunciated in the New Directions document, and they will be the guiding principles on which future policy direction in the Department will be set. Since the release of that paper last fall, there have been two papers that have been prepared: one
related to allocation policy, and the other selective fishing. Don Lawseth will be speaking about the most recent one, on selective fishing in Canada’s Pacific fisheries. The allocation framework identified a proposed approach to sharing Pacific salmon, but recognized that conservation was the primary objective and that allocation was to be met within that framework. Selective fishing certainly is directed at a more conservation-based approach to managing our fisheries, and again is consistent with that New Directions policy.

There are other policy papers that were also committed to by Fisheries and Oceans Canada, and they involve improved decision making and wild salmon. I’m going to briefly describe some of the proposed principles under consideration in this wild salmon policy. First of all, the Wild Salmon Policy for Canada is actually part of a global conservation ethic. There is a new ethic, not so much new to people in this room, but I think new, perhaps, in a societal sense, to protect wild Pacific salmon and their habitats. Everyone has a role in protecting salmon habitat from further irreversible depletion, and to conserve the genetic diversity and abundance of salmon populations for future generations.

As I mentioned, we’re preparing a draft Wild Salmon Policy for broad discussion and consultation; this is a policy that requires input and support from a broad range of constituents. The ultimate goal, consistent with the UN Convention on Biological Diversity, is to ensure long-term viability of Pacific salmon populations in natural surroundings. Hence, the emphasis on habitat and on maintaining the biodiversity and viability of these populations.

Considerations
There are a number of issues that this policy must address. These are things that we need to keep in mind, both in establishing principles and the more detailed guidelines for implementing this policy. With respect to fisheries, the objective of maximizing sustainable yield is a risky proposition, especially when we’re talking about fishing on large, mixed-stock aggregates where you have stocks of different productivities - where you can over-harvest some and under-harvest others. To a large degree, the kinds of ocean fisheries that have developed over time have been of this nature. We are particularly concerned with areas where the historical catch and spawner data are unreliable, or where stock productivity has changed over time. This may be due to habitat factors, natural variability in marine conditions, longer term changes in climate - or anything else that might affect productivity.

Habitat is another issue. We have to be concerned about the health of salmon-producing habitats, or the availability of fish to fill productive fish habitats, and we have to make every attempt to ensure that the habitats that are currently degraded are properly restored. We have to make some headway on the net gain of productive capacity that we are striving to achieve. With respect to salmon cultivation, we recognize that carefully managed cultivation, may be an effective way to restore badly depleted wild salmon populations. However, we also must recognize that cultivation can adversely affect wild salmon, in some circumstances. So we need to keep in mind, when we look at restoration or recovery plans, that enhancement-type activities might play a role but we also need to be very strategic on how we use them.

Wild salmon productivity depends on environmental conditions. Climatic conditions can change rapidly. We’ve seen in the last ten years a decline in the marine survival of coho salmon, not just in southern BC, but as we heard, in Oregon as well. We believe these declines are related to environmental conditions in the ocean. Recent conditions have also led to low marine survival for many Fraser sockeye stocks, and high in-river mortality. So the policy needs to be adaptable to changing conditions. We talk about natural processes that are variable and cannot be predicted with high accuracy. Data are insufficient to provide more accurate predictions in some cases, and we need to recognize these uncertainties in achieving conservation objectives. A precautionary approach to management recognizes that we have uncertainty about things like marine survival and the impact of our fisheries. Therefore management decisions have to be suitably conservative.

Principles of a Wild Salmon Policy
It’s important that we establish some principles around which we plan this policy. Flowing from these principles will be guidelines that would apply in particular cases; for example, to do with enhancement activities that would lead towards achieving our objectives. Principles are based on salmon conservation biology, genetic diversity, risk management, and the precautionary approach. We’ve identified a number of principles for consideration in this policy.

**Principle 1:** Wild Pacific salmon will be conserved by maintaining the greatest diversity of local populations, and their historical range, and through preservation of their habitats.

This is the case that Laurie Weitkamp mentioned in the United States, where they’ve identified evolutionarily-significant units. We are also concerned, as is the global conservation community, with preserving the greatest possible diversity of wild salmon populations. Brian Riddell’s statements in his paper, that John Fraser read out this morning, are very applicable to this.

**Principle 2:** Wild Pacific salmon will be managed and conserved as
aggregates of local populations, which we are calling conservation units.

This is very similar to the approach taken in the United States with respect to evolutionarily-significant units.

**Principle 3:** Minimum wild salmon abundance levels will be established for each conservation unit, to prevent the extirpation or extinction of local populations. To do this, limit reference points would be established for each conservation unit.

For those of you not familiar with this terminology, this is the minimum abundance that must be maintained to reduce the risk of extirpation to a level that is acceptable under the conservation objective. So this is a minimum level for the conservation of these units.

**Principle 4:** Once a limit reference point for conservation is achieved, then fisheries will be managed to optimize sustainable benefits.

To do this, a large reference point would be established. It could be Maximum Sustainable Yield or it could be some other level, for each conservation unit. This reference point would represent the escapement or level of exploitation that will optimize long-term sustainable benefits. Obviously, the development of these kinds of targets will require extensive consultations, and will reflect not just the economic value, or short-term production values, but would reflect the longer-term values that people are wanting to see from the resource.

**Principle 5:** Strategic intervention may be used; i.e. enhancement may be used when necessary to preserve populations at greatest risk of extinction.

As I mentioned before, we need strict guidelines, in terms of time, place, technique, to ensure that enhancement technologies do not adversely, and irreversibly, affect the long-term fitness of wild salmon. It's been pointed out that you don't want to tamper with Mother Nature too much; she's quite capable, if left alone, to restore things. If conditions are appropriate, we might be able to help things along a little bit in some cases.

**Principle 6:** Conservation of wild salmon will take precedence over other production objectives, involving cultivated salmon.

This just reflects the priority of wild salmon over other types of production.

**Next Steps**
Finally, I'd like to point out that implementation of this policy will require a lot of additional work, from developing guidelines around the principles of the policy to defining conservation units for all species. Laurie Weitkamp provided a bit of insight into what's going on in the U.S. determining Limit Reference Points (LRPs) for Conservation Units and that it is not as straightforward as it seems. In many cases it will require research or monitoring programs over a period of time. Developing optimal abundance targets for each Conservation Unit will require extensive consultations with all potential users and other members of society. Undertaking new research where information is lacking and reviewing existing practices and guidelines that affect wild salmon conservation will be challenging tasks.

In conclusion, I would like to go back to earlier this morning when Ken Wilson was talking about Fraser sockeye, and identifying the need for everyone to come to some sort of consensus on what our objectives should be. In the context of Fraser sockeye, Ken was pointing out that that is a major stumbling block. I think that the Wild Salmon Policy is a step forward, at least in providing a context for coming to some agreement on what the conservation objectives should be for these stocks. Then above that level, above the conservation objectives, you still have the issue of what the target should be, or what the optimum yield should be, for a particular Conservation Unit - that's something for broader consultation. Just to reiterate, this is something that's currently a work in progress, and will be the subject for public consultation and discussion later in the year. We will be looking for broad input from all off you in addition to others.

**Selective Fisheries:** Don Lawseth, Regional Coordinator, Selective Fisheries, Pacific Biological Station

I will touch on our policy, where we're going with that, and talk about what we did during the last year with selective fisheries, and tell you a little bit about where we're going this year. Selective fisheries is a cornerstone to the new directions in conservation-based Pacific fisheries, announced by our Minister in June 1998. I joined this initiative about a month later, and it's been quite a journey, just fascinating, with more to come.

Why are we moving in this direction? We have heard about mixed-stock fisheries. There are two sides to selective fisheries: avoidance, and in the policy document mentioned below we describe this as the first line of defense; and there is releasing, or letting go of what you catch. The whole purpose behind this is, of course, to follow a conservation-based approach, conserve those stocks that are in trouble, but find fishing opportunities where you can on stocks of abundance.

Given the environmental uncertainty that we're facing, and Canada's international commitments - such as the Biological Diversity Convention and the Code of Conduct for Responsible Fishing – selective fishing is important. The Canadian Code of Conduct for Responsible Fishing is led by the commercial
fishing industry. This all leads to the ecological and precautionary approach, which is where we're trying to go with selective fishing.

Where does the Department stand on this? Here's a direct quote from the recently released selective fisheries policy paper: "All Pacific fisheries in which a by-catch is an issue, will meet specified standards of selectivity. In fisheries where selective harvesting standards are not met, and by-catch remains a constraint to achievement of conservation objectives, fishing opportunities will be curtailed".

The policy paper talks about all fisheries, but I'm going to focus on salmon today, because this is a salmon meeting. But note that we are looking at all fisheries. We also have target deadlines for setting and meeting selective fishing standards. In the salmon fishery, we're looking at setting standards, and meeting those standards, by the year 2001. At this point I don't know what these standards are; we need to talk, and we'll be working closely with harvesters to design and develop these standards. We've made tremendous gains, and all three sectors are working very hard, with tremendous leadership, to move in this direction. We need something to measure that; we've got to know when enough is enough, and when we can stand up and be proud of what we've accomplished. We need to set these benchmarks, and then meet them.

How do we get there? First, we implement measures, and then we build a toolbox. We need to gain new scientific knowledge, and we need to monitor the results. Very importantly, we need to increase harvester awareness and skills. We're developing lots of techniques and methods, but all the techniques, gear improvements, and 'right things' to get us there are only as good as the skills and knowledge of the people that are using and applying them. We really need to work on that area. I see lots of areas where we're almost there – but we do need to bring the harvesters on side so that they actually have the right attitude and the skills to do it.

Many people here are very aware of the measures implemented last year. We implemented extensive time and area closures and monitoring in all fisheries, and revival tanks were mandatory on all vessels. There was mandatory brailing as opposed to hauling the catch over the stern (ramping), and sorting on seine vessels, and reporting programs - logbooks were mandatory in some areas. There were standardized brailer designs, as a condition of license, and use of knotless web. These are all just examples; there were more measures than this in some areas. Mandatory net designs, mesh-types, hang ratios, maximum soak (setting time) times with gill nets - in some areas a maximum of 30-minute soak-time (The purpose of this, of course, is to bring the net in early enough while many of the fish are still alive, as opposed to letting them hang in the net for a long period of time.) Daylight fishing only was conducted in some areas with gill nets. It seems that coho have a visual capability to avoid nets during the daytime, more than at night. Barbless hooks were implemented in both the troll and recreational fisheries.

I use the term 'toolbox' because really what we're trying to do here, is develop a whole range of techniques, methods and gears that we can use either now, or in the future. We have to think in the future, beyond the current coho crisis. It's very easy just to focus on the coho crisis, but we've got to think further down the road, and build this toolbox, to make sure we have lots of things in there that we can apply, depending on what the concern of the day is. That is the way I am thinking when we work with these measures and techniques.

There have been experiments before this thrust in 1998. In the '80s, and up to 1998, there was work carried on up in the Skeena River looking at different ways to carry out the seine fishery. There's been work done on the Fraser, looking at weedlines, trying to avoid steelhead. In 1998, with the coho crisis, the Canada Fisheries Adjustment and Restructuring Program was announced, and selective fisheries was a part of that. With that, we funded last year about 40 experimental pilots including: brailer designs, mesh in seine bunts, escape grids in seine nets, and team harvesting. Team harvesting is an interesting approach. A group of the seiners in the north got together and said, what we'd do is draw names out of a hat, form ten teams of three boats, and each of those teams will fish in a different area. The rules of engagement were that only one net was allowed in the water at a time; when the rings are up, another boat would fish. That slows the fishery down, allows people a chance to handle the fish carefully, and should increase the post-release survival of the coho that are returned to the water.

In the gillnet fishery, I mentioned that we experimented with daylight fishing, weed-lines, tooth-nets, hang ratios, and we also cracked the door to look at trap-nets, notwithstanding the comments that Ben Van Alen had about 400 traps in Alaska. We're looking at trap nets, fish wheels, weirs, and beach-seines, because it appears they have a low post-release mortality rate, and a high capability to select fish.

To develop new knowledge, we carried out some critical experiments. Our Science Branch collaborated with the fishing industry and with Simon Fraser University to carry out a very large experiment in the Alberni Inlet, where we looked at the effects of long-term mortality of coho, using various commercial fishing gear. Getting at the long-term mortality is very difficult. We have lots of work from which we can tell how well a fish survived for two or three hours, or two or three days, if
they're held in net-pens. What we don't know is what happens beyond that. The Alberni Inlet experiment was an attempt to get at that, because it was in an area where we knew the fish were going to go back to a particular system (there's a hatchery on that system, and there's a fishway where we could video count the upstream migrants and at the same time look for the tags). This begins to give us an idea of the longer-term effects of some of these gear on mortality rates.

In the recreational fishery, there was an experiment in the Work Channel near Prince Rupert, looking at motor-mooching with cut-plug herring as bait, a very specific type of gear; and we also monitored catch and escapement more intensively. We also looked at timing distribution using DNA sampling. I think Ron mentioned that we collected nearly 8,000 DNA samples last year.

What did we learn? We found that harvesters are really creative, and there are some excellent ideas coming forth. There's tremendous leadership in all three sectors. The BC Aboriginal Fisheries Commission, with Craig Orr, has taken the lead in bringing First Nations into this picture and there is a new video which describes where First Nations are going with selective fisheries. The recreational community is coming on-line very strongly, with lots of proposals this year to look at various gear-types or lures, and selective capability. And the commercial fishery has shown a great stride forward, by leading a workshop last November - a technical workshop, that invited everybody. All three sectors participated and it was an excellent update.

We found that revival tanks work, but they need some improvement, and we hope to work on that this year. We found that daylight gillnetting works for avoiding coho, and that short set-times are less stressful on coho when we measure 30 minutes against 60 minutes. We also learned that brailing is less stressful on coho than ramping and that seine can have a very low release mortality, under the right conditions. This goes back to what I mentioned a minute ago about controlled conditions, and with everybody cooperating and fishing in the right way. Tooth-tangle nets, which are nets that are designed to tangle fish by the teeth, as opposed to the gills, facilitates a live release, and weed-lines, which are lines that sink the net below a certain level, with a large mesh in the top part of the net, allows fish like steelhead to pass through that upper water column. Both of these show promise. We need more investigation in that area. We found that coho caught on baited mooching gear - this is the experiment in Work Channel - had a higher mortality than the 10% average or standard that we've been using. Indeed, in that experiment, mortality was slightly over 25%.

Where are we going in 1999? I think you'll see similar measures to those introduced into the fisheries last year. We need to initiate education and training programs. We want to work with all three harvesting sectors to do that. We hope to make big strides on that this year. We need more post-release mortality work, particularly in the recreational fisheries, and we expect to work on that as well and we need to study post-release stress of trap nets and fishwheels. We now have information on gillnet, seine, and trawl, in terms of what some of the medium-term post-release mortality is, but we now also need to do some work on the trap nets and fish wheels. Probably one of the ways we'll do this is by looking at the blood chemistry stress level work that Pat Gallaugher and her team initiated in the Alberni Inlet study last year. We find it to be an excellent indicator of post-release mortality and we'll probably apply that to the fish wheels and trap nets this year.

We'll continue the catch and escapement monitoring programs to evaluate the overall effects of these measures. And, we'll continue the timing and distribution studies. I think we certainly need to increase the selectivity studies with the recreational and troll harvesters; we plan on a fairly strong push to look at hooks, lures, and ways of avoiding the stocks of concern with the hook-and-line fisheries. We'll continue to encourage and support First Nations to become more selective, and we'll continue to explore the selectivity of traps and fish wheels. We'll test some pilot studies in real fisheries, some of the work that was carried out last year in experimental areas. I think we need to look at real fishery situations. We will investigate new ways of monitoring the catch in-season, and maybe in real time, to actually develop a more responsive and active fishery.

Beyond 1999, there are several things that we're working toward, or at least in my mind where we're going with this: we need to work for a transition from CFAR, which is the adjustment program, to harvester-funded experiments and catch monitoring. The CFAR program ends after next year, and a way must be found to keep this work going. We need to set selectivity standards, as I mentioned earlier, and time lines to meet those standards. I think we really should look at ways of slowing the fisheries down, wherever we can. As mentioned earlier today, fisheries in the future will be less sea-ward, moving inland, away from the mixed-stock areas. And we'll continue to look at alternative gear.

I want now to give you a quick update of where we are with proposals for 1999. We had a deadline of April 15th, and at that time, we received 195 proposals. It rather overwhelmed us, but it certainly shows a strong interest in the area. We've gone through an extensive process of having those proposals reviewed by each of the sectors. Then a federal-provincial team of officials went through every proposal and applied a points-rating system against set
criteria. We had about 30 criteria to measure each of those proposals and the proposals are all being ranked. We'll look at funding the top proposals. Soon, we'll announce a first round of proposals that will be approved-in-principle. It will be a small, conservative list, because as we go through this we talk to the proponents and negotiate how much of the total allowable catch may be used to help fund the proposal, what the real dollar value is - and then as money is saved we move down the list funding more proposals.

**Discussion on New Fisheries and Oceans Canada Policy Directions**

A participant raised the question of catch and release mortality rates and asked why the management of sports fishing effort was sticking with 10% mortality when a recent study suggested that a mortality of >26% was more accurate. She also raised the question of mortality rates from a recent study in the sports fishery around Langara.

Don Lawseth noted that 10% is a standard set by reviewing data collected for years between Alaska and Oregon. Although last year’s experiment produced a rate of 25%, this was one specific type of gear.

He suggested that the most important thing they learned from this study was the need to research the effects of the different types of gear. Then managers can be more specific in terms of what standards are set.

Ron Kadowaki mentioned that as part of the creel survey of the catch monitoring programs, Fisheries and Oceans collects information on the kinds of fishing that are occurring in the various regions and this may lead to different mortality rates being used to manage the recreational fishery. It would likely be that this will be on an area by area basis, based on the kinds of fisheries that are occurring.

The participant suggested that if there is a risk to salmon then the highest mortality estimate should be the one to set standards by.

Ron Kadowaki replied that in the Work Channel area, where the study was done, this is the major method of fishing, and the 26% will be applied in that area.

However, in the other areas there will be better monitoring in 1999. He noted that in terms of risk aversion, fishing plans are very restrictive overall, and the level of fishing that will be conducted in 1999 will be very risk-averse and conservative, in the sense of mortalities in the stocks of most concern.

One participant questioned whether the ‘red and yellow harvest zone model’ would apply to the recreational fishery.

Ron Kadowaki replied that the figure was not directed at any particular fishery, but instead was a more stock-based, in terms of whether the abundance is at a particular level. If so then this is the fishing mortality rate that you might apply. How that rate would be allocated is a separate issue.

The participant questioned whether the Wild Salmon Policy deals with protection of wild salmon from impacts from farmed fish.

Ron replied that it has to do with the concerns about cultivation, that they consider this as an extreme form of enhancement, and so in this way it is certainly the intent to cover those kinds of impacts.

A question was raised about over-escapement and the concern that the Wild Salmon Policy should consider that salmon carcasses are the main source of nutrients in rivers, riparian systems, and juvenile salmon. He noted that BC has nutrient-poor river systems and that much money is spent from a number of sources to solve the problem by fertilizing rivers, without letting nature do its own job. He questioned whether the policy would consider managing for carcasses in these rivers.

Ron Kadowaki replied that recognition of the ecological significance is important, but that practically speaking, how it is implemented, is still to be worked out. He commented that they are not just looking at the production or harvest value of salmon but also at the role it plays in the ecosystems.

The chair of the BC Aboriginal Fisheries Commission commented on the importance of consulting with First Nations when developing new policies and new directions. For example, he noted that First Nations don’t agree with the allocation policy that the federal government has put forward. He noted that First Nations had requested the opportunity to help develop the framework for the wild fish policy as a partnership between First Nations and Fisheries and Oceans Canada, but that it appears that the policy has already been developed. He also addressed the issue of the Convention on Biological Diversity and Canada’s commitment to this Convention by quoting the clause from the Convention on Biological Diversity, “subject to national legislation, respect, preserve and maintain knowledge, innovations, and practices of indigenous and local communities, embodying traditional lifestyles, relevant for the conservation and sustainable use of biological diversity, and promote their wider application, with the approval and the involvement of the holders of such knowledge, innovations, and practices.” These points are important to indigenous people who use a knowledge-based system that is not easily transported to another entity.

A member of the Conservation Council noted that the Wild Salmon Policy is definitely a step in the right direction, and encouraged Fisheries and Oceans Canada to “move forward very
quickly in defining these conservation units."

The Council member also raised the question of mortality rates and spawning success for non-retention fisheries and recommended that Fisheries and Oceans Canada address this in the 1999 selective fishing experiments. The question of whether the Wild Salmon Policy will identify the units that need protection, and whether this will require better assessment and monitoring than there is at present, was also raised.

Ron Kadowaki replied that in terms of increasing the monitoring, there are some additional resources received last year to increase coho monitoring to above what it’s been in recent years. For the coming year, this program is in place still at a lower level. The intent is to apply the resources in a more strategic sense. He noted that on a larger scale, when we get away from just looking at coho, there is certainly a resources issue with respect to the Department’s assessment capabilities, coast-wide, and this applies to all salmon species, not just coho. He concluded that when they talk about making risk-averse management decisions, they need to take into account the kinds of information that are not available, as much as the kind of information that is, and be appropriately cautious.

Don Lawseth noted that the policy papers are for discussion - they will be out for quite a period of time, and they are looking for consultation. He noted that they will not be looking at finalizing a policy on selective fisheries until probably at least January, 2000, as they want to incorporate the results of another season of experiments and testing and leave a long period of time to receive feedback.

In terms of the long-term survival questions raised by the Council member, he noted that in the experiment in Alberni Inlet, in 1998 there were about 17,000 tags put on coho. In viewing the tags at Stamp Falls, and recovering the tags in the hatchery, and looking in the streams around the area, they were only able to recover about 20% of the tags. So there remains a huge question about what happened to 80% of those fish. There are at least three possibilities: the tags fell off; the fish went somewhere else (coho are very difficult to find in smaller streams), or they died. Don noted that “at this point, I’m learning from John Fraser to say, when I don’t know, I don’t know. And we just don’t know, but we have to find out.”

A question was raised about the scientific reports which identify three runs of chum in the lower Fraser River that are threatened with immediate extinction. The participant noted that Fisheries and Oceans Canada is now allowing more sensitive, selective chum fisheries in the lower river, yet how can the new selective chum fisheries preserve the three threatened runs, while still harvesting abundant stocks of chums?

Ron Kadowaki replied that although he was not familiar with these particular streams, in terms of a policy, it is clear that they need to identify what sort of conservation units or aggregates they want to conserve, and establish levels that they could then use as criteria for taking action such as ‘no fishing allowed’.

He suggested the best case would be when we look into the future, our hope is that for chum in the lower Fraser, we can identify units of production that we’re trying to conserve, identify what the standards, benchmarks, or limit reference points may be for those stocks, and then apply the necessary rules of harvest to conserve them.

**Broader Issues of Concern to the Council**

Will Climate Change our Salmon Fisheries?
Paul H. LeBlond, PFRCC member

Fisheries scientists discussing the causes of fish stock fluctuations are somewhat reminiscent of the blind men examining the elephant, each emphasizing some important feature which is only part of the whole. Some blame modern fishing methods, others invoke chaotic behaviour within a complex ecosystem, others still attribute population changes to climate fluctuations. Of course, everything goes on at once.

Five principal threats to the sustainability of living marine resources have been identified by the U.S. National Research Council.

1. Fisheries Operations
2. Chemical Pollution and Eutrophication
3. Alterations of the Physical Habitat
4. Invasions of exotic species
5. Global Climate Change

That Global Climate Change is mentioned last does not of course mean that it is less important than other threats. It tends to be considered as the influence of last instance because it occurs at spatial and temporal scales beyond our common understanding. Global Climate Change describes environmental variations which take place on the scale of the planet and over periods longer than seasonal variations and even longer than well-recognized semi-periodic phenomena such as El Niño. Such long term changes occur naturally: the geological record tells us about ice ages and extraordinary droughts of the past. What is of concern today is mostly the impact of changes in atmospheric composition caused by human activities. Increased concentrations of greenhouse gases, mainly CO2 and methane, alter the global radiation balance and lead to global warming of the ocean and the atmosphere, changes in wind,
ocean currents and precipitation patterns, sea-level rise and other perturbations. Ozone-depleting substances (e.g. CFCs) lower stratospheric ozone levels and lead to higher UV-B radiation at ground level. These phenomena have potentially wide-ranging biological effects, and may well impact on fisheries.

Pre-industrial fishermen accepted natural fluctuations in fish populations as "Acts of God". They could hardly imagine that their own efforts could deplete the sea's bounty. Even a visionary like Jacques Cousteau still spoke in 1950 of the sea as "the great cornucopia." Modern fishing has changed all that. Extraordinary progress in fishing power and data analysis have led to what Tony Charles calls the "fallacy of controllability": a belief that a fishery can be more controlled than is realizable in practice. Fisheries collapses are now routinely attributed to overfishing or management errors.

So, now we are faced with managing the impacts of global climate change on fisheries (some would rather try to manage the change itself). In the past few years, capture fisheries seem to have reached the limit of what's available to traditional fishing methods. There is no slack left. In the days that fisheries caught only half of what was available, a twenty percent decrease in ocean productivity had little effect on catches. Today, when we can catch everything, marginal changes in ocean productivity reflect directly on fisheries. Changes in climatic conditions have direct economic impacts. What can we expect from global climate change?

The first step towards addressing this question is of course to identify what climate change, if any, has taken place so far, and then to find out what is expected in the future. Long-term trends are weak, imbedded within much larger higher-frequency variability.

Nevertheless, there is a clear and statistically significant signal. Global temperatures have increased by about 0.5°C over the past century. Similarly, ocean temperatures have increased slightly (at least in the Northeast Pacific: 1.96°C/century (+/- 1.15) at Station Papa and sea level has risen (at a rate of about 1 mm/century). Debate continues as to the possible anthropogenic nature of these trends and as to whether the predictions of climate models are to be trusted. The discussion takes place at the scientific level, leading to refinements of the understanding of the intricacies of global climate. Climate forecasting in atmospheres with higher CO₂ levels is a subject of intense international study. The interpretation of observed changes is also subject to debate, some preferring to see sudden "regime shifts" rather than long-term trends in the data. While it is tempting to think of long term changes as taking place only very slowly, there is evidence from past records that significant changes can happen over rather periods of only a few years.

The first step towards addressing this question is of course to identify what climate change, if any, has taken place so far, and then to find out what is expected in the future. Long-term trends are weak, imbedded within much larger higher-frequency variability.

While there may be a broad consensus that a better understanding of ecosystem interactions and responses to climate change would be of great benefit, there is no unanimity on how much of an improvement is required and how best to achieve it. This is indeed a period of great challenge and opportunities for fisheries science and ocean biology. Many problems have quickly passed from the realm of intellectual curiosity to that of pressing necessity, attracting significant intellectual interest and increased funding.

Research related to the effect of climate change on fisheries is currently progressing along a number of avenues. Evidence for the impact of environmental conditions on fish stocks is first to be sought in the time domain, through correlations and comparisons. Spatial distributions also provide information on habitat sensitivity. Beyond observations and correlations, researchers imagine models of mechanisms linking climate fluctuations to those of the ecosystem or to specific stocks. Competing models must be tested, compared and assessed for their predictive ability. Many researchers are not satisfied with simple links between climate variations and commercial fish stocks, pointing out that physical changes first affect primary production and that higher trophic levels respond only indirectly. How to model the complexity of the ecosystem without becoming mired into the chaotic behaviour of nonlinear systems?

Are there perhaps some critical interactions between physical parameters and growth rates, or between predators and preys that capture the essence of the fishes' response to climate change without invoking the full complexity of the ocean food web? What is to be done now, while fisheries scientists are struggling with the problem? What decisions
should be made in the absence of sufficient information and understanding? This is the basic question which arises in all issues related to climate change - and indeed, when one thinks about it, in all future contingencies. Should one take precautionary measures in spite of incomplete evidence or go on with "business as usual" until there is enough information to make firm decisions? Answers to this question depend very much on how risks are perceived and who assumes them. People who have nothing to lose from application of the precautionary principle enthusiastically support its application in the interest of future benefits. On the other hand, those who stand to suffer on the short term by the implementation of precautionary measures generally oppose them and are not convinced that the long-term benefits are worth the sacrifices. These different perspectives also strongly condition the attitudes of various groups to the very nature of the information about climate change.

It is clear that while scientific research is absolutely necessary to clarify and quantify the risks involved, the problem has to be approached from other directions as well. The economic and political issues are already widely debated. The views and positions of many groups have been strongly expressed and there is a need to find common ground to plan a safe course into the future. Enhancing public debate and broadening scientific discussion on these issues will contribute to this process. The Pacific Fisheries Resource Conservation Council plans a workshop on "The effect of Climate Change on B.C.'s Fisheries," to be held in the fall of 1999. The workshop will bring together scientists, fishermen, policy makers and the public to develop a forward-looking perspective on the issue of Climate Change and Fisheries.

Footnotes

FINnAL \REMnARKS:
Iona Campagnolo
The moderator noted in her final remarks that when we began to speak for the salmon in March 1995 (see Getting the Missing Fish Story Straight: The East Coast Fishery Crisis and Pacific Coast Salmon Fisheries), there were possibly more voices than were heard today. She reminded us that that was a time when we were still talking about gear types and allocation; therefore there has been much progress. She noted that it’s also a moment to say that we recognize we’re in a time of transition - that every single person here recognizes the transition. “The rules under which we’ve operated since time immemorial, were created for few people on a giant planet, and now we’re moving to that equation being completely reversed -many people on a tiny planet. And it calls on all of us to make a significant intellectual accommodation with a whole new world ethic, that we call sustainability.”

John Fraser
On behalf of the members of the Pacific Fisheries Resource Conservation Council I wish to express our gratitude for your attendance here and our gratitude and thanks to Simon Fraser University, and to Dr. Iona Campagnolo, who not only did a marvelous job of chairing today’s meeting, but with a vigour which I have seldom seen in a democratic meeting, moving us to completing on time. The other sponsors for this meeting were the Fraser Basin
Council, through Iona’s presence here, and Fisheries and Oceans Canada.

For those of you in Fisheries and Oceans Canada who are here, and who’ve been with us all day, you have all been to many meetings where you’ve taken an awful beating. Most of the time, most of you have managed to bite your tongue or your lip, and stay civil. I hope that you noticed today that while the questions were direct, there was a measure of affability and gentleness about this audience, towards you all, which I hope you will accept as our gesture of goodwill and also, by the way, our support for the very hard work that you have to do (without sufficient resources as I said earlier). I want to also express our appreciation to the members of the provincial government who played a significant part in our discussions and to thank the Deputy Minister, Mr. Valentine, for his presence here. I would like to note the fact that he stayed around for quite a period of time, to have a chance to hear many of your views, and we appreciate that.

I want to say one thing about the program today. As Iona said a couple of times, we could spend a whole day on some of these issues. They are all important, and the contribution that everyone here has made to these issues, mattered.

These meetings, especially those hosted by Simon Fraser University, have had an effect on the community, beyond this room, among those who fish on this coast, both traditional commercial, both native commercial and food fishing and the sports fishery. All of these meetings have also had an effect on the two levels of government. You saw some significant witness of that, today. I think it’s appropriate for us to say together, that here in this room, we are all of one view – and that both levels of government must work together to put the fish first.

Acknowledgements

We wish to thank all those who made the time to participate and/or deliver presentations in this full day workshop. Thanks also to the Pacific Fisheries Resource Conservation Council for sponsoring the event in partnership with Continuing Studies in Science at Simon Fraser University and the Fraser Basin Council; Iona Campagnolo who graciously agreed to moderate and did an excellent job; Jason Hosegood for rapporteuring, Janice O’Bryan for transcribing the sessions and Craig Orr for editorial assistance in preparing this report.

Speaking for the Salmon
Workshop series supported by
Continuing Studies in Science at
Simon Fraser University,
8888 University Drive, Burnaby,
BC V5A 1S6, tel: 604-291-5466,
fax: 604-291-3851, website:
http://www.sfu.ca/cstudies/science/