

# CHAPTER 16

## *What is limiting our ability to effectively manage salmon?*

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### **Introduction**

This paper focuses on British Columbia and one particular policy issue: '*salmon management*'. It really is a microcosm of the experience I have seen in resource management agencies around the world. The question I ask is, "What is it that is really limiting our ability to effectively manage salmon – is it politics, is it habitat loss or is it overfishing?" I want to offer you my most recent view about that, a view which has changed considerably over time. In a number of ways, I will be reiterating some of the points raised by John Fraser in Chapter 1. The view that I will present to you is basically a cynical view.

When I was an undergraduate student I took an introductory economics course and I will never forget what the professor said on the very first day of this course: "Economics is the study of the allocation of scarce resources". In ecology, the study of the ecosystems is basically the same thing – our aim is to understand how scarce biophysical resources are used by a community of organisms to build a food web structure in which creatures become both resources for one another and threats for one another. We are getting very good at building ecosystem models today and understanding at least something about the biophysical basis for production and factors that can influence it. There is *economics* telling us that we are dealing with the allocation of scarce resources and there is also *ecology* telling us that we are dealing with the allocation of scarce resources. My question is, "What resource is it that is preventing us from bringing the ecology and the economics together into some more effective ecosystem management for Pacific salmon?" We know we have to deal with freshwater problems, marine problems and fishing pressures - I question why we are not doing ecosystem-based management. Is it because we cannot plan ahead or is it because we cannot control fishing interests? I do not think either of these is the problem.

### **The problem: not getting good information**

I believe that what is getting us into trouble today is that we cannot manage ecosystems effectively, particularly our salmon resources here in the Northwest, without good information. Good information is critical for allocating management resources in order to sustain salmon and we are simply not getting that information. The scarcest resources we have are human resources and financial resources, both of which are required to gather data.

In British Columbia the public has spent hundreds of millions of dollars in fixing the wrong things while many stocks keep declining. This expenditure has been based on the pretense that freshwater habitat issues are the main causes of salmon declines, and that artificial production schemes can solve these problems. Very large amounts of money are spent on trying to protect and manage salmon in British Columbia. I was shocked to learn, for example, that the public (DFO) expenditures for salmon

management/protection in 2002, per kilogram of salmon captured through fisheries, was approximately 50% of the Florida supermarket price for wild salmon steaks per kilogram.

My basic argument is that we are not allocating the financial and human resources that we have for salmon management in an optimum way (and that is also true for fisheries around the world). The first priority has to be the allocation for gathering information. As a scientist, I regularly field questions as to why the salmon are declining and the survival rates are going down, and what is changing in the ocean? As to the question of whether we, as scientists, are looking at the ocean, the answer is *no*. We are not out there looking at the ocean - we are not getting that information. There is practically nothing being allocated, relative to what is needed, toward the gathering of information needed to answer the kinds of questions that the public is asking us. Without ocean information gathering, we will continue to misallocate human resources. The interface between ecology and economics really is in how the public allocates resources to salmon and marine management and protection, and they will continue to be wrongly allocated.

### Declining marine survival rates

In British Columbia the most important single problem for salmon populations is declining marine survival rates (Figure 16.1).

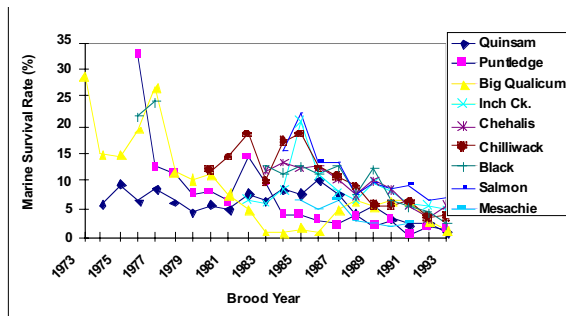


Figure 16.1. Declining marine survival rates in BC coho hatchery salmon from 1973 – 1993.

Every scientist you ask will tell you that the reason there have been major declines in coho salmon, in Rivers Inlet sockeye and pink salmon, Vancouver Island chinook salmon, and a number of other stocks, is not because of freshwater habitat loss or overfishing. Rather, it is because the marine survival rates are going down. The Rivers Inlet sockeye stock collapsed 5-6 years after the fishing was closed completely. We have had virtually complete protection of coho salmon and chinook salmon along the British Columbia coast for the last several years and yet we are not seeing any significant recovery.

Similar to the findings of Jeff Hutchings (Chapter 3), it is clear that shutting down fisheries is not the answer to recovery. Something else is going on that is driving survival variations much larger than the fisheries impacts, and it is not fishing.

Observations of the time trends in marine survival for coho salmon show us that the two kinds of salmon, hatchery fish and wild fish, have exactly the same kind of patterns whether they are protected in their freshwater rearing period through growing in a hatchery or whether they are growing in the wild.

It has been suggested that what happened to the sockeye in Rivers and Smith Inlets had something to do with the obvious impacts of logging on the streams around there and Owikeno Lake. If you have ever been to Owikeno Lake you would know that logging progressed around the lake relatively slowly and, if logging had been the problem, Rivers Inlet sockeye would have declined slowly over time and would not have declined dramatically in one year by 90% as they did in 1994; such a sudden decline suggests a marine survival problem.

The Department of Fisheries and Oceans, other agencies, and NGOs have spent very little money trying to uncover the causes of that problem and to determine whether or not those causes involve something like marine mammals, that we could potentially do something about. Out of the \$90 million per year being spent on salmon in British Columbia, only about \$300,000 per year is being spent to try and understand what is going on in the ocean. This is virtually nothing in view of the high costs of doing research in the ocean.

*Chekamus River coho salmon marine survival experiment*

We have recently completed an experiment which examined marine survival rates for coho salmon from the Chekamus River near Squamish B.C. The purpose of this activity was to determine when and where the apparent very high ocean mortality is occurring. We released a small number of coho salmon (15 in total) from the Tenderfoot Hatchery with ultrasonic tags. To carry out the study we borrowed an ultrasonic receiver system from the University of Miami, hydrophones from the Hubbs Marine Lab in California and as another set of receivers from a private company based in Nanaimo, BC.

We probably learned more from these 15 fish than we have about coho salmon in the ocean in a very long time. Results showed that the first four of the 15 coho, as we expected from other studies, were killed within a mile or two of the hatchery, probably by merganser ducks. The remaining 11 coho made it down to near the river mouth and then, within a matter of 3-4 hours, four of those were eaten by seals. Out of the original 15, about 7 survived to reach the middle of Howe Sound a few days later. We critically need information like this to better understand factors determining marine survival in salmonids, and where to do more of the critical but expensive marine research.

**Re-allocation of resources**

I ask you this question, “Why are we not allocating more of our scarce management resources to building an understanding of what is going on in the place where the problem is?” If we close down just one of the large British Columbia salmon hatcheries whose returns are so poor today because of poor marine survival, that would provide enough money to set up a monitoring network along the British Columbian coast. This would allow us to find out a great deal in a few years about marine mammals, food supplies and other possible agents that could be causing these dramatic changes in salmon.

The largest expenditure for salmon in British Columbia, and certainly by far in the Pacific Northwest, is on habitat management. This is based on the assumption that declining habitat and deteriorating habitat are the main reasons for the disappearance of salmon. British Columbia, for example, has spent hundreds of millions of dollars on habitat restoration programs and the federal government of Canada has spent upwards of \$140-150 million over the last few years on habitat. Why do we see so little work being carried out to try to find out, from the population information that we already have on salmon, just exactly what the freshwater habitat impact on those fish has already been? Very few such studies have been attempted, and, in fact, only one that I know of (which examined interior BC coho) showed a serious negative habitat effect. Other studies hint that there may even be positive impacts on habitat change, rather than negative ones. However, the results of these studies have been questioned because the population data are poor, and this is because we are not investing enough in gathering basic population information on salmon. The biggest problem is that there are many whose jobs depend on continuing to pretend that the problem lies in freshwater; when half the employees of an agency are trained for, and their jobs dependent upon, a freshwater management approach, it is not surprising that they resist change, wherever that change might be needed.

**BC watersheds study**

The following case study demonstrates how tenuous the argument is for spending so much on habitat restoration, anywhere in the Pacific Northwest. A graduate student at the University of British Columbia, Maria Morlin, has recently completed a study which involved sixteen watersheds around Georgia Basin. These watersheds were chosen because it was possible to go back about 25-30 years with aerial photography in these areas and map out habitat changes over time. For each of these watersheds there are reasonable salmon escapement trend data and, for most of them, information on freshwater fry abundances. These watersheds cover the kinds of changes, in terms of habitat, that are observed in the most intensively developed areas in BC; for example, areas along Vancouver Island, such as the east coast where development has been rapid, and the Fraser Valley. These watersheds vary widely in the extent of

disturbance in recent years; some are relatively well-protected (water supply watersheds), some are recovering from old logging damage, and some are experiencing urban and agriculture development. Figure 16.2 shows the locations of these watersheds and Figure 16.3 describes the results of this study. In Figure 16.3 Morlin plotted trend indicators over the set of 16 watersheds, including fry abundance indicators in the top panels of the graph, and escapement trend patterns where higher values mean positive trends in abundance of spawning fish and negative values mean decline in abundance. These are plotted against a variety of habitat changes. Clearly, no correlation was observed between habitat change and coho escapement or fry density. In fact, if anything, there is a very weak positive correlation between salmon abundance and agricultural development in the Fraser Valley where several of the most productive salmon streams are heavily impacted by agriculture. There is certainly no association between old growth forest and any factor except a few indices of coho fry abundance.

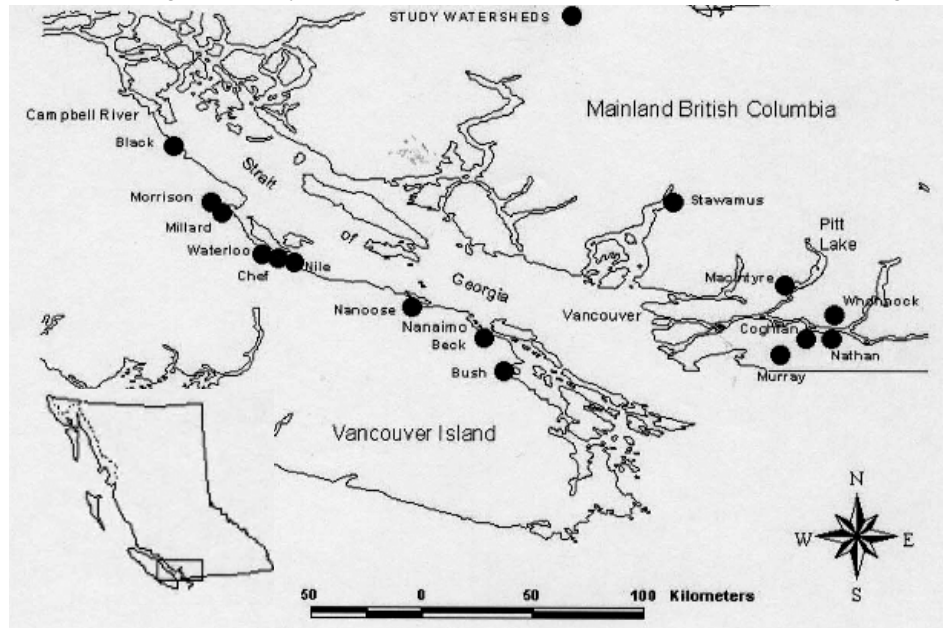


Figure 16.2. Locations of Maria Morlin’s study on 16 southern BC watersheds.

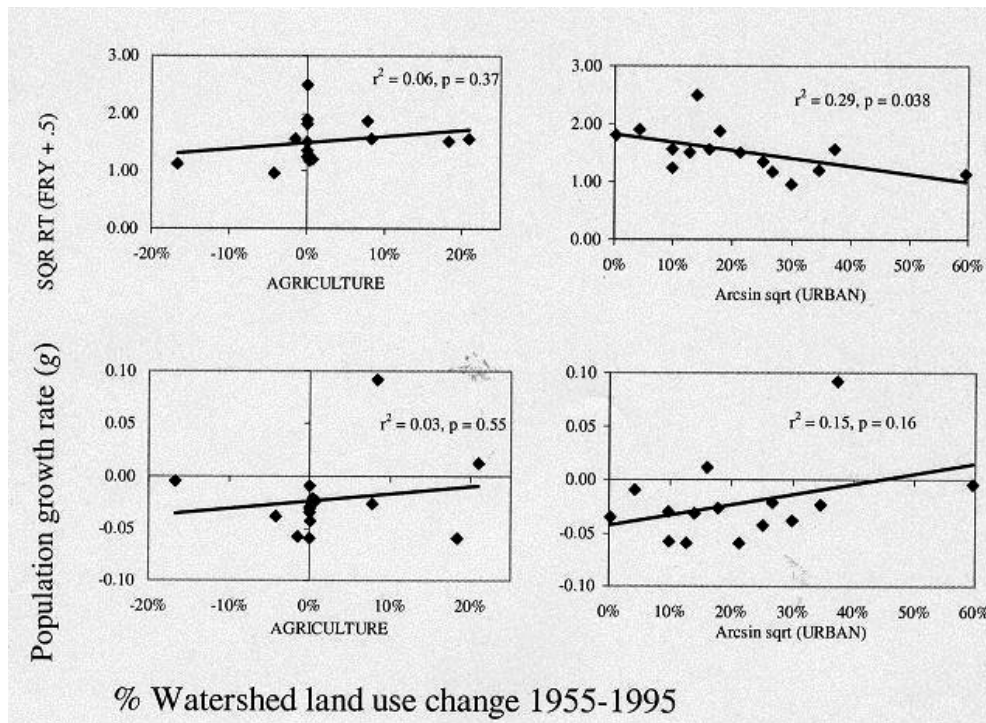


Figure 16.3. Correlation between habitat changes and coho escapement or fry density in the Morlin study.

Data like these tell us that the habitat changes we are observing, that look horrifying to us from an anthropocentric point of view, are not really at the heart of the problem. Rivers in British Columbia are still capable of, and are still, producing large numbers of juvenile salmon, but these fish are not surviving after they leave the rivers. Why is it that a graduate student, rather than those people who are directly concerned in management agencies with monitoring habitat changes, is the one to produce a study like this? Why isn't this kind of analysis of the effectiveness of habitat protection and management being conducted on a routine basis to support decision-making for allocation of scarce management resources?

### Hatchery Production and Wild Stock Management

Figure 16.4 provides another hint that things are going seriously wrong. The graph represents time plots of hatchery releases of coho salmon from the hatcheries around Georgia Strait. There was a brief period of very high production in the early 1980s, then things settled back down, and from 1990 to 2002 there has been a gradually increasing trend in hatchery releases. This has occurred during a period of time when we know the marine survival rates of those fish would have been extremely poor and during a time when most of the fisheries for coho and chinook, in the Georgia Strait area at least, have been closed.

We also know that there is a negative correlation between marine survival of wild salmon in Georgia Strait, and hatchery releases - apparently there is competition between hatchery and wild fish in the relatively restricted environment of the Str. Why then are we increasing hatchery production at a time when we know we are not going to catch that production, and when we know that it may be causing decreases in survival of wild salmon? Something has gone seriously wrong with the management system when it can make this kind of misallocation of money and resources.

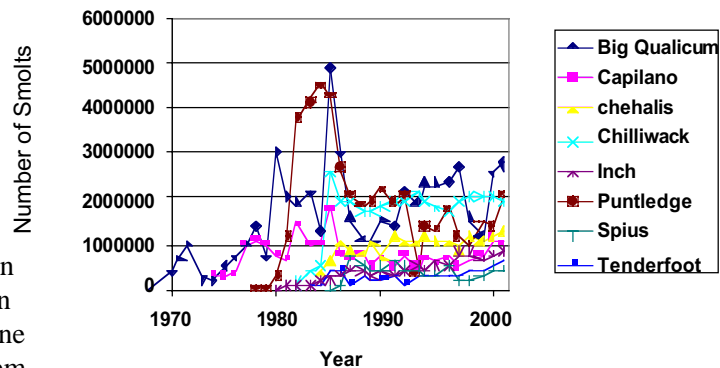


Figure 16.4. Georgia Strait coho releases from 8 hatcheries (1979 – 2000).

### Risk management

There has been much interest recently in trying to deal with the biodiversity issue, particularly for species such as coho salmon where there are very large numbers of small stocks. To do this, we must face up to the basic issue that there is no way to manage a Pacific salmon multiple stock complex, whether it is Fraser River sockeye or coho along the coast or chinook salmon, without putting some of these stocks at risk of extinction. From many long-term data sets on fish, we know we will see a pattern like that shown for coho salmon in Figure 16.5. As exploitation rates go up, we expect yield to go up (shown in purple) to some peak, and then to drop down when we overfish. Even near that peak or the maximum sustained yield exploitation rate, 30-40% of the stocks are going to be overfished and at risk of extinction. The only way that the extinction risk can be brought to zero, so as to maintain complete biodiversity, is if we do not fish.

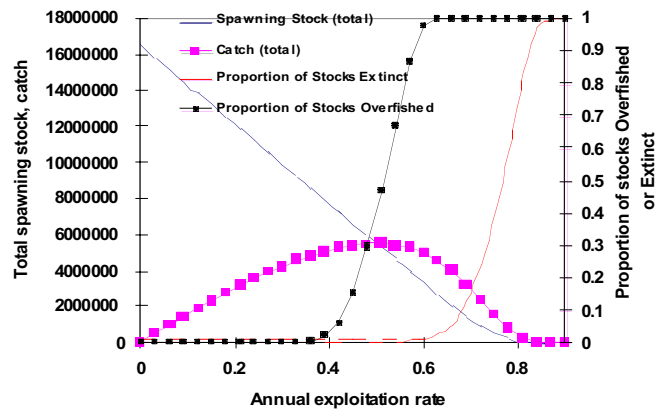


Figure 16.5. Effect of increasing coastwide exploitation rate of BC coho stocks.

We are not facing up to the fact that we cannot have our cake and eat it too – that is, we cannot have biodiversity without a loss in harvest value. I am not arguing that we ought to go out and remove 90% of the salmon stocks and leave only the most productive ones. What I am pointing out is that we are not facing the risk management problem honestly. When we do see improved marine survival rates, we will not have in place any protocols or strategies for dealing with the trade-off issue. What we have been doing instead in the face of that risk management trade-off problem, is to spawn scapegoats and ‘quick fix’ solutions.

We used to think that we could pump up productivity in a large number of stocks through salmonid enhancement so that the weaker ones could keep up with the ones being harvested at higher rates because they could already sustain them. Then we turned to habitat management. Most recently we have spawned a number of new scapegoats to try to avoid the risk management problem; we can blame aquaculture for the problems, and we will probably get into marine mammal culling before too long. The evidence is growing that mammal predation is at least part of the problem, and mammals are certainly convenient scapegoats in any case. There has been much bureaucratic fiddling under the Endangered Species Act (USA) or Species at Risk Act (Canada) to identify threatened populations and define Ecologically Sustainable Units. Yet none of this activity really addresses the trade-offs in an honest and rigorous way. We are doing everything but getting the information and facing the issues.

In the absence of any clear public policy direction about how to deal with this risk management problem - and if we are to operate along trade-offs where we determine which stocks we will write off in order to be able to harvest the others - we are liable to see arbitrary and capricious solutions. In the past, the solution has been a shifting baseline syndrome, where we have concentrated management on the more productive stocks while praying that the less productive ones would not entirely disappear. In the last few years, we have seen a shift to the opposite extreme where we are shutting down entire fisheries - very valuable fisheries - in order to protect a few relatively small and unproductive stocks. The most recent examples are the closures of fisheries to protect the upper Fraser River and upper Skeena River coho salmon stocks, as if they were major contributors to the fisheries. Now that several sockeye stocks have been listed by COSEWIC as ‘at risk of extinction’, we may see major restrictions on the most valuable single fishery in British Columbia, the Fraser River sockeye fishery. Perhaps this is wise management, and perhaps it is time to protect biodiversity and stop the shifting baseline, at any expense to the fisheries. What I do not see going on out there, however, is any kind of really honest discourse and debate about whether it is really worth it - whether the positive benefits of risk management in maintaining biodiversity are justified. We are not facing the fact that it is a trade-off, similar to the trade-offs that you have to make when investing in the stock market between risky stocks and safer ones.

### **Conclusion**

There will doubtless be recommendations to increase funding for salmon protection and restoration, which will include statements that we need more information, more habitat, and more of this and more of that. In view of our track record to date and the apparent inability of our management agencies and institutions to respond to knowledge when we do get it, do you really think these are a responsible recommendations? I would rather see my tax money going to support my children’s education, the health care system and the other things that many people need and value, than to a fisheries management system that is apparently incapable of using that money wisely.