Climate Impacts on Salmon Management and Recovery in Puget Sound, Georgia Basin, and Coastal Watersheds: A Summary of Afternoon Discussion Sessions

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Summary Notes for the Afternoon Sessions
February 2, 2005

On Wednesday, February 2, 2005, the University of Washington's Climate Impacts Group hosted a one day meeting on the impacts of climate variability and change on salmon management and recovery in Puget Sound, Georgia Basin, and coastal watersheds. The meeting brought a diverse range of representatives together for a day of presentations and discussions. Participants included:

- federal, regional, state, tribal, and local resource management agencies,
- academic and federal research groups,
- non-profit groups,
- public/private utilities, and
- consulting agencies.

The following is a summary of the panel discussion (2:40-4:00) and the Mantua/Francis audience discussion (4:00-4:55). More information on the meeting, including presentations, is available at http://www.cses.washington.edu/cig/outreach/workshopfiles/salmon05/index.shtml.

Panel Discussion: What Does Climate Variability and Change Mean for Short-term and Long-term Salmon Management Objectives (2:40-4:00)

Moderator: Ed Miles, Climate Impacts Group

Panelists: Mary Ruckelshaus, NOAA Fisheries Northwest Fisheries Science Center
Kit Rawson, Tulalip Tribe
Paul LeBlond, Pacific Fisheries Resource Conservation Council
Phil Miller, Washington Governor's Salmon Recovery Office
Mike Lapointe, Pacific Salmon Commission

The purpose of the panel discussion was to bring representatives from U.S. and British Columbia fish management agencies together for a focused discussion on how climate variability and change may affect short-term and long-term salmon management objectives. The panel discussion was preceded by several presentations on the Pacific Northwest (PNW) climate variability and change and projected impacts on PNW salmon, including two case studies looking climate impacts on salmon in southern British Columbia and Washington's Snohomish River basin (a developing approach). Panelists were asked to reflect on the day's presentations and their own experiences when answering the following questions:

- What have we learned about climate impacts based on the day's discussions and the case studies?

- What does climate variability and change mean for short-term harvest, allocation, and hatchery production and operations decisions?

- What does climate variability and climate change mean for long-term salmon recovery planning? How we might consider climate change and variability within monitoring programs for salmon recovery?

- Do the current management techniques and procedures we rely on to buffer salmon populations against seasonal to interannual climate variability actually increase vulnerability to decadal scale climate variability and change by reducing adaptability?

- How can climate information be better integrated into short-term and long-term management strategies and decision-making processes?

- What advice do the panelists have for the way forward? What are the research and policy needs that will support integration of climate information into salmon recovery and management in the Puget Sound, Georgia Basin, and coastal watersheds?

Prof. Ed Miles invited the panelists to focus on the first three questions collectively before answering the last three. The questions were used to structure but not constrain the general discussion; the panel and audience were allowed to introduce new concepts or questions as they saw appropriate. Major points that arose during the discussion included the following:

- *Communication is needed:* We need to better communicate information on climate impacts and, in particular, the uncertainties to decision makers and planning entities. Information needs to be translated and communicated simply.

- *The pace of institutional change is slow:* Institutional change is difficult and takes time. Institutions often only change in the face of crisis.

- *Smaller scale assessments are needed:* Climate modeling, impacts assessment, and ecological modeling need to be done at smaller, sub-regional scales to handle the biocomplexity of different salmon stocks.

- *Scientific "vetting" would be valuable:* A framework for "vetting" scientific information on regional climate impacts similar to the Intergovernmental Panel on Climate Change would be valuable for end users. This could be integrated into the proposed Washington State Academy of Sciences.

- *Parallel strategies are needed:* A parallel strategy needs to be developed that moves modeling and assessment work forward while also moving the institutional/planning issues forward. We cannot wait until the models are refined enough to tell us all of the answers (an unlikely goal anyway).

- *Flexibility is needed:* Recovery plans need to be flexible to account for variability, change, and uncertainty.

The following is a summary of the panel discussion.

Discussion Summary

Mary Ruckelshaus, who sat closest to the moderator, was the first to respond to Prof. Miles's request that the first three questions be addressed.

Mary Ruckelshaus: Regarding question 3 and the importance of climate change for salmon recovery planning…we need to do two things. First, the climate science and fisheries communities need to communicate to and work with policy (and planning) groups such as the Snohomish Forum. What are the vulnerabilities of chosen restoration strategies given climate projections? Secondly, population diversity models need to account for adaptive responses of salmon populations to climate change (e.g., adaptive changes in life history/coping mechanisms), not just evolutionary timescales. The diversity components are probably more sensitive than total abundance.

Kit Rawson: Regarding questions 1 and 2, I agree with Kim's [Hyatt] summary [from his earlier presentation] that salmon are not simple indicators. We know that salmon have complex life cycles but we always try to find the pieces, the one perfect correlate, that we can latch onto get the forecasts or in-season escapement numbers we want. This works for a few years until we realize that one correlate is not enough. The complexity becomes unavoidable. We need to come up with management plans that are robust to both trends and variations in climate. One thing that struck me is that we have found that the volume and timing of flow is a good indicator of stray rates of hatchery fish. Climate change models show that flow will change over time and we need to be aware of that for understanding, predicting, and managing straying. Alan's [Hamlet] comment that climate is easy to miss because it happens slowly is absolutely true. We need to remember that salmon have evolved over time. All management plans need to preserve diversity to help keep populations robust.

Paul LeBlond: I see this [fishery management and salmon preservation] as a control problem. In the case of fisheries management, one wants to achieve certain escapements, population viability, etc.. This is analogous to driving car. You have to have a sound mechanical vehicle to drive down the highway; in fisheries, you have to have a management infrastructure that measures and monitors to move you along. You need to consult maps and have other information when you drive; in fisheries, you need an assessment process for fisheries management and the capacity to assess fish, habitat, and other information. To drive you need skills provided by education and training; in fisheries, you need also need skills. To drive, you need to stay awake; in fisheries, success is dependent on the keenness of managers. All of these are long term considerations that must be kept in mind but in the mean time you must be able to respond quickly, often in the span of one day or one week for harvest decisions. If you are not prepared to respond through investments in modeling and flexible planning, you are up a creek (and the fish are not).

Phil Miller: Salmon management plans are being developed around [Washington] state in response to the Endangered Species Act listings. The plans are generally guided by the objective to restore healthy and harvestable stocks. The plans focus generally on freshwater habitat, hatchery reforms, and harvest management and not on oceans and climate, but the plans are building in a margin of error when setting objectives/actions that should, to some extent, take these variables and the uncertainty into account. What I have taken from today is that we may experience more less favorable cycles and more adverse conditions in ocean and freshwater systems. Great uncertainty is likely to be the norm. Recovery plans need to be precautionary and resilient to uncertainty. I think the plans are attempting to be so, but they are being developed in the absence of real information about climate change and ocean conditions.

Mike Lapointe: What we have observed in the Fraser River in 2004 has convinced us that climate is changing. In 2004, the Fraser set 15 daily maximum water temperature records. One and a half million fish were unaccounted for, making it the third lowest escapement since 1953. Regarding question 1, I have learned that we are beginning to learn about linkages between salmon and climate but there is still much uncertainty. Understanding populations on regional scale is most important but getting to regional scale climate scenarios is most difficult. In both freshwater and marine environments, we understand some causal links between climate and lifecycle responses but (1) climate projections may not be able to give us information about the parameters we care about, and (2) causal links involve proxies and proxy relationships may change in the future. Regarding question 2, we have to continue to include climate forecasts and take uncertainty into account. Regarding question 3, is there enough resilience built into recovery plans to deal with uncertainty? We have to start focusing our efforts on the most vulnerable populations.

At this point, Ed Miles invited the audience to comment on the first three panel discussion questions and/or comments from the panel.

Kim Hyatt: Regarding Mike's final question about focusing on the most vulnerable populations - how much effort should be spent trying to maintain diversity? Where is the balance between an 11th hour investment to save something that's unsavable while other stocks are in moderate decline (and therefore potentially savable)?

Mary Ruckelshaus: This is an institutional problem. Once a species is listed, we [NOAA Fisheries] are obligated to try to protect the species. The agency cannot give up under the law. We have looked at prioritizing diversity types, specifically looking at the conservation biology principles of redundancy, resilience, and replication (the three "Rs"). In Puget Sound, for example, the 22 remaining species of Chinook are divided into five subregions. We are setting biological criteria at a regional scale for viable ESUs; each subregion needs 2-4 stocks. This allows for choice among stocks that are less rare.

Phil Miller: Perhaps recovery efforts are implicitly overambitious. There is a lot to be accomplished with the current listings and a tremendous level of implied investment. This [issue of prioritizing stocks] will come to a head as we are forced to make decisions about which to stocks to monitor. We will, in effect, be choosing what is most important since we have limited funds to monitor and we'll have to be responsive to what we learn from monitoring. There is not a lot of money for new monitoring.

Alan Hamlet: Will social and management institutions be able to respond fast enough to deal with the changes we expect?

Paul LeBlond: Institutions respond to crisis. For this situation to be perceived as a crisis there has to be strong political and public support. There is as much uncertainty in this as the science.

Phil Miller: The question is how compelling is the info? How well is it communicated? If the information is compelling and communicated well, you'll get institutional response.

Ed Miles now asked the panel to respond to the second set of questions.

Mike Lapointe: Question 4 seems to be a loaded question. The question refers to hatchery practices, transport around dams, and other short-term practices that are required to maintain fish abundance but are known to have long term consequences. Perhaps a better question would be to ask what the impacts of our actions are on salmon diversity compared to diversity in absence of our actions.

Phil Miller: Who buffers the fish from the fisherman and how well do we handle that pressure in light of uncertainty about climate impacts, etc.? This is a political question as much as a science issue.

Paul LeBlond: Regarding question 6 and the way forward…Fish have to have an economic value in order to be protected. This value mostly comes from being caught ("landed value"). Some will argue that hatchery or farmed fish are just as good as wild fish. That opinion may change with time. With respect to moving forward in the direction of modeling, we have to go to the smaller scale for climate change impacts and more detailed ecological models. Coho are easier since they do not go that far into the ocean. Fish that spend more time in the ocean will be more difficult to model. How do we define diversity? Through behavior (e.g., selection of different streams, timing of runs)? Through genetic diversity?

Kit Rawson: Regarding question 4 and current management techniques…In the Puget Sound area, we have really modified harvest management strategies over the last 6 years in such a way as to potentially decrease vulnerability to climate variability and climate change. Rather than focusing on fixed escapement numbers, harvest management strategies are based on fixed exploitation rates. So you see variations in spawning and escapement coincident with variations in ocean conditions. The rates are easier to implement and hence reduce implementation error as emphasized in Randall's [Peterman] presentation. Regarding modeling and research, models that allow us to look at diversity of life history trajectories will be helpful. We need to look at the relative success of different life history patterns and their relative successes under different climate conditions (monitoring success of different populations in different years as climate conditions vary).

Mary Ruckelshaus: How do we move forward? I am pleasantly surprised by how much the research community does know in terms of incorporating uncertainty into modeling. We need to improve our ability to communicate that uncertainty and to translate global climate model projections to regional consequences to implications for salmon. Let's try to set up something like the IPCC [Intergovernmental Panel on Climate Change] consensus system for evaluating what's understood about regional climate impacts. If those of us doing the modeling can draw on what is consensus and what is less certain, we can use that (vetted) information in recovery planning, habitat models, etc.. Another question is how do we hedge? How do we plan for the unknown unknowns? How do we make better decisions in the future in the face of unknown-unknowns? Scenario planning is promising for this but a lot of work still needs to be done. We need to talk with and convince decision makers about the need to hedge. [The Intergovermental Panel on Climate Change is a panel of 2,500+ scientists who synthesize the latest climate research every five years to develop a comprehensive consensus document on what we know about climate change. For more information on the IPCC, go to: http://www.ipcc.ch/]

Mike Lapointe: Climate change is a tremendous opportunity. Quantitative decision analysis (to link climate, salmon, and uncertainty to different objectives of recovery plans) could be used but have not been applied to fisheries very much. They have been applied in the Snake River basin. These tools could be a good technique to help managers understand uncertainty. A big component is communicating uncertainty. It takes a while for it to sink in.

Phil Miller: I've heard the beginnings of compelling messages today - greater variability, more adverse impacts over time, greater need for precaution/margin of error – all interwoven with uncertainty. These underscore aspects that are already coming into recovery plans or things that will need to be adjusted in recovery plans. I have the following advice regarding messaging [each repeated three times]: communicate, simple, and translate. Communicate with decision makers. They tend to ask simple questions - who are you? Why should I listen to you? What do you know? Why should I trust you? What does it mean? These questions should have simple answers. You need to be able to communicate why monitoring is necessary, which information is critical to have, which would be nice to have.

Ed Miles: How much time do you think we have to communicate this message as Phil says we need to? This question is largely directed to Pete Lawson, Kim Hyatt, and Bob Francis. We see clear evidence of adaptation over past 50-100 years but our climate change projections show a greater rate and magnitude of change than the 20th century.

Kim Hyatt: In talking with the fisheries science community across Canada, I have often heard scientists say they need to wait until the impacts models are more refined before dealing with the institutional issues. This is totally wrong in my opinion. Those models are built on 25-50 years of data but we may only have a couple of decades before we are *truly* up to our ears. We have to have a parallel strategy and move on all fronts (science, institutional, etc.) now; we do not have the luxury to wait.

Pete Lawson: The time it takes to change the social system is probably longer than the fish have. But how does a social system change without crisis when there is no perceived salmon crisis now? How do you get the resources to study the unknown unknowns, as Mary mentioned, when you can't get the money now to study healthy but declining fish stocks? Society waits until you have six fish left before recognizing the crisis.

Alan Hamlet: There is an analogy here with the Social Security "crisis". It's all a matter of how it is sold. We have to show what is likely to happen.

Ed Miles: Regarding Mary's proposal to set up an IPCC-like process to legitimatize what we have consensus on and what we need more information on…I don't want to let that concept slip by.

Mary Ruckelshaus: I was thinking of an IPCC-like process for downscaling of climate information to the regional scale. The stringent standards for screening information are what's appealing. The governor in Washington is thinking about a Washington Academy of Sciences for advising the state on science issues. This could be integrated into that science academy.

Phil Miller: The Washington Academy of Sciences actually has a pretty good chance of getting established and this concept would be a good fit. There are a number of opportunities to deliver the climate change message. The message he would anticipate being delivered would be a reinforcement of what's being included in those [recovery] plans.

Paul LeBlond: Mary' suggestion is excellent. The good thing about an IPCC type approach is the inter-governmental aspect. If this group brought in the scientific community and the authority of the agencies that would sign on to the report, it would provide a very strong voice. Consensus is lowest-common denominator – not alarmist. Perhaps this is something the Climate Impacts Group would want to take the lead in doing.

Randall Peterman: The IPCC is good if you can make it work quickly but it is not necessarily required. [Referenced a book on social learning and the environment that he assigned as class reading]. If you communicate science well and strongly, when effect is felt, change will happen. Three examples from the book include acid rain, the ozone hole, and climate change. It's worth reiterating that the burden of proof has to be allocated equitably. You don't hear about uncertainties in economic estimates of job losses when someone complains that dealing with climate change, for example, will cost 7,500 jobs.

Ed Miles: What kind of rapid response mechanism could be created to do the job that Mary suggested?

Responder (not identified): We need to define the focus of the group Mary suggested. I don't think there would be support for another climate group but there would be for a fish group.

Presentation and Discussion on Salmon Management and Sustainability Science (4:00-4:55)

This discussion began with two brief presentations from Nate Mantua and Bob Francis on salmon management and sustainability science (presentations and background papers for this discussion are available on the meeting web site). Bob suggested a shift in thinking with respect to salmon management to incorporate the approach advocated by sustainability science: start with outcomes to be avoided and work backwards to identify relatively safe corridors for a sustainability transition (Kates et al. 2001). Bob also proposed consideration of an "Earth System Analysis" approach (Schellnhuber 1999). The Earth System Analysis approach advocates that the least speculative and most essential principle of earth-system control is the creation of a manual of minimum safety standards for operating the earth system, i.e., "guardrails" for responsible management.

Bob set the stage for the discussion by asking the audience to consider the following questions:

- What is the concern here [with respect to salmon management and recovery] – salmon or the Puget Sound Basin?
- What are some important nature-society interactions having to do with Puget Sound salmon?
- Within the context of these interactions, what are some important outcomes to be avoided?

- How might we begin to achieve a more holistic perspective of the Puget Sound earth system? (referencing the three approaches outlined in Schellnhuber 1999)
  - The birds-eye principle? (a macroscopic technique where you observe from a distance)
  - The digital-mimicry principle? (use of simulation models)
  - The Lilliput principle? (reducing the scale of study to a small but ecologically comprehensive setting)

The following is a summary of that discussion.

Phil Miller: Regarding the first question, I would have thought the question is whether this is about salmon or the Puget Sound *economy*. The answer is both.

Bob Francis: But isn't there more to salmon than just economics?

Kit Rawson: Yes, there is more to salmon than just economics. Salmon are the equivalent to living for the native communities in Puget Sound. That vision has to be (and has been) communicated. I have trouble with the question on outcomes to be avoided. The vision of where we want to be is something that works better in terms of knowing where you are.

Bob Francis: The panel implied that salmon lack sufficient adaptive capacity. Is adaptive capacity something that we can measure?

Kit Rawson: Salmon were adaptable. The question is whether we're pushing them too far. Salmon could stand to increase adaptive capacity.

Bob Francis: Then maybe what we want to avoid is losing any more adaptive capacity.

Seshu Vaddey: You cannot always frame the discussion the way you want to because it is not politically or institutionally feasible. The irony is working for the Corps. In January I worked flood control for the Corps and we had flooding. The media was out there because of the floods. I found myself pointing out basins where flooding wasn't a problem because of dams; I found myself having to defend something that I never believed in. This creates a dichotomy with the environment at one end and human safety at the other. I like the concept of the earth system analysis because when we look at things as a system, we see that what is human is environmental.

Susan Bishop: Mary Ruckelshaus suggested an integrative science consensus panel. We have integrative models and integrative recovery planning set up, but we don't have integrative infrastructure to make salmon recovery work over the long term. Also, you need grass roots support for salmon recovery and a means for bringing different people's preferred outcomes together and prioritizing them.

Unidentified audience member: I wonder if framing the problem in terms of outcomes to avoid would enable opposing interests to come together better than the approach of asking them to agree to what they would like the future to look like. Getting coalitions together where people can agree on *something* could be great start for movement. We all can probably agree that we don't want to die, but can't all decide on how we want to live.

Phil Miller: It might be very useful to juxtapose the questions of what we want/what we don't want, because different people are motivated by what we want versus what we don't want.

Alan Hamlet: Salmon are diverse. We should have diverse planning approaches too. We are bad at deciding what we want the world to look like (we get it wrong). Hatcheries are an example of people deciding the way they want things to work and it has not turned out that way. Climate change is going to force us to learn to make decisions quickly and we won't have time to make them recursively.

Pete Granger: I think of salmon as a food source both economically and culturally. There is an important nature-society interaction through fishing. Do we want to continue fishing or not? We're not paying much attention to changing harvest techniques (still using purse-sein and gillnets). I would like to think that people would want to switch back to traps (more selectivity than current methods). This would create a higher quality, higher price product. We need to pay more attention to harvest techniques.

Bob Francis: Recreational fishing has changed. Would like to maintain it.

Pete Granger: What about making Puget Sound off limits to all but recreational fishing?

Kit Rawson: Maybe we should declare Puget Sound a region for producing salmon rather than a region that supports 3% annual population growth? It's all about tradeoffs.

Bob Francis: This approach (the earth systems approach) focuses on tradeoffs.

Bob concluded the discussion with a few slides summarizing his own take on outcomes to be avoided (including loss of salmon biocomplexity, further degradation of salmon habitat, and loss of Puget Sound marine fisheries and culture) and a slide on things to do (including developing a better understanding of the relationship between habitat and biocomplexity, and regarding climate variability as a context for fishery resources).

Concluding Comments from Ed Miles

Ed Miles concluded the day's meeting by noting what we have achieved. We have begun a conversation in a broadened context but based on the discussions, it is evident that there are three major problems of integration. First, salmon operate on multiple scales and impacts vary by species at each spatial scale. Second, we are not yet at a point where we can deliver consensus on impacts on salmon in all the dimensions despite significant advances. Third, we must make more advances on integrating what we know into the decision making arena (relating to Phil's comment about communicating and translating). We ought to work on the IPCC-like framework suggested by Mary and selling this as a fish question rather than a climate question. The discussions will continue.

*****End of meeting*****