MAY 14-15, 2001 FISH MEETING - TRANSCRIPT OF DISCUSSIONS

DAY 1

Michelle *McClure*, NMFS Northwest Fisheries Science Center
Cumulative Risk Initiative

Cody: On the graph that showed the tradeoff in mortality changes, was the x-axis survivorship from egg to the top of the dam? And the ordinate was from the *Bottom* of Bonneville to the second birthday?

McClure: Yes.

Cody: Is it known what the major contributing factors are for those order-of-magnitude losses?

McClure: Let me start with freshwater. There are a variety of factors from egg to fry, including sedimentation. Eggs don't get fertilized. Then from fry to the smolt stage, when they start migrating, there's predation and lack of food. Any number of things can happen at that stage. In the estuarine-early ocean phase, that's a very stressful time for fish, as they transition from a freshwater physiology to a salt water physiology. So there is some natural mortality that happens there. Again, it's predation. That would be the stage where indirect effects from the dams that are likely to be expressed, and other environmental factors.

Boesch: What you're really saying is that, assuming the rest of the model is correct, to increase survivorship to the point where you get lambda equals one, you'd have to increase the survival in the estuary-early ocean phase by a factor of about four. It's a big increase.

McClure: Right. As this paper has gained notoriety, I have tried to stress exact numbers. Because I think actually both percentages are very misleading. A 400 percent increase in survival is misleading, and a five percent increase in mortality can seem a little less than it might be. Right now, we've got a 1.7 percent survival. If we can get that up to 7 in the estuary, I think that fits better.

Boesch: So, if you were managing the estuary, in terms of enhancing the habitat, the target you'd have to reach to contribute to bringing the population growth to one would be a four-fold increase in survivorship in that segment of the continuum.

McClure: Right. There are a couple of things to consider. If that's the only place you're going to act, and there will be improvements likely through other actions, the hydropower system and that sort of thing. The other is that this particular analysis was done on the most recent five brood years of the Snake River salmon spring-summer Chinook, which had very low returns. So this in fact influenced by the time period that you choose.

Boesch: You said when you looked at the survival rates of the various stages, you knew the overall survival rate and then you had some reasonable estimate to the dam stage and then you

used the literature value for the ocean and then solved the ocean-estuary by difference. How sensitive is that to the basic assumption of the ocean survival rate?

McClure: The value that we used is an eighty percent survival from year to year in the ocean. If you had a big change, 0.8 survival to 0.2, that would matter. But smaller changes don't affect the outcome - this matrix is robust through a wide variety of parameter values. We've looked at different estuarine, early ocean, and fresh water values.

Quinn: I think that value —?0.8 —?is probably in the right ballpark. Yet I think it's also probably worth pointing out that just because it's in the literature doesn't mean it's data based. In truth, it's basically made up, and everyone cites it because Ricker is the God of population dynamics in salmon. Steve Matthews published one for Bristol Bay sockeye. I'm real curious; I looked it up, and it's basically made up, too. Again, it's probably about right, and there's probably some transition estuary-early ocean when the fish are small, when the good die *Young*, and it would probably make a huge amount of difference if it became first 0.9 then 0.7, but it should be borne in mind that there's still a lot of uncertainty about that number.

Goldman: I wonder if your survival has fish that have gone through the turbines?

McClure: For Snake River salmon spring-summer Chinook, and this varies from ESU to ESU, about 77 percent of the fish are transported by barging, so there's no mortality from going through turbines with them. The other way fish can get through is through spill, which is far less traumatic than going through the turbines.

Curtis: What estimates are there for mortality in the estuary as compared to the time of entering the ocean? Say the first couple of months after they move out of the estuary into the ocean.

McClure: For this particular ESU, again I'd emphasize the Snake River spring-summer Chinook, they don't appear to spend a lot of time in the estuary -- just a couple of weeks before heading out to the ocean. But the systems (estuary and ocean) are dependent on each other and at this point, we can't tease the two apart. Other ESUs spend a lot more time in the estuary. So, for example, Snake River fall Chinook spend a number of months there.

Curtis: But you have no estimate.

McClure: I have no estimate.

Quinn: So, your estimate of the mortality rate from the last dam to when they hit that 0.8 percent... So what is the mortality rate during that period?

McClure: 98.3.

Quinn: And have you done it for any one of the listed or under-yearling ocean-type *Young*sters, which would be much smaller bodied, have you run those numbers?

McClure: We don't have the ability to separate them out quite as well from the ocean-type fish. And so we were able to calculate basically that whole first year as a lump, but it was lumping together freshwater and estuary.

Quinn: So you don't have any estimates of those from Bonneville Dam?

McClure: Not yet.

Quinn: Because obviously those are the type that would be most instructive in general and most useful as a comparison.

McClure: I agree, but we don't have anything separate on the estuarine-early ocean survival of the fall Chinook. It's in the second birthday.

Quinn: What about this couldn't you do for them? You know fecundity. You could start with a stock below Bonneville Dam. In fact, you take on a hatchery. I mean it seems like you could put the same numbers together.

McClure: Yeah, we probably could and we haven't.

Quinn: It would be interesting, even on the back of an envelope....

Courtney: If I could just interrupt for a minute because I want to be sure that we capture everything we need to capture. Which is that Tom is I think pushing toward the idea of getting more information, which may or may not be available, which would then help us understand something. And I want to be clear as to whether that information is actually available.

McClure: It's certainly less precise, if it is available. We certainly can look into it.

Courtney: But before we go too far, the question is could you do that in a way that could be done and still reported back in a way to have any meaningful input into this process?

Casillas: [Inaudible, but suggesting how they can do it].

Quinn: Don McIsaac (UW) generated such things for three years for wild Chinook. He had wild fish, he had fish that were captured as fry and reared at the hatchery for awhile and then tagged. He had hatchery/wild and then wild that were wire-tagged....

McClure: That sound like it would be very useful.

Courtney: So to cut to the chase, can we get it done in time, and is someone going to be tasked to do it?

Casillas: We can certainly look at it.

Boesch: As I understand it, the analysis is based upon the initial starting point of how many eggs are produced. Have you looked into the alternative management strategy with respect to enhancing survival... dams, estuaries, and so on, as opposed to alternatives to basically increase the initial reproductive output. The spawning-habitat issues. Would that have a bigger effect than in the estuary - you're dealing only with what you're left with...

McClure: I think what you're asking is if you open up more habitat, will that make a bigger difference than increasing survival rate?

Boesch: Right.

McClure: At this point, because survival rates are low enough that in fact the population is declining, in most cases they don't appear to be faced with a limitation of available spawning habitat. So fall Chinook, which are mainstem spawners in the Snake River, again their abundance is lower than what could be supported in that area. If, however, you opened up habitat which was of much higher quality, and by so doing you increased survival during the first year, then you might actually have a larger impact. It would be dependent on not only having more habitat available, but on access to habitat.

Cody: On the ordinate here you have estuarine and early ocean survivorship combined. And we learned that there are only a couple of weeks that they spend time in the estuary. So how many weeks then are included in this phase of the mortality in the early ocean?

McClure: About 7-8 months.

Cody: So maybe 15 times as long. And then is there no estimate of dividing that mortality?

McClure: At this point, we can't divide the two.

Courtney: You listed several things that could affect that estuarine-early ocean survival. I think it would be useful to go through that again. I know you are reluctant to partition the estimated value of lambda amongst different contributing factors (ocean and estuary). I think Martin's [*Cody*] question is asking, 'Isn't it common sense if you have a period of two weeks, and a period of six months... as a first approximation a ratio of one to 15 in terms of importance is a good place to start.

McClure: Well, it might be worthwhile to go through the list. We've certainly done a lot to the estuary. We know that below Bonneville there's predation from terns and from other aquatic birds, we know that there's likely to be marine mammal predation, we know that any indirect effects due to the dam are likely to be expressed at that time, we know there may be water quality issues at that life stage, we know that there are a number of competing species in the estuary that might compete with food.

Boesch: On the other side, you would have to assume that refuge potential is less once it moves out to the open water so that susceptibility to predation may be higher.

McClure: That's true, but 65 percent of historic marshes in the estuary have been diked and drained.

Boesch: Right. Absolutely. But I mean as a fish is moving from the estuary to the near-shore ocean, that's one thing it's giving up even though it's compromised from what it was. There's no place to hide...

McClure: Right. That's a good point.

Curtis: How concentrated are predators around the estuary-ocean transition zone?

Casillas: [Inaudible]

Courtney: Wouldn't it be useful to try to put some numbers on this, however reluctant you are to partitioning mortality? I think it would be useful surely to say, 'If you have some information on the effects of squaw fish and the effects of terns, and you think that it's taking 30 percent of the smolts, or something like that, that would allow us to go through this list and say, 'Well, I've written down dams, predation, toxicity, loss of food to competitors, starvation, freshwater-ocean transition, and then the early ocean itself. I know you can't go further with the lambda analysis and partition the table any further, but wouldn't it help to say, even in terms of putting qualitative values on this that say 'important,' 'less important.' And that would allow us to get to the issue of how exactly how important is any estuarine effect when we come on to talk about the conceptual model, trying to understand the impact. If it's predation by terns, or toxicity by sediments, whatever it is to say, 'Here's where the major impact would be.' And wouldn't that be a useful thing in terms of the process we're engaged in?

McClure: Between the various impacts, and without knowing the magnitude of those impacts, basically what we're going to be able to say at this point is, 'If you can reduce mortality, or increase survival by such and such, by any one of these actions, this will be your response in population growth rate. But without knowing the magnitude of any of those factors, it would be very difficult. We've been working on getting the estimates down to stock levels. 30 million smolts are being taken, but are those mostly steelhead, or hatchery fish?

That's a really different question than what the effect on land is. Until we have a really good estimate of the effect of those toxins, I can't tell you what the effect on population growth rate is. I can tell you <u>if</u> the effect is 10 percent, 27 percent, 83.6 percent.

Collier: I want to go back to your point about how to parse out the different stresses and how they may be related to mortality.... Trying to parse out is not very productive....

Goldman: There's been such a long history of Pacific salmon investigation. It's almost as if the wheel has gone full circle. In the early days, there was a big concentration on predation. Then I was particularly interested in fertility aspects. I haven't heard much on much on getting after the survival as they hatch and come out of the gravel.

McClure: EPA is funding two studies that are addressing that exact issue. Nothing definitive yet.

Quinn: Doesn't the very large variation in total marine survival from year to year argue against a strong estuarine importance? The variance seems to be driven more by nearshore marine processes.

McClure: It certainly argues that ocean conditions play a large role.

Quinn: Beyond the scope of our control, unfortunately.

Cody: Does that have anything to do with El Nino effects?

Quinn: Sure. But regardless of the climatological effects, there's a huge variation. And the estuary simply isn't changing that much from year to year... Certainly plenty of populations with no estuarine damage or change undergo huge year-to-year variation in marine survival.

Boesch: It strikes me that in other fisheries where there are offshore spawners... One of the ways that estuary condition is an important aspect of their success is it's underpinned by some fairly good statistical correlations. In other words, if you have a year to year variation of conditions in the estuary that you think are conducive to estuarine survival and can correlate those conditions over many years to the cohort success then it makes a strong case. So, I wonder whether there's any attempt to look at how variation of estuarine conditions, say as a result of flow variations, in the Columbia are able to be correlated with the ultimate success of that cohort?

Casillas: None that I'm aware of. [Inaudible].

Don Weitkamp, Parametrix, Inc.
Overview of Listed Salmonids

Quinn: The presentations focus on importance of the estuary. With all the horrors of the river -- eight or nine dams -- you're still losing only about 50 percent of the fish. Yet, in the estuary and the near-ocean period, fish losses approach 98 percent. Not clear whether fish are being lost mainly in estuary or near ocean. Is this a pasture or a trap?

Weitkamp: Well, it depends on the life history type we're talking about. I'd say the estuary is important, not that the salmon like it or dislike it so much, but it's obviously an important part of their life cycle, particularly for the fry and fingerlings. They've got to do a substantial amount of rearing, and they've got to have conditions where they can do this. Food supply... I think there's a lot made of predation. There are a lot of predators and there's competition for the same food sources. So I wouldn't say this is necessarily a friendly environment, or a place they like to be, but a place they need to be. And they need to have decent conditions there. A lot of these fish probably aren't present in the lower estuary for more than a week or two, but some of them are

definitely there for a month or two. And during that time, they need to grow and grow substantially so they can survive in the ocean. Predation in the ocean is a big factor.

Quinn: To say that fish die of predation is almost a truism. At some point, they're going to end up in somebody's stomach. I'm trying to get at this business of where they're dying. My suspicion is that they die primarily early in the ocean, rather than the estuary.... They're evolved for salinity, that's the plan.

Curtis: How productive is the Columbia estuary relative to other estuaries?

Weitkamp: I don't have that information, but Si [*Simenstad*] will address that for corophium later today.

Goldman: We have often been told that the salt wedge provides a nutrient trap and therefore is a very productive component. I'm wonder if the salt wedge in this estuary behaves in some unusual fashion so that we don't have this conglomeration of particles, particularly organic particles, that filter feeders feed on up the food chain.

Weitkamp: I don't see any information that would indicate it's unusual, would you Si?

Simenstad: No, on the contrary, it's probably one of the strongest turbidity maximums that you'll find in the literature.

Courtney: So how do you reconcile that with empty stomachs?

Weitkamp: I can't say that we have any clue. I didn't want to make too big a deal out of the fact that there's an indication that some fish aren't getting enough to eat, other than the fact that I haven't seen it for any other estuary.

Courtney: Where are the data from?

Weitkamp: Most of the data are from Jones Beach, upstream of the estuary.

Courtney: So it could be something else entirely, something that has nothing to do with conditions in the estuary.

Weitkamp: That's true.

Schiewe: Might be hatchery fish. The run is 80 percent or more of hatchery fish. The years in which you find limited stomach contents is when you have overlap between Chinook and steelhead, suggesting perhaps that they've over-produced artificially.

Young: When you presented the bathymetry slide and pointed out that a lot of the shallow-water habitat is not shoreline oriented and you speculated that that's a very rough environment that hasn't been utilized. Do you have any data that those areas are not being utilized?

Weitkamp: I don't believe we do.

Young: I think your point is very important. If these areas are in fact deserts, then the focus of some of these analyses should shift more toward shoreline habitat. But before we go there, we'd better validate that hypothesis.

Weitkamp: I wasn't trying to imply that they're a desert. That's a much less hospitable environment for the fry and fingerling-sized sub-yearlings out there where it's relatively high energy than the shoreline areas.

Courtney: But it does sound like someone needs to be tasked to collate the data to find out relative densities of the fish in different areas.

Weitkamp: That would be desirable.

Cody: In terms of the diets, I'm looking at McCabe's paper (1983). Would we regard these data as representative of the current situation in the estuary?

Weitkamp: I'm not aware of great changes since that paper was published.

Cody: If we take shad, for example, it seems to be a substantial competitor for daphnia but not for corophium.

Weitkamp: True.

Cody: And so, therefore, we would anticipate relatively little competitive effect of shad.

Weitkamp: The daphnia is probably more of an important food source in the lower river upstream of the estuary where if we have an effect on food supply, it may be most crucial.

Goldman: Has there been stable isotope work on who's eating whom?

Simenstad: Not much.

Courtney: Is there comparative data from other estuaries that can give us insight into the Columbia River estuary food web?

Weitkamp: The white paper shows data for Chinook from several estuaries -- Fraser, Chehalis, Duwamish, Puyallup, Puget Sound. The last three are very modified estuaries with different food supplies. It's difficult to make any kind of a comparison that you have much confidence in.

Courtney: I wonder if any of the panel members agree that there's no simple comparison between modified and unmodified in terms of changes in food webs.

Goldman: Water temperature and availability through fish by-passes are very important for improving survival.

Curtis: I have a question from the McCabe paper. I'm struck by the very low number of cutthroat trout they collected relative to the other species. I was curious if this is an anomaly.

Weitkamp: One of the reasons is the susceptibility of the fish to the gear they were using. However, anadromous cutthroat would be a relatively small portion of the population in the estuary.

Courtney: You raised a flag with me when you indicated you're not happy with one particular data set. The small salmon being in the estuary for 6 months, and then you said they're either totally food-limited or the data are wrong. I'm going to press you on that since one of my jobs is to flesh out uncertain information. So what do you think is really happening?

Weitkamp: Six months rearing in the lower estuary is not very representative except for cutthhthroat trout and bull trout. More likely 1-2 months.

Courtney: Well this is a key part of the analysis in terms of trying to figure out how important the estuary is. Others of you who have experience with the estuary, do you agree with Don?

Weitkamp: I don't view the time fish are present in the estuary as defining the importance. The amount of growth that has to take place there is very important.

Courtney: But I think you'll see tomorrow that way that we're headed with the analysis includes trying to figure out level of exposure to different environmental conditions. At which point it becomes key to figure out whether they are there for 2 months, 4 months, 6 months. So that's a key variable.

Simenstad: I think six months is extreme; two months is about the maximum you would see.

Curtis: What about growth in the 50 miles of river upstream of the estuary? Do any of these fish really rear and go through a substantial amount of growth there?

Weitkamp: I haven't seen anything. Literature implies they're moving through there fairly quickly.

Goldman: I've always heard, particularly for sockeye in lakes, their growth rate really determines whether they spend two years or three years in the lake. Why would that be any different? I would think that a departure from the estuary to the sea would be very related to how much they can feed in the estuary.

Weitkamp: It may be. Keep in mind that this is a huge estuary and it's tough to get a good picture of what's going on in the estuary. In other estuaries, there are a variety of things that happen.

Boesch: My experience shows that these kinds of fish that use estuaries in some important part of

their life cycle tend to be quite opportunistic. They'll eat what they can get. And so you find differences in what they'll eat from one estuary to another, depending on what's available. Secondly, almost in all cases, everything is food limited. You can always expose them to more food and they'll grow more rapidly. So it's a question of how seriously food limited they are and whether it affects survival. Anyone disagree with those points?

Weitkamp: There's a lot in the literature that points to juvenile salmon being highly opportunistic.

Quinn: Studies suggest that year-to-year variation in survival is almost independent of size. That within a year, the larger fish survive that's a comparatively small effect to time. So the hatchery studies that compare time of release and size, the date makes much more difference than size. In fact, at many release dates, the smaller fish survive at higher rates than the larger fish. So the date is probably a much more important factor.

Courtney: How well are we going to be able to associate a stock with a particular time when they're in the estuary? How good are the data going to be when we try to do that?

Weitkamp: I'd say it's reasonable. It depends on where the stock comes from. We can make reasonable estimates of how long they're going to be there.

Cody: Relative to the differences among the 14 ESUs, you gave us a fairly good picture of what the juvenile salmonids do with respect to being within a meter of the surface, near the shoreline, with current velocities are around 3 meters per second, salinity tolerances.... Are those generalities that apply across all of these 14 ESUs, or is there a diversity amongst all these....

Weikamp: As the fish increase in size, it gets much less restrictive, other than steelhead, which seem to have a propensity to stay close to the surface -- not necessarily the shoreline, but close to the surface. The range of velocities they use seems to increase as they increase in size, and so they become much less restricted in their habitat requirements.

Cody: But between two ESUs that are using the estuary at the same size, would there be similarities in their use of it?

Weitkamp: I'd say most likely. Sockeye migrate actively downstream, whereas chinook and steelhead have a much slower migration rate. So there are behavior differences even when they tend to be of the same size. The one big difference between chinook and steelhead is that the latter seem to be more surface oriented in the smolt size.

Si *Simenstad*, University of Washington
Columbia Estuary 'Ecoscape'

Courtney: It sounds to me at the end there that you're making a pitch for what needs to be monitored. You talked about your various metrics. Is there anything in your proposed metrics that we've got information on that can be used in helping us evaluate the impacts of this proposed action? Or are your metrics essentially things that we should be looking at in the future?

Simenstad: The ability to predict potential change is key because of salinity restructuring on benthic communities and vegetative habitat in key locations like the interface at Cathlamet Bay. In other words, if that interface moves appreciably, there's going to be a response by the benthic and vegetative community. Trying to predict that I think is quite important.

Boesch: What sort of salinity changes would be meaningful in shallow water?

Simenstad: Overlaying benthic community structure with the salinity structure from the CREDDP studies, it would suggest that the mean isohaline would be an important feature. The important thing is how good is our ability to predict that in shallow-water habitat because that's where the critical change is going to be.

Boesch: Question from the last workshop as to whether the model is accurate for Cathlamet Bay. In answering my question just now, you talked more about mean condition, rather than low flow, high flow.

Simenstad: More the means rather than the extremes that sets the vegetation and benthic community.

Boesch: So a model of extreme low-flow conditions might be useful? (Yes)

Quinn: What are the physical things that are likely to be connected to these metrics?

Simenstad: The physical changes, the attributes, that are going to be most important, are the vegetation and the benthic communities in those systems.

Whitney: The real challenge is to explicitly link these measurable metrics in terms of diversity of landscape to capacity in say _____. To me, that's the challenge, to relate it to a model such as CRI. You want to link your landscape attributes to capacity as well as to productivity.

Simenstad: I don't think you can disconnect opportunity and access because the physical environment will potentially limit access to capacity. Just measuring capacity won't necessarily reflect actual access.

Whitney: I guess my point is... At what point in your exercise do you explicitly link these measurable attributes of salmon life history...

Simenstad: Basically, I think you have to do that empirically to determine what the timing and characteristics of different life history types that occupy those various habitats in various regions through that system. I don't think we can extrapolate; we just do not have data at that level. We really don't know what the timing, the life history structure, and what the habitat utilization is that we could use to build that linkage.

Whitney: Well, without making that linkage between these attributes and salmon population ___,

how would you be able to compare whether channel dredging or anything would influence salmon life history diversity.

Simenstad: Right now, all we can do is use the data from other systems.

Courtney: Let me just interject and say that I think your questions are great and getting at the crux of the issue. Part of what we're trying to do here is to evaluate that decision-making framework, given that there are uncertainties in both the data and the structure of modeling those ____ populations....

Whitney: Are you [Simenstad] familiar with the EDT model? Is that something that would be useful in the estuary?

Simenstad: As I've seen it applied in the estuary, I don't think so. But I think the problem is with the application and not necessarily with the model. EDT is a very best-professional-judgment-driven model. I'm not totally excited about that approach.

Boyle: Question about plants.

Boesch: Do you have a sketch of that diversity?

Simenstad: Yes. If you look at chinook in the Chehalis system, they spend anywhere from days to weeks in tidal forested slough channel. Once they get to the fingerling size, they move to the tidal marsh habitat, where more brackish species reside. And they start feeding more extensively on coriphrium in the flats and in the tidal channels, etc. So there's quite a synchrony to habitat choice, which seems to be correlated with salinity, but is tide to habitat.

Boesch: The ones you mentioned are all sort of at the shallow-water end of the habitat spectrum. Is that where that diversity primarily is manifested?

Simenstad: I think so.

Boesch: So it's not so much the consequence of the channel deepening on the channel morphology and habitats in the open estuary, but how that might influence mainly vis-à-vis salinity? (Yes)

Cody: To put it another way, as I see it, the possibility for the project to influence these factors varies quite a bit, and it seems that the one with the highest potential is perhaps the habitat quality where we have the possibility of influencing yet more increase in the macrophytes, for example? Is that where you see the potential for the greatest impact of the project?

Simenstad: That and if there is any effect on ability to access that. If the project were to further fragment the linkages among those high-quality habitats, that would go hand in hand.

Cody: And habitat opportunity you described as pretty much a product of bathymetry and flow.

Simenstad: Yes. Tide, bathymetry, river discharge are the key factors.

Curtis: The fish can handle the salinity change, and the corophium could re-colonize. The primary risk of salinity intrusion would be damage to vascular plants and increasing the salinity of the soil because plants are an important source for fixing carbon, which is an important part of primary production of the estuary.

Courtney: These are key points that we're going to need to re-emphasize when we look one more time at the model tomorrow morning, when we look at the physical modeling about our capacity to pick up those very things and where we want to see our monitoring and modeling stations.

Walter *Pearson*, Battelle Marine Sciences Laboratory
Conceptual Model for the Columbia River Estuary

[*Pearson* provided an overview of how the model will be used to describe ecosystem function and interactions relative to effects of the project on fish. The panel questioned exactly how the model addresses the effect of the project on habitat opportunity.]

Pearson : This is not the analytical tool for the quantitative analysis. This is a tool to help us organize the information, and at some point to figure out what's important to look at analytically.

Courtney: Document 2 issues to highlight usefulness of the model.

Cody: So in a sense then this is the outline of the job before us. Because we have to determine the influence of the project on these issues.

Cathy *Tortorici,* NMFS
Proper Functioning Condition

Boesch: I know you said you haven't developed a PFC for the estuary, but would this approach in terms of describing the habitat environmental conditions that you think are required, has NMFS begun that with respect to the estuary?

Tortorici: Yes, but we're still very much at the beginning stage. It's very complex.

Boesch: Why would it be inherently more complex than say, stream condition?

Tortorici: In the PFC we're working on, it's not only the estuary we're working on. It's upstream as well as the ocean-estuary interface.. It's all 3 of those things combined. In addition, data are limited.

Courtney: Does the panel see the connection between the PFC and the conceptual model?

Boesch: It says here that it's going to provide 'descriptive and qualitative indications' - yes, could do that -- 'of how historical conditions -- no, not that I heard -- 'and/or a PFC' -- no because it didn't give some specific indicators, criteria that were used in the other PFC example. So I'd say the conceptual model has a long way to go to meet two of the three expected uses.

Tortorici: Fair enough.

Dunne: I'd like to get a sense of how you think you will be able to integrate PFC with this matrix. I don't understand how you can incorporate historical conditions when they're so poorly, or incompletely, understood. We hardly even understand current conditions, let alone historical conditions. What's your strategy or timeline?

Tortorici: That's what we're struggling with. We're essentially using our best professional judgment of what's in the literature. What we need to do next is to send that around to the scientists in the region and ask them where can you get the information from to build those more detailed metrics? Because of the general lack of information, I suspect it's going to rely heavily on their best professional judgment. It's going to be an evolving thing. We're going to have to have more regional consensus and more peer review of it to make sure that the information that's being used in it is coming together from the group of scientists.... I realize it's not the most precise answer, but it's kind of where we're at. I really wanted to have this by the end of the year.

Historically, there were certain habitat features that were important to the fish, and we have a sense of those I believe and so let's take a look at those features and try to use that information in some way to value what's going on in terms of current baseline and overlaying this project on top of it. I wouldn't say that we're trying to reconstruct historical conditions. We're just trying to learn from historical conditions as a methodology to help us with what we see right now.

Quinn: I think Tom [*Dunne*] is right; there are decades of forestry and fisheries work.. But I'm not sure it necessarily took all those decades to get this kind of document.

Tortorici: Right. It's taking people in our office sitting down for months and months putting their heads together to work this out. But having the knowledge base to know where to get the information....

Dunne: But that's the point. It's the knowledge base that took 20 years.. I didn't mean you sat around for 20 years...

Quinn: Maybe one suggestion: The forestry and fish data are heavily observational and hardly ever experimental. You might move a bit faster on some of these things through well-designed experiments. There are a lot of things you can get faster than 20 years.... that's awfully slow.

Dunne: But presumably one advantage of some kind of adaptive management process is getting to those answers.

Tortorici: Absolutely. What I've been more than willing to do is to share with the group what we've got so far. If they want to comment on it, that would be fine.

Boesch: I'd just like to say that you [NMFS] don't really have a choice but to try to understand the present-day relationships between the fish and the habitats and then assume that the values are the ones you're going to manage for. I'm actually, despite other lines of questioning, fairly optimistic about being able to tackle that. Already you've had Dan's [*Bottom*], Antonio's [*Baptista*], and Si's [*Simenstad*] analysis of the historical changes -- trying to model historical changes in depth and flow -- very valuable to understand that in the long term. You have the analysis, some of which Si showed in terms of the changes in the desirable habitats in terms of wetlands and so on. So, I think we have a strong basis of reasoning that those are valuable as opposed to some of the alternatives.

The question that I have, though, is that one of the things about estuaries, the common pitfalls that people get into in trying to understand and manage them, is that they think they're static features. And really they're quite dynamic and ephemeral. Inherently, they're about change. I would urge you rather than always thinking about the past, to think about the future in terms of what are the opportunities to manage for positive values with the changes that are taking place. Case in point: Si talked about the deposition that's taking place on the tidal flats. The point is to think about the future in terms of the changes that would be taking place in that context. Channel deepening maintenance is just one of those changes. Then determine where are our opportunities to manage those processes constructively for the value of the habitat. Rather than always thinking about we want to reconstruct some picture of the past. It's Dorian Grey; you're not going to get there.

Tortorici: I agree with you..

Cody: So we don't really have an archetypical idea of PFC, right? We would've defined the estuary 500 years ago, or 100 years ago, as 'properly functioning.' There's a possibility that we might define it today as 'properly functioning,' and also a possibility that in the future we might define it as 'properly functioning.' But all of those estuaries -- the 500 year-old, the 100 year-old, the current, and the future -- are all different. But in some sense, they all have the possibility of meeting your criteria. So in that sense, it's not an 'archetypic' concept, but more of an 'ecotypic'concept.

Courtney: Think about all the things we've heard today and the different assessment techniques. We started out looking at the Kareiva et al paper, which is highly quantitative, but essentially doesn't allow us to get at anything in the estuary with any degree of confidence. It says this whole year class is important, but it doesn't tell us what role the estuary plays. And I think the comment was made that even if we could partition it out further, all those factors interact so much that you can't take a quantitative approach and have it mean very much.

Then whether you look at the conceptual model or at the PFC approach, essentially they're not really ready to be used in any predictive sense. So really, you're [NMFS] left with a tool that doesn't allow you to make any real predictions. How will you make a prediction without having a

quantitative or qualitative model in which you have any faith?

Tortorici: I think the issue, Steve, is that we have to be able to say something. And it's the confidence with which we say it, and the scientific basis with which we say it that we're struggling with right now. So it doesn't mean that we can't use some element of PFC in the description of the effects analysis in our Biological Opinion. It's just that the extent to which we can rely on it perhaps will be more limited than in another Biological Opinion where we have a fully developed matrix. We're going to make a decision, but it will be expressed with the caveat of uncertainty.

Courtney: It seems to me you're moving toward a PFC approach and you're going to try and lay that out. But is that going to be formalized in any way so that we know what your decision boxes are?

Tortorici: Yes. Certainly in the Biological Opinion. That's the document that tells the story of how we describe this system, of how we made this decision. The extent to which we use the PFC approach in that I'm not prepared to say right now.

Courtney: Is the conceptual model of use to you in allowing you to formalize the different potential impacts?

Tortorici: We haven't talked internally enough about the total relationship between PFC and the model. I'm not saying those two things are diametrically opposed; we just need to think about it more.

Courtney: I just want to emphasize that there's no way we can get to a quantitative model in the sense of understanding what it does to a population in any timeframe that's relevant to this project.

Tortorici: I'm not saying no, but I don't think so.

Dunne: Starting from the project, it seems to me you have a chance because you can address current concerns and correct problems as they arise. But starting from the whole ecosystem, I don't think you have a chance. If you start with the ecosystem, it's too large. If you start with the project, it's too narrow.. Why not ask, 'What could go wrong?' Start from there.

Tortorici: I really don't think that starting with the 'whole estuary' is where we're coming from. We understand that there's a project and that we have to deal with impacts related to the project. But, what is the context in which you view those impacts? Are we viewing it in the context of just the project or how that project causes indirect or cumulative impacts? It's not that we're avoiding a discussion of the project impacts. We [project managers] felt we needed to provide the panel with a grounding in the physical and biological processes of the estuary before moving into a discussion of project impacts.

Goldman: It seems to me that considering what we think we know about climatic change, that we ought to have a futuristic component built into this to address the prospect of, for example, low

flows.

Tortorici: I agree with you; it's just a bit daunting to figure out how to go about doing that. But we're open to suggestions.

Curtis: To what extent do you think you'll be able to use habitat information from other systems on the West Coast in refining your PFC model?

Tortorici: I personally would be OK with it, and I believe to some extent we've already done so, where it's appropriate.

Panel Discussion

Courtney: You've now heard what techniques are available, and you've heard about their limitations and their strengths. This will allow us to move forward to evaluate project effects. Are there any comments from the panel at this point?

Boesch: I just want to add to the discussion between Cathy [*Tortorici*] and Tom [*Dunne*] where Cathy concluded that the decision was to lay out all the facts before getting to the discussion of the impacts of the project. I think what Tom was trying to say was that waiting until you have everything on the table may not be the best approach.. I think the frustration is that we're trying to understand the relationship of all this tremendous amount of information, and lack of information, to try to put it in the context with what we understood was the charge to help all of you think through the potential impacts of the project to all these listed fish. So I would hope that tomorrow, and in subsequent meetings, that we would always try to come back to a discussion of the impacts of the project.

Secondly, I think I've heard a continued strand of concern about the subtle importance of these shallow-water habitats. We know that there's been a historic reduction of these habitats. We know that these habitats have been affected by a number of physical processes, which could conceivably be affected by altering the morphology of the lower estuary. And we know that in some general sense we've lost the complexity of those habitats, which has allowed diverse genotypes and phenotypes to use this system. Maybe the upcoming sediments workshop could focus on these shallow-water habitats. I'd really like to get our arms around that. The relationship of altering the morphology, and then maintaining that alteration over the long-term to these shallow-water habitats, I think is the essence of our task.

Having said that, I want to qualify it. We've been focusing on the brackish water portion of this system. That's only about 1/6 or 1/7 of the channel deepening portion. I'm curious about the area of the river that is more constricted where the alteration of the channel is a more significant alteration to the cross-section of the system. To what degree is that part of the river important to the salmon? And in that context, how can we understand the consequences of channel deepening? How does channel deepening affect depth and flow in that part of the river?

Goldman: I'd like to add to that. One of the things that bothers me is that we seem to be totally

focused on the estuary. Maybe there's a feeling that nothing can be done upstream. Yet these fish are going to come down the river. Maybe I'm jumping ahead to mitigation, but it seems to me that if you can get an increase in littoral habitat along the mainstem of the river, you might be mitigating downstream migration problems with a better source of food, maybe slightly warmer water. Rather than focusing on an area where there seem to be so many unknowns that we're kind of back to the adage that 'No level of sophistication in modeling can compensate for having missed the most important variable.' It seems to me we have to look a little harder in the estuary, and at least come to the decision -- whether it's food supply, toxics, not enough shallow-water habitat, or predators -- and get some numerical insight into that if we can extract it from this estuary or from another estuary.

Cody: My impression of what we've heard today is that I've gotten an increasingly detailed picture of the diversity of processes and components in the estuarine system. Although fascinating, they are not perhaps the tools we need to meet our charge. I see a strong parallel between the conceptual model and the PFC. I think the conceptual model simply says that these are the processes that take place in the estuary, and I think for a good reason, the focus is on the estuarine ecosystem.. And when the PFC is completed, presumably it will enumerate the same sorts of important processes and put values on them. So the two are very close. I still haven't fully embraced this idea of PFC because I'm not sure that it can accommodate the fact that similar ecosystems can function in different ways.. One size -- the PFC -- does not fit all ecosystems.

I think perhaps the closest we came today to approaching our charge is the penultimate slide Walter [*Pearson*] showed on the issues. I thought if the rows of that matrix could be prioritized with respect to what we imagine the impacts of the project might be, it would simplify things. But then if we were to add a couple of columns like the first column would ask, 'what is a reasonable consensus of the impact of the project on the issues Walt listed in his first column?' It seems to me that we might be able to come to consensus on whether this is not worth considering as a potential impact because it's essentially negligible, or whether we might want to give that considerably more thought. And then in the second column, I would add to that slide, is basically given that this is the consensus of the impact of the project, then we read over and we see that that issue affects say habitat-forming processes and then we have to make the decision about its importance.

Courtney: Martin [*Cody*] has suggested that we spend more time on that penultimate slide.. Work through the things that cause the most grief, and then try to work through the conceptual model and perhaps we can help prioritize. One of our goals is to identify information gaps. Does the panel see anything we're missing?

Goldman: I'd like to know from a hydrologic standpoint how much of the shoreline we might dry by this deepening, how much more velocity in the mainstem, how much estuary and shallow zone we might lose around the edges in terms of habitat.

Courtney: I guess these are things Antonio is charged with coming back with in three months or so.

Eriksen: We have information on changes in water elevation. I'd be happy to show it to you, but they're pretty minor. It doesn't show any change until you get upstream to about river mile 65 or so, and then you start to pick up a little more change where the river is more constricted. By the Portland-Vancouver area, there's a one-tenth, few-tenths of a foot change.

Curtis: Could you address the same thing for the salinity wedge? It'd be nice to know how many acres of vegetation would be impacted by moving the salt wedge up as a result of the project.

Eriksen: We looked at that in the original workshop five years ago. We found very minor changes in those shallow-water areas -- one-tenth to three-tenths parts per thousand increase in salinity in the areas that have concentrations between zero and five parts per thousand. These were the maximum changes that we found in our analysis. That was the analysis that all the agencies agreed to. That's all documented in the original report.

Curtis: So if Antonio's [*Baptista*] independent modeling is consistent with the original modeling done by the folks from Vicksburg, and you have a quantitative estimate of the salinity change in the area affected, then we'd be a long way toward answering that question.

Eriksen: I think all the information you need on the effect of salinity changes to the benthic plant community are in the original analysis.

Courtney: Are there any other gaps we need to discuss?

Cody: I think we've covered everything qualitative.

Quinn: Are there components of the Columbia River system, sub-estuaries, if you will, that can be used as sort of a template for what things ought to be like for PFC. Or are there comparable estuaries elsewhere?

Simenstad: can't look to other systems (outside the estuary) because they're so different. The problem with inside the estuary is that all sub-systems are heavily impacted.

Day 2

Courtney: (Recap of what he heard yesterday): Evaluate adequacy of and completeness of data and the approaches that are going to be adopted - we're in good shape. There was some critique of our ability to reach quantitative conclusions, but I did hear that we as a group identified all the issues and that we identified all the data sets, and with one or two exceptions, there was nothing else that the panel could identify that needed to be done. So in terms of our meeting goal -- adequacy and completeness of the data sets -- it's a qualified yes that we're looking at the appropriate scope.

The group also heard the panel's suggestion that you adopt as quantitative and as explicit an approach as possible. Nevertheless, the panel understood the use and the need for a conceptual

model that will tie things together. We heard some interest in hearing more about upstream areas. Also heard a suggestion in terms of prioritization of the concerns raised during the consultation documents and the reconsultation process. Suggestion that we go through Document 2 in light of the conceptual model.. Put on record that the regulatory agencies need to have ALL of that addressed, even though we may elect to try to deal with the things that are most burning. Nevertheless, from a process point of view, regulatory agencies are going to want to see all of those things considered.

Today, I want to try to tie some things together in terms of making the linkages that the panel was asking for. Then, consideration of the modeling approaches, and tell you about what's happened in the last two weeks. Then we'll try to integrate everything we've heard so far and come to completion.

Doug *Young*, FWS, and Kim *Larson*, ACE
Matrix Update

The Fish and Wildlife Service and Corps provided an overview of multi-agency efforts to update and refine the matrix. *Young* explained that the modeling outputs would link to a 'post-processing output' that would identify an effect from the project. The conceptual model would be used to indicate where further analysis would be needed. *Young*: "It's very important that we have a good baseline developed... It's also important when we write our effects analysis that we've addressed every single linkage we can think of in the estuary that might have an effect from the project. So the conceptual model is, in effect, giving us a roadmap to where we need that biological group to do tough discussions of what are the true effects.'

Courtney recommended that *Sullivan* provide information relevant to the discussion on water velocity values. *Curtis* said model needs to employ a gradient of velocities because velocity is different throughout the estuary. *Dunne* criticized the items in the matrix's cells as being "too cryptic." Outputs need to be more explicit. *Larson* explained the results represent "a first cut;" that biological information will be melded with the matrix over time. *Boesch* felt the group is 'on the right track,' provided more detail is added. He saw the value in having the effort defined 'before the fact, before the model results are actually produced..' He also praised the effort as collaborative, involving all the parties.. Some concern was expressed about whether critical parameters of concern have been left out. *Larson* explained that this is an iterative process, seeking input from the group. *Courtney* suggested the model integrate biological concepts of connectivity and access as they are affected by the various physical factors; suggested looking at whether a change in connectivity can be predicted as a result of the project.

Courtney summary: Potential other data on velocity should be looked at, and the matrix should be modified accordingly. The matrix is missing potential biological effects and needs to be tied in better with the conceptual model. No mechanism by which a significant or insignificant project effect can be identified.

Quinn: Three points: With regard to velocity, the preferred or appropriate velocity doesn't just

scale to the size of the fish, but to the motivational state of the individuals. If you're looking for Coho fry in a stream, you're going to look to slow water in a pool, but those same fish when they're migrating, they're going to be in the fastest water possible. It's not just because they're bigger, it's because they're migrating. So your larger individuals may be in a migratory mode whereas your *Young*sters may be in the margins feeding. So it's not simply that this velocity is inappropriate, it needs to be scaled. You guys are emphasizing the differences among the ESUs. Well that's precisely where this should come into play.

Second, with regard to temperature, I'm reading 0-18 degrees as lethal. Certainly 18 degrees isn't lethal? I'm not sure what to make of that.

Third, it seems like one-fourth of a part per thousand is pretty fine grained for the salinity.

Baptista: Even if you needed it, we couldn't deliver it.

Boesch: What we're really doing here is not to define absolute truth, but to look at changes. And so for example, with regard to temperature, it might be helpful in this model to say, 'In the conditions where temperature might be stressful to the fish -- however you might define that --- would you predict any change in temperature post project?' If the answer's no, then you don't have to debate the issue about whether it's 18 degrees or 21 degrees. You're just really looking at the change. Dan's [*Bottom*] point is that we don't really understand connectivity, but we can at least ask the question, 'Is there a change in connectivity?'

Casillas: [Inaudible].

Sullivan: If you're looking for habitat change, you do have to get the numbers somewhat right because when you model, you could really interpret the wrong results.

Antonio *Baptista*
<u>Update on Physical Modeling</u>

Boesch: I think if you could pull this off, it would take us a very long way to understanding what kind of physical changes there may be and how to interpret them.

Baptista: There is some indication from the previous work we did in *Bottom* et al. that it's reasonable to expect some meaningful results could come from this.

Dunne: If I remember correctly, you said the spatial domain ends at Longview. The Corps has already done some calculations that would lead one to believe that the biggest impacts are likely to be on the river. But that reach doesn't emerge as a zone of interest to the biologists who've been making presentations to us. Yesterday, we heard that there's a lambda value calculated from Bonneville to the ocean, but all the action is interpreted to be in the estuaries.. So, I just want to make sure that we don't have a plan where we're going through all this.... and we get to results and somebody says, 'Wait a minute -- what about the river?'

Courtney: I think we're going to have a little discussion about the river later today.. But we need to canvass with the project managers to figure out what's going to be done about other parts of the project. For the moment, though, I'd like to maximize our usefulness to Antonio. Perhaps I could raise a few issues that I think need to be addressed. One is the issue of verification. Where you're going to have some, but limited, verification of your model. I'm trying to lay out any potential uncertainties. Do you feel it's a fairly robust model despite the fact that you'll have a limited data set?

Baptista: I think what we have is adequate to address the questions we've been given..

Courtney: Panel?

Dunne: I thought that also about the WES profile. Unless he spends an unlimited amount of time investigating individual discrepancies, we'll have enough results to interpret adequate to answer the question.

Courtney: Because we have limited verification, is there any increased uncertainty in the approach? Not in the data or the model results, but in the approach. I think what you're saying, Tom, is that this is a good approach.

Dunne: On any reasonable timescale, you'll always have to interpret the results. You'll end up interpreting basically on hydraulic intuition.

Goldman: I'd like to go back to one of the early parts of your presentation where dissolved oxygen is considered unreasonable to expect results from. Is there any evidence from the data that there aren't any serious sags in oxygen? We're all aware of the inverse relationship between temperature and oxygen, and that holds very nicely if you don't have any major pollution sources.. So is there any evidence of any serious oxygen sags during the warmer summer months in the estuary.

Simenstad: I don't think there's much evidence for that in the estuary, not that it's been well documented...

Goldman: Upstream?

Simenstad: Upstream there's some evidence from the backwater sloughs that there's some potential for that.

Baptista: I think that's right, but I hesitate to say so definitively.

Boesch: That's unlikely to be affected by channel geometry, though. I just want to add on to your question, Steve, about the adequacy of the model. I think Antonio made a good point of how an exercise like this is sort of an inexorable approach to perfection. One never reaches it. And at some point, not using the tool because we want to make it more and more perfect becomes the

enemy of the good. I really think you have an advantage here in having two types of modeling approaches that can be compared, and also the work that's been done here which compares favorably with the state-of-the-art any other place. That's a strategic advantage, which ought to be used maximally.

Courtney: Thank you for that comment. My last question is, 'Is there anything we can do in terms of experience from other places, to if not validate this model at least validate this approach?

Boesch: One of the failings of a lot of other modeling exercises around the country is how uncertainty is swept under the rug and ignored. One deterministic output or solution is given to the managers without a companion description of the range of uncertainty associated with those predictions. For that reason, I think this is a valuable approach.

Cody: I agree with my colleagues that I think this takes us a fair way forward, and it's a pretty good framework as far as it goes. And as far as it goes is the third column, the derived variables which are essentially a description of the potential changes in the physical habitat for the salmon. And it seems to me that the project managers will need to consider a fourth column, which is really the biological responses. And so we have very little here about first of all the fish responses to those changes in habitat; the changes in potential predators, prey, competitors; and all of that sort of thing. So that really is a column of further interpretation that is added beyond the model. There is a fairly large area of endeavor beyond the model.

Courtney: I'd like to raise one other issue. Are there geographic locations in the estuary for which we need more detailed information, better resolution? And, do you have enough information right now to make comparisons between side channel and channel areas? Do you need more information, for example, on Cathlamet Bay?

Baptista: I think I know where the mine fields are.

Panel Discussion

Courtney: All of you should have a copy of the document, "Consultation Conferencing: Technical Issues." These are all issues raised by NMFS and others through the consultation effort. Simply put, alteration of flows, salinity, and turbidity maximum are all being addressed by the models proposed. The associated biological factors — reduced ability to function as an ocean conduit for the fish — are things we need to address.. Sand transportation into the ocean is not part of the purview of this process. Similarly, "dredging forecast, too low" will be addressed by the Corps in its EIS. Sediments and exposure pathways will be addressed at the next workshop. Changes in bathymetry we're beginning to address through the model. Some information, too, on migration routes if we're going to have any impact on the channel. The things we are addressing perhaps more directly through the physical model and conceptual model would be how physical changes could potentially impact the food web or the physical and biological parts of their habitat. Entrainment, stranding, and dredging windows are completely outside anything that we've

discussed to this point. Lastly, monitoring of physical and biological processes.. We have a workshop scheduled for these, but I would suggest that we are already working through the process of defining what are the issues of concern, we're setting out assumptions that ultimately are going to be the kind of things that a monitoring program is going to be looking at and testing. So in terms of where we are with Document 2, a number of things are already being addressed or are outside the scope of this process. Any comments from the panel?

Cody: What about the three items — entrainment, stranding, and dredging windows — are these up for discussion at any time or is this thought that this is not a significant issue, or what?

Young: I was going to modify Steven's comment because I believe we have discussed the dredging window. Yesterday, we talked about fish timing and occupancy. So the modeling outputs should give us a good idea of.... that the overlay of project timing and... If we were to implement the project, we've now talked about timing the 14 ESUs through the estuary....

Cody: Yes, we did. So that would then leave entrainment and stranding as issues up for discussion?

Young: I would argue, at least for the stranding issue, we will have more information on shallow-water habitats and timing of fish occupancy, and you might be able to super-impose those two.

Larson: Well, that's not stranding. Stranding refers to the stranding of fish due to ship-wake traffic.

Young: That's basically what I'm arguing. If you know about shallow-water habitat, then maybe it doesn't model up on the shores....

Larson: Mostly the river channel....

Courtney: We don't have to cover everything in these workshops. If entrainment and stranding are issues that are going to get discussed and discussed adequately in the consultation process, we don't have to address them. If the project managers want to have discussion on those two remaining items, we can certainly schedule it in. Any other comments on Document 2? If not, then I'd like to evaluate our success in addressing the four goals of this workshop. [Goals have essentially been met, although more work remains to be done on the matrix].

Dunne: Now that we've heard what Antonio [*Baptista*] can map, I'd like to hear what the plan is for treating the other two [goals] in the light of what's possible to do.

Courtney: One of the suggestions we've had is that since that involves a little more actual work, that if we finish in good order, we might put those folks in "a smoke-filled room" later this afternoon and make that happen.

Quinn: So we're going to return to goal 1? I am unable to summarize the information gaps that have been identified here.

Courtney: Well, we're recording everything, and Doug has been religiously writing up all of our conclusions. I can't spout them all back to you right now, but we have captured them.

Quinn: Well, I guess I'm feeling we haven't tried exhaustively to identify all the gaps.

Dunne: I'm a little bit the same way. For example, here we are at the end of the Fish and Estuarine Ecology workshop. Do we know where the fish are, and when?

Courtney: Well, we haven't had those explained to us fully, but yes, we do know that answer.

Quinn: We haven't explicitly discussed adult salmon at all, for example.

Cody: I think the emphasis has been on the juveniles and sub-yearlings because the thought was that was what was important.

Quinn: Well, but when FWS and NMFS gave their presentation in Seattle, Doug [*Young*] and Ed [*Casillas*] said, 'Let's remember that they're both sets of stages, right?' If this is the session to deal with all the fish issues, it seems like we'd like to make sure...

Tortorici: If there are gaps you think you need to know about, please tell us.

Dunne: I thought the goal of the whole workshop is to make you [project managers] comfortable.. Since I'm the one that's raising it, not you, I'm assuming you're comfortable with how much we know about where the fish are. I'm just making sure that's true. We're nickel and diming to the nearest 0.25 ppt on the salinity, but we have no idea where the fish are. If you're comfortable with that, that's okay.

Larson: We do have basic information on what habitats the fish are using. We know, for example, that sub-yearlings are using shallow-water habitats, and yearlings are using in-channel habitat, channel margins... We do know these things. That's what we based the original EIS on. What the [NMFS] Science Center is going to be doing is to try to verify what habitats -- even what micro-habitats --- report the salmon and what things are necessary to make that habitat good or bad. We document fish where we find them. As far as adult fish, Tom [*Quinn*] talked a little bit about what your grad students have done...

Quinn: If all we know is what my grad students have generated....

Weitkamp: Your study is the only one done on adults and their movement in the lower river, so it is the direct source of information for that area. Realistically, there are very few studies on adult movements in any estuaries.

Quinn: Yeah.. I know.

Courtney: We had planned more presentations on the fish, but following feedback from you a

couple of weeks ago, we pared that down. Some of the exhaustive natural history hasn't been reported. I think there's kind of general agreement and the major concern, as I understand it, in terms of things that haven't been addressed yet is in the peripheral areas.

Casillas: We are concerned with not knowing where the fish are. But because we don't have the information, this process is not going to generate that information. We're agreed that we need that information, and we have a process to actually do that. We can make some generalities about areas we think are important relative to the fish of concern. That's where the peripheral habitats come into play. In terms of how the fish actually use it, we're not entirely positive, but we're not going to get that information here. We recognize that.

Dunne: Under number one [Document 2], it says, 'Reducibility to function as a conduit to the ocean.' What does that mean?

Casillas: This list [Document 2] was generated from our Biological Opinion. Our Science Center has identified four primary areas of concern: 1) uncertainty, 2) modeling verification, 3) toxics, and 4) restoration.

Courtney: So in your opinion, are we adequately addressing those four issues?

Casillas: [NMFS expressed satisfaction that the proceedings are addressing all four issues, although toxics remain to be discussed at the next workshop.]

Goldman: Coming back to the comments on the adults, there seems to be a tacit agreement that we're not going to talk about upstream migrants. Basically, we've been concentrating on the estuary as a nursery for downstream migrants. What about the upstream?

Casillas: We're not excluding that. In fact, we've invited Mary Moser here to discuss that.

Moser: Turbidity effects in the adult tracking we've done above Bonneville Dam would be a factor. Potential alteration in their orientation navigation in the lower river, repositioning the halocline... The other adult that has received little attention is the cutthroat. We know almost nothing about what they're doing.

Cody: The message I got yesterday from Michelle's [*McClure*] talk was that the mortality associated with the adults was relatively low, particularly in comparison with other age classes, and even if it were 100 percent, it would not bring lambda up to a value of one. Is that a reasonable summary? And, therefore, I would assume that our attention has been diverted from the adults for that reason.

Quinn: I think the model did include some mortality of adults in the upstream area, didn't it?

Cody: Some..

Quinn: The assumption is that the fish are pretty safe while they're out at sea. They're dying

rapidly in the estuary or the first year at sea, and then they had to also model in some loss upriver, is that right?

Casillas: Yes. She basically lumped everything after the second year, which included everything going upriver. The adults are something I think we can talk about fairly well, and I think we could get agreement as to how we want to deal with that. So that's why we've been less concerned about them.

Bottom: Back to juvenile uncertainty, I agree with Kim [*Larson*] that we have some general sense about where fish are, but with each level you go to in taking that information to make decisions, then you ask more questions and you know less and less. Yes, we know sub-yearling tend to use shallow-water habitats. We know from other estuaries that some of these peripheral places are among the most important for sub-yearlings.. We do know that the larger yearlings tend to be more in the channel and those are the ones we've characterized the most, and yes, those fish don't seem to stay in the estuary a long time. But if you then come down to the level of what is the impact of this project, then you're up against having more site-specific, empirical data you'd like to have to really look at.. That's where we're lacking, not the general knowledge of what we think fish do, but in terms of how do you really look, quantify, put bounds on how important it is on a habitat level or within a region of the estuary. If you go beyond that and ask, 'From a life-history, diversity standpoint, are we maintaining that diversity by not overly risking a particular life history type or a particular stock, then the information becomes even less. So each iteration of those questions, when you're trying to protect the diversity of the population structure, becomes more onerous and less certain.

Tortorici: Did we resolve the question that you had about 'reducibility to function as a conduit to the ocean'?

Dunne: My understanding is that that is no longer an issue. After you condensed the issues into four, then that was no longer an issue. Is that correct?

Tortorici: Just to summarize again. These were issues that were raised as part of the BiOp.. And then what we did internally in NMFS is that we took a look at the issues, and in a way, we did our own prioritization and said, of the issues, what are the four big ones that we'd really like to see some emphasis placed on? And those were the issues that Ed mentioned. It doesn't mean that those other issues don't need to be addressed as part of the administrative record for the project and that they're not issues of significance. It's just that we had our own internal dialogue in terms of prioritization. I think that this one about the ability 'to function as a conduit to the ocean' just speaks to the issue of if we're altering conditions within the estuary, what does that mean in terms of the fishes ability to move through that part of the system in a functional way and get out into the ocean. That's all that's really talking about. Are we creating some conditions that could prevent the fish to do what they need to do to get prepared to move out into the ocean?

Dunne: But do you have some specific idea that there's something about this project that one might think would reduce the ability to function as a conduit to the ocean?

Tortorici: That's part of what we discussed in the BiOp.

Dunne: What is it specifically about the project that you've identified as perhaps reducing the ability to function.

Tortorici: Well we've talked about this quite a bit in the workshops in terms of changes in salinity, changes in flow, changes in habitat types that these fish might require in terms of preparation as they move out into the ocean. I think what might be catching us up is this word 'conduit'. It might sound like a 'tube', and that's really not what that word was meant to be.

Dunne: But all that can be predicted -- what we've seen so far -- is depth, velocity, salinity. Now do you know what the linkage is between any of those things and the fishes' decision to swim to the ocean?

Tortorici: I think you're asking an important question, and that's where the biological interpretation of that modeling is going to come into play. In terms of how we're valuing those changes in a project vs. a base condition, and what that means in terms of habitat availability, fish movement, etc. I can't answer that question for you right now. One of the things we discussed at lunch, based on what Martin [*Cody*] had said, and what was in the matrix, was trying to do some combination of Antonio's matrix with the existing one we have to get at the question of how we can better connect the physical description with the biological impact and try to bring that back to you to get your reaction to it. We've been struggling with this issue for years.

Cody: So it sounds like it might be moving in a profitable direction.

Tortorici: We hope so, yes. That's been one of the benefits of this whole panel process in terms of trying to get us to think about connecting these dots together and forcing us to sit down and really examine this and end up with something that's more meaningful from the standpoint of instead of just generating a bunch of numbers regarding the physics of the system, what does that mean to the species.

Goldman: I come back to this question about the upstream migrants. You're pretty concerned that that's not an issue in this project, right?

Casillas: No that's not true. It is an issue. I don't think we've put on the table at this stage, every issue that has to be considered. It just isn't one of the top four issues, which doesn't mean that it has no intrinsic merit.. I think we're more interested in having the issue addressed in the Biological Assessment and in the BiOp what we think is going to happen and in that process resolve how we're going to deal with it. In our mind, the issues with the juveniles are more prominent because we felt we were more behind the curve than we are with the adults. I think the Corps has addressed a number of these concerns, but we want to keep the issue on the table to discuss, but in the BA/BO and not necessarily in these workshops. Back to Tom's [*Dunne*] point, this list [Document 2] represents what we think are the *potential* impacts when altering the habitat that's useful to these fish. And we think all these issues should be addressed in the BA. But it is our 'wish list'. Our main concerns are the four I mentioned earlier.

Quinn: The thing is there may be a very high probability that in fact there's a change.. The question is whether change is going to make a difference. That's the harder thing to determine. Putting aside the uncertainties in the model, I'd be willing to bet that there will be something different somewhere. And the question is, is it someplace that's going to make a difference for fish.. And that's a little trickier.

Dunne: Suppose the map says that there will be five percent increase in the saline area. Is that good or bad? How can you ever imagine telling me whether it's significantly better? You don't even know the science.

Young: I think that's what we were trying to develop in the matrix, if you will, a rule set where we would have a common understanding among the groups -- a common understanding of where our beliefs of the science are telling us we should be concerned about. And I think we were saying that if we saw significant changes from the modeling output, that would trigger discussions of that biological review team to talk about what more do we know about that change?

Dunne: What I'm hearing is it isn't known whether an increase is 'good' or 'bad'.

Curtis: I think with salinity we do, Tom. Yesterday, when Si [*Simenstad*] was here, we talked about salinity, and we asked what would be the critical issue. And we agreed that the fish themselves could handle the salinity change, and probably the corophium could re-colonize, and there's some potential for influencing them. I thought the primary risk would be damaging vascular plants that are very important right now because they're an important source for fixing carbon. This vascular plant component, then, is an important part of the primary production of the estuary. And that increasing the salinity of the soil in the emergent vegetation was something that you would want to consider. So, if I were going to map that, I would map the amount of this type of vegetation you have now, and if you increase salinity, how high do you have to get salinity to create a situation where this plant won't grow, and how much of a change is different? I think you're going to have to use professional judgment. Is two percent change in the area something we can live with, a half percent, or ten percent? I don't think you can do it statistically. I think you have to do it by scientific judgment..

Cody: Sure, but the gradient in salinity will still exist, and there will still be a point along that salinity gradient where these vascular plants can grow and contribute to the primary productivity of the estuary. They may be shifted a couple of hundred meters upstream, say, if they're a consequence of increased salinity.

Curtis: Then there should be no net change. But you could map that out. You might estimate that that would be true. I think what we're seeing is that there is a way to map it. And we do have a critical biological parameter to overlay on that map.

Larson: COE didn't look at soil salinity. Superimposed the change in salinity over where vascular plants are distributed in the estuary. No GIS maps, but have done that analysis to some degree.

Bottom:. Geographic component is important because the existence of those plants is also tied into the existence of shallow-water habitat. That habitat is within that critical transition zone. So if you start moving the location of that zone, you run the risk of moving it into a different type of habitat, which may function differently. That would be significant.

Curtis: I agree, but my assumption from Antonio's [*Baptista*] presentation was that, based on the type of modeling he could do, he could tell you the salinity influence on these areas you're concerned about with whatever certainty his model can predict these changes. And that you could actually make some estimates of changes.. We [the panel] would really like quantitative estimates from all the work people are doing and it seemed to us that the modeling was a way to get to some of these estimates. Then you have to agree on the biological outcome. And the area that was suitable habitat for these plants seemed to be one that made sense to me. It was tough for me to see how [a small increase in salinity levels] would be directly crucial to the salmon.

Baptista: [Talked with Kate Sullivan about linking gross weight to temperature].

Cody: If you know food level.

Baptista: She has an approach to food level.

Quinn: There are three things: There's temperature, food, and growth. If you have temperature and food, you can stimulate growth. You need at least two factors out of three. I'm still struggling to see how this will help us.

Bottom: I'm not sure I'd be able to extend the data to the estuary without having some information on the prey resource and the fish feeding....

Quinn: If you actually knew the fish's growth rate, and knew exactly what temperature it had been exposed to during that period, you could simulate what it had eaten.. Or, if you knew what it had eaten and the temperature, you could probably simulate its growth rate. But I just wonder how we will have enough information to do this?

Bottom: That's exactly what we've been doing. What we're seeing is a very interesting trade-off between those factors. But each site we're looking at has a different prey base and some of the marshes are warmer than others. Those make a big difference, as well as the morphology of the habitats which determine at a micro-scale whether growth is positive. It would be a very tough thing to do with the level of knowledge we have. We have some data on benthic invertebrates, but we have no data on terrestrial insects that most of these fish probably eat as sub-yearlings in shallow habitats.

Courtney: I'd like to bring the discussion back to where Doug [*Young*] had originally intended to take it. You're kind of asking the next level of question, and I think we've got a more basic question, which is, 'Is it useful to try to do some simple analysis on the results that come out of Antonio's models. Is it useful, for example, to do some non-parametric test, which says in all the different runs there is, or is not, a significant effect when you compare before and after project.

I'm not clear whether Antonio's results will be expressed as a simple comparison, or as some sort of analytical or statistical form, or whether it's even useful to talk about statistics in terms of the data you generate.

Baptista: I'm pretty sure there will be statistics on these histograms with the base, histograms with the plan. How different they are. It would be difficult for me to conceive of any output that doesn't have some level of statistical analysis of before and after, but again, that still doesn't link it to the biological side.

Courtney: Right. There's a difference between biological significance and statistical significance. You can have one without the other in either direction. I think the question is aimed in part at the power of your analysis, as well. Is it conceivable that you will find some results that might show some difference, but which where there's no statistical power to detect a real biological difference?

Baptista: The moment you put biological in that sentence, I can't provide the answer alone.

Courtney: I understand.

Tortorici: Steven, I think this issue of statistics is the question at hand. There may or may not be a statistical difference. How you interpret that, from a biological standpoint, is still at issue. So, as a person with a scientific background, I feel less compelled on the statistics end and more compelled to talk among the biologists here to see if we can get any interpretation independent of that.

Quinn: Since the status quo is obviously so lousy, the fact that it changes from the status quo is not necessarily a bad thing. If the status quo were great, that would be one thing, but since it's so rotten, maybe we shouldn't assume that change has got to be a bad thing. Might just make it better.

[COFFEE BREAK]

Upstream Presentation
Karl *Eriksen*

Whitney: What might appear to be a couple of inches of water level change in wetlands could be a significant change in the remaining amount of wetlands in that upriver section. Also, it's not so much just a change in water level, but it's where the dredge spoils are going to be placed. It also precludes the opportunity to increase channel diversity in wetlands in those areas where the dredge spoils are placed. So talking about how small a change you're going to have by itself, minimizes the problem.

Eriksen: This is what happens in the river. Dredge material disposal was carefully sited to avoid impacts to wetlands. I think there's about 20 acres of wetlands in the entire disposal plan out of nearly 2,000 acres of disposal. Most of the disposal is away from the shoreline so that it won't

interfere with vegetation along the shoreline and the critical habitat for salmon. What impact two inches might have on any of those wetlands along the river I'm not sure of.

Mishaga: The attempt to simplify these issues, we always revert back to steady-state systems. This is a good example. We're looking at a system where there's a small change to the system. I think you always have to come back to the fact of what's happening in terms of the system variability.. When you look at the changes that you would get at Bonneville and how flows and fluctuations are changing, and then you superimpose it upon this kind of change, I'm trying to figure out how the ecological system will react to that.. Paul *[Whitney*] has a good point here, but we always have to come back to figuring out what this change means in terms of how the system operates, and can we go from this kind of change to dealing with the fact that we've got variability.

Eriksen: I'm just showing the change. You guys can deal with the rest. This part of the river is pretty well confined. Parts of it are leveed. Even the natural banks are 6-7 feet high, and where they're natural, they're a more vertical clay type of bank, as opposed to the broad sandy beaches that are generally disposal sites. So within these water-surface levels, you're well down in the river itself. You're in the main channel and fluctuations are not going to be seen in a broad area.

Tortorici: In the confined area, what sort of habitat surveys did you conduct along the shoreline?

Eriksen: I have to refer you to the wildlife appendix in the EIS for that. There was a pretty extensive evaluation of habitats along the river in areas that were considered for disposal siting.

Tortorici: For disposal sites, but in terms of areas that weren't for disposal sites that might be affected by a change in water surface elevation, was anything like that....

Eriksen: No. No questions like that ever came up.

Courtney: I'd like to press the panel here. You've seen now what's being done in the upper reaches of the river, and what's been done in the past, and I guess the issue is do you want to hear more about this, or are you content that this is going to get re-evaluated and you think it's appropriate to wait and see?

Curtis: It is useful for me to see that we're talking about 2 or 3 inches of low-flow conditions, and then if they have the data that are available to the agencies on the types of habitat that are connected in that section of river, I assume that the agencies can make that interpretation.

Tortorici: That's why I asked the question about whether the Corps did survey work in the upper river to see what sort of habitat types exist. What Karl was saying was that they did that for disposal sites, but outside those areas, those surveys weren't done. So this change in water surface elevation and how it spreads out and impacts existing habitat, the information is not there.

Courtney: Devil's advocate position: Two inches; what possible impact could that have?.

Tortorici: Well, I can't answer that right now.

Eriksen: When you talk about gaining and losing acreage, you have to remember that the side slopes of the river are just a continuous slope. You're just going to slide up and down that with your water surface. You're not going to gain or lose within a depth interval a definable amount of acreage.

Cody: Are you saying, Karl, that the project would take place over a time period sufficiently long so that the vegetation that is there would simply adjust in position on the river bank and maybe occupy a lower one if the river level were dropped 2.5 inches?

Eriksen: This impact would be a long-term impact. It would be there for the duration of the project. There would be plenty of time for a vegetative community to adjust to this change.

Cody: But the impact is not going to be felt instantaneously.

Eriksen: It would be over a period of two years before it became fully felt.

Cody: So the question then becomes is the two-year time period the sort of time that a plant community would need to move downslope on the river banks and reoccupy a nice happy position?

Eriksen: Yes.

Harding: I'm going to turn the question right around back at you, Martin.

Cody: Well, then, I would support Cathy in saying that if we knew what plants were there constituting the riverine vegetation. If they were short-generation time, then almost certainly the answer would be, 'Yes, they can readjust quite easily.' If they were longer generation, then I wouldn't be so sure. I think the point is well taken that a couple of inches could be significant.

Tortorici: It's the spread.

Goodman: There might be an opportunity to re-connect if we've lost connections with some of those adjacent water bodies as part of mitigation.

Dunne: Do you have cross-sections of these things?

Eriksen: Even the cross-section surveys we run can't get to the shoreline when we get up to about five feet of water. I can't get up to the top two inches..

Dunne: So can't you just draw the cross section and show what two inches looks like on it? Then you can figure out how long it takes the vegetation to adjust.

Eriksen: We could do that.

Siipola: I'd like to point out that the reason it's narrow up there is because of the steep banks on both sides. All the vegetation down there (Sauvie Island) is cottonwood, that sort of thing.

Dunne: So that has implications for the habitat exchange, which is zero, more or less? It has implications for how much spatial vegetation you have to adjust. And it has implications for the absence of wetlands on the site, so it's not as if we're re-connecting channels, but... Karl may be regretting now that he didn't do more of a description of the site.

Quinn: What's the typical vertical change from day to night and from day to day from the dam operation? Because if there's a lots and lots of variation from day to day, it's hard to see an inch or two affecting the vegetation much..

Eriksen: At Portland, where this change really starts to come in, you see a two-foot fluctuation day to day because of the tide. You can't get a good handle on how much the change in discharge at Bonneville creates because it depends on how it corresponds with that. Tide change, too. So especially with these kinds of flows, you can't get a good correlation on discharge and stage.

Cody: The fact that there is a two-foot variation on a daily basis doesn't really preclude the possibility that the change in the mean two inches could affect vegetation.

Courtney: Is the panel content to leave the issue of further up the river, or would you like to hear more at some point about how this side of things is developing. Charles is nodding yes.

Goldman: I was just thinking that it would actually be nice to take a field trip down the river to actually see the habitat.

Perry: We'd be happy to set that up.

Courtney: We have actually thought of that, but let's assume that doesn't happen. We have a couple more workshops. Presumably this will get addressed at some point during the negotiations. Are you interested in getting a report on this at some point, or have you heard enough on it? For instance, do you want to learn more about the vegetation?

Cody: Well, some statement like, 'In view of the bank morphology, the amount of usable salmonid habitat in this reach of the river that's affected by a 2.5-inch change in the river level is trivial,' would be useful to have on the books, I should think.

Courtney: Do you want to have that reported back to you?

Curtis: From what I've heard, it sounds as if NMFS and the FWS would like to be assured that was or wasn't the case. Just a statement is unlikely to satisfy anyone.. So whether we hear the report or not, I think somebody's going to have to do that analysis. I think that's a piece of work that's going to have to be done.

Whitney: It seems to me pretty logical that if you're going to reduce water level in the wetland, you're going to dry it out and lose wetland. Ed [*Casillas*] made a point at the last workshop that we can say there's going to be no impact by averaging away because we're looking at a small increment of dredging. To me it's just logical that if you reduce this water level, you're going to be drying out wetlands. You're going to be losing channel diversity, which we all agree is important for the life history of salmon.. And we can't do what Ed's talking about and average it away. It seems to me it would be much better to say it's not good for salmon or wetlands. Admit that and address it in mitigation. I don't see what the issue is, what we're arguing about.

Courtney: I think we're arguing about the scale of the impact.

Whitney: In the Portland metropolitan area, between 1980 and 1990, 40 percent of the total wetlands were lost. That's a lot of wetlands being lost. It seems to me that there's a tendency to minimalize these things in this assessment process. I think the process would be much better and could go forward more smoothly if we just admit the effects.

Casillas: We're not asking to admit. What we're interested in is having some way to look at what's going on, not just in an average way, but in a more detailed way. We would like some greater definition on habitat change.

Courtney: Let me see if I can capture what we've agreed on so far. It seems to me that we've been charged by several members of the panel that they'd like to know that you're going to get explicit statement on habitat change in the river and that it's appropriate that that be done. Currently, because the surveys haven't been done, we don't know the scale of the impact in this part of the river, but some explicit discussion is appropriate. Whether it gets reported back to the panel is less important.

The Group moved on to a synthesis of project manager notes/'homework assignments':

- Missing data: adult migration routes (not much information exists; need to state it)
- If any concerns with *Bottom* et al. analysis/outputs/regions, get to Antonio immediately
- Get additional dissolved oxygen data (a surrogate for temperature)
- Add extra column to Antonio's matrix: biological response
- Refine matrix for velocity (0.3 cm/sec) and temperature (lethal, sublethal)
- PFC: Develop a better understanding of how to link to process
- Antonio: Add 1 more month to modeling effort (low flow/high temperature)
- Review existing data for more ocean/stream type migration timing
- River: More emphasis on the analysis
- Shoreline wetting and drying
- Take the conceptual model to a more analytical level
- Regionalize riverine portion of the model (Si *Simenstad*)

Larson: How do you expect to get information on adult migration routes in the timeframe we're dealing with? I don't think NMFS has any information on that. I don't know where you go to shop for it in the four-month time period.

Tortorici: The issue is that if you don't have information on the potential project impact then that needs to be stated. We can only address it in a limited fashion, or we can't address it at all, rather than just being silent on it within the document. We need to try to find information where it's available.

Larson: I think the people who know about it are sitting right next to you, and they're saying that information's not available.

Quinn: I'd go to the fisheries managers -- WDFE and ODFW -- they're going to know where the fishermen go, where the catches are, where the gill netters are. There will be information; it won't be telemetry. Fishermen are going to know where the fish are. [A lot of anecdotal information].

Larson: So what do we do with that information?

Courtney: I think the project managers are going to decide whether and how that gets translated into any action. [Moves on to ask the panel if there's anything they want to make sure happens in the next workshop].

Dunne: In all these issues it would be better to learn how things work. Tell the story. Present the conceptual model. So I think we can probably preclude the confusions we get into by presenting numbers at one another by telling the story of how it works, and then presenting the numbers. When you're looking at the matrix, if you say maybe the dredging project might affect the graphs, then you don't know how to analyze that problem or how to assess whether the impact that you guess at is significant. But if you require yourself to say here's a rational linkage that I think the project will have an impact on. A lot of our discussion, particularly today, we're tossing up variables and saying, 'Well. what about x?' We have the project and we have 'x', but there's no protocol for analyzing whether there's a relationship.. So how I propose we look at sediment and sediment transport in the next workshop, we should acknowledge that if there's an effect between dredging and 'x', it means that the process by which dredging affects 'x' however indirect. And we should be state what reason would lead us to believe that process is.

Goldman: Sediments are always a concern. Sometimes they're badly contaminated, sometimes they're very clean, sometimes they have a lot of BOD, sometimes they have heavy metals associated. Once suspended, sediments can biomagnify in the food chain through the invertebrates that feed the *Young* salmon and perhaps reduce their viability.. It would be nice for next time to have some evidence of the cleanness or dirtiness of the sediments that are actually going to be dredged. Obviously, the big problems are in the harbors where the toxicity is likely to be greater. But rather than speculating about that, it would be really nice to have some numbers and some analysis..

Cody: Back to Document 2, number two on that list is 'dredging forecast is too low..' Is this an ongoing difference of opinion, and might it be resolved by next time?

Courtney: I don't know. What are you guys [Project Managers] doing about it?

Quinn: What does it mean? [Several people answered at once]. Oh, so the thought was that more material would actually have to be removed than was stated [in the EIS].

Curtis: At the first panel meeting I suggested that since the panel doesn't really have a lot time for data mining that it would be useful to have the sediment data that the Corps generated extracted from the table and put into a more user-friendly format. That is the concentration of contaminants in sediments in the existing channel and also in the off-channel areas for the data that you have. I believe Parametrix or somebody is doing that. I think, too, that what Charles [*Goldman*] is suggesting is very useful. The anecdotal information is that the sediment is a high percentage of sand. To the extent that that can be quantified, that would be useful. Data from real sample —?COD or BOD on some of these samples —?would be great.

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