

Comments on the NOAA Technical Memorandum; *Role of the Estuary in the Recovery of Columbia River Basin Salmon and Steelhead: An Evaluation of Limiting Factors*

General:

This is a balanced, well written document covering a difficult subject area in the field of salmon recovery. In fact, we acknowledge the challenges here, and wish to clarify that our comments should be considered constructive rather than critical. The subject material is difficult, because of a simple lack of preceding, groundbreaking studies; and the resulting lack of knowledge.

The authors acknowledge in the opening paragraph that, “efforts to recover these populations at risk have almost exclusively focused on identifying and modifying risk factors directly associated with the large hydroelectric dams” We note that this circumstance creates its own problems. Either we know enough about estuary structures, functions and ecological community linkages to assume that problems necessarily have their source upstream; or we lack that knowledge, and need to identify the true issues prior to setting out to correct them. This document provides a thorough discussion of the state of the science, and identifies missing information needed to quantify and attribute harmful perturbations on salmon and steelhead to human caused effects.

However, the report then seems to jump to a short list of factors they will consider, to the exclusion of a fairly extensive, but not quite all-inclusive list of factors that could be at play. They do so on the basis of applying two criteria: 1) that empirical evidence be accessible to show that the factor has undergone a significant change in recent times, and 2) that similar evidence can be gathered to demonstrate there was a potential contribution of the hydro system in affecting the diversity and quality of habitats. It is not at all clear how, or why, these criteria were applied, or what function they would play in devining the overall role of the estuary in influencing anadromous salmonid life histories, except that they were somehow of use in shortening the list of factors to be considered.

Somewhat more confusing is the factors that remain on the short list (the role of water flow, availability of salmon specific habitat, toxics affecting the quality of habitats available, and predation by Caspian terns) in comparison to the longer list getting only a mention: climate and climate change, water flow, access to and quality of habitats, sediment, salinity, temperature, toxics, predators (terns, cormorants, pike minnow), and hatchery and harvest practices. We suggest the authors include a full explanation and rationale for choosing the 4 factors they did choose, from this list. Not that a simplifying principle is, necessarily, a flaw, when considering the complexity of the estuary and its potential for affecting migrants and their behavior, but we are concerned that a lack of documentation of these types of decisions can result, at times, in inconvenient conventional wisdoms driving future work. On the other hand, a documented simplifying assumption tends to remain just that.

The discussion of estuarine water flow which follows immediately, tends to deepen the confusion, since the authors work their way through an explanation of climatic cycles, and ocean indexes, each time explaining the relative size of the associated change in the estuarine environment. After the paper has described tidal effects, salinity gradients, the influence of the Basin's weather patterns, and, finally, the historic effect of irrigation water withdrawals, it becomes difficult to imagine that the 'potential contribution' of the hydrosystem will be demonstrable anywhere beyond the relatively local influence of water releases below Bonneville Dam.

We are hopeful that the authors will revise their explanation of their rationale in the final version, as well as strengthen a few other discussions. For instance, the limitations on salmon survival in the estuary are addressed only superficially, with evidence provided only by association, i.e. salmon are present in the estuary, and salmon, at least to some extent, use prey resources in the estuary. More should be offered to help understand how the existing habitat is limiting in space or quality, or, for instance, how do the authors postulate toxins play a role? Likewise, there is little information provided that the estuary and plume provide habitat that would enhance survival to adult stage. The basis for such assumptions should be explained.

Also lacking, is a discussion of the relative measures of survival in the estuary, plume, or ocean, other than a statement that NOAAF could not differentiate the contribution of the estuarine phase from the early ocean phase in their BO analysis. We don't doubt the difficulty of this problem, but the authors' confidence to pull ahead seems to suggest better identification has become possible in the interim. However, a clear statement to that effect is not readily apparent.

We note that recent strong returns of adults could suggest that neither the estuary, nor the effects of the hydrosystem have little effect on how many adults return to the Columbia River Basin. It could be argued that this effect is stock specific, and that the estuary may be limiting for Snake River steelhead, and lower river chum, but at this time that is only one hypothesis. The report's approach ignores the relative effects of the hydrosystem compared to other effects, both human; as manifested in freshwater, and global changes (global warming); and natural, as in climate on decadal cycle, or on multi decadal cycles. These issues and any suggested resolutions should be addressed in the report.

Finally, we wish to emphasize that our comments are not intended to argue for doing less in estuary habitat enhancement, but rather to better and more clearly understand the relative impacts of what we do with the available resources.

Specific Comments:

Page 8, top of page; the first mention of climatic and decadal scale regime shifts should represent the relative importance of these issues. The report mentions only that "they should be taken into account," which is not helpful in providing guidance. The last 3-4 years of dramatic changes in adult returns make it clear that these changes can greatly enhance our other mitigation efforts. .

Further, we need to better understand what is limiting for populations in the estuary, and how they functionally interact with the estuary ecosystem.

Page 10, Para 1; this includes a clear statement of purpose, but is lost further in the document: “it is necessary to define how each ESU uses the estuary.” It is then acknowledged that empirical information describing that use is absent, but that the authors believe it possible to link estuarine use by salmon ESU’s through expression of accepted life history types and strategies. We agree, but consider it important to explain how it is that estuary habitat is considered limiting.

The Salmon at Rivers End Draft report poses this question, but is all but hidden: page 156, last Para: “Given the fundamental lack of information on absolute growth and variability of juvenile salmon in the estuary (Chapter 6), it is impossible to assess the potential of carrying capacity limitations during juvenile salmonid rearing in the estuary. This is a particularly important gap in our analysis because our conceptual approach to understanding what estuarine conditions potentially limit the production and survival of Columbia River salmon (Chapter 1) questions whether carrying capacity is necessarily an important factor at all.”

Page 12-17: The paper’s assumption that the estuary and plume have a role in salmon recovery is likely valid, but defining that role in much more than a conceptual way is probably not possible at the current time..

Page 19: The authors state: “...we propose that a primary goal of salmon recovery actions in the Columbia River estuary should be to restore these ecosystems in such a way that it increases the spatial structure and diversity of target populations.” This seems a classical approach, and theory holds that complex structure should lead to more community diversity; but there is no mention in the report that either the structure, or the postulated response has been substantiated for migrating salmonids in the CRE what’s this? Is it the Columbia River Estuary? If so, I’d suggest we spell it out.

Page 21: The potential for improvement in population status from estuarine actions takes the approach of improving population viability. Elsewhere in the document, elements of population viability are spatial structure and life history diversity (p. 9), and not simply survival and abundance. However, on p. 21 the authors assess the role of limiting factors based on mortality and habitat. This appears to be an inconsistency. If so, it should be resolved.

Page 44: A concise conclusion statement like that appearing here is an example of an instructive wrap-up that helps focus the reader on the main issues. We suggest this type of conclusion statement or one identifying key findings could be added to the end of each section of the report.

Pages 49 to end: P 44: The model analysis conducted on the Caspian tern predation effects was the only clear quantitative evaluation of impacts on certain life history types and, perhaps, ESUs. All other factors were treated in a more qualitative fashion, with no modeling analyses conducted. Attempting to rank limiting factors based largely on the qualitative assessments presented in the paper is a difficult if not subjective task. Thus the ranking reported herein and reflected in tables 6 & 7, might well be considered an initial goal, rather than a supporting

element of future work proposed in the estuary. The quantification of a range of factors affecting migrating salmonids, seems an elemental piece of knowledge, and, daunting as it may be for a system such as the estuary, should not be bypassed in favor of suspected sources of adverse impacts, or even limited to only those factors we believe are manageable. Rather, this discussion, currently located at the end of this report; could more effectively become its frontispiece.

In this same section, water flows are identified several times as a most important limiting factor affecting a variety of species in both the estuary and/or plume. The implication is that the current hydrograph constrains salmon productivity and that restoring the historical seasonal profile in terms of timing and magnitude will affect estuarine and near shore processes that can foster the rebound of most ESUs. This perspective needs to be reconciled with the recent surge in salmon abundance observed across a broad array of ESUs. These stocks have rebounded substantially with the current water management policy in place. Also, this proposition would need reconciliation with other NOAA reports that differ in their suggestions of seasonality and the relative roles of freshwater and the marine environment.

Page 52: Assumption #2 on this page is not well supported by data of which we are aware. Likewise, Assumption #7 may be a bit of overstatement. Basin wide, it likely is not accurate that the majority of many ESUs are transported. The number of collection facilities, stock specific Fish Guidance Efficiencies (FGE's), and current levels of spill at transporting projects most likely ensure that the proportion of transported listed fish, remains quite variable.

Closing comments:

It seems that the authors leave us with a few key factors in the Columbia River Estuary, which, if not exactly defined as a combination of extrinsic factors causing an intrinsic productivity, or mortality response in estuary residents and migrants; are, at least good candidates for the position of limiting factors: flows, and habitat. The paper also includes one factor, predation, that, if not actually a limiting factor in the classic sense, may actually be a response to perturbations in the first two factors. This information should be considered extremely preliminary due to understandably limited data at present. However, very few mechanisms were proposed to support this conclusion, and, without some knowledge of the mechanisms at work, it is understandable that the authors could offer few suggestions as to what actions may be necessary to moderate the identified factors.

In a system as vast and varied as the estuary, it seems prudent to take cautious actions. Focus on the simple, direct relationships prior to moving onward toward those actions that are more likely to have more complex, or less direct effects, as well as less certain opportunities for success. Yet, the authors seem to have confidence that tern predation is indeed a factor in estuary salmon survival, and they do so with few of the compunctions that accompanied upriver evaluations of bird predation. Although its difficult to see any kind of attempt to control the now-augmented (by upriver Terns and Cormorants forced downriver) estuary bird populations as likely to have the level of success that would be needed to contribute towards significantly improved salmon survival. We suggest further investigation may be warranted in this regard.

Additionally, as we've noticed in other DRAFT White Papers, the estuary review seems to consider alterations in factors affecting juvenile migrants almost to the exclusion of those that might have a toll on adult migrants. Again, this seems understandable in light of the confidence with which CRI type analyses predict juvenile to adult survival to be the most sensitive portion of the anadromous salmonid life cycle, and the repeated assertions by the NOAAF matrix models that the estuary presents the key opportunity to make great improvements along those lines.

However, given the fact that the estuary also is the last we would expect to see of these fish for two to four years, and that the gap between the two visits to this ecosystem would seem to place importance on the estuary simply because it's the first and last place we can hope to estimate migrant abundance; we think it reasonable to expect that the authors would fully consider any implications that the estuary may rise in importance simply because the alternatives were disqualified from consideration at the outset. That being said, it may very well be true that we simply don't have any information to better guide us through these potentially confusing circumstances, and are left with no alternative upon which to focus, except the estuary. If that's the case, and we are simply led to the estuary by default, it's hoped that a better, more foundational rationale will be developed to support the type of effort and funding that would be needed to proceed in the estuary. Establishing the physiological, functional, or behavioral mechanism at work that might cause the estuary to be of such importance seems a good first step.

The authors of this review, seem to be in the best position to propose solutions and have, in fact, offered the Limiting Factors Synthesis as a classic step in the right direction. However, they seem to leave us with the Synthesis as more of a summary of what an investigational approach might look like, rather than a sound directive. An extension of this classic view to encompass survival rates, and all components of the life cycle, and the significant functions of the estuary system, might lead to increased confidence in the approach adopted.