REVIEW – Asotin Subbasin Assessment
Interior Columbia TRT
April, 2004

Introduction

The Interior Columbia Technical Recovery Team read a draft version of the Asotin Subbasin Assessment (dated March 3, 2004). We recognize that this was an incomplete draft version, and appreciate the opportunity to comment on the draft in this early stage. In this document, we present our comments and recommendations to improve this particular assessment, as well as general comments applicable to any subbasin assessment. We provide a general peer-review of the scientific basis of the assessment, focusing on guidance on appropriate treatment of parameters important for viability (the four VSP parameters: abundance, productivity, spatial structure and diversity). We have worked to emphasize improvements that are particularly important for strong recovery planning. These comments are intended to be used by NOAA-Fisheries Domain Teams as they work with subbasin planners during the final stages of subbasin assessment.

General Comments

Treatment of VSP Parameters

An important component of a subbasin assessment is its comparison of current population status against some reference – pre-development population status or recovery/viability goals are obvious standards for this comparison. We are intimately aware that the IC-TRT has not yet released specific viability goals for use in the sub-basin assessment process (under its current timeline). However, subbasin assessments can still describe current status (with respect to each of the parameters) and compare that status with historical conditions and/or with interim goals. Following are some specific suggestions with respect to each parameter that we include as general guidance for all subbasin assessments. We include comments specific to the Asotin assessment in the next section.

VSP Parameter 1: Abundance

Abundance is a measure of the number of individual organisms in a population. The definition is simplistic, but the concept is complicated by how the number is expressed and the time scale over which abundance is measured. Salmonid population monitoring and management typically relies on annual counts of adults or spawners as the abundance metric. When considering the effects of genetic processes or environmental variation on salmonid populations, abundance is more commonly measured over an entire generation (i.e. multiple years) and is most informatively expressed as a calculated effective population size (Ne)[1], rather than an absolute count (Nt) over some time period. Also, effective abundance can be calculated for a single year and expressed as the effective number of breeders (Nb)[2]. McElhany et al. (2000) cite various salmon population abundance guidelines that have been developed incorporating the concepts of annual abundance, effective population size over a generation, and effective number of breeders in a population. The following discussion about parallel application of VSP parameters and guidelines, ICTRT products and sub-basin assessments assume that abundance is measured and expressed as annual index or total count.

The conservation genetic literature indicates that populations with less than 500 effective individuals are subject to a variety of disadvantageous genetic processes, including inbreeding and increased possibility of genetic drift that undermine the long-term viability of a population. Therefore, the ICTRT did not identify any populations that were judged to have a carrying capacity less than 500 fish under pristine conditions. Although current population size may be less than 500, there should be sufficient habitat (spawning/rearing) capacity to support at least 500 adults for the population to be characterized as independent.

Abundance metrics are among the parameters used to assess population viability. The VSP guidelines for abundance recommend that a viable population should be large enough to: have a high probability of surviving environmental variation observed in the past and expected in the future; be resilient to natural and anthropogenic disturbances; maintain genetic diversity; and support/provide ecosystem functions (see VSP document for a more detailed discussion of this topic). Because abundance and productivity are inter-related, ICTRT viability assessments will consider these two parameters together. The ICTRT has tentatively adopted the Viability Curve concept (e.g., McElhany et al. 2003) as a framework for defining population specific abundance and productivity criteria.

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[1] The size of an ideal population experiencing genetic change at the same rate as the population under consideration and having an equal sex ratio, binomial lifetime variance of offspring produced, and constant population size.

[2] The effective number of breeders per year related to Ne by N_e - gN_b, where g is the average age at spawning.

Subbasin plans should consider the following points relative to abundance:

- Historical abundance should be documented. If historical abundance is not known, can it be estimated? Subbasin plans should discuss historic abundance or at a minimum, historic potential abundance.

- Current abundance and inter-annual variation among counts should be documented, including an assessment about the precision of counts. Context for this information is particularly important – a graph or figure showing the trend in abundance through time can be very useful. It is also informative to know the actual metric used to enumerate abundance, such as adult weir counts, index counts of adults or spawners, expanded index counts, etc.

- Do hatchery-origin fish contribute to the population and if so, is the number or proportion of hatchery-origin fish in the population known?

- Current potential abundance should be estimated, based on available/accessible habitat and habitat quality.

VSP Parameter 2: Productivity

The productivity of a population is a measure of its ability to sustain itself or its ability to rebound from low numbers. As described above, the TRT is considering productivity in conjunction with abundance in the form of a viability curve. In subbasin assessments, authors should consider the following:

- Provide an estimate of current productivity (e.g., spawner:spawner ratio, annual population growth rate) that includes an evaluation of the variation and/or certainty in that estimate.

- If hatchery fish are present and spawning, provide estimates of current productivity assuming that hatchery fish contribute to subsequent generations and that they do not contribute to subsequent generations.

- Include a description of how these estimates were derived. The description should describe the source for data used, the time frame, specifics on age breakdowns (when used), treatment of hatchery origin contributions, etc.

VSP Parameter 3: Spatial structure

A population with adequate spatial structure will include more than one spawning aggregate and will allow the expression of natural patterns of gene flow and life history characteristics. Some spatial structure factors that should be considered in a subbasin assessment include:

- A description of historical spatial distribution and the supporting documentation for that distribution.

- A description of current distribution and supporting documentation for that distribution.

- Identification of any particularly important or high quality spawning or rearing areas (currently and historically), especially if they appear/ed to function as "source" areas within the population, and justification for identifying those specific areas.

- A description of the suitability of habitat patches that are not currently occupied for spawning and/or rearing.

VSP Parameter 4: Diversity

Diversity, important for the long-term persistence of salmonid populations, whether it be genetic or phenotypic, has often not been characterized. Currently, the TRT is considering the use of EPA ecoregions in a diversity criterion, particularly where information on known diversity is lacking. This approach assumes that habitat differences, as reflected by ecoregion provide the opportunity for the expression of relevant diversity. Some considerations that subbasin plans should include with respect to diversity are:

- Characterize historical diversity, or the potential for diversity in genotypic, morphological and life history characteristics, with a description of the data underlying that characterization.

- Characterize current diversity, or the potential for diversity in genotypic, morphological and life history characteristics.

- Provide support for any conclusions regarding change in diversity (i.e. age of return, size, migration timing), when data are available.

- Identify any known conditions that appear likely (qualitatively or quantitatively) to have affected the potential for life history (or other) diversity to be expressed (e.g. high temperatures in mid-summer attributable to water withdrawals prevent early migrating and spawning fish from reaching spawning grounds). This should also include addressing the influence of hatchery programs on native populations.

All VSP parameters and population considerations

For each VSP parameter, some interpretation is important. Below are several aspects that subbasin assessments should discuss:

- How do current and historical conditions for each parameter compare? Characterize the magnitude of the difference (can be qualitative).
- How do current conditions compare to minima in conservation literature (e.g. $500=N_e$); and/or interim goals?
- How do conditions (with respect to each VSP parameter) that are projected under future scenarios (e.g. PFC, or the subbasin plan of conservation actions) compare to minima in conservation literature, interim goals and historical conditions?
- How are these conclusions (particularly those related to projections) affected by uncertainty or variation in estimated values or projections? In other words, are the differences observed significant, given any issues/uncertainties in the model or analysis leading to estimated values or projections?

Model Presentation, Limiting Factors and Synthesis

We also identified a number of other general issues important for presenting a strong assessment.

- In most cases, habitat model results (including EDT results) seem most appropriately viewed as a ***relative*** measure, rather than an absolute number. Thus, the empirical assessment should be kept separate (or at least clearly delineated) from model results.
- Limiting factors should be discussed in terms of causal mechanisms/ecosystem processes. In other words, if lack of large woody debris is identified as a limiting factor, has this situation been generated by a reduction in buffer width?; by timber harvest upstream?, etc.
- Identifying the life stage(s) affected by a particular candidate factor can help support its designation as limiting factor or not. For instance, dewatering below spawning and rearing areas may be more important if it occurs during juvenile outmigration.
- Ensure that the assessment is restricted to biological considerations. The plan can certainly include decisions based on factors other than biological importance, but the reasons for those decisions should be clearly identified.

- When multiple reaches, spawning aggregates or sub-areas within the population are assessed, the results from each area should be considered within the context of the entire population. For example, reach A might have a dearth of LWD, whereas reach B has a significant sedimentation problem. However, reach A is not currently, and was likely never a major spawning or rearing area, whereas reach B supports the majority of spawners in the population. In this case, the sediment problem in reach B is likely to be of greater importance than the LWD in reach A. The synthesis and final conclusions of the assessment should reflect this context.

- In situations where a subbasin includes only a portion of a population, what is the overall importance and role of this portion with respect to the entire population?

- Similarly, if a subbasin includes multiple populations, what is their relative status and relationship to each other, historically and currently (i.e. was one a powerhouse, and one, even historically, likely to have been relatively marginal?)

Asotin Assessment: Specific Comments

The Asotin sub-basin assessment uses the Ecosystem Diagnosis and Treatment model (EDT) to identify habitat factors limiting the abundance and distribution of summer steelhead/rainbow trout and spring Chinook salmon in the watershed, and to formulate working hypotheses and objectives for conservation efforts. The write-up is generally well-organized, and the authors have clearly worked to consider a wide variety of information in this document. We were also impressed that the authors made a substantial effort to address all four VSP parameters in the steelhead section. This solid draft could be improved however, by providing an enhanced treatment of those VSP parameters, a more thorough description of the model and its results, an integration of the model results at the population scale, and a clear separation of scientific results from socio-economic decisions.

VSP Parameters

Abundance

The EDT tool can be useful for modeling system changes and quantifying expected/potential changes in variables such as fish abundance, thus allowing comparisons among various strategies. The Asotin planners contrasted EDT outputs of steelhead abundance with current estimates in the last paragraph on page 18, and again in the *Abundance* discussion within section 4.3.4.2 on page 24. We caution against contrasting EDT outputs concerning abundance with estimates of current abundance. EDT is not structured to model current conditions for validating current abundance estimates, or vice versa. We note the general consistency between the interim NOAA-

Fisheries goal of 400 adult steelhead for the subbasin, WDFW data indicating the subbasin might support more than 600 spawners, and the ICTRT criterion of 500 adults (or habitat capacity to support 500 adults) to be considered an independent population.

We also suggest a somewhat longer-term perspective in the description of current status, rather than on the last 2-3 years alone.

The statements about data quality (bottom of page 24) and quantity should be emphasized. Improved abundance monitoring is important to be able to accurately measure performance or attainment of this VSP criterion and progress towards achieving abundance-based sub-basin goals. The insufficiency of data quality and quantity to effectively measure abundance is repeated on page 25. We understand the Assessment may not be the correct document to address data limitations, and anticipate this subject would be addressed in the Monitoring and Evaluation chapter of the Management Plan.

Productivity

While the Asotin assessment provides modeled estimates of productivity, it is unclear how those estimates were derived (see also section on model presentation). Greater explanation about what these productivity estimates are, and what they mean would be extremely helpful. (For instance, the assessment notes that a productivity of 2.0 would allow for limited population growth. Understanding what this metric means is critical to understanding the conclusion. While it is clear that it is derived from the EDT run, it should be clearly stated along with a brief explanation that EDT is a steady state model, the productivity index generated by EDT is in the form of a Beverton-Holt intrinsic return/spawner parameter and that indices generated by the model are designed to be used in a relative sense, and are not intended to estimate current trends in the target population.) Without better support and documentation about productivity it is difficult to determine how appropriate the values and the conclusions are.

Spatial Structure

The Asotin assessment does include a description of historical spatial structure. However, it does not appear to contrast the current distribution of steelhead or Chinook salmon in the subbasin with that historical spatial structure. Without this comparison, it is difficult to tell whether or not the current spatial structure is impaired. Highlighting any differences will strengthen the assessment. In addition, the assessment concludes that the quality, quantity and spatial structure of salmonid habitat in Asotin Creek is sufficient to support *O. mykiss.* Stronger support for this conclusion is needed. For example, is there assurance that sufficient habitat will remain, and not be further degraded? What aspects of the current distribution make it sufficient?

Diversity

For steelhead, the primary aspect of diversity addressed is the uncertainty concerning resident vs. anadromous forms, which is not discussed further in the results of the analysis, limiting factors, or implications for management. For spring chinook, there is essentially no discussion of diversity other than the conclusion that an increase in life history diversity from 29% current to 86% for PFC as modeled with EDT would provide enough genetic diversity and spatial structure to have a "negligible risk of extinction." If there are no data available on phenotypic (e.g., life history) or genotypic characteristics, that should be indicated. The life history trajectories modeled in EDT could be discussed beyond just reporting the percentages under the three scenarios modeled. For example, what were the major life history types suspected to be present historically that might be important considerations for restoration? Are there limiting factors or reaches that appear to be key to restoring those life histories? Habitat diversity is an important link to population diversity that can lead to phenotypic and genetic divergence. It would be helpful to characterize the diversity of the habitats used and the implications for restoration.

Model Description and Results

In general, we found the description of the EDT model and the interpretation of its results to be somewhat limited. It was challenging to impossible to interpret what had been done, and what assumptions, data, or features of the model led to its results. (The description of the Information Structure on page 2, for example, would certainly confuse a naïve reader.) We suspect that most subbasins that use the EDT model will have a similar issue. One possible partial solution is to request some "boilerplate" language from MBI, Inc. to describe the model and its assumptions that could be used by all subbasins.

Several issues in particular, if addressed, would vastly improve the assessment. First, as described above, treating the EDT results as a relative rather than an absolute measure is likely to be more appropriate. This is particularly true in situations like the Asotin, where the modeled estimates of abundance under current conditions do not match empirical observations. Second, we definitely appreciate the effort to consider life history diversity in the model. However, it is unclear what the percentages displayed mean. A further description of what the percentages are, and how the potential life history trajectories were determined would be helpful. In addition, some level of interpretation would be extremely useful. For instance, in comparison with model run under historical conditions, were any particular life histories not viable under current conditions (i.e. all early-outmigrating smolts were not viable under current conditions)? Third, a discussion of how much of the difference between historical and current conditions was attributable to differences in out-of-subbasin factors, and how much was attributable to in-basin factors would begin to provide a context for the relative impact of changes in freshwater habitat. Fourth, a clearer discussion of the uncertainty associated with the EDT model, and an explicit comparison with other assessment methods

(WDFW's parr capacity estimation, for example) would provide critical context for decision-making based on these analytical results. Finally, an explicit discussion of why results were achieved (i.e. did particular assumptions about the effects of a particular condition drive the results?) would be extremely useful.

Population-level synthesis

Limiting factors are discussed in terms of channel and riparian conditions. While these are the direct habitat influences on population viability, there needs to be some logical linkage among those conditions, the ecological processes that produce them, how those processes have been disrupted, and the measures proposed to restore them that follow in the proposed management portion of the plan. For example, a reach may have high sediment levels compared to the template. Is that a result channel/riparian conditions in the reach or increases in sediment from the watershed above?

We appreciate the effort (e.g. Table 13) to identify the relative importance of specific reaches for restoration or protection. However, some consideration of current use and/or historical suitability would also be important to include in this discussion. In addition, this entire section could be greatly strengthened by clarifying what is meant by "protection potential" and "restoration potential." Specifically, what factors were considered in the ranking (e.g. total gain in abundance and productivity, contribution to diversity, life stage(s) affected, historic contribution to population, etc)?

Clarify socio-economic from biological considerations

The assessment should be restricted to considering only technical information when assessing habitat condition and when assessing the value of habitat for protection or restoration. Social, economic, or policy issues that may foster or restrict the ability to protect or recover habitat should be considered during the development of the management plan. For example, pg. 60 of the draft Asotin Subbasin Aquatic Assessment states that the Lower Asotin and Middle Asotin geographic areas, according to the results of the EDT assessment, are two of the top ten areas indicated as having high values for both protection and restoration. However, these two geographic areas were removed from consideration for restoration based on a perceived non-technical constraint – the lack of opportunity for restoration because of the extremely low likelihood that existing infrastructure in the Lower and Middle Asotin geographic areas could be altered to accommodate habitat restoration. Adhering to strictly technical guidelines when assessing the relative significance of protecting or restoring habitat function fosters credibility in the assessment process. The appropriate place to consider socio-economic limitations to habitat protection and restoration is during the development of the management plan.

If it is determined that a reach should be eliminated from consideration for non-biological reasons, we strongly suggest that an evaluation of the impact of that exclusion be included in the technical portion of the document.

Some Specific Details of the Asotin Assessment

These comments address some specific details in the Asotin assessment that are less generally applicable, but may be worth considering.

1. Page 16, first paragraph. There is a strong implication that WDFW does not know whether resident fish occur in the Asotin, whereas later in the assessment resident fish occupancy is described.

2. Page 22 and 23. Life history assumptions differ between Asotin Creek and Tenmile Creek without a clear description of the empirical basis for that difference.

3. Page 24, "*Abundance*". Interim goals were established by NOAA Fisheries, not the TRT. Also, the decline in observed spawners following the elimination of hatchery plants is probably worth discussing in the context of population productivity.

4. Page 25, "*Spatial structure*". This model may fit a "patchy panmictic" population better, since the assessment suggests that there are no subpopulations. Also, given the anthropogenic impacts on habitat quality, it may be appropriate to address the rate of habitat patch creation vs. destruction more substantively.

5. Page 30. Harvest assessment. A single sentence summary of the total harvest impact would be very useful.

6. Table 12, Hatchery impacts in general. Context for hatchery releases would be useful. How do the numbers of releases compare to numbers of smolts naturally produced? Are these releases likely to have any detrimental or positive impacts?

7. Page 33. Restoration and protection potential. Suggestion that "improving performance of Asotin summer steelhead is strongly tied to actions in the mainstem Columbia and Snake Rivers" – might also consider ocean conditions in this category.

8. Table 13 and 14 are somewhat inconsistent between the dot size and the rankings.

9. Table 15. Scaling the rank has the effect of prioritizing projects with a large bang over a small distance. This may be appropriate, but should be mentioned.

References

McElhany, P., M. H. Ruckelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evoluationarily significant units, U.S. Dept. Commer., NOAA Tech Memo NMFS-NWFSC-42.

McElhany, P., T. Backman, C. Busack, S. Heppell, S. Kolmes, A. Maule, J. Myers, D. Rawding, D. Shively, A. Steel, and C. Steward. 2003. Interim report on viability criteria for Willamette and lower Columbia basin Pacific salmonids. Report from the Willamette/Lower Columbia Technical Recovery Team. (Available from Northwest Fisheries Science Center, 2725 Montlake Blvd. E., Seattle, WA 98112.)