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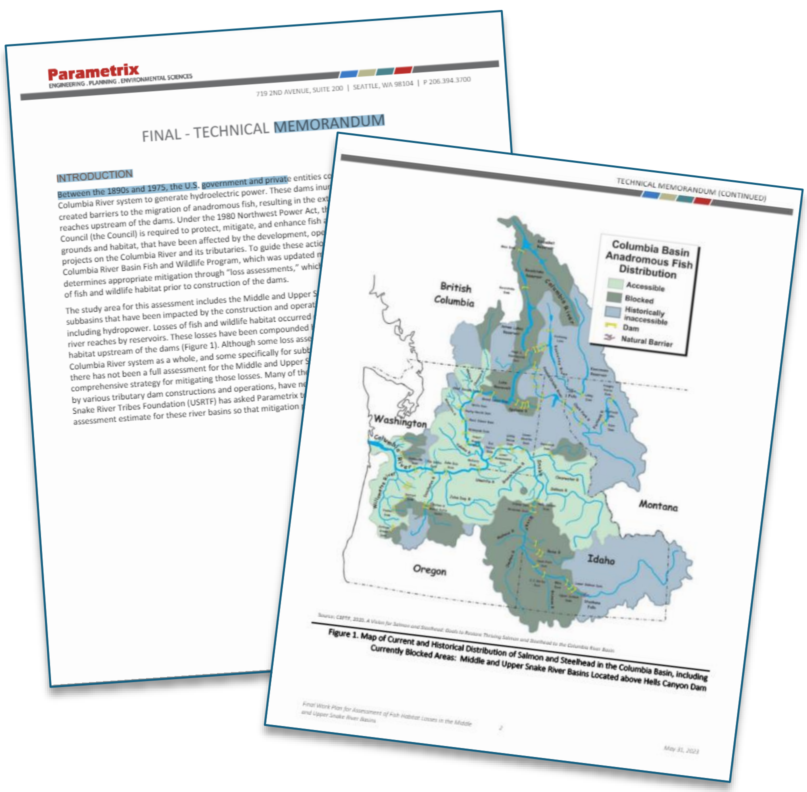
Review of Technical Memorandum: Loss Assessment of Spring/Summer Chinook in the Upper Snake River Basin



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ISAB Review of Technical Memorandum: Loss Assessment of Spring/Summer Chinook in the Upper Snake River Basin

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USRT staff Dennis Daw, Daniel Stone, and Scott Hauser were especially helpful in organizing the site tour and providing information and support from the assignment's development to its completion. Julie Davis made the tour run smoothly, and Robin Camp shared inspiring information about USRT's tribal youth education program.

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EXECUTIVE SUMMARY

The Upper Snake River Tribes (USRT) Foundation asked that the ISAB review the scientific elements of a loss assessment of spring/summer Chinook salmon in the Upper Snake River Basin. To address the USRT's specific review questions, the ISAB provides ideas of how to improve the presentation of results and specific comments about the analysis performed. In general, the ISAB agrees that USRT's use of an intrinsic potential model to assess loss of spring/summer Chinook salmon in the upper Snake River was a good first step that yielded valuable information under a constrained budget. However, the ISAB has concerns about the accuracy and uncertainty of the results, and concerns about how the model was used in the large leap from assessing habitat suitability and availability to quantifying and distributing the historical numbers of spring/summer Chinook salmon in stream reaches above the Hells Canyon Complex.

The ISAB offers five suggestions for next steps to produce a more complete analysis with increased certainty:

1. Explore more fully the current intrinsic potential model used in Parametrix (2023) to better understand the effect of assumptions made and scalars used.
2. Experiment with alternative intrinsic potential models that consider other biologically relevant covariates, e.g., temperature, precipitation, and discharge.
3. Explore the effects of landscape alterations from human disturbances and the expected effect of climate change.
4. Explore other modeling methods for cross-model comparisons, to increase accuracy and to reduce uncertainty.
5. Incorporate Indigenous knowledge to inform the analysis.

We hope that this review will help USRT with plans for assessments of loss and current habitat capacity for spring/summer Chinook salmon and other fish stocks and species. Although the suggested next steps will require additional effort, they will be critical for informing future actions to reintroduce anadromous fish above the Hells Canyon Complex.

ISAB Review of Technical Memorandum: Loss Assessment of Spring/Summer Chinook in the Upper Snake River Basin

I. Review Request

On February 27, 2024, a request by the Upper Snake River Tribes (USRT) Foundation[1] was approved for the Independent Scientific Advisory Board (ISAB) to review a Technical Memorandum prepared by Parametrix (2023) for USRT in their effort to assess loss of spring/summer Chinook salmon in the upper Snake River Basin.

As described in the USRT request letter:

> This Loss Assessment is an initial step in addressing the Columbia River Basin 2014 Fish and Wildlife Program's strategy on anadromous fish mitigation in blocked areas, which includes the principle:
>
> > *Restoration of anadromous fish to blocked areas should be investigated as mitigation for the impacts of hydropower dams that blocked historical passage of adult and juvenile fish. The abundance of native fish species should be restored throughout blocked areas where original habitat conditions exist or can be feasibly restored or improved.*
>
> The intent of this request is to ensure the document follows the scientific principles established by the Northwest Power and Conservation Council for blocked area mitigation and to determine if there are additional issues that warrant consideration for this assessment.
>
> Chapman and Chandler (2003) estimated that 1 to 1.7 million adult Pacific salmon and steelhead passed the area prior to 1860 that is now blocked by the construction of the Hells Canyon Complex (HCC) in the 1950s to 1960s. The impacts from the construction and operation of the HCC compounded existing impacts associated with other hydroelectric,

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[1] The Upper Snake River Tribes (USRT) Foundation is composed of four Indian tribes of the Upper Snake River region in Idaho, Nevada, and Oregon: The Burns Paiute Tribe, Fort McDermitt Paiute-Shoshone Tribe, Shoshone-Bannock Tribes of the Fort Hall Reservation, and Shoshone-Paiute Tribes of the Duck Valley Reservation.

water storage, and water diversion projects constructed by the U.S. government in the subbasin. These impacts led to the complete blockage and elimination of anadromous fish populations from many of the watersheds in the middle and upper Snake River.

The Loss Assessment of Salmon and Steelhead in the Upper Snake Basin [provided by Parametrix (2023) to USRT] distributes the estimated 1.4 million spring/summer Chinook salmon throughout the tributaries of the Upper Snake Basin. The USRT member tribes are following a stepwise process to complete a variety of assessments to determine the best path towards meeting the blocked area mitigation principles of the Fish and Wildlife Program, goals of the Hells Canyon Complex Fisheries Resource Management Plan, and Columbia Basin Partnership Phase II goals. The Loss Assessment is the first step in determining the feasibility of salmon reintroduction in select tributaries of the Upper Snake Basin, with a particular emphasis on river systems that connect to member tribes' reservations or those near existing fisheries in the Salmon River Basin. The USRT member tribes are following an analogous path to the Upper Columbia United Tribes in their Phase 1 and P2IP process.

The USRT asked that the ISAB focus on the scientific elements of the Loss Assessment (Final Technical Memorandum, Parametrix, May 31, 2023) and the supporting material on methodology (Parametrix 2024). In addition to the scientific methodologies and findings, these documents and the Story Map Loss of Salmon and Steelhead in the Upper Snake River Basin provide context of the geography, legal and policy background for mitigation, and the timeline of blockage in the Upper Snake Basin, which, although not the scientific subject of the review, helped inform the review.

The specific questions for the review include:

- What are the strengths, uncertainties, and limitations of the overall approach and specifically the use of previously reported values in the literature, habitat-based and life-cycle models, and the hybrid multiple approach used flexibly based on scale and other factors?
- If there are gaps or technical flaws, how might they be addressed?

Our review below is organized in two parts. First, we provide summary answers to the review questions; second, we provide specific comments on sections of the Parametrix (2023) Loss Assessment technical memorandum.

II. SUMMARY ANSWERS TO THE USRT REVIEW QUESTIONS

The Parametrix (2023) Technical Memorandum provides an informative summary of the approach used to assess loss of spring/summer Chinook salmon above the Hells Canyon Complex. An Intrinsic Potential (IP) model was used to allocate an estimate of historical numbers of adult spring/summer Chinook salmon among 12 formerly occupied *damsheds* (i.e., watersheds upstream of specified dams). As defined by Burnett et al. (2007), IP is a "calculated metric" that "reflects species-specific associations between fish use and persistent stream attributes."

The Parametrix (2023) product provides methodological detail at a general level, so it cannot serve as a standalone document to fully understand the integrity of the science and the adequacy of the assessed losses. The additional material provided (Parametrix 2024) was helpful, but it did not completely satisfy the need for transparency and for understanding the accuracy, error, sensitivity, and uncertainty of the results. Although the IP modeling used in this assessment was largely based on that used by Giorgi (2018) in the Upper Columbia River (BPA Project No. 2016-003-00, reviewed in ISAB 2019-3; pages 34-35), too little documentation of intermediate data derived for and by the IP model in USRT's application of the model are provided to assess their validity and applicability (see review subheadings below for more detail). In addition, some of the details of the IP model, as applied by USRT, are unclear. In general, the future steps need to be more transparent and presented in the context of alternate approaches and analyses.

The ISAB's (2019-3) earlier review of Giorgi's (2018) report noted several limitations that also apply to the present effort. Specifically, the intrinsic potential analysis is limited to physical habitat, and it is a coarse representation of physical habitat. The ISAB's 2019 review of Giorgi (2018) also noted that IP modeling has the benefit of not requiring expensive field work to estimate habitat quality and quantity. As such, IP is generally considered a useful first step in assessing habitat long vacated by anadromous salmonids (Duda and Hardiman 2023). However, if the historical IP is assumed to be a proxy for current IP in the Snake River, validation or refinement of these habitat estimates with other tools, such as modeling for juvenile rearing capacity and bioenergetic growth potential, are needed if the results are to be used, for example, for guiding restoration and reintroduction efforts.

The ISAB recognizes the important historical ecological and cultural links between people and salmon in the Upper Snake River Basin. To the extent that USRT would like to do so in next steps, we support the inclusion of Indigenous knowledge and Tribal preferences for harvesting locations and other culturally important geographies to help guide reintroduction plans and protocols. Indigenous knowledge would likely be of great utility to help guide restoration efforts and decisions (see Lander and Mallory 2021; Mehltretter et al. 2024), and we encourage inclusion of Indigenous knowledge in future development of this plan.

Presentation and Communication of Model Predictions of Losses

Many published works discuss best practices for applying habitat and population models to inform management and restoration (Grüss et al. 2017; Swannack et al. 2012; Rose et al. 2015). These works describe how best to communicate the predictions from the habitat and ecological models to diverse audiences, including non-scientists (Cartwright et al. 2016), and managers and decision-makers (Bodner et al. 2021; Schuwirth et al. 2019; Weiskopf et al. 2022). Proper presentation of results helps ensure that the audience appropriately interprets the results. Proper presentation also assures the audience that the authors are aware of the model's strengths and weaknesses, and that the authors are using the results that are appropriate to the model structure and conclusions are supported by the confidence we have in the predictions.

Two specific actions that can be taken by USRT to improve communication of the model predictions of losses are: (1) clearly state the questions to be answered by the modeling, and (2) present the results in the format of how the results will be used to answer the questions. Both actions involve relatively small effort, as they do not involve changing the existing modeling results. In multiple places in the technical memorandum, the purpose of the loss assessment (i.e., the objective of the modeling) is stated in general terms, and then the modeling results are presented with high precision in tables and figures. Without further information, the unstated implication is that the model predictions will be used with high precision to identify where to focus restoration efforts and even as possible numerical targets of numbers of fish for restoration.

USRT should explain the longer-term plans, of which this analysis is the first step, in the documentation. Knowing the plan would help the reader understand the context of these analyses and how these predictions are being used. Based on discussions with the USRT staff, the presumption or image that the modeling results will be used as shown without any explanation to the contrary, overstates how the results will be used. USRT explained to the ISAB that the results were part of a FERC-related effort and that USRT planned on additional modeling to focus the restoration efforts. Presently, the modeling reported in the memorandum might be mistakenly viewed as the only source of information on losses, and falsely presume that the results will be used directly and quantitatively to inform the restoration decisions. The addition of a description of the overall strategy planned by USRT would help readers understand why and how this modeling was done and how its predictions will be used. This would likely alleviate concerns that too much confidence was being placed on highly precise predictions whose accuracy is unknown.

Next Steps

The broader concerns that ISAB has about the IP modeling effort by Parametrix (2023) are issues with validity, uncertainty, and lack of corroboratory evidence as might be provided by other models, field surveys, and/or traditional Indigenous knowledge. Iacarella and Weller (2024) explain the importance of using multiple models to better understand how assumptions, limited data, and lack of verification can produce poorly supported or faulty inferences. Building on ISAB (2019-3), which suggested several steps to address these issues, we offer the following steps for additional work designed to increase confidence in model-predicted losses and as USRT proceeds to subsequent steps in the overall analysis:

1. Explore more fully the current IP model used in Parametrix (2023) to better understand the effect of assumptions made and scalars used. A key question is whether the rankings of damsheds by IP are over or under sensitive to the assumptions and mathematical scalars.
2. Experiment with alternative IP models (see Duda and Hardiman 2023) that consider other biologically relevant covariates (e.g., temperature, precipitation, and discharge). The IP effort could be bolstered with other approaches (e.g., habitat-based limiting-factor modeling or occupancy modeling; Ramos and Ward 2022).
3. Explore the effects of landscape alterations from human disturbances (within and downstream of the HCC watershed, including biotic interactions with introduced species) and the expected effect of climate change (see Isaak and Young 2023; Isaak et al. 2015).
4. Explore other modeling methods such as life cycle, species distribution and environmental niche models (e.g., Peterson and Soberon 2012; Araujo et al. 2019; Parken et al. 2006; Iacarella and Weller 2024) for cross-model comparisons to increase accuracy and to reduce uncertainty.
5. Incorporate Indigenous knowledge to inform the analysis, as it will likely inform where large numbers of adult spring/summer Chinook salmon congregated for holding and spawning prior to dam construction.

Use of an established IP model for spring/summer Chinook salmon by USRT represents a good first step in that it yielded (or will yield with subsequent runs and steps to reduce uncertainty) spatially explicit information about the habitat potential and constraints for anadromous fish reintroduction. The IP framework met needs for a relatively low-cost approach. Additional effort will be needed to address concerns of validity, accuracy, and uncertainty as USRT's analysis proceeds to subsequent steps designed to target specific damsheds and refine numerical goals of numbers of fish. Although the suggested next steps will require additional effort, they will be critical for informing future actions to reintroduce anadromous fish above the Hells Canyon Complex.

Story Map

Although not part of our scientific review, the Story Map provides an excellent introduction to the history of dams in the Upper Snake River Basin. The side-by-side story of the chronology and basin areas affected, along with pictures of the dams, provides essential context to the broader dialogue around reintroduction. Adding the four USRT member Tribes' reservations and locations (or including Indigenous territories map layer) would enhance the geographic representation.

III. SPECIFIC COMMENTS ON THE LOSS ASSESSMENT

As noted above, the Loss Assessment Memorandum by Parametrix (2023) includes a general context of the geography, a legal and policy background for mitigation, and a timeline of blockage in the Upper Snake River Basin. That information provided important context for our comments below that focus on the scientific sections of the document.

Some of ISAB's general and specific comments and questions about the Parametrix (2023) Technical Memorandum were addressed during a meeting and field visit with USRT and other entities on 29-30 May 2024 (held in Boise, Idaho and area). USRT subsequently provided written answers and explanations based on a list of questions that ISAB provided the USRT before the May 2024 Boise visit. The ISAB review below is based on the Parametrix (2023, 2024) documents and the answers provided to questions related to our field visit in May 2024.

A. COMMENTS ON SECTION 2 OF PARAMETRIX (2023): EXISTING LOSS ASSESSMENTS AND PLANNING STATUS IN THE STUDY AREA

This section of the Memorandum summarizes background information from existing loss assessments, subbasin plans, and provides information about fish stocks and other ESA groupings. Much of the information was adopted from two Columbia Basin Partnership Task Force documents (CBPTF 2019, 2020). The section also summarizes information from USRTF's (2018) Hells Canyon Complex Fisheries Resource Management Plan and describes the motivation for and purpose of conducting the current loss assessment.

B. Comments on Section 3 of Parametrix (2023): Methods for Estimating Historical Distribution of Salmon in the Snake River Basin above Hells Canyon Dam

1. Approach

As described by Parametrix (2023), a decision was made to use a "hybrid approach" to estimate historical abundance of spring/summer Chinook salmon in damsheds above Hells Canyon Dam. Although it was not clear what was hybridized, the approach taken was largely based on Giorgi (2018, itself based on Cooney and Holzer 2006), which was applied in the Upper Columbia River to assess potential habitat for anadromous salmonids above Chief Joseph Dam. The approach was then broadened by using an estimate of historical run size for spring/summer Chinook salmon above Hells Canyon Dam and allocating the estimated historical run size based on a derived index combining habitat quantity and quality.

Section 3 could benefit from a brief overview of the main considerations used when deciding to undertake the spatially explicit loss assessment, as this would provide the context for some of the modeling decisions. Will the historical IP model – due to its reliance on "durable" features – be used to inform a current IP analysis and/or the rankings of IP by damshed? This information would better communicate how the results of the so-called hybrid approach will be used to inform planning decisions.

While the choice of IP modeling over other types of modeling (e.g., species distribution models, ecological niche models, occupancy modeling based on thermal thresholds; see Iacarella and Weller 2024) is considered a good first step, an account of the assumptions, limitations, and uncertainty associated with using the IP model, or any such model (Araujo et al. 2019), should be fully documented. Some assumptions were reported in Parametrix (2023) and Parametrix (2024), as described below, but the list is not comprehensive and the analysis does not examine the impacts of what are, in some cases, potentially critical (highly influential on predictions) assumptions. One of the main assumptions about the upper Snake River Basin's historical capacity was implicit, but this assumption was made explicit when ISAB prompted the USRT for an answer to a question about assumptions. An account is presented below showing the progressive clarity and specificity about the assumption of capacity:

<u>From Parametrix (2023):</u>

> Page 3*: "…assuming that habitats were undisturbed, highly productive, and capable of their historic functions at the time that historic populations existed."*

Page 22: "*For our analysis, we assumed a total run size of 1.445 million spring/summer Chinook salmon.*"

From Parametrix (2024):

Page 4: *"Assumptions*

***Assume Total Historic Run Size** of spring/summer Chinook Salmon in the Upper Snake River Basin (above Hells Canyon) is **1.44 million** returning adults.*

***Limits of Anadromy** = accessible habitat of Chinook Salmon defined as streams with less than 20% gradient. All reaches greater than 20% gradient, plus all reaches upstream of those reaches were removed from the geodataset*."

Page 5: "*For our analysis, we assumed a **total run size of 1.445 million** spring/summer Chinook salmon (NPPC 1986;1987b. Compilation of Information on Salmon and Steelhead Losses in the Columbia River Basin; Numerical Estimates of Hydropower Related Losses).*"

From Answers to Questions that ISAB provided USRT in May 2024:

*"The main assumptions are that **the upper Snake River Basin was near capacity 150-200 years ago**, salmon production was directly proportional to habitat quantity and quality, and that the habitat can be evaluated based on basic geomorphic features (slope, width, valley confinement), all other processes/factors that determine habitat were 'working as they should,' i.e., not explicitly addressed in the model."*

An early account of IP modeling, detailed by Bidlack et al. (2014) for Chinook salmon in Alaska, summarized what the IP modeling approach assumes and what data it can use:

"*The distinguishing characteristic of IP modeling is the recognition that aquatic habitat is strongly influenced by the persistent geomorphic structure of the watershed; IP models assume that salmon species and populations have evolved and adapted to their environment within this watershed template. Persistent geomorphic landscape characteristics or habitat features that can be estimated or measured using remotely sensed data or digital elevation models (DEMs) are chosen as model variables."*

2. Data and Analysis Structure

The Parametrix (2023) report describes various aspects of data available and used but lacks key details, including values and summary tables. For example, it would have been useful to present information on the size of the damsheds and their respective stream kilometers (and miles) and watershed areas in square kilometers (and square miles).

The term “damshed” is used and becomes an important nodal aspect in the analyses. “Damshed” was defined in a footnote of page 3 of the document as: “the area upstream of a dam—specifically, to the potentially suitable habitat that was rendered inaccessible to anadromous fish by the construction of the dam.”

While the selection of a 20% maximum slope over 200 meters for passage of anadromous salmonids is supported in the literature, Duda and Hardiman (2023) also identified maximum abrupt vertical drops of 3.7 meters. Field and/or remotely-sensed verification (such as via recent LiDAR from the 3D Elevation Program (U.S. Geological Survey) is required to identify these kinds of natural barriers. The ISAB recognizes that existing data products for natural barriers may not be available for all basins in this analysis, but identifying where data products exist is an important task as these barriers can cause otherwise suitable habitat to be inaccessible in a system that was below the 20% slope criterion as determined based on 200 meter stretches of river habitat. When and where possible, field verification is highly recommended to assess slope criteria over a range of discharges and whether 200 meter reaches are adequately short enough for the desired evaluations.

3. Total Run Sizes

The Parametrix (2023) technical memorandum documents the various estimates of historical run size available in the literature in Table 5 of Section 2 but then chose a single estimate by the Northwest Power Planning Council (NPPC 1986), which happens to be the oldest and largest of the estimates. The report rationalizes this choice because it also provided estimates above the Hells Canyon Complex, but additional justification is needed for this selection. According to Table 8 of Parametrix (2023), which was based on Table 6 of NPPC (1987), the portion of the run estimate for spring/summer Chinook salmon above Hells Canyon Complex (1,443,000, but ultimately rounded to 1,445,000 for later calculations), relative to the entire Columbia River Basin (5,018,000), is about 29%. It is this percentage of the run that may be the most relevant value from the NPPC (1986, 1987) estimates, rather than the magnitude of the run, which has been modified by the subsequent works cited in Table 5 of Parametrix (2023), including ISAB 2015.

Because the end calculation for allocating the historical run size among damsheds within the Upper Snake River system is based on the proportion of total weighted habitat (Table 12), it would be easy to present the allocation of run size from the range of the run-size estimates that are presented in Table 5 of Parametrix (2023, drawn from Table 12 of CBPTF [2019]).

4. Total Accessible Habitat

While the approach taken by Parametrix (2023, 2024) was largely based on Giorgi (2018), the products presented would benefit from additional transparency. The Parametrix (2023, 2024) documents describe numerous data sets obtained and analyzed, but limited tables of these data summaries and analyses are presented, thus a critical review of the science of these important intermediate steps cannot be provided. As examples of the kinds of intermediate products that should be presented, see Tables 5, A.1, and A.3 in Giorgi (2018), and Table 4 and Figure 2 in Duda and Hardiman (2023).

Spatial arrangement of quality habitat within damsheds was not considered for it will likely be important for explaining how fish distribute within a damshed (Carnie et al. 2015). The spatial arrangement of good habitat within a damshed matters if the watershed has contiguous quality patches of habitat versus patches that are broken up and relatively isolated.

One set of calculated values that Giorgi (2018) provided was the fraction of "all rated habitats" that were "immediately accessible above lower mainstem dams" (see Tables 5, A.5, and A.7 in Giorgi 2018). The ISAB notes that values in Table 11 in Parametrix (2023) suggest that the mainstem Snake River habitat and tributary reaches below tributary dams immediately accessible above Hells Canyon, Brownlee, Swan Falls and C.J. Strike dams accounted for 42% (6,397 km) of all historically accessible habitat (15,075 km) above Hells Canyon Dam.

The ISAB notes that the magnitude of total habitat rated Low, Medium, and High was 15,075 km (9,367 mi), which seems to be very high (but plausible with many dendritic watersheds). The USRT should confirm these values and other stream-length numbers for accuracy.

5. Intrinsic Potential Habitat Model

The Parametrix (2023) IP modeling effort converted categorical ratings of <u>habitat potential</u> (High, Medium, Low, Negligible, None) into numeric ratings by using a <u>Numeric Habitat Multiplier</u> (i.e., 10, 6, 2, 1, 0; see Table 10). However, there was limited justification for these conversion values as opposed to other, more standardized, values. This discontinuous numeric system can have the effect of magnifying differences in habitat potential. The sensitivity, justification, and consequence of using this multiplier lack documentation. For a comparative analysis, Cooney and Holzer (2006) used the following conversions: 1.00 for High, 0.50 for Moderate, 0.25 for low, and 0 for both negligible and none (see p. C-18 of Cooney and Holzer 2006). Burnett et al. (2007), whose group helped pioneer IP modeling, used a continuous scale of 1 (highest) to 0 (lowest) for rating of individual variables (i.e., stream gradient, valley width index, and streamflow) for coho salmon and then a geometric mean of these three variables to derive an IP rating. While the introduction of unique twists and novel algorithms is not discouraged, they should be vetted for their scientific basis and how they influence model calculations. It would be helpful to present the results of a unique derivation and compare them side-by-side to results derived from use of values in critically reviewed and published accounts for illustrative purposes.

Duda and Hardiman (2023) provide an excellent example of comparing results from various IP modeling approaches. A good start would be to compare results from Parametrix's (2023, 2024) results using their Numeric Habitat Multiplier (0-10) to those that would result from using the weighting method (0-1) of Cooney and Holzer (2006). See Figures 2 and 3 of Duda and Hardiman (2023) for an example of a good way to graphically express the comparison of the results.

In the Parametrix products, all variables related to IP need to be defined carefully. Much confusion results when variables are not defined or given units. For example, it would be helpful if the authors demystified the original meaning of this scale (high -> negligible). What determined "high" vs. "medium" vs. "low" vs. "negligible"?

The ISAB suggests that USRT consider in their analyses (quantitatively or qualitatively as part of interpretation) the possibility that historical water temperatures would have limited spring/summer Chinook salmon distributions and use of otherwise suitable spawning areas. Georgi (2018, p. 3) incorporated a temperature threshold of 22° C to eliminate some stream reaches from having habitat potential, but this was based on relatively current conditions for mean July temperatures from data recorded during a 30-year period from 1971 to 2000.

6. Weighted Relative Habitat Quality Index

It is confusing that this section is titled "Weighted Relative Habitat Quality Index" and then switches to the use of "relative habitat score" as the metric that is described. Consistent use of terms would be helpful.

As described on page 24 of the Parametrix (2023) document, a formula was derived to calculate a "relative habitat score" for each stream reach, by multiplying the numerical habitat index values by reach length and then multiplying that by bankfull width. It is questionable and unclear what multiplying by bankfull width did to this metric. Bankfull width was a factor in determining habitat suitability, and wide reaches are designated as less suitable habitat for spawning and initial rearing of spring/summer Chinook salmon. It seems likely that multiplying a relative habitat score by bankfull width would overemphasize wider stream reaches as suitable Chinook salmon habitat. If so, the approach taken would mistakenly distribute historical adult salmon numbers to wide streams for which the habitat suitability score indicates have little value for spawning and initial rearing for spring/summer Chinook. How such inconsistencies are addressed is important for accurately attributed to damshed.

At the very least, the effect of using bankfull width on the habitat and fish metric should be explicitly documented. A 3-D bar graph would be one way to show this. The first row could be the habitat values (ordered low to high by damshed), derived from use of the Cooney and Holzer (2006) scalar (0 to 1). The second row of bars would be what resulted from the 0-10 scalar of Parametrix (2023) before multiplying by bankfull width. The third row would be what resulted from multiplying by bankfull width (adjusted by a scaled down y-axis to make bar height comparable). The result may produce different ideas regarding perceived importance of damsheds to spring/summer Chinook salmon. A similar 3-D bar graph could be constructed using adult fish numbers by damshed. These graphs, and related tables, would be very helpful to determine the value and worthiness of the scalars.

Another concern about using bankfull width for a scalar is that modeled bankfull width (based on GIS of current conditions) may differ from the historical condition. Slope could also be different because of reservoirs, upstream disturbances, etc. Some thought should be given as to how these current conditions might influence the assessment of historical conditions.

Spatial arrangement of quality habitat within damsheds was not considered in the modeling. As stated more completely above, it would likely be important historically and currently for how fish populate and use the habitat.

7. Allocation of Total Run

While deriving values for a Weighted Habitat Index by damshed involved a series of calculations, the allocation of total run was straightforward. Conveniently, whatever historical number is chosen for future use can be readily adopted and allocated among the damsheds.

The ISAB cautions, however, that quantitative models do calculations with very high precision, for example, generating exact numbers of fish in the loss assessment. Precision must be distinguished from accuracy, which is how close the predictions are to truth (e.g., Peters et al. 2004; Raimondo et al. 2021; Planque et al. 2022). Models can generate predictions that have all combinations of low or high precision with low or high accuracy. However, a model generating highly precise predictions does not mean that the results will be interpreted for management at the same high level of high precision as implied by the calculations. High precision is readily, and all too often, falsely equated with high accuracy. In some situations, highly precise predictions are interpreted as categorical or even qualitatively when ultimately used to inform management and regulatory decision-making (Swannack et al. 2012). Presentation of model results in reports should match how the results are being used to answer the management questions. This ensures transparency of how modeling results are intended to inform management and increases the confidence the audience has in the modeling effort.

C. Comments on Section 4 of Parametrix (2023): Summary of Chinook Salmon Losses in the Snake River above Hells Canyon Dam Based on Location of Blocked Habitat Access

The results provide new information about the losses of spring/summer Chinook by damshed and over time. Considering this is new information, it would be relevant to highlight 1) analytical outputs that were expected and those that countered initial expectations and 2) outputs and readily available data that shed light on the adequacy of assumptions.

A relatively simple step the USRT can do is to present the existing results that are presently in tables and figures in the memorandum in a format consistent with how the results will be used to answer the management questions. Many tables of numbers of fish, without an explanation of how they will be used, can create the image to some readers that the results will be used to, in the extreme, to determine the exact number of fish that were lost and need to be restored for each damshed. Such a use of the modeling results is beyond the confidence level we have in the predictions. One could move the existing tables, along with additional tables, to supplemental information to ensure transparency and then present the results in the main report using new graphics. For example, one can show the predicted proportions on a spatial map, color-coded by 4-6 categories of proportions (0-0.2, 0.2-0.4, 0.4-0.6, etc.). The same legend and colors can also correspond to the numbers of fish, assuming a total run size. By color coding, one moves from highly precise predictions to categories and viewing these graphically across damsheds shifts the interpretation from numbers to a more comparative interpretation. Presentation of the results should be done in ways that are consistent with how USRT plans to use these predictions. During our discussions with USRT, it was obvious that they recognized the importance of presenting results as they are actually being used, but explaining this in the report, in combination with a presentation of the general strategy (see above), would help make the use of the modeling results transparent and increase confidence in the results.

The conclusion of Parametrix (2023) suggests that the results will be “useful… in discussions about improving fish passage … and when developing a strategic approach for species recovery.” This seems to imply that restoration efforts will focus on habitat with high intrinsic potential, but further elaboration, justification, and caveats would be useful. Such a discussion should expressly link the modeling objectives to an actionable outcome as a supported logic pathway.

IV. LITERATURE CITED

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