Reviewer: 1

The authors provide a well-written Introduction on the issue of steelhead overshoot and fallback. While overshoot and fallback probabilities have been reported elsewhere, little is known about the actual abundance of steelhead with this behavior. This is a valuable contribution and a roadmap for further work at other hydroelectric projects in the Columbia River Basin. The paper could benefit by providing more context on the choice of Priest Rapids Dam as the focus of the paper for reader outside the region. For instance, Priest Rapids (PRD) and Ice Harbor dams are the first dams above the confluence of the Snake and Columbia rivers and PRD is therefore in a strategic location to monitor lower Columbia and Snake River fish moving up into the mid-Columbia.

*Added language*

The section on estimating overshoot fallback abundance is very long with multiple elements. This section would benefit from adding 2–3 sentences at the beginning that describe the overall approach used (e.g., lines 268–270). Then go on to describe how each component was constructed. The authors neglected to mention what elements of their Bayesian analysis used priors, why, and what form.

*This section has been revised to be clearer. The priors used have been included.*

The results of their study are appropriately presented in the Results section. Some clarification of the equation on line 214 is addressed elsewhere in this review. The word “rates” should be carefully used, it formally refers to dx/dt. In most all cases, proportion or percent (%) is the correct terminology.

*Use of the term rates has been eliminated*

The value of Tables 1–2 would be improved if some of the sub-abundance values were converted to proportions to better illustrate relative magnitudes.

*Added percentages for emphasis*

Perhaps in the section on Conservation Implications, the issue of more fish overshoot into the Snake River should be once again addressed. McNary Dam is regarded by many scientists as having the largest overshoot problem followed by Snake River dams. This paper is in an excellent position to recommend similar studies of overshoot abundance be conducted elsewhere in the Columbia/Snake river basin. Such studies would be helpful in focusing remediation efforts to reduce overshoot and improve fallback success.

*Language was added referencing the protective measures in the 2020 CRS BiOp for McNary and the four lower Snake dams.*

Specific Comments

Abstract, line 17: What does SD refer to, it seems to be a poor acronym for annual mean proportion.

*SD = standard deviation and typically doesn’t need to be defined.*

Abstract, line 20: Reword “number of dams where fish were detected upstream….”

*Deleted phrase as it was redundant*

Line 21: Readers unfamiliar with the Pacific Northwest will not understand the distinction made between lower Columbia River and Columbia River.

*Defined lower Columbia in text*

Line 51 and throughout manuscript: The word “rate” means a time-based measure of occurrence. Use instead proportion, probability, or preferably, percentage as identified by the authors use of %.

*Eliminated the term rate*

Section “Study Area,” lines 84–93: Description needs to be expanded to include geographic significance of Priest Rapids Dam and why it was chosen as the focal point of this analysis.

*Proved justification (first location count and sample UCR steelhead)*

Line 87: Omit the word “also.”

*Deleted*

Lines 107–125: Explain what were the Bayesian priors that were used and why.

*Priors have been described.*

Line 112: IPDS not defined.

*Definition included immediately prior*

Line 110: Provide references for multistate spatial CJS model.

*References have been added.*

Line 114: The word “drawn” should be replaced with “modeled using a multinomial…”

*Language changed*

Line 151: Explain “overshoot return tags,” what does the return element refer to? Authors are using tag detection, not tag returns from harvest.

*Provided clarifying language*

Line 163: The role of the normal distribution in this analysis needs to be explained.

*Added language just prior to this equation explaining the normal distribution.*

Line 214: The exponent of 0.99 is nearly one, which reduces the equation to overshoot abundance = 41.46T, in other words, OA is 41.46 times larger than the known number of overshoot tags observed at PRD. Why if the sampling fraction at PRD was a representative sample ≈ 15% (line 1010) of all fish, shouldn’t the multiplier be 1/0.15 = 6.67? Please explain.

*This equation was based on adult steelhead tagged as juveniles, T, (unknown percentage and presumed to be much lower than 15%) and not tagged as adults at PRD.*

Lines 231: Reword “number of dams fish overshoot…”

*Added clarifying language*

Lines 234–235: Dams do not overshoot, reword. How can you have an overshoot rate when zero dams were overshot? Did you mean fish did not overshoot?

*The y-intercept or zero dams was less than one suggesting some natural mortality and not all attributed to dam passage.*

Lines 252–254: The KS test is not appropriate if the data being used are not the actual observations but rather “expanded detections.” Needs reanalysis with just actual data or perform test based on simulated null distribution.

*We re-did this analysis, using the arrival days at Prosser Dam of all fish PIT tagged within the Yakima basin and known overshoots (fish tagged at Priest that were later detected at Prosser). These two distributions of arrival days can be compared with a KS test. Methods and results were revised to reflect this change.*

Line 413: Reword “number of dams fish overshoot….”

*Reworded for clarification*

Lines 422–433: This paragraph needs to be put in context. Begin by stating cluster analysis was performed on the DPS by Blankenship et al. (2011).

*Paragraph was deleted*

Table 1: This table would be easier to interpret if estimated overshoot fallback abundance was also converted to percent of adjusted dam counts. It seems one purpose of this table is to illustrate the magnitude of the overshoot fallback problem over time, percentages would therefore be helpful. Lower the position of “run year” in the header, same with “Adjusted Priest Rapids Dam Count.”

*Table has been changed*

Table 2: Again, the significant of these finding may be best expressed in percentages after providing totals. Fix the table header.

*Table has been changed*

Table 3: Relevance of “known overshoot fish” needs to be explained in the caption. The high expansion rates and low precision should be referenced in the Discussion section.

Reviewer: 2

Comments:

This manuscript presents information about adult steelhead behaviors in the Columbia River. Some steelhead in this system migrate upstream past their natal tributary and then pass dams via fish ladders, a behavior called “overshoot”. To successfully home, these fish must fall back over or otherwise past the dams, incurring potential risk of injury or mortality. The manuscript uses two datasets of PIT-tagged steelhead and a series of modeling exercises to estimate the abundance of adult steelhead exhibiting overshoot behavior and the proportions that successfully fall back and enter their presumed natal tributary. The author(s) demonstrate a good understanding of the ecological issues surrounding steelhead overshoot in the Columbia River basin, and the presented estimates are a useful contribution to help address the ongoing hatchery and dam management challenges associated with an undesirable steelhead behavior.

While I think the methods, results, and overall conclusions were quite reasonable, I found the manuscript difficult to read. In particular, the jargony and often overlapping terminology was hard to follow and distracted more than enlightened. I also strongly encourage the author(s) to ensure that the key terms are clearly defined and then consistently used throughout all manuscript elements. They should also reconsider the overall structure of the manuscript. There are four stated objectives, but the methods, results, and discussion sections are - at best - only loosely structured around these ideas. Additional section sub headers and text that clearly links content to objectives would go a long ways towards improving readability. Lastly, as written, the manuscript is very narrowly tailored to address a small group of fish managers in the Columbia River basin. Are there implications from this research that might apply to other regions, species, or readers?

*Great point. Added a paragraph in the conservation implications section that suggest applicability to other less-monitored large freshwater systems.*

Line by line comments.

Line 35. “to in the Columbia River”

*Added language*

line 39. It seems likely that the use of refuges occurs both upstream and downstream?

*Added language*

Lines 43 – 45. The sentences presume that the reader knows a lot about several very local management activities: juvenile barging, improper(?) Hatchery practices, and ladder placement. These claims surely make sense if one has read the cited 2018 paper, but may need more explication here for unfamiliar readers.

*Added language*

Line 47. Another relevant overshoot example from a river without dams is detailed by Eiler et al. (2015) for Chinook salmon in the Yukon River (<https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fdoi.org%2F10.1371%2Fjournal.pone.0123127&amp;data=04%7C01%7Candrew.murdoch%40dfw.wa.gov%7C438846cc55e6409c950d08d89c0ef54f%7C11d0e217264e400a8ba057dcc127d72d%7C0%7C0%7C637430935360935114%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&amp;sdata=zOUsveWq4GghrXPacqaB7cX16sFZNcITVMgvM6zmy4w%3D&amp;reserved=0>).

*Added reference.*

Line 48. Known-origin should probably be hyphenated in all uses.

*Origin was deleted*

Line 53. It is not clear what “the following March” means in this use? Following fallback? Following fall migration? Might also want to clarify what role “spilled water” has in this statement.

*Sentence was deleted*

Line 54. A better paragraph topic sentence is needed here, especially with the introduction of a new term “overshoot fallback abundance”.

*Added language for clarification*

Line 58. Is there a demonstrable example of this negative bias in the Columbia basin or elsewhere?

*Unfortunately, not yet. We do have unpublished data we hope to publish when the data time series are complete.*

Line 60. The statement starting with the word “failure” is difficult to follow. Does “presence in” mean entering or being detected in a non-natal tributary?

*Change sentence structure for clarity*

Line 68. “sluiceway” is a new, undefined term – is this equivalent to spillway?

*Added the term debris sluiceway*

Line 75. Typo. Conversation instead of conservation.

*Changed*

Line 84. Needs a better subheading or topic sentence. The content of this paragraph is really about the three DSPs, not the study area per se.

*Changed topic sentence*

Line 97. I recommend changing to active voice here. “We systematically sampled adult summer steelhead”. Or at least clarify who did the sampling.

*Changed*

Line 99. “biological data” is very vague.

*Added details*

Line 101. To what does the 15% refer? Wild and hatchery fish separately, combined? Was the target achieved?

*Added clarification*

107. “Overshoot return abundance” and “overshoot fallback abundance”are used in rapid succession, introducing potential confusion. See general comments. I also found this subsection quite confusing, in part because there are multiple models and estimation terms. However, there are also two data sets: fish tagged as juveniles and another for fish tagged as adults. Although these datasets were partially described in the previous paragraph, I strongly recommend that the two datasets are better differentiated up front and then there is clear indications regarding which data set were used with each model and overshoot metric.

*The section was reorganized, and some headers changed. Each PIT tag data set is described in a separate section.*

Line 111. Please define “double instream pit tag detection systems”. As a style consideration, I suggest using past tense for these descriptions.

*Deleted double not necessary*

Line 113. Throughout the manuscript, “PRD” “Priest Rapids Dam” and “Priest Rapids” are used interchangeably, though I think PRD was the intention. Please check for consistency.

*Changes made*

Line 122. Again, past tense probably more appropriate.

*Changes made*

Line 126. Not clear that “Escapement estimates” constitutes a new subsection, or belongs under the “overshoot fallback abundance” header?

*Changed subheader to overshoot fallback abundance*

Line 133. Although the reader later learns that the three letter codes are for pit detection sites, that should probably be clarified here, with similar site definitions across codes. For example, PRV does not have a description akin to the other sites.

*Added clarifying language*

Line 142. Why introduce the “Program Brach” method at all if it was not used in the current study? In addition, the term “overshoot abundance” is used here, another departure from the subheading terminology.

*Good point deleted entire sentence*

Line 150. Another new term: overshoot return abundance. See previous comments about subsections and linking text to specific objectives.

*Changed*

Line 157. Another new term: total overshoot abundance. These pieces do not logically flow from one to another.

Deleted “total”

Line 160. “Overshoot reach survival rate” – how is this different from “overshoot migration success” that is also not really defined but starts the next paragraph? Is success different than survival?

*Language changed and now migration success is consistent*

Line 176. Typo . were vs where; also, “these data” since data are plural.

*Corrected*

Line 188. Insert “steelhead” before overshoot?

*Inserted*

Line 190. Why use the average rate of 15%? Weren’t the annual rates calculated?

*Data were pooled across years, so we used the average sample rate for that period.*

Line 195. Please provide some justification for why 2015 was selected. If only because it was a low-water year, does that potentially bias any conclusions based on these data?

*Added justification. Water temperatures in a low water year represent future conditions due to climate change.*

Line 199. The end of this paragraph doesn’t really provide methodological details for how the temperature data were used.

*Added justification.*

Line 203. Need to clearly articulate which dataset was used for this summary (adults tagged at PRD) and also that the estimates were annual estimates.

*Added language*

Line 205. Again, annual data. Probably replace “related” with “correlated”

*Added language*

line 207. Group… Were. Verb mismatch.

*Changed*

line 210. A little unconventional to include citations in results.

*Deleted sentence. Information is in the table.*

Line 212. This reads more like methods than results. Similar comment for line 220.

*Deleted redundant methods*

Line 217. The count here refers to wild steelhead?

*Added*

Line 223. Why “in addition”?

*Deleted*

Line 225. Majority… Were. Verb mismatch. This sentence does not make sense: how can fish be both last detected at PRD and subsequently detected downstream of PRD?

*Added language to clarify. I prefer the plural*

Line 227. Proportion… Were. Verb mismatch.

*I prefer the plural*

Line 228. I suggest replacing “observed” with “detected” in most instances.

*Changed when appropriate*

Lines 233, 240,251. Past tense more appropriate.

*Changed*

Line 236. Can a probability be observed?

*Changed to estimated*

Line 242. This also reads a bit like methods. How were the detection probabilities calculated?

*Added methods in Method section*

Line 246. Insert “was” before at Ice Harbor Dam.

*Added*

Line 249. Is this a repeat of the information online 237?

*Deleted*

Line 253. PIT-tagged (hyphenate compound modifier)

*Added*

Line 253. Overwintering-related (hyphenate compound modifier)

*Deleted*

Line 275. This sentence is confusing. What is meant by “a similar number of dams required fallback”?

*Deleted and changed*

Line 285. Presumably this reporting is a reference to Richins &Skalski (2018)?

*Added*

Line 299. Ambiguous “this” – which study is this in reference to?

*Changed*

Line 318. Presumably no fish were detected after they died. Rephrase.

*Changed*

Line 328. Again, mean is in reference to annual estimates?

*Added*

Line 338. Passage related (hyphenate compound modifier)

*Added*

Line 344. Need to insert steelhead passage into this statement since the number of dams could not simply increase.

*Added*

Line 359. “Delays in migration” is in reference to overshoot fish only?

*Deleted paragrpah*

Line 367. Population specific (hyphenate compound modifier)

Added

Line 368. In what ways, specifically, were the current results consistent with the 2018 results?

*Deleted*

Line 377. Was this 61% return rate a finding in the current study? There does not appear to be any information in the Results section.

*Added mean to results*

Line 396. Does the word “only” here mean the detectors operated for just one year? Or was 2014 the first year? This detail and the comment about only examining patterns for the year 2015 seem like they belong in the methods section.

*Deleted*

Line 401. I don’t recall the 32% or 56% values being reported in results. Why do they show up here? Was comparing UCR versus Snake River overshoot differences one of the study objectives?

*No, we were simply trying to highlight the need for more similar research in the Snake River.*

Line 408. Some fish may have gone undetected, or some spawning areas?

*Correct. Undetected in some spawning areas*

Line 415.Typo: the is.

*Changed*

Line 426. The clustered aggregate language, perhaps lifted from the Blankenship reference, is confusing without explanation.

*Deleted entire paragraph*

Line 450. Relatively low compared to what?

*Deleted relatively*

Line 465. What is meant by “existing monitoring programs” – juvenile bypass and adult ladder sites?

*Added adult salmonid*

Line 561 citation runs off the left margin in my PDF.

Fig 1 caption. DPSs and IPDS should be spelled out since figures should be able to stand alone.

*Language added*

Fig 2. Should y-axis label be something like ‘ predicted probability’? Caption should also be modified to reflect this and symbology should be defined.

*Changed y-axis label to “Overshoot Return Probability”. Adjusted the caption to read “Logistic regression between the number of dams to the furthest upstream detection location for known origin overshoot steelhead detected at Priest Rapids Dam and the overshoot fallback proportion detected downstream of Priest Rapids Dam, 2010-2017.”*

Fig 3. Should y-axis label be ‘detected at’ rather than ‘arriving at’ since true arrival timing was likely unknown? See previous question about using 2015 T data. Would the fig look the same if T from other years was substituted?

*Caption language changed*

Associate Editor

Comments to the Author:

The manuscript “Abundance and Migration Success of Overshoot Steelhead in the Upper Columbia River” describes the movement ecology of adult summer steelhead in the Columbia River, with respect to up- and downstream passage at various dams. The author used an extensive, multi-year PIT tag data set to estimate overshoot and fallback rates for adult summer steelhead, relating fallback and migration success with magnitude of overshoot.

The manuscript received two peer reviews, one quite favorable and another less so. The less-favorable review cited weak document structure, extensive grammatical errors, and limited scope of interest among the flaws plaguing the manuscript. Although I found the manuscript interesting and of potentially great importance to steelhead conservation, particularly in light of climate change, I also found it to be rife with errors and difficult to read. The study appeared to lack any testable hypothesis. Moreover, I believe the implications of the study would be more relevant to NAJFM or a similar management-oriented journal.

Therefore, based on the comments received and my own review, I recommend that this manuscript be rejected for publication in Transactions. However, I strongly encourage the author to heed the advice of both reviewers and my comments, below, should he consider submitting a revised manuscript to a more appropriate journal.

General comments:

I encourage the author to reconsider use of the term “migration” throughout the manuscript. In many cases, this term is used to describe in-river movements that are not necessarily associated with any seasonal migration. Animals move for a variety of reasons (feeding, thermoregulation, etc.), but not all of these describe “migrations”.

The manuscript is largely descriptive and lacks any clear hypothesis. I encourage the author to clearly state expectations to be tested in the Introduction, then test hypotheses through Methods described. I believe this exercise will improve the structure of the document and highlight the importance of the study.

Citations should be provided where “overshoot” and “fallback” are defined.

Throughout, the authors cite the risk of genetic introgression from overshoot steelhead. It is perhaps a subtle but important distinction that introgression follows on hybridization, which is the more immediate risk. Introgression only occurs when genes from an immigrant are successfully integrated into the recipient population. This may or may not involve a cost to the recipient population. Hybridization, however, is a more immediate process and could result in deleterious gene combinations that lower fitness and preclude introgression.

The Discussion is unduly verbose and should be revised to present a clear interpretation of results and synthesis with current understanding.

Line comments:

Line 3: Plural “migrations” incorrect

*Corrected*

Lines 12-15: Here, “physiological stress” is listed as a “physiological effect”. This is both circular and meaningless. More specific examples of effects should be used as examples.

*Changed “physiological stress” to “stress”*

Line 19: As previously noted, not all movements constitute “migrations”

*Changed “migration” to “movement”*

Line 23: Remove “(d)”, the unit is not relevant here

*Deleted*

Line 29: commas around “of those”

*Commas added*

Line 41: relevance of “undetermined”?

*Deleted*

Line 55: comma after “stream”

*Added comma*

Line 65: Logical sequence. I suggest moving sentence beginning with “Khan et al. (2013) found that…” to follow “…to their natal tributary.”

*Moved sentence*

Line 101: Remove space before “November”

*Removed*

Line 104: Comma after “PRD”, and after “Rivers”

*Commas added*

Line 120: “multiplication”…does the author mean “product”?

*Changed to product*

Lines 175-177: Awkward sentence structure

*Reworded sentence*

Line 181: The author previously cited that fallback rate varies with spill. How was interannual variation in spill treated during pooling of data from different years?

*We did not explicitly examine factors the contributed to variability of fallbacks (e.g., Richins and Skalski 2018). Deleted reference to spill in the introduction because was not significant for wild fish.*

Lines 205 and 211: These are “positive” relationships? State if so.

*Added positively*

Line 235: Add “with” after “well”. That said, meaning of this sentence is unclear.

*Added “with”*

Line 240: I cannot imagine that the author knows the total migration distance of these fish, as ocean migration distance is likely unknown, and could easily differ by thousands of miles among individuals. The in-river component of migration is another story, and is presumably the intended subject of this sentence.

*Added freshwater travel distances for clarification*

Line 275: Space between “fall” and “back”. Here used as a verb.

*Space added*

Line 280: How was randomness established?

*Deleted random*

Line 282: Remove “s”…fallback rates

*Deleted*