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December 8, 2020

MEMORANDUM

TO: Fish and Wildlife Committee Members

FROM: Erik Merrill and Leslie Bach

SUBJECT: Discuss four potential ISAB assignments

BACKGROUND:

Summary: Staff will discuss and seek the committee's input on four potential ISAB assignments. The discussion will be informational, and no committee decision or recommendation is needed. The committee's input will help inform Chair Devlin's consideration of approval of the assignments in his role on the ISAB Administrative Oversight Panel. The potential assignments include:

1. A request from NOAA to review scientific findings and subsequent debate on juvenile fish size selectivity in dam bypass systems and implications for estimating and interpreting fish survival (i.e., Faulkner et al. 2019, 2020 and Storch et al. 2020)
2. A request from CRITFC to compare research findings on avian predation impacts on salmon survival (i.e., Haeseker et al. 2020 and Payton et al. 2020)
3. A request from the Administrative Oversight Panel to evaluate "A Synthesis of the Coast-wide Decline in Survival of West Coast Chinook Salmon" (Welch et. al 2020) and its interpretation of the implications of smolt-to-adult return values as well as the Fish Passage Center's review of the paper (FPC 2020)
4. A proposal by the ISAB to produce a state of the science report about American shad impacts on management and restoration programs in the Columbia Basin

Draft review requests are provided below for each potential assignment.

Relevance: These four review assignments highlight scientific issues with important management implications. The debate about analysis of juvenile fish bypass information informs hydrosystem management, particularly regarding spill. The avian predation research comparison could help inform whether to focus more attention on avian predator management. The Welch et al. paper challenges the efficacy of freshwater actions in face of coast-wide Chinook salmon declines in survival. American shad have become the most abundant anadromous fish in the Columbia River Basin, but the ecosystem and management implications are uncertain and could be significant.

Workplan: Independent scientific review is an integral and ongoing component of the Fish and Wildlife Program and the Division's workplan.

Background: The potential reviews are targeted and narrow in scope, and thus the ISAB could work on the reviews concurrently and produce timely reports. The assignments would be well within the ISAB's budget and leave ample budget for other assignments during the fiscal year.

When the Administrative Oversight Panel approved the [ISAB Fiscal Year 2021 Work Plan](#) in June 2020, they asked the Ex Officios to recommend a list of prioritized assignments from the larger set of potential assignments described in the work plan. In September, the ISAB Executive Committee considered the work plan assignments and identified a few priority assignments that the full ISAB considered. The ISAB Ex Officios and members agreed that reviews concerning 1) data sources, calculations, and interpretations of smolt-to-adult return rates (SARs) and 2) American shad would be timely and beneficial to undertake early in fiscal year 2021.

Although the first three assignments listed above could be part of one comprehensive SAR review report, we thought completing the reviews as separate documents would maintain the focus on each of the specific issues. Findings from these smaller, focused ISAB reports could then be used to develop a larger summary guidance document on SARs. We feel that this review approach will help readers discern among the different aspects of this interrelated issue.

We envision that the bypass, avian, and coastwide survival reviews could be completed in approximately four months by April 23, 2021 and that the American shad review could be completed by August 1, 2021. We would organize online briefings from regional experts to provide critical information for the reviews. We propose that these online briefings be tailored to a wider audience than just the ISAB and encourage fish and wildlife managers and policy makers to attend.

More Info:

Review Request #1: Review of analyses of juvenile fish size selectivity in dam bypass systems and implications for estimating and interpreting fish survival

NOAA Fisheries asks the Independent Scientific Advisory Board to review scientific findings and subsequent dialogue on fish size selectivity in juvenile bypass systems and implications for estimating and interpreting fish survival.

It has long been observed that juvenile salmonids that encounter multiple juvenile bypass systems during downstream migration return as adults, on average, at a lower rate than those that have fewer bypass encounters. Two, non-mutually exclusive, hypotheses have been put forth to explain this phenomenon: 1) bypass systems impart some sort of damage or stress that results in mortality, but not until the fish have completed passage through the hydropower system; 2) bypass systems select for individuals that are smaller or have other characteristics that result in a survival disadvantage regardless of passage routes at dams.

The Fish Passage Center and the Comparative Survival Study (CSS) have promoted using an index of average cumulative powerhouse passage for groups of fish, which they call PITPH, to capture the effect of passage route taken by juveniles and to estimate the magnitude of delayed mortality in the estuary and ocean. This metric is based on predicted powerhouse passage probabilities from dam passage models and does not track the passage history of individual fish. It is currently being used to guide management decisions regarding the amount of water spilled at federal dams.

Addressing the issue of effect of passage history on ocean mortality is important because the current management strategy of maximizing spill is designed to route fish away from bypass systems.

[Faulkner et al. \(2019\)](#) sought to investigate whether differences in length between fish utilizing alternative passage routes might help explain differences in associated adult return rates. They found that smaller fish were more likely to enter juvenile bypass systems than larger fish and that smaller fish were less likely to return as adults. They also found that apparent effects of bypass passage on adult returns were diminished or disappeared when fish length was taken into account. In a comment to the journal, [Storch et al. \(2020\)](#) were critical of the data and approach adopted by Faulkner et al. (2019). In addition, the 2019 CSS report ([McCann et al. 2019](#)) had an appendix (Appendix G) that was also critical of Faulkner et al. (2019).

Review questions for the ISAB:

1. Was the Faulkner et al. analysis scientifically sound and were the data it used appropriate for addressing the question?
2. Were the conclusions drawn by Faulkner et al. supported by their results?

3. Does the ISAB have recommendations to improve the analysis?
4. Are the criticisms raised by the Storch et al. comment and the CSS report appendix valid and supported by the evidence, and do any of those criticisms weaken Faulkner et al.'s results or conclusions?
5. Was the [Faulkner et al. \(2020\)](#) response to the Storch et al. comment appropriate and were their criticisms of the Storch et al. methods valid?
6. Is PITPH an effective index of the powerhouse passage of individual fish, and is it valid to use it to draw causative inferences about effect of powerhouse passage on ocean survival?

We appreciate the ISAB's ongoing review of fish passage and survival analyses and look forward to a constructive discussion and review. If feasible, we would appreciate a completed review by April 23, 2021.

References

- Faulkner, J.R., B.L. Bellerud, D.L. Widener, and R.W. Zabel. 2019. Associations among fish length, dam passage history, and survival to adulthood in two at-risk species of Pacific salmon. *Transactions of the American Fisheries Society* 148:1069-1087.
- Faulkner, J.R., B.L. Bellerud, D.L. Widener, S.G. Smith, and R.W. Zabel. 2020. Associations among fish length, dam passage history, and survival to adulthood in two at-risk species of Pacific salmon: response to comment. *Transactions of the American Fisheries Society* (in print).
- McCann, J., B. Chockley, E. Cooper, B. Hsu, G. Scheer, S. Haeseker, R. Lessard, T. Copeland, E. Tinus, A. Storch, and D. Rawding. 2019. Comparative survival study of PIT-tagged spring/summer/fall Chinook, summer steelhead, and sockeye: 2019 annual report. Contract report to the Bonneville Power Administration. www.fpc.org/documents/CSS/2019CSSAnnualReport.pdf
- Storch, A.J., S.L. Haeseker, G. Scheer, J.A. McCann, B. Chockley, T. Copeland, and R.B. Lessard. 2020. Comment: Associations among fish length, dam passage history, and survival to adulthood in two at-risk species of Pacific salmon. *Transactions of the American Fisheries Society* (in print).

Review Request #2: Compare research findings on avian predation impacts on salmon survival (i.e., Haeseke et al. 2020 and Payton et al. 2020)

Columbia Basin fish and wildlife managers, policy makers, and researchers have expressed concern about differences in the conclusions and management implications of the following two studies: *Avian predation on steelhead is consistent with compensatory mortality* ([Haeseke et al. 2020](#)) and *Measuring the additive effects of predation on prey survival across spatial scales* ([Payton et. al 2020](#)).

Significant questions remain about to what extent avian predation is additive or compensatory. At its most basic, additive means that the survival rate of the prey population is directly proportional to the predation rate; whereas, compensatory means that other life cycle factors may work to negate or counteract the effects of predation mortality on survival rates ([Haeseke et al. 2020](#)). These questions and conclusions ultimately impact decisions about future regional management actions to reduce impacts of avian fish predators (i.e., hazing, re-locating, culling, and such). For example, with the conclusion that avian predation is compensatory, Haeseke et al. 2020 concludes, “Management efforts to reduce the abundance of the bird colonies are unlikely to improve the survival or conservation status of steelhead ...” The contrasting conclusion of Payton et al. 2020 that Caspian tern predation may be an additive source of mortality has important implications for predator management actions designed to increase survival of endangered salmonids.

The Columbia River Inter-Tribal Fish Commission asks that the ISAB review and compare the Haeseke et al. 2020 and Payton et al. 2020 analyses, results, and interpretations, preferably in the context of the draft Avian Predation Synthesis Report, compiled by Real Time Research for the U.S. Army Corps of Engineers.

Review questions for the ISAB:

1. Were the Haeseke et al. 2020 and Payton et al. 2020 analyses scientifically sound, and were the data used appropriate for addressing the question?
2. Were the conclusions drawn by Haeseke et al. 2020 and Payton et al. 2020 analyses supported by their results?
3. How do the modeling approaches of Haeseke et al. 2020 and Payton et al. 2020 differ, and do these analytical differences or other reasons account for the contrasts in their conclusions?
4. Does the ISAB have recommendations to improve the analysis?
5. What are the management implications of the results?

If feasible, we would appreciate a completed review by April 23, 2021.

References

- Haesecker, S.L., G. Scheer, J. McCann. 2020. Avian predation on steelhead is consistent with compensatory mortality. *The Journal of Wildlife Management* 84(6):1164–1178. <https://doi.org/10.1002/jwmg.21880>
- Payton, Q., A. F. Evans, N. J. Hostetter, D. D. Roby, B. Cramer, and K. Collis. 2020. Measuring the additive effects of predation on prey survival across spatial scales. *Ecological Applications* 00(00):e02193. 10.1002/eap.2193 <https://doi.org/10.1002/eap.2193>

Review Request #3: Evaluate "A Synthesis of the Coast-wide Decline in Survival of West Coast Chinook Salmon" (Welch et. al 2020) and its interpretation of the implications of smolt-to-adult return values as well as the Fish Passage Center's review of the paper (FPC 2020)

The Independent Scientific Advisory Board is asked to review scientific basis for the analysis of regional declines in Chinook salmon abundances and the conclusions and recommendations of "[A Synthesis of the Coast-wide Decline in Survival of West Coast Chinook Salmon](#)" (Welch et. al 2020). A review by the ISAB could provide an important context for interpreting the findings and important questions raised by this recent publication and the Fish Passage Center's review of the paper ([FPC 2020](#)).

Welch et al. 2020 examined SAR data for Chinook salmon for the Pacific coast to determine whether there are large-scale patterns of salmon survival based on coded wire tag data. Welch et al. report Chinook salmon survival has declined broadly across the Pacific coast and SAR values of 1% or less are widely observed. They highlight the use of the low SAR values to support management actions in the Columbia River Basin and question the validity of the interpretation of those SAR values. They note that similar declines in SAR values have been observed in west coast rivers without major dams and suggest that "contemporary survival is driven primarily by broader oceanic factors rather than local factors." They identify several methodological issues related to analyzing coded wire tags and PIT tags to calculate SAR values. Based on these interpretations, they indicate that targets for restoring salmon populations in the Columbia River Basin may not be attainable and question whether restoring freshwater habitat or improving dam passage will improve returns of salmon. The authors suggest that salmon recovery efforts should focus on actions in the marine environment rather than freshwater habitats. Welch et al. 2020 called for "a systematic review by funding agencies to assess consistency and comparability of the SAR data generated and to further assess the implications of survival falling to similar levels in most regions of the west coast." These findings and their interpretations raise critical questions that should be examined more closely.

In response to requests from the Oregon Department of Fish and Wildlife and Washington Department of Fish and Wildlife, the Fish Passage Center conducted a

technical review of the Welch et al. paper and raised issues about the paper's methods, results, and interpretations (FPC 2020).

A review by the ISAB would provide information for the Council and regional policy makers for interpreting the findings of the Welch et al. paper about SARs, salmon survival, and appropriate management actions and also the Fish Passage Center's criticism of the paper.

Review questions for the ISAB:

1. Was the Welch et al. analysis scientifically sound, and were the data it used appropriate for addressing the question?
2. Were the conclusions drawn by Welch et al. supported by their results?
3. Does the ISAB have recommendations to improve the current analysis and interpretation of SAR values in the future?
4. Are the criticisms raised by the Fish Passage Center supported by the evidence and do any of those criticisms weaken Welch et al.'s results or conclusions?
5. What are the management implications of the ISAB's conclusions and recommendation?

If feasible, we would appreciate a completed review by April 23, 2021.

References

Fish Passage Center (FPC). 2020. Technical review of Welch et al. (2020), titled, *A synthesis of the coast-wide decline in survival of West Coast Chinook Salmon (Oncorhynchus tshawytscha, Salmonidae)*. Memorandum from Michele DeHart (FPC) to Bill Tweit (WDFW), Tucker Jones (ODFW), and Margaret Filardo (citizen). December 4, 2020. <https://www.fpc.org/documents/memos/53-20.pdf>

Welch, D.W, A.D. Porter, and E.L. Rechisky. A synthesis of the coast-wide decline in survival of West Coast Chinook Salmon (*Oncorhynchus tshawytscha, Salmonidae*). *Fish and Fisheries* 2020; 00: 1– 18. <https://doi.org/10.1111/faf.12514>

Review Request #4: American Shad Impacts on Native Fish Management and Restoration Programs in the Columbia Basin

Summary Request: The ISAB proposes to produce a state of the science report about American shad and their potential impacts on native fish management and restoration programs in the Columbia Basin.

Rationale: Native to the Atlantic coast of North America, anadromous American shad (*Alosa sapidissima*) became established in the Columbia River through migrations of fish introduced to the Sacramento River in California in 1871 and from fish stocked directly in the Columbia, Willamette, and Snake rivers in the 1880s. But it was not until hydrosystem development increased food sources, upstream passage, and reservoir habitat suitable for American shad that they reached the high abundance and expansive distribution observed over the past few decades. 7.5 million shad passed Bonneville Dam in 2019 and 5.8 million in 2020, representing 91% and 82% of all fish passing Bonneville Dam in these years. American shad are the most abundant anadromous fish species in the Columbia River, which is the largest population within their current native or expanded ranges. Such high abundances and associated biomass conceivably could have substantial impacts on the aquatic ecosystem.

Despite their high abundance, attention to American shad in recent Fish and Wildlife Programs is minimal compared to earlier plans in the 1990s that called for exploring ambitious control actions to reduce American shad interactions with salmon and steelhead. To our knowledge, such actions have not been explored. Many questions remain about the potentially complex ecological consequences of shad abundance for native fish communities and ecosystems of the Columbia River and the nearshore ocean. For example, there is evidence that American shad compete with juvenile Chinook salmon for food, but they may also provide a food source for both juvenile and adult Chinook salmon and for white sturgeon. Moreover, they may buffer juvenile salmon from predation in the river, estuary, and ocean, and may buffer adult salmon from sea lion predation. Thus, their net effect on salmon might be beneficial, neutral, or deleterious, and it might not be the same for all species or stocks.

In addition, high abundances of shad create problems for processing fish in collection facilities, deplete dissolved oxygen in fish ladders, and hinder identification of migrating fish in fish counting locations. Upriver migrations of spawning of shad are strongly controlled by temperature, which requires inter-annual variation and trends in water temperature and other environmental factors to be considered in assessing their ecological and operational impacts. Better understanding of the biology of American shad and its influences on the food webs of the Columbia River basin will inform management of both shad and other non-native species, such as northern pike and smallmouth bass. The ISAB currently includes members with expertise on American shad in North America, making such a review timely.

Review Questions:

1. What are the trends in American shad abundance in the Columbia River, and what are their potential ecological impacts on native aquatic communities of the Columbia River and nearshore Pacific Ocean?
 - How thoroughly do we understand the complete life cycle of American shad in the Columbia River (e.g., spawning locations, juvenile residence in freshwater, timing of outmigration, ocean residence, freshwater and marine survival rates)? Are there multiple life history patterns?

- What risks do American shad present for anadromous salmonids and freshwater communities (e.g., food web effects, predation, disease, habitat utilization)?
 - Can increases in American shad abundance cause greater predation on juvenile salmon and steelhead by increasing the food supply for their predators or reduce predation by saturating predators on juvenile and adult salmonids?
 - Can American shad populations impact the freshwater and marine food webs through competition or indirect food web effects?
 - Do high abundances of American shad create significant biological or non-biological impacts (e.g., redirected sport fishing effort, reduced up-river passage efficiency through the hydrosystem, upriver nutrient transport).
2. Based on the answers to these questions, should management of American shad in the Columbia Basin change? If so, what management alternatives should be considered?

Products: The review would result in a synthesis report (~50 pages) and presentations to the Council and professional forums in the Basin. Although work to draft journal publications is generally not funded through the ISAB budget, the authors may also publish a summary of the report in a peer-reviewed journal, to ensure wide access and distribution.

Methods: The ISAB would synthesize scientific findings from American shad research in the Columbia Basin and summarize management actions and alternatives either undertaken or considered in the Basin. We would organize briefings from scientists and managers who have studied or managed American shad in the Columbia Basin and elsewhere. Several ISAB members have conducted American shad research and may also brief the group. We propose that these online briefings be tailored to a wider audience than just the ISAB and encourage fish and wildlife managers and policy makers to attend.

Timeline: Assuming most of this American shad review would occur after the other three assignments are done, we suggest the review would be completed by August 1, 2021.