



Independent Scientific Review Panel
for the Northwest Power & Conservation Council
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MEMORANDUM

January 20, 2004

TO: Doug Marker, Fish and Wildlife Division Director, Northwest Power and Conservation Council

FROM: ISRP

SUBJECT: Proposal to Evaluate the Biological Effects of the Northwest Power and Conservation Council's Mainstem Amendments on the Fisheries Upstream and Downstream of Hungry Horse and Libby Dams, Montana (ISRP 2004-3 Preliminary Review)

Per the Northwest Power and Conservation Council's December 23, 2003 request, the ISRP reviewed the Proposal to Evaluate the Biological Effects of the Northwest Power and Conservation Council's Mainstem Amendments on the Fisheries Upstream and Downstream of Hungry Horse and Libby Dams, Montana. The proposal was submitted by the Montana Department of Fish, Wildlife, and Parks, Brian Marotz, Principal Investigator.

Summary of Findings and Recommendation

The ISRP finds that the proposal (1) is pertinent to the current issues of balancing headwater ecological impacts with lower Columbia River benefits of flow augmentation, (2) is prepared by qualified staff with appropriate and unique background by virtue of previous studies at the sites, and (3) describes an overall plan that is well suited to providing pertinent information needed by policy makers. However, key methodological details are lacking, and these are needed for adequate peer review. The proposal should better describe the several models to be developed and used. It would be helpful if they were presented as syntheses of empirical data rather than merely theoretical and conceptual.

The ISRP recommends a response to this review, similar to that used with proposals on a regular review cycle. We are fairly confident that the proponents can provide the details needed to complete our review. We also recommend that the proposal be organized according to the normal BPA proposal guidelines. This would stimulate the authors to provide the normally required information in an easily recognizable format.

Background

The proposal was generated in response to the Council's mainstem amendments that directed the region to test, implement, and evaluate an interim summer operation, beginning in the summer 2004, that implements new drafting limits at Hungry Horse and Libby Dams. Summer drafting

for flow augmentation would be limited to 10 feet from full pool by the end of September (elevations 3550 and 2449, respectively) in all years except the lowest 20th percentile water supply (drought years) when the draft could be increased to 20 feet from full pool by the end of September. The Council's hypothesis is that the proposed operations will significantly benefit listed and non-listed resident fish in the reservoirs and in the portions of the rivers below the reservoirs without discernible effects on the survival of juvenile and adult anadromous fish when compared to ordinary operations under the Biological Opinion.

This proposal is intended to test the first part of that hypothesis, whether resident fish will significantly benefit from the proposed operations. The proposal does not intend to evaluate physical and biological changes that occur in the Lower Columbia River from McNary Dam to downstream of Bonneville Dam that result from the modified drafting strategy at Libby and Hungry Horse Dams. That will require a separate study.

Specifically, the proposal intends to:

1. Evaluate the benefits for listed bull trout and resident fish of the Council's proposed reservoir drafting strategy.
2. Evaluate habitat changes and biological responses associated with proposed stabilized flows and velocities in the Flathead and Kootenai Rivers downstream of Hungry Horse and Libby dams, respectively.

Review Charge

The ISRP reviewed the proposal with the criteria provided in the 1996 Amendment to the Power Act, which directs the ISRP to review projects in regard to whether they:

1. *are based on sound science principles;*
2. *benefit fish and wildlife;*
3. *have a clearly defined objective and outcome*
4. *with provisions for monitoring and evaluation of result, and*
5. *are consistent with the Council's fish and wildlife program.*

Specific Questions

The Council directed the ISRP to review the proposal with the following technical questions in mind:

1. Will the proposal generate additional information on fish growth, survival, and population productivity needed to fully understand the ecological consequences of specific dam operating strategies?
 - A. Does the proposal describe scientifically sound methods and experimental design to evaluate the benefits for listed bull trout and resident fish of the Council's proposed reservoir drafting strategy?

B. Does the proposal describe scientifically sound methods and experimental design to evaluate habitat changes associated with stabilized flows and velocities in the Flathead and Kootenai Rivers?

2. Previous research conducted by Montana Fish, Wildlife & Parks provides site-specific quantitative data and techniques to assess the potential impacts of summer flow augmentation on reservoir and river systems and provide an environmental base-line for comparison. Does the ISRP have any observations on the evidence compiled to date?

3. The Montana Fish, Wildlife, and Parks proposal describes three general approaches to quantitatively assess biological and physical responses associated with the new operating strategy:

- Physical and Biological River and Reservoir Modeling
- Estimating Growth and Survival of Fish Populations
- Developing Conceptual Aquatic Community Models

Are these approaches sound, individually and in combination?

In addition to the Council's questions above, the proponent, Brian Marotz, provided some further perspectives, questions and observations to consider (Attachment). Marotz's memo solicits specific advice from the ISRP on questions and operational scenarios to be evaluated by the proposed studies, tools to use in the assessment, and the strength of the evidence gathered over many years of previous research and analysis. The proponents also provided a short report outlining the pertinent results of past work (an appendix to the proposal).

ISRP Review

The ISRP finds the proposal to be highly pertinent to the longstanding, but still current, issue of balancing headwater environmental impacts of providing water for flows in the lower Columbia River with the lower-river benefits accruing to migrating juvenile salmon. The relevant portions of the Council's Mainstem Amendments prescribe an operational experiment in which the seasonal elevations of Montana's Libby and Hungry Horse reservoirs and the daily discharges from the dams would be held more stable than current operational guides allow. The environmental benefits of these stabilized operations would be tested and potentially established through the proposed research by comparing various physical and biological end points with the same or similar end points determined in previous research under the less-stable regimes. The proposal presumes that a companion study would be conducted in the lower Columbia River by others to document any detrimental effects on juvenile salmon there from the changed operations. The ISRP considers such comparative studies essential to resolving the technical issues of both expected benefits to the upper river basin (through "before-and-after" studies of the reservoirs and rivers) and the relative magnitudes of physical and ecological changes in up-river and lower river zones. The research should generate additional information needed to fully understand the ecological consequences of specific dam operating strategies.

From past reviews, the ISRP knows the proponents are highly qualified to conduct the planned research. Essentially the same team has spent more than a decade collecting data from the field

and synthesizing the information in a variety of empirically based models. This research was favorably reviewed by the ISAB in 1997 (ISAB Report 97-3). The proponents provide a summary of some pertinent points in an appendix to the proposal and have documented their work in the peer-reviewed literature. They have worked collaboratively with the well-respected University of Montana Biological Station.

The three general approaches proposed—physical and biological river and reservoir modeling that synthesizes empirical data, comparisons of fish growth and survival before and after operational changes, and further development of aquatic community models—are sound, in principle. The ISRP especially appreciates the previous and proposed syntheses of field data in predictive models. Models developed earlier can be updated with more recent data and tailored for calibration and use with the results from proposed field sampling. Various operational scenarios, actual and hypothetical, can then be evaluated with these models.

Despite these favorable impressions, the ISRP review was hampered by a lack of methodological detail in the proposal. Such details are necessary for the Panel to judge whether the team plans to use scientifically sound methods and experimental designs. The proposal does not follow the usual BPA proposal structure, which would have prompted many of the types of information we find lacking or insufficiently developed. Although the appendix provides some synthesis of past work, it is not clear how many of the references cited support the planned studies. A more detailed synopsis of previous results should be included to justify the currently proposed work. Such a synthesis could be paired with the planned studies to ensure that the previous work forms an adequate baseline. The 1997 ISAB report noted that it might take 20 years of data collection to develop an adequate case for significant biological changes. More details in this proposal might allay that concern.

Figures would help the proposal. At a minimum, it would be helpful to reviewers to include a map showing proposed study streams, data collection sites (in the streams, reservoirs, and rivers) and a schematic layout of the models and their interactions.

Without more detailed justification, the reviewers sensed an overload of models. Models built on other models could create a house of cards. Although we believe (partly from the earlier ISAB review) that the existing models are firmly based on data, the proposal could do a better job of giving this assurance.

Some terms that are fundamental to the proposal need better explanation and definition. For example, what is meant by “effectiveness” and “benefit”? Both are quite subjective terms. Although the general notion may be clear, a scientific study plan should try to pin down these with more precise language and quantitative definitions that include features that can be measured. In this way, expectations can be stated and tested.

As evidenced by Marotz’s e-mail memo that accompanied the proposal for our review, the operational scenarios to be implemented and tested experimentally are not yet established. Although the Council’s Mainstem Amendments are vague on this point, the proposal might have made some specific recommendations based on past experience. Other than the stated limit of 10 feet drawdown for reservoirs, how stable is “stable “ for reservoir elevations and dam

discharges? Are peaking power discharges to be eliminated or just dampened? If ramping rates are a concern, the discharges cannot be completely stable. Even slowly ramped daily fluctuations in river elevations would not avoid the problem of an unproductive varial zone. Although Marotz solicits the ISRP's advice on these details, he and his team are in a far better position to recommend and justify the scenarios they believe are advantageous for their environments or that would be reasonable compromises between optimal upriver endpoints and providing some additional water for the lower river. The ISRP looks forward to seeing what this team would like to propose.

At some point in development of this work, a more explicit before-and-after experimental design will have to be selected for the rivers and reservoirs than is presented in the proposal. The formal BACI (Before-After/Control Impact) analysis comes to mind, but it might not be feasible if adequate control sites/conditions are not available. With the baseline data and models, can a simple design be selected? We believe that such a comparison can be made, but the proposal lacks sufficient details for us to evaluate the detailed plans.

Reviewers were unsure about the quality of the IFIM models. Too often, IFIM modeling has been done in a rote manner with little regard for whether reality is adequately represented, for either physical habitat or biological preferences. Habitat preferences of fish based only on depth, velocity, and substrate are poor characterizations, according to many research studies. Better habitat preference models exist in the fish and wildlife literature. Habitat selection models could be developed from the data generated by the proposed radio-tracking component of the study. Would it be advantageous to reassess these habitat availability and preference models before using them?

The proposal refers to "tiered flows" now used in the Kootenai River below Libby Dam for benefit of white sturgeon, yet the proposal does not explain what these are. Have the modified Kootenai flows been studied for benefits to other parts of the ecosystem? Is such tiering considered a good model to pursue?

The explanation of the use of weirs on tributary streams left many questions. Will the study be able to place weirs and PIT tag detectors on all tributary streams? It seemed as though only certain index streams would be used. If so, how are they to be selected? Are spawners (or other migrants) necessarily going to enter their natal stream? Would not some fish be thwarted by a weir and stray elsewhere? How will such straying effect recapture rates and subsequent statistical comparisons? There was no reference to methods for analysis of the anticipated mark-recapture statistics, e.g., Jolly-Seber-Cormack methods. How many tributaries are needed to get a valid pattern for the mainstem segment? We assume an experimental design is planned by which fish from tributaries are characterized for growth and survival so that these features can be "subtracted" from changes seen in the mainstems that are the focus of attention for operational changes. But how this will be done is too vaguely explained for an adequate review.

The reference to determining unregulated flows stimulated more questions. A definition and explanation would be helpful. Determining unregulated flow for a reservoir with multiple tributaries and a programmed release schedule at the dam can be complex. How it is relevant to the objectives of this study is not clear.

The proposed radiotelemetry studies for actual habitat use determinations were well received, but there were questions about likely small sample sizes and how the results will be merged with the IFIM habitat models. How will relationships to factors like woody debris, proximity to riparian vegetation, habitat complexity (e.g., boulders in the stream) be incorporated? Will more up-to-date habitat selection models be used?

The budget was not reviewed in detail, but did not clearly specify the timing and duration of the work. Does the budget represent one year or three years of work?

Attachment

From: Marotz, Brian [mailto:bmarotz@state.mt.us]

Some thoughts on the ISRP review from Brian Marotz, Montana Fish, Wildlife, and Parks.

We believe that the most rapid and direct path to inform policy on dam operation can be achieved by running the existing river and reservoir models. This would require only minor updates to the model code to enable assessments of the proposed operations on river and reservoir habitat. The models were constructed using years of empirical data to calibrate the models that can be verified through additional sampling. The model components can be examined separately to assure that each trophic level response conforms to field observations. Habitat change resulting from various dam operating scenarios can be related to biological production simply, using basic biological principles. For example, it is well established that the varial zone is biologically unproductive and that it takes roughly five weeks for recently flooded substrate to be colonized and resume production. Radio relocations can be used to validate model predictions of habitat utilization. Primary production is proportional to the volume of the euphotic zone, etc. In the past, the independent scientists reviewed the reservoir models and associated research and came to conclusions supportive of these results. We would like the ISRP's opinion on this portion of the proposal. **What specific questions or operating scenarios should the model simulations address? What specific dam operations data should we analyze using the models?**

The remainder of the proposal includes methods to assess biological responses at the population level. These aspects will require a longer term research program, and therefore would not inform policy on operation for several years. Our strategy is to use basic relationships that can inform policy in a year or two, then phase in greater detail over the next several years. Initially, we would focus on fish growth and condition factor and attempt to isolate factors unrelated to dam operation. Later, we would use detailed information on fish survival at each life stage to conceptualize mechanisms driving biological responses to various operating strategies. Ultimately, field data would be organized in an empirically calibrated mechanistic model with predictive capability for assessing fish populations. We would appreciate input from the ISRP on tools available for isolating factors influencing fish survival that are independent of dam operation effects. This is a difficult analytical problem that we intend to address by separating factors in the natal tributaries from factors influencing fish after they emigrate to the rivers/reservoirs influenced by dam operation. The basic problem is it remains uncertain if field sampling can achieve enough resolution to tease out factors unrelated to dam operation and directly tie population responses to dam operation. **Are there additional tools that we can use to improve this assessment?**

Finally, decision makers need biological evidence to weigh predicted resident fish benefits and potential impacts to anadromous fish when operations in the Mainstem Amendments at Hungry Horse and Libby Dams are implemented. **What tools can ISRP recommend for assessing potential tradeoffs? [This question goes beyond the two objectives of the proposal under consideration.]**

We submitted a supporting document on reservoir operation and stable river discharges in the Flathead and Kootenai subbasins. **We would appreciate input from the ISRP on the evidence we've compiled to date.**