Population Viability Model for Snake River White Sturgeon (E.3.1-6, Chapter 3)

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I. Introduction

The purpose of modeling white sturgeon populations in the Snake River affected by the Hells Canyon Complex is to determine the probability of long-term population survival. The Population Viability Analysis model was designed and run at the Oak Ridge National Laboratory to simulate the white sturgeon population viability in the Snake River. The period use for viability was the next 200 years. The model is used to provide a framework around which to organize existing sturgeon information.

II. Conclusions

1. "The PVA process has been valuable in a number of ways. First, it provided us with a framework around which to organize existing information from the scientific literature and from researchers working in the Snake and Columbia rivers. Second, developing the PVA model to describe the relationships between river habitat and white sturgeon dynamics improved our intuition about these relationships. Third, we used the model to highlight key factors limiting white sturgeon recruitment in each river segment. Two important limiting factors identified by this analysis were poor water quality in Brownlee Reservoir and larval export from shorter river segments. Finally, the model predicted that persistence beyond the next 200 y[ears] is less likely in some river segments than in others under current operations. While the model can stimulate discussion and identify unanticipated relationships, other factors that are not included or are not sufficiently quantified to give precise quantitative predictions may be operating. Therefore, we recommend continued studies to quantify the parameters needed in PVA model relationships or directly test the importance of these factors affecting white sturgeon recruitment." (Page 23, Paragraph 1)

Response: The BLM agrees with this modeling approach and findings.

III. Study Adequacy

The model should be accepted by the BLM as a usable tool for developing projections for the long-term white sturgeon survival. The model is a synthesis of facts that can hypothesize the future of white sturgeon in various segments of the Snake River.

IV. BLM Conclusions and Recommendations

Conclusions

The Population Viability Analysis (PVA) model was applied to all of the reaches of the Snake River inhabited by white sturgeon. The model is complex and attempts to incorporate all of the current research concerning white sturgeon biological behavior and habitat utilization in the Snake River. It uses all of the pertinent white sturgeon information from other scientific sources. The model represents serially linked reservoirs and free-flowing river segments that contain populations of white sturgeon. The populations are only connected by downstream migration. The model asked how long the population is likely to persist if historical hydrologic patterns continue. No upstream migration is possible due to the dams in the Snake River.

The PVA model represented three mechanistic sources of mortality that depend on temperature and river flow. They are: (1) survival of eggs and larvae, (2) survival to age-1, and (3) survival of all ages through summer conditions in the reservoir. Parameters included in the model are comprehensive and include: age distribution, genotypes, reproduction, fecundity, mating aggregations, simulated inheritance, incubation, mortality sources, and larval export. Mortality sources included turbine, angling, water quality, larval export, habitat-related, flow-related, baseline, and temperature-related.

The model uses complex equations to factor in all the positive and negative influences known to affect the Snake River in the context of existing habitat parameters that have been quantified by the Applicant's research staff. While the results mirror what has been hypothesized by the biologists, this independent model supports their hypothesis concerning water quality affects on Snake River white sturgeon and suggests some additional research needs.

The PVA model is a tool that provides researchers with a means to better understand their specific white sturgeon findings on a broader scale. The results are not absolute and the modelers clearly state this fact. The model will be improved as additional information is supplied concerning habitat parameters in reaches such as the one below Hells Canyon Dam in the Hells Canyon Reach. It was necessary for the modelers to insert assumptions in portions of the model when specific data was insufficient or non-existent. These deficiencies were clearly noted. This report is a support document for the other white sturgeon studies that are presented and should be viewed as such.

Summary

- The model indicates that there is a high likelihood that white sturgeon in the Hells Canyon Complex reservoirs will become extinct within 200 years.
- Their extirpation will be primarily due to poor water quality.
- Larval export is also predicted to have a serous impact on reservoir population survival. The model predicted that unless water quality in Brownlee Reservoir is improved the sturgeon population could not be recovered.
- Larval white sturgeon are swept downstream for a period of time after emergence. The short length of both Oxbow and Hells Canyon reservoirs is predicted to cause the swim-up larvae produced at the dam tailraces (the only

location for spawning in Oxbow and Hells Canyon reservoirs) to be swept from the reservoirs before they can develop into a bottom dwelling stage that is not susceptible to flow.

- The most likely production of larval white sturgeon for Brownlee Reservoir occurs 111 miles upstream. It is unlikely that many of these fish would reach the reservoir. Those that do reach the reservoir must contend with the adverse water quality conditions and are unlikely to survive.
- Although these are results of empirical modeling, they parallel the thinking and assumptions of the White Sturgeon Technical Advisory Committee.

Recommendations

A number of parameters needed to improve the PVA model input are suggested in the report:

1. Additional studies of the dispersal strategies and spatial ecology of white sturgeon are needed to evaluate minimum river length requirements.
2. Additional studies are needed that quantify hydraulic data for run, pool, riffle and rapid for the area below Hells Canyon Dam that can be incorporated into the model (The Applicant is now collecting this data according the report. See pg. 13, paragraph 4).
3. Studies are needed that test the importance of each of the limiting factors in the model.