THE EFFECT OF THE LONG LAKE VALLEY PROJECT ON LARVAL SUCKERS IN UPPER KLAMATH LAKE, OREGON

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INTRODUCTION

Long Lake Valley, a dry lakebed in the Upper Klamath Lake basin, is being studied by the Bureau of Reclamation as an offstream storage reservoir to augment water supplies in the Klamath River basin in dry years. Because moving water to and from the proposed Long Lake Valley (LLV) offstream storage would affect how water moves through Upper Klamath Lake (UKL), and because the existence of the LLV storage has the potential to change how UKL is managed in terms of the elevation of the lake and the outflows, the construction of the LLV storage could affect the pathways and travel time of endangered Lost River and shortnose sucker larvae that enter UKL after spring spawning. One goal of the reconnection of the Williamson River delta in October 2007 was access to additional high-quality rearing habitat by larval suckers spawned in the Williamson River. Therefore, any alteration of Klamath Project operations that has the potential to either increase or decrease the concentration of larval suckers and their residence time in the delta is of interest. The U.S. Geological Survey (USGS) developed a hydrodynamic and heat transport model of UKL (Wood and others, 2008). This model was used to investigate how the transport of sucker larvae might be affected by the construction of the LLV offstream storage, under the assumption that the larvae are transported passively through the system.

MODEL BOUNDARY CONDITONS AND FORCING FUNCTIONS

Early spring wind data to force the model have been collected around the lake since 2006. Basin hydrology conditions of inflow, outflow, and lake elevation, both under the assumption of No Action and the assumption that the LLV project was in place, were simulated by the U.S. Bureau of Reclamation using the Water Resources Integrated Modeling System routing model for years dating back to 1961. The years that were of most interest in terms of the effects of the project on the basin hydrology were all prior to 2005. In order to deal with the mismatch between the availability of wind data to force the model and the basin hydrology, the wind forcing was decoupled from the basin hydrology. Six scenarios of basin hydrology that represented an interesting range in conditions from years prior to 2005, and two scenarios of wind forcing that represented an interesting contrast in conditions (2006 and 2007) were selected.

Passive drift of larval fish spawning in the Williamson and Sprague Rivers was simulated using two numerical tracers injected into the modeled system at the Williamson River boundary. The concentration of the first tracer represented Lost River suckers; the second tracer represented shortnose suckers. In order to facilitate comparisons between simulations, the timing of the input of the tracers was kept the same for all of the simulations, even though it is known that the larval drift is variable from year to year. The peak concentration of each tracer was determined such that the same number of larvae was put into the modeled system for all simulations.

CONCLUSIONS

During the spring, when larval suckers drift into Upper Klamath Lake through the Williamson River, the direct pumping to and from the proposed Long Lake Valley storage is not likely to be the aspect of the LLV project operations that most affects larval transport and residence time in the lake. Because most of the pumping to fill LLV is likely to occur in the early spring before the larval drift starts, and because most of the pumping into UKL from LLV is likely to occur in the late summer and fall, pumping velocities during May and June will usually be small. The availability of the LLV storage will, however, change the way that the elevation of UKL and the outflow at the Link River and A Canal are managed. The results of these preliminary model runs indicate that the change in lake elevation as a result of project operations could have a large effect on larval transport and residence time in the lake during May and June. In general, higher lake elevation leads to more of the Williamson River inflow moving into and through the restored Williamson River delta and into Agency Lake.

The speed and direction of the wind blowing over the lake can have a significant effect on larval transport. This is because a wind reversal tends to move water entering the lake from the mouth of the Williamson River northward along the shoreline, whereas prevailing winds tend to move the water southward along the shoreline.

Important limitations of this study include the following. The results represent the potential for loss or gain due to LLV project operations that would be superimposed on other losses to the larval population, including predation and other causes of mortality, that are not simulated. The losses or gains due to LLV project operations predicted by this modeling effort, compared to expected losses due to mortality, are smaller in magnitude, although not insignificant. A second limitation of this study is the assumption that larval drift is entirely passive. Although this seems reasonable for small larvae, the drift measurements made in the Williamson River show that the larvae have some ability to limit their drift to nighttime hours; thus, a behavioral component is indicated.

This work is a condensed version of the work reported in Wood (2009).

REFERENCES

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