

DEVELOPING FLOW RECOMMENDATIONS TO ENHANCE RECOVERY OF ENDANGERED FISH BELOW FLAMING GORGE DAM

Recovery of endangered species is a primary mission of federal agencies whose activities affect environmental resources. EAD is working with the Western Area Power Administration (Western) and other federal agencies to determine release patterns from Flaming Gorge Dam that would enhance recovery of three species of endangered fish.

■ PROBLEM/OPPORTUNITY

Three species of endangered fish — Colorado pikeminnow, razorback sucker, and humpback chub — are found downstream of Flaming Gorge Dam, a hydroelectric facility on the Green River in Utah and Colorado managed by Western and the Bureau of Reclamation. Dam operations affect the seasonal, daily, and hourly pattern of river flow; these patterns, in turn, can affect the aquatic food base and habitat conditions upon which these species depend. Release patterns that would reduce the impacts of dam operations and enhance the recovery of these species are being formulated.

■ APPROACH

EAD is part of an interagency team composed of representatives from the Bureau of Reclamation and U.S. Fish and Wildlife Service that is developing an integrated set of flow recommendations for the Green River below Flaming Gorge Dam. A “lines of evidence” approach was used to determine flow management strategies that would meet the needs of each species. Recommendations are being developed on seasonal patterns of release, including peak and base flows under different hydrological conditions.

Critical peak flow values were identified by evaluating the geomorphology of the river channel and floodplain and sediment characteristics. This information was used to determine the flow needed to rework sediment deposits,

prevent vegetation encroachment and channel narrowing, and inundate floodplain wetlands. Base flow recommendations were developed to maximize the availability of low-velocity nursery habitats during the summer.

EAD performed a detailed analysis of flow variability in unregulated tributaries by using a parametric statistical approach. EAD also developed functions that described the effects of flow variability on important low-velocity nursery habitats. These relationships were used to develop recommendations for hydropower-induced fluctuations.

In addition, in cooperation with the Cold Regions Research and Engineering Laboratory of the U.S. Army Corps of Engineers, EAD developed a model of ice formation and



Bypass release at Flaming Gorge Dam in June 1997

breakup and empirically tested the effect of release fluctuations on ice cover integrity. These findings were used to develop winter flow recommendations.

■ RESULTS

EAD has made flow recommendations. A key objective is to restore the intra- and inter-annual variability of flows. This would be accomplished by operating Flaming Gorge Dam differently in years with different hydrologic conditions. Restoration of variability would meet a number of important ecological requirements for different endangered fish. The recommendations include intentional releases above power plant capacity in years with above-average runoff. These peak releases would be timed to cause significant overbank flooding, thereby providing nursery areas for the razorback sucker. They would also rework in-channel sediment deposits and prevent channel narrowing, thus providing nursery habitat for the Colorado pikeminnow and humpback chub. Moreover, base flows would also vary from year to year, depending on the hydrologic conditions, and would be scaled to provide suitable conditions for low-velocity in-channel nursery habitats. Reducing peak and base flows in drier years would help prevent the establishment of vegetation along the channel edge. Recommended levels of flow variability in the summer would be based on natural levels of variability and on the relationships between fluctuation and nursery habitat area. The recommendations would reduce the impact of flow on power generation while promoting the recovery of endangered fish.

■ HISTORY/STATUS/FUTURE

This work originated in the development of Western's power marketing environmental impact statement, which EAD began in 1991 and published in 1996. Since publication of the EIS, EAD has provided scientific support to Western in the form of technical environmental analyses (especially ecological and hydrological analyses) and a complex power systems model that enables the effects of changes in Western's operation and marketing on power revenue to be evaluated. When the flow recommendation report is final, EAD will help develop an implementation plan and a biological assessment for the flow recommendations. It will continue to be involved in technical evaluations of facility operation in the Colorado River Basin. Total funding for the EIS and supporting analyses was \$9 million. Technical support since the EIS has totaled about \$2.9 million. EAD is also involved in evaluations of Glen Canyon Dam, Flaming Gorge Dam, and the Aspinall Unit.

■ COMMUNICATION OF RESULTS

The report *Flow Recommendations for Endangered Fishes in the Green River Downstream of Flaming Gorge Dam* was developed in October 1998. A final report is due for publication in late spring of 1999. The report *Effects of Daily Fluctuations from Flaming Gorge Dam on Ice Processes in the Green River* will be finalized in spring of 1999.

EAD presented the results of its study at the annual meeting of researchers on Upper Basin endangered fish in January 1998.