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Feature Article

Using artificial floods for restoring river integrity

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There is growing recognition by resource managers on the importance of the natural flow regime in maintaining river integrity downstream of large dams. Historically, artificial floods from reservoirs were regarded simply as flushing flows for removing fine sediments in downstream receiving waters or for reservoir maintenance (Reiser et al., 1985). These flushing flows tended to be aperiodic and infrequent, being implemented during the most economically feasible time of the year and usually over multi-annual periods (e.g., 5–7 year intervals). Indeed, the use of artificial floods to meet ecological needs in concert with economic and societal needs is a rather recent development, and is in line with current adaptive management principles. The use of artificial floods for restoring some semblance of the natural flow regime in regulated rivers is quite complex, involving multiple interest groups and being system specific. As a consequence, relatively few examples of integrating artificial floods in flow management schemes are noted in the literature (e.g., Molles et al., 1998). For instance, even the widely publicized Glen Canyon experimental release occurred once, although plans are now being considered for additional floods in this system (Powell, 2002).

The Spöl River flows from Livigno Reservoir on the Italian/Swiss border through the Swiss National Park. Through various negotiations, the different interest groups agreed to implement a flood release program to improve ecological conditions in the river downstream of the reservoir (Fig. 1). The situation was such that the implementation was considered a classical win-win situation, and indeed, the concessions of flow management from the reservoir have been changed because of the positive results of the initial floods. The program consisted of employing multiple intra-annual floods each year. The

Figure 1. Photograph of the River Spöl at one of the study reaches (Punt Periv) under residual conditions (1.6 m^3/s) and during the experimental flood (42 m^3/s) on 5 July 2000.

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current agenda is to incorporate two artificial floods of sufficient magnitude each year, with flood magnitude determined through annual monitoring of ecological conditions in the river. For example, the magnitude of later floods was increased from that of the initial floods because of sequential changes in sediment composition following each flood (see papers in this feature). The results clearly emphasize the importance of monitoring for a flood program to be adaptive and successful.

This special feature represents various facets of the flood program on the River Spöl over a four year study period. Scheurer and Molinari (2003) describe the historical, engineering, and management decisions resulting in the flood program. The papers following present the monitoring results from the different research groups involved in documenting ecological responses of the river to the floods. Specifically, Mürle et al. (2003) report on morphological changes in river structure and riparian vegetation, Uehlinger et al. (2003) document changes in primary producers and system metabolism. Robinson et al. (2003) and Jakob et al. (2003) show responses by the macroinvertebrate assemblages to the floods, and Ortlepp and Mürle (2003) report on the changes in the fishery. We hope the publication of our findings will inspire resource managers of other reservoir/river systems to implement similar flow programs for improving the ecological state of regulated rivers.

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