Reservoirs and Channelization Projects

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Large flood control, hydropower, and water supply reservoirs produce a whole series of impacts on riverine fisheries. These are primarily related to the blocking of fish movements, and disrupting of sediment transport mechanisms and river flows or hydrographs. Sediments are trapped in reservoir sediment storage pools (Figure 1), while waters in their flood pools are used to produce water level fluctuations to serve the needs of hydropower and flow augmentation for downstream commercial navigation traffic. Little account is taken of the effects of these water level manipulations either on the river's biota downstream of the dams, or in the reservoir itself.

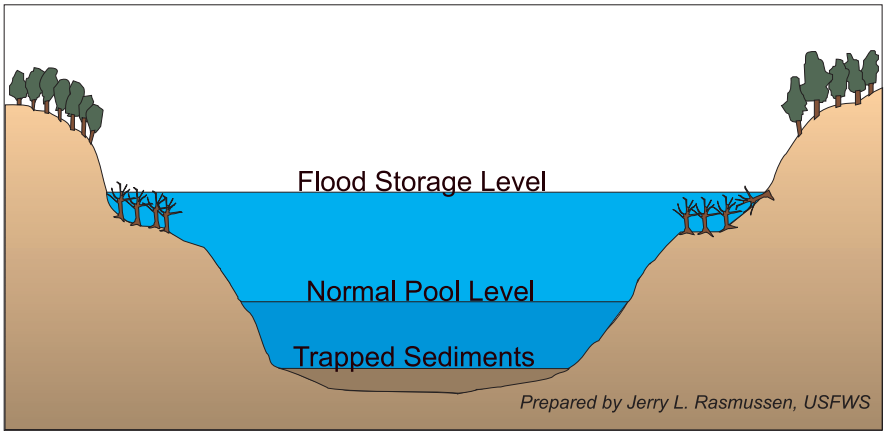

Figure 1. Flood control and hydropower reservoirs block fish movements; disrupt natural hydrographs and sediment transport; and alter water quality, water levels, and nutrient outputs.

Because reservoirs trap river sediments, their outflow waters are relative clear and sediment free (Figure 2). These are what hydrologists refer to as hungry waters, hungry in the sense that they want to pick up and carry a sediment load. Because of the rock lined channels of bank stabilization and navigation projects that usually occur below these reservoirs, the only place these hungry waters can find the sediments they need is in the stream bed or navigation channel (Figure 3). This leads to channel deepening or bed degradation, which in turn lowers water tables and drains floodplain channels and backwaters (Figure 4).

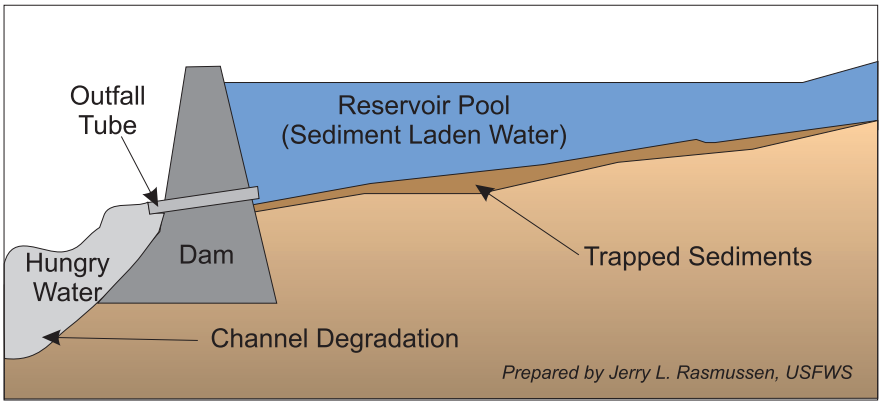

Figure 2. Reservoir outfall waters are relatively sediment free, or "hungry" to pick up and carry sediments. These "hungry waters" cause stream bed erosion or degradation downstream.

This same dewatering or draining takes place in tributary mouths and starts an upstream erosion process called “head cutting”, which continues upstream in the tributaries until the grades or elevations between the river and the tributary are equalized. But before this happens, “head cutting” can wash out roads and bridges, and the U.S. Army, Corps of Engineers is called in to stop it. They do so by installing concrete grade stabilization structures. These structures are nothing more than small concrete check dams, which create small waterfalls.

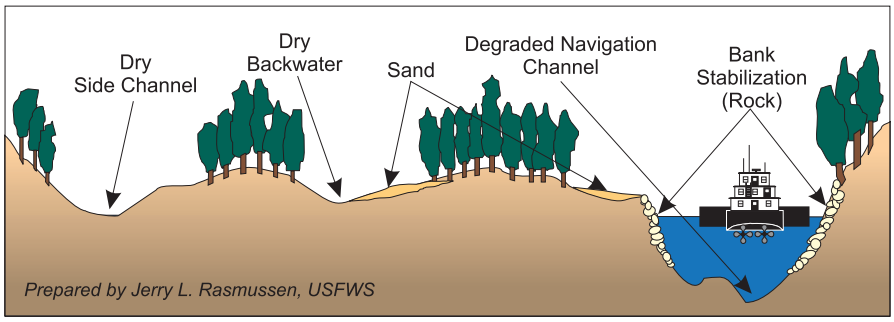

Figure 3. Main channel bank stabilization and bed degradation on channelized rivers dewater floodplain backwaters and side channels, destroy-

Figure 4. A typical side channel on the Middle Mississippi or Lower Missouri rivers as seen during high water stages (left) and during normal or low water stages (right). This is caused by degradation of the main channel river bed which produces significant impacts on the aquatic biota.

These small waterfalls are large enough to prevent upstream fish movements (Figure 5), thus eliminating fish access to many tributary habitats which are among the last remaining spawning and nursery areas available to large river fish. Small hydropower projects produce similar impacts. Fish passage devices installed on these structures have been largely unsuccessful.

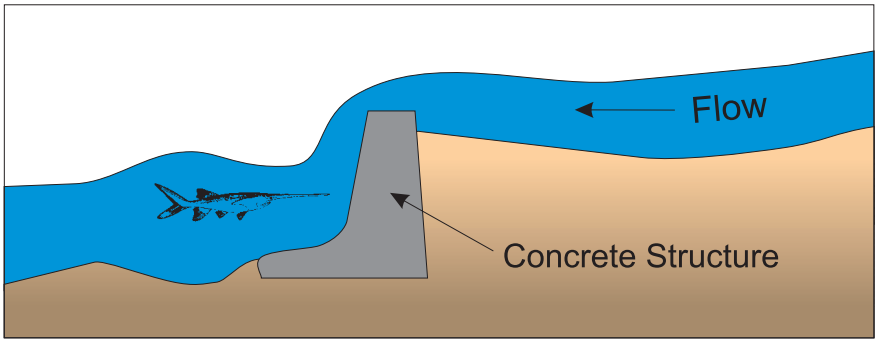

Figure 5. Grade stabilization structures used to stop head cutting also block fish from reaching important tributary spawning areas.

Another problem with flood control and hydropower reservoirs is their influence on a river's hydrograph. Historically, normal river hydrographs looked something like the one shown in Figure 6a. They featured a rise in water level elevation corresponding to spring rains, and a summer or fall rise corresponding to snowmelt in the mountains, or fall rainfall. Native species evolved under these scenarios and used such water level rises to trigger spawning movements onto floodplains and in the case of birds, for nesting on islands. Additionally, they were important in providing feeding and resting areas for spring and fall waterfowl migrations.

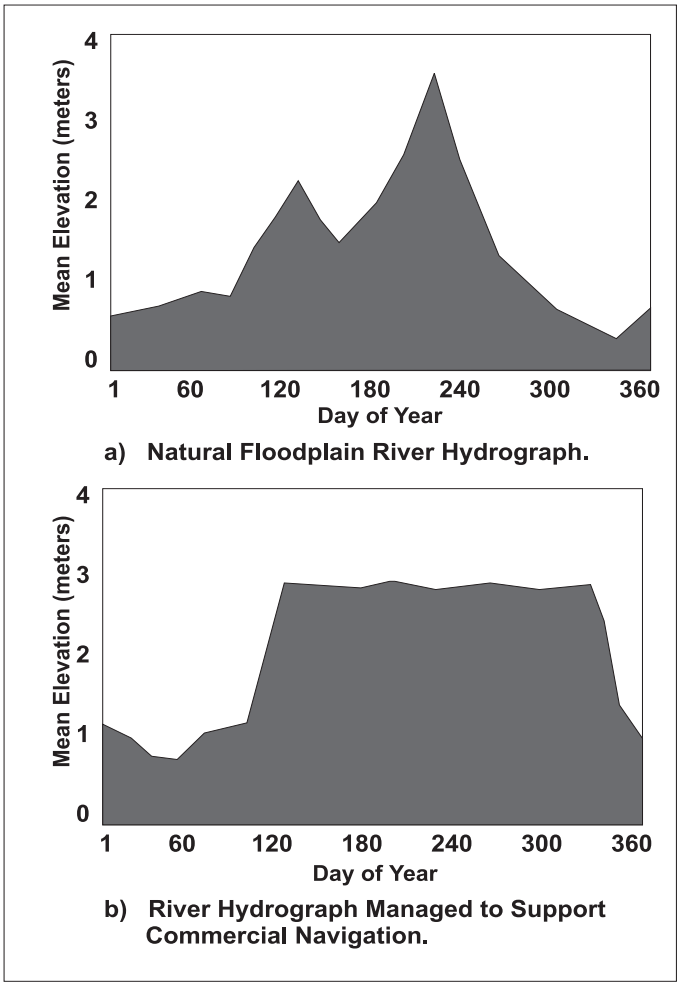

Figure 6. Stable water levels serving commercial navigation (b) eliminate water level fluctuations (a) which native organisms used as ques for timing their spawning and nesting activity.

Under management scenarios for commercial navigation, river water level elevations are raised in the spring and held stabile throughout the navigation season as shown in Figure 6b, virtually eliminating the triggering mechanisms native species used to reproduce and complete their life cycles. Because of this, many of our native riverine species often fail to spawn or nest, and are becoming increasingly threatened.

Restoration of native riverine fishes thus requires that reservoir drawdowns and releases from flood control and hydropower reservoirs take into account the needs of fishes resident both within the reservoir itself as well as downstream. Additionally, action is needed to reduce bed degradation below reservoirs and to ensure that floodplain channels and wetlands remain connected to the river's main channel. **See Ecosystem Restoration.**

Jerry L. Rasmussen, March 9, 1999