How cascade reservoirs impact on spawning activity of four major Chinese carps in the upper Yangtze River?

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The four huge cascade reservoirs (Wudongde, Baihetan, Xiluodu, Xiangjiaba) which had been constructed or under construction in the upper Yangtze River would dramatically alter the hydrological regime， and imposing significant pressure on spawning activity of four major Chinese carps. However, details of the changes in reproduction of Chinese carps affected by cascade reservoirs operation are not well understood. Based on daily discharge and daily sediment concentration data during 2011-2020, 1-D hydrodynamic-sediment transport model was used to assess the degree of natural flow regimes alteration after cascade reservoirs operation. Compared with the hydrodynamic characteristics before cascade reservoirs operation, the high-pulse duration and the rise rate of discharge or water level would decrease, which has a negative effect on the carps’ breeding amount. The shortened duration of flow peaks may not maintain drifting of the eggs, causing their mortality. The spawning onset would be postponed by about 15 days because of the delay of the flood starting time. The carps’ spawning grounds would move to the upstream because of the increase of water depth. Other flow properties such as the base flow discharge and the fall rate of discharge would be improved, which can further increase the adverse impact of cascade reservoirs operation to a certain extent. This work is fundamental to improve the strategic decisions of cascade reservoirs operation and river management to better support the carp population growth.