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Reservoirs and tailwaters act as both sinks and sources of organic matter in an arid river

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Worldwide, more than 16 million artificial lakes and reservoirs provide drinking water, irrigation, navigation, flood control, and hydropower affecting 50% of the world's rivers. In comparison, unregulated streams and rivers compose a continuous ecosystem where a gradient of physical processes function to drive biological processes from headwaters to the river deltas. Flow regulation by damming has converted many rivers into a series of lake and river reaches likely altering the transport of organic carbon (OC). Yet the combined effect of reservoirs and their tailwaters on OC transport is less understood. We studied a series of reaches on the Yampa and Green Rivers located in the upper basin of the Colorado River, USA to quantify how reservoirs and their associated tailwaters affect OC quantity and quality. We measured particulate (P) OC and dissolved (D) OC fluxes, along with composition and bioavailability of DOC in unregulated rivers, above and below Fontenelle and Flaming Gorge reservoirs, and tailwaters from early snowmelt to base flow hydrological conditions. In unregulated reaches, hydrological variability of snowmelt versus base flow drove variation in DOC and POC concentrations. Both reservoirs were sinks for POC and were neither a sink nor a source of DOC to downstream reaches. Reservoirs altered OC-cycling by increasing hydrological residence time, thereby changing the sources of OC to downstream reaches. However, the DOC exported to downstream reaches from both reservoirs was less bioavailable than DOC upriver of the reservoirs. Flaming Gorge reservoir, which had a longer residence time than Fontenelle reservoir, exported a likely mixture of transformed terrestrial and algal DOC. Last, tailwater segments below the reservoirs generated algae OC, exporting 2-3 g C m-2 d-1 of POC to downstream ecosystems, thereby further increasing the transport of autochthonous OC by reservoirs. Transformation of OC from terrestrial to more algal-like may lead to underestimation of the quantity of terrestrial OC buried in reservoirs because total fluxes of OC do not represent transformation processes in river-reservoir-tailwater ecosystems.