

Impacts of Dam-orientated Water-Sediment Regulation Scheme on the Lower Reaches and Delta of the Yellow River, China: A review

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The Water-Sediment Regulation Scheme (WSRS), beginning in 2002, was an unprecedented engineering effort to manage the Yellow River with the aims to mitigate the siltation both in the lower river channel and within the Xiaolangdi Reservoir employing dam-regulated flood water. Ten years after its initial implementation, multi-disciplinary indicators allow us to offer a comprehensive review of this human intervention on a river-coastal system. The WSRS generally achieved its objective, including bed erosion in the lower reaches with increasing capacity for flood discharge and the mitigation of reservoir siltation. However, the WSRS presented unexpected disturbances on the delta and coastal system. Increasing grain size of suspended sediment and decreasing suspended sediment concentration at the river mouth resulted in a regime shift of sediment transport patterns that enhanced the disequilibrium of the delta. The WSRS induced an impulse delivery of nutrients and pollutants within a short period (~20 days), which together with the altered hydrological cycle, impacted the estuarine and coastal ecosystem. We expect that the sediment yield from the loess region will decrease due to soil-conservation practices, and the lower channel erosion will also decrease as the riverbed armors with coarser sediment. These, in combination with uncertain water discharge concomitant with climate change, increasing water demands and delta subsidence, will put the delta and coastal ocean at high environmental risks. In the context of global change, this work depicts a scenario of human impacts in the river basin that were transferred along the hydrological pathway to the coastal system and remotely transformed the different components of coastal environment. The synthesis review of the WSRS indicates that an integrated management of the river-coast continuum is crucially important for the sustainability of the whole river-delta system. The lessons learned from the WSRS in the Yellow River provide insights to the integrated management of large rivers worldwide.

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