Impact of hydropower development on fish habitat in the lower Yalutsangpo River

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The Yarlung Tsangpo, which is the upper stream of the Brahmaputra River, is one of the highest major rivers in the world. It passes through the world's largest and deepest canyon, the Yarlung Tsangpo Grand Canyon in Eastern Tibet. The water surface elevation drops from 2900m to 600m through the canyon, implying huge hydropower resources. Owing to its distinctive and variable landforms, the Yarlung Tsangpo possesses rich and diverse habitats for terrestrial and aquatic organisms. This study intends to explore the potential impacts of a cascade hydropower development in planning on the local ecosystem. A fish habitat suitability model was applied to predict the changes in the habitats of an endemic fish species Schizopygopsis younghusbandi in the upper reaches of the Yarlung Tsangpo Grand Canyon. Based on remote sensing morphological data, a 2D hydrodynamic model of this river section was built using MIKE21. Adult fish prefer deep water and high flow velocity for living, and shallow water and low flow velocity for spawning.  Combined with the physiological data of the fish, a habitat suitability model (HSM) was set up to calculate the habitat suitability index (HSI) and identify the distribution of suitable habitats for the fish's various life cycle stages before and after dam construction. The river would widen and deepen upstream of dams, thereby increasing the effective area for the fish's spawning (WUAS). The effective area for the fish's adult phase (WUAG) would depend on the pattern of environmental flow released by dams. Generally, the WUAG would increase during dry seasons and decrease during wet seasons compared to before dam construction. Since power generation conflicts with the demand for ecological flow, a tradeoff scheme was proposed to balance aquatic ecology and hydropower development with the seasonal variation of ecological flow in consideration.