

The Aquatic Ecological Characteristics of Highland Rivers in Qinghai-Tibet Plateau

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ABSTRACT:

This study presents findings of systematic investigations and analyses on running-water biodiversity of macroinvertebrate assemblages in Qinghai-Tibet Plateau and lowland regions in China. The Yalutsangpo River, the most important but still unexplored major river in Tibet was included. The results indicate that the highland rivers have higher regional biodiversity compare to the lowland rivers with the similar flow and substrate conditions. In the investigated highland rivers, even though the local taxa richness was not high at a single site, the taxonomic composition was notably different among different sites, resulting in high regional bio-diversity. In Yalutsangpo River, the biodiversity and composition of macroinvertebrates are strongly affected by altitude gradients. Local diversity represented by taxa richness and regional diversity represented by beta diversity index and K-dominant curves revealed that both local and regional diversities were the highest in the altitude region 3000–4000 m a.s.l., among which suitability of aquatic habitat was higher due to better integrated environmental conditions including stream condition, water temperature, and aquatic and riparian vegetation.

The Zoige Marsh, located in the Northeastern Qianghai-Tibet Plateau, is the largest highland marsh in the world. It harbors many endemic and endangered species and behaves as the major water source to the headstream of the Yellow River. However, due to climate change and misuses of the marsh, like drainage of the marsh, peat exploitation, livestock grazing, the Zoige Marsh has suffered severe ecological stresses on the ecosystems since the last decades. Our findings indicated that the drainage of Zoige Marsh has resulted degradation of aquatic biodiversity to a large extent. As the marsh was drained, the drainage channels developed into eotic rivers and the drained swamp developed into grassland. The species composition of macroinvertebrates in the swamps, the rivers, and the grasslands were remarkably different. The swamp habitat supports a much higher regional diversity compare to the eotic river habitat and grassland habitat, owing to the distinct variation of species composition among the swamp sites. Generally, the drainage of the Zoige Marsh has resulted in some of the swamps dry out and caused degradation of high-regional diversity swamp ecology to poor-regional diversity grassland ecology. Even though some of the drainage channels support a high aquatic ecology, the scale of the channels is too small compare to the large range of the swamp.

The analysis of relations between macroinvertebrates and environmental parameters indicated that the altitude, stream condition (e.g. river pattern, riverbed structures, substrate composition), and water temperature were the main parameters influencing the composition of macroinvertebrates in the plateau. It is essential to conserve suitable conditions of these parameters to protect the unique aquatic ecosystems in the plateau. To be specific, the drainage work in the Zoige Marsh should be held down for protection of the high-regional diversity swamp ecology. Restoration of peat layer and barriers on the drainage channels are recommended for restoration of the Zoige Marsh.