Effectiveness assessment of using riverine water eDNA to simultaneously monitor the riverine and riparian biodiversity information

Haile Yang[1], Hao Du[1], Hongfang Qi[2], Luxian Yu[2], Xin-Dong Hou[3], Hui Zhang[1], Junyi Li[1], Jinming Wu[1], Chengyou Wang[1], Qiong Zhou[1], and Qiwei Wei[1]

[1]Yangtze River Fisheries Research Institute Chinese Academy of Fishery Sciences
[2]The Rescue and Rehabilitation Center of Naked Carps of Qinghai Lake
[3]China University of Geosciences

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Abstract

Both aquatic and terrestrial biodiversity information can be detected in riverine water environmental DNA (eDNA). However, whether riverine water eDNA can be used to simultaneously monitor aquatic and terrestrial biodiversity remains unverified. To assess the effectiveness of using riverine water eDNA to simultaneously monitor the riverine and terrestrial biodiversity information, we proposed that the monitoring effectiveness could be approximated by the transportation effectiveness of land-to-river and upstream-to-downstream biodiversity information flows. Subsequently, we conducted a case study in a watershed on the Qinghai-Tibet Plateau. The case demonstrated that there was higher monitoring effectiveness on summer or autumn rainy days than in other seasons and weather conditions. The monitoring of the bacterial biodiversity information was more efficient than the monitoring of the eukaryotic biodiversity information. On summer rainy days, 43-76% of species information in riparian sites could be detected in water eDNA samples, 92-99% of species information in riverine sites could be detected in a 1-km downstream eDNA sample, and half of dead bioinformation (i.e., the bioinformation labeling the biological material that lacked life activity and fertility) could be monitored 4-6 km downstream for eukaryotes and 13-19 km downstream for bacteria. In this case, we tested the eDNA monitoring effectiveness assessment framework, in which the land-to-river monitoring effectiveness was indicated by detection probability, and the upstream-to-downstream monitoring effectiveness was described by the detection probability per kilometer runoff distance and by the half-life distance of dead bioinformation. It provided a new and usable tool for designing monitoring projects and for evaluating monitoring results.

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