Roles of riffle and pool structures in POM dynamics in the downstream reaches of dam reservoirs

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Introduction

As dam tailwater ecosystems are supposed to depend on lentic plankton supplied from dam outflows as a major trophic source, the retention efficiency of lentic plankton, an ability of the channel to reduce the drifting plankton by filtering and deposition, is critical for recovering a normal state of trophic structure in the stream ecosystem.

In our previous studies, we estimated the transport distance of lentic plankton in dam and lake tailwater reaches and found that simplified channel geomorphology (i.e., riverbed degradation, loss of riffle-pool structure) by dam impacts can lead to reduction of the retention efficiency.

The present study aims to evaluate the roles of riffle and pool structure in transport and retention of the lentic plankton in the field, and to find out conditions of riffle and pool geomorphs increasing the retention of lentic plankton.

Methods

Two dam tailwater channels with different riffle and pool structures were selected. The Uji River below Amagase Dam showed a channel geomorphology characterized by a combination of short riffles and long-deep pools, probably derived from the riverbed degradation as a dam impact, whereas the Nunome River below the Nunome Dam had long riffles and short-shallow pools, partially as a result of artificial sediment replenishment works conducted for 6 years before the present study.

Longitudinal changes of relative contributions of three sources (i.e., lentic plankton, allochthonous terrestrial plant and autochthonous epilithic algae) comprising of suspended particulate organic matter (POM) in dam tailwater ecosystems were estimated by means of the concentration-weighted stable isotope mixing model using combined $\delta^{13}C$ and $\delta^{15}N$.

Result and Discussion

Relative contribution of lentic plankton was generally reduced within the riffle zone and that of terrestrial plant was decreased in the pool zone. The reduction in contribution of lentic plankton was found to be in proportional to the length of riffle, but the retention efficiency was higher in the short riffle than in the long riffle (Fig.1).

The results indicate that riffle and pool structure has an important role for POM dynamics in the dam tail water reaches. Some recommendations of geo-morphological management for restoration of dam tail water ecosystems are discussed based on our findings on the particular features of riffle-pool structure enhancing the retention of lentic plankton.

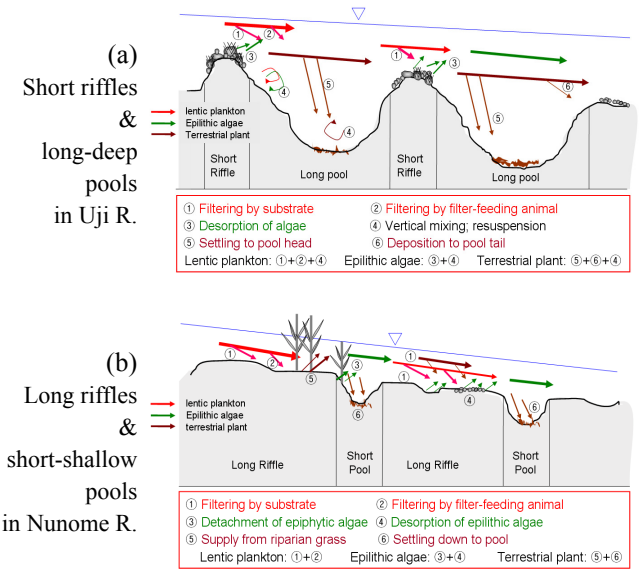

Fig.1 Conceptual schemes of suspended POM dynamics in relation to riffle & pool structure