PARTICULATE ORGANIC MATTER RETENTION AS AN ECOLOGICAL INDICATOR FOR RIVERBED MANAGEMENT

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Reservoir dams are known to degrade ecological functions of riverbed in dam downstream reaches by alteration of channel geomorphology (e.g., riverbed degradation and channel incision) caused by reduced bed load transport. Recent river management particularly in dam tail waters has a growing concern on riverbed management (i.e., through sediment replenishment, bypass tunnel, dry dam without impoundment) for recovering functions of habitat conditioning and of material cycling acceleration. From a perspective of riverbed management considering sediment and flow regime controls, therefore, development of ecological evaluation methodology for desirable geomorphology is increasingly required (Takemon 2011). Retention of particulate organic matter (POM) is an important capacity of riverbed, because it retains suspended materials leading to provide energy resources to heterotrophic foodwebs as well as to enhance purification. In particular, dam downstream ecosystems disturbed by input of large amount of plankton from reservoir outflows are supposed to be highly reliant on the plankton as major trophic source. Therefore finding an effective riverbed conditions for increasing the retention of lentic plankton is critical to restore the degraded 'reservoir-river hybrids' to a normal state of 'lotic ecosystem' (Ock and Takemon 2010).

In the present study, we investigated the downstream changes of POM source composition and concentrations aiming to evaluate roles of (1) riffle-pool reach in two dam tailwaters in Japan (Uji R. changed to short riffles-long pools by riverbed degradation and Nunome R. maintaining long riffles-short pools by sediment replenishment) and (2) gravel bar in the braided reaches of Tagliamento River in Italy, characterized by highly dynamic fluvial geomorphology created by natural flooding events and sediment supply). Advanced analyses of stable isotopes ($\delta^{15}N$ and $\delta^{13}C$) and C:N ratio can identified the three sources effectively, and estimate their relative contributions longitudinally. The results showed that the relative contribution of lentic

plankton trended to be reduced steeply during passing riffles, whereas that of terrestrial plant decreased during passing pools, indicating that riffle-pool geomorphology have sorting capacity to POM components according to its source origins. On the other hands, the braided channel in Tagliamento River showed high POM retention capacity when compared with other deep channels. Moreover, the hydromorphological heterogeneity within an island bar resulted in source-specific retention process and capacity along shoreline (Figure 1). Allochthonous and autochthonous particles were highly deposited along barhead and bartail shorelines, respectively. This spatial diversity of POM quantity and quality along shore will lead to highly heterogeneous habitats in braided channels. Overall, the results suggest the significance of riffle-pool and bar geomorphology in riverine POM retention for enhancing trophic spiraling efficiency of nutrients and for providing spatial heterogeneity of trophic origin of POM. They can contribute to evaluation of riverbed management in consideration of ecological functions.

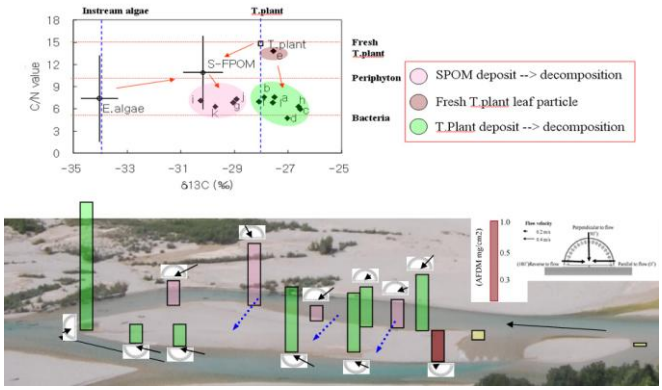

Figure. 1 Spatial distribution of standing stock of benthic POM (lower) and results of their source composition analysis by stable carbon isotope and C/N ratios (upper) in a braided island bar in Tagliamento River. The bar graph and arrow means the density of benthic POM, and secondary flow velocity and direction, respectively.

1 Ock G. and Takemon Y. (2010), "Estimation of transport distance of fine organic matter in relation to channel morphology in tailwaters of the Lake Biwa and reservoir dams" *Landscape and ecological engineering*, Vol 6, 161-169.

2 Takemon Y. (2010), "Habitatology for linking sediment dynamism and ecology", *proceeding of International symposium on sediment disaster and river environment in mountainous area*, Kyoto, Japan, 25-32.