

Evaluation of Cross-sectional Geomorphology for Lentic Habitat Restoration in the Uji River

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INTRODUCTION

Background

Most of rivers in the civilized countries have lost biodiversity due to deterioration of habitats through the riverbed degradation derived from various artificial works such as channelization, sand mining and dam construction. For the nature conservation in these human impacted rivers, restoration of habitats is required on a priority basis.

Reduction in sediment dynamism due to the impact of the Amagase Dam lead the Uji River to the bipolarized river channel, which decreased the connectivity of the main channel and lentic habitats on the banksides, affecting the ecological environment of biological communities.

After redevelopment of the Amagase Dam, the planned peak discharge will be increased up to 1,500 m³/s in the near future. Accordingly, the government has enlarged cross-sectional area of the Uji River in order to enable the peak flow. In order to restore the deteriorated nature in this river, the cross-sectional morphology should be planned to create desirable lentic habitats considering the future water level rise at peak discharge.

Objectives

This paper aims to develop new methods for evaluation and creation of lentic habitats on the banksides in the degraded rivers, based on interrelationships among the species richness of benthic animal communities in the lentic habitats, RSCC (reach scale channel configuration) and underground clay layer distribution.

Study Area

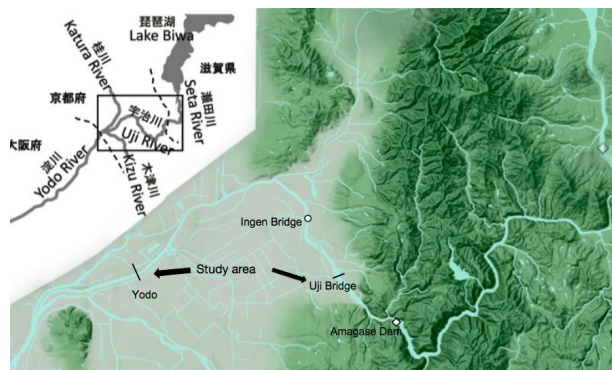


Fig. 1 Location of Uji River and the study area.

METHODOLOGY

Relation of the benthic animal communities to physicochemical conditions

Benthic animal sampling and physicochemical measurement were conducted in the three habitat types of Riffle (n=3), Wando (n=4) and Pond (n=7) habitats. Relations of the community parameters to geomorphologic conditions and inundation factors were analyzed using correlation analysis and NMDS (nonmetric multidimensional scaling).

Habitat potential evaluation

Evaluation of lentic habitat potential was made based on interrelationships among the species richness of benthic animal communities, FVSI (Floodplain vertical shape index), perimeter length and underground clay layer distribution. Historical changes in FVSI and perimeter length were estimated in the 38.9-50.5kp in the Uji River. Longitudinal distribution of underground clay layers was detected based on the open-source data of the geologic column

along the Uji River. The elevation of the clay layer surface was used for evaluation of the suitable elevation to create the pond habitats on the banksides.

Proposal of target image of artificial lentic habitats

Based on the results of lentic habitat potential elevation at each section, a potential map for creating artificial lentic habitats was proposed along the Uji River.

RESULTS and DISSCUTION

Compositions of benthic animal community in Group1, 2 and 3 ponds were classified into distinctive groups characterized by particular taxa showing preferences to specific relative height like Hemiptera, Odonata and some Diptera families (Fig. 2).

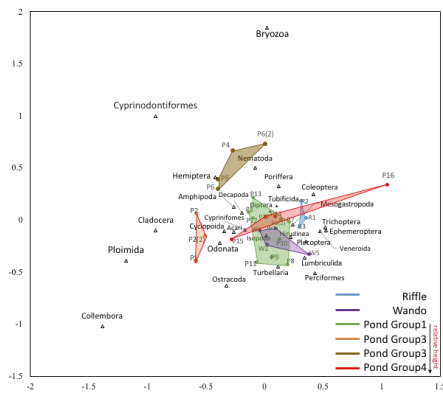


Fig. 2 Bipolts of NMSD for all pond habitats.

Different symbol colors correspond to habitat types.

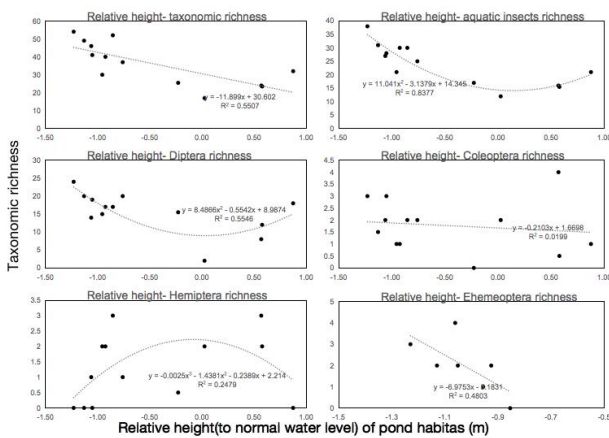


Fig. 3 Relations of taxonomic richness to the relative height distribution of pond habitats
Compositions of benthic animal community in a pond

habitat can be predicted by its relative height (Fig. 3).

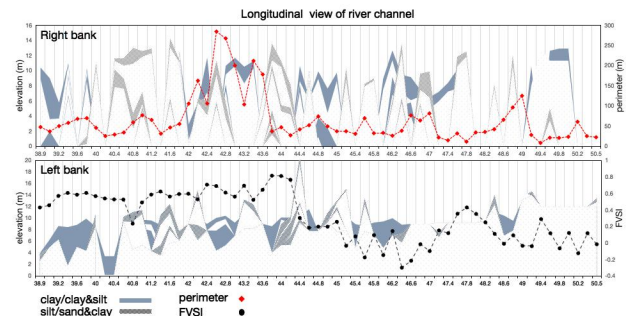


Fig. 4 Longitudinal distribution of the clay layers in Uji River(38.9Km-50.5Km)

A small value of FVSI corresponds to a concave shape cross-sectional shape, a high value of Perimeter indicates a higher habitat potential area. A reach with both characteristics was judged to be a high habitat potential site and suitable for carrying out artificial construction of pond habitats; A reach with one of these two characteristics had better be modified with cross-sectional geomorphology before the enlargement works of the cross-sectional area.

CONCLUSION

A new habitat potential assessment method was developed based on FVSI, perimeter, clay layer distribution, and their relations to benthic animal communities. This method will be applicable to the nature restoration works in rivers with channel degradation and loss of lentic habitats like Uji River.

REFERENCE

(1) Katano I, Negishi JN, Minagawa T, Doi H, Kawaguchi Y, Kayaba Y (2009) Longitudinal macroinvertebrate organization over contrasting discontinuities: effects of a dam and a tributary: Journal of the North American Benthological Society, 28(2): 331-351
 (2) Choi M, Takemon Y and Sumi T (2012) The Historical Changes of Aquatic Habitat Structure in the Kizu River, 18th Congress of the Asia and Pacific Division of the International Association for Hydro-Environment Engineering and Research, SS4F-2