SUITABLE FLOW DEPTH AND VELOCITY FOR SPAWNING OF AYU, PLECOGLOSSUS ALTIVELIS

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Hydraulic structures such as a dam, weir and water gate affect on the flow depth, velocity, bed topology, water quality and so on, so that the hydraulic structures affect on the water environment for plants and aquatic lives in and around rivers. Therefore, before construction of such hydraulic structures, to conduct the environmental assessment is necessary. However, high accurate environmental assessment can not be conducted at present, because the preference curves of the flow depth and velocity are not clear. Several conditions such as water temperature, velocity, flow depth, channel slope, BOD, COD, pH, SS and so on may affect on the suitability of spawning of ayu. Nagaya et al.(2004) pointed out that the effects of the flow depth, velocity, SS and water temperature are dominant for spawning of ayu.

In this study, preference curves of the flow depth and velocity for spawning of ayu were investigated on the basis of the field data which are obtained in the present field survey and previous one. It was found that the flow depth is not important than the velocity, and also that the velocity near the bed is more important than the bulk mean velocity, due to ayu spawn on the bed. Fig. 1 shows the amount number of data, in which the spawning was reported, for each class of the depth averaged velocity. The number of data increases with an increase of the velocity in the range of U_m<0.6 and number of data is almost constant in the range of 0.6<U_m<1.0. The number of data decreases with an increase of the velocity in the range of U_m>1.0. This is because it is quite difficult to swim in such high velocity flow. It can be said that the velocity in the range of 0.6<U_m<1.0 is quite suitable for spawning of ayu, so that the suitability index of velocity in such range is set to 1. Moreover, the following preference curve of velocity for spawning of ayu can be gotten from Fig. 1. Environmental assessment of suitability for spawning of ayu become possible to use the preference curve of the velocity, because suitability index of velocity SI(v) can be obtained. Next, the expression of SI(v) is shown.

$$
\begin{aligned}
&SI(v) = 0 \ (0 \le U_m(\text{m/s}) < 0.3) \\
&SI(v) = 3.3U_m - 1 \ (0.3 \le U_m(\text{m/s}) < 0.6) \\
&SI(v) = 1 \ (0.6 \le U_m(\text{m/s}) < 1.0) \\
&SI(v) = -1.4U_m + 2.4 \ (1.0 \le U_m(\text{m/s}) < 1.7) \\
&SI(v) = 0 \ (1.7 \le U_m(\text{m/s}))
\end{aligned}
\tag{1}
$$

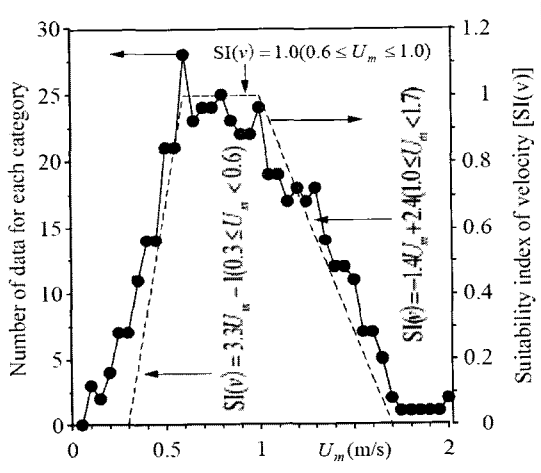

Fig. 1 Preference curve of velocity for spawning of ayu

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