PLUNGING AND STREAMING FLOWS IN POOL-AND-WEIR FISHWAYS

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Fishways are the constructions which are installed at the side of a large weir for the purpose of giving assistance of migration to fish between the upstream and downstream habitat. The fishways are classified to three types such as a stream type, operation type and pool-and-weir type. Many fishways installed in Japanese rivers belong to the pool-and-weir type.

It was pointed out that pool-and-weir type fishways has the following weak points. Sometimes plunging flow and streaming flow are alternately generated so that the rotation in the pool changes alternately. Rajaratnam *et al.*(1984) pointed out that the streaming flow is generated when the normalized discharge is higher than 0.25 and also the streaming flow is generated when the normalized discharge is lower than 0.25. However they substituted the pool length for the overflow depth above the weir, when deriving the normalized discharge from the momentum equation. Such a substitution has a physical problem.

It was investigated that whether two sets of the assumptions, i.e., the Froude number is low and the theory of the plunging flow can be applied to the streaming one, are valid or not on the basis of experiments. As a result, it was shown that the two parameters such as $L_x/(L_y+\Delta y)$ and $\Delta h/\Delta y$ control the flow pattern as shown in Fig. 1. The formula which can predict the flow pattern in the pool-and-weir fishways is proposed as follows:

$$\frac{\Delta h}{\Delta y}=0.42\left(\frac{L_x}{L_y+\Delta h}\right)^{0.85} \tag{1}$$

Eq.(16) can predict the flow pattern belongs to the plunging flow or streaming one from the two parameters such as $L_x/(L_y+\Delta y)$ and $\Delta h/\Delta y$.

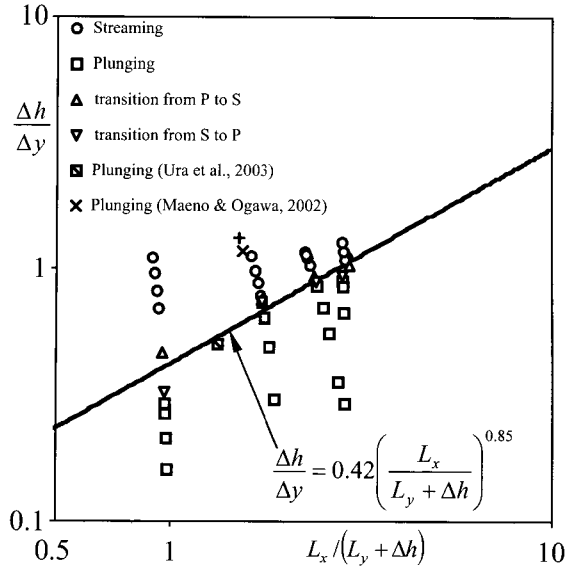

Fig. 1 Relationship between $L_x/(L_y+\Delta y)$ and $\Delta h/\Delta y$ and prediction of flow pattern

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