

## EFFECTS OF IMPROVEMENT OF POOL-AND-WEIR FISHWAY WITH A SLOPE

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After installing the weir in the river, the difference of the water level between the upstream and downstream become quite large, so that it becomes difficult for the aquatic lives to migrate there. A fishway is the construction which gives a helping migration to the migrating fish.

A pool-and-weir fishway was installed beside of the large weir in the Onga River where is located at the north of Kyushu Island, Japan. This fishway consists of 18 pools and 19 weirs and the difference of the water level between the headwater and the first pool (0.37m) is larger than the admirable value (0.15m). It is reported that the most of fishes could not migrate there in this fishway (see Onitsuka et al., 2004).

This is due to the facts that the falling velocity from the headwater to the first pool is higher than the burst speed of the small fishes. Ura et al.(2003) tried to find the improvement method on the basis of the experiments. Several types of the slope which attached on the first weir were constructed in the experimental flume and the velocity measurements were conducted. As a result, Ura et al.(2003) found the method to allow fish migration. In this method, the angle of the slope is 45 degree.

Fig.1 shows the histogram of the instantaneous dropping flow near the dropping point ( $x/L=0.24$ ,  $y/h=0.89$ ,  $z/B=0.05$  and  $x/L=0.24$ ,  $y/h=0.89$ ,  $z/B=0.30$ ) and also the accumulative value. The mean values at  $z/B=0.05$  and  $0.30$  are  $-53$  and  $-50$  degree, respectively, so that the suitable angle for migration at  $z/B=0.05$  and  $0.30$  are  $-53 \pm 15$  and  $-50 \pm 15$  degree, respectively. The number of data which in the suitable angle at  $z/B=0.05$  and  $0.30$  are 87.2% and 96.3% , respectively. Almost instantaneous dropping flows are suitable for migration.

The observation of migrating fishes at this fishway with a digital video camera and velocity measurements with a 3-D electromagnetic current meter were carried out after the improvement. The number of fish which tried to migrate near the side wall is larger than that at the central region of the fishway, because instantaneous velocity near the side wall is smaller than that at the central region, irrespective of that the time averaged velocity of both regions are almost same and also the eddy scale around the fish is larger than the body length of the migrating fishes. The analysis considering the instantaneous eddy scale and body length of fish is quite important, because the fish does not feel the time averaged velocity but the instantaneous velocity.

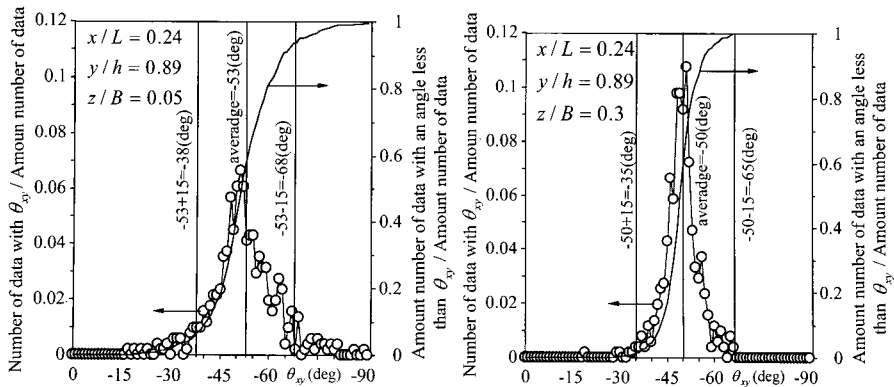


Fig. 1(a) Instantaneous angle of dropping  
Flow at  $z/B = 0.05$

Fig. 1(b) Instantaneous angle of dropping  
Flow at  $z/B = 0.30$

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