25-12 Larval Avoidance Enhances the Entrainment Reduction Performance of Cylindrical Wedgewire Screens

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A laboratory study was conducted in 2010 to estimate parameters of an avoidance/exclusion model that addresses three distinct mechanisms by which cylindrical wedgewire (CWW) screens can reduce entrainment: hydraulic bypass, avoidance, and mechanical exclusion. CWW screens with slot widths of 2, 3, 6, and 9 mm were tested at flume velocities of 0.08, 0.15, and 0.30 m/sec, with through-slot velocities of 0.08 and 0.15 m/sec. Tests were conducted by releasing neutrally buoyant beads, fish eggs of approximately 1 and 3 mm diameter, and fish larvae with robust (Atlantic tomcod, striped bass) and slender (white sucker) body forms at a location of known high probability of entrainment immediately upstream of the test screen. The length, body depth, and number of the test subjects carried past, entrained through, or excluded and retained on the CWW screen was recorded. Tests were done with both live and dead larvae, and under ambient daylight and nighttime conditions. Avoidance curves, expressing the relationship of probability of avoidance with fish length, and exclusion curves, expressing the relationship of probability of exclusion with greatest body depth, were fit to data for each set of test conditions using nonlinear regression. Avoidance was typically higher during the day, for the smaller slot sizes, for the lower through-slot velocity, and at higher ratios of flume/slot velocity. Exclusion of live larvae was reduced as slot velocity increased on 2 mm CWW screens. Exclusion of white sucker eggs (3.3 mm diameter) by 2 mm CWW screens was nearly 100% at either through-slot velocity, but was somewhat lower (70%-95%) with 3 mm CWW screens. The probability of being swept off, if excluded, was higher for the white sucker eggs than for fish larvae, was higher for the low slot velocity (0.08 m/sec), and increased with increasing flume velocity. The 2010 laboratory study confirmed that avoidance of the CWW screens tested occurs for fish larvae, and that expected avoidance capability has an exponentially increasing relationship with length. The performance of CWW screens for reducing entrainment was a combination of the potential for bypass, avoidance and exclusion. Selection of an optimal slot width CWW screen should account for these three performance components.

https://afs.confex.com/afs/2011/webprogram/Paper4915.html