science summary

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Low-cost modifications of the Crump weir to improve fish passage

Science Summary SC010027

A new report provides technical details of a low-cost solution to improve fish passage at the many sloping and triangular weirs that inhibit fish migration in our rivers and streams.

In order to complete successful and productive life cycles in our rivers and streams fish need to have freedom of movement. Our exploitation of the resources provided by flowing waters has resulted in a large number of obstructions that can hinder free passage of fish, reducing their success and the ecological status of some watercourses.

Traditional solutions to improve fish passage for upstream migrating fish involve construction of expensive fishways to bypass the obstructions. A great many of the weirs and dams have sloping downstream faces, including some that have specific triangular profiles designed to accurately measure river flows. These latter types are used in the Environment Agency's hydrometric (flow measuring) network.

There are too many of these weirs to be remedied by expensive traditional fishway solutions, so this project aimed to identify an alternative low-cost solution to improve fish passage on such weirs. In particular, it sought a solution that could be employed on the Crump weirs that form a significant part of the Environment Agency's hydrometric (river flow measuring) network, without compromising gauging accuracy.

The study, jointly funded by the Environment Agency and the Engineering and Physical Sciences Research Council and carried out by Cranfield University, trialled a large number of alternative baffle arrangements in a simulated weir, before identifying a preferred geometry for detailed investigation on a case study site at Brimpton Weir on the River Enborne.

The preferred solution identified from the trials consists of baffles placed in parallel rows down the sloping weir apron, with a gap in each and every baffle that runs at an angle progressively across and down the weir face. This oblique channel can be reflected from side to side on narrow weirs forming a V-shaped channel in these cases. The baffles retard flow, maintain a consistent depth of water, and prevent water velocities increasing down the weir. The velocity in the oblique channel is particularly low. Comparisons of modelled depths of flow and water velocities with the size and swimming speed of a number of fish species suggests that the solution creates conditions that most of them may be able to exploit to find passage over a wide range of flows.

Laboratory-scale modelling cannot take account of the effects of aeration at field scale, nor the behaviour of fish. The solution proposed here will therefore have to be field-tested to confirm its suitability. In addition, the modelling highlighted the difficulty of employing the solution without compromising gauging accuracy.

The solution set out in this report can be immediately trialled by Environment Agency fisheries staff on some of the large number of sloping non-gauging weirs. However, there remains a conflict between employing the recommended solution and meeting the needs of hydrometry to operate gauging structures in accordance with British and International Standards. Further work will be required jointly by hydrometry and fisheries scientists to resolve these conflicts. Modifying the set-up for gauging weirs, for example by locating the baffles further downstream of the crest, may be a solution.

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