

Developing and testing ways to stop Asian carp from passing through Lock and Dams

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INTRODUCTION

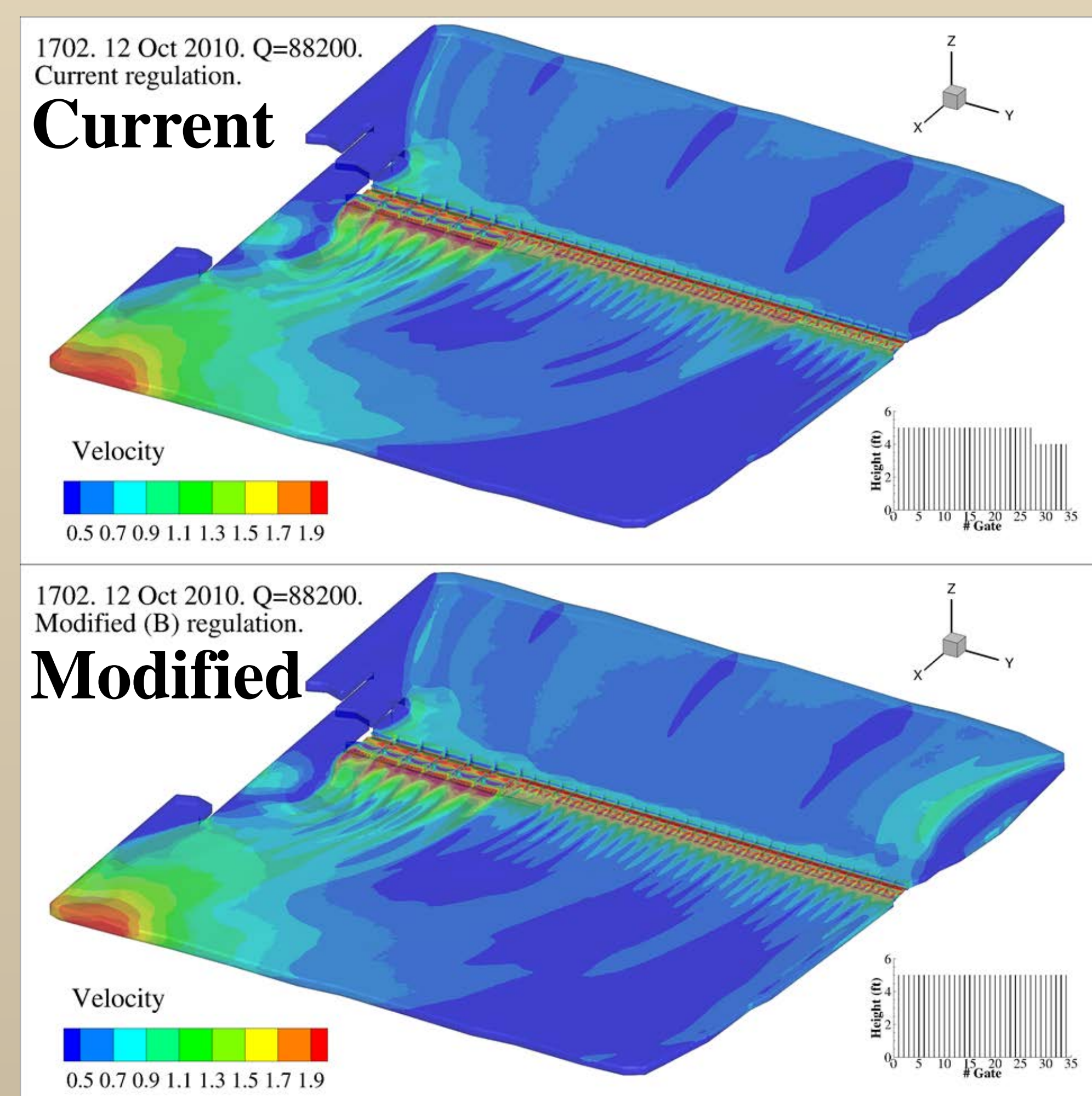
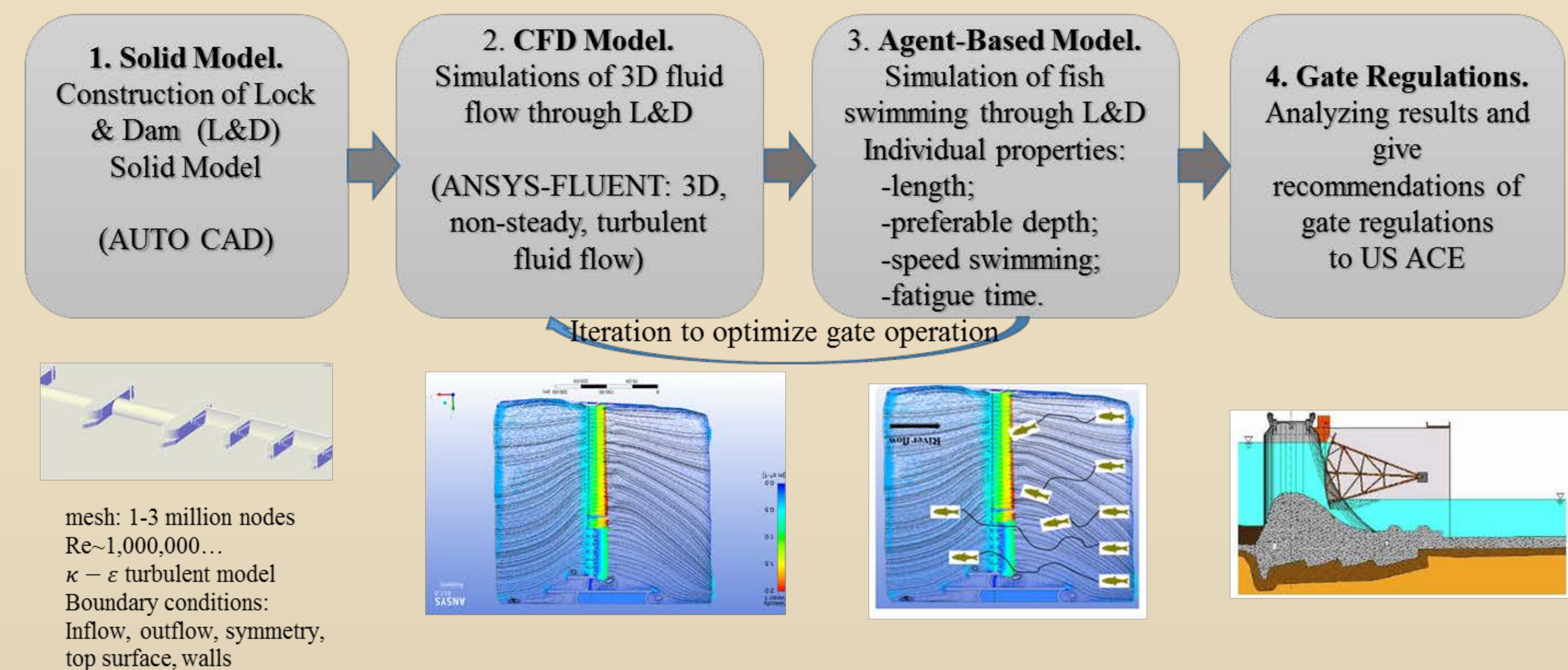
The imminent threat of Asian carp swimming up the Mississippi River into Minnesota waters demands new and effective approaches to selectively block these species. The locks and dams located in the Mississippi River already create flow conditions that appear to slow the passage of many fishes with relatively low swimming performance, but this attribute has never been systematically examined. Nor has the possibilities for altering gate openings to reduce carp passage been examined. In this study we developed a numeric approach based on a combination of high fidelity computational fluid dynamics (CFD) and agent-based (AB) modelling to achieve these objectives and then applied it to Lock and Dam #5 (which is located at a key location on River just south of Lake Pepin). This numeric model is explained to the right. Its findings have already been applied to Lock and Dam 8 where it is predicted to reduce an already low passage rate by half.

RESULTS

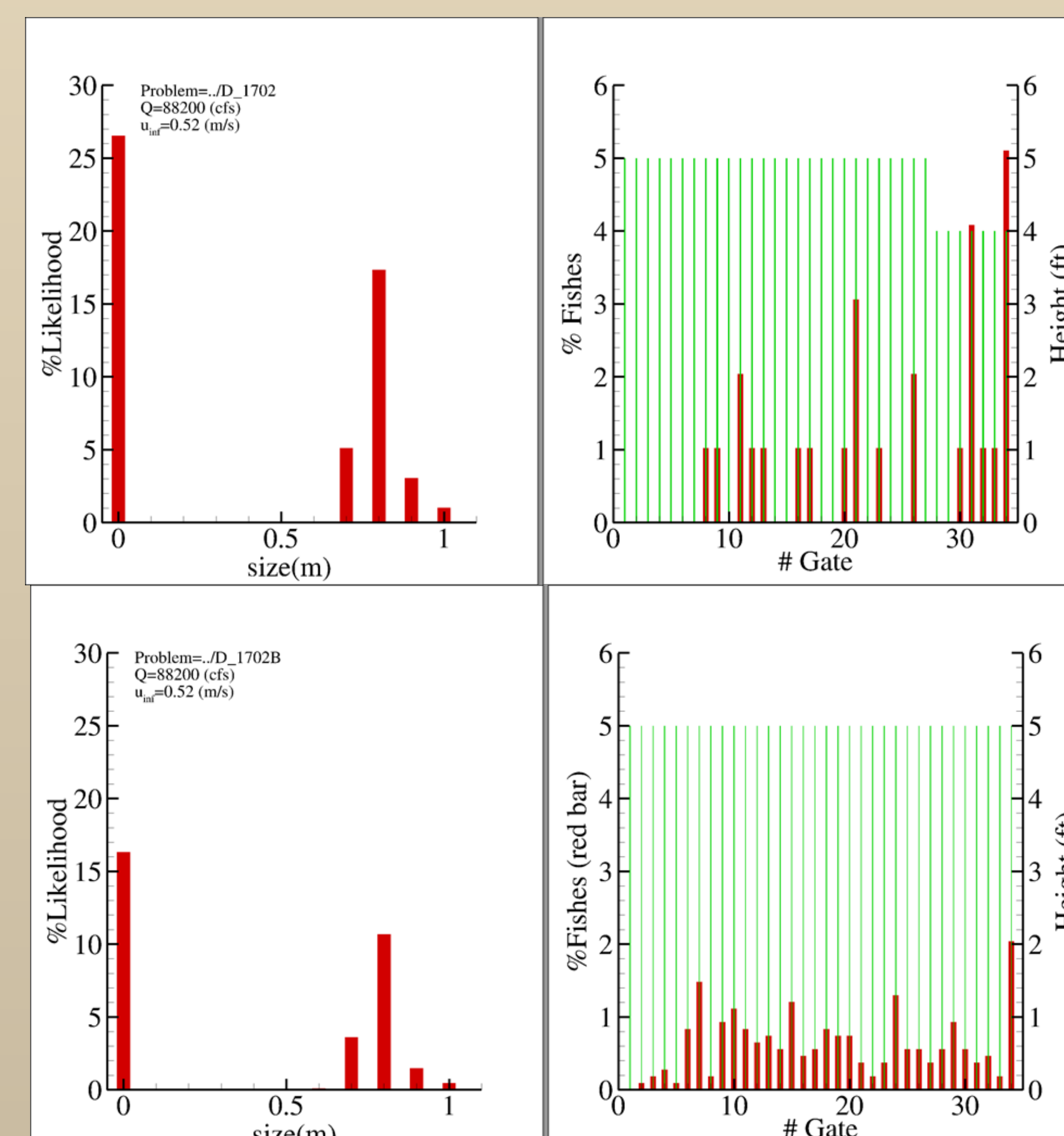
The model was run for five flow conditions at Lock and Dam #5. Under current operating conditions a carp passage likelihood index was between about 30% and 60% in dependence of flow discharge. This passage index dropped by about 50% on average after modifications of dam's gates operation. In the example below (flow rate of 88,000 cfs), passage likelihood was reduced by an average of 50% for adult silver carp after small adjustments in gates.

Algorithm of CFD-AB Model

The Concept of Computational Fluid Dynamic + Agent-Based (CFD-AB) Model: universal and can be used for any L&D.



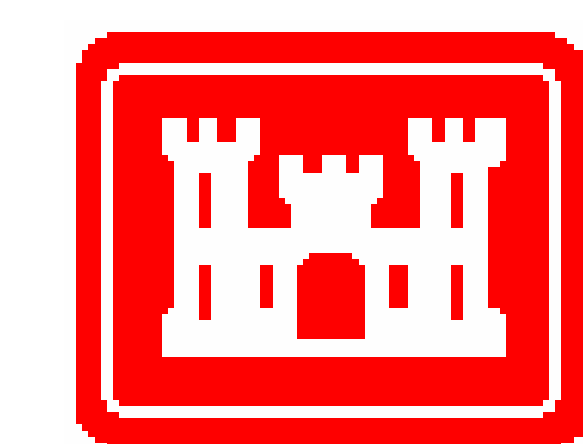
Contours of velocity flow in the region around L&D#5 for **current (top)** and tentative **modified (bottom)** gate configurations at $Q = 88.2K$ cfs. (gate almost open?)



Left: %Likelihood fish passage.
Right: Green bars show gate regulations - height of roller and tainter gates. Red bars indicate at percent of fishes (%Fishes) passed through the specific gates (#Gate).

Acknowledgements

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