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Characterization of the interaction between a rough boundary layer and multiple cylinders wakes ALINE COTEL, University of Michigan, OLIVIER EIFF, IMFT, PRATIK PRADHAN, University of Michigan — Among many ecologically important aspects of fish locomotion, turbulence is thought to create large stability challenges for fishes. Turbulence is a ubiquitous, highly variable feature of aquatic habitats (Denny 1988). Species that are more prevalent in "energetic water" (high flow, high turbulence) have more effective control systems and greater ability to generate propulsive power to maneuver. There are direct engineering applications of such work: the design of fishways, fish ladders, culverts, etc. No work to date has explored the interaction of a rough boundary layer (typical of natural environments), with wake flows in the context of fish responses to turbulent fluctuations. The research performed at IMFT under the umbrella of the NSF IREE grant used complimentary laboratory experimental studies to further apply the results from our previous field observations (Cotel et al. 2005) and current laboratory experiments by determining how a rough turbulent boundary layer interacts with the flow structures created by obstacles (cylinders arrays) in the channel. PIV data were acquired for a variety of flow regimes. The results show a strong interaction between the turbulent boundary layer created by the roughness elements and the wakes behind the cylinder arrays, having strong implications for fish behavior in such environments.

Aline Cotel
University of Michigan

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