An Experimental Approach for the Quantitative Assessment of Downstream Swimming Fish Behavior

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Abstract

The RETERO project develops new methods to Reduce, Replace and Refine (3R-principle) animal experiments for assessing the risk of harm to fish when passing through turbines or pumps. Since behavior of fish influences the mortality risk during turbine and pump passages, knowledge about species-specific behavior and its triggers are necessary. A primary objective of the RETERO project is the study of fish behavior in hydraulic conditions similar to turbine and pump intakes. Therefore, an experimental conduit was constructed at the Hubert-Engels Laboratory of Technische Universität Dresden (Germany) specifically for the RETERO project’s study on fish behavior, equipped with a 3D camera infrared tracking system. The conduit was designed to model hydraulic conditions typical for turbine and pump intakes. In the experimental setup the effects of flow velocities exceeding the maximum swim speed of fish, as well as spatial velocity gradients and illumination conditions, on the fish behavior are studied. The data from studies involving brown trout (Salmo trutta) allow for an analysis of how these fish react to flow accelerations and velocities surpassing their sprint speed, using quantitative metrics for movement and activity. An initial evaluation of these experiments highlights the potential of this approach for further research.

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