FISHVIEW

Assessing fish passibility using a robotic fish sensor and hydrodynamic imaging

Final report
Publishable summary

Prof. Maarja Kruusmaa, Tallinn University of Technology

Tel: +372 5183074
Email: Maarja.kruusmaa@ttu.ee

The life-cycle of migrating fish such as trout and salmon depends on environmental conditions in the Baltic Sea and its connecting rivers. Upstream migration brings fish into rivers, where conditions are suitable as spawning grounds, and contain the necessary habitats for juvenile fish. Thus the life-cycle of migratory species heavily depends on the possibility from the sea to rivers. Establishing and maintain favorable environmental conditions for migrating fish has proven internationally to be a challenging task. Particularly complex is the problem of passing barriers such as dams and weirs where the fishway structures provide a way to pass the obstructions and reach the spawning grounds. However, the majority of fish passes are not fully functional.

Therefore, the main goal of the FishView project work is to provide a robust methodology to improve fish passibility in the river basins of the Baltic Sea.

FISHVIEW uses a novel approach to give researchers the “inside view” of a river pass. We design a device that experiences water flows similar to the lateral line sensing organ of fish. This device is immersed in river fish passes and records the signals in the flow. The signals are analyzed with machine learning methods. As the result, we hope to be able to tell how to build fish passes that all migrating fish can use.

The main results of FISHVIEW project are:

1. Development of the flow sensitive probe inspired by fish lateral line sensing capable of sensing pressure with a distributed array of pressure sensors at high frequencies. This allows recording small pressure fluctuations simultaneously around a fish like body and perceive the flow from “fish perspective”.
2. Signal processing methods from those sensor probes for estimating flow properties, such as velocity and direction but also turbulence related properties (such as for example turbulence kinetic energy) as well as more abstract “signatures” of locations in flow for classification.
3. Computer simulations of the flow in fish passes, that use our sensor data and simulate the flow properties of a computer model of a fishpass. We have used our device for measuring flows in 3 different fishpasses, analysed the flow conditions and suggested improvements.