Can hydropower and salmon coexist? Students explore ways to improve downstream migration in Kemijoki.

A group of three students from the master's Program in Water and Environmental Engineering in Aalto University have researched experimental ways to improve salmon migration in Kemijoki River. The research was conducted as a part of the WAT project course and the work was done in collaboration with the ELY-center for Kainuu, of which Dam Safety Expert Eija Isomäki represented.

In recent years, fish migration has caused a lot of public debate. Fish stocks – especially the stocks of migratory fish species, such as salmon – are under threat due to hydropower dams in rivers limiting their instinct to move upstream to lay their eggs. They also limit the young salmon's travel downstream to grow in the sea. The main cause of debate seems to be the different viewpoints for sustainability. Hydropower is an efficient way to produce renewable energy. However, the negative effects hydropower dams have on the migratory fish is undeniable making the practice unsustainable from an ecosystem point of view. The struggles of upstream migration have been discussed widely but the issue of downstream migration has been overlooked for a long time. The aim of this project was to address the issues salmon might face during their way down and find ways to make their travel safer in Kemijoki.

According to the reviewed literature, the group found that hydropower related deaths of the ypung salmon, smolts, were often caused by the water turbine itself or the high drop when swimming through the spillways. Furthermore, the dams may slow down the travel of the smolts, exposing them to predators and stress. Based on the available information, the group decided to focus on two dams in Kemijoki, Valajaskoski and Petäjäskoski, because in between these two dams the mortality rate was the highest.

Based on the research the group found that the solutions for both targeted dams should consist of three aspects: a bypass technology, a guiding technology, and an optimized turbine design. The group found that the most suitable bypass technology was a hydraulic fish way, which directs the fish over the dam through pipes. For the pipes to attract fish and transport the fish efficiently a flow is generated in the pipe using a pumping system. This technology is easily adjustable and cost efficient, which is why the group considers this experimental solution as the best candidate for Kemijoki.

To lead the smolts to the hydraulic fishway, the group would implement floating barriers and bubble barriers to guide the fish towards the hydraulic fish way. The floating barriers are a fencelike structure floating in the water and a bubble barrier forms a curtain of air bubbles, which the fish avoid due to lack of visibility.

Finally, the group recommends further investigating the injury types caused by the turbines. The research can then help to find with safer designs causing less injuries to the fish. The turbine modifications were not seen as urgent, and thus the group suggests transferring to safer turbines within the regular replacement schedule.

Questions and comments on the project can be directed to the group members:
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