



Removal of small dams and its influence on physical habitat for salmonids in a Norwegian river

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While research and implementation of upstream migration solutions is extensive, and indeed often successful, full scale restoration projects and investigations of their influence on fish biology are rare in Norway. Acid deposition in Norwegian catchments peaked in the 1980's and resulted in both chronically and episodically acidified rivers and Salmonids in River Nidelva, one of the largest catchments in southern Norway, where extinct for decades. During this period hydropower development in the river paid limited attention to aquatic ecology. Weirs were constructed for esthetic purposes in the late 1970's and turned a 3 km stretch into a lake habitat, well suited for lake dwelling fish species, but unsuited for migration, spawning and juvenile habitat for salmonids. Since 2005, continuous liming to mitigate acidification has improved the water quality and a program for reintroduction of Atlantic salmon has been implemented. We used hydraulic modeling to plan the removal of two weirs on a bypass reach of the river. The 50 meters wide concrete weirs were blasted and removed in 2007, and ecological monitoring has been carried out in the river to assess the effect of weir removal. Topographic mapping, hydraulic measurements and modeling, in combination with biological surveys before and after the removal of the weirs, has proved to represent a powerful method for design of physical habitat adjustments and assessing their influence on fish biology. The model results also supported a rapid progress of planning and executing of the works. While telemetry studies before weir removal suggested that adult migration past the weirs was delayed with several weeks the fish can now pass the reach with minor obstacles. Spawning sites were discovered in the old bed substrate and were occupied already the first season after water velocities increased to suitable levels for spawning. Accordingly, the densities of Atlantic salmon juveniles have shown a marked increased after the conclusion of the project. Catches of pike and cyprinids on the reach is reduced, indicating that their habitat is no longer suitable, while salmon anglers have found new favorite spots in the restored pools and runs.