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FISH MIGRATION SYSTEM OVER A WOODEN DISCHARGE SILL LOCATED ON THE BISTRA MĂRULUI RIVER

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Abstract

The multitude of discharge sills, including that in the study on the Bistra Mărului River, destroyed the longitudinal connectivity of the river by blocking the migration of different migratory species. The most important migratory species in the Bistra Mărului River are the Salmonidae and especially the Indigen trout (Salmo trutta fario). All components of the system proposed for fish migration can be detachable and used at another discharge sill, are corrosion-resistant and will not damage the fish. Complying with the design and then implementation of the proposed system will help fish recolonize upstream habitats. This engineering solution helps to implement the Water Framework Directive for the recovery of ecosystems.

Keywords: fish migration, lotic ecosystem, Bistra Mărului River, fish passage, discharge sill.

1 INTRODUCTION

The overflow thresholds have varied shapes, different sizes and are arranged in all the relief areas. These transverse hydrotechnical constructions have different functions (water supply, protection of flooded bridges, etc.) but from an ecological point of view, all these transverse hydrotechnical structures partially or totally destroy the longitudinal connectivity of the watercourses. Two things are essential to the ecological functioning of freshwater ecosystems; longitudinal and lateral connectivity. Lateral connectivity can be stopped by building ditches and trenches (Aadland 1993, 2010; Sedeno-Diaz and Lopez-Lopez, 2009; Sommerwerk et al., 2010; Bănăduc et al., 2016; Lenhardt et al., 2016). This lack of connectivity to critical fish habitats will result in declining fish populations in that area. Stopping fish from migrating upstream is due to transversal hydrotechnical constructions, favoring the fragmentation of habitats. An essential vector of the lotic ecosystems is the longitudinal connectivity of the watercourses (Fischer and Cyffka, 2014; Voicu and Breţcan, 2014) and must take the proper steps to protect this vector and implicitly the lotic ecosystems (Kemp and O'Hanley, 2010 2015; McKay et al., 2016). An important issue for the European Union is the transversale hydrotechnical constructions that lead to the interruption of the longitudinal connectivity of the rivers (Kay and Voicu, 2013). Some of the key factors that should maintain or restore longitudinal connectivity under the Water Framework Directive are river administrators (Voicu and Merten, 2014). In each country, transversal hydro-technical constructions have to be equipped with fish migration systems or the improvement of existing ones. New systems for the migration of fish over dams and overflow thresholds have to be tested and implemented constantly to help recover fish communities in Europe (Voicu and Dominquez, Voicu and Baki, 2017).

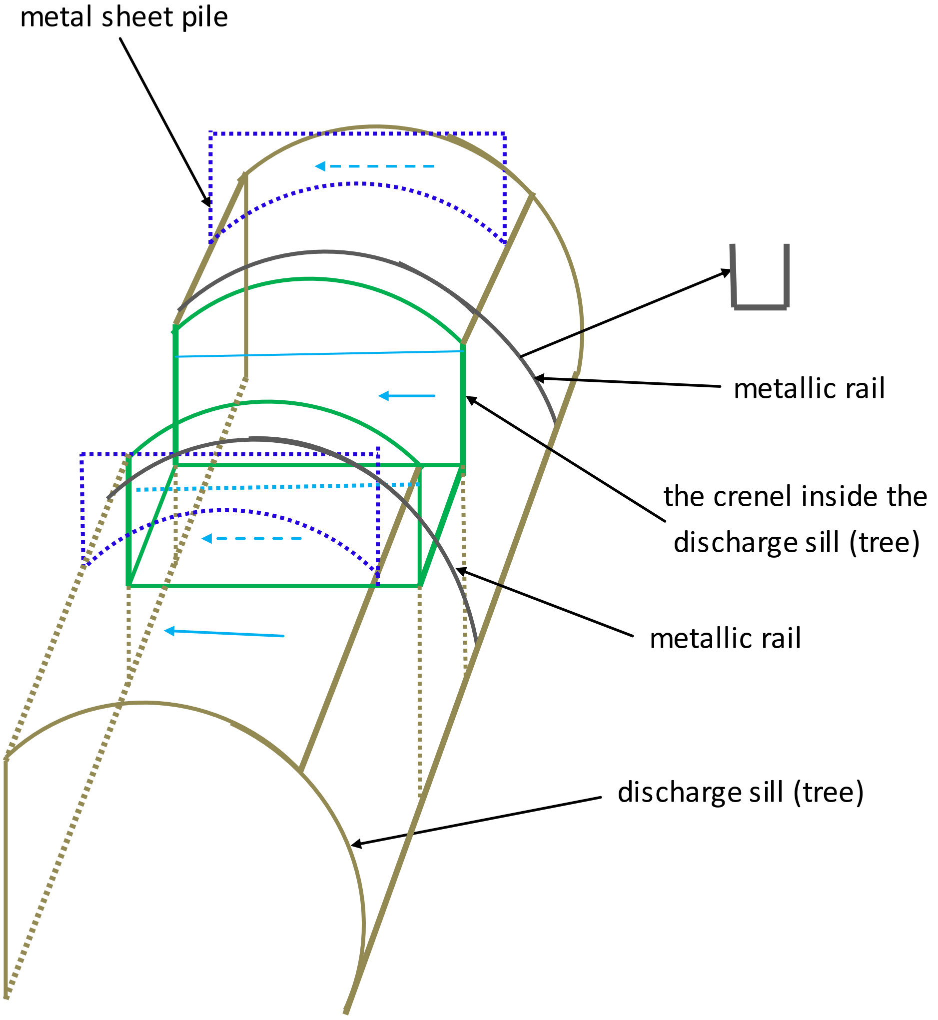
The over 12 discharge sills on the Bistra Mărului River and its tributaries block both migratory and non-migratory species. On the Bistra Mărului River there are several discharge sills made of wood materials (figure. 1a). One of them is made of a tree with a diameter of 1,2m fixed in the banks of the river (figure 1b). The fall of water is slightly more than 1 m, which completely blocks any migratory species of fish on the Bistra Mărului river. The length of the spill threshold is 8 meters. The Bistra Mărului River is located in the Timiş river basin. The length of the Bistra Mărului River is about 34 km, the surface of the river basin is about 291 km² and the multiannual average flow is about 2 m³/s.

Figure 1a. Discharge sill located on the Bistra Mărului River (google earth.com)

Figure 1b The discharge sill made from a tree

2 METHODS, RESULTS AND DISCUSSION

Fixed on the discharge sill are wooden bars that have the role of dissipaters (figure 1b). On the discharge sill(shaft), a crenel of 40cm wide and 60cm length will be made. The upper edges of the crenellate remain semi-circular (figure 2).



On both sides of the discharge sill crenel, two U-shaped metal rails will be attached between the two metal sheet piles (figure 2). A metal frame is formed which supports two bearings. There are two such metal frames. The bearings are fixed to resilient rubber separators and not to slip sideways (the bearings must run linearly) on the U-shaped rails. Before the bearings, a metal frame is inserted into the metallic space (U) (figure 3). Two such metal frames will be fixed to the bearings. On the vertical bars belonging to the metal frame with two bearings are fixed two very hard metal springs (figure 3). After the bearings are fixed inside the U-rails, a metal cornice for each rail (figure. 3) is fastened on both U-bars. These metal studs have a tapered stopper on the top to prevent the bearing from moving vertically more than 1 mm. The same thing happened with the side stops that do not allow the bearing to move horizontally more than 1 mm on both sides. The metal frame made of bearings and metal bars welds a semicircular metal sheet pile. This metal sheet pile perfectly closes the crenel in the tree, that is, the discharge sill, when it is in the initial position. The metal frame as well as the pylon moves on the metal rails. Two metal handles that penetrate through the semicircular metal sheet (figure. 3) are welded to the metallic frame. These handles allow the system to move from the initial position to the final position.

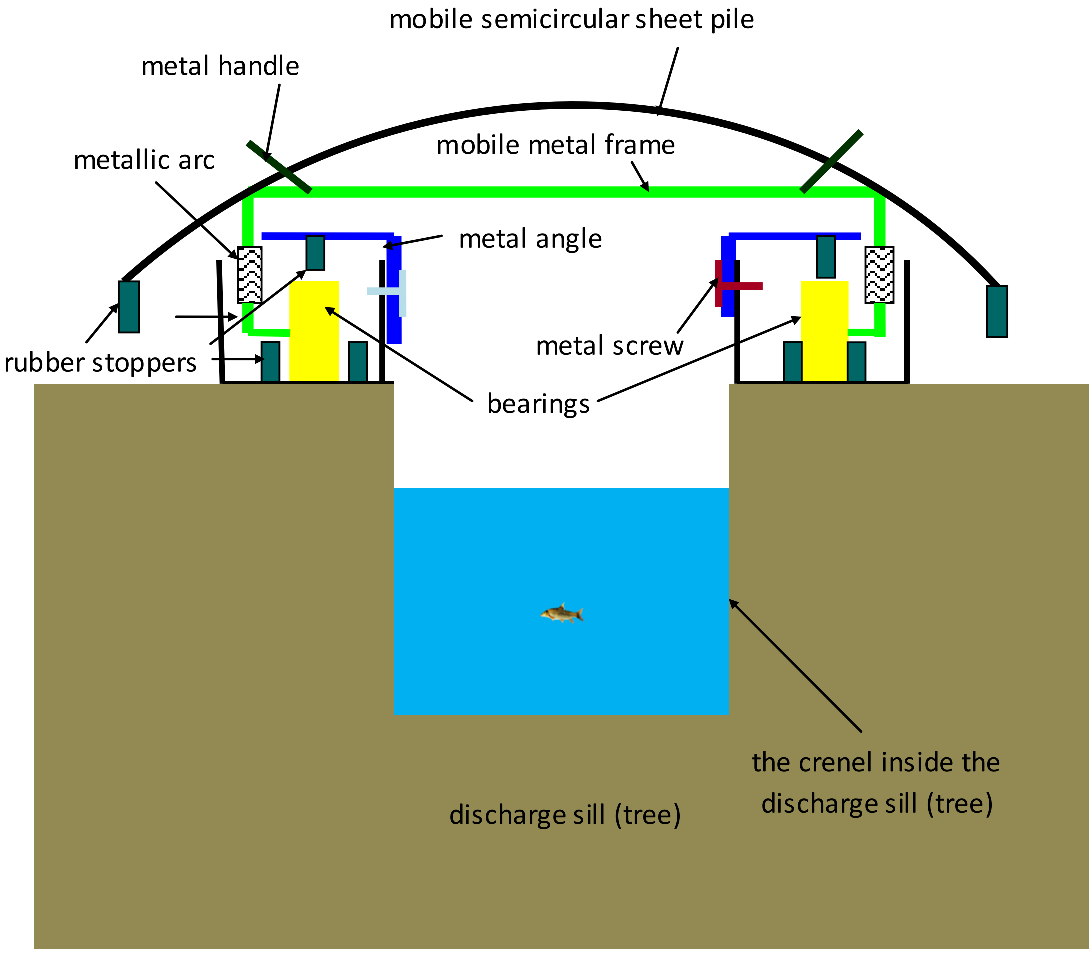


Figure 3 Positioning of the mobile system (metal frame and semicircular sheet pile) - indicative scheme

Two metal bars in the form of a rectangular parallelepiped are welded to the metallic frame. From these metal bars, a rigid plastic palpation channel or non-corrosive metal can be attached to the fish migration. This channel has the size of the crenel in the spill threshold and has the same slope with it (figure 4). On the horizontal surface of the channel for the migration of the fish, there are fixed river rocks as dissipaters (fig.4). The fish migration channel is fixed to the metal bars by means of the metal screws (figure 4). Bars welded by the mobile metal frame and fish migration channel weigh more and keep the system in the final position that allows the fish to migrate upstream - downstream of the spillway. The river's depth of about one meter in the immediate vicinity of the spillway, upstream and downstream of it, allows the stationing and work of specialist personnel in the riverbed so that the system can be assembled or disassembled.

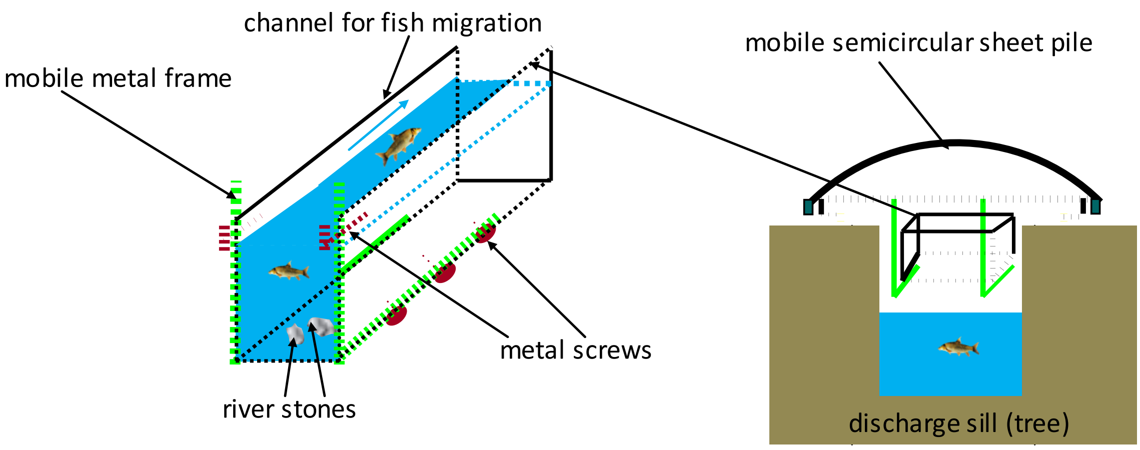


Figure 4 Positioning the Fish Migration Channel - Indicative Diagram or scheme

3 CONCLUSIONS

This system may also be functional for rectangular parallelepiped discharge sills not only for circular ones such as the one presented in the study. The metal bars can fix any channel model for the migration of classical fish (fish ladder, slots etc) and innovative canals. This migration system does not affect the structure or functionality of the spill threshold. At the moment when the migratory system of ichtyofauna is no longer needed, the crenel is closed by means of the mobile semicircular metal sheet pile. All components are corrosion resistant and can be easily replaced. The costs of this system are reasonable and maintenance is minimal.

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