

## Fish migration solution with mobile and folding aluminum plates

Current fish migration systems need to be improved or others need to be built. Many of the classic systems are damaged and so the fish can't climb over the overflow thresholds. Thus, a metal ramp (sheet pile) with a semicircular upstream end (fig.1) is fixed on the discharge sill. The water that flows over the discharge sill will flow into the metal sheet pile. The metal sheet pile will be fixed to the spillway but also to the concrete pillars of the river bed by means of metal dowels.

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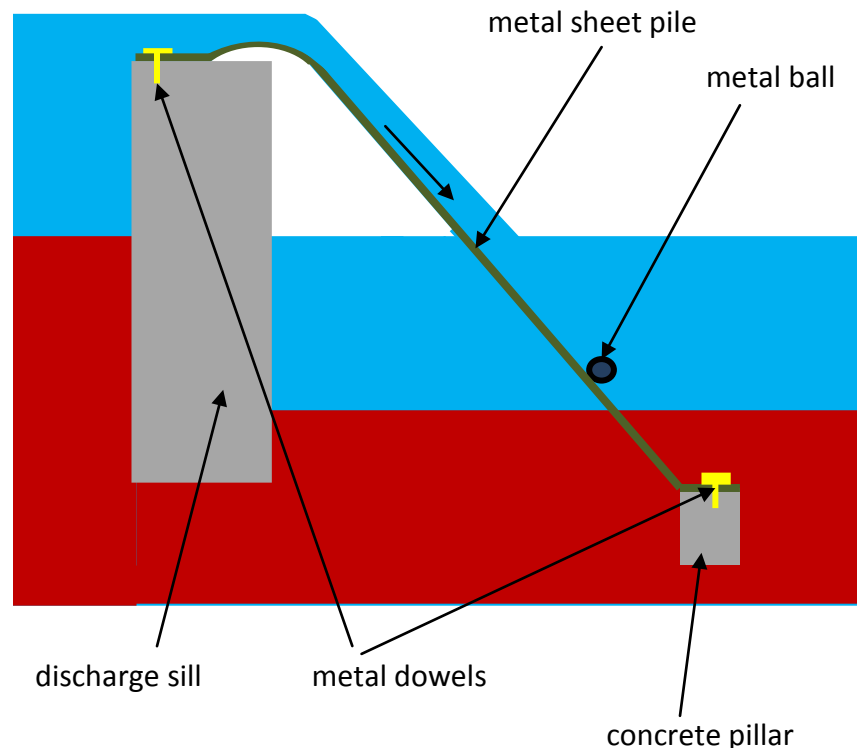


Figure 1 Positioning of the metal sheet pile - indicative diagram

From the metal sheet pile, several metal balls or metal cylinders with stop function will be welded in line (fig.1). The metal sheet will be welded symmetrically and close to the edges, on both sides and on two metallic rails. Inside these rails will be fixed metal bearings that will be kept in a vertical position by means of a metal bar (fig. 2). The metal rails are fastened (welded) to the metal sheet pile a few inches upstream of the metal balls or metal cylinders.

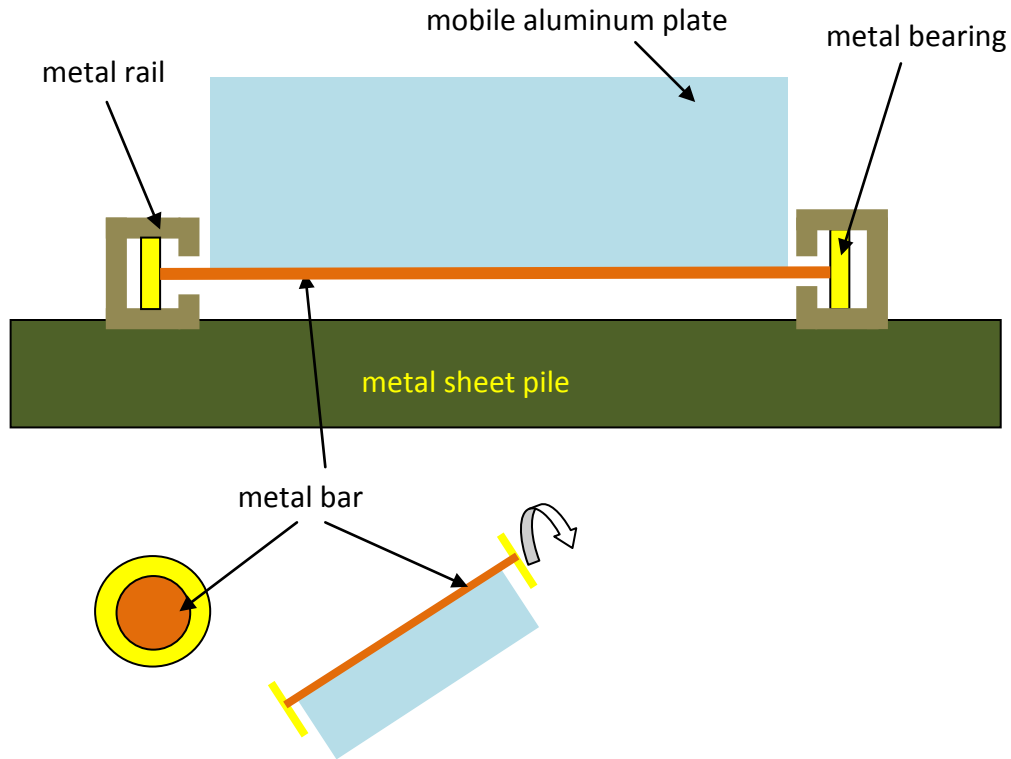


Figure 2 Positioning the metal rails and bearings inside these rails - indicative diagram

An mobile aluminum plate will be attached to the metal bar. (Figure 2). The metal bar to which they are attached and the bearings and the aluminum plate will stop in the metal balls (or metal cylinders) that are slightly higher than the middle of the metal bar (fig.3).

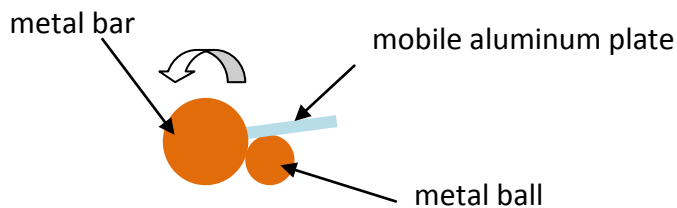


Figure 3 Positioning of the metal bar to the metal ball- indicative diagram

On a concrete pillar located upstream of the spillway an electric winch is fixed (fig. 4). Also on this pole is a metal bar on which a windlass is fixed. The movable aluminum plate has welded on it some bearing and spring stops (fig. 5) which do not allow an angle of more than 110 degrees between the aluminum plate and the metal sheet pile. Thus, when pull on the cable, the aluminum movable plate slides down to the 110 degree angle and catches the fish that it pushes over the discharge sill. The winch stops exactly when the aluminum mobile plate reaches the upstream edge of the discharge sill. Linear bars are

fixed to the half-shells of the metal pallets (fig.5). After reaching the maximum point, the winch releases the cable the next second and the system reaches its initial position.

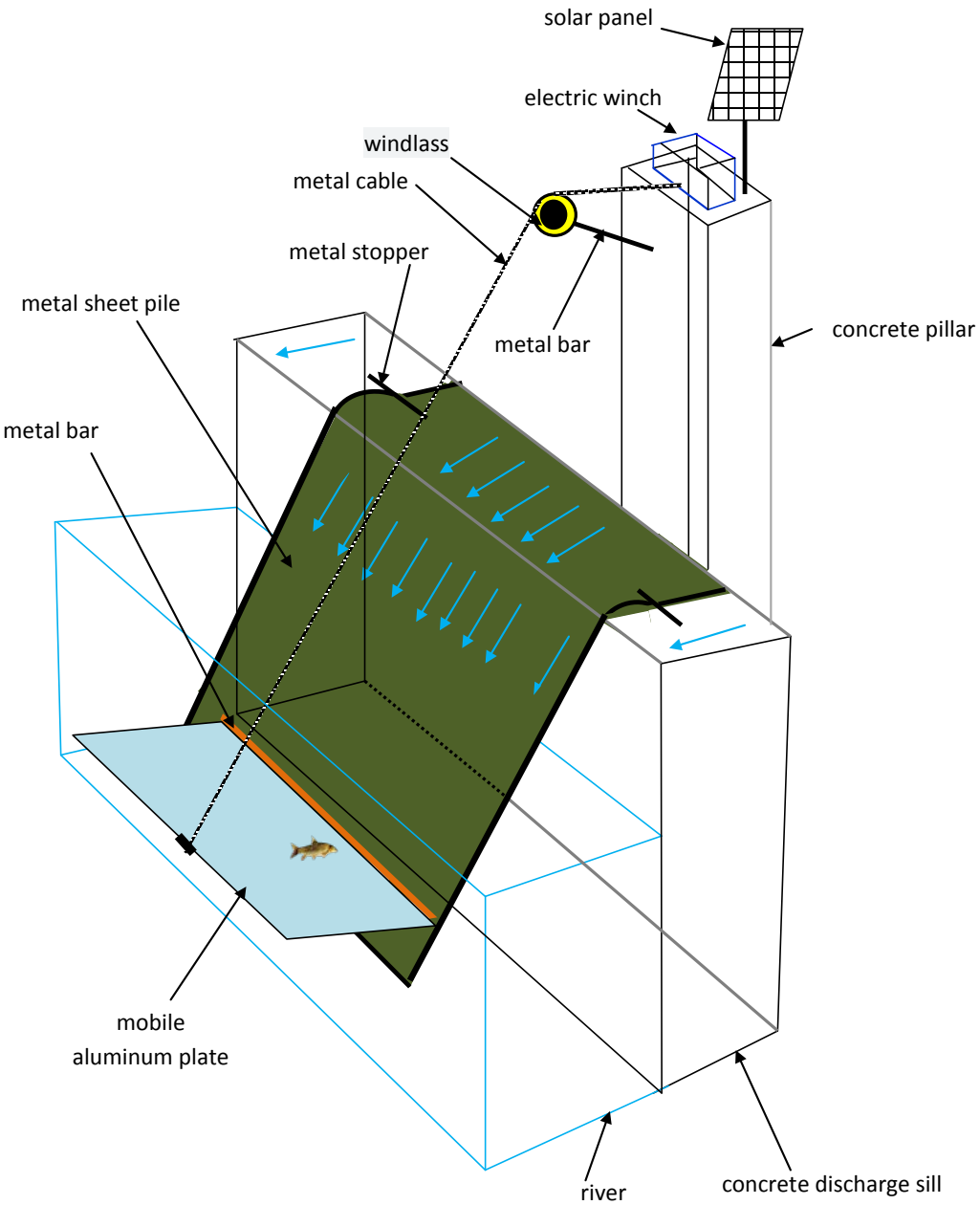


Figure 4 Positioning the mobile aluminum plate inside the river- indicative diagram

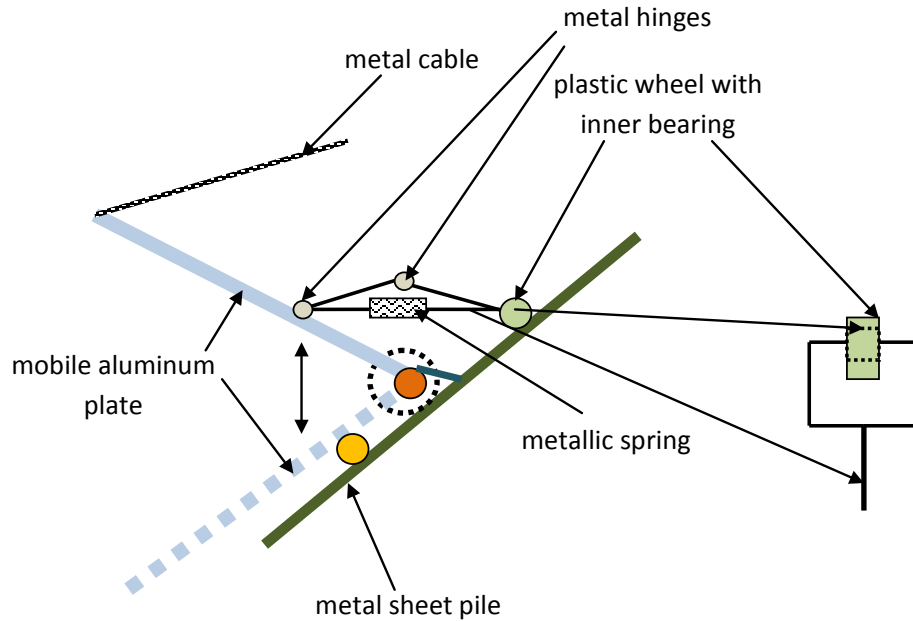


Figure 5 Position of stopper with spring- indicative diagram

This stop has an important role in maintaining the aluminum plate at an angle to the metal palm which is fixed to the overflow threshold of about 110 degrees. The 110 degree angle allows the fish to be kept between the aluminum plate and the metal sheet pile. The retainer is made of high strength metal bars bonded together by two metal hinges and a metal spring. The retainer is also provided to move on the metal plate with a metallic wheel with inner bearing (fig. 5). When the winch cable pulls from the aluminum plate, the stop spring cushions the impact between the plastic wheel and the metal plate.

But all the metallic springs allow the stopper to pass through the semicircle of the metal sheet at its upstream end. The metal bar that supports the aluminum plate is secured with a rubber-resistant surface (fig. 5) that helps push the fish over the spill threshold without getting hurt. On the semicircle at the upstream end of the metal sheet pile there are sensors that disconnect the winch. The aluminum movable plate comes down and stops in metal balls or metal cylinders (located inside the water) welded to the metal sheet pile. The cylinders or metal balls will be completely covered by a durable rubber surface while at the same time damaging them with the metal bar. At the moment of impact, the mobile aluminum plate folds in the water stream in an almost horizontal position. The impact between the metal balls and the metal bar on which the aluminum plate is welded is primarily cushioned by the penetration of the system into the river water.

On both sides of the system about 2 cm of it will be fixed on the spill threshold metallic fences. These metal fences, when folding the aluminum movable plate, stop the fish from escaping laterally. All fish captured in this system reach the overflow safe (fig.6). The winch can be operated with solar panels or other energy sources. When the resistant

rubber surface reaches the maximum of the upstream semicircle of the metal pendulum, the winch suddenly stops due to a sensor located on the metal sheet pile. In the next, after all the fish were pushed upstream of the spillway, the system supported by the winch cable reaches the river. The system starts up with the ichthyofauna sensors present on the metal sheet pile in the river but above the aluminum plate. Sensors can only start the system for one fish or more fish.

Generally, when migrating, more fish are gathered near the spill threshold, so the aluminum plate will push upwards several fish upstream. The system is robust and can lead to a single climb of dozens of fishes. In winter the ichthyofauna sensors can detach, so the system will be inoperable. In case of damage, any system components can be easily replaced. Flooded floats do not damage the aluminum plate because it stays below the water level in a near horizontal position. The length of the aluminum plates should not exceed 5 meters in length and a width of 1.5 m in order for the system to operate at the optimum parameters.

There are discharge sills less than 5 meters long where the aluminum plate will have the entire length of the spill threshold. But there are also spill thresholds of tens of meters even more than a hundred meters where many such systems can be installed which, of course, will work independently of each other. Construction and execution costs are not high. If quality materials are used, it may be long. The system can be used anywhere in the world.

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