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SESSION 07 RIVER RESTORATION TECHNIQUES

RESTORING OF LONGITUDINAL CONNECTIVITY OF CRISUL REPEDE RIVER IN FRONT OF THE DACIA BRIDGE WEIR INTO ORADEA TOWN

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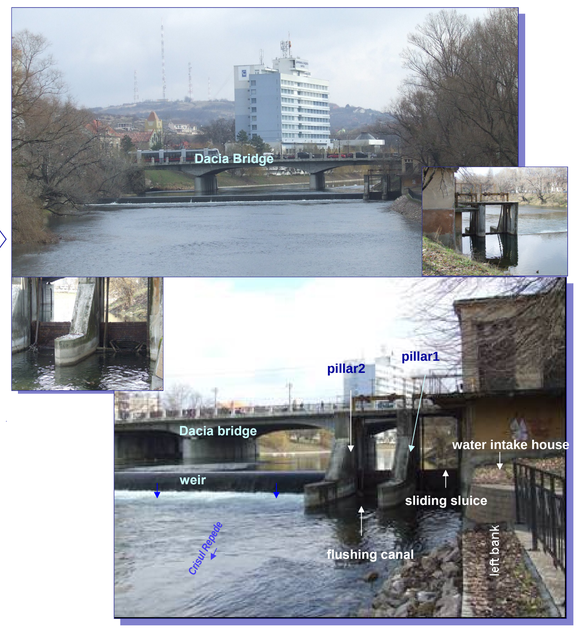
INTODUCTION

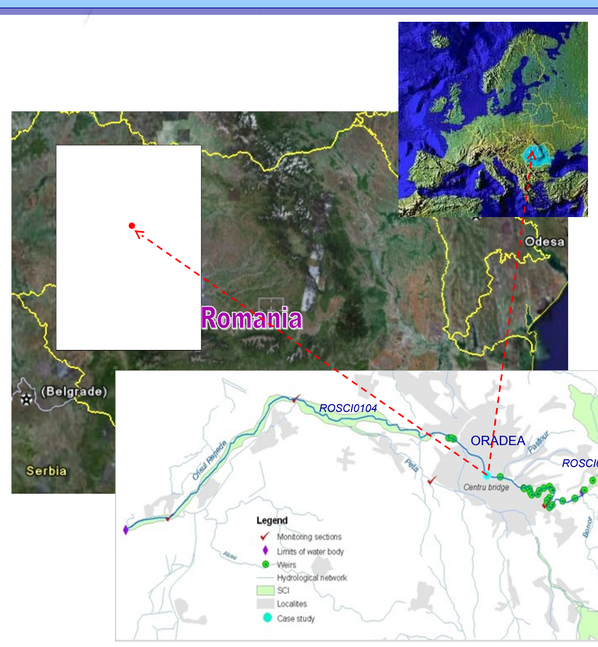
This paper represent a part of a complex study regarding the restoration of longitudinal connectivity of Crisul Repede River accomplished in a framework of a more large Programme of Measures for restoring longitudinal and lateral connectivity of Crisul Repede River, included in the Water Basin Management Plan of Crisuri, catchments area according the WFD, that must be implemented by 2015.

For this purpose, was selected as a case study a weir, located near the Dacia Bridge over the Crisul Repede River, in Oradea Town. To facilitate fish migration upstream Dacia bridge weir on the Crisul Repede River two technical solutions using the gravitational fall of water are proposed. The proposed solutions provide the building of some migration systems placed on both banks of Crisul Repede, meant to facilitate the access of the migratory fish species from the area (common nase (Chondrostoma nasus), barbell (Barbus barbus) and freshwater bream (Abramis brama)), towards the reproduction areas. The proposed migration systems are consisting of several components: rectangular modules, basin for rising the water level, windows for fish access, metal grill, fastening systems and pillars, metal dowel etc.. Taken into account that the selected case study is part of the program of the longitudinal connectivity restoration measures from the Management Plan of Crisuri River Basin, the paper has a high practical value.

Why this case study

- Height of 1.5 m and 1 m drop, that blocked fish migration;
- Water body "*Crisul Repede → Bonor – boundary (RW3.1.44_B7)* – is a heavily modified water body;
- Presence of 2 Sites of Community Interest located upstream and downstream Oradea Town;
- Presence of 3 protected migratory fish species (*Chondrostoma nasus, Barbus barbus, Abramis brama);*
- Selected case study is included in Measures Programme of Crisuri RBMPlan, for longitudinal connectivity restoration, in order to be applied till 2015.





Study area

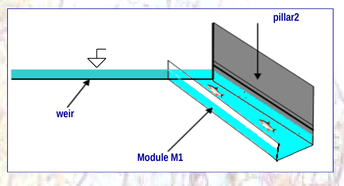
The study area is located in the lower basin of Crisul Repede River, in Oradea City, the north – west part of the Romania. The area is one of transition from hills to the Pannonian plain, characterized by a temperate continental climate with oceanic influences. Along the 2.3 km of study area there are three weirs that interrupt the Crisul Repede River connectivity and blocking fish migration. We proposed solutions for all weirs but in this paper are presented two solution for selected case study.

The Dacia Bridge weir, selected as a case study is placed on "*Crisul Repede → Bonor – boundary* water body", part of Crisul Repede River, in Oradea downtown. This weir aims to stabilize the riverbed near the bridge and to water capture by the means of water intake currently inoperable, located on the left bank of the Crişul Repede River.

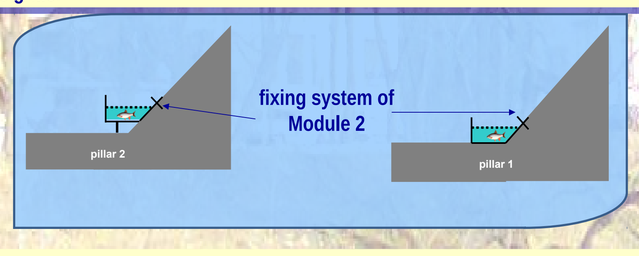
In this area the Crişul Repede River bed is 70 m wide near the weir; its discharge is of 23 m3/s and the water velocity is 4 m/s.

First solution

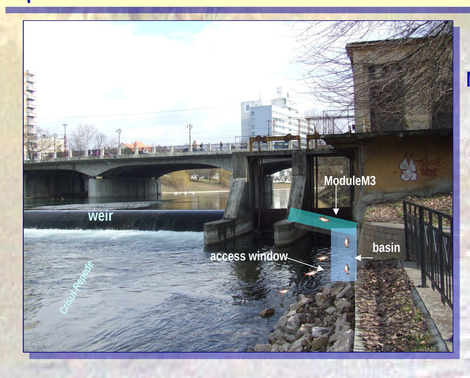
1. The first solution to facilitate fish migration upstream/ downstream of Dacia weir aims to build a rectangular canal consisting of several modules which can be made of concrete or stainless steel. The upstream end of the canal will be attached to the outer side of the pillar 2. The first module length starts from the weir crest and continues up to the second pillar seat.

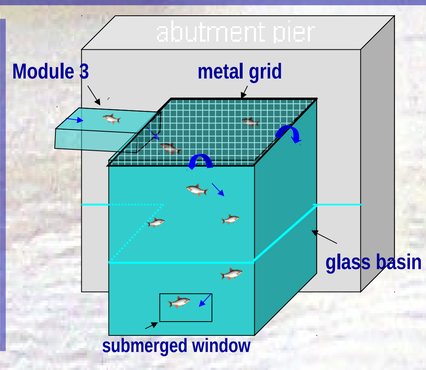


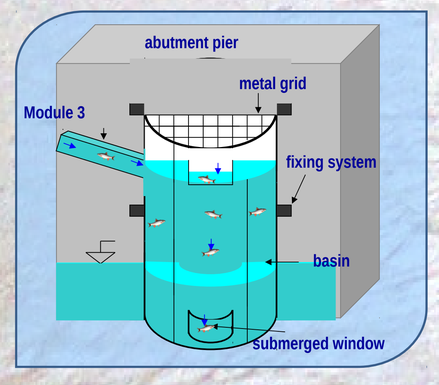
2. The Module 2 of the rectangular canal is set on inclined plane on the front side of two pillars. The migration canal of fish fauna will be fixed on the piles using some support dowels; it is fixed to the pile 2 by the means of a supporting bar. In order to protect the fish, the canal will be covered by a protective grille.



3. The module M3 will be positioned on an inclined plane between the pillar 1 and the left bank abutment pier and will be connect to a glass basin for water level rising. A three-window basin is going to be fixed to the abutment pier: two small windows for the overflow and a large window under the water allowing fish to migrate upstream the weir. A basin without overflow windows can also be provided; the overflow window can be located over the grille protecting the migratory fish. The basin is provided with a metal frame and the rest is made of very resistant transparent glass.







4. The basin for water level rise can have a semi-cylindrical form, with an overflow window in the upper part and a submerged window for fish access, in the down part.

Fish zone of study area

According to the reference fish zoning (Bănărescu, 1964), the study area is part of the ***nase fish zone***, being characteristic for rivers in hill areas, generally characterized by a rocky riverbed, sometimes pebbly and covered by sand, clay or even mud.

CHARACTERISTIC MIGRATORY FISH SPECIES ARE:

nase (*Chondrostoma nasus)* - protected by Bern Convention (Appendix III);

barbel (*Barbus barbus)* - rare species, protected Habitats Directive (Annex V), annex 4A of Low nr.462 and Red List of RBDD;)

bream (*Abramis brama)* - IUCN Red List of Threatened Species.

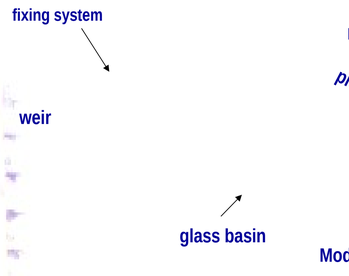
zarte (*Vimba vimba) – not detected;* IUCN Red List of Threatened Species. Version 2013.1;

Other fish species detected in study area:

- chub (*Leuciscus cephalus)*
- spined loach *(Cobitis taenia) – Habitate Ditective;*
- rotengle *(Scardinius erithrophtalmus)*
- Prussian carp *(Carassius auratus gibelio)*
- riffle minnow *(Alburnoides bipunctatus)*
- gudgeon *(Gobio gobio)*
- bitterling *(Rhodeus sericeus amarus)* – *Bern Convention (App. III);* Red List of RBDD
- perch *(Perca fluviatilis) - IUCN Red List*

Total identified fish species: 12
Migratory fish species: 3
Protected fish species: 7
Not detected species: 1

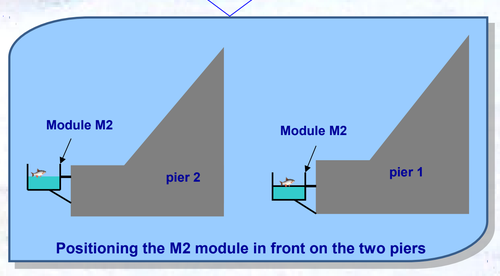
Second solution



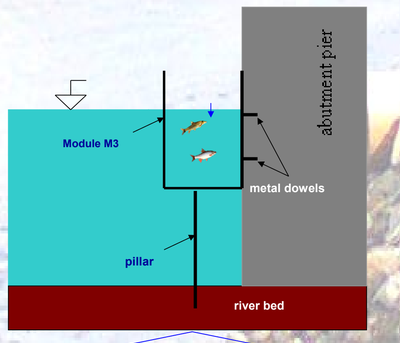
The *second solution* to facilitate the fish fauna migration upstream/downstream of Dacia weir consists in providing a resistant glass basin to raise the water level located right in the corner between the pillar 2 and the weir. The upstream end of this basin will be frontally attached to the weir whilst its side will be connected to the outer side of the pile 2 of the sliding sluice.
The basin is provided with a window for fish access, placed on its downstream side and will be covered by a metal grille.
Right beside the window for fish fauna migration a metal (galvanized steel) rectangular channel will be attached; it will be larger than window for fish access and composed of three modules (M1-M3).

The module M1 of the migration canal will be attached to the outer side of the pier supporting the second sliding sluice. *The module M2* will be attached to *the module M1* and will be extended up to the left bank abutment pier.

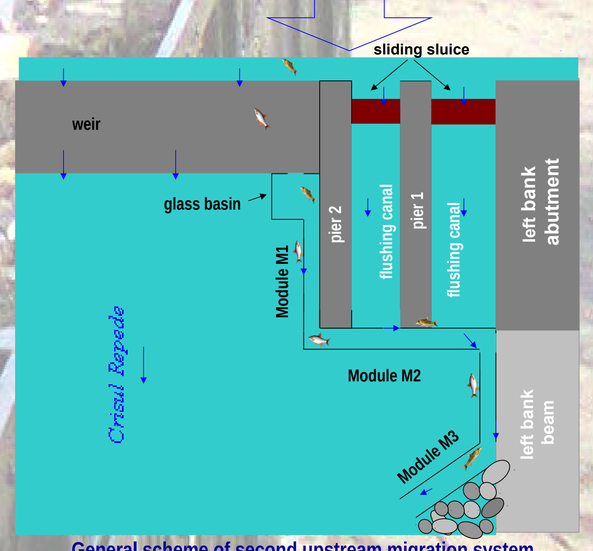
It will be fixed to the front side of the pies and also to the left bank abutment pier by some metal dowels. The upstream ends of the module M2 will be "S-shape" rounded for an easier connection to the glass basin and the left bank abutment pier.



The M3 module will connect the downstream end of the module M2 and the river.
The upstream end of the module is attached to the left bank beam and downstream end will descend gradually into the river bed to avoid stones at the beam basis and to facilitate fish access into the migration canal.



Module M3 will be attached to the left bank beam by means of metal dowels, being supported by two pillars in the riverbed.



General scheme of second upstream migration system

Conclusions

1. Components of the proposed migration system can be made of light materials (sheet metal, resistant glass, carbon fiber, etc.) that offer some advantages (large range of use, quick assembling, less expensive durability and maintenance), and if is necessary it can be easily disassembled.

2. Restoring the longitudinal connectivity of the river will contribute to ensure protection of protected fish species. All fish species present in the study area are part of the Crisul Repede River natural freshwater ecosystem and are an important part of recreational fisheries from the Oradea Town area.

2. Achieving of a migration system will lead to the restoration of the longitudinal connection in front of the Dacia Bridge weir and will reconnect a habitat with a length of about 2.3 km, on the reach of the Crisul Repede River comprised between the Centru Bridge weir and Railway Bridge weir, contributing to the insurance of some optimal conditions for developing migratory fish species from the study area.

4. The proposed fish migration systems will give some *ecological* (ensuring of fish migration and facilitate access to new aquatic habitats; increasing of biodiversity); *economical* (improving of local ecosystems functionality and ecological status of water body, in the study area) and *social benefits* (improving recreational and angling opportunities) for the study area.