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Session D7: Fishway with Two Entrance Locations: Understanding its importance for Iberian Barbel

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Presenter Information
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FISHWAY WITH TWO ENTRANCE LOCATIONS: UNDERSTANDING ITS PERFORMANCE FOR IBERIAN BARBEL

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0. Presentation

Ecohydraulics research group
University of Valladolid
Hydroaholics + ictioaholics

Public funding → Private funding

Ecological flow, environmental impacts, river restoration, fisheries management...

Research projects → Fish passes projects

http://www.gea-ecohidraulica.org/
1. INTRODUCTION
2. Methods
3. Results
4. Conclusions
Hydropower plants with turbine exit channel:

- Medium and large rivers (1st y 2nd order)
- Different elevation at the base of the dam (+0,5/1,5 m) and turbine exit channel

1. Introduction
Problems for fish movement:

- Upstream: flow dispersion / physical barriers
- Downstream: minimum depth over the spillway / turbines

1. Introduction
1. Introduction

Solutions (I):
- 1 fishway: dam or turbine channel?
- 2 fishways: dam and channel
1. Introduction

Problems (I):

- 1 fishway: fish guidance/ maintenance
- 2 fishways: budget / maintenance
1. Introduction

Solutions (II):
- 1 fishway with two entrances and “fish chute & atraction flow” spillway
## 1. Introduction

<table>
<thead>
<tr>
<th>Fishway design</th>
<th>Main stem</th>
<th>A – Branch (Turbine channel)</th>
<th>B – Branch (River )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope</td>
<td>8.8%</td>
<td>8.8%</td>
<td>9.8%</td>
</tr>
<tr>
<td>Number of pools</td>
<td>9</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Height drop between pools</td>
<td>0.25 m</td>
<td>0.25 m</td>
<td>0.25 m</td>
</tr>
<tr>
<td>Pool dimension (L x W)</td>
<td>2.6 x 1.6 m</td>
<td>2.6 x 1.6 m</td>
<td>2.3 x 1.5 m</td>
</tr>
<tr>
<td>Width of the notches</td>
<td>0.40 m</td>
<td>0.25 m</td>
<td>0.20 m</td>
</tr>
<tr>
<td>Bottom orifices</td>
<td>0.25 x 0.25 m</td>
<td>0.15 x 0.15 m</td>
<td>0.15 x 0.15 m</td>
</tr>
<tr>
<td>Flow discharge</td>
<td>0.390 m³/s</td>
<td>0.220 m³/s</td>
<td>0.170 m³/s</td>
</tr>
<tr>
<td>Volumetric Energy Dissipation</td>
<td>180 W/m³</td>
<td>75-125 W/m³</td>
<td>75-125 W/m³</td>
</tr>
</tbody>
</table>
1. Introduction
2. METHODS
3. Results
4. Conclusions
2. Methods

a) **Hydraulic assessment (flow, water velocity and altimetry)**
2. Methods

b) Biological assessment

Pit tags and video-cameras:
* 4 antennas
* 2 video-cameras
* 113 *Luciobarbus bocagei*
1. Introduction
2. Methods
3. RESULTS
4. Conclusions
3. Results

- **Movement pattern:**
  - No differences:
    - Two entrances
    - Length
    - Sex
3. Results

Location time of the fishway by channel entrance:

- Natural channel = 12 days
- Turbine channel = 25.5 days

\( p = 0.062 \) (Wilcoxon)

Median of transit time (1 meter height):

- Natural channel = 30 minutes/m
- Turbine channel = 26 minutes/m

No differences (neither with other fishways in the Duero basin)
3. Results

**Turbine channel**
- 57.1% location
- 25.5 days
- 63.2% success
- 26 min/m transit time

**Natural channel**
- 42.9% location
- 12 days
- 63.6% success
- 30 min/m transit time

**Release area** (0.6 km downstream):
- N = 113
- $L_{fish} = 17.3$ cm

• In summary:
- 62.5% locate the fishway
- 37.5% ¿? no data
1. Introduction
2. Methods
3. Results
4. CONCLUSIONS
4. Conclusions

Two entrances fishways are an interesting alternative to significantly increase the number of fish that exceed the dam on this kind of hydropower plants.

Areas to pay attention during execution of the project: fishway water entrance and outlets, and transition pool between branches.

*Luciobarbus bocagei* can locate and ascend this kind of fishway without difficulty through both entrances.

There were no differences in bological performance between two branches.
Dankjewel!

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The end?