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

Item Type	event;event
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Download date	2025-04-22 22:16:25
Link to Item	<a href="https://hdl.handle.net/20.500.14394/25139">https://hdl.handle.net/20.500.14394/25139</a>



# ◀ FISH PASSAGE 2015 ▶

International conference on river connectivity best practices and innovations



June 22-24, 2015 | Groningen (The Netherlands)



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

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UVa



Escuela Técnica Superior  
de Ingenierías Agrarias Palencia



G E A

Grupo de Ecohidráulica Aplicada



IBERDROLA  
RENOVABLES

# 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



1. INTRODUCTION
2. Methods
3. Results
4. Conclusions

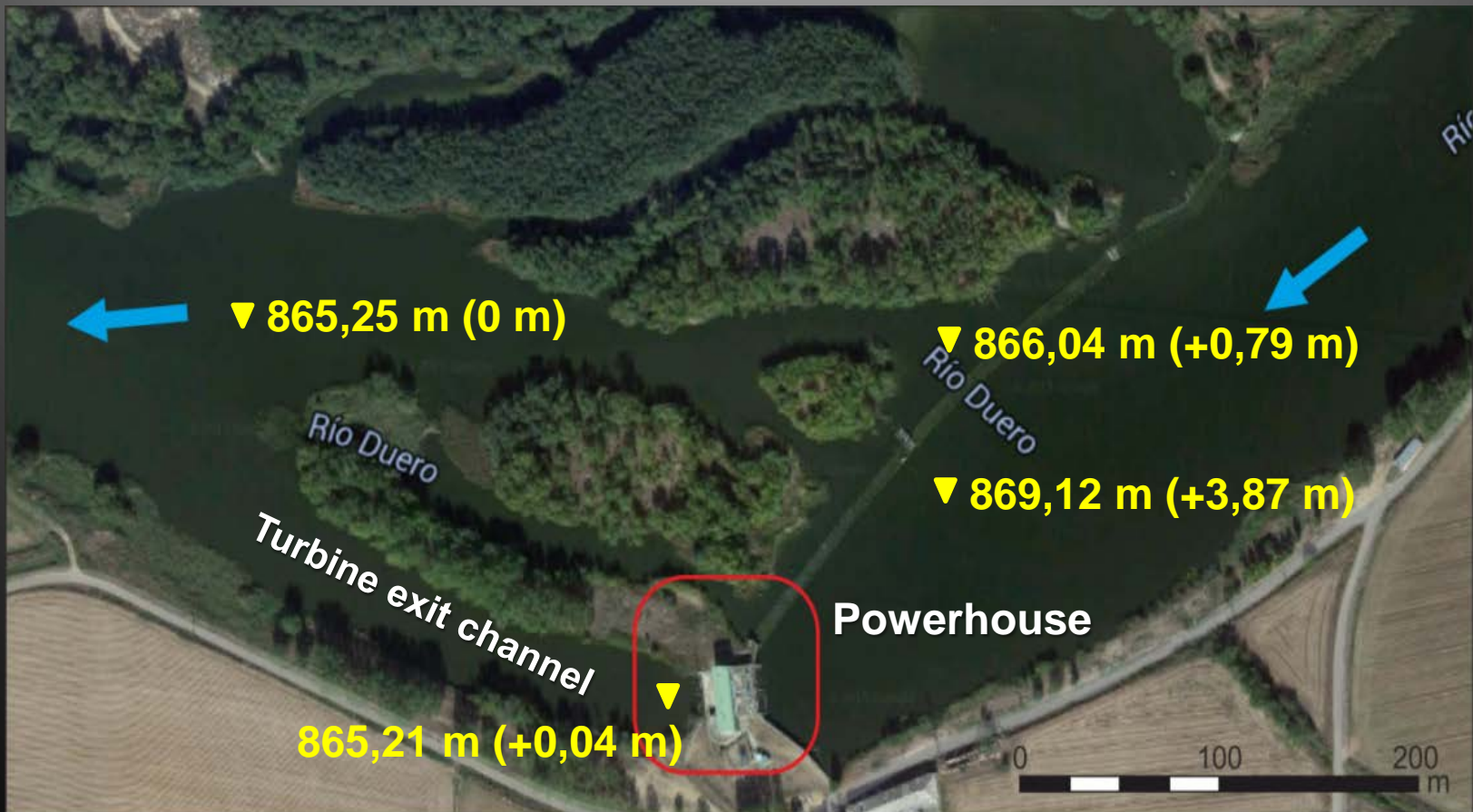




# 1. Introduction

## Hydropower plants with turbine exit channel:

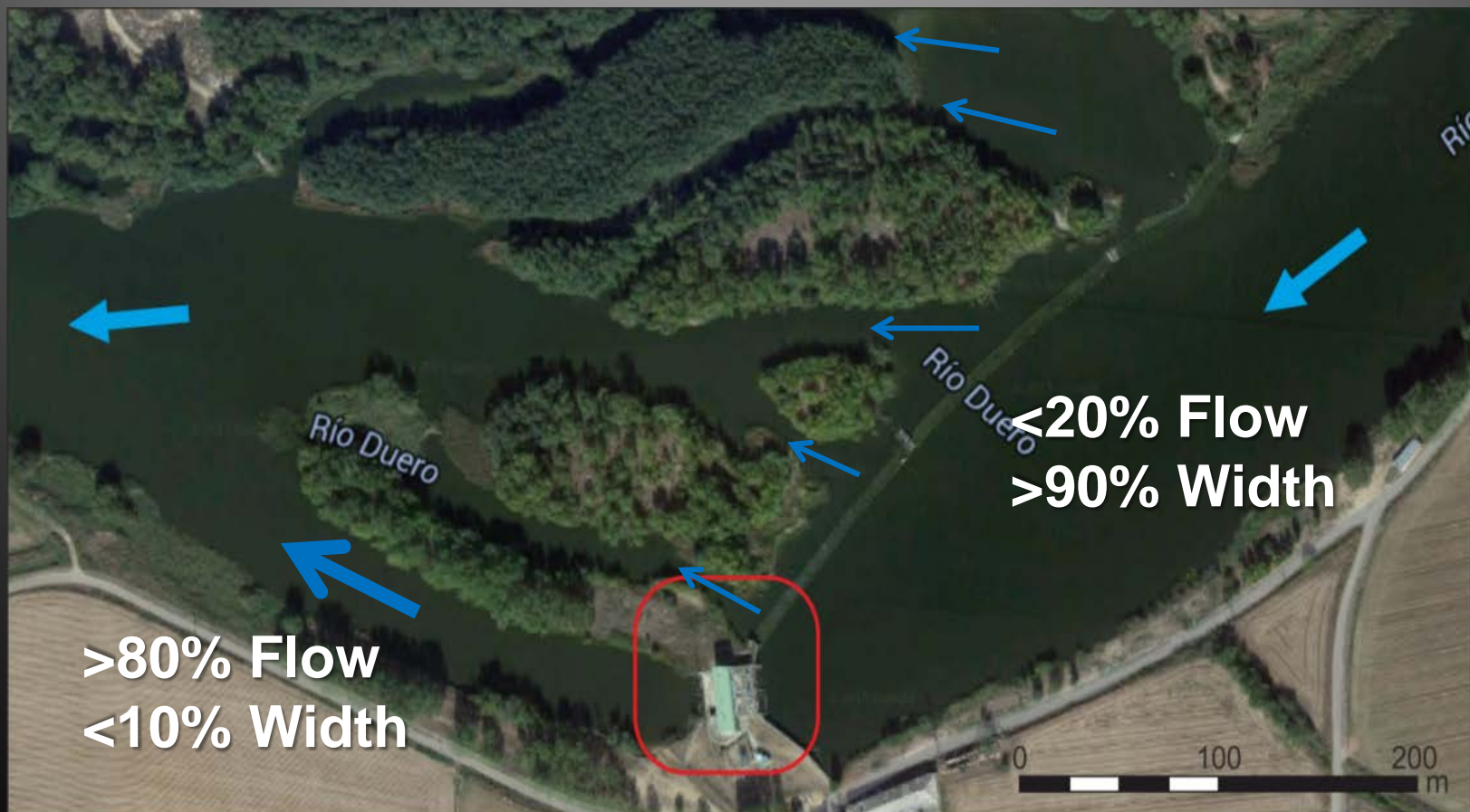
- Medium and large rivers (1<sup>st</sup> y 2<sup>nd</sup> order)
- Different elevation at the base of the dam (+0,5/1,5 m) and turbine exit channel



# 1. Introduction

## Problems for fish movement:

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





# 1. Introduction

## 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

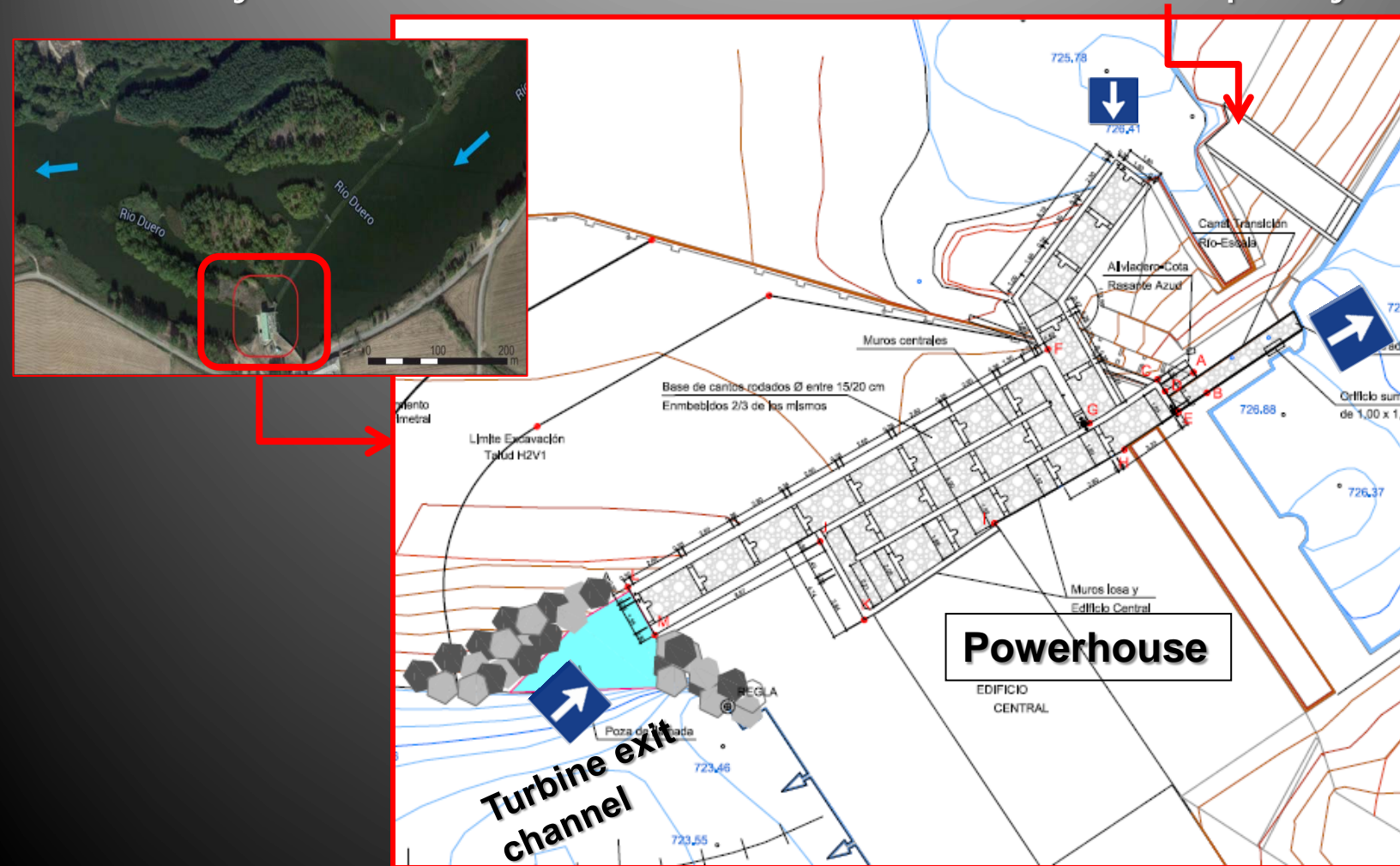




# 1. Introduction

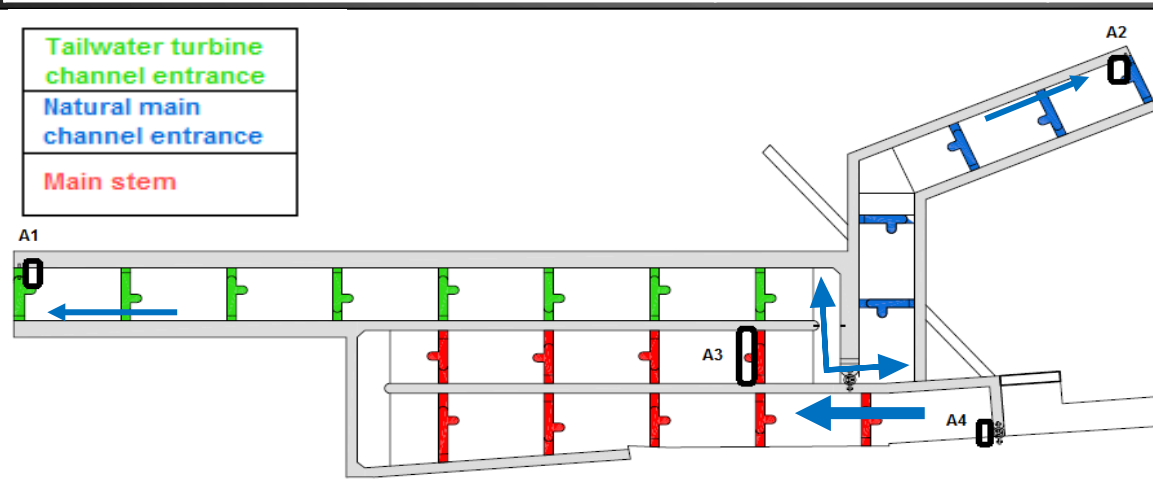
## Solutions (II):

- 1 fishway with two entrances and “fish chute & attraction flow” spillway



# 1. Introduction

Fishway design	Main stem	A – Branch (Turbine channel)	B – Branch (River )
Slope	8.8%	8.8%	9.8%
Number of pools	9	9	5
Height drop between pools	0.25 m	0.25 m	0.25 m
Pool dimension (L x W)	2.6 x 1.6 m	2.6 x 1.6 m	2.3 x 1.5 m
Width of the notches	0.40 m	0.25 m	0.20 m
Bottom orifices	0.25 x 0.25 m	0.15 x 0.15 m	0.15 x 0.15 m
Flow discharge	0.390 m <sup>3</sup> /s	0.220 m <sup>3</sup> /s	0.170 m <sup>3</sup> /s
Volumetric Energy Dissipation	180 W/m <sup>3</sup>	75-125 W/m <sup>3</sup>	75-125 W/m <sup>3</sup>



1. Introduction
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3. Results
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# 2. Methods

## a) Hydraulic assesment (flow, water velocity and altimetry)

Altimetry



Flow

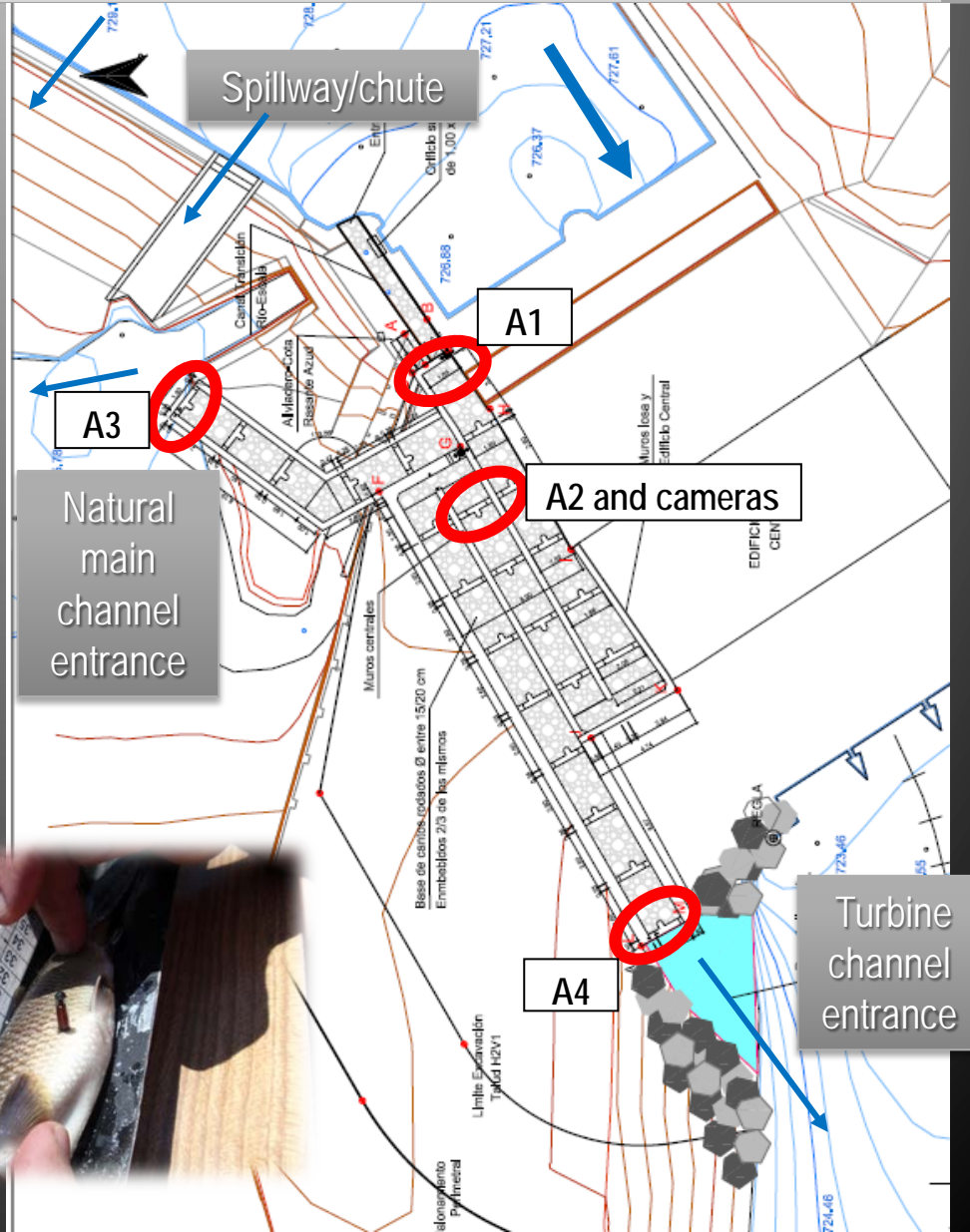


# 2. Methods

## b) Biological assesment

Pit tags and video-cameras:

- \* 4 antennas
- \* 2 video-cameras
- \* 113 *Luciobarbus bocagei*





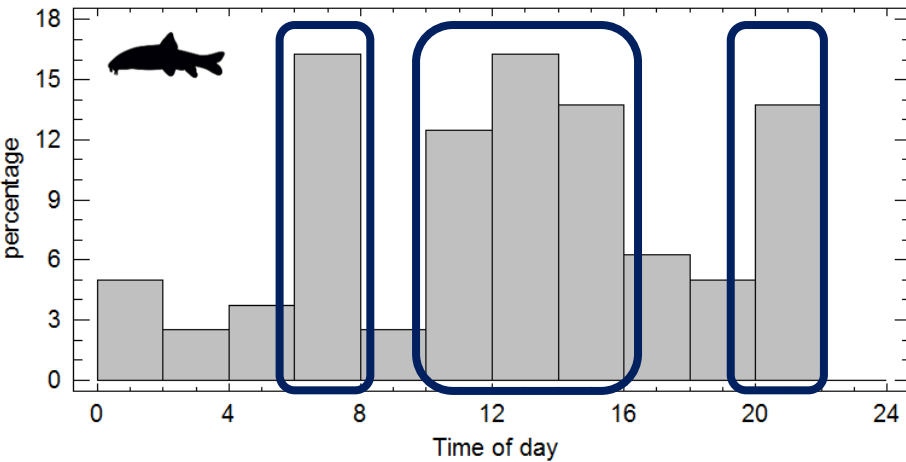
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# 3. Results

Diel movement pattern

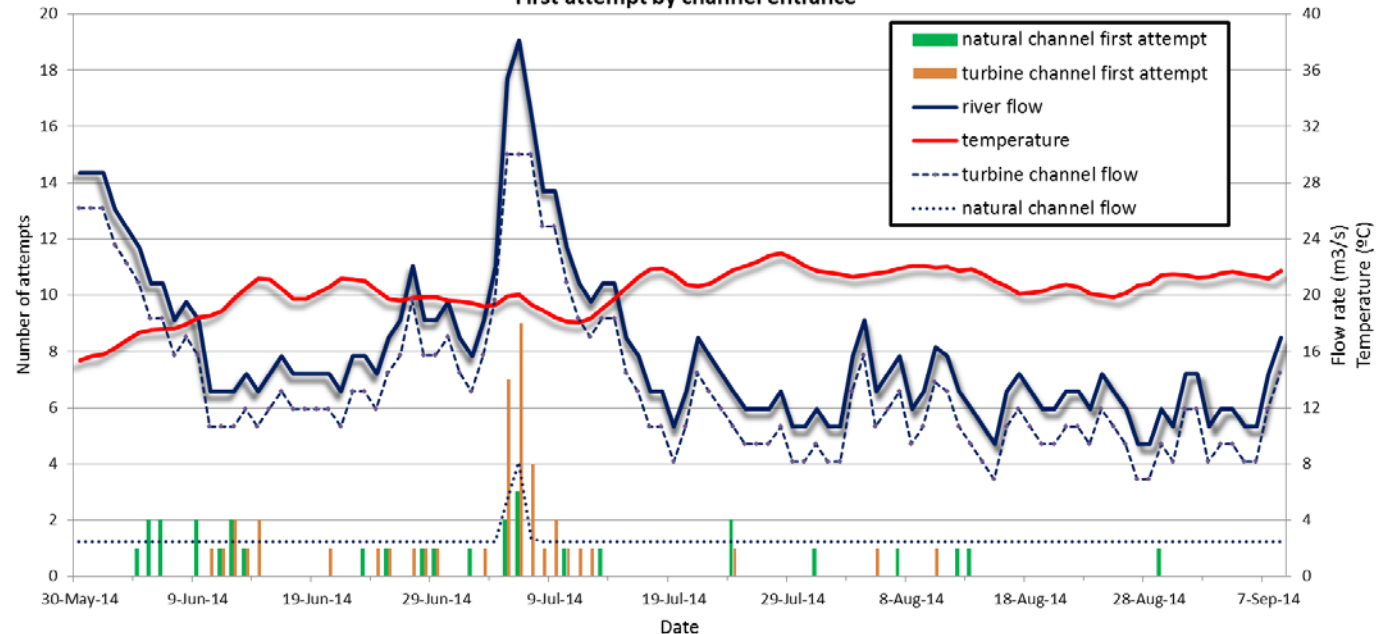


- Movement pattern:

No differences:

- Two entrances
- Length
- Sex

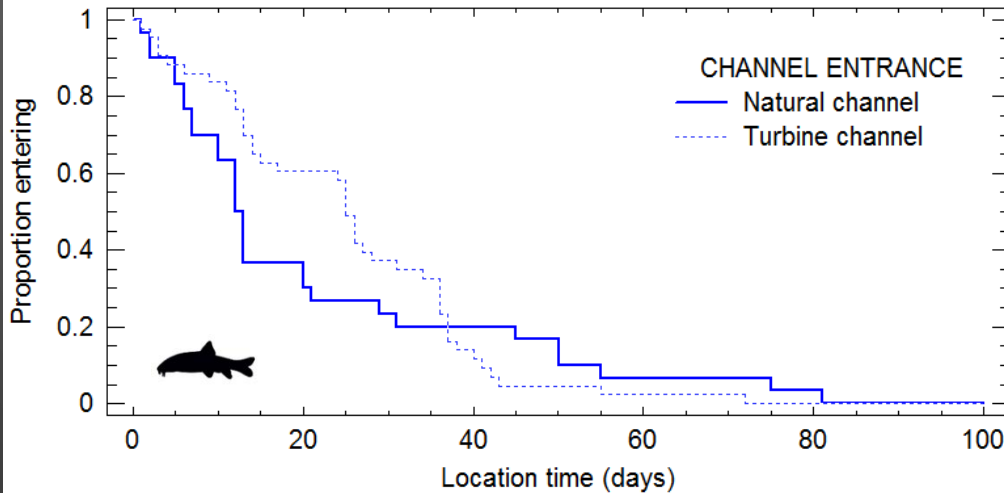
First attempt by channel entrance



# 3. Results

Location time

Location time of the fishway by channel entrance

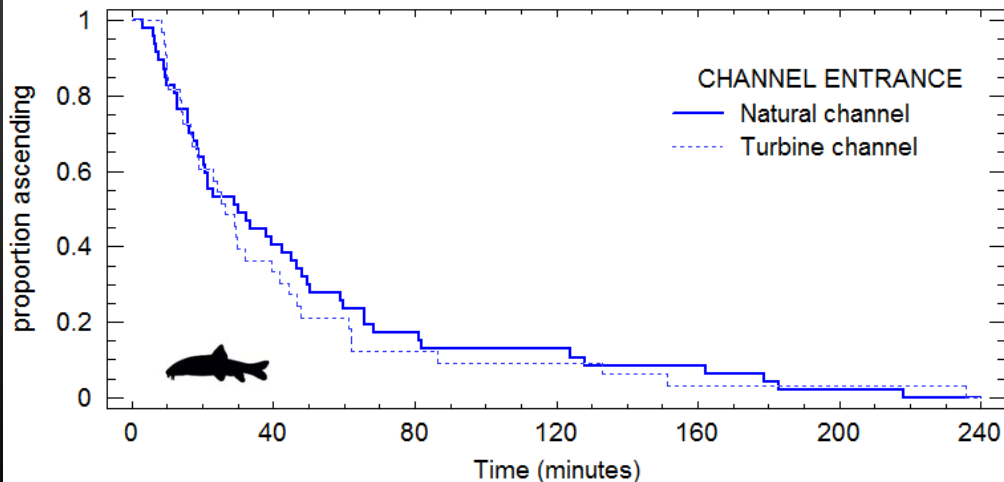


Median of time location:

- Natural channel = 12 days
  - Turbine channel = 25,5 days
- $p = 0,062$  (Wilcoxon)

Transit time

Transit time (per meter height)



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

- In summary:

## Turbine channel

- \*57,1 % location
- \*25,5 days
- \*63,2 % success
- \*26 min/m transit time

\*62,5 % locate the fishway

## Natural channel

- \*42,9 % location
- \*12 days
- \*63,6 % success
- \*30 min/m transit time

\*37,5 % ¿?  
no data

Release area  
(0,6 km downstream):

\*N = 113

\*L<sub>fish</sub> = 17,3 cm





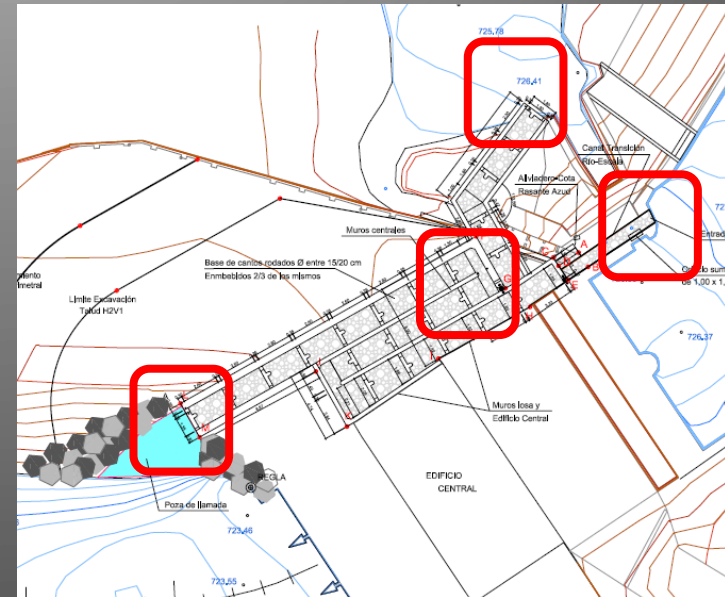
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# 4. Conclusions

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 biological performance between two branches.





The end?

Dankjewel!

Acknowledgements:

Sergio Makrakis &  
Leandro Celestino  
(UNIOESTE, Brasil)

[www.gea-ecohidraulica.org](http://www.gea-ecohidraulica.org)