Jun 23rd, 4:15 PM - 4:30 PM

Session C6: Does Yellow Eel Prefer Old Pool and Weir or New Vertical Slot Fish Pass During Their Upstream Migration?

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DOES THE EUROPEAN YELLOW EEL PREFER OLD POOL AND WEIR OR NEW VERTICAL SLOT FISH PASS DURING THEIR UPSTREAM MIGRATION?

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Fish Passage 2015
Groningen, The Netherlands, June 20th – 24th

With the financial support of the European Fisheries Fund
INTRODUCTION

Yellow eel is one of the life stages of the European eel *Anguilla anguilla*

Some individuals farther from the sea continue to colonize rivers.

But, their upstream colonization process in inland waters is usually disturbed by barriers such as hydropower dams.

Life cycle of the eel (Knigths 2009)

Hydropower dam of Lixhe

Size diversity of the yellow eel stage at Lixhe

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Fish pass may help eels to continue upstream migration

Fish passes can be:
- the old pool-and-weir configuration fish-pass (OFP),
- and the new pool-and-vertical slot configuration fish-pass (NFP).

Preference of eels for the two configurations of fish pass remains unknown.

And yet such knowledge is crucial to improve eel-management and conservation plans.

This study aims to investigate on: the PREFERENCE for eels in term of the fish pass use between the old and new configuration
METHODS

Study area

The study area

The study was conducted in the River Meuse at:

- the Lixhe dam
- close the Dutch border in Belgium,
- 323 km upstream from the North Sea.
METHODS

This map shows the study site with positions of:

- the release site
- the old fish pass
- the new fish pass
- the inlet and outlet of fish passes
- and the detection stations

OFP - The old pool-and-weir configuration fish-pass
NFP - The new vertical slot configuration fish-pass
★ Detection station

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These pictures show trapping and detection in old fish pass (OFP), with positions of:

- the nonselective cone-trap pool,
- the cone and
- the detector

**METHODS**

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These pictures show trapping and detection in new fish pass (NFP), with positions of:

- the net traps and
- the detector
RESULTS

Configuration of fish passes

OFP – Old pool-and-weir fish pass built in 1983

Water in pools 1.3-5.9 m³
Flow 0.3 m³/s (maximum)
Pool sizes 1.4-5.35 × 0.9-1.6 m
Length 121 m
Slope 6.8 %

NFP – New pool-and-vertical slot fish pass built in 1998

Water in pools 17.6-36.4 m³
Flow 1.0 m³/s
Pool sizes 4.7-9.7 × 2.5 m
Length 145 m (inlet to trap) and 305 m (with upstream canal)
Slope 5.4 %

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**METHODS**

**Trapping, tagging and detection**

1. **Trapping**
   - Measured eels were tagged.
   - Trapped eels were counted and measured.

2. **Tagging**
   - RFID tag
   - Tagging and RFID tagging in 2013

3. **Release**
   - Eels tagged were released 0.3 km downstream of Lixhe dam.

4. **Detector**
   - Tagged eels were detected at their second passage in fish passes.

**To test “PREFERENCE” of eels for fish pass use**

1. Detection success of RFID system
2. Environmental conditions of migration
3. Preference of eels for fish pass use

**Measured eels were tagged.**

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RFID Detection success

The old fish pass (OFP)

The new fish pass (NFP)

Chi square test, p<0.0001

Number of eels

<table>
<thead>
<tr>
<th></th>
<th>OFP</th>
<th>NFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catch</td>
<td>435</td>
<td>396</td>
</tr>
<tr>
<td>Tagging</td>
<td>396</td>
<td>196</td>
</tr>
<tr>
<td>Detection</td>
<td>287-836 mm</td>
<td>291-690 mm</td>
</tr>
<tr>
<td>P50</td>
<td>408 mm</td>
<td>397 mm</td>
</tr>
</tbody>
</table>

Eels tagged, n = 396, range = 287-836 mm, P50 = 408 mm
Eels detected in OFP, n=129, range = 291-690 mm, P50 = 397 mm
Eels detected in NFP, n = 67, range = 302-746 mm, P50 = 382 mm

Relation between tagging and detection

RFID detection results revealed:

- Higher detection rate (nearly half of tagged eels)
- Higher detection in old fish pass
- Size range of detected eels overlapping with that of tagged eels
Detection results showed:

- Higher detection in year of eel tagging (2013: 35.1%) before decreasing in the following year (2014: 14.4%)

Our results mean:

- Very good performance of RFID system
- No selectivity in eel sizes for fish passes
- Best detection efficiency to old fish pass
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OFP – Old fish-pass
NFP – New fish-pass

Detection occurred from 11 April to 8 August, with
earlier detection and
longer migration season
in old fish pass (OFP)

Migration seasons 2013-2014

NFP, n = 67 eels
OFP, n = 129 eels

Cumulative frequency, (%)

Number of eels

Julian days

Dates

OFP, n = 67 eels

OFP, n = 129 eels

Migration parameters of detected eels
RESULTS

Migration parameters of detected eels

Comparison of fish passes revealed:
- **Similarity**
- detection at low river discharge <180 m³/s and
- and when waxing and waning phases of moonlight
- **Difference**
- detection at low temperature 14-18°C
- and daylight 8:00-18:00
- in only old fish pass

These parameters show:
- migration starts early in season and occurs also in daylight in old fish pass

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Preference of yellow eels for fish pass

Utilization behaviour revealed annually:

- higher fidelity rate of eels for old fish pass (OFP)
- higher rate of eels changing the fish pass for new fish pass (NFP)

Results of detection, migration parameters and fish pass use clearly support:

- release of eels from right bank does not favor fish pass (NFP) located on same bank
- and configuration of fish pass affects its utilisation by eels,
- with the old fish pass as the preferred migration route of eels.

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These findings provide insight into the fish pass use for migrating yellow eel stage.

Our results clearly show that yellow eels can use the new configuration fish pass, but “the OLD configuration fish pass” was their preferred migration route.

This study may help to promote more intelligent eel conservation plans:

1. further reflection before ending the use of old fish pass,
2. improvement of eel comfort in fish pass and,
3. increase the attractiveness and efficiency of new fish pass.
THANK YOU TO OUR RESEARCH TEAM

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