Jun 22nd, 11:10 AM - 11:25 AM

Session B1: Fish-Friendly Management of First Dams in the Tidal Area of the Gironde Estuary (France, SW)

Vanessa Lauronce
*MIGADO*

William Bouyssonnie
*MIGADO*

C. Rigaud
*Irstea*

Follow this and additional works at: [http://scholarworks.umass.edu/fishpassage_conference](http://scholarworks.umass.edu/fishpassage_conference)

Part of the [Aquaculture and Fisheries Commons](http://scholarworks.umass.edu/aquaculture_and_fisheries_commons), and the [Hydraulic Engineering Commons](http://scholarworks.umass.edu/hydraulic_engineering_commons)


[http://scholarworks.umass.edu/fishpassage_conference/2015/June22/24](http://scholarworks.umass.edu/fishpassage_conference/2015/June22/24)

This Event is brought to you for free and open access by the The Fish Passage Community at UMass Amherst at ScholarWorks@UMass Amherst. It has been accepted for inclusion in International Conference on Engineering and Ecohydrology for Fish Passage by an authorized administrator of ScholarWorks@UMass Amherst. For more information, please contact scholarworks@library.umass.edu.
Fish-friendly management of first dams in the tidal area of the Gironde estuary (France, SW)

Innovations and best practices

V. Lauronce, W. Bouyssonnie

With Irstea technical and scientific collaboration

C. Rigaud, Irstea

And with partnership

FISH PASSAGE 2015
International conference on river connectivity best practices and innovations
June 22-24, 2015 | Groningen (The Netherlands)
Fish-friendly management of first dams in the tidal area of the Gironde estuary, France (SW)

Gironde salt estuary: the largest in European
(75 km long, surface 635 km²)

Many diadromous species still present
(Shads, salmon, lampreys, sturgeons and eels)

All along the two banks, numerous marshes with available growth habitats very important for eels

Only 10% connected with estuary because of tidal barriers

37% may be connected by implementing effective and low cost management measures
Various types of gates

- Tide gates
- Horizontal flag gate
- Tide gates with window present in the gates

All these barriers aim to prevent floods and to limit entrance of salt or brackish water into the up-stream marshes

Objective of the studies

- Facilitate upstream fish migration (multi-species)
- Limit the impacts on the upstream marshes
✓ Why is the upstream fish migration blocked by these tidal weirs?

Illustrations: D. Filloux, 2011

Low tide – doors are open

Beginning of the rising tide – doors begin to close

Rising tide – doors still closing

High tide – doors are closed and the fishes blocked
Glass eels and young estuarian and marine species are mainly present between the reversal current and the high tide (2 - 3 hours).

but, 90% of the flood tide doors are closed 5-10 minutes after the reversal current.
Fish-friendly management of first dams in the tidal area of the Gironde estuary, France (SW)

⇒ Test of different systems to optimize upstream accessibility

Wooden blocks preventing the total closure of the doors

Stiffeners (« raidisseur ») to slow down the closure and allow seasonal adjustments
Fish-friendly management of first dams in the tidal area of the Gironde estuary, France (SW)

Optimized management of the window sometimes present in the door or gate

Telescopic gate allowing to keep a defined upstream water level
Fish-friendly management of first dams in the tidal area of the Gironde estuary, France (SW)

⇒ Important informations to be collected to choice and to calibrate the best system for a given site (a dam / a marsh)

Description of the upstream marshes land-use to propose compatible measures

Topographic data to estimate the maximal acceptable volum of water which can be introduced upstream during a tide

Hydraulic data to carry out simulations (water level at the tide, river flow...)

![Image of marshes](image1.png)

![Image of topographic data](image2.png)
Fish-friendly management of first dams in the tidal area of the Gironde estuary, France (SW)

- **Hydraulic simulations** to adjust systems to respect the different constraints (according to acceptable volume, upstream swamp uses, tidal coefficient, river flow…)

![Diagram showing hydraulic simulations](image)

- **Different proposal and simulations with different systems and tidal coefficients (50, 80 et 100)**

![Diagram showing different tidal coefficients](image)
Fish-friendly management of first dams in the tidal area of the Gironde estuary, France (SW)

✓ Result of hydraulic simulation
✓ Scenari choice according to acceptable volume

For example: Laffite marsh – acceptable volume = 5 000 m$^3$ in summer and 20 000 m$^3$ in winter

<table>
<thead>
<tr>
<th>Managements</th>
<th>Max water level in the swamp</th>
<th>Max flow from downstream</th>
<th>Entrance volume in the swamp from downstream</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stiffeners open on 5 cm</td>
<td>1.95 m</td>
<td>0.50 m$^3$/s</td>
<td>5 000 m$^3$</td>
</tr>
<tr>
<td>Stiffeners open on 10 cm</td>
<td>2.10 m</td>
<td>0.90 m$^3$/s</td>
<td>9 500 m$^3$</td>
</tr>
<tr>
<td>Stiffeners open on 20 cm</td>
<td>2.30 m</td>
<td>1.70 m$^3$/s</td>
<td>16 700 m$^3$</td>
</tr>
<tr>
<td>25 cm large indentation at 2.30 m from the ground</td>
<td>1.75 m</td>
<td>0.26 m$^3$/s</td>
<td>1 600 m$^3$</td>
</tr>
<tr>
<td>50 cm large indentation at 2.30 m from the ground</td>
<td>1.85 m</td>
<td>0.55 m$^3$/s</td>
<td>3 200 m$^3$</td>
</tr>
<tr>
<td>100 cm large indentation at 2.30 m from the ground</td>
<td>2.00 m</td>
<td>1.10 m$^3$/s</td>
<td>6 400 m$^3$</td>
</tr>
<tr>
<td>200 cm large indentation at 2.30 m from the ground</td>
<td>2.20 m</td>
<td>2.20 m$^3$/s</td>
<td>12 800 m$^3$</td>
</tr>
</tbody>
</table>

Proposal of a double management summer / winter with different openings according to season

Use of stiffeners, so entrance volume water lowers because valves close it slowly during the rising tide
Fish-friendly management of first dams in the tidal area of the Gironde estuary, France (SW)

- Monitoring to check measures efficiency
  - No floods in the upstream marshes

- Upstream salinity and suspended matter monitoring
  - No impact of salinity and incoming suspended matter

- Fish monitoring downstream the obstacle (hand-held dip nets) to check blockage or predation
  - No apparent blockage
Fish-friendly management of first dams in the tidal area of the Gironde estuary, France (SW)

- Monitoring to check measures efficiency
  - Upstream fish monitoring (during commercial fishery with scientific traps)
    - To check species taking advantage of the management measures,
    - To understand the timing of presence and passage of the different species (*during the tidal flow, day/night, all along the year,...*),
    - To optimise management measures giving first results
Fish-friendly management of first dams in the tidal area of the Gironde estuary, France (SW)

- Monitoring to check measures efficiency

- Upstream fish monitoring (during commercial fishery with scientific traps)

  - Experimental fisheries in the 5 experimental sites since 6 years (31 experimentations)

  - Sessions at different tidal coefficients (50 to 110) during all the rising tide

  - Net visited every 20 min. to evaluate the migration rhythm
Fish-friendly management of first dams in the tidal area of the Gironde estuary, France (SW)

✔ Monitoring to check measures efficiency

☐ Upstream fish monitoring (during commercial fishery with scientific traps)

More than 15 different observed species

A mean of 75 juveniles observed by minute of water admission
Fish-friendly management of first dams in the tidal area of the Gironde estuary, France (SW)

- Monitoring to check measures efficiency
  - Glass eels enter during the first part of the tidal flow
  - One hour before high tide, 80% of glass eels have already passed through the obstacle (possibility to close the dam before the high tide to prevent incoming of salt water or to reduce significantly the admitted water volume)

```
High tide
```

![Graph showing glass eel migration through dams at different locations along the estuary, with peaks indicating high tide and relative abundance of eels.](image-url)
Monitoring to check measures efficiency

- Suspended matter and glass eels display a similar rhythm
Monitoring to check measures efficiency

- No correlation between glass eel abundance and tidal coefficient

![Graph showing fish abundance vs tidal coefficient for different locations](image-url)
Electrofishing surveys are performed to monitor the trend of glass eel densities in the upstream marshes.

Significant increase of glass eel densities after implementation of the management measures.
Fish-friendly management of first dams in the tidal area of the Gironde estuary, France (SW)

The first benefits and inconvenients of these management system

<table>
<thead>
<tr>
<th>Management system</th>
<th>Benefit</th>
<th>Inconvenient</th>
<th>Approximate cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wooden blocks</td>
<td>- Cost-effective</td>
<td>- Need to have the <strong>same management all the year.</strong></td>
<td>60€ /blocks, and 6 blocks by gate</td>
</tr>
<tr>
<td></td>
<td>- <strong>System totally autonomous</strong></td>
<td>- Poor salinity or swamp accepting salinity</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Install at less 6 blocks to not deform the doors</td>
<td></td>
</tr>
<tr>
<td>Stiffeners</td>
<td>- Allow different management according seasonal needs</td>
<td>- More expensive to install</td>
<td>1 500€ / stiffener (2 stiffeners for horizontal flag gate, and 4 with a tidal doors)</td>
</tr>
<tr>
<td></td>
<td>- Water volume admission lower</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Autonomous system, no apparent from exterior</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimized management of a window present in the tidal door</td>
<td>- Allow different management according to seasonal needs or coefficient</td>
<td>- <strong>Poaching more easily</strong> with windows in the top of the doors,</td>
<td>3 500€ / window</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- <strong>Visible from the exterior</strong> (water admission can afraid people)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- <strong>Important supervision to prevent manipulation from people</strong></td>
<td></td>
</tr>
<tr>
<td>Telescopic gate</td>
<td>- Management can be different according to season</td>
<td>- <strong>Important supervision to prevent manipulation from people</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Possibility <strong>to conserve an important water level upstream and to manage it according to needs.</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Conclusions

- Those systems are cost-effective and compatible with upstream land-use for a high number of tidal weirs and areas

- Benefit to many species

- Such systems may be operating during all the migration season and all tidal coefficients (no correlation with the tidal coefficient or distance to the sea). Possibility of seasonal adjustments for some of them

- Other systems are probably possible and should be tested to comply with managers specific needs
Fish-friendly management of first dams in the tidal area of the Gironde estuary, France (SW)

Thank you for your attention

Financial and technical partnerships
Fish-friendly management of first dams in the tidal area of the Gironde estuary, France (SW)

Fish passage 2015 - Groningen