Session E5: The Iron Gate Dams in the Danube River and Their Importance for Endangered Sturgeons

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The Iron Gate dams in the Danube River and their importance for endangered sturgeons

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Aim & Structure of Session

- Provide state-of-the-art knowledge on sturgeon behavior with regard to fish passes for upstream and downstream migration
- Provide ideas and proposals for the needed Feasibility Study to reopen the Iron Gate dams
- E5: Introduction 2 talks – 4 expert talks
  E6: 1 talk – Round Table / Panel discussion
Status of Danube Sturgeons (2010 IUCN Red List)

- Beluga or Great sturgeon
  *Huso huso* (*Tl* max 9 m)
  Status: *A – Ex/CR*

- Danube or Russian sturgeon
  *Acipenser gueldenstaedti* (*Tl* max 4 m)
  Status: *A+P – Ex/CR*

- Fringebarbel or Ship sturgeon
  *Acipenser nudoventris* (*Tl* max 2 m)
  Status: *P – Ex/CR-Ex? †*

- Sterlet
  *Acipenser ruthenus* (*Tl* max 1.5 m)
  Status: *P – Vu/Vu-declining in MD*

- Common or Atlantic sturgeon
  *Acipenser sturio* (*Tl* max 6 m)
  Status: *A – 0/Ex †*

- Stellate or Starred sturgeon
  *Acipenser stellatus* (*Tl* max 1.9 m)
  Status: *A – Ex/CR*

Population trend IUCN 2014
# The Endangered Sturgeon Problem

Not a single cause-effect relationship

<table>
<thead>
<tr>
<th>Common ecological needs/biological traits</th>
<th>Threats by human impacts/pressures</th>
</tr>
</thead>
<tbody>
<tr>
<td>long life cycle, late puberty, spawners complex age structure</td>
<td>over-fishing, by-catch, poaching, illegal caviar trade, diminished populations (<em>poor legislation</em>)</td>
</tr>
<tr>
<td>reproduction in fresh water, migration triggered by high flow</td>
<td>migration disrupted by dams/weirs, no reproduction (<em>hydropower, navigation</em>)</td>
</tr>
<tr>
<td>spawning sites, homing fidelity success unpredictable</td>
<td>habitat destruction (<em>flood control, navigation, new infrastructure</em>)</td>
</tr>
<tr>
<td>spawning: site morphology, flow regime and water quality</td>
<td>habitat destruction (<em>flood control, navigation, pollution – new emerging pollutants</em>)</td>
</tr>
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Aim: to close the natural Sturgeon life-cycle
→ needs joint and simultaneous actions in the Upper, Middle and Lower Danube
Case example, Lower Danube: Melioration of Danube Navigation

DANUBE I: Calarasi – Braila (rkm 375–175)
Sill in Bala Branch may disrupt sturgeon migration
IN EXECUTION PHASE – Alternatives planned

DANUBE II: RO-BG stretch (rkm 845 – 375)
Planned technical constructions may impact sturgeon habitats
IN DESIGN PHASE
Recent Research: sturgeon migration – tagging

Bala Branch:
Migration route of beluga no. 2S18
From: Alin M. Bădiliță, György Deák, Carmen G. Nicolae, Ștefan Diaconescu, AACL BIOFLUX 2013.

Iron Gate II, downstream:
Spawning migration, sturgeon abundance & behavior downstream of HP-currents
Radu Suciu
State-of-the-art (swimming performance)
Fish/Sturgeons cannot overcome flow velocities >1.5-1.7 m/s

<table>
<thead>
<tr>
<th>Critical flow velocity (m/s)</th>
<th>Burst flow velocity (m/s)</th>
<th>Species</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5-0.7</td>
<td>0.8-2.5</td>
<td>Sturgeons (rapid and slow flow in fish pass)</td>
<td>Webber et al. (2007)</td>
</tr>
<tr>
<td>ca. 1.5</td>
<td>&lt;2.5</td>
<td>Sturgeons</td>
<td>Wiesner &amp; Jungwirth (2007)</td>
</tr>
<tr>
<td>0.8-1.5</td>
<td>---</td>
<td>Sturgeons</td>
<td>Reinartz (2002)</td>
</tr>
<tr>
<td>1.5-1.7</td>
<td>---</td>
<td>All fish (finding entrance of fish passes)</td>
<td>Own experience based on literature</td>
</tr>
</tbody>
</table>

**Bottom sill:** Measured flow velocities: 0.1 – 1.0 m/s (INCDPM)
**Bottom sill area:** Modelled reference near bottom 0.7 – 0.9 m/s
**Model BOKU Vienna:** sill III 1.3 – 2.2 m/s; full sill (abandoned) 2.4 – 3.5 m/s

Reference: IAD-Report 2013
Hydropower: Iron Gate dams I and II

Iron Gate gorge (Reservoir)

Iron Gate dam I (1972, rkm 943)

Iron Gate dams II (1984, rkm 842) & ship locks
Hydropower: Iron Gate dams I and II

- Reopening will provide >800 rkm with potential spawning habitats
- Extremely complex situation: will need up to 8 fish pass facilities
- Believers & non-believers: science must provide a sound basis (Feasibility Study)
Structure of Session

- Jürg Bloesch – Introduction I: Overview Danube sturgeons
- Wilco de Bruijne – Introduction II: Iron Gate dams
- Dmitrii S. Pavlov et al. – Behavior of sturgeons
- Mike Parsley – Case study Columbia River
- Boyd Kynard – Sturgeon upstream passage
- Steve Amaral – Sturgeon downstream passage
- Radu Suciu et al. – Sturgeon monitoring Danube
- Panel / Round Table Discussion
Panel: IG Problems / FS Tasks

- FP design (alternatives) for sturgeons?
- FP dimensions for sturgeons?
- FP entrance: ramp, attractive current
- “Fish friendly” turbines
- FP success control & subsequent upgrade

- Behavior of sturgeons downstream and upstream of the dams? (Ethohydraulics; different species)
- Flow velocities sturgeons can overcome?
- 2D and 3D hydraulic/hydrological modelling vs. flow measurements
- Monitoring of sturgeon migration (Telemetry)