Wetland restoration projects in the Danube Delta Biosphere Reserve/Romania

2013
Danube River and Danube Basin

817,000 sq.km catchment basin – 8% of Europe surface
Part of the Man and Biosphere Programme of UNESCO since 1990

Included in Ramsar Convention List since 1990

Included in World Heritage List since 1990
HUMAN INDUCED CHANGES IN DANUBE DELTA

Nitrogen: 300,000-400,000 t/year
Phosphorous: 45,000-60,000 t/year
Oil: 45,000-50,000 t/year

HUMAN INDUCED CHANGES IN THE LOWER DANUBE RIVER

BY

HABITAT REDUCTIONS

DAMMING UPSTREAM FLOODPLAIN AND 22% OF THE DELTA

AND

BUILDING BARRAGES AT KM 942 AND KM 863 FROM RIVER MOUTHS

BY

HABITAT ALTERATIONS

POLLUTION

AND

DREDGING CHANNELS

LEGEND
- Damming (22%)
- Pollution
- New channels

(after Staras, 2000)
## Pêcheries de l'État
Production de la pêche en eau douce

<table>
<thead>
<tr>
<th>Espèces</th>
<th>1923</th>
<th>1924</th>
<th>1925</th>
<th>1926</th>
<th>1927</th>
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<tbody>
<tr>
<td>Morue</td>
<td>700</td>
<td>2,850</td>
<td>2,390</td>
<td>2,320</td>
<td>3,840</td>
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<tr>
<td>Esturgeon</td>
<td>1,290</td>
<td>1,490</td>
<td>1,160</td>
<td>1,250</td>
<td>2,460</td>
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<tr>
<td>Sterlet</td>
<td>320</td>
<td>490</td>
<td>230</td>
<td>270</td>
<td>740</td>
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<tr>
<td>Pastrouga (Variété d'esturgeon)</td>
<td>530</td>
<td>330</td>
<td>320</td>
<td>330</td>
<td>620</td>
</tr>
<tr>
<td>Silure</td>
<td>11,160</td>
<td>14,920</td>
<td>10,680</td>
<td>6,470</td>
<td>11,420</td>
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<tr>
<td>Carpe</td>
<td>49,890</td>
<td>60,190</td>
<td>19,240</td>
<td>33,010</td>
<td>55,820</td>
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<tr>
<td>Sandre</td>
<td>11,710</td>
<td>12,770</td>
<td>9,470</td>
<td>8,250</td>
<td>10,870</td>
</tr>
<tr>
<td>Brème</td>
<td>6,440</td>
<td>6,450</td>
<td>11,930</td>
<td>8,390</td>
<td>10,870</td>
</tr>
<tr>
<td>Brochet</td>
<td>31,750</td>
<td>30,670</td>
<td>23,430</td>
<td>45,890</td>
<td>36,070</td>
</tr>
<tr>
<td>Tanche</td>
<td>3,470</td>
<td>6,150</td>
<td>2,600</td>
<td>5,390</td>
<td>11,760</td>
</tr>
<tr>
<td>Maquereaux</td>
<td>1,190</td>
<td>470</td>
<td>2,710</td>
<td>670</td>
<td>3,840</td>
</tr>
<tr>
<td>Carassin</td>
<td>8,810</td>
<td>15,260</td>
<td>5,280</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Trigle</td>
<td>720</td>
<td>590</td>
<td>300</td>
<td>180</td>
<td>130</td>
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<tr>
<td>Perche</td>
<td>5,470</td>
<td>6,270</td>
<td>4,040</td>
<td>2,630</td>
<td>6,370</td>
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<tr>
<td>Rouget</td>
<td>610</td>
<td>570</td>
<td>280</td>
<td>520</td>
<td>910</td>
</tr>
<tr>
<td>Muge</td>
<td>8,900</td>
<td>4,950</td>
<td>2,040</td>
<td>1,590</td>
<td>3,220</td>
</tr>
<tr>
<td>Raie</td>
<td>5,150</td>
<td>3,920</td>
<td>1,730</td>
<td>830</td>
<td>620</td>
</tr>
<tr>
<td>Autres espèces</td>
<td>105,020</td>
<td>87,690</td>
<td>67,150</td>
<td>87,420</td>
<td>98,630</td>
</tr>
<tr>
<td>(Caviar)</td>
<td>270</td>
<td>280</td>
<td>500</td>
<td>350</td>
<td>200</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>25,340</td>
<td>25,631</td>
<td>16,548</td>
<td>17,576</td>
<td>26,000</td>
</tr>
</tbody>
</table>
The diagram illustrates the damming and channel excavation activities in the Danube region. The map is divided into two sections:

**Legend (Excavation period):**
- 1880-1902: Yellow
- 1903-1916: Blue
- 1930-1940: Purple
- 1941-1951: Green
- 1952-1960: Red
- > 1960: Orange

**Legend (Building period):**
- 1960-1970: Yellow
- 1971-1980: Light blue
- 1981-1989: Green

The map is color-coded to represent different periods of damming and channel excavation, with specific years highlighted in various colors. The map includes a reference to Staras (2000) for further information.
PHASES IN THE DANUBE DELTA RECENT HISTORY

Legend
- Lakes
- Arms
- Channels

Pristine status
(Hartley, 1887)

Building polders and channels
(1880-1989)

Legend
- Agriculture
- Fishculture
- Forestry

Restoration works (1994-2000)
(after Staras, 2000)
CHANGES IN HYDROLOGY AND WATER CHEMISTRY

**DANUBE RIVER**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Water inflow (cm/s)</td>
<td>309</td>
<td>359</td>
<td>620</td>
<td>700</td>
</tr>
<tr>
<td>P(PO₄) (mg/l)</td>
<td>&lt;0,01</td>
<td>0,06</td>
<td>0,07</td>
<td>0,05</td>
</tr>
<tr>
<td>N(NO₃) (mg/l)</td>
<td>0,4</td>
<td>1,5</td>
<td>1,5</td>
<td>0,6</td>
</tr>
<tr>
<td>P(PO₄) inflow tons/year</td>
<td>100</td>
<td>700</td>
<td>1400</td>
<td>1100</td>
</tr>
<tr>
<td>N(NO₃) inflow tons/year</td>
<td>4000</td>
<td>17000</td>
<td>29300</td>
<td>13500</td>
</tr>
</tbody>
</table>

(modified after Staras, 2000)
CLIMATIC CHANGES AND THEIR IMPACT ON DANUBE DELTA

DANUBE RIVER low water level has a major impact on DANUBE DELTA

- Water (lacustrine) surface reduction
- Marsh or lacustrian areas changes into partial or total drained fields
Low water level impact on shoreline vegetation

- Macrophytes habitat reduction
- Bushes and reed expansion
DANUBE RIVER low water level has a major impact on DANUBE DELTA

- Eutrophication

- Reduction of aquatic species which consist basic food resource of birds

Migration from colonies
Ob.1. Protect and maintain population of species and habitats with ecological values
Ob.2. Manage water circulation in order to improve the ecological conditions
THE RESTORATION PROGRAMME

- **WETLAND RESTORATION**
  - Research, design, monitoring
  - Civil works

- **HYDROLOGICAL SYSTEM REHABILITATION**
  - Research and design
  - Civil works
In 1994 - Babina (2,100 ha), - agricultural polder -
in 1996 - Cernovca (1,580 ha) - agricultural polder -
in 2000 - Popina (3,600 ha) - fishpond -
in 2002 - Fortuna (2,115 ha) - agricultural polder -
in 2006 - SF. Gheorghe arm’s meanders (687 ha)

In 2008 - Holbina - Dunavat (5,630 ha) - fishponds -

TOTAL: 15,712 ha
### BABINA-CERNOVCA PILOT PROJECT

**DANUBE ENVIRONMENT FORUM, TULCEA, ROMANIA, JUNE 27-29, 2013**

<table>
<thead>
<tr>
<th>Project status</th>
<th>Babina (2,100 ha)</th>
<th>Cernovca (1,580 ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>1994</td>
<td>1996</td>
</tr>
<tr>
<td>Implementation</td>
<td>1994</td>
<td>1996</td>
</tr>
</tbody>
</table>

- **Babina** (2,100 ha): Fully implemented, reverted to wetland since 1994.
- **Cernovca** (1,580 ha): Fully implemented, reverted to wetland since 1996.

**Present status:**
- Babina: A mosaic of water types, clear to turbid water systems, depending on the connectivity to the river.
- Cernovca: Fully implemented, reverted to wetland since 1996.
BEFORE FLOODING
Abandoned agricultural polder in the Danube Delta before restoration

Agricultural polder in the Danube Delta after restoration
Babina-Cernovca area
(satellite images)
Babina-Cernovca area
(satellite images 2013)
Lakes of Babina restored area

- 40.4 ha
- 26.9 ha
- 20.4 ha
CONTACT OF CLEAN WATER FROM RESTORED AREA WITH DANUBE WATER RICH IN SEDIMENTS
CONTROL FISHING RESULTS IN RESTORED AREAS INDICATES THE PRESENCE OF BOTH REPRODUCERS AND YOUNG FISH
- **S = 3,600 ha, fish ponds**
  - Research: 1996-1999
  - Implemented since 2000
  - Status: permanent

wetland connected to the river
S = 2,115 ha
-Former polder for forestry
-Research: 2000-2002
-Present status: implemented
S = 5,630 ha, former fish farms

**Research:** 1993-1996

**Result:** Restoration strategy

**Implementation status:** investment funds available since 2003

**Evolution:** water system reverted from turbid plankton-dominated state to clear macrophyte-dominated one
Hydrological connectivity restoration

MEANDERS PROJECT

$S = 687 \text{ ha}$

3 islands - created as a result of rectification of Danube arm - were proposed to be connected to river
BENEFITS OF ECOLOGICAL RESTORATION
BABINA&CERNOVCA PILOT PROJECTS - S=3,600HA

UNSUSTAINABLE / ABANDONED POLDERS

WETLAND REHABILITATION

FILTERING

ECONOMICAL RESULTS

- FISH: 34 KG/HA/YEAR
- REED: 1-2 TONES/HA/YEAR
- PASTURE: 0,5 UVM/HA/YEAR
- 50-100 EURO/HA/YEAR with low costs instead subsidies

ECOLOGICAL VALUES

- NUTRIENT REMOVAL
  - 15 KG PHOSPHORUS/HA/YEAR
  - 335 KG NITROGEN/HA/YEAR
- SEDIMENT RETENTION
  - 11 TONES/HA/YEAR
- HABITAT FOR BIRDS AND FISHES
- AESTHETIC VALUES
- WATER STORAGE

WATER STORAGE
ECONOMICAL INDICATOR: MAXIMUM COST/BENEFIT RATIO
BABINA&CERNOVCA PILOT PROJECTS - S=3,600HA

COSTS:
RESEARCH, DESIGN & IMPLEMENTATION: 100,000 EURO

BENEFITS:
FISH YIELD: 3,600HA x 34KG x 0.5EURO/KG = 60,000EURO/YEAR
REED HARVEST: 3,600HA x 1T/HA x 16EURO/T = 60,000EURO/YEAR
TOURISM: 10TURISTS x 100DAYS/YEAR x 10EURO/DAY = 10,000EURO/YEAR
CATTLE: 100HA x 0.5UVM/HA x 100KG x 2EURO/KG = 10,000EURO/YEAR

TOTAL VALUE: 140,000 EURO/YEAR
at low labour costs
Objectives:

1. Reduce nutrients and sediments inflow to the delta by:
   - close or semi-close the artificial North-South oriented canals
   - reduce section of the (semi-)natural West-East channels

2. Improve water circulation inside the delta and create refuge for fish at lower water level by: silt removal from natural canals
Legend

- Calibrated Channels: 5 sections
- Channels Blocking: 8 channels
- Un-silting works: L=329.5 km
CONSTRAINTS

- POLITICAL DECISION
- PUBLIC AWARENESS
- LEGISLATIVE FRAMEWORK
- STAKEHOLDERS PARTICIPATION
- ECONOMIC INTEREST
- WATER QUALITY
- FUNCTIONAL INTEGRITY
- IRREVERSIBLE MAN MADE CHANGES
- GAPS IN KNOWLEDGE

(after Staras, 2000)
Changes in natural shape

And OWNERSHIP

Different concessionaires

POLDER

Canal

Private Owned

Area of Regional Interest administrated by County Council (polder)

STATE OWNED

Dam

Private Owned

WATER: managed by National Company “Romanian Waters”

Area of National Interest administrated by DDBRA

SHORELINE FORESTS: managed by National Company “Romsilva”

(after Staras, 2000)
ECOLOGICAL RESTORATION PROGRAMME

2005 – 2015

- part of the Master Plan for sustainable development of the Danube Delta Biosphere Reserve -
ECOLOGICAL RESTORATION PROGRAMME
2005 – 2015

Stage I - 2005 - 2008

1. Carasuhat  S= 2,863 ha
2. Murighiol-Dunavăț S= 2,538 ha
3. Sulina S= 475 ha
4. Chilia I + II  S= 2,950 ha
5. Murighiol S= 2,260 ha
6. Ceamurlia I S= 2,900 ha
7. Holbina-Dunavaț S= 5,630 ha

Total Stage I : S= 19,616 ha

Restored areas

- 1. A.A. Babina  S= 2.100 ha
- 2. A.A. Cernovca  S= 1.580 ha
- 3. A.A. Fortuna  S= 2.115 ha
- 4. A.P. Popina S= 3.600 ha

Total S= 9,395 ha

Polder
Total S = 5,876 ha

Fish Pond
Total S = 13,740 ha
Restored areas

1. A.P. Babina  S= 2.100ha
2. A.P. Cernovca  S= 1.580ha
3. A.P. Fortuna  S= 2.115ha
4. F.P. Popina  S= 3.600ha

Total S= 9.395ha

Task 1
Desiltation works  L = 70 km

Task 2
Wetland restoration

Polder  Total S = 32,512 ha

Fish Pond  Total S = 13,570 ha
SIREASA
2010

Support from
NATURE
WETLANDS ECOLOGICAL RESTORATION PROJECTS TODAY

Zaghen 2013
DANUBE ENVIRONMENT FORUM, TULCEA, ROMANIA, JUNE 27-29, 2013

WETLANDS ECOLOGICAL RESTORATION PROJECTS TODAY

Carasuhat 2013

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WETLANDS
ECOLOGICAL
RESTORATION
PROJECTS:
FUTURE?
THANK YOU