

**DANUBE DELTA NATIONAL INSTITUTE
FOR RESEARCH AND DEVELOPMENT
TULCEA * ROMANIA**



The Danube Delta and Wetlands projects in Romania



Romanian Ministry of Environment and
Sustainable Development

2007

Final Wetlands Workshop of the UNDP/GEF Danube Regional Project 18-20 April 2007 Tulcea, Romania

**DANUBE DELTA NATIONAL INSTITUTE
FOR RESEARCH & DEVELOPMENT
TULCEA - ROMANIA**

Romulus Ştiucă
General Director

Iulian Nichersu
Department for Informational System

Marian Tudor
Department of Ecological Restoration



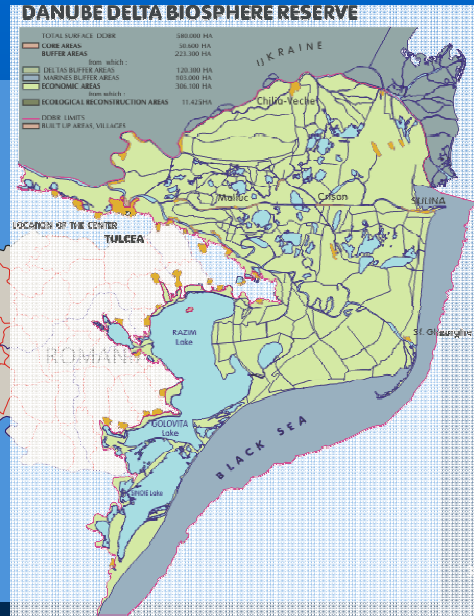


DANUBE DELTA

EUROPE

The largest
protected area
in EUROPE
 $S=5.800 \text{ km}^2$.

ROMANIA



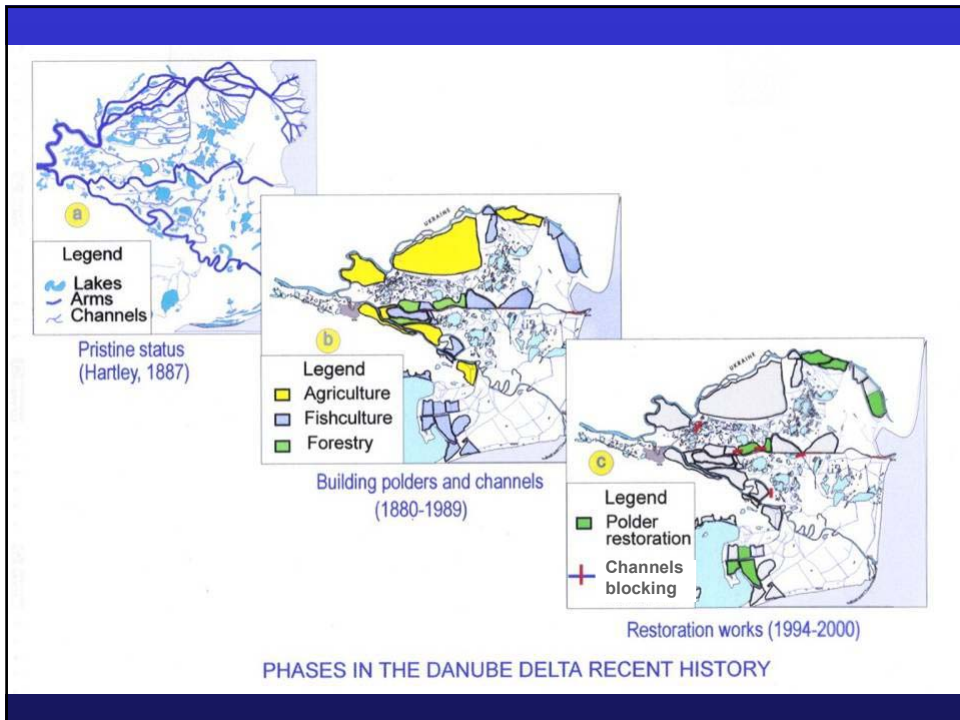
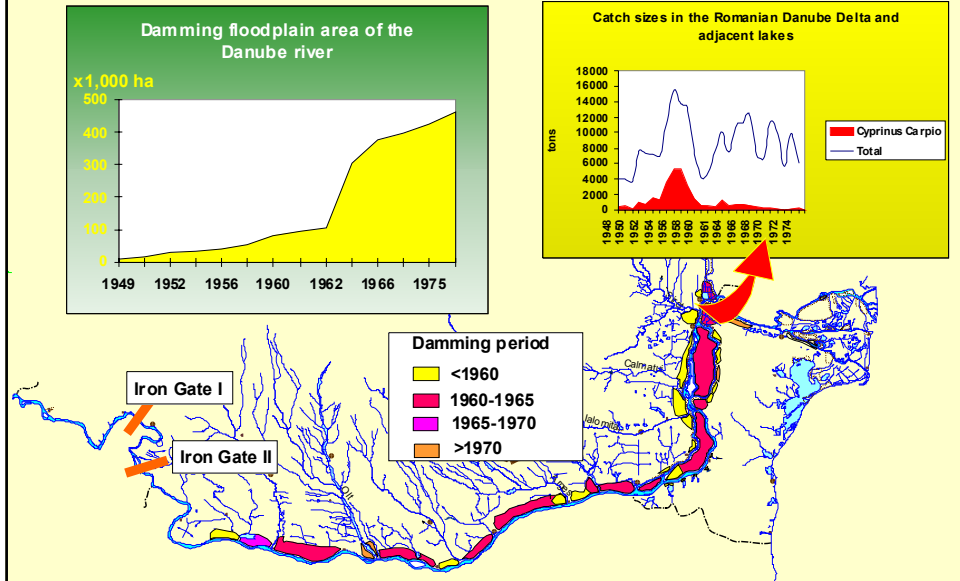
WHY ECOLOGICAL RESTORATION PROGRAMME ?

Motivation:

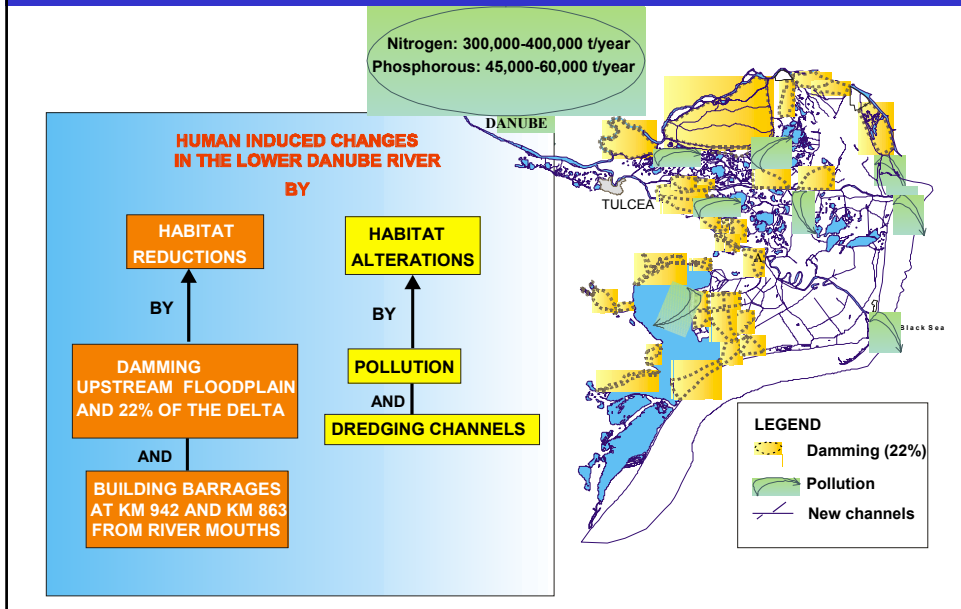
- Human impact
 - upstream Danube Delta
 - in the Danube Delta
- Global climatic changes

DAMMING FLOODPLAIN UPSTREAM DELTA

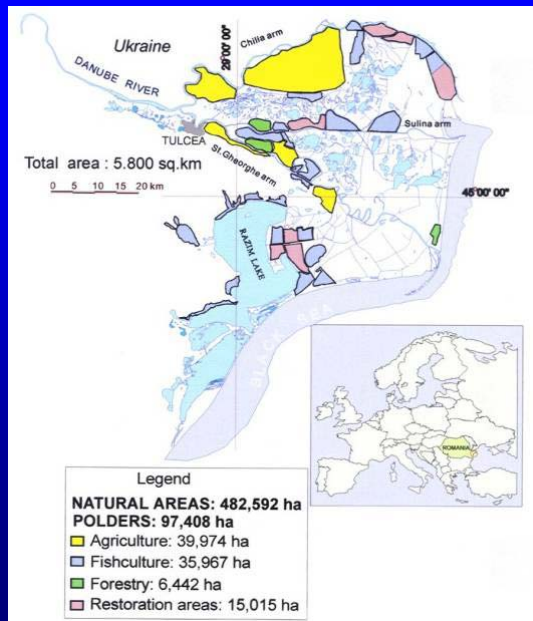
DAMMING OF DANUBE RIVER FLOODPLAIN IMPACT ON DANUBE DELTA'S FISHERY



HUMAN INDUCED CHANGES IN DANUBE DELTA



DANUBE DELTA BIOSPHERE RESERVE PRESENT LAND USE



CHANGES OF HYDROLOGY AND WATER CHEMISTRY

DANUBE RIVER

Water inflow (cm/s)

P(PO₄) (mg/l)

N(NO₃) (mg/l)

P(PO₄) inflow
tons/year

N(NO₃) inflow
tons/year

DELTA ECOSYSTEMS

Before 1960 1971-1980 1980-1989 2003-2005

309 359 620 700

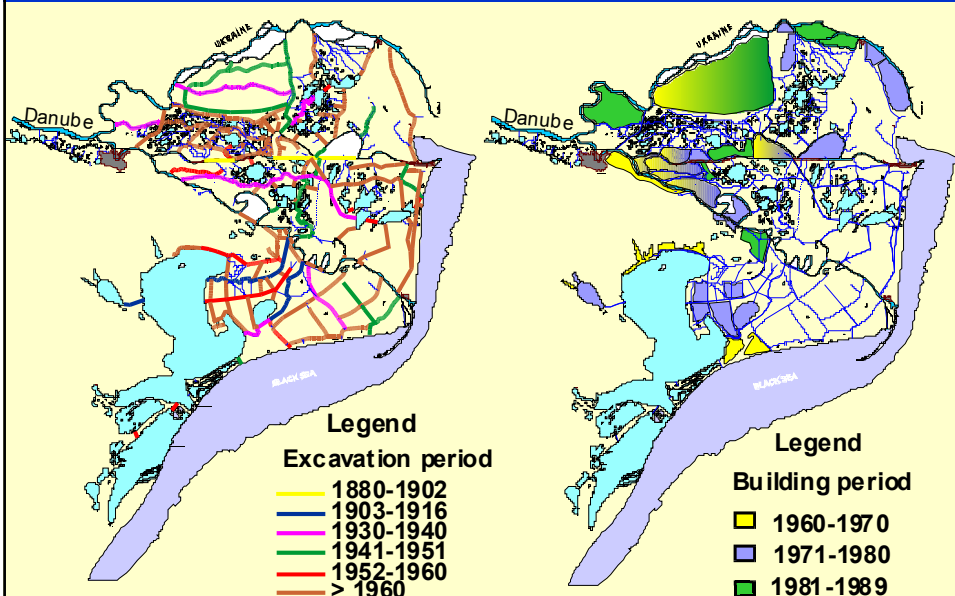
<0,01 0,06 0,07 0,05

0,4 1,5 1,5 0,6

● 100 ● 700 ● 1400 ● 1100

■ 4000 ■ 17000 ■ 29300 ■ 13500

DAMMING AND CHANNEL EXCAVATION



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 lacustrine 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

- **Eutrofication**



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



Migration from colonies



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

Easy access of predators (golden wolf, fox, ratoon dog) and hunters to colonies due to lake dry bottom



Impact on fishermen's communities

- Fish migration to deeper waters

- Longer distances between localities and fishing areas



MEASURES

In the period 1994-2006



ECOLOGICAL RESTORATION MANAGEMENT OBJECTIVES

**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 HAS TWO MAIN CATEGORIES OF PROJECTS

1. WETLAND RESTORATION

- Research & design
- Civil works for implementation
- Monitoring

2. WATER CIRCULATION IMPROVEMENT

- Research & design
- Civil works for implementation
- Monitoring

ADDITIONAL COMPONENTS

Restoration of:

- habitats and ecosystems
- endangered species
- affected landscape

The main actors

PARTNERS:



WWF Auen Institute, Rastatt, Germany



RIZA Institute, Lelystad, The Netherlands



ROMANIAN MINISTRY
OF ENVIRONMENT AND
SUSTAINABLE
DEVELOPMENT



WORLD BANK



DANUBE DELTA NATIONAL INSTITUTE
FOR RESEARCH AND DEVELOPMENT
TULCEA / ROMANIA

1. WETLAND RESTORATION PROJECTS

Objectives

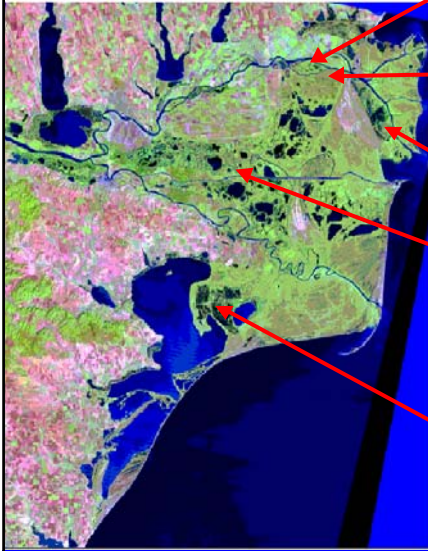
- **Restore:**
 - specific functions of the wetlands
 - lateral connectivity and reintegration in the natural river pulse system
 - natural habitats that support biodiversity and natural resources
- **Recover traditional economic activities of the local communities**

RECOVERING OF THE NATURAL FUNCTIONS OF WETLANDS



- Hydrological
- Bio-geo-chemical
- Ecological
- Social-economic

Implemented Restoration Works in the Danube Delta



◆ 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

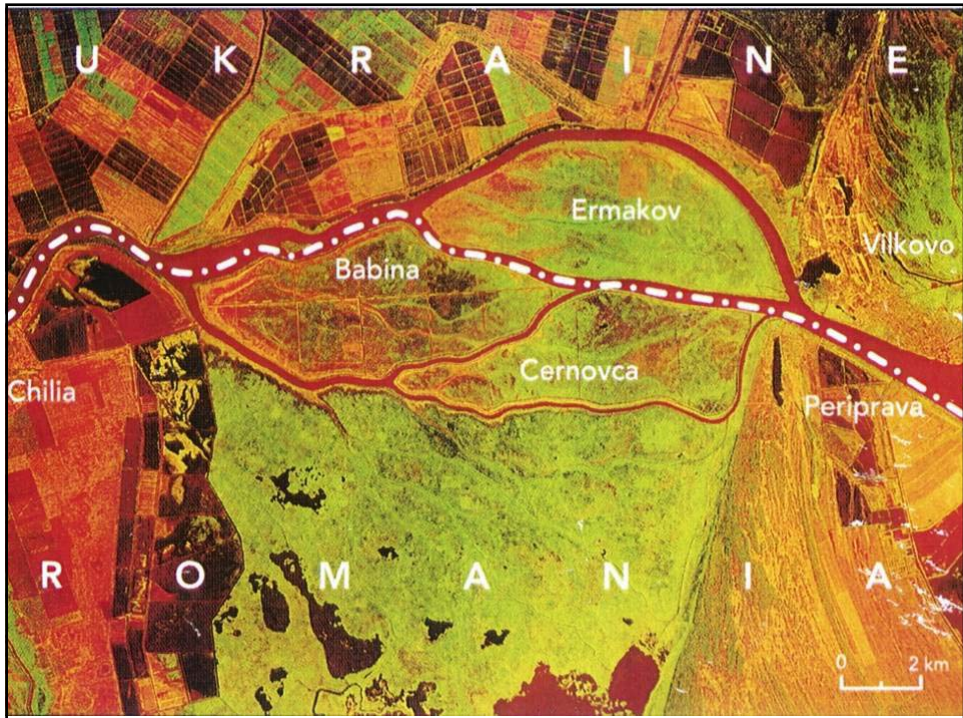
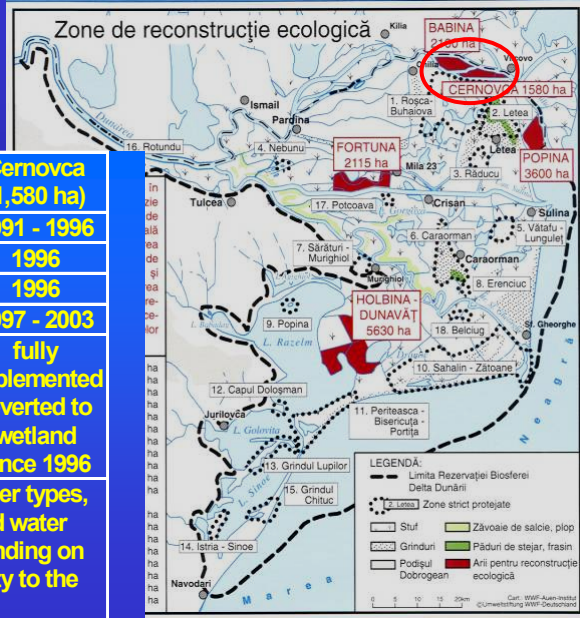
Holbina - Dunavat (5,630 ha)
- fishponds -

TOTAL: 15,025 ha

**SUCCESSFULLY
IMPLEMENTED PROJECTS**

BABINA-CERNOVCA PILOT PROJECT

	Babina (2,100 ha)	Cernovca (1,580 ha)
Research	1991 - 1994	1991 - 1996
Design	1994	1996
Implementation	1994	1996
Monitoring	1995 - 2003	1997 - 2003
Project status	fully implemented reverted to wetland since 1994	fully implemented reverted to wetland since 1996
Present status	a mosaic of water types, clear to turbid water systems, depending on the connectivity to the river	



BEFORE FLOODING



AMENAJARE AGRICOLĂ ABANDONATĂ ÎN DELTA DUNĂRII
Abandoned agricultural polder in the Danube Delta before restoration

2 YEARS AFTER FLOODING



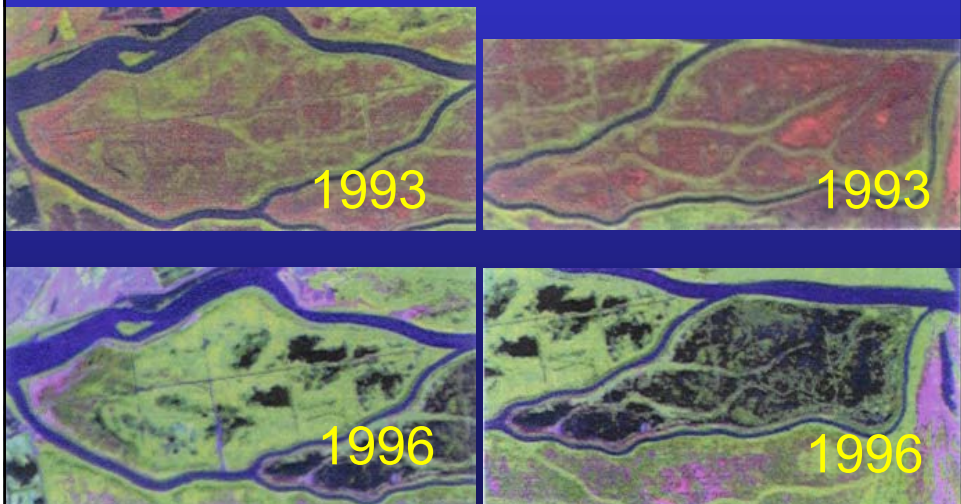
AMENAJARE AGRICOLĂ RENATURATĂ ÎN DELTA DUNĂRII
Agricultural polder in the Danube Delta after restoration



AMENAJARE AGRICOLĂ ABANDONATĂ ÎN DELTA DUNĂRII
Abandoned agricultural polder in the Danube Delta before restoration



Babina-Cernovca area (satellite images)



**BIOLOGICAL FILTERING CAPACITY
OF THE PALUSTRIAN AND AQUATIC VEGETATION**



**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 FISHES



**BENEFITS OF ECOLOGICAL RESTORATION
BABINA&CERNOVCA PILOT PROJECTS - S=3,600HA**

UNSUSTAINABLE / ABANDONED POLDERS

WETLAND REHABILITATION

ECONOMICAL RESULTS

FILTERING

ECOLOGICAL VALUES

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

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

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

COSTS:

RESEARCH, DESIGN & IMPLEMENTATION: 100,000 EURO

BENEFITS:

FISH YIELD: $3,600\text{HA} \times 34\text{KG} \times 0.5\text{EURO/KG} = 60,000\text{EURO/YEAR}$

REED HARVEST: $3,600\text{HA} \times 1\text{T/HA} \times 16\text{EURO/T} = 60,000\text{EURO/YEAR}$

TOURISM: $10\text{TURISTS} \times 100\text{DAYS/YEAR} \times 10\text{EURO/DAY} = 10,000\text{EURO/YEAR}$

CATTLE: $100\text{HA} \times 0.5\text{UVM/HA} \times 100\text{KG} \times 2\text{EURO/KG} = 10,000\text{EURO/YEAR}$

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

SUCCESSSES

DANUBE DELTA
RESEARCH & DESIGN
INSTITUTE
&
DANUBE
DELTA
BIOSPHERE
RESERVE
AUTHORITY
AWARDS FOR
ECOLOGICAL RESTORATION



AGIR AWARD - 1995
GENERAL ASSOCIATION OF
ROMANIAN ENGINEERS

EUROSITE AWARD -1995
EUROPEAN COMMUNITY



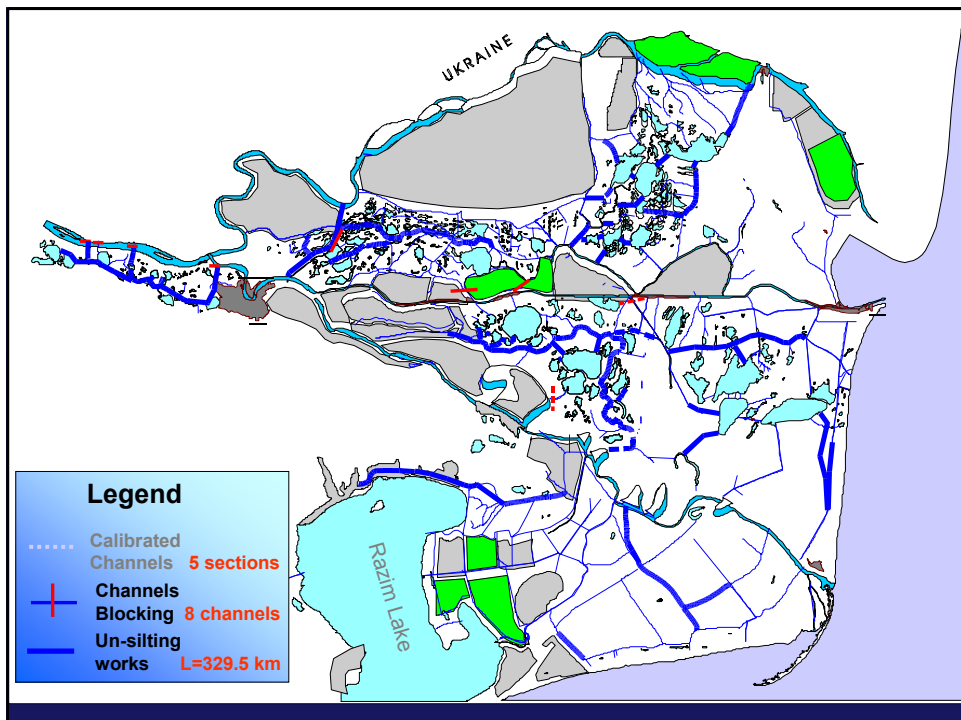
WWF CONSERVATION MERIT AWARD -1996
WORLD WIDE FUND FOR NATURE (WWF)

2. WATER CIRCULATION IMPROVEMENT

Objectives

- close or calibrate the artificial North-South oriented canals
- calibrate the (semi-)natural West-East channels
- calibrate the lake entrances

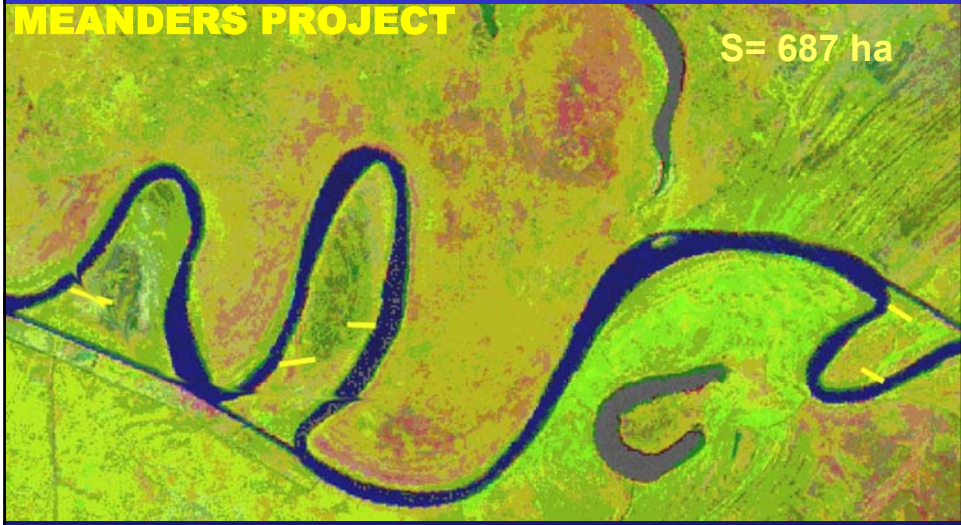
From 3,400 km of channels 344 km have been dredged, 8 canals - closed and 5 sections - calibrated



Hydrological connectivity restoration

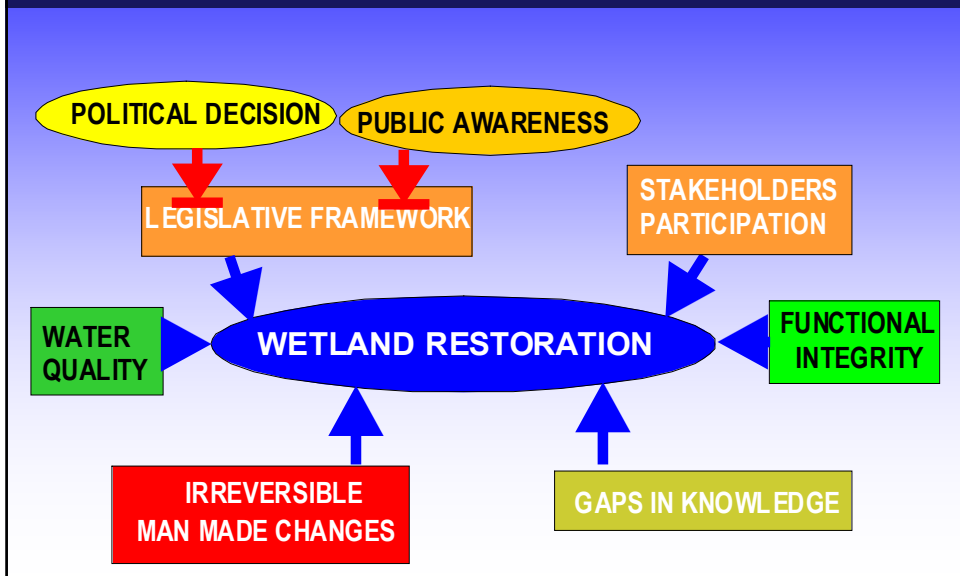
MEANDERS PROJECT

S= 687 ha



3 islands - created as a result of rectification of Danube arm - were connected to river

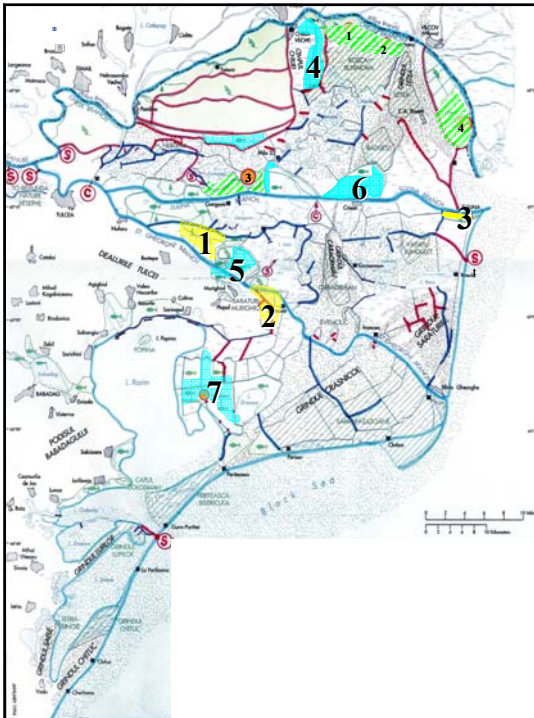
ENCOUNTERED CONSTRAINTS





ECOLOGICAL RESTORATION PROGRAMME 2007 – 2013

Foto: Erika Schneider
WWF Germany



ECOLOGICAL RESTORATION PROGRAMME 2007 – 2013

Stage I - 2007 - 2009

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

Agri-polder Total S = 5,876 ha

Fish Pond Total S = 13,740 ha

Total Stage I : S= 19,616 ha



ECOLOGICAL RESTORATION PROGRAMME 2007 – 2013

Stage II – 2009 - 2013

Task 1
Desiltation works $L = 70$ km
of existing channels

Task 2
Wetland restoration

Agri-polder Total S = 32,512 ha

Fish Pond Total S = 13,570 ha

ROMANIAN GOVERNMENT INITIATIVES



MINISTRY OF ENVIRONMENT
AND SUSTAINABLE DEVELOPMENT



PROGRAMME:
**ECOLOGICAL & ECONOMICAL RESIZING
OF LOWER DANUBE – ROMANIAN SECTOR**

The word "AIM" is written in a bold, yellow, sans-serif font with a black outline, centered against a background of a blue sky with white clouds.

AIM

**Scientific and technic fundament for
Integrated Flood Protection Management
on Romanian sector
of Danube Floodplain**

An aerial photograph of a lush green floodplain with a winding river and several polders. The text is overlaid on the image.

ACTUAL STATE

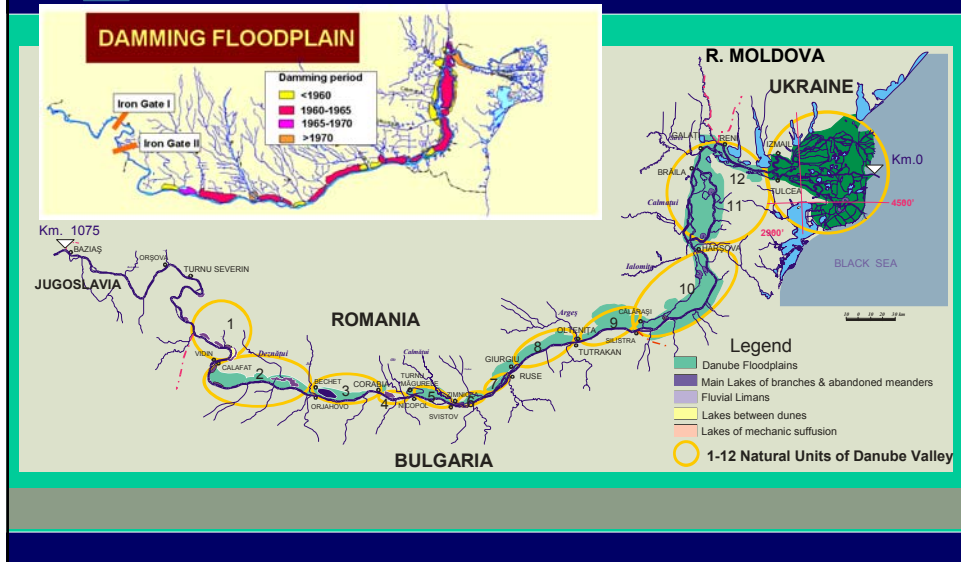
Danube Floodplain = 513.900ha

**ANTHROPIC - 430.000 ha - 53 polders with
1.200km dykes**

NATURAL - 83.900 ha

- tributaries mouth**
- Braila Small Island**

HISTORICAL DANUBE FLOODPLAIN UNITS IN NATURAL REGIME OF WATER FLOW



ARGUMENTS FOR THE PROGRAMME

- **Inefficient flood defense dykes** due to:
 - new maximum historical water level
 - too long defense dikes difficult to maintain
 - common defense of polders, ports and settlements
- **Modification of river hydrological equilibrium**
- **Integrated Flood Protection Management**

OBJECTIVE 1

Reassessment of settlements defense lines against floods

ACTIONS

- **ELABORATION OF DIGITAL TERRAIN MODEL (DTM) FOR REAPPRAISAL OF DEFENSE LINES OF SETTLEMENTS AGAINST FLOODS** with circular dike build on General City Planning
- **ELABORATION OF INUNDABILITY SCENARIOS** based on Hydraulical Modelling

OBJECTIVE 1

Reassessment of settlements defense lines against floods

EXPECTED RESULTS

- **Hidro-geo-morphologically units of Danube floodplain mapping based on tridimensional terrain model (MDT)**
This model will be realized by transversal and longitudinal transects via agri-polders and Danube's tributaries mouths.
On terrain hypsometry, flooding scenarios will be developed, based on hydraulic modeling
- **The adopted hydraulic model is projecting, depending on 2006 year water level and discharge, various flooding scenarios, from which the optimal one will be selected in order to restore the water circulation in the area, the nearest possible to natural state before damming.**
- **Settlements and ports defense dikes height**

OBJECTIVE 2

Polders restoration in order to recover natural functions of wetlands including conservative interest areas

ACTIONS

- Establishment of water flooding regime and after-effect in agri-polders by draining of former lakes Bistreț, Potelu, Suhaia, Greaca, Călărași and so, for their ecological restoration.

OBJECTIVE 2

Polders restoration in order to recover natural functions of wetlands including conservative interest areas

EXPECTED RESULTS

- **Re-integration into the natural hydrological regime of the Danube River**
- **Recovery of wetlands natural functions – hydrological, bio-geo-chemical and ecological**
- **Restoration of hydrological and ecological equilibrium**
- **Natural habitats enlargement as areas for fish and birds breeding**
- **Development of traditional activities: fishing, husbandry, natural vegetal resource harvesting, ecotourism**

Ecological restoration pilot



Abandoned
Agri-polder



Flooding
breach



Success of
ecological
restoration

OBJECTIVE 3

Reassessment of economic activities in agriculture/fish polders into a mixed concept economic and room to the river

ACTIONS

- Reassessment of agri-polders economic activities based on cost/benefit ratio for investments on dikes and other hydro-technical construction maintenance
- Establishment of the controlled flooding regime for room to the river at maximum Danube water levels endangering the defense systems

OBJECTIVE 3

Reassessment of economic activities in agriculture/fish polders into a mixed concept economic and room to the river

EXPECTED RESULTS

- Limitation of flooding catastrophic effects
- Ecological/adapted integrated management

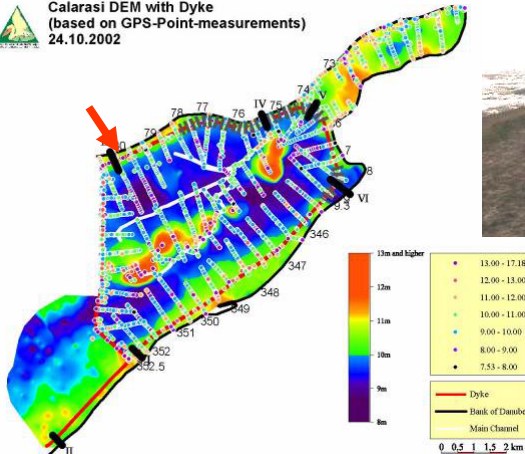
PROGRAMME: ECOLOGICAL & ECONOMICAL RESIZING OF LOWER DANUBE – ROMANIAN SECTOR

- **2006-2007 Research studies**
- **2008-2010 Feasibility studies for:**
 - Settlements flood defense
 - Ecological restoration
 - Room to the river

Călărași Răul Island – April 2006



Calarasi DEM with Dyke
(based on GPS-Point-measurements)
24.10.2002



Controlled
flooding breach

•The 1st ecological restoration project in
Danube Floodplain

WETLANDS – NUTRIENTS REMOVAL

**MONITORING AND ASSESSMENT OF
NUTRIENTS REMOVAL CAPACITY OF
RIVERINE WETLANDS IN ROMANIAN
LOWER DANUBE FLOODPLAIN**

Sector between Corabia (km 630) and Turnu Magurele (km 590)



UNDP | GEF
DANUBE
REGIONAL
PROJECT

ROMANIAN DEMONSTRATION SITE



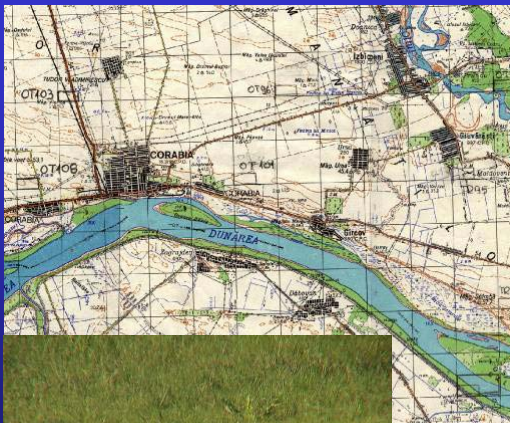
Proposed Pilot Project

Romanian Lower Danube Floodplain
Sector between Corabia (km 630) and Timu Magurele (km 590)

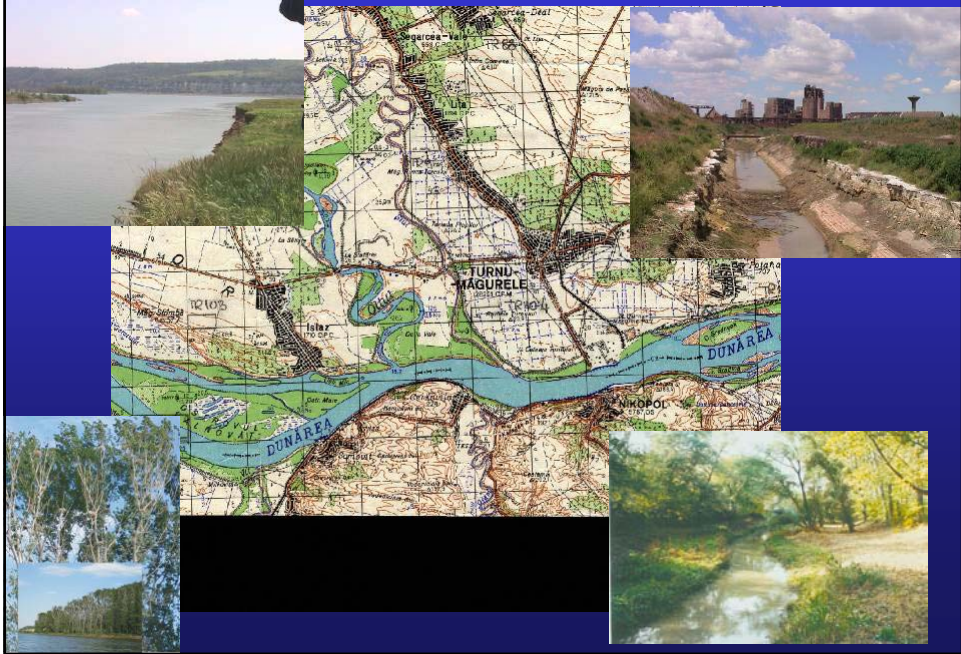


UNDP | GEF
DANUBE
REGIONAL
PROJECT

SITE CHARACTERIZATION (1)



SITE CHARACTERIZATION (2)



HUMAN IMPACT

- The wetland areas in this sector are characterized by a reduced hydrologic exchange which restricts the exchange of matter to short periods of high flow
- Moreover, agricultural practices, livestock grazing, manufacturing and processing operations and urban development variously contribute chemical wastes, pesticides, nutrients and inorganic sediments.



General objectives are to quantify:

1. nutrient, sediment and hydrologic inputs and outputs of the river floodplain and also tributaries mouth input;
2. productivity and uptake and release of nutrients by marsh vegetation;
3. changes in water, sediments and soil.



CONCLUSIONS

A. GÂRCOV WETLAND

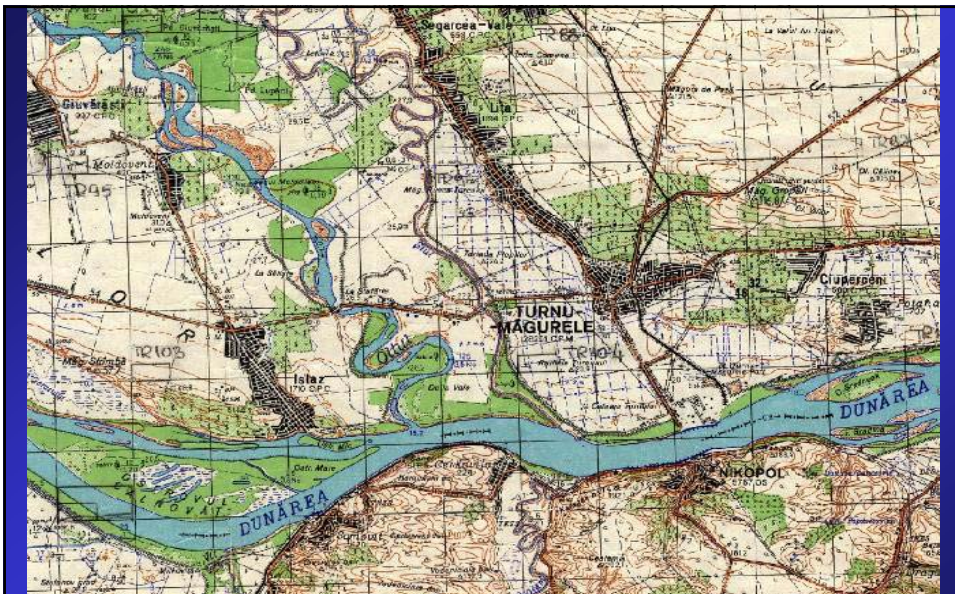
- The sediments of Garcov Marsh is more loaded with organic matter and phosphorous than the sediments from the Garcov Lake,
- The sediments of Garcov Lake is more loaded with nitric nitrogen than the sediments of Garcov Marsh,
- The concentrations of inorganic phosphorus, expressed as phosphorus from orthophosphate, respect the assumption of Garcov filter, in all the sampling periods,
- The total phosphorus, that included the inorganic and organic phosphorus, indicate lower values in marsh area as a result of active sedimentation processes in lake area,
- The nutrient removal capacity of the wetlands located in the studied area of the lower Danube river valley is demonstrated by the more diverse and more abundant phytoplankton recorded in the inflowing waters (in comparison with the outflowing waters),

B. Tributary rivers to the Danube River (Olt and Saiu rivers)

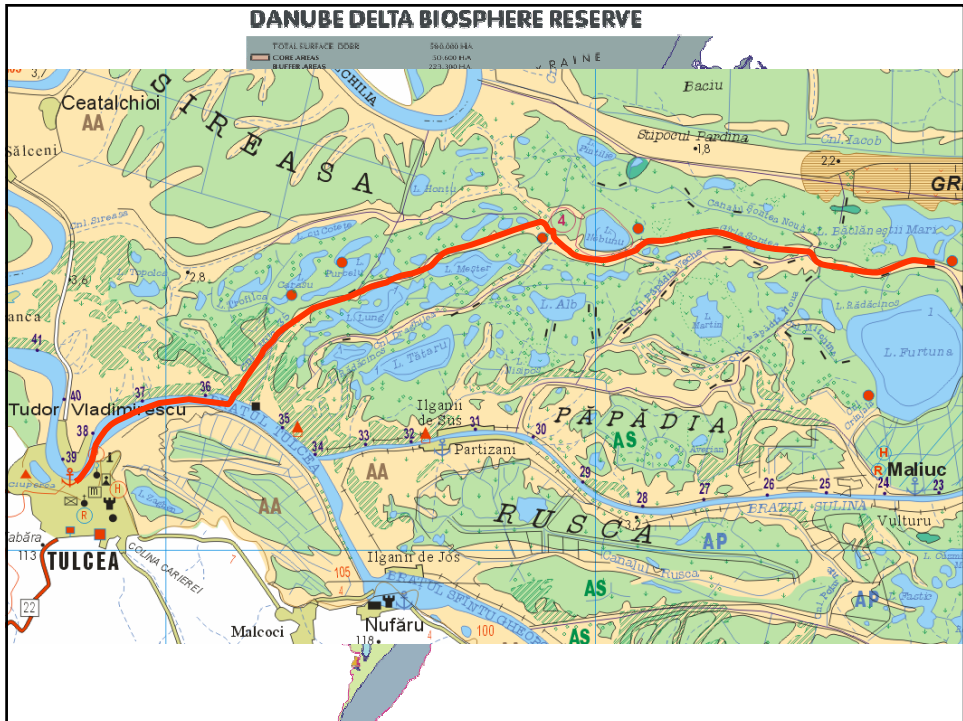
- The sediments of Danube River tributary (Saiu River) are highly loaded with mobile phosphorous at the top of the layers,
- The contribution of nitrogen from nitrate in the Danube river, represents 2.36% from Olt, and 0.1% from Saiu, in mass flow,
- In the Danube, the contribution of ammonium nitrogen, in mass flow, of Olt, represents 3.27%, and Saiu 0.15%,
- The contribution of Olt, in inorganic phosphorus from orthophosphate, at the Danube concentration, represent 5.49%, and Saiu 0.29%,
- The nutrients contributions of Saiu, represents 0.1% inorganic nitrogen and 0.148% total phosphorus from the Danube nutrients concentrations,
- The nutrients contributions of Olt, represent 2.38% inorganic nitrogen and 2.74% total phosphorus from the Danube nutrients concentrations,

C. Potelu Lake

- The organic matter was found in the sediments of adjacent area in big concentration except two points that are close and directly linked with the Danube River waters,
- There is a medium correlation coefficient between P₂O₅ from the top of sediments (September) and P total from the water (August), fact that proves the link between the mobile phosphorous from sediments and total P from flooding water,
- The nitric nitrogen from sediments and the one from water have no correlation fact due the nitrogen accessibility for micro-organisms and the chemical easy mobility
- Average biomass was higher in the former Potelu Lake, dominated by copepoda 690 indiv/l, with high biomass: 62.7 mg/l ww).



In 2007 the area will be included in the EERLD-RS PROGRAMME as potential area for ecological restoration, being part of the former lake Potelu



**ENJOY YOUR SMALL
DANUBE DELTA
TRIP!**