



Adaptive Management of Barriers in European Rivers

Greece AMBER National Workshop

RIVER CONSERVATION ACTIONS

Restoring Mediterranean rivers: ideas from Spain

Diego García de Jalón

Universidad Politécnica de Madrid



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 849682

Athens May 8th 2019

Restoring Mediterranean rivers

OVERVIEW

- A. What is the situation of river problems and restoration initiatives in Spain?
- B. How to do effective restoration in Mediterranean Rivers: *ideas*
- C. Are Environmental Flows enough?

River Problems in Spain

- Pollution
- Water Demand
- Floodplain occupation
- Floods
- Gravel extraction
- Anoxia, toxicity, ..
- Flow regulation by **1200** large dams
- Channelization
- Levees
- Sediment deficit

CUMULATIVE EFFECTS IN TIME AND SPACE

- Rivers have lost sediments
- Rivers have lost their dynamism
- Rivers have been fragmented and lost their natural connectivity
- Rivers reaches below cities are always polluted
- Rivers have reduced their native biodiversity
- Rivers have been invaded by introduced species



River Restoration initiatives in Spain

1. Local Restoration Projects
2. National River Restoration Strategy (2007)
3. Program of Measures in RBMP's (2015)

River Restoration initiatives in Spain

1. Local Restoration Projects



Presa del molino de Yanci en la regata Latsa antes y después de la demolición

1. Local Restoration Projects

Channelization in 'GREEN'



[Transcurso de la obra]



[Obra ejecutada]

Técnicas

Rollo estructurado en fibra

Gavión flexible laminar

Gavión flexible

Herbazal estructurado en fibra vegetado

Geomalla

Manta orgánica

Productos

Fiber roll™

Chamber revetment™

Rock roll™

Plant carpet™

Manta C350 de North American Green

Red de coco

1. Dam Removal: Presa de la Pedriza (río Manzanares)



River Restoration initiatives in Spain

2. National River Restoration Strategy (2007)

630 Restoration Projects Implemented (MAGRAMA, 2012)

Restoration Types	Nº Projects	%	
Levees removal and setback	37	5.9	Geomorphology
Transversal Barriers Elimination	41	6.5	
Channel Morphological recovery	103	16.4	
Riparian Space increasing	42	6.7	
Limiting uses and exploitation	11	1.8	Pressures
Fish passes & Habitat Improvement	55	8.8	Cosmetics
Revegetation & Selviculture	145	23.1	
Invasive species removal	34	5.4	
River Cleaning	43	6.9	Social Use
provision of recreational, cultural & trails	116	18.5	

2. Improving riparian landscape



río Anzur
antes de llegar
al núcleo de
Aldea del
Nacimiento.
Fotos tomadas
antes y
después de la
actuación.



2. Bio-engineering



Figura 3.5 La recuperación del espacio fluvial es esencial para la aplicación de técnicas de bioingeniería en la apertura de un cauce por Bustiello de Paredes, CH Cantábrico, 2009, 2012.



Figura 3.6 Estabilización de taludes mediante la aplicación de técnicas de bioingeniería en Allepuz (CH Júcar): antes del comienzo de las obras y durante su realización

2. Invasive species removal

Arundo donax



Figura 3.7 Eliminación de especies invasoras en Rambla de los Puertos (T.M.Cartagena)

2. River Cleaning

removal of trees & bushes



Río Tajuña

2. River Órbigo Restoration Project

IRF EUROPEAN RIVERPRIZE FINALIST

Budget 3,084,697 €



eliminating embankments and rip-raps along a total of 13.4 km and setting them back along another 5.2 km.

2. River Órbigo Restoration Project

Public Participation Process



ACHIEVEMENTS:

- Recovery of 480 ha of flood prone to attenuate floods naturally
- Greater infiltration rate in the alluvial natural floodplains,
- soil fertilization

3. Fluvial Restoration under WFD

Porpouse:

- a) To Prevent further deterioration
- b) To Protect and enhance the status of aquatic ecosystems

River Basin Management Plans: stablish for each **Surface**

Water Body:

- a) Objective: river ecosystem Conservation and to achieve Good Ecological Status
- b) significant pressures and impact of human activity
- c) Status Assesment (ecological and chemical)
- d) **Program of Measures** that must be implemented
- e) recovery of the costs of water use

DPSIR analysys Driver, Pressures, Status, Impacts & Response

3. Fluvial Restoration under WFD

Program of Measures in Spanish RBMPs:

- a) Reduction of pollution
- b) Reduction of water abstraction pressures
- c) Surveillance and monitoring
- d) Increase irrigation efficiency
- e) Morphologic improvement
- f) Hydrological improvement
- g) Conservation & improvement of Ecosystems**
- h) Flood protection
- i) Construction of storm tanks
- j) Adaptation of the sanitation network
- k) Actions to reduce urban runoff
- l) Establishment of separative networks

Environmental Flows are implemented in all Water Bodies

Dam Removal: *presa* de Umbrías, en el río *Aravalle* (Barco de Avila)



B. How to do effective restoration in Mediterranean Rivers.

IDEAS

- River Restoration is based on our **knowledge** of how a river works and on our **perception of its values**.
- Management and governance of rivers should be based on a **better knowledge of their status and problems**, and then, should promote better River Restoration actions
- River Restoration actions should be aimed to reduce the **degree of artificiality** of rivers and improve their **functioning as ecosystems**,
- Also, River Restoration should promote their **public use** , linking the awareness of users with their **environmental perception and education**.

Design philosophy on River Restoration

Minimum requirements:

- **Water** in Quality and Quantity
- **Sediments**
- Fluvial **space**
- **Connectivity**
- Restoration needs **Time** to complete

C. Designed **Environmental Flows** are enough?

Are Environmental Flows a 'Panacea'?

- Our knowledge is very simple and purely **qualitative**.
- **Prediction** capacity is low
- **Data** from implemented Environmental Flows Case Studies are very **scarce**

We **must be humble** about our Knowledge on ecological responses to Flow Alterations, ... but **not stupid**.

C. Ecological Limits of Hydrologic Alteration

Poff et al., 2010

- How much water can we extract from the river flow, without degrading their natural communities?
 - 5% of the natural flow? **Qenv. = 95%**
 - 10%? or 25% ? **Qenv. = 90% or 75%**
 - 50%? **I have great doubts**
 - 80? or 90? **NO WAYS!**

River Bonsai Concept

Reality: River Duero RBMP

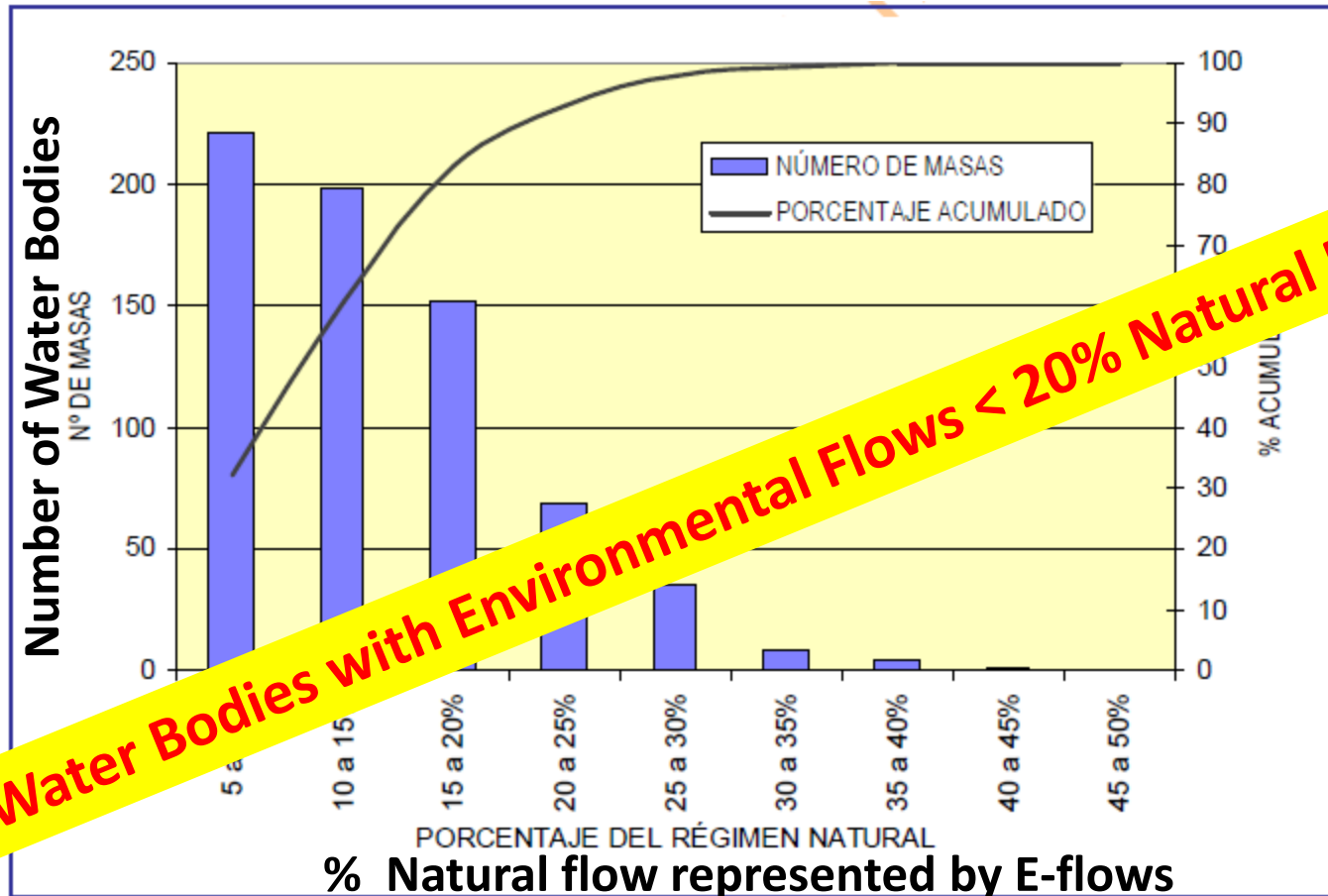


Figura 107. Histograma que representa los porcentajes de la aportación natural total fijados como caudales ecológicos en relación al número de masas de agua superficial.

Bonsai River Concept

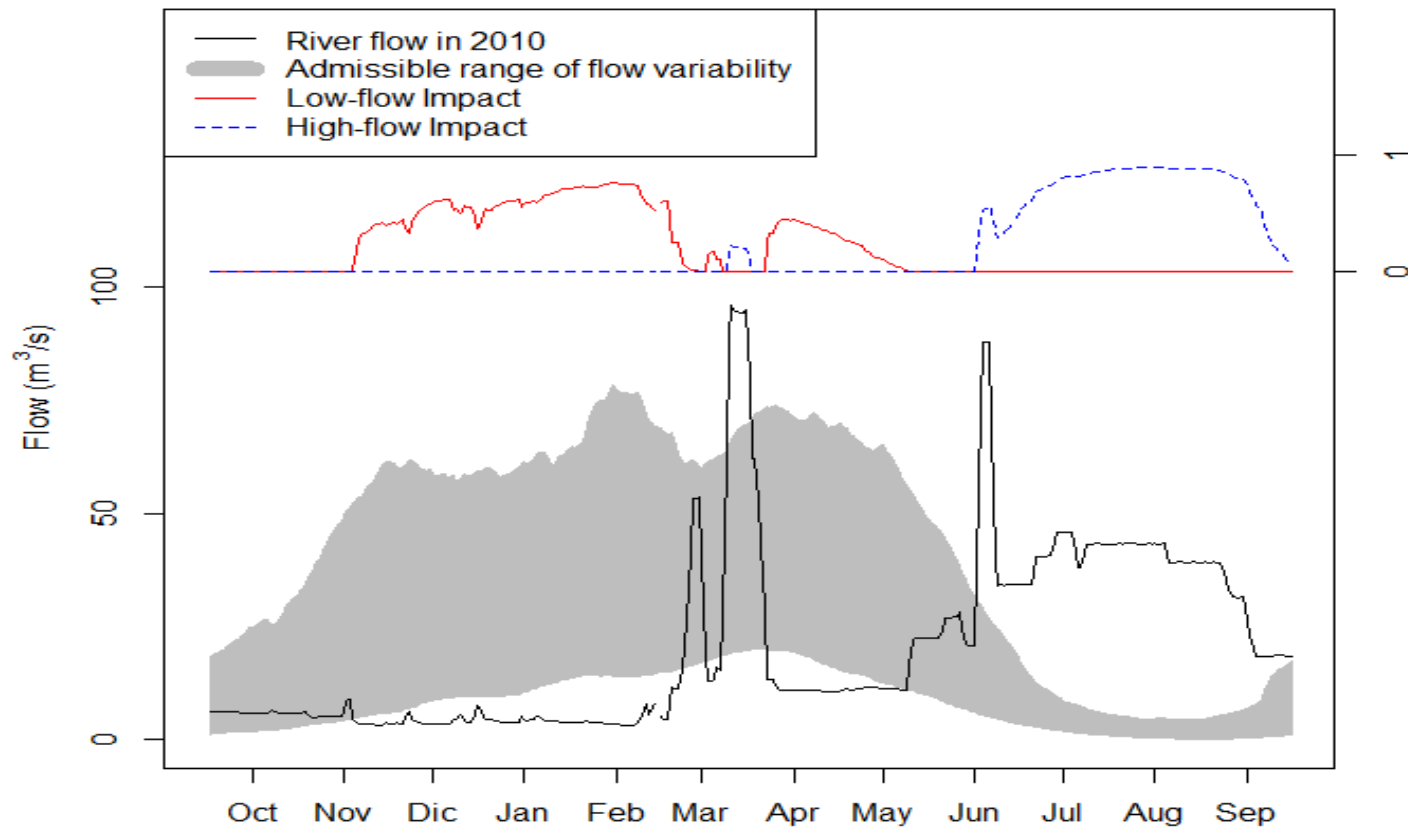
Fluvial Ecosystem Resilience

- Decreases capacity for self-recovery
- Population fragmentation
- Increased susceptibility and fragility
- Potentiation of impacts
- Elimination of species in the basin



Regulation intensity: **polluters pay**

IMPACTS: according to how much instream flows were outside of the 'Range of Natural Variability' along the year (*García de Jalón et al, 2015*).



Changes in Sediment budget



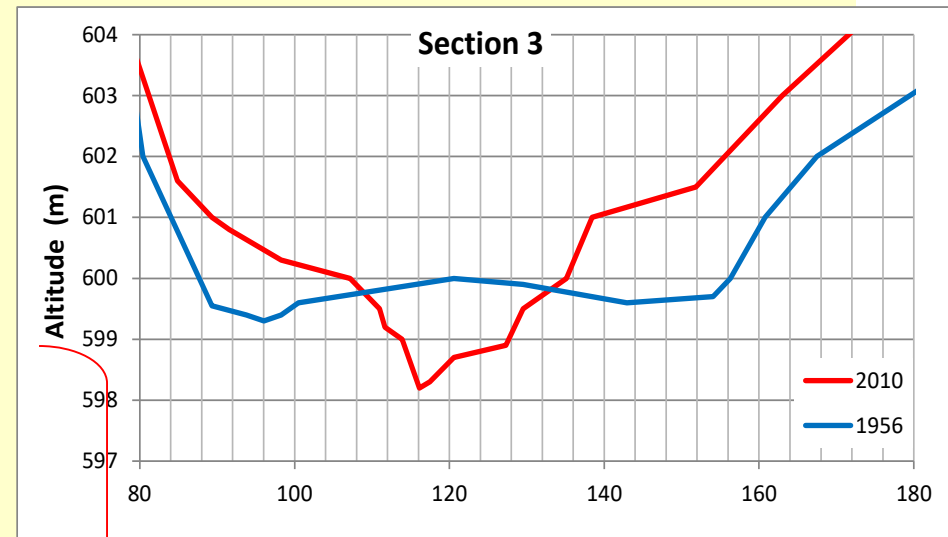
- the reservoirs built act as huge sediment traps
- Rivers below dams have lost all most their sediments
- unbalance between water and sediments produces channel incision.

Channel Geo-morphic changes

- Alteration of erosion and sedimentation processes:

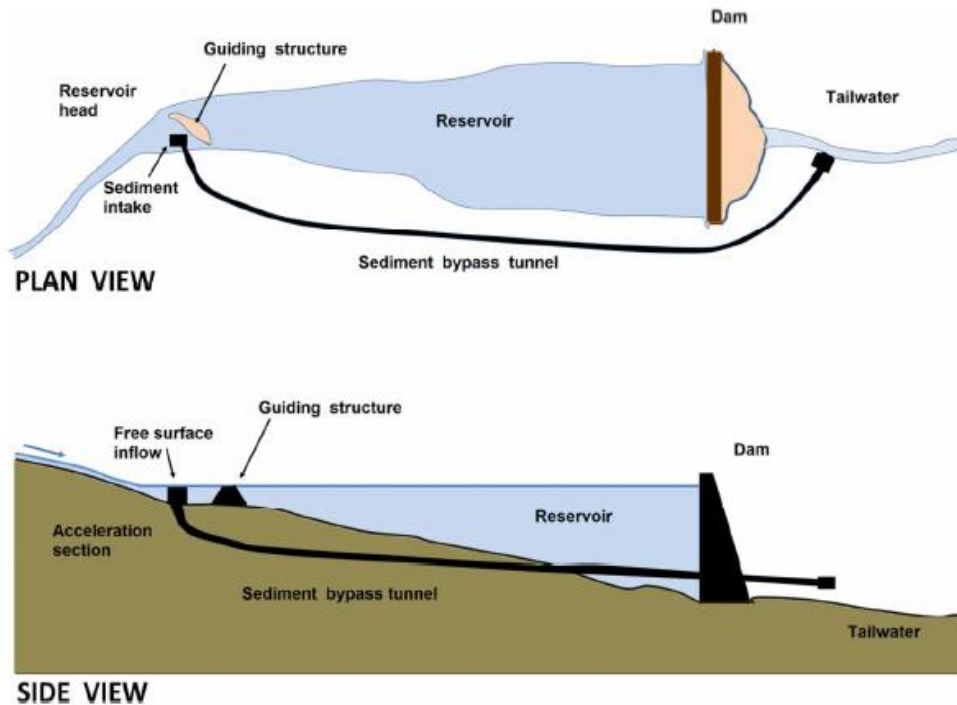
- Reduction
- Unbalance

- Incision
- Decrease in channel size
- Channel Stabilization



The river Bonsai concept

Mitigation of Sediment deficit



By-pass Sediment Tunnel

Fig. 7. Scheme of a sediment bypass tunnel system associated with a reservoir designed with the sediment intake located at the reservoir head under free surface conditions (based on Auel & Boes, 2011).

Sediment Hydraulic Pumping

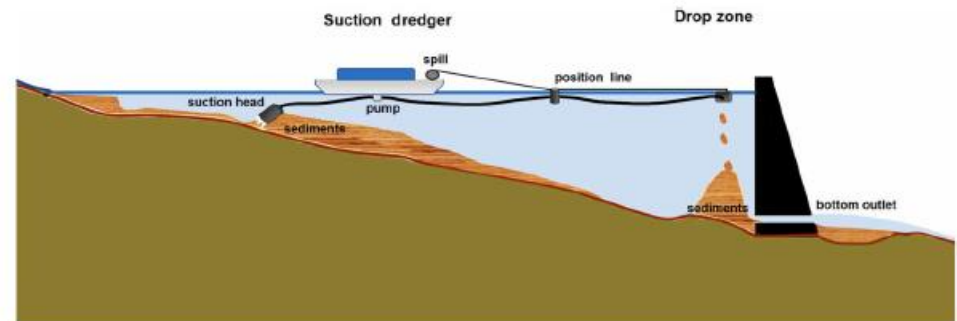


Fig. 8. Hydraulic pumping system to remove accumulated sediments from reservoir tails into the bottom outlet of the dam, in order to be flushed downstream of the dam (Bartelt *et al.*, 2012).

The evolution of river Ruecas (Guadiana basin)

Channel narrowing & incision

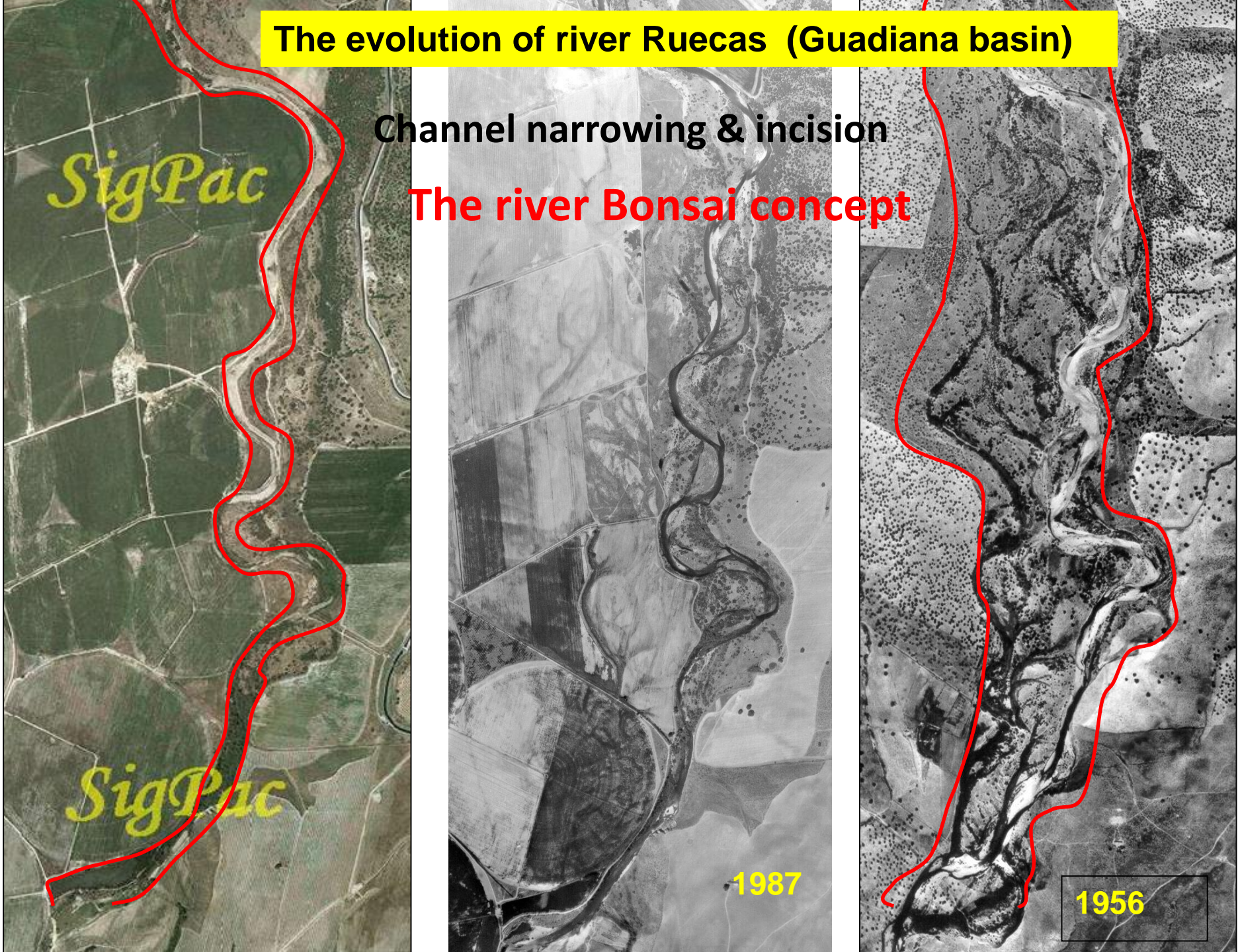
The river Bonsai concept

SigPac

SigPac

1987

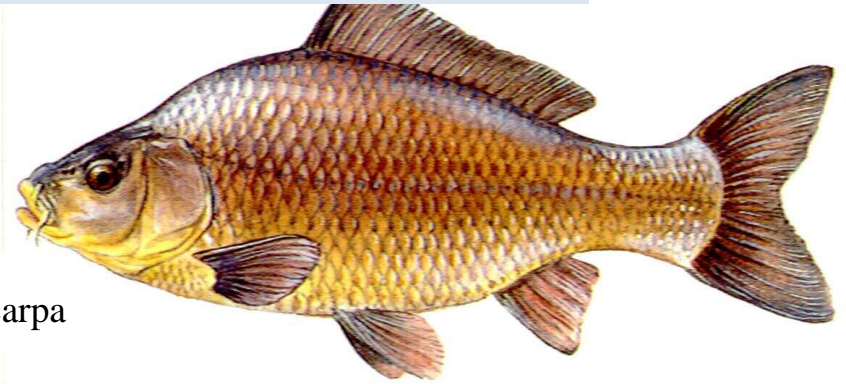
1956



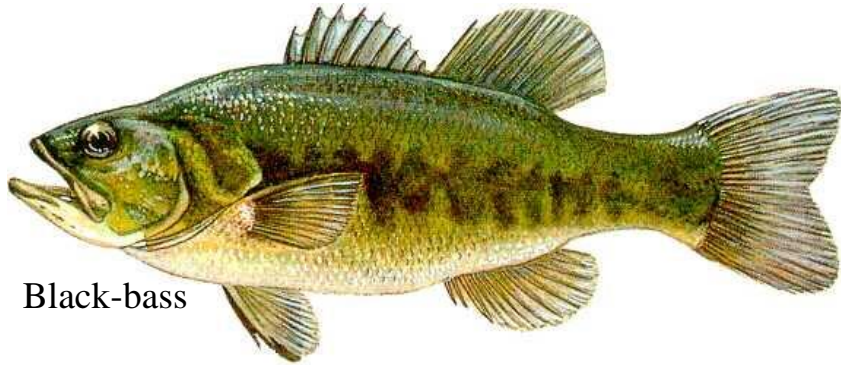
Introduced species become dominant



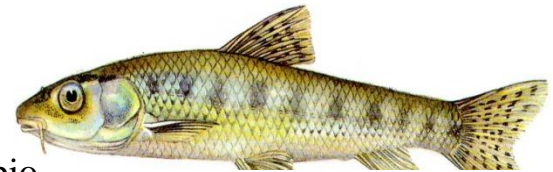
carpin



carpa



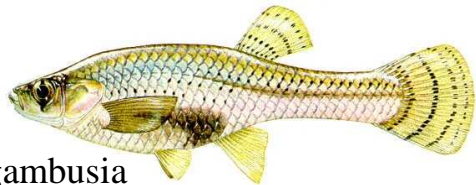
Black-bass



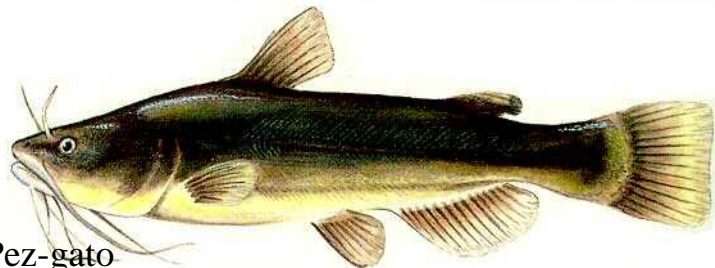
gobio



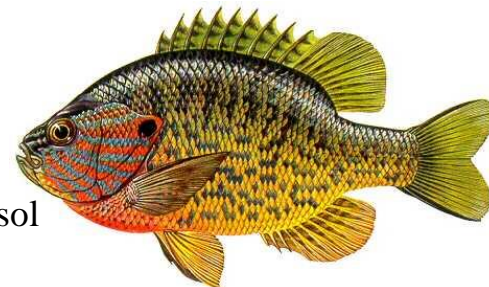
lucio



gambusia



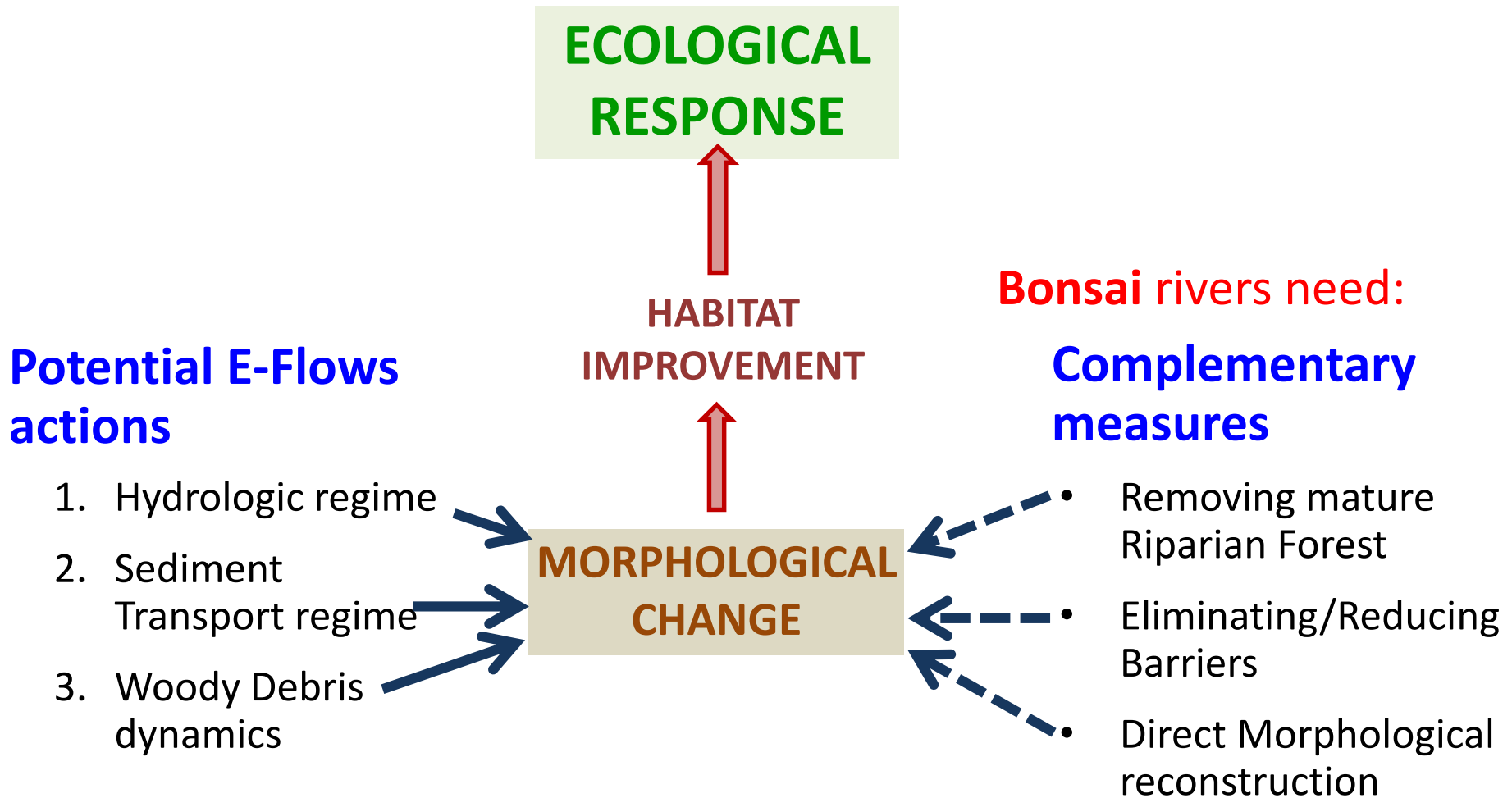
Pez-gato



Pez-sol

CONCLUSION

Restoring present Mediterranean rivers needs to adopt a new E-Flows template



A wide-angle photograph of a massive concrete dam spanning a valley. The dam is a long, grey structure with several spillways. In the foreground, there's a road and some greenery. The background shows rolling hills and mountains under a blue sky with light clouds. The text 'Thank you for your attention' is overlaid in a large, blue, 3D-style font.

**Thank you for
your attention**