



8<sup>th</sup>  
World Water  
Forum

Brasília-Brazil  
2018



# L' Albufera of Valencia and the Tancat de la Pipa, a constructed wetland

8<sup>th</sup> WORLD WATER FORUM | BRASÍLIA-BRASIL, MARCH 18-23, 2018

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# L'Albufera, its origin

- A wetland heavily modified by man:
  - Originally an open sea bay.
  - Transformation: seawater → freshwater.
  - Silting process (XIX-XX), accelerated by man.
- Currently:
  - 14.000 ha of rice fields, 5.200 ha of “Tancats” and 2.800 ha of lake.



# Environmental crisis in the 70's



Industrial development



Urban growth



Changing agricultural practices

- Great changes in the quality of the water
- Reduction of habitats
- Loss of biodiversity

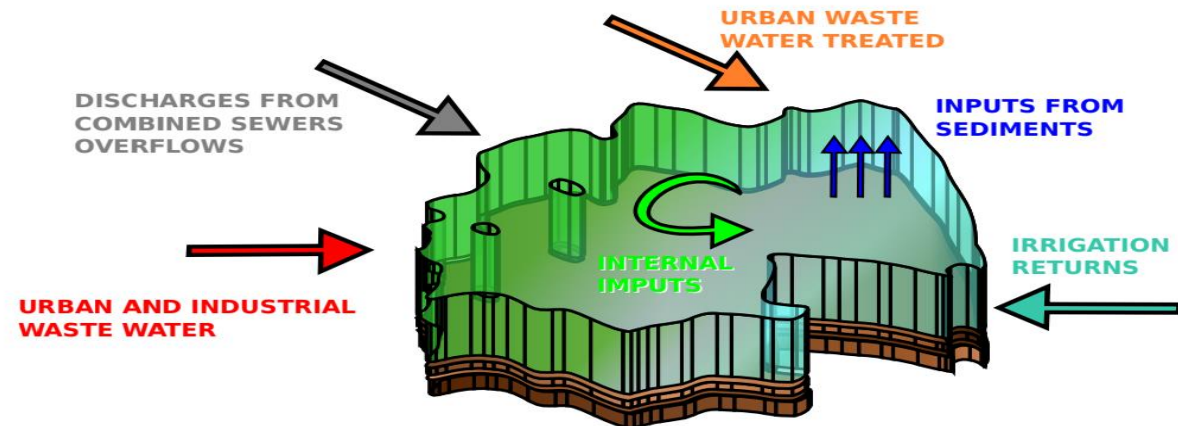
## Eutrophication



## THE PROBLEM OF L'ALBUFERA

- Today l'Albufera is considered hipereutrophic, for its high nutrient concentrations and phytoplankton, being far of achieving the good ecological potential.
- Nevertheless, l'Albufera of Valencia is one of the most important wetlands in the Mediterranean, and the third of the Iberian Peninsula.

What is the cause of this change in water quality?



# Current sources of water



Irrigation returns



Wastewater treatment plants



Ephemeral streams

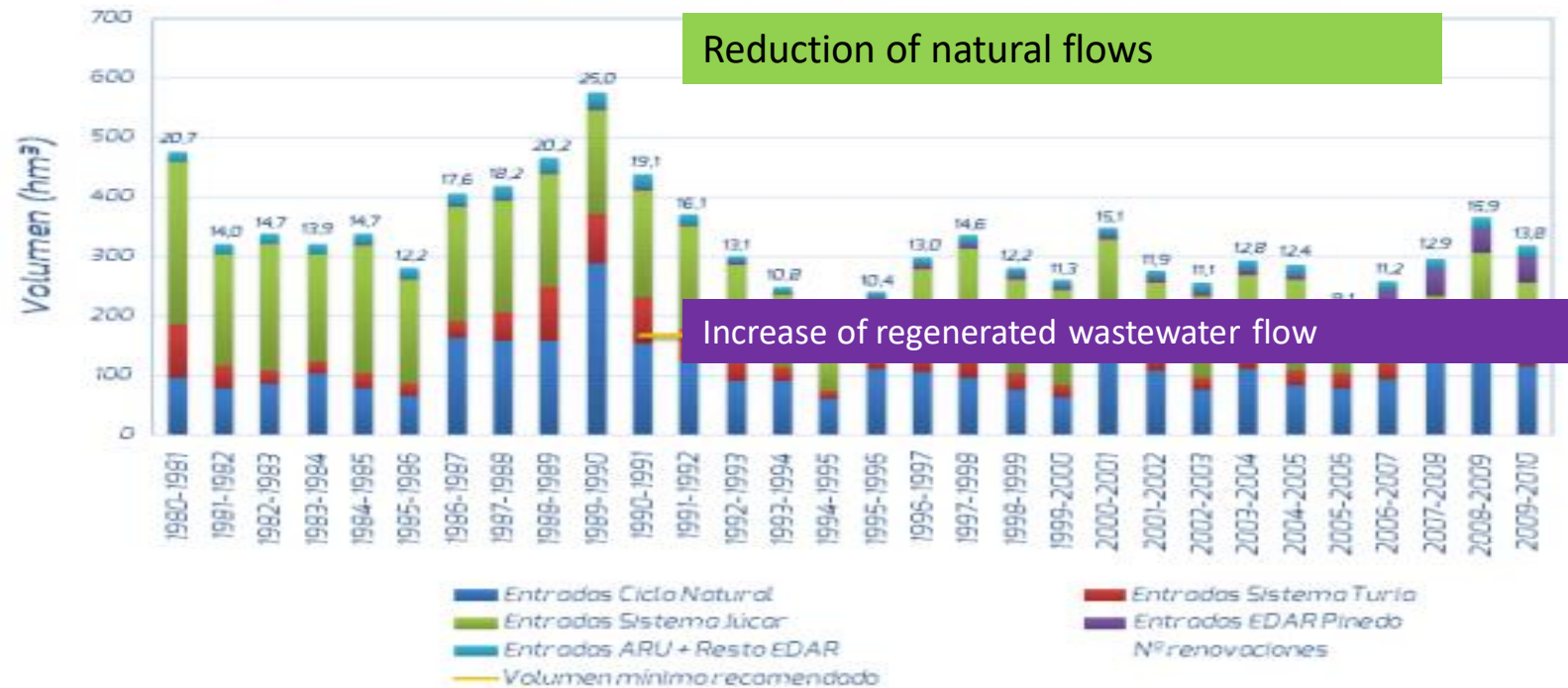


Springs



## Sources of water inflows to Albufera Lake

*Procedencia de las aguas de entrada a l'Albufera*



Source: Confederación Hidrográfica del Júcar

# Habitat

## Great environmental value:

- Predominantly rice fields (irregular habitat)
- Springs, dunes, Mediterranean forest, salt marshes,...
- Wide biodiversity linked to habitats (water birds, etc.)
- Degradation and loss of these habitats
- Environmental remediation projects



# Birds

- A key area for birds.
- The birds depend directly on ecological health of the habitat.
- Resting area on the migration route.





# l'Albufera, protected environment

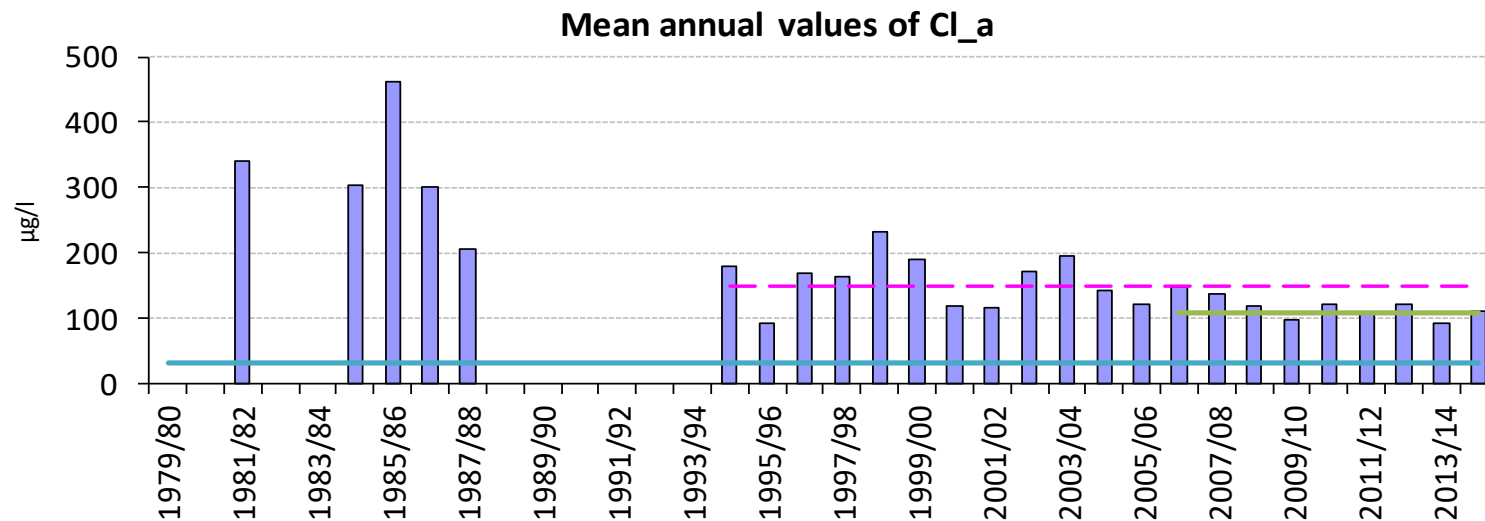
- Declared **Natural Park** in 1986
- **Ramsar site** since 1989 (wetland of international importance)
- Subject to the regulations of the European Union:
  - **Water Framework Directive, Habitat and Birds Directives**
- Natural area included in the **Natura 2000** network.

• **The current ecological status is far from its optimum.**

• **What is being done?**

# Achieving good ecological potential

- Difficulty to reach the good ecological potential (30  $\mu\text{g} / \text{l}$  Chlorophyll a) in the lake of L'Albufera in the short and medium term.
- In the regulations of the Júcar River Basin Management Plan, objectives are established for Chlorophyll a: 90  $\mu\text{g} / \text{l}$  in 2021 and 30  $\mu\text{g} / \text{l}$  in 2027.



# Minimum water requirements and reduction in Phosphorus discharge

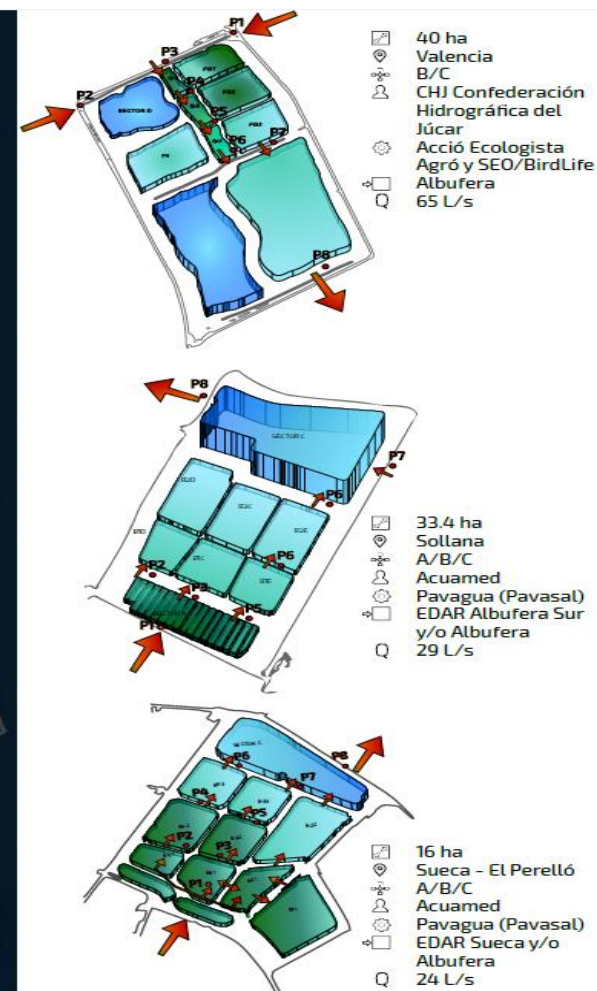
- In the current Júcar River Basin Management Plan (approved by RD 1/2016), the minimum water requirements of the lake are set at **210 hm<sup>3</sup> / year** (percentile 90% of the inflows to the lake).
- The series of contributions to the lake has been estimated using a balance model for l' Albufera, built on Aquatool (UPV) and calibrated with data from the control network.

# Achieving good ecological potential: reduction in Phosphorus discharge

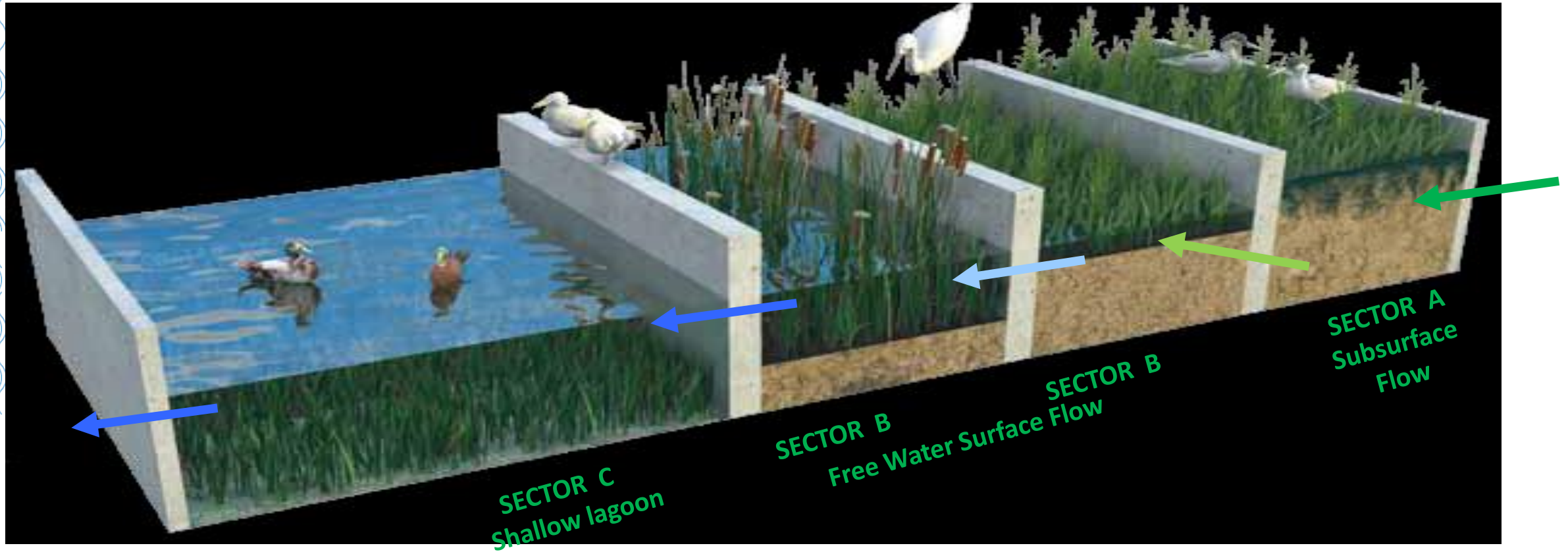
The regulations of the Júcar RBMP establishes that within the scope of the l'Albufera Natural Park of Valencia, the discharges from urban wastewater treatment plants greater than 2,000 equivalent inhabitants must comply with values lower than 0,6 mg/l Total Phosphorus annual average concentration

## PROGRAMME OF MEASURES of Júcar River Basin Management Plan

- Control of external loads (construction of waste water treatment plants, enlargement of sanitation systems, etc.).
- Control of internal loads: water treatment by constructed wetlands.



# Constructed Wetlands



# Constructed Wetlands

These constructed wetlands serve several functions:

- improving water quality,
- restoring lost habitats in the Natural Park and enhancing biodiversity;
- as well as providing space for public use.

# Constructed Wetland Tancat de la Pipa



**Area: 40 ha (Valencia)**

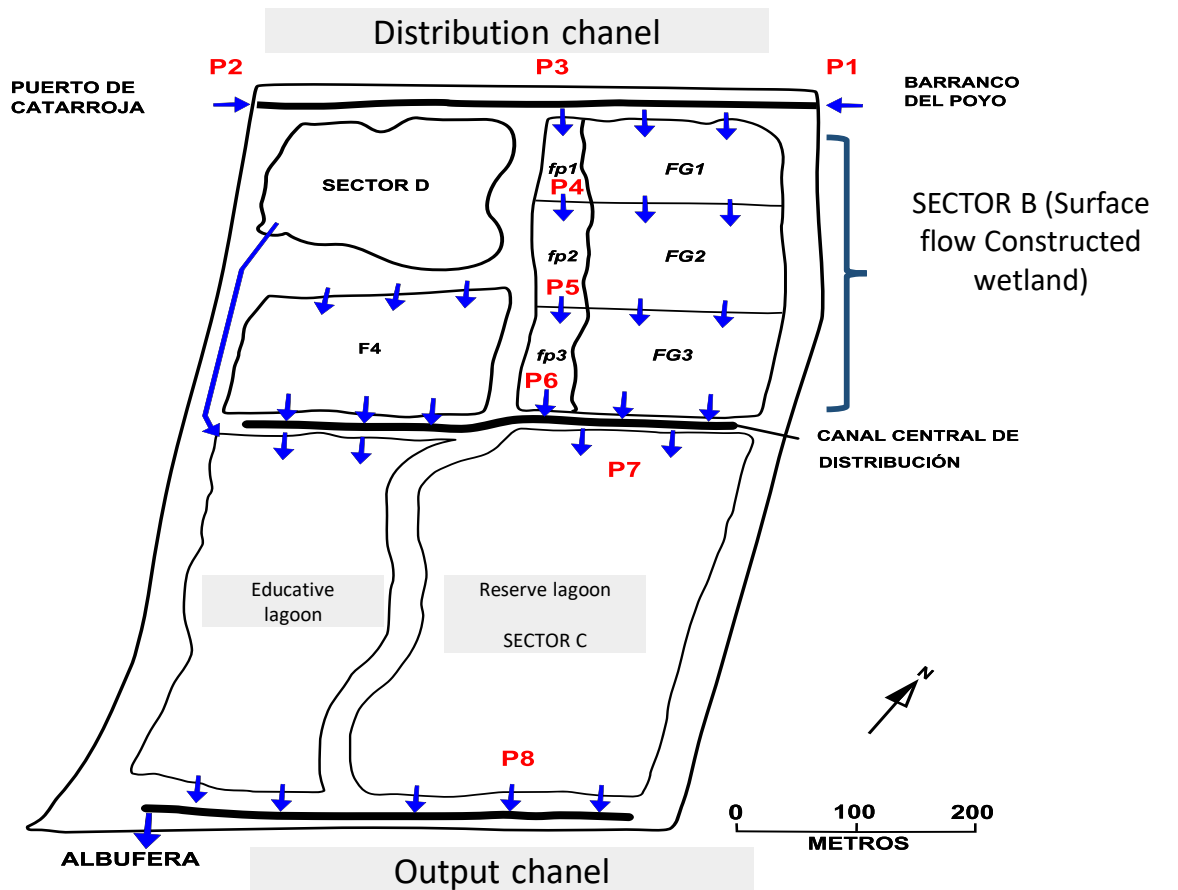
Sector B (surface flow), C (lagoon)

**Owner:** CHJ Confederación Hidrográfica del Júcar

**NGO:** Acció Ecologista Agró and SEO/BirdLife, through stewardship agreements.

**Water comes from:** Albufera

**Flow:** 65 L/s (5600 m<sup>3</sup>/d)

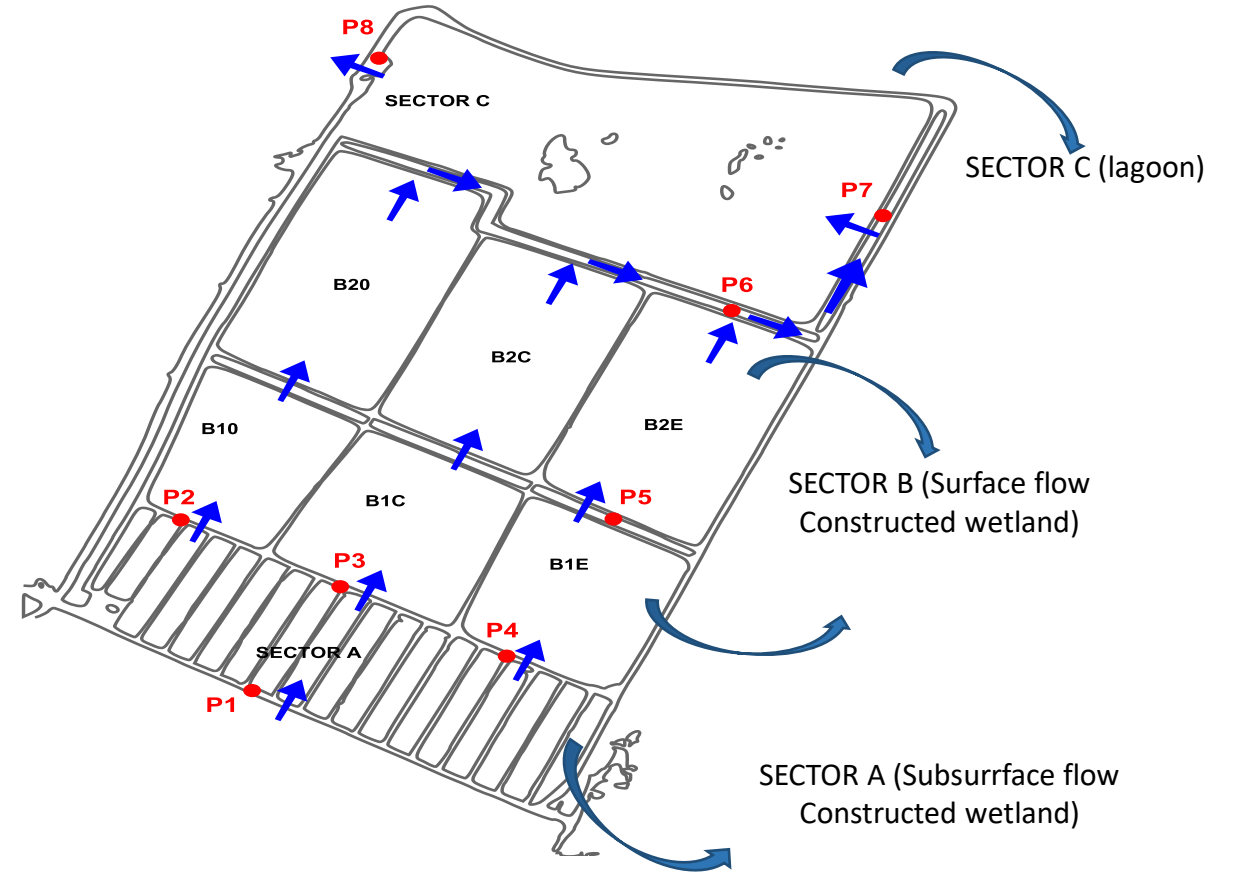




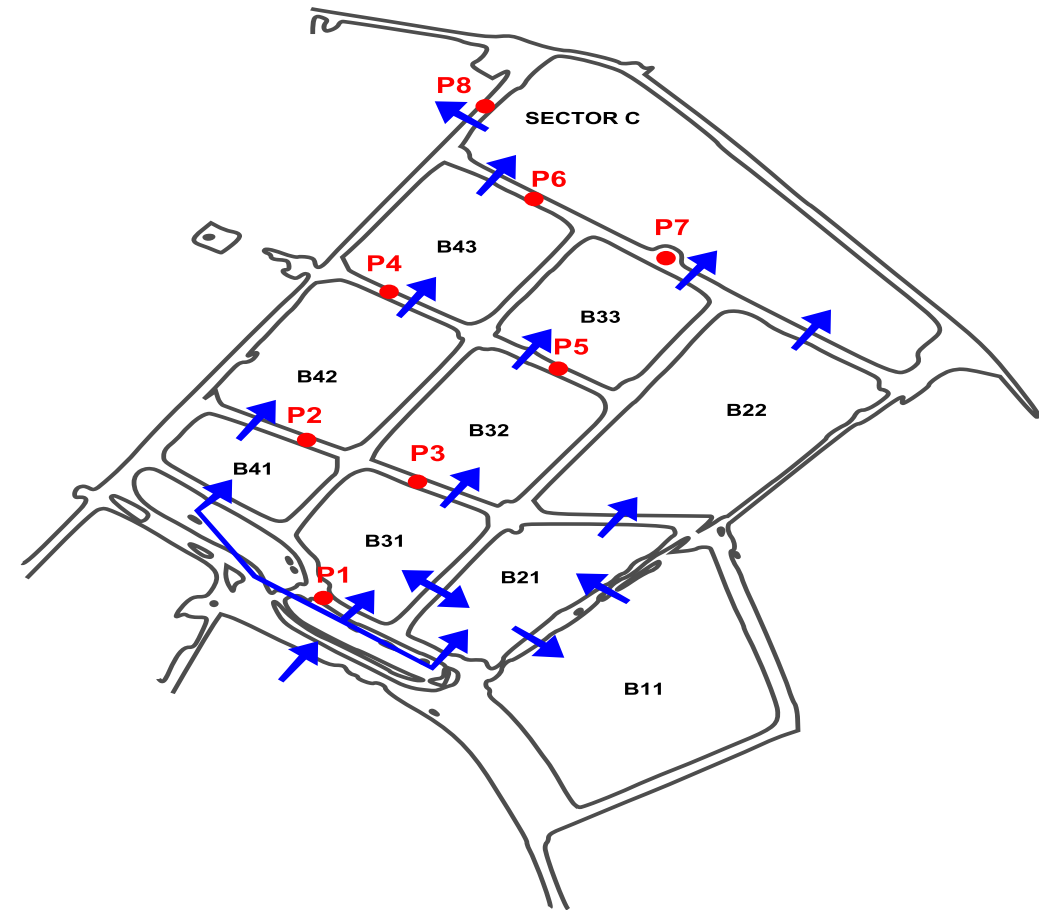
# Constructed Wetland Tancat de Milia



**Area:** 33,4 ha (Sollana)  
**Sectors:** A (subsurface flow), B (surface flow), C (lagoon)  
**Owner:** Acuamed  
**NGO:** Fundación Global Nature  
**Water comes from:** WWTP Albufera Sur and/or Albufera  
**Flow:** 29 L/s (2500 m<sup>3</sup>/d)



## Constructed Wetland Tancat de l'Illa



**Area:** 16 ha (Perelló)  
 Sectors A (subsurface flow), B (surface flow), C (lagoon)  
**Owner:** Acuamed  
**NGO:** Fundación Global Nature  
**Water comes from:** WWTP Sueca and/or Albufera  
**Flow:** 24 L/s (2000 m<sup>3</sup>/d)

- Hydrological planning is contributing to unifying efforts between administrations to recover the lake's status.
- Artificial wetlands help to the recover of the status, not only by improving water quality, but also by recovering spaces to regenerate habitats and by promoting public use.
- The participation of land stewardship entities reduces the effort of public administrations in managing these spaces and facilitates the contribution of external financing.



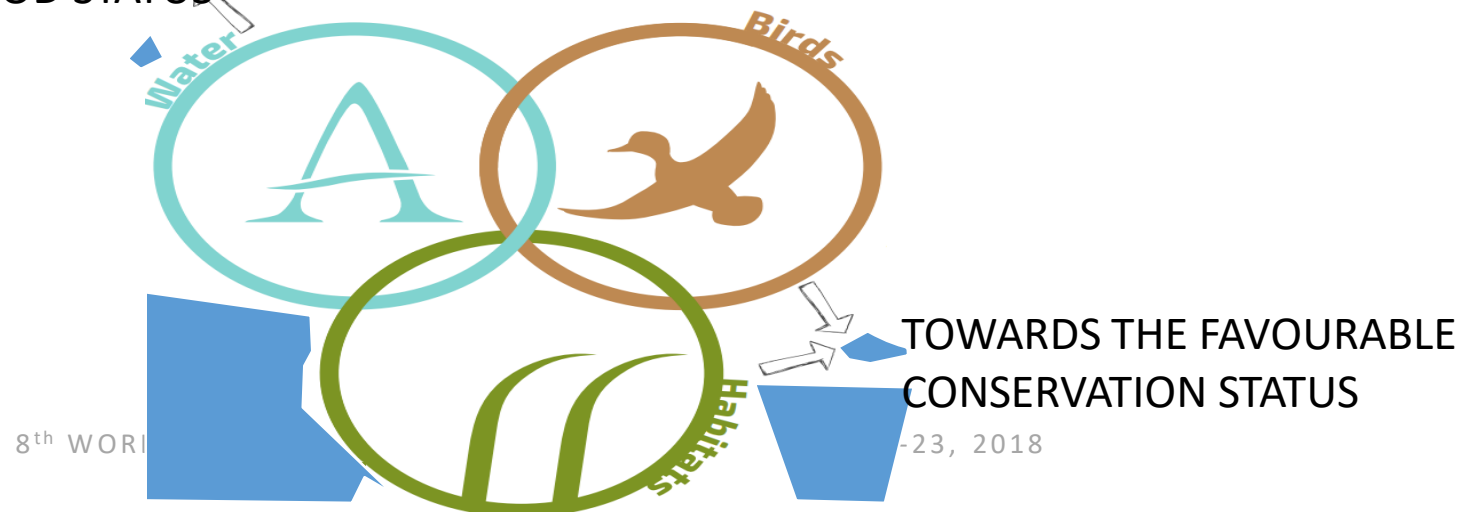
LIFE12 ENV/ES/000685 ALBUFERA

Integrated management of three constructed wetlands in compliance with the Water Framework, Birds and Habitats Directives

## OBJECTIVES OF THE PROJECT:

- Establishing the most adequate management rules in artificial wetlands in order to jointly optimize water quality and habitat and biodiversity improvement, according to the implementation of the Water, Habitats and Bird Directives.
- Proving that the joint management of the three artificial wetlands contributes to improve water quality and biodiversity in the Albufera.
- Establishing a methodology to determine good status indicators for bird conservation to apply in other Natura 2000 wetlands.
- Providing recommendations addressed to the competent administrations to set a basis in the development of management plans for Natura 2000 areas and hydrological management plans.

TOWARDS THE GOOD STATUS  
OF WATER



# RESULTS - WATER

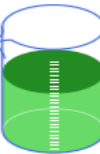


It has been shown that in the range of the hydraulic loading rates (HLR) tested (0005-0150 m<sup>3</sup> / m<sup>2</sup> / d), the improvement of quality of water in their physicochemical and planktonic aspects is evident.



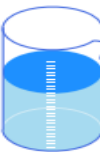
## Input (green glass, left of photo):

- Chlorophyll *a* (Chl *a*) = 80 µg/L
- Suspended solids (TSS) = 46 mg/L
- Total phosphorus (TP) = 0.27 mg/L
- Total nitrogen (TN) = 3.8 mg/L



## Output (transparent glass, right of photo):

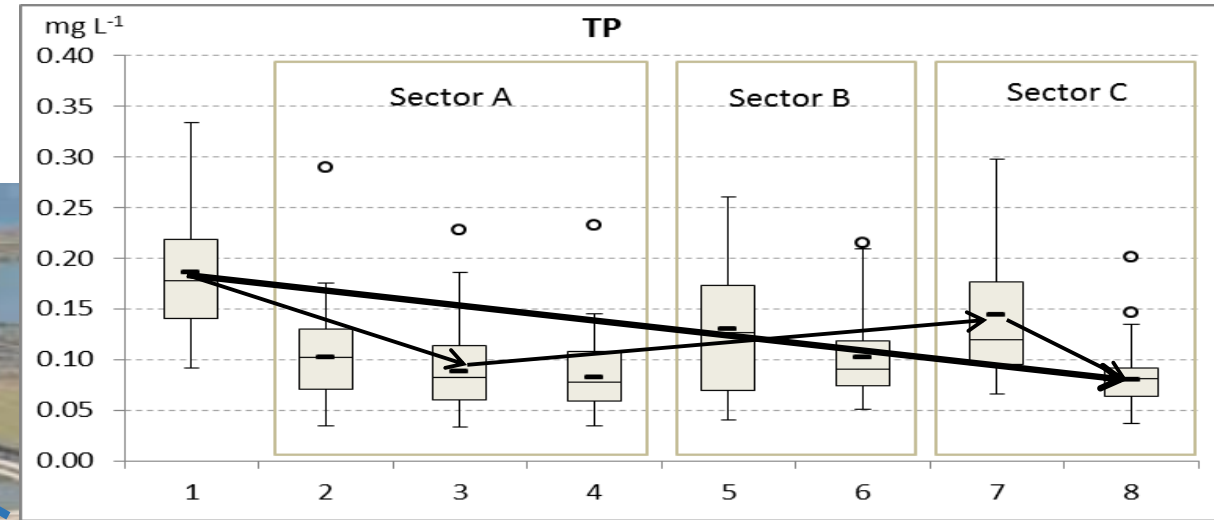
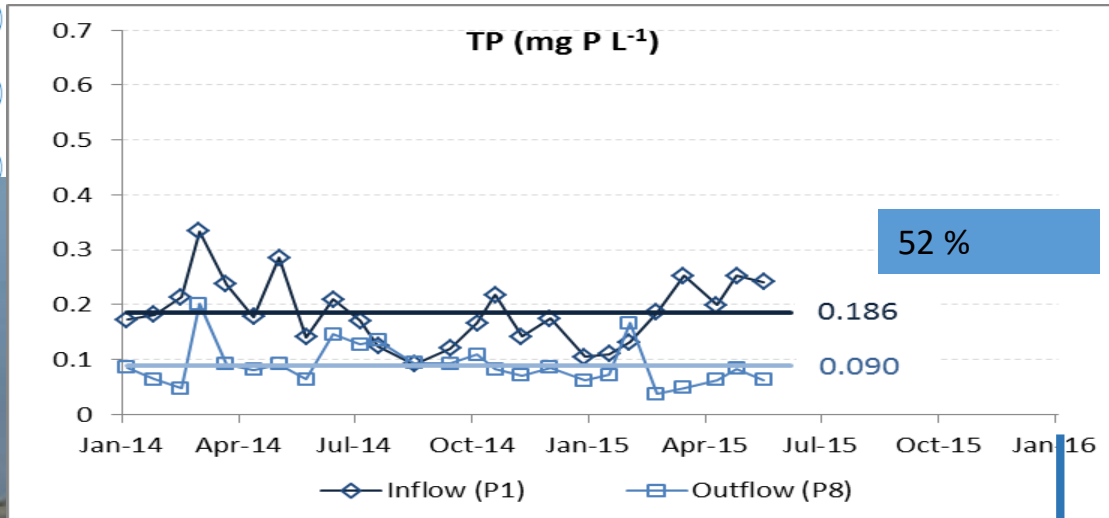
- Chlorophyll *a* (Chl *a*) = 27 µg/L
- Suspended solids (TSS) = 32 mg/L
- Total phosphorus (TP) = 0.15 mg/L
- Total nitrogen (TN) = 1.7 mg/L



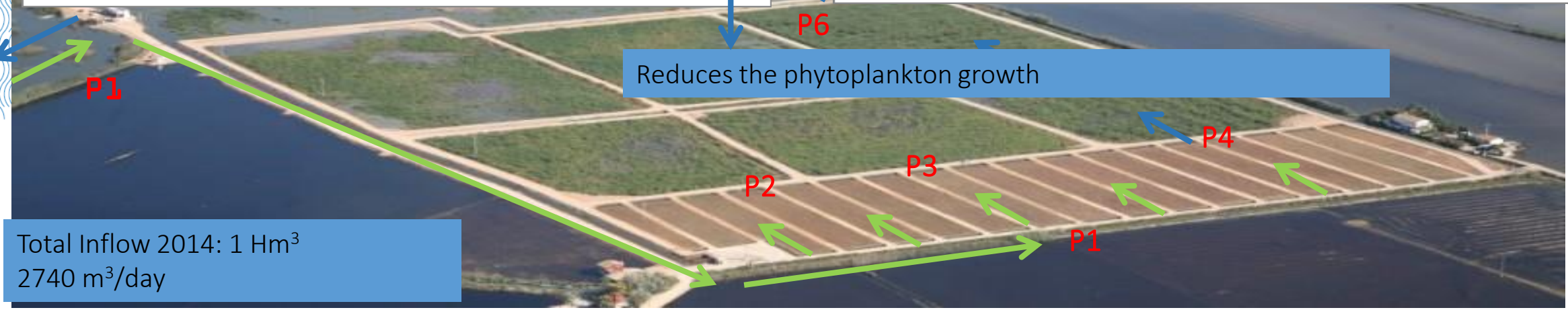
Subsurface flow sectors have very good results in all the variables studied, including the Chemical Oxygen Demand (COD). Surface flow sectors work efficiently removing suspended matter and nutrients, if they have high vegetation cover, but exported organic matter.

# Water quality results

## Total Phosphorus



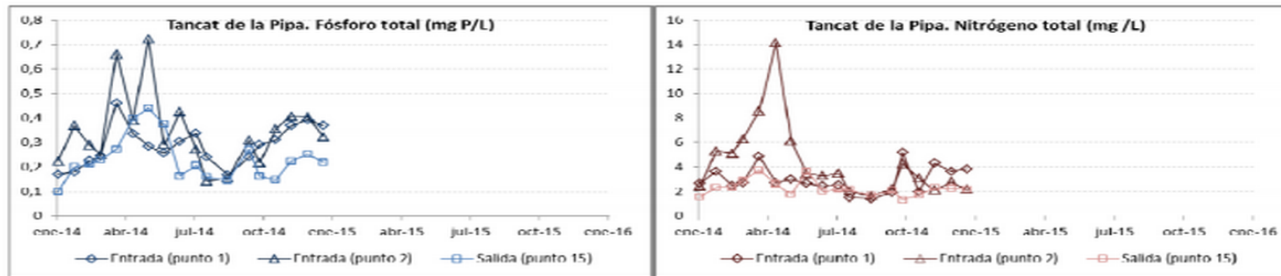
Reduces the phytoplankton growth



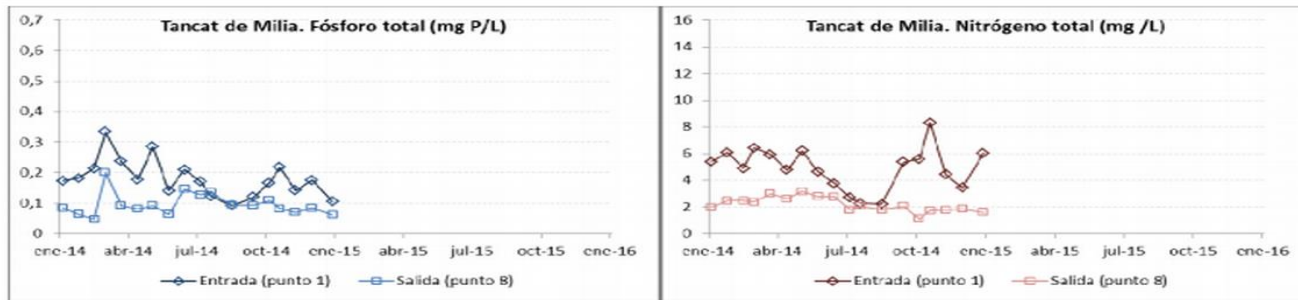
Total Inflow 2014: 1 Hm<sup>3</sup>  
 2740 m<sup>3</sup>/day

# WQ online results

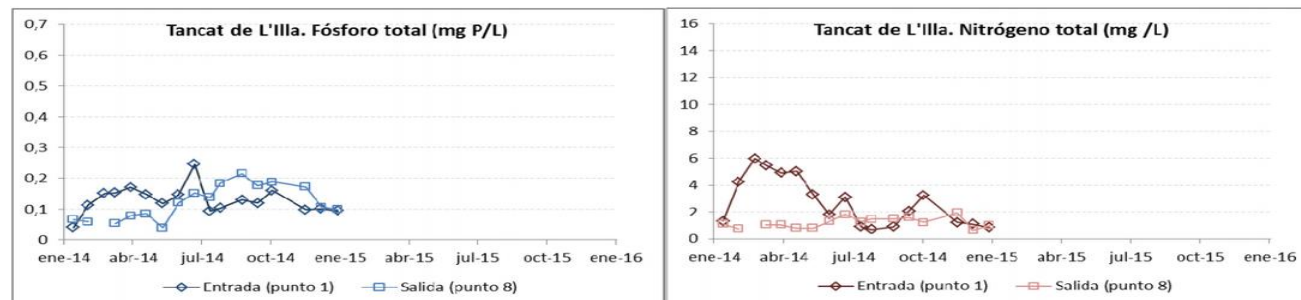
## TANCAT DE LA PIPA (Entradas y P15)



## TANCAT DE MILIA



## TANCAT DE L'ILLA

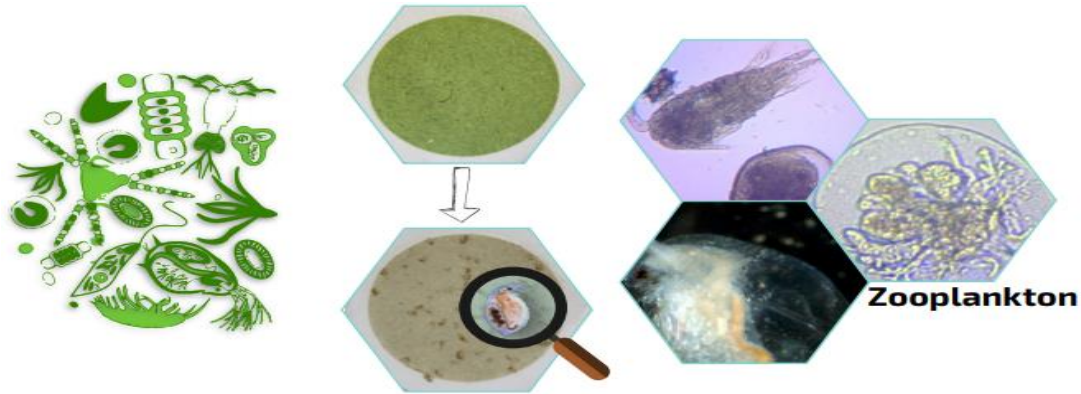


[www.lifealbufera.org](http://www.lifealbufera.org)

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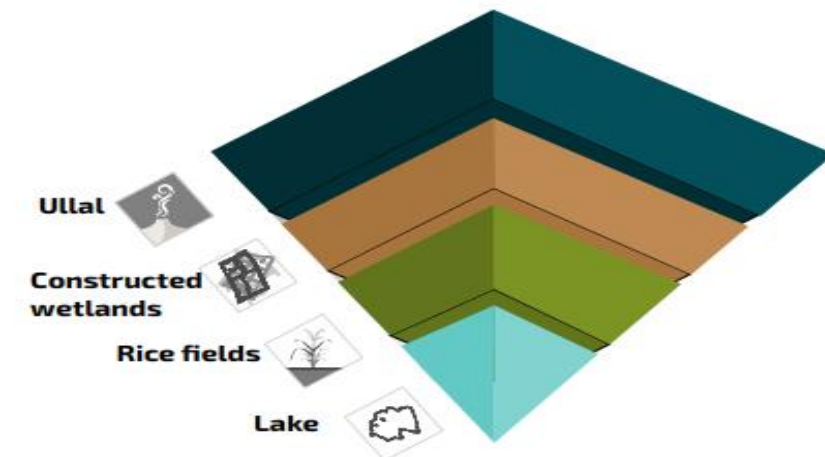


## RESULTS - WATER



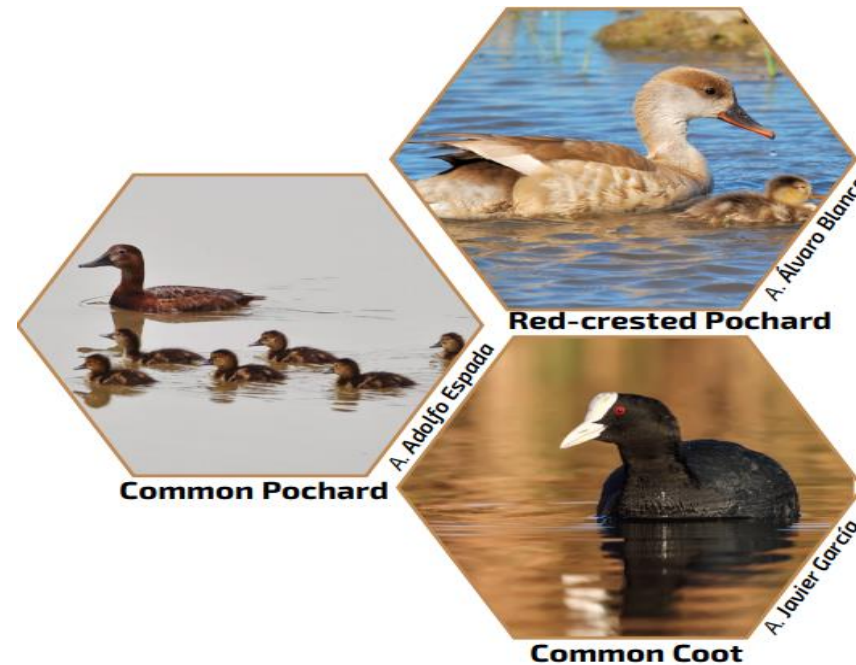
Zooplankton concentration increases as it passes through the constructed wetlands, especially in those more vegetated. In addition, the zooplankton organisms that more increase are big filter feeders, as the water flea (*Daphnia magna*). This result is highly positive since we are returning to the lake clear water and full of filter feeders that play an important role within the lake.

Quality indices of macroinvertebrates indicate that constructed wetlands have an environmental quality that could be below that of Ullal Baldoví but better than the lake or the rice fields.



## RESULTS - BIRDS

For those species linked directly or indirectly to the good water quality in this space, such as red-crested pochards, common coot or common pochard, with high FRV of the conservation status of population size, the constructed wetlands help to increase productivity, initial survival, rate of recruitment of young birds to adult fraction of the population and act as refuge over the loss of habitat in the vicinity of the lake, and especially draw lessons to apply to the rest of the SPA. These results contribute to the fulfillment of the objectives of the Water Framework Directive (WFD) and the Birds Directive.



# RESULTS - VEGETATION

## HELOPHYTE VEGETATION

**Plantations.** Monoculture had higher survival, especially yellow lily, which has shown a high resistance to predation. Although other plant species have had a lower survival and / or slower growth, it is considered important to bet on creating systems with plant diversity.

**Substrate treatment.** From the tests performed drying, puddling and tilling, it can be concluded that the most advantageous treatment is drying.

**Harvest.** Project experience indicates that the best time to run the mowing is the end of winter.

## SUBMERGED VEGETATION

Planting in protective enclosures -4 m<sup>2</sup> - medium sized and subsequent scaling up to 30 m<sup>2</sup> - has been a very effective technique, but also laborious. Among the factors that determine the viability of the plantations are the water transparency -greater success with more transparent water- and a very careful maintenance of protective fences to minimize the entry of predators (fish and birds). The more successful species have been *Myriophyllum spicatum*, *Ceratophyllum demersum*, *Potamogeton pectinatus* and *Zannichelia peltata*, reaching 100% colonization of the protected surface. It has been proven a direct link between the treatment of substrate (dried) and the withdrawal of fish with vegetation growth, both within the enclosures as spontaneous.

# GLOBAL RECOMMENDATIONS

## Management recommendations in the constructed wetlands:

- Operating at hydraulic loading rates between 0.05 and 0.15 m<sup>3</sup> /m<sup>2</sup>/d, from the lake and/or irrigation ditches. Working in the high range maximizes nutrient removal and favors the presence of species of interest, such as red-crested pochard and coots.
- Promote the diversity of depths to favor species with different requirements, always keeping some cells with 20- 30 cm, and others with 30-50 cm in which the herbivorous pressure by purple swamphen is reduced.
  - Establishing zones with different degrees of helphyte vegetation cover improves water quality and favors species of interest; increasing the border of vegetation in the lagoons favors red-crested pochard and common coots.
  - Increase the coverage of submerged macrophytes, because of its importance for species linked to water quality.
  - Install systems for excluding ichthyofauna of large sizes.
- To keep water monitoring programs, habitats and birds, to assess the achievement of the objectives of improving the conservation status and generate early warnings of threats.
  - Continue with the model of participatory management, with the participation of universities, NGOs, governments and local actors.
  - Carry on the opening of constructed wetlands to the public through communication activities and public use.

# GLOBAL RECOMMENDATIONS

## **Recommendations for improving the conservation status of l'Albufera:**

- Increase the area of marshy vegetation on the border of the lake, for example by creating new artificial wetlands, providing surfaces both with emergent vegetation (surface flow constructed wetlands with a variety of depths) and with dry substrate associated formations (e.g. by creating islands, alterons or subsurface flow constructed wetlands). It is estimated that an area of about 200 hectares could provide significant improvements in the status of the lake. This undoubtedly would improve the quality of a greater volume of water, the initial productivity of the birds, their survival rate and recruitment of youth to adult fraction, while reducing intraspecific competition and predation rate among species .
- Create specific feeding areas for herons and purple swamphen in the channels of the constructed wetlands, thus improving their conservation status and reducing the pressure on other elements of the constructed wetlands.
- Establish indicators of management objectives and maintain monitoring systems to assess the achievement of management objectives.
- Generate a coordination committee among the reserve areas of l'Albufera, favoring the integration of management objectives defined in the constructed wetlands for compliance with the environmental objectives of the Natura 2000 network and the Water Framework Directive in l'Albufera.

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# Thank you very much for your attention!!!

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