

Dune and pool restoration in Cortadura Beach (SW Spain)

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Abstract

Extensive Spanish dune areas were totally altered due to massive littoral building projects during the 1960's. After the 1988 Spanish Shore Act, the Coastal Authority, Ministry of Environmental Protection, has been aware of the problem and has undertaken a strong policy of dune restoration. Amongst the present experiences, the restoration of "La Gallega" – a fresh water pond - and the surrounding dunes should be highlighted.

Techniques developed for a sustainable management (definition of land uses, restriction of vehicle access, cleaning of the area, installation of facilities for the visitors, impermeabilization, sand trapping, revegetation, environmental information, etc.) are explained. The cost of all the units involved in the project, as well as the measures taken into account to get the different authorities involved in coastal zone management (National and Regional Governments, Municipalities, Army, etc.) to an agreement were also important.

Furthermore, other complementary actions, carried out to guarantee a minimum level of fresh water at the pond and to improve its water quality, will increase the biodiversity by achieving the recovery of some protected species of amphibians like *Pleurodeles walt* and *Pelobates cultripes*. Finally, a monitoring campaign will be carried out in order to check the suitability of the former activities.

1. INTRODUCTION

The environmental restoration of dune systems has been taken into account along the Spanish coast since 1990 due to its importance as an integral part of a dynamic cycle in which sand is constantly exchanged. Dunes contribute, during high energy storms, to the formation of submerged sandbars, which dissipate wave energy by breaking. Later, swell returns sand from offshore bars to the beach. So, a natural, cheap and efficient defencing system against shore erosion is achieved (Gomez-Pina et al., 2002).

Amongst these performances, the restoration of "La Gallega" is herein highlighted due to the scarce duration of wet episodes in a freshwater pond (where some protected species of amphibians live), and the solutions designed to solve this problem.

2. STUDY AREA

2.1 Location and characteristics

"La Gallega" is a narrow fresh water pond located at the isthmus of Cadiz, between the main road and the dune system, facing the Atlantic Ocean (Fig.1). Its maximum dimensions are 250 meters long and 50 meters wide, decreasing as the water level goes down.

Rain water is percolated through sand dunes to the clayish bottom of the pond. At least, two species of strictly protected amphibians (BOE,

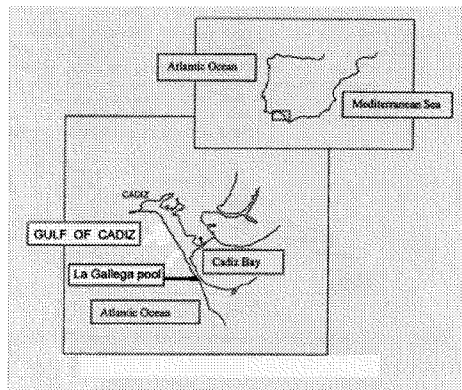


Figure 1: Location of "La Gallega" pool.

1980; Blanco and Gonzalez, 1992) inhabitate the lagoon: the *Pleurodeles walt* (a kind of endemic newt) and the *Pelobates cultripes* (a small frog).

2.2 Environmental concerns

The lagoon becomes an oasis for these animals and their only place for breeding. Regrettably, wet episodes are not too long in the south of Spain (Fig.2). Moreover, sun and wind increase the evaporation rate, making the water level decrease very fast. As a consequence, only adults can survive by digging themselves into the dunes looking for a humid atmosphere where to wait for

the next raining season. Tadpoles and larvae will die.

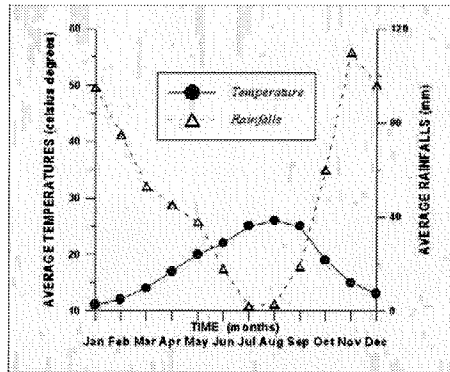


Figure 2: Average temperature (celsius degrees) and rainfalls (mm) at Bay of Cadiz .

Furthermore, the construction of a collector for sewage waters has increased the permeability of the bottom, making the lagoon unable to keep the water in (Fig. 3).

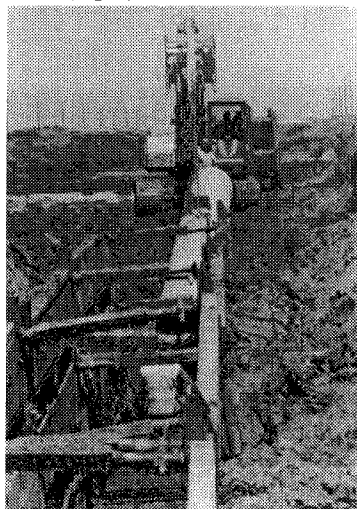


Figure 3: Backhoe places the sewage water collector and mixes sand and clay strata.

3. ACTIONS DEVELOPED

In order to avoid this biodiversity losing process, the Coastal Department has designed some actions which have just started.

The main work is related to the restoration of the impermeabilization by laying a new stratus of clay. An underground cistern will be built to provide fresh water in case of occasional drought episodes. Thus, tadpoles and larvae will be able to become into adults.

Other complementary tasks, as ordering of land uses and vehicle access, cleaning of the area as well as providing facilities for the visitors, will be carried out. For a more detailed explanation of these standard performances (design of a perimeter fence, information signs and posters, etc.), Muñoz-Perez et al. (2000) should be consulted.

Furthermore, installation of willow fences (which reduce wind speed and, therefore, produce the deposition of sand) and plantation of *Ammophila arenaria* (Ramirez et al., 1998) will contribute to the stability of the dune system

Budget (VAT not included) is about 330.000 euros, and works will be finished in 5 months. The investment will be payed with European Funds by the Federal Coastal Department. On the other hand, local and autononical authorities agreed to be in charge of the maintenance tasks and costs.

4. CONCLUSIONS

A project for the restoration of the impermeability of a pond and the construction of an underground cistern, which will provide fresh water when drought episodes occur, has been designed into a dune system in the Gulf of Cadiz.

This actions will help to two species of protected amphibians to breed and develop. A monitoring program to know the usefulness of this new methodology is being carried out.

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