Erosion policy options for the Costa da Caparica - PT

1. Policy Objective & Theme

- ADAPTATION TO RISK: Managing impacts of climate change and safeguarding resilience of coasts/coastal systems
- ADAPTATION TO RISK: Preventing and managing natural hazards and technological (human-made) hazards

2. Key Approaches

- Knowledge-based
- Ecosystems based approach
- Socio-economic
- Technical

3. Experiences that can be exchanged

The different policy options that are available for eroding coastlines that are heavily used as a tourist attraction.

4. Overview of the case

Coastal erosion is a serious problem south of the Tagus river mouth opposite Lisbon. A series of anti-erosion measures have been taken over the last fifty years. The case looks at the options that have been taken and what measures are now needed to try and stabilise this vulnerable region.

5. Context and Objectives

a) Context

The area is located in the southern region of the Tagus river mouth and to the north of Setúbal Peninsula between Cova do Vapor to the south of Costa da Caparica village, in the municipality of Almada. Millions of people use the Costa da Caparica beach during summer and the urban seafront re-development is included in a major national programme for urban areas. This coastal zone is a plain coast with an arc shape that represents the most important fossil cliff in Portugal. The cliff is protected from the sea by a considerable extension of sand. The Portuguese coast has, in general, a high population in relation to the rest of the territory and Almada municipality is no exception, exacerbated by its proximity to the capital city, Lisbon with its 3 million inhabitants. Coastal erosion is a very serious problem and probably will increase as a response to the continuous weakening of the river sediment sources, the dredging works, the mean sea-level rise, the waterfront human settlement, the changing of the morpho-dynamics pattern and other causes. These erosion events, together with insufficient coastal management plans increase the vulnerability risk and the need for protection against coastline retreat, overtopping, flooding and infrastructure destruction.

There are records of erosion in Costa do Vapor dating from 1947, reaching Costa da Caparica village in 1958. The first defence work, a groyne, was constructed in 1959 and a second added in 1962 followed by a third and a sea-wall a year later. These works were intended to constitute a hard nucleus to hold the coastline. In 1959, a dyke was also built on the south side (between Cova do Vapor and Costa da Caparica) with the aim of avoiding sea flooding during storms which over-washed the existent dunes. Nonetheless, in 1964, the central area of Costa da Caparica was seriously flooded. The dyke was re-inforced and a further small groyne was constructed. Between 1968 - 1971 the three groynes of Cova do Vapor were enlarged. Between 1972 - 2000, the coastline was more or less stable. However, the persistent winter of 2000/2001 demonstrated that this area is very unstable and vulnerable. In Costa da Caparica, after this winter, a great part of the groyne sea defences were damaged, there was no sand on the beaches and the beaches stayed partially under water at high tide.

b) Objectives

The main objective was to determine the best policy option for this stretch of coastline. Urban pressure and erosion lead to particular difficulties concerning the management of the area and few studies have been done on these types of impacts in Portugal.

6. Implementation of the ICZM Approach (i.e. management, tools, resources)

a) Management

The Instituto de Hidráulica e Recursos Hídricos (IHRH) was responsible for this work.

b) ICZM tools

The actual urban waterfront is defended by coastal structures that need maintenance and constant re-formulation with respect to the length of the groynes and the seawall crest. In such highly exposed areas, "soft" coastal defences are not effective. It is, therefore, not only necessary to adopt a “preventive” policy but also a “curative” one because of the severity of the present problems. The interventions in the defence works with artificial sand nourishment consist basically of:-

- Re-shaping of the existent groynes:
- Increasing the length of those that will have a “structural” role.
- Reducing the length of the ones that could be, in the medium-term, eliminated.
- These operations should be preferentially realized downdrift of the structures in the north or updrift of those in the south, in order to improve the capacity of sand retention.
- Reshaping the existent seawall.
- Recognising the vital importance of the seawall in terms of defence and the existence of alternatives such as a retreat of built waterfront (streets and buildings).
- Pathways and seaside road renovation.
- Proceeding with artificial sand nourishment using sand originating off-shore.
- Feeding the beaches updrift (south) of the groynes field of Costa da Caparica, between the groynes of Costa da Caparica and updrift (south) of S. João's beach.
- These deposit places should always be located updrift (south) of the areas to be nourished so that they will be modelled by the action of the sea and so moved to re-configure the beach. The dunes of S. João's beach will also benefit from this operation.

The medium-term (five-year) solution, in conjunction with artificial sand nourishment, will eliminate some intermediate groynes and will increase the length of those that will become the defence structure groynes. However, the destruction of some groynes will only be done if monitoring surveys demonstrate their inefficiency. The need to increase the length of the defence structure groynes, as well as their configuration, will be better assessed after monitoring. In addition, the need for constructing a breakwater should also be assessed after monitoring data within the next few years.

7. Cost and resources

No costs are available.

8. Effectiveness (i.e. were the foreseen goals/objectives of the work reached?)

The research into new coastal defence technical solutions and/or the improvement of the current ones should be promoted. However, it is not expected that more environmental and cost effective solutions will appear in the next years. This coast line is evolving, and if nothing is done or planned carefully, it is possible that in the future, important repercussions will occur. The urban area must be restricted to where over-wash and flooding risk are absent. It is not coherent to expand the construction of buildings or beach supports to areas where the risk of destruction is very high after building sea defences to protect these

infrastructures. In 2000/2001 severe and persistent sea actions occurred, where it was shown that the area is vulnerable and that the destruction of the sea defences is a possibility. It is essential to always remember that the area is very unstable, and there is a great probability of change with extreme physical dynamics. The capacity to forecast the medium and long-term beach evolution continues to be very limited due to scientific constraints. Apart from this limitation, the inadequacy of field data (namely topo-hydrographic studies) is a major obstacle for the quantification, understanding and forecasting of the phenomena. It is important to implement a monitoring plan capable of recording data, and to improve the understanding and comprehension of the dynamic processes in the area. The quantity of sand needed for artificial sand nourishment is very large (up to two million cubic meters), therefore, using just locally available amounts is out of the question (e.g. using ripping techniques as used in emergency interventions). The sand to be used will be from off-shore or sediments dredged for harbour maintenance, provided that it has the right quality for this purpose. It is important that the artificially introduced sand is similar to what is on the beach, in terms of size, colour and quality.

9. Success and Fail factors

This area is more or less in equilibrium after the groyne field construction in Costa da Caparica (1972) and three groyne expansions in Cova do Vapor (1968/1971). It is important to note the great urban expansion that occurred between 1972 and 1996, despite the fact that the coastal stretch was still vulnerable to storms, even with the coastal defence works. This expansion of the waterfront urban area could reach the adjacent area, provoking worsening and increasing effects of sea actions and risks. In the persistent winter of 2000/2001, the destruction of the beach-users' facilities improperly located above the primary dune in S. João beach occurred. This beach lost a great amount of sand and the dunes suffered an intense erosive process. The beach-user facilities must and will be relocated, but the beach and the dunes, according to the historical record and the recent dynamics, are unlikely to recover their profiles through only natural actions.

10. Unforeseen outcomes

The sea defences built in 1972 have had an important role in Costa da Caparica defence. The seawall was able to stop Costa da Caparica from flooding, but the now degraded groyne field was not able to recover the beach configuration. It is not rational to expand the construction of buildings or beach supports to areas where there is a high risk of destruction, after building sea defences to protect these infrastructures.

11. Prepared by

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12. Verified by

It has not been possible to verify this case.

13. Sources

- COVA DO VAPOR COSTA DA CAPARICA (PORTUGAL). EUROSION Case Study F. V. Gomes F. T. Pinto

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