

MORPHOLOGICAL EVOLUTION OF COVA-GALA: UPDATE WITH THE COSMO 2020 AND 2021 TOPO-BATHYMETRY

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ABSTRACT

The Mondego River mouth downdrift topo-bathymetric evolution is analysed based on the three latest COSMO monitoring programme surveys and on the March/2020 MOSAIC.pt research project topographic survey. The analysis accounts for the nourishment operations performed in Cova-Gala to partially restore the littoral drift captured by the river mouth jetties, and complements a previous analysis, for the 1975-2019 period, building upon the consolidated knowledge. The results highlight the vulnerability of the two southern cells of the groyne field and the short duration of the geotextile sand bags based dune protection solution.

Keywords: Topo-bathymetry; Monitoring; Morphodynamics; Erosion; Inundation.

1. INTRODUCTION

Cova-Gala, in the west coast of Portugal, is an urbanized maritime front threatened by erosion and wave overtopping. It is protected with a five groyne field and a backshore system of dunes and three seawalls (Figure 1a). The extension of the Mondego River mouth north jetty, in 2008-2010, triggered the updrift sand trapping. In 2007, the Port Authority started a nourishment plan of Cova-Gala. The sediments dredged from the river mouth are deposited between the 1st and 3rd groynes and the 2 and 8 m ZH bathymetric contours (Figure 1a). In 2018, dune erosion and overwash have escalated south of the 5th groyne. In response, during the first semester of 2019, the dune base was protected with geotextile sand bags, covered with 120x10³ m³ of sand. This work aims to update the morphological evolution analysis ended in 2019 (Oliveira *et al.*, 2021).

2. METHODOLOGY

Surveys of successive dates were compared, through surface mapping software, for the identification of erosion/accretion patterns and quantification of associated areas and volumes. They were: the topo-bathymetric COSMO monitoring programme surveys of August/2019, August/2020 and July/2021 (<https://cosmo.apambiente.pt/>); and the MOSAIC.pt research project topographic survey of 11/March/2020 (<http://mosaic.lnec.pt>).

3. RESULTS

The maps of the annual evolution (Figure 1, b and c) indicate that: i) the topo-bathymetry of the area compared, 4.6x10⁶ m², had annual variations, Δz , in the range 5 to 4 m; ii) the larger magnitude of accretion was verified in the first year in front of the groyne field, certainly due to the 580x10³ m³ nourishment operation, whereas the larger erosion, verified in the second year, occurred south of the 5th groyne, in an alongshore submerged trench; and iii) the balance erosion/accretion was 1105/1059x10³ m³ in 2019-2020 and 1186/1478x10³ m³ in 2020/2021, indicating that the nourishment operations performed in the beginning and end of the maritime winter (including the 230x10³ m³ estimated in 2020), provided an overall sediment equilibrium within the zone, despite the high fluxes involved.

The maps of the seasonal evolution (Figure 1, d and e) reveal that between August/2019 and March/2020, the central zone of the sector north of the 1st groyne is the least vulnerable to erosion, like in previous maritime winters (Oliveira *et al.*, 2021). The sector between groynes reveals accretion in the lower beach face in the two northern cells, likely with sediments from the nourishment interventions. South of the 5th groyne, high erosion is detected, despite the 120x103 m³ of sand locally deposited in the previous season. From March to August/2020 there was an overall accretion at the beach face except in the two southern cells. The erosion observed around the 1st groyne head was likely due to the spreading of the shoal deposits. However, these sediments neither benefited the two southern cells nor the sector south of the 5th groyne.

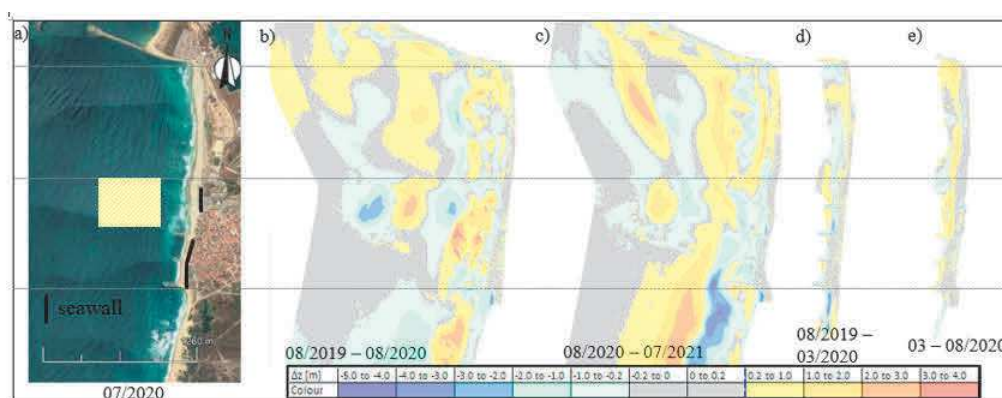


Figure 1. Cova-Gala coastal zone: dredged deposit location (a); and maps of the morphological differences, Δz , in 08/2019 - 08/2020 (b), 08/2020 - 07/2021 (c), 08/2019 - 03/2020 (d), and 03/2020 - 08/2020 (e).

4. CONCLUSIONS

The 2019-2021 topo-bathymetric evolution of Cova-Gala suggests that the nourishment interventions should be extended to the backshore and foreshore because, despite the overall benefit of the submerged nourishments, the cells between the 3rd and 5th groynes reveal insufficient profile recovery after the maritime winter, and the geotextile encapsulated sand bags based solution, south of the 5th groyne, only grants temporary dune protection.

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