

# Abstract

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## **Shoreline Changes Due to Construction of Alexandria Submerged Breakwater, Egypt**

During the last few years, Alexandria coastline has faced many flooding problems. In winters of 2003 to 2006, many surge storms struck the Alexandrian coastline water and sand overtopped the seawall and destroyed many parts of it. In the coming years, these kinds of storms are likely to increase due to the phenomenon of SLR. The impacts of Sea Level Rise will be felt through both an increase in mean sea level and through an increase in the frequency of extreme sea-level events such as storm surges (Church et al., 2008). The option of raising the level of the defences is not feasible due to both reductions in amenity and cost ineffectiveness, as existing infrastructure would have to be sacrificed to accommodate larger defences. This leads to the proposed deployment of a submerged offshore rubble mound breakwater and / submerged offshore artificial reefs, to induce wave breaking and energy dissipation, in order to limit the wave heights reaching the beach (El-Sharnouby and Soliman, 2010 El-Sharnouby et al., 2007 Soliman and Reeve, 2009). More recently, submerged offshore artificial reefs applications have varied widely, including: aquaculture production coastal protection (Seaman and Jensen, 2000) and habitat protection (Baine, 2001). Artificial reef materials should last a minimum of 30 years to provide cost-effective ecological service, and to be non-toxic to the marine environment (Grove et al., 1991). This paper presents the shoreline changes due to the construction of a submerged breakwater. A case study of a submerged breakwater, which was constructed at Alexandria coastal area, Egypt, to stabilize the eroded beach of Miami - Asafra - Mandara -Montaza areas in years 2006 to 2008, is presented. The breakwater system consists of one main parallel part and two overlapping parts approximately 150 to 300 meters offshore. The total length of the breakwaters is 2520 meters with water depth ranging from 2.5 to 8.5 meters at the location of the structure. A bathymetry surveying has been conducted in years 2006, 2008, 2009 and 2010. These data are presented and analyzed to introduce the shoreline response due to the construction of the submerged breakwater using the Digital Shoreline Analysis System (DSAS) which is a software application added to the Geographical Informational System (GIS) software &quot; ArcView &quot;. The analysis of the collected data shows shoreline accretion along most areas of Miami beach, western part of Asafra beach, eastern part of Mandara beach and Montaza beach with range from 0.4 to 8.7 meter per year. In contrast, areas of shoreline erosion exist at eastern part of Asafra beach and western part of Mandara beach with range from -0.8 to -20.8 meter per year. A beach width varied from 25 to 50 meters compared to 0.0 to 25 meters before the submerged breakwater installation has been established in most areas of the protected beach. References Baine, M. (2001). Artificial reefs: a review of their design application management and performance. *Ocean & Coastal Management* 44, No. (3-4), 241-259. Church, J. A., White, N. J., Aarup, T., Wilson, W. S., Woodworth, P. L., Domingues, C. M., Hunter, J. R. and Lambeck, K. (2008). Understanding global sea levels: past, present and future. *Sustainability Science* 3, No. 1, 9-22. El-Sharnouby, B., Nagy, H. and Abdrabbo, F. Stability of shoreline for Miami -Montaza area. Technical note, Faculty of Engineering, Alexandria University, Egypt, 2007 El-Sharnouby, B. and Soliman, A. Shoreline response for long wide and deep submerged breakwater of Alexandria city, Egypt. *Proceeding of 26th International Conference on Seaports and Maritime Transport*. Alexandria, Egypt, Port Training Institute, Arab Academy for Science, Technology & Maritime Transport, 2010. Grove, R. S., Sonu, C. J. and Nakamura, M. Design and engineering of manufactured habitats for fisheries enhancement: Artificial habitats for marine and freshwater, (Fisheries. W. J. Seaman and L. M. E. Sprague (ed.)). San Diego, California, Academic Press, Inc., 1991, pp. 109 – 149. Seaman, W. J. and Jensen, A. C. Purposes and Practices of Artificial Reef Evaluation. *Artificial reef evaluation: with application to natural marine habitats*. (W. J. E. Seaman). Boca Raton, Florida, USA, CRC Marine Science Series, CRC Press LLC, 2000, pp. 1 – 20. Soliman, A. and Reeve, D. Applying the artificial submerged reefs techniques to reduce the flooding

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