








Article

# A Potential Beach Monitoring Based on Integrated Methods

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**Abstract:** This study focuses on the analysis of sandy beaches by integrating sedimentological, geomorphological, and geophysical investigations. The beach represents an extremely variable environment where different natural processes act simultaneously with human activities, leading to the gathering of different methodologies of the Earth Sciences to study its evolution in space and time. The aim of this research is to propose a potential procedure for monitoring the morpho-sedimentary processes of sandy beaches by analyzing the textural and compositional characteristics of the sands and quantifying the volumes involved in the coastal dynamics. The study area includes two Apulian sandy beaches (Torre Guaceto and Le Dune beach) that are representative of the coastal dynamics of a large sector of the central/northern Mediterranean Sea involving the southern Adriatic Sea and the northern Ionian Sea. Sedimentological and ecological investigations allowed to describe the textural and compositional characteristics of the beach sands by interpreting their sand provenance and the physical/biological interactions within the beach. The topographic surveys carried out with a Terrestrial Laser Scanner and an Optical Total Station, aimed to quantify the variations of sediment volume over time, whereas the Delft3d software was applied to analyze the effects of the dominant wave motion on the sedimentary dynamics. Lastly, the geophysical techniques which included Sub Bottom Profiler procedures, Ground Penetrating Radar investigation, and resistivity models enabled us to calculate the sand sediment thickness above the bedrock.

**Keywords:** pocket beach; beach monitoring; beach dynamics; sediment thickness

## 1. Introduction

Coastal zones can be defined as complex natural ecosystems where hydrodynamic, sedimentary, morphological, and biological conditions and human disturbance interact at different spaces and time scales [1–3]. Coasts are often seen as fundamental resources to be “exploited”, especially for touristic and economic purposes. However, social interests, economic investments, and the protection of natural ecosystems must meet the requirements of Integrated Coastal Zone Management (ICZM), which considers the fragility of coastal ecosystems and landscapes.

As reported from the latest United Nations reports, about 37% of the world's population lives within 100 km of the coast. This area is settled by a wide range of activities