

Chapter 4

Transformation Strategies in Anthropogenic Coastal Erosion: Global Successes and a Roadmap for Boğaçay

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ABSTRACT

Coastal erosion, which is increasing globally, is a multidimensional disaster triggered by human interventions. This study compares the erosion crisis at the Antalya Boğaçay Project with successful intervention examples worldwide and proposes sustainable solutions. Environmentally friendly approaches such as the Dutch “Sand Engine” project, sediment bypass systems in the US, and Australia’s geotube applications have achieved 70-90% success rates in coastal stabilization. Dynamic coastal management, artificial reefs, and targeted sediment recharge techniques are critical solutions for Boğaçay. The study analyzes the applicability of these strategies to the Turkish coast through hydrodynamic modeling, ecosystem-based design, and disaster risk management perspectives. Consequently, it emphasizes that coastal erosion is an interdisciplinary disaster management issue rather than an engineering problem, and an adaptive management framework is presented for the Mediterranean basin.

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INTRODUCTION

Konyaaltı Beach is one of the Mediterranean's most significant coastal ecosystems with considerable recreational and ecological value (Akiner et al., 2025a; Durap & Balas, 2024). The beach remained in natural balance for hundreds of years due to sediments brought in by the riverside, Boğaçay. However, the Boğaçay Project, which was initiated in 2017, disrupted sediment transport by lowering the riverbed below sea level, and thus, coastal dynamics have been altered to a great extent. Hence, coastal erosion has occurred, and the beach has become narrow.

Any coastal engineering works affecting natural processes may produce permanent changes, especially when the sediment balance is disturbed. Understanding how the Boğaçay Project affected coastal evolution is a key consideration for planning similar projects.

This dynamic nature of coastal systems is the product of natural processes interacting with human interruptions. Usually, these systems attain a state of more or less equilibrium through factors such as sediment transport, wave energy dissipation, and any variation in sea level. However, the increasing number of human projects on the coast erodes this natural balance, with many hitting the coastline in recent decades. The Boğaçay Project is a critical instance for the Konyaaltı coast and the management of similar ecosystems. Any restriction in the natural sediment flow induces a chain of effects leading to physical regression and ecological losses (Bruun, 1962; Dionísio António et al., 2023; McCall et al., 2010).

Coastline morphology is directly related to basin-scale processes. Infrastructure interventions in such sensitive areas can have an effect locally and all along the coastline. So, while gaining insight into the morphological consequences of the Boğaçay Project, basin-coastal integrity must also be evaluated (Akiner 2025, Arabi et al. 2008, and Akiner and Lačnjevac 2022).

Since the physical changes are only one aspect of coastal management, ecosystem services, biodiversity, and socioeconomic impacts have an equal role to play. Konyaaltı Beach is a recreational area and a tourism destination that offers economic opportunities to the locals. Thus, the great shrinking occasioned by coastal erosion poses serious threats to business, residential, and agricultural lands alongside the coast (Das & Swain, 2024). This entire threat structure denotes that coastal engineering projects should never be judged on a purely physical basis (Koç et al., 2015; Ferreira et al., 2022).

The slow death of coastal ecosystems under global climate change and anthropogenic pressure runs parallel to environmental degradation and monetizes these scenarios into disasters for all socioeconomic systems. A prime example is the Boğaçay Project, carried out in 2017 on the Konyaaltı coast of Antalya. By dredging the river bed of Boğaçay to 1.5 m below sea level, the project disrupted

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