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How can beaches be managed with respect to seagrass litter?

Seagrass meadows produce large amounts of leaf material that is shed and eventually may reach the shore, often building important banks of seagrass litter. These deposits often represent a source of concern for the manager, whenever they accumulate in beaches and shorelines used for recreational purposes. This chapter describes the formation of these litter banks, their role on the littoral systems and discusses possible management options.

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The nearly continuous growth of seagrass leaves implies that each shoot produces a large number of leaves every year, ranging from about 30 in the case of *Zostera noltii* to 6 in the case of *Posidonia oceanica* (see chapter 3). These leaves eventually reach a senescent stage and are shed. A fraction of this material, representing roughly 25 % of the production of the seagrass meadow, is transported to shore and deposited along the coastline (Fig. 14.1). Because the production of seagrass per unit area is in the order of 500 grams of dry weight per m², the amount of litter reaching the coastline will depend, besides currents and winds, on the width of the meadow. A moderately wide (1 km) belt of seagrass may deliver seagrass litter in excess of 125 kg of dry seagrass material per meter of coastline each year. Moreover, this is not a continuous process, but occurs mostly in the fall, when loss of material from the seagrass is highest coinciding with enhanced wave action and transport.

The amount of material cast accumulates at the beach, developing cushions of up to 4 meters in height, such as observed in some Mediterranean shores adjacent to large *Posidonia oceanica* meadows. This material has multiple functions, as these cushions protect the shoreline from erosion, delivers inorganic materials in the form of shells and carbonate produced by the plants and their epiphytes, nurtishes the beaches, is the basis for a rich invertebrate food web, and, when transported further inland by the wind, may act as seeds for dune formation, also supplying dune communities with organic matter and nutrients.

Yet, European shores are no longer the wild environment they once were, as the use of beaches as recreational sites for society has generated an important demand for clean

beaches. Conspicuous seagrass litter, although in fact a fingerprint of a lush adjacent seagrass meadows and, hence, adequate environmental quality, is considered a nuisance by a fraction of the beach users and beach managers and is often removed using heavy machinery (tracks, tractors, etc.). This management option, however, causes considerable damage to the beach and coastline ecosystems, as it disrupts the benefits derived from the cushion of seagrass litter, as described above, and also impinges considerable damage to the physical integrity of the beach. This damage is caused by (1) altered packing of the material due to the transit of heavy machinery on the beach; (2) removal of beach materials because not only the mineral particles associated to the seagrass litter are removed but also large amounts of sand, intermingled with the seagrass litter, which may



Figure 1. Photo of cushions of beach cast material. Photo: Carlos M. Duarte

represent up to twice, by weight, the seagrass litter removed.

Scientifically designed experiments of alternative management options have, to our knowledge, not been attempted. However, some alternative practices have been implemented with apparent success. The best practice is a no removal policy of beach cast material. However, this is not a possible option when materials accumulate in amounts sufficient as to interfere with leisure activities on the beach. In such heavily-used beaches, no-removal periods should be set to encompass the largest amount of time possible, when demands for beach space of users are low or moderate. At the same time, the public should be informed of the beneficial functions of that material and the fact that it should be considered as a fingerprint of good environmental quality offshore from the beach. Ideally, these efforts would result in a reduced pressure by users to have the seagrass litter removed. This demand can be monitored using user satisfaction leaflets or questionnaires, as to assess the thresholds of

materials the users consider to reach nuisance levels. When removal must occur, this should avoid use of heavy-duty machinery and removal of the material outside the beach. The least-damaging practice may involve mixing the seagrass material with the sand as to bury the materials below the surface, thereby avoiding losses of beach sand and seagrass-associated minerals.

In addition to materials accumulated on the beach, some managers have been known to remove seagrass growing in shallow waters near the beach. This is indeed a most detrimental practice, as it enhances beach erosion, since the seagrasses removed trap particles, dissipate wave energy and fix the sediments with their rhizome and root networks. Hence, increased beach erosion is the likely consequence of removing shallow seagrass stands. Provided the worldwide tendency towards beach erosion, derived from increased sea level, preserving seagrass beds may prove critical to attenuate the erosion trends.