



Contents lists available at ScienceDirect

Waste Management

journal homepage: www.elsevier.com/locate/wasman

Marine litter from beach-based sources: Case study of an Eastern Mediterranean coastal town

Michelle E. Portman^{a,*}, Ruth E. Brennan^{a,b}^a Technion - Israel Institute of Technology, Faculty of Architecture and Town Planning, Technion City, Haifa 3200003, Israel^b Centre for Environmental Humanities, School of Histories and Humanities, Trinity College, Dublin 2, Ireland

ARTICLE INFO

Article history:

Received 24 February 2017

Revised 23 July 2017

Accepted 25 July 2017

Available online xxxxx

Keywords:

Marine litter

Marine Strategy Framework Directive

Land-based sources

In situ collection

Coastal litter

Bathing beaches

ABSTRACT

Marine litter has been a serious and growing problem for some decades now. Yet, there is still much speculation among researchers, policy makers and planners about how to tackle marine litter from land-based sources. This paper provides insights into approaches for managing marine litter by reporting and analyzing survey results of litter dispersal and makeup from three areas along an Arab-Israeli coastal town in view of other recent studies conducted around the Mediterranean Sea. Based on our results and analysis, we posit that bathing beach activities should be a high priority for waste managers as a point of intervention and beach-goers must be encouraged to take a more active role in keeping beaches clean. Further, plastic fragments on the beach should be targeted as a first priority for prevention (and cleanup) of marine litter with plastic bottle caps being a high priority to be targeted among plastics. More survey research is needed on non-plastic litter composition for which amounts and geographic dispersal in the region vary greatly from place to place along Mediterranean shores. In general, findings of this study lead us to recommend exploring persuasive beach trash can design coupled with greater enforcement for short term waste management intervention while considering the local socio-economic and institutional context further for long-term efforts.

© 2017 Elsevier Ltd. All rights reserved.

1. Introduction

Marine litter requires immediate attention from waste managers and waste planners (Ryan, 2015). It is a growing problem worldwide, with myriad consequences for both environmental and public health (Derraik, 2002; Gregory, 2009), especially as development along coasts increases and populations are more reliant on coastal, and especially beach areas for economic and social well-being.

Many countries are trying to address the problem of marine litter from land-based sources, particularly along beaches. Some are doing so on a local or national level (Chen, 2015). However, it is clear that coordinated transnational efforts must be made in view of the transitory and ubiquitous nature of marine litter; once litter is in the oceans it is very hard to collect and remove. This is especially well-known in the Mediterranean Sea which is a semi-enclosed sea with a very slow flush rate; large populations live along its coasts and environmental awareness among many of

these inhabitants is not particularly high (Laubier, 2005). Efforts to address the acute problems of beach litter by the 22 countries on the Mediterranean seashores are beginning to take shape, albeit slowly (Alkalay et al., 2007; Laglbauer et al., 2014; Poeta et al., 2014; Munari et al., 2016; Poeta et al., 2016; Pasternak et al., 2017).

On the international level, marine debris has been addressed by recent global declarations such as “The Future We Want” (UN General Assembly, 2012), and by more focused efforts such as the The Honolulu Strategy (UNEP/NOAA, 2011) and the EU’s strategy on plastics, as described in Action 9 of the EU Joint Communication on International Ocean Governance (EU, 2016). A major effort in preventing and addressing marine litter from various sources has been the Marine Strategy Framework Directive 2008/56/EC (MSFD) (European Parliament, 2008). The MSFD established a framework for each Member State of the EU to take action to achieve or maintain Good Environmental Status (GES) for the marine environment by 2020. Number ten of the eleven “descriptors” of GES requires that “Properties and quantities of marine litter do not cause harm to the coastal and marine environment”. Other conventions and agreements that address marine litter problems specifically are MARPOL and the Barcelona Convention in the Mediterranean region and the Bucharest Convention, the Helsinki Convention, and OSPAR in other regions.

* Corresponding author.

E-mail addresses: mep@technion.ac.il (M.E. Portman), ruth.brennan@tcd.ie (R.E. Brennan).

To address the problem of marine litter, waste managers and planners need to be clear about what it is and where it comes from; in other words, they need information about its generation and dispersal. While several studies have conducted surveys and identified a variety of activities generating marine litter (e.g., [Slavin et al., 2012](#); [Alkalay et al., 2007](#); [Poeta et al., 2014](#); [Munari et al., 2016](#)) the novelty of this paper is its surveying of litter found on a coastal area within a single town over time and space. Although all three of the spaces surveyed are beaches, different activities take place in each. This paper links to the qualitative study, [Brennan and Portman \(2017\)](#), conducted at the same case study site and draws insights from it to address the specific types of litter found.

Marine litter is commonly defined as “any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment” ([Galgani et al., 2010](#)). It reaches the oceans through deliberate disposal or unintentional discharge, either at sea or from land by way of rivers, drainage systems and wind ([UNEP/MAP, 2012](#)). Thus, marine litter can be broadly categorized as land-based (originating on land) or marine-based (originating at sea). The former comes mostly from agricultural, industrial and recreational activities whereas the latter originates mostly from fisheries, boating and shipping ([UNEP, 2009](#)).

Estimates of the exact portion of marine litter originating on land vary somewhat. Reports from Greece classify land-based litter (69%) and vessel-based waste (26%) as the two predominant sources of litter with fisheries making up the remainder ([Koutsodendris et al., 2008](#)). [Slavin et al. \(2012\)](#) similarly found that 77.5% of litter on beaches in Tasmania, Australia had a land-based origin, compared with 22.5% from marine sources. But by and large it is clear that a significant amount of marine litter comes from land-based sources ([Thiel et al., 2013](#)). Therefore, a number of marine litter studies have pointed out the need for up-to-date, detailed and contextual research that focuses on landside inputs, such as the recreational activities taking place on beaches ([Alkalay et al., 2007](#); [Slavin et al., 2012](#); [Laglbauer et al., 2014](#); [Munari et al., 2016](#)).

There is particularly great importance associated with understanding how beach activities influence marine litter in the Mediterranean Sea region where the bathing season is long and beaches are generally crowded and close to population centers ([European Commission, 2016](#); [Pasternak et al., 2017](#)). As a case in point, in an early study of marine litter along Israeli beaches, [Golik and Gertner \(1992\)](#) concluded that the makeup of the litter surveyed suggested it was left by beach goers. Many more recent studies of coastal waters in other parts of the world have come to similar conclusions (e.g., [Thiel et al., 2013](#)).

Further, much of the most problematic litter, due to its persistent qualities, is plastic (e.g., [Barnes et al., 2009](#); [Gregory, 2009](#)) which has often been found to be left by beach goers (e.g., [Slavin et al., 2012](#); [Poeta et al., 2014](#)). This plastic adds to the general amounts of plastic expected to reach the oceans in the near future from landside activities. A mega-study conducted by [Jambeck et al. \(2015\)](#) estimated that between 4.8 and 12.7 million metric tons of plastic waste alone entered the oceans in 2010 from land-based sources. The authors of that study estimate that the amount of plastic waste that will enter the marine environment from land-based sources will increase by an order of magnitude by 2025.

This paper reports on and analyzes surveys of coastal litter dispersal and makeup in view of other recent research efforts in the region and beyond. Our case study along Israel's Mediterranean coast surveyed beach cleanliness under varying spatial and temporal conditions. Litter types were reported using two sampling regimes: one comparing three study sites with different activities and the other focusing on litter composition. Thus we seek answers to questions about: (i) the quantity and distribution of marine litter at different locations along the beach; (ii) landside coastal activities that contribute to near-shore marine litter; and (iii) the

predominant debris materials found along the shore at the study site in relation to other bathing beaches surveyed in the Mediterranean Sea basin. We address these questions using a comparative empirical research design which compares results to previous studies and seeks to draw conclusions about what kind of management actions would be most appropriate to reduce marine litter generated on coasts.

2. Methods

Depending on how they are designed, litter counts can reflect the presence, amounts and types of marine debris. Evaluative sampling of nearshore marine litter reflects the long-term balance between inputs, land-based sources or stranding, and the processes of export, input, burial, degradation and cleanups. Factors influencing densities and whereabouts of litter, such as cleanups, storm events, rainfall, tides and hydrological changes may alter litter counts and influence the evaluation of fluxes in nearshore marine waters. Even if surveys can track changes in the composition of litter in coastal waters, they are sometimes not sensitive enough to monitor minor changes in overall abundance ([Galgani et al., 2015](#)). This problem can be addressed to some extent by recording the rate at which litter accumulates on beaches, through surveys performed at logical temporal and spatial intervals while controlling for some influencing factors in a single geographic region.

Keeping these factors in mind, we used two different measures for our survey of litter at the case study town of Jisr-Az-Zarqa (hereafter “Jisr”): (1) the Clean Coast Index (CCI); and (2) litter-type monitoring. The first is a measure of beach cleanliness that has been used by previous marine litter studies in the Mediterranean context ([Alkalay et al., 2007](#); [Laglbauer et al., 2014](#); [Munari et al., 2016](#)). We used the CCI to compare littering behaviors at different points along Jisr's one and a half kilometer coastline which reflect different beach-going activities. The CCI is a useful method for surveying bathing beach cleanliness that is increasingly being used due to its straightforward approach, feasibility, objectivity, and suitability to Mediterranean beaches (see [Alkalay et al., 2007](#)). Also, its frequent past and current use (in the sources mentioned above) renders the results of this study comparable to those of studies taking place in other locales.

We used the second measure to understand beach litter composition in the town at two different points in time at Jisr's officially designated bathing beach, before and after opening of the swimming season. Official “bathing beach” areas are those designed in a land use plan, dedicated to recreational beach activities, particularly swimming. During the swim season, which lasts from approximately mid-May to the end of September, lifeguard services are provided by the local municipality and funded at least in part, by the national government. This second measure follows a protocol that conforms with the recommended minimum requirements for beach litter monitoring that implements the MSFD and is based on recommendations from the European Commission-mandated Technical Subgroup on Marine Litter (TSG-ML, [European Commission, 2013](#)). The Technical Subgroup on Marine Litter recommendations are based on the OSPAR Commission Guidelines for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (OSPAR, 2010), UNEP Operational Guidelines for Comprehensive Beach Litter Assessment ([Cheshire et al., 2009](#)) and the NOAA Marine Debris Shoreline Survey Field Guide ([Opfer et al., 2012](#); [European Commission, 2013](#)).

2.1. Sampling sites

We sampled during the late spring and summer months at three sites within the municipal borders of Jisr when rainfall in

Download English Version:

<https://daneshyari.com/en/article/8870457>

Download Persian Version:

<https://daneshyari.com/article/8870457>

[Daneshyari.com](https://daneshyari.com)