

LITTER ABUNDANCE, COMPOSITION AND SOURCE ESTIMATION IN 161 BEACHES, BASED ON RECORDINGS FROM A NATIONAL VOLUNTARY CLEAN-UP CAMPAIGN IN GREECE, MEDITERRANEAN

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Abstract

Abundance and composition of beach litter was assessed for 161 beaches in Greece, with the participation of volunteers in 2010, 2011 and 2012. This study showed that plastic is the dominant litter material (43-51%) while plastic lids from water/beverage bottles are the most affluent (8-12%) litter item regarding former use. Recreational activities seem to account for more than 20% of the beach litter load in the Greek coasts.

Keywords: *Pollution, South-Eastern Mediterranean, Beach, Coastal management*

Introduction

Marine litter is identified as a global environmental issue that poses a threat to marine ecosystems and negatively affects marine-based human activities. In this work we present the results of recordings made by volunteers of beach stranded litter in 161 coasts from all over Greece. The aim of this study is to evaluate the beach litter composition and origination on the Greek coastline, with the participation of volunteers [2], to promote public environmental awareness and to provide a baseline study for the development of future beach litter management plans.

Methods

For the purposes of the present study, data were collected on May 2010, 2011 and 2012 from 161 beaches, with the participation of thousands of volunteers (2010 in 16,495; 2011 in 21,020; 2012 in 17,238) of the “Clean up the Med” nationwide campaign of voluntary beach clean-ups, coordinated by the environmental N.G.O. Mediterranean S.O.S Network. The campaign takes place once a year, each May in Greece, where thousands of volunteers remove manmade debris from local beaches while recording them in a questionnaire, the “Beach Observation Questionnaire” (B.O.Q). With guidance provided by the B.O.Qs, and the research working group, the volunteers counted and classified all items of litter they find in the beaches in terms of former use (e.g. plastic bags, plastic bottles of water, detergents, aluminium beverage containers, fishing lines etc.). All data were statistically processed and re-classified by material in the following 12 categories: plastic, paper, nylon, Styrofoam, fabric, metal, glass, wood, rubber, foam, building materials, leather.

Results and Discussion

According to the acquired data all litter items that were recorded and removed from the surveyed beaches account for 89,652, 83,039 and 27,074 in 65, 53 and 43 Greek beaches in 2010, 2011 and 2012 respectively. Plastic was the dominant litter material (Table 1) in the studied beaches, accounting for 43-51% of the total litter items, in accordance with the global tendencies [1,2,3]. Plastic dominance was followed in all years by paper (14-18%) and metal (12-14%; Table 1) showing the same tendency as in previous studies in Greece [2]. High paper litter abundance compared to global levels probably indicates recent pollution due to its low pervasiveness [1,2].

Tab. 1. Percentages of the top five litter material categories. Other materials include all material categories with low contributions.

| Litter Material Categories | 2010 (%) | 2011 (%) | 2012 (%) |
|----------------------------|----------|----------|----------|
| Plastic | 51 | 44 | 43 |
| Paper | 14 | 19 | 18 |
| Metal | 14 | 14 | 12 |
| Wood | 7 | 7 | 6 |
| Glass | 6 | 6 | 5 |
| Other Materials | 9 | 10 | 16 |

Plastic lids from former water/beverage containing bottles (8-12%) appear to be the most abundant litter in the Greek beaches (Table 2). Plastic bottles (6-7%), plastic pieces (5-7%), straws (5-7%), cardboard (6%) and paper

pieces (7%) are some of the dominant litter in the majority of the beaches (Table 2).

Consequently, more than 20% of litter found in the studied beaches are related to the consumption of water and beverages near or on the beach, suggesting recreational activities as a major contributor to the beach litter load [2, 3].

Tab. 2. Percentages of the top five former use categories. Other include categories with contribution >5%.

| Year | Use | % |
|------------------------------------------|---------------------------------------------------|----|
| 2010 | Plastic Lids (water/ beverage containing bottles) | 12 |
| | Straws | 7 |
| | Plastic bottles (water/beverage) | 6 |
| | Plastic Bags | 5 |
| | Plastic Pieces <50cm | 5 |
| Other (each category participation < 5%) | | 65 |
| 2011 | Plastic Lids (water/ beverage containing bottles) | 8 |
| | Plastic bottles (water/beverage) | 7 |
| | Cardboard | 6 |
| | Plastic Bags | 5 |
| | Straws | 5 |
| Other (each category participation < 5%) | | 69 |
| 2012 | Plastic Lids (water/ beverage containing bottles) | 8 |
| | Paper Pieces | 7 |
| | Plastic bottles (water/beverage) | 7 |
| | Plastic Pieces <50cm | 7 |
| | Straws | 5 |
| Other (each category participation < 5%) | | 66 |

Former use categories that individually include relatively low amounts of litter (<5%) but when grouped they total significant contributions, suggest that apart from recreation, the studied Greek beaches are also affected by urban/domestic activities, with litter related to domestic use (detergents, sanitary paper etc.) reaching levels of at least 8% and fishery, with related litter items accounting for more than 5%. The present study was made possible with the participation of volunteers of different age groups, whose direct involvement in coastal management issues lead to the promotion of environmental awareness and to the achievement of a large-scale survey.

References

- 1 - Derraik, J.G.B., 2002. The pollution of the marine environment by plastic litter: a review. *Mar. Poll. Bull.* 44: 842-852.
- 2 - Kordella, S., Geraga, Papatheodorou, G., Fakiris, E. and Mitropoulou, I.M., 2013. Litter composition and source contribution for 80 beaches in Greece, Eastern Mediterranean: A nationwide voluntary clean-up campaign. *Aquatic Ecosystem Health and Management*. 16 (1) 111–118.
- 3 - Koutsodendris, A., Papatheodorou, G., Kougiourouki O., Georgiadis M., 2008. Benthic marine litter in four Gulfs in Greece, Eastern Mediterranean; Abundance, composition and source identification. *Estuar. Coast Shelf Sci.*, 77: 501-512.