

MULTIPLE PHASE MICROPLASTIC ASSESSMENT OF THE GREEK MARINE ENVIRONMENT

R. Seary ^{1*}, C. Acasuso-Rivero ², A. Miliou ², R. Standerwick ², M. Demetriou ², D. Chuda ² and I. Siwka ²

¹ Swansea University, Department of Biosciences - 630994@swansea.ac.uk

² Archipelagos, Institute of Marine Conservation, PO Box 42, Samos, Greece.

Abstract

Microplastic pollution is of growing concern worldwide and hence the assessment of its extent in the Greek marine environment is of uppermost importance due to the vast, albeit fragile biodiversity it possesses. In 2009, the first research phase assessed 114 beaches of the Greek islands and mainland producing evidence of microplastic contamination at all sites, leading to further study of an extra 49 sites in 2011. In order to evaluate the impact of this contamination at the lowest level of the trophic chain, the 2012 investigation focused on deposit feeder microplastic ingestion of *Holothuria* spp. from the NE Aegean, finding an average of 4.68 fibres ingested per individual.

Keywords: *Plastics, Aegean Sea, Pollution*

Introduction

A newly defined threat, microplastic fibres and particles ($\leq 5\text{mm}$), have become a major constituent of debris in the marine environment [1]. The small size of microplastic particles make them easily accessible to many marine biota and, feeding unselectively, filter feeders and deposit feeders ingest these plastic particles in the place of their natural food source, giving them the potential to accumulate throughout the food chain [2]. In order to collectively assess the level of microplastic pollution in the Greek environment, this study investigates microplastic contamination of beach sediments on a wide scale, in addition to quantifying the uptake of microplastics by deposit feeding *Holothurians*.

Materials and methods

Beach sediments were sampled from the shore line at 3, 25 metre intervals in 114 sites during phase 1 of research in 2009 and in 49 sites during phase 2 in 2011. 50 ml of each sediment sample was mixed with 100ml saturated salt solution and shaken vigorously. Solution was left for 30 minutes to allow microplastic particles to float to the surface, where they are removed with a syringe and processed using WhatmanTM GF/F filters and a vacuum filtration apparatus, microplastic fibers were then visually identified. During phase 3 of research (2012), 18 *H.forskali* and 4 *H. tubulosa* individuals were stored in tanks of filtered sea water for 24 hours. The sample containing *Holothuria* faeces was shaken and left for sedimentation, water was then removed and filtered through WhatmanTM GF/F filters, microplastics were then visually identified.

Results

All 114 sites sampled in 2009 were contaminated with microplastic fibres. Overall, in 2009 the most contaminated locations were the Attika peninsula and Ikaria Island, at a mean microplastic level of 20.13 ± 16.03 (SD) and 19.79 ± 10.74 (SD) fibres per 50 ml of sediment, respectively (Fig. 1). All 49 locations sampled in 2011 exhibited microplastic fibre contamination. Sifnos Island displayed the highest microplastic contamination, at 112.08 ± 67.54 (SD) fibres per 50 ml of beach sediment. Locations sampled in both 2009 and 2011, Rhodes and Ikaria, showed an increased mean microplastic level per 50ml of sediment (Fig. 1). 100 % of the *Holothurians* examined were found to have ingested microplastic fibres, at an average of 4.68 microplastic fibres per individual. One exceptionally high result measured 32 fibres for *H.forskali* individual. As well as confirming that microplastic particles are ingested by deposit feeding organisms at the lower level of the food chain, the results indicate that all Greek beaches are potentially polluted with microplastic fibres, showing a trend of increasing microplastic contamination over time. This provides strong evidence that enhanced efforts to reduce plastic debris in marine ecosystems are an immediate priority, whilst further and more extensive research is also required in order to provide a better understanding of the extent of microplastic fibre contamination at different levels of the food chain, as well as in marine sediment and water.

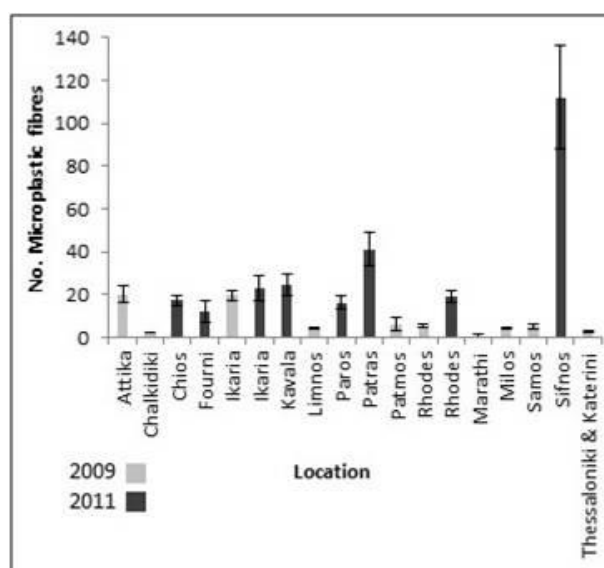


Fig. 1. Mean frequency of microplastic fibres per 50 ml of beach sediment \pm standard error (SE) per location sampled in 2009 and 2011.

References

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