LITTER AS A SOURCE OF HABITAT ISLANDS ON DEEP WATER MUDDY BOTTOMS

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Abstract

Certain types of marine litter, usually considered as pollutants, may also be a resource, serving as artificial reefs on sedimentary bottoms. In order to study this aspect, marine debris was collected by bottom trawl from muddy bottoms (depths of 45-700m) in the waters around the Maltese islands, during July 2005. The associated fauna was identified and quantified. Litter was found to support a higher abundance of organisms than the surrounding sediment, but a lower species richness. However, the suite of epifaunal species on the debris was different from the infauna of the surrounding substratum. Thus litter was found to increase the overall biodiversity of particular areas.

Keywords : Metals, Plastics, Pollution, Secondary Production, Biodiversity.

Introduction

Litter is usually viewed as a pollutant due to its detrimental effects, especially while still floating or suspended [1,2,3]. However, relatively inert, sunken marine litter may potentially serve as a resource for benthic fauna. Anthropogenic material may act as an artificial reef especially where hard substrata for settlement are at a premium. To explore this aspect, marine litter from sedimentary bottoms in deep water (45-700 m) around the Maltese Islands was sampled. The sessile biota associated with the different kinds of debris was identified and counted. The results obtained were compared with data on the infauna of the sediment on which the litter was settled, in order to evaluate the contribution of such deep-water debris to benthic biodiversity on these grounds.

Methods

Samples were collected by trawling during a research cruise on the RV *Sant' Anna* made in July 2005 as part of the ongoing MEDITS trawl survey programme [4]. Litter was gathered from 44 hauls made in deep water (45 - 700m) around the Maltese islands (Fig. 1). The debris was separated into different categories (cloth, glass, metal, plastic, pottery and sacks). For each item, the surface area was measured and any associated live macrofauna were identified and counted; abundance was then standardised per m^2 of litter substratum. The data were analysed using univariate and multivariate (non-metric multidimensional scaling and agglomerative, hierarchical clustering) methods.

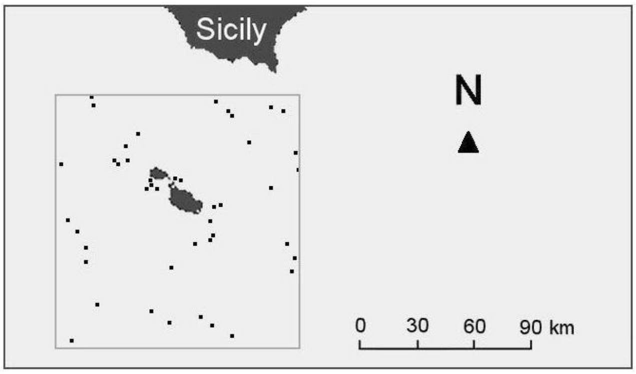

Fig. 1. Map of the 44 sampling stations (dots) distributed around Malta.

Results and Discussion

The marine debris recovered consisted of 47% plastic, 13% metal, 13% glass, 4% cloth, 3% sack and 2% pottery. The biotic growth density on all litter collectively was 141 (412 s.d.) individuals per m^2 of litter substratum. Biota was more abundant on litter than in the surrounding sediment, where the mean density of infauna was 64 individuals per m^2 as estimated from $0.0625m^2$ box core samples (DM unpublished data, 2005). However, the sediment supported a higher species richness (38 species from a collective sediment surface area of $1.88m^2$, DM unpublished data, 2005) than the marine debris (47 species from a collective litter surface area of $635.62m^2$). Nevertheless litter supported a totally different suite of fauna from that of the sediment, which would otherwise have been absent without the debris.

The mean Shannon-Wiener diversity per m^2 of litter substratum was 0.14 (0.30 s.d.). This low value and high standard deviation are a result of many litter items either without epibiota or with only one species, consequently resulting in a diversity index of zero. The associated mean Pielou's evenness measure per m^2 of litter substratum was 0.7 (0.25 s.d.), calculated excluding those litter items with no growth, or with a Shannon-Wiener index of zero. Calculated thus, evenness was quite high, confirming that an overall low diversity was primarily due to several litter items being colonised by only one species. Metals and pottery items had a relatively high epifaunal abundance and a high species richness, but both parameters were low for sacks, plastic and cloth. The exception was glass, which had a relatively high species richness but a low abundance of epifauna.

Multivariate classification of the different litter types based on species abundance data resulted in three groups: plastics and glass, pottery and metals, and sacks. This seemed related to the surface texture of each litter type. Plastic (especially bottles) and glass usually had very smooth surfaces, while metal and pottery had much rougher faces. The woven fabric of sacks had a totally different texture from all other litter types. Classification based on presence/absence of different faunal species resulted in three groups: metals, plastics and sacks, and pottery and glass. This classification may be related to the different resting position of the litter types on the seabed, and to the stability of this orientation. Sacks and plastic bags can be easily turned over by slight water movements, while metal cans and plastic bottles are highly prone to being rolled over, smothering the attached fauna. Glass bottles are heavier than both plastic containers and metal cans, therefore are less susceptible to rolling. In contrast, pottery is the litter type on which the orientation of fauna with respect to the substratum and the water column is least liable to change.

Conclusions

Anthropogenic debris was found to support a higher abundance of organisms than the surrounding sediment, but a lower species richness. However, the suite of epifaunal species on litter was different from the epi- and infauna of the surrounding sediment. Thus the presence of litter on deep water sedimentary bottoms increases the overall biodiversity of particular areas. A more diverse benthic biota may result in a more diverse demersal fish fauna due to the greater scope for trophic specialisation and possibly an increase in secondary production.

References

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