COASTAL MARINE LITTER IN THE CENTRAL MEDITERRANEAN : BASELINE INFORMATION ON BEACH STRANDING, COASTAL DENSITIES AND RATES OF PHOTODEGRADATION

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Floating marine debris is considered to be a potential environmental hazard especially in semi-enclosed waters such as the Mediterranean. The Maltese Islands lie at the junction between the two major Mediterranean basins, and therefore are ideally situated to provide data on the background levels of the densities of marine litter of the whole region as well as on exchanges of floating debris between the Western and Eastern Mediterranean.

The present paper reports on a study undertaken in 1991-92. It presents baseline qualitative and quantitative data on marine litter within the Central Mediterranean coastal areas, as found stranded on beaches, or floating at sea. It also reports on the rate of degradation of certain types of plastics. The potential economic impact of litter on sea crafts was also assessed.

Marine litter can originate from two sources : ship traffic or land-based sources. Two beaches located near Fomm ir-Rih (North-East, Malta) were surveyed in August 1991 and April 1992 in order to assess qualitatively and quantitatively the extent of pollution by marine debris originating from sources at sea. These beaches were remote from built-up areas and with very limited accessibility, so that most of the litter found stranded on their shoreline must have originated from the sea. The extent of litter on the beaches was investigated using belt transects. The litter was counted, weighed, and its age, fabrication material and previous contents recorded. Litter densities, percentages by weight and number of the various components were calculated. Frequency distributions showing the geographical origins of containers in the study areas were tabulated and correlated with shore profiles and degree of beach exposure.

The slopes of the beaches under study were generally found to be low and litter tends to be easily trapped on this type of shores. This study revealed a wide range of fabrication materials and contents for beach-stranded marine litter. The mean density of shore-stranded litter ranged from 60 to 650 g/m^2 according to position on the beach away from the waterline. This was in general comparable to that reported in other regions in the Mediterranean. Plastic litter occupied the highest percentage by number of items, with wood being also predominant. Litter was found to be both of local and foreign origin.

Litter density distribution down-shore, generally showed a bimodal distribution. Containers marketed or manufactured locally accounted for the modal classes of both beaches. Twelve different countries of origin were identified in all. Most containers were current production types but one was manufactured in 1986. Litter accumulation was found to be influenced by the extent of exposure of beach localities as well as by local patterns of wind and sea currents.

Sea surveys in inshore waters around Malta were carried out during winter 1991. Floating megalitter was counted and recorded from a boat moving in a straight course or along the shore at distance of up to 3 km offshore. Only litter which was observed within 10 m on either side of the boat was recorded. The area of water observed in a single trip was therefore equal to the distance covered by the boat multiplied by 20 m. The density (frequency) of litter was then expressed as the number of items observed per unit area.

An overall mean density of 41 items per km^2 of floating megalitter was recorded for the coastal areas around Malta. In 55% of the surveys, the highest densities were recorded for plastic debris. The highest mean density for plastics in fact was 158 items per km^2. The next predominant type of litter at sea was found to be wood at 21.6%, with nylon occurring at 5.1%.

A survey amongst boat owners indicated that the negative economic implications of such marine litter may be considerable. A number of cases were reported in which water intakes of yachts were clogged by floating litter, or litter got entangled with craft propellers or drive shaft. Cases of floating debris interfering with radar signals were also reported.

The rates of photodegradation of plastics exposed to different environmental conditions were measured by tensile testing of standard test strips. The rates of photodegradation were assumed to be negatively correlated with the exposure time required by the test strips to reach 5% elongation before they break (ie. time required by plastic to turn brittle). Two types of plastics were utilized: low density polyethylene (LDPE) and enhanced photodegradable ethylene-carbon monoxide co-polymer (E/CO). Test strips were exposed to sunlight either in dry conditions (on a roof top) or while continuously washed by seawater, being attached to floating platforms at sea. Exposure experiments were simultaneously undertaken in Malta and U.K. (Farnborough College of Technology). Data for E/CO test strips is tabulated below :

Mean Exposure days required by test strips to reach 5% elongation

	Jul-Sep.	Oct-Feb.
Wet Exposure in Malta	21	25
Dry Exposure in Malta	13	22
Wet Exposure in U.K.	71	74
Dry Exposure in U.K.	65	60

These data indicate that rates of degradation were substantially lower at sea and under U.K. prevalent climatic conditions. Other data on the tensile properties of the exposed plastics, will be published elsewhere.