

A. DEIDUN, S. SALIBA, P.J. SCHEMBRI

Department of Biology, University of Malta, Msida - MSD 2080, Malta.
alan.deidun@um.edu.mt

QUANTITATIVE ASSESSMENT AND PHYSICAL CHARACTERISATION OF *POSIDONIA OCEANICA* WRACK BEACHED ALONG THE MALTESE COASTLINE

QUANTIFICAZIONE E CARATTERIZZAZIONE FISICA DI DETRITI DI *POSIDONIA OCEANICA* SPIAGGIATI LUNGO LE COSTE MALTESI

Abstract - The percentage moisture content, temperature, and percentage organic content (expressed as ash-free dry weight) of wrack, as well as the distribution of leaf lengths at different depths within *Posidonia oceanica* banquettes stranded along Maltese beaches, was determined. The standing dry weight biomass of wrack beached along the entire Maltese coastline was estimated to be ca. 1,150 metric tons at any one time.

Key-words: wrack, banquettes, coast, *Posidonia oceanica*, Malta.

Introduction - Mediterranean coastlines receive copious amounts of dead seagrass debris, mostly dominated by *Posidonia oceanica*, which forms accumulations known as ‘banquettes’. The only previous study on seagrass wrack accumulations from the Maltese Islands (Deidun *et al.*, 2009) has addressed the ecological impacts of ‘beach grooming’ on Maltese coastlines, but has not provided estimates of the amount of seagrass wrack deposited. This study attempts an estimation of the total seagrass biomass beached annually along Maltese coastlines and reports the values for a number of wrack-specific physical parameters.

Materials and methods - The following parameters were determined for each of the six Maltese beaches sampled (groomed beaches = White Tower Bay, Qarraba and Fomm ir-Rih; ungroomed beaches = Selmun, Salina and Xatt l-Ahmar): the percentage wrack cover, the average depth of the banquettes, and the percentage organic carbon of the sediment underlying the wrack. The wrack physical parameters measured were: (i) temperature at different wrack depths, (ii) the ash-free dry weight of wrack collected at different depths as a proxy for percentage organic content, and (iii) the distribution of different leaf lengths at 10 cm-depth intervals within the banquette (estimated after oven drying).

Results - Whilst winter banquette temperatures were remarkably constant with depth, summer temperature increased steadily from a depth of 10 cm to a depth of 50 cm, after an initial decrease between 0 and 10 cm. The wrack percent organic matter content estimated as ash-free dry weight for the different beaches sampled ranged from 0.08% ($\pm 0.01\%$) to 0.41% ($\pm 0.11\%$), with the highest values being recorded on the ungroomed beaches. With few exceptions, the highest values of sediment percentage organic content were generally recorded at distances of 5.0-7.5 m away from mean sea level (MSL), in the region of the strandline, and values decreased with increasing landward distance. The longest leaf lengths were recorded from stations closest to the sea, in the uppermost stratum of the wrack, and in winter. Only minor differences in the distribution of the various leaf length categories between groomed and ungroomed beaches were observed. The total deposition of wrack along the Maltese coastline was estimated making the following assumptions: (i) deposition can only occur along ‘gently sloping’ shores and not along sheer cliffs and boulder

shores; (ii) the total length of low-lying rocky coastline for the Maltese Islands is 70.1 km (Anderson & Schembri, 1989); (iii) seagrass (*Posidonia oceanica* and *Cymodocea nodosa*) meadows are mainly distributed in infralittoral waters off the northeast and southeast coasts of the Maltese Islands, such that a total coastline length of 48.1 km was considered as suitable for wrack deposition; (iv) although wrack deposits can extend up to 30 m inland, as at White Tower Bay, along most of the Maltese coastline the deposited wrack only forms a narrow band, ranging from 0.5 m to 3 m in width – the median width of 1.75 m was therefore assumed for wrack deposits along low-lying rocky coastlines. Based on these assumptions, the maximum total surface area occupied by wrack deposited along the Maltese coastline at any one time was estimated to be 0.084 km². If an average wrack depth of 0.5 m is assumed, the maximum total volume of seagrass debris deposited along the Maltese coastline is estimated to be 42,000 m³ at any one time. Since the mean mass of 1 m³ of air-dried wrack is 27.3 kg ± 2.4 kg, then the maximum total dry mass of wrack beached along Maltese coastlines at any one time is estimated at ca 1.15×10⁶ kg, or ca 1,150 metric tons.

Conclusions - The wrack organic content values reported in this study are similar to those reported by Ince *et al.* (2007) for wrack stranded on south-western Australian beaches and which was derived from Australian *Posidonia* spp. and from red and brown algae (percentage organic content: 0.10-1.40%). Guala *et al.* (2006) report a total of 3251 metric tons DW of seagrass debris as being collected annually from 18.2 km of Sardinian beaches (equivalent to a wrack mass of 178.6 metric tons DW km⁻¹). In this study, an estimated maximum standing wrack mass of 72.2 metric tons DW of seagrass debris from a combined beach length of ca 0.35 km, or 112.8 metric tons DW km⁻¹ of beach, is reported (since air-dried weights of wrack are being compared, a mean mass of 27.3 kg ± 2.4 kg for 1 m³ of air-dried wrack and a mean banquette depth of 0.5 m were used for the calculation). The slightly lower figure of standardised wrack mass for Maltese beaches could be attributed to the fact that the Maltese values were computed on data determined for a shorter sandy beach extent. Aged banquettes were characterized by a predominance of shorter leaf lengths, indicative of a higher degree of wrack attrition and decomposition, implying that ungrooved beaches contribute more detritus to the beach ecosystem than groomed beaches.

References

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