ROLE OF ENVIRONMENTAL VARIABLES IN STRUCTURING DEMERSAL ASSEMBLAGES ON TRAWLED BOTTOMS ON THE MALTESE CONTINENTAL SHELF.

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Abstract

Demersal assemblages from trawl surveys made at depths of 45-800m in trawled areas within the 25NM Fisheries Management Zone round the Maltese Islands were related to environmental characteristics on the seabed. Depth, temperature, and mean grain size all affected the structure of the demersal assemblages but depth and temperature gradient were overall the most important in that order; while mean grain size seemed more important for relatively shallow bottoms (<80m) than for deep ones.

Keywords : Demersal, Fisheries, Sediments, Temperature, Trawl Surveys.

Introduction

Prior to joining the European Union, Malta managed a 25 nautical mile Exclusive Fishing Zone. Post-EU membership, Malta was allowed to retain this zone, which covers an area of 10,700 km^2, as a Fisheries Management Zone (FMZ) as there are indications that demersal fishery stocks within the zone are distinct from those outside [1]. For shallow shelf resources (<200 m) within the FMZ, adult populations of demersal fish are believed to be isolated to some degree from adjacent populations and exchange of adult individuals between these populations may be limited. At present, there is little information on the distribution of biological assemblages in relation to environmental variables within the Maltese FMZ, even if such information is essential for the management of living resources. A programme of research to address this is being implemented.

Methods

Otter trawl samples were collected from stations at depths between 45m and 800m distributed within the Malta 25NM FMZ in the summer of 2003, 2004 and 2005 as part of the ongoing MEDITS trawl survey programme. Samples were collected with a semipelagic experimental trawl net (IFREMER GOC 73) and each haul lasted for ca 45 minutes, depending on the depth and substratum type; trawl speed was ca 3 knots. Bottom temperature was measured with a temperature probe attached to the net. The entire catch from each haul was sorted, and the fauna were identified and counted. Samples for sediment analyses were collected in 2004 and 2005 from a limited number of stations using a 0.0625mÂš box corer. Sediment granulometry was determined according to the procedures described by Buchanan [2].

The macrofaunal data were analysed by first constructing a similarity matrix from the root-root transformed biomass data using the Bray-Curtis similarity measure and then applying non-metric multidimensional scaling (nMDS) ordination [3]. Relationships between measured abiotic characteristics (depth, temperature, mean grain size) and demersal assemblages were determined using the BIOENV procedure and by superimposing scaled individual variables onto the sample locations on the two-dimensional nMDS ordination plots. All the analyses were made using the PRIMER 6 statistical software package [3].

Results and Discussions

The visual correlations between the environmental variables and the groups generated by the nMDS ordination indicate that all three physical parameters seemed to play a role in structuring the demersal assemblages. The BIOENV correlation analyses gave relatively high values of Spearman's coefficient for depth, temperature, and to a lesser extent, for mean grain size. (Figs 1 and 2).

The most important environmental variable responsible for the observed patterns of change in community structure was depth. Depth has also been shown to be the main factor determining the distribution of marine fauna in other areas of the Mediterranean [4]. Temperature was second in importance, while the correlation coefficient for mean grain size was relatively low when compared to the coefficients for depth and temperature. While mean grain size explained well the distribution of the relatively shallow water stations (46-82m), it was not as important in structuring the deeper water assemblages. In summary, the depth and temperature gradients, with their accompanying environmental and biological changes, are the main factors responsible for the patterns in community structure observed.

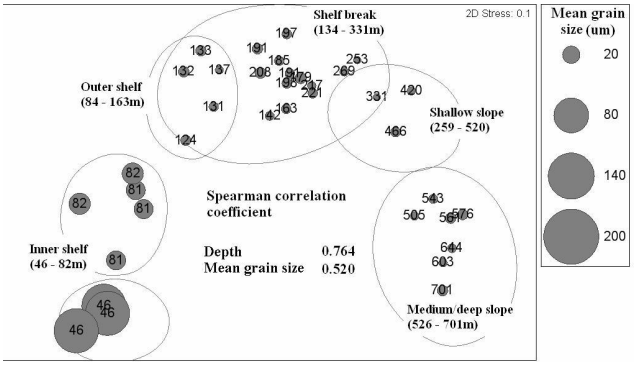

Fig. 1. Non-metric multidimensional scaling (nMDS) plot for the sampling stations from 2004 and 2005, based on biomass with superimposed scaled values of mean grain size (μm). The numbers on each station position give the mean depth for that station.

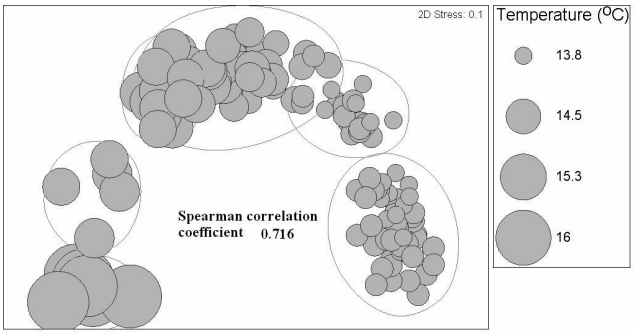

Fig. 2. nMDS plot with superimposed scaled values of temperature (^{o}C) for all three years (2003, 2004 and 2005).

References

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