

# ECOLOGIC AND TAPHONOMIC TRENDS IN MOLLUSCAN DEATH ASSEMBLAGES OF HUMAN-IMPACTED AREAS: ISRAELI EASTERN MEDITERRANEAN

Yael Edelman-Furstenberg<sup>1\*</sup>

<sup>1</sup> Geological Survey of Israel - yael@gsi.gov.il

## Abstract

Man-induced changes in the Israeli Mediterranean shore had a strong ecological imprint on the biota. Molluscan death-assemblage results from near a sewage outlet show that species richness and number of specimens/gram sediment are considerably lower than those from peripheral stations. Unexpectedly, there is a considerable difference in species richness and total abundance/gram sediment between summer and winter in death assemblages from the treated sewage outlet station. This may point to extremely high sedimentation rates for this station and/or extremely strong impact of the sewage on the fauna.

**Keywords:** *Sediments, Sewage Pollution, Mollusca, Eastern Mediterranean*

## Introduction

During the past decades man-induced nutrients were introduced to the eastern Mediterranean. These man-induced changes in the Israeli Mediterranean shore had a strong ecological imprint on the biota. This is especially true for the area of Palmahim, in the vicinity of the treated sewage sludge outlet. Recent foraminifera and polychaete studies [1] show great variations along the eastern Mediterranean shore tracking eutrophication trajectories. Macrobenthic invertebrates such as shelled molluscs are known to be sensitive indicators of seafloor oxygen levels, water energy and sediment mass properties. After death, skeletal macrobenthic material is buried and preserved in the sediment record. Investigating the death assemblage record of these organisms should capture the composition and community structure of the living community better than a short-term or single biological census due to the summing of seasonal and annual variations. In this way, ecological characterizations based on macrobenthic death assemblages can be considered as a more complete "modern" picture than information based on live censuses alone.

## Material and Methods

A sub-sampling of box core sediment samples were examined from an along-shore transect that crosses the treated sewage sludge area but also includes areas peripheral to the main impact area, parallel to Hyams [2] study area. Molluscan death assemblages from summer (07.03) and winter (01.04) from three stations were analyzed and species richness, evenness, relative and total abundance were calculated. Also, taphonomic characteristics (shell state preservation) of the dominant bivalve shells from the different stations were scored.

## Results and Discussion

Thirty five gastropod species were identified and 45 bivalves. Assuming that the molluscan death assemblages average out the seasonal and annual variations, each sampling site should have yielded similar data for samples taken during summer and winter. Yet, molluscan results from the area of the sewage outlet (station PL3-summer) show that species richness and number of specimens per gram sediment are considerably lower than those from the same location during winter as well as from the peripheral stations PL29 and AS1. Twenty two species (Margalef's richness index of 8.9) and 0.4 mollusc abundance/gram sediment were recorded for the summer station at PL-3 as opposed to 39 species (Margalef's index of 13.1) and 4.3 molluscs abundance/gram sediment recorded for the winter sampling of the same station. The expectation was that the sewage sludge, which enters the water year-round, would affect the faunal assemblage of both sampling periods in the same way, by suppressing the fauna. However, the removal of the sludge during the winter (strong water currents, biological churning of the sediment, [1]) inhibits a long-term effect on the faunal composition and assemblage community structure, which is only seen as a local and direct result during the summer sampling, when the sludge covering accumulates.

This unexpected difference in species richness and total abundance between summer and winter in death assemblages from the treated sewage outlet station (PL3) is similar to that seen in the live benthic foraminifera data (Fig. 1). The number of foraminifera specimens per cc in station PL3 was low during summer sampling and high during winter sampling [1]. In the figure both the foraminifera and molluscan measurements are shown against the sludge accumulation thickness, which is thick during the summer, ~10 cm, and non-existent during the winter. This may point to extremely high sedimentation rates for this station on the one hand and extremely strong impact of the sewage on the fauna on the other hand. It seems that under extremely stressful environmental conditions, such as anthropogenic impacts on marine environments, the time-averaged death assemblage is skewed, and acts more like a "snapshot" assemblage [3]. Thus, even a time-averaged death assemblage carries effects of the anthropogenic

impact on the community structure of the molluscs.

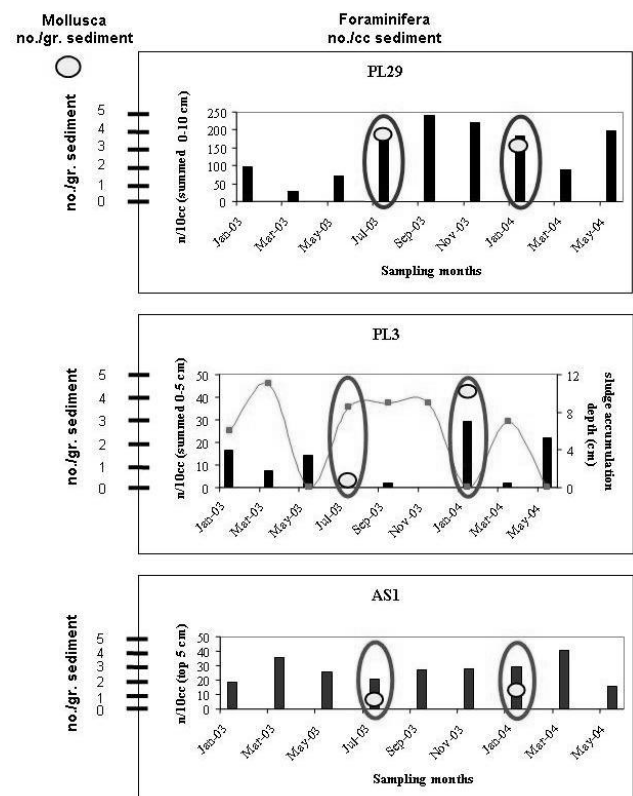


Fig. 1. Molluscan differences between summer and winter in the sewage area (this study) are similar to those seen in the live benthic foraminifera [2]. Bar graphs: total standing stock of living (stained) individuals/10 cc from PL29, summed over the top 0-10 cm of the sediment; PL3, summed over the 0-5 cm; and AS1, summed over the top 0-5 cm. Sludge accumulation thickness is shown for PL3. Circles: total molluscan abundance

## References

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