

The Levantine bathyal - a desert at the bottom of the sea?

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The Levant basin is the easternmost part of the Mediterranean Sea, east of the line connecting Rhodes, Crete and the coast of Cyrenaica. It is isolated from the deep Atlantic waters by the topographical and hydrological barriers posed by the shallow Gibraltar Straits and the Sicilian-Tunisian sill. The Levantine deep waters are distinguished by severe oligotrophy and salinity and temperature values that are higher than in the rest of the Mediterranean.

Investigations of the Levant bathyal biota were initiated with the voyages of the "Pola" one hundred years ago (1890-1893), the most extensive deep-sea expedition to take place in the Levant basin. The Danish Oceanographical Expedition to the Mediterranean, aboard the research steamer "Thor", sampled nine sites along the western limits of the Levant, from Cyrenaica to Rhodes, in 1910. The Lamont Geological Observatory research vessel "Vema" collected plankton samples in July-August of 1956. During a ten-day sojourn in the Levant in January 1987, the "Meteor 5" obtained deep-sea biota from the region between Crete, Cyprus and Israel. The small number of scientific expeditions to the Levant prompted FREDJ and LAUBIER (1985), in their seminal work on the deep Mediterranean benthos, to declare that "the Levant Sea has practically never been studied". The paucity of data bolstered the concept of eastward faunal attenuation: FREDJ and LAUBIER (1985) stated that only 20% of the Mediterranean deep-sea species are known from its eastern part.

A series of eleven cruises conducted between 1988 and 1991 to study the bathyal biota off the coast of Israel brought up a wealth of new data. The 37 species collected at depths between 200-1,530 m add seven new records for the Levant basin and extend the distribution of sixteen more species to the easternmost boundary of the Mediterranean.

As knowledge is gained on the Levantine bathyal biota, and the inventory of its components becomes more complete, so the list of organisms considered absent from the Levantine basin diminishes. Even thus, the impoverishment of the Levantine bathyal fauna is clearly evident. GOREN (1986), who studied the recolonization of the Red Sea at the post glacial period, indicated that the number of fish species in the Red Sea is much lower than in similar Indo-Pacific regions. It is suggested that the Mediterranean, which like the Red Sea underwent severe temperature and salinity changes, has not yet reached its biotic climax. However, these environmental upheavals do not account for the extreme fauna sparsity of the Levant bathyal compared with the bathyal biota at other regions of the Mediterranean.

The Mediterranean received a substantial part of its fauna from the Atlantic Ocean following the last glacial period, bringing into the sea temperate, subtropical and some tropical species. Yet, in the Levant basin, warming of the surface water together with large-volume flooding of fresh and low salinity water caused by deglaciation is considered to have resulted in restricted thermohaline convection, stagnation of subsurface water and deposition of sapropels at water depths greater than 600-1,000 m (VERGNAUD-GRAZZINI *et al.*, 1977; MUERDTER *et al.*, 1984; HERMAN, 1989). Thus, during interglacial periods, the Levantine bathyal underwent faunal extinctions induced by environmental deterioration caused by the anoxic episodes, followed by partial faunistic replenishment in glacial periods. Therefore, we suggest that the impoverishment of the Levantine bathyal fauna results from it being doubly blighted: during glacial periods the prevailing high temperature and salinity prevented settlement by members of the stenothermic and stenohaline Atlantic bathyal, as far as they were able to cross the Gibraltar and Sicilian sills, while during the postglacial, anoxic conditions in the bathyal restricted its recolonization.

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Polychaetes of the leaf stratum of a *Posidonia oceanica* bed: spatial and seasonal analyses

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In the framework of an investigation on vagile fauna of *Posidonia oceanica* beds (GAMBI *et al.*, 1992), Polychaetes were sampled in the leaf stratum of a continuous *Posidonia* meadow off Lacco Ameno (Island of Ischia, Gulf of Naples, Italy). Samples were taken by SCUBA diving using a hand-towed net (400 µm mesh size); this sampling tool allows the capture of different benthic vagile taxa of the *Posidonia* canopy, although it is not very efficient for Polychaetes (GAMBI *et al.*, in press). Collections were made monthly, from July 1981 to June 1982, along a transect at 1 m, 3 m, 10 m, 15 m and 25 m depths. Each sample consisted in two hand-towed net replicates.

Polychaetes were found in 53 of the 60 samples examined, for a total of 1,811 individuals and 135 species. 38 taxa occurred only once with one individual, while 27 taxa (445 individuals) belonged to sessile, tubicolous forms that will be not considered in the following analysis. The best represented family was that of Syllidae (55 species and 865 individuals). The total number of species and individuals in the different months showed similar trends with two peaks in February-March and from September to November and two minima in July-August and in December-January (Fig. 1). To better define the spatio-temporal distribution pattern of the species, monthly data were grouped in four seasonal groups (summer, autumn, winter and spring) and analyzed by means of the Factorial Analysis of Correspondence (C.A.)

Along the first factorial axis (F1), that was significant, sample points were distributed according to depth (Fig. 2). The highest depth differences were observed in summer and spring. This is because in these seasons several physical conditions (e.g. summer temperature stratification) coupled with *Posidonia* features (leaf growth and plant epiphyte production) enhance the environmental differences between shallow and deep stands of the *Posidonia* beds, thereby resulting in more pronounced differences in the Polychaete populations associated. Seasonal differences in Polychaete community structure were higher between summer-spring and autumn-winter samples especially at shallower depths (from 1 to 10 m) where more fluctuating environmental conditions occur. On the contrary, these were almost negligible in the deepest samples (25 m) where the environment is more stable and less stressed.

The most abundant species, and those that best contribute to such a pattern were *Grubeosyllis clavata*, *G. limbata*, *Syllis prolifera*, *Autolytus sp.1*, *Platynereis dumerilii*, *Nereiphylla nana*, *Raphidrilus nemasoma* and *Oriopsis armandi*, characteristic of shallow depths, and more abundant in summer and spring. *Sphaerosyllis pirifera*, *Grubeosyllis vetezei*, *Pionosyllis lamelligera*, were more frequent at intermediate depth (10 m), while *Eurisyllis tuberculata*, *Odontosyllis gibba*, *Exogone rostrata*, *Sphaerosyllis hystrix*, *Nereis rava* and *Kefersteinia cirrata* characterized the deeper samples (15-25 m), especially in autumn and winter. *Amphiglena mediterranea* occurred, on the contrary, at all depths and in all seasons.

As a whole, two main Polychaete assemblages seem to be recognizable: one associated to shallow stands of the bed with higher seasonal fluctuations in species composition and abundance; another associated to the deeper, more stable stands of the bed with less changes in time.

With these general trends the spatial and seasonal distribution of Polychaetes in the *Posidonia* leaf stratum is consistent both with the environmental conditions of the bed and with the behaviour of the other groups of the vagile fauna studied (GAMBI *et al.*, 1992).

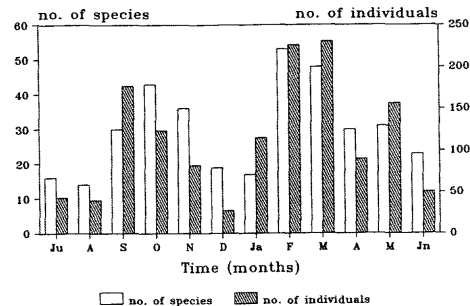


Fig. 1.- Monthly trends of the total number of species and individuals

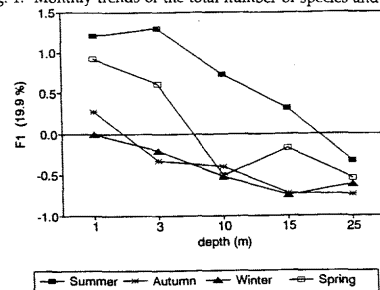


Fig. 2.- C.A. sample-point ordination along first factorial axis (F1)

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